SLR Consulting

Hillsong Church Greater West Development
1 Water Street, Werrington, NSW

Preliminary Salinity Assessment

Our ref: 4064-R1
2 March 2017

Geotechnics | Groundwater | Contamination | Ground Risk Management

DOCUMENT AUTHORISATION

Hillsong Church Greater West Development
1 Water Street, Werrington, NSW
Preliminary Salinity Assessment

Prepared for SLR Consulting

Our ref: 4064-R1
2 March 2017

For and on behalf of
Asset Geotechnical Engineering Pty Ltd

Mark Bartel

Mark Bartel
BE MEngSc GMQ RPEQ MIEAust CPEng NER (Civil)
Managing Director / Senior Principal Geotechnical Engineer

DOCUMENT CONTROL

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Asset Geotechnical Engineering Pty Ltd
Suite 2.05 / 56 Delhi Road
North Ryde NSW 2113
02 9878 6005
assetgeo.com.au

Contents

1. INTRODUCTION

1.1 General

This report presents the results of a preliminary salinity assessment for the above project. The assessment was commissioned on 17 February 2017 by Craig Cowper of SLR Consulting. The work was carried out in accordance with the proposal by Asset Geotechnical Engineering Pty Ltd (Asset) dated 17 February 2017, reference 4064-P1.

Drawings supplied to us for this investigation comprised:

- Survey plans (prepared by: LTS Lockley; ref: 42599DT; dated: November 2015)
- Preliminary architectural plans (prepared by: NBRS Architecture; ref: 15467; dwg: 000 – 010, 100 – 110, 300 and 400 and 1000 – 1004.; dated: January 2017)

Based on the supplied drawings, we understand that the project involves construction of a church complex consisting of a three-storey auditorium building with administrative offices, with ancillary structures that include a single storey childcare facility with an associated playground and a service area. Future developments are understood to include extensions on either side of the main auditorium, which include a smaller auditorium to the north and a children's ministry building to the south. The parking lot for the complex is proposed to be constructed in three stages, with the first stage consisting of 186 parking spaces. No basements have been proposed for the development. The finished floor level of the main auditorium is at approximately RL 26.5m AHD.

1.2 Scope of Work

The objective was to assess the surface and subsurface conditions with respect to salinity, to provide a preliminary salinity assessment to support a Development Application for the proposed development.

The following scope of work was carried out to achieve the project objectives:

- A review of existing regional maps and reports relevant to the site, held within our files.
- Clearance of underground services at proposed test locations.
- Visual observations of surface features.
- Subsurface investigation at four locations to sample and assess the nature and consistency of subsurface soils and bedrock at accessible areas of the site.
- Carrying out laboratory tests on the recovered soil samples.
- Engineering assessment and reporting.

This report must be read in conjunction with the attached "Important Information about your Geotechnical Report" in Appendix A. Attention is drawn to the limitations inherent in site investigations and the importance of verifying the subsurface conditions inferred herein.

2. SITE DESCRIPTION

The site is located off Old Western Highway between the Cobham Remand centre and Wollemi School, as shown in Figure 1. It is roughly rectangular and has a street frontage with the unpaved section of Water Street for about 50m. The block is about 158m wide and is about 192m deep. A vacant grassland borders the site to the north.

Topographically, the site is located in a region of flat topography, with no discernible slope changes. The overall ground surface slopes in the region are about 2° - 3°.

The site shows no signs of recent previous occupancy and historical aerial imagery from 1943 indicates that the major portion of the site has been grasslands, except for some residential structures in the south and south-west corner.

Site drainage is expected to be by surface run-off or percolation through the clayey surface soils. Vegetation consists mostly of prairie grass and a spare copse of trees located in the south-eastern periphery of the site. Cacti plants (Prickly Pear – a controlled invasive weed) were also noticed in this region. It was observed that large tracts around the site showed patches of dormant foliage where no grass growth was observed. Fissures or cracks were also observed in some regions, both of which are indicative of reactive or saline soils, and may be indicative of high relative wetness index. We note that the 1: 100,000 Salinity Potential Map of Western Sydney indicates the site is in a region of high salinity potential.

Rock outcrops were not observed. A dried-out waterhole was observed in the central north region of the site. The ephemeral Claremont Creek is located to the southeast of the site. This periodically flows in a northerly direction.

Soil Landscape type is characterised by the South Creek Landscape. This is typically marked by floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain. Geotechnical hazards associated with this landscape include - flood hazard, seasonal waterlogging, localised permanently high water-tables, localised water erosion hazard and localised surface movement potential.

3. FIELDWORK & LABORATORY TESTING

3.1 Borehole Investigation

The fieldwork was undertaken on 17 February 2017 by a Geotechnical Engineer from Asset, and included subsurface investigation at four locations.

Buried metallic services and utilities within the site boundaries near the proposed test locations were cleared by referring to DBYD utility maps.

The boreholes were drilled to target depths of 1.2m to 1.5m. The test locations are shown on the attached Figure 2. Engineering logs are provided in Appendix B together with their explanatory notes.

The test locations were set out by our Geotechnical Engineer by measurements relative to existing site features. The subsurface conditions encountered were logged during drilling. Surface levels at the test locations were estimated by interpolation from levels shown on the survey plan provided (prepared by: LTS Lockley; ref: 42599DT; dated: November 2015.

On completion of logging and sampling, each borehole was backfilled with the drilling spoil. Remaining spoil was left and trimmed neatly flush or slightly mounded to the adjacent ground surface.

3.2 Laboratory Testing

Soil samples recovered during the fieldwork were delivered to a NATA registered laboratory. The following tests were carried out on selected samples:

- Soil aggressivity testing (chloride, sulphate and pH).
- Salinity testing (Cation Exchange Capacity, Exchangeable Sodium, resistivity and salinity).

Test results are attached. Testing was carried out generally in accordance with AS1289 "Methods of Testing Soil for Engineering Purposes" or as described in the laboratory test results.

4. SUBSURFACE CONDITIONS

4.1 Geology

The 1:100,000 Penrith Geological Map indicates the site is underlain by quaternary alluvial soils (clay, silt and fine-grained sand) overlying Bringelly Shale.

4.2 Subsurface Conditions

A generalised geotechnical model for the site has been developed is shown in Table 1. For a detailed description of the subsurface conditions, refer the attached engineering logs and explanatory notes. For specific design input, reference should be made to the logs and/or the specific test results, in place of the following summary.

Table 1 - Generalised Site Geotechnical Model

Unit	Origin	Description	Depth to Top of Unit [1] (m)	Unit Thickness [1] (m)
1	Topsoil/ Residual	CLAY, medium to high plasticity, brown to dark brown, traces of fine to medium grained sand and fine to medium grained subangular to subrounded gravel, some rootlets, grass fibres and twigs.	Ground surface	0.2 – 0.4
2	Residual	CLAY, medium to high plasticity, brown, traces of fine to medium grained sand and subangular gravel, traces of ironstones and ironstaining observed. Generally stiff to very stiff.	0.2 – 0.4	0.9 – 1.3

Notes:

1. The depths and unit thicknesses are based on the information from the test locations only and do not necessarily represent the maximum and minimum values across the site.

4.3 Groundwater

Groundwater was not observed in the boreholes during drilling depths of 1.2m to 1.5m, even though the soil was observed to be noticeably moist in borehole BH2 from 0.8m. It is noted that the groundwater observation may have been made before water levels had stabilised. No long-term groundwater monitoring was carried out.

4.4 Laboratory Test Results

Results from the laboratory testing undertaken on selected soil samples are included in Appendix C, and are summarised in Tables 2 and 3.

Table 2 – Laboratory Test Results: Salinity Assessment

Test Location & Depth (m)	Conductivity (dS/m)[1]	Soil Texture Group	Multiplication Factor	EC_e (dS/m)[2]	Salinity Class
BH1 (0.0 – 0.2)	0.12	Clay loams	9	1.08	Non-saline
BH2 (0.0 – 0.2)	0.08	Clay loams	9	0.72	Non-saline
BH3 (0.3 – 0.4)	0.1	Clay loams	9	0.9	Non-saline

1 1 dS/m = 1,000 µS/cm = 640 mg/kg

2 Typical sea water has EC_w = 50 dS/m

Table 3 – Laboratory Test Results: Aggressivity Assessment

Test Location & Depth (m)	Chloride (mg/kg)	pH	Resistivity (Ωm.cm)	Sulphate (mg/kg)	Soil Condition (A or B)	Exposure Classification (Concrete) AS 2159-2009	Exposure Classification (Steel) AS 2159-2009
BH1 (0.0 – 0.2)	670	8	2,047	80	B	Non-aggressive	Non-aggressive
BH2 (0.0 – 0.2)	260	7.4	2,057	40	B	Non-aggressive	Non-aggressive
BH3 (0.3 – 0.4)	860	7.3	2,375	20	B	Non-aggressive	Non-aggressive

5. DISCUSSIONS & RECOMMENDATIONS

5.1 Salinity

The laboratory test results indicate that the tested soils are classified as Non-saline (DLWC[3], Table 6.2) with an **ECe of <2dS/m**.

Therefore, it is concluded that a Salinity Management Plan is not required for this project, and no further salinity assessment is required.

Notwithstanding the above, given that the site lies within an area mapped as having a high salinity potential, and noting that there are surficial vegetation features suggestive of salinity in the area, it is recommended that design and construction of the development be in accordance with the recommendations in 'Building in a Saline Environment', by Department of Environment and Climate Change, 2008.

5.2 Aggressivity to Concrete

The laboratory test results indicate that the soils are classified as "Non-aggressive" with respect to concrete piles (as per AS2159-2009 Piling-Design and Installation).

In accordance with AS 2159-2009 Section 6.4 Design for Durability of Concrete Piles, "For the range of chemical conditions in the soil surrounding the piles, the condition leading to the most severe aggressive conditions shall be allowed for."

Therefore, for a 50-year design life, minimum concrete strength of **32MPa** and a minimum cover to reinforcement of **60mm** (cast-in-place piles) is recommended for a "Mild" environment in AS2159-2009 for concrete piles. The cover should be increased to **75mm** for a 100-year design life. The concrete strength and cover requirements are a minimum, and should be reviewed by the pile designer / structural engineer to take other design considerations into account.

5.3 Aggressivity to Steel

The laboratory test results indicate that the soils are classified as "Non-aggressive" with respect to steel piles (as per AS2159-2009 Piling-Design and Installation).

Corrosion allowance, coating protection systems, and cathodic protection should be adopted as per AS2159-2009 for a "Non-saline" exposure classification, with a uniform corrosion allowance of **<0.01mm/year**.

[3] Department of Land and Water Conservation, "Site Investigations for Urban Salinity", 2002

6. LIMITATIONS

In addition to the limitations inherent in site investigations (refer to the attached Information Sheets), it must be pointed out that the recommendations in this report are based on assessed subsurface conditions from limited investigations, focused on salinity and aggressiveness characteristics of the soils. Further investigation would be required for other aspects of the development such as building footings and retaining walls.

This report and details for the proposed development should be submitted to relevant regulatory authorities that have an interest in the property (e.g. Council) or are responsible for services that may be within or adjacent to the site (e.g. Sydney Water, Roads and Maritime Services), for their review.

The document "Important Information about your Geotechnical Report" in Appendix A provides additional information about the uses and limitations of this report.

FIGURES

APPROXIMATE ONLY – SUBJECT TO DETAIL SURVEY.

SOURCE: "GOOGLE MAPS"

THIS DRAWING IS USED TO ILLUSTRATE SITE LOCATION ONLY, AND MUST NOT BE USED FOR ANY OTHER PURPOSE. COPYRIGHT OF SOURCE DRAWING REMAINS WITH GOOGLE MAPS

0 1:5000 250m

issue	date	description
A	17.2.17	INITIAL ISSUE

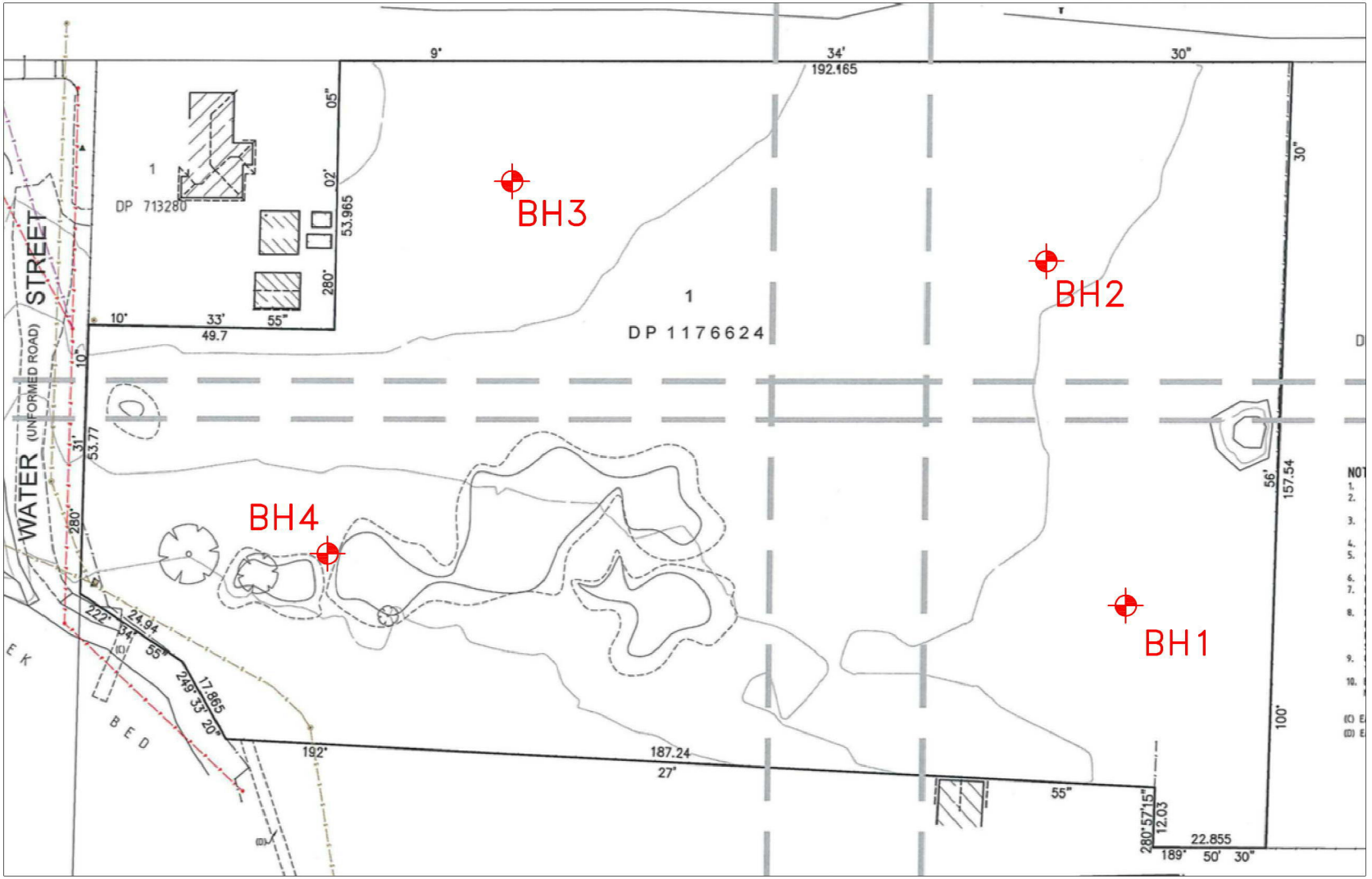
assetgeo
Asset Geotechnical Engineering Pty Ltd
2.05/56 Delhi Rd, North Ryde NSW 2113
t: 02 9878 6005
e: info@assetgeo.com.au

HILLSONG GREATER WEST DEVELOPMENT
1 WATER STREET, WERRINGTON, NSW
for
SLR CONSULTING

SITE LOCALITY

drawn: DJ
date: 17.2.17
checked: MAG
scale: 1:5000 A4

job no.: 4064
fig: 1
issue: A



APPROXIMATE ONLY – SUBJECT TO DETAIL SURVEY.

SOURCE: "LTS LOCKLEY"

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0 1:1250 40m

issue	date	description
A	17.2.17	INITIAL ISSUE

assetgeo
Asset Geotechnical Engineering Pty Ltd
2.05/56 Delhi Rd, North Ryde NSW 2113
t: 02 9878 6005
e: info@assetgeo.com.au

HILLSONG GREATER WEST DEVELOPMENT
1 WATER STREET, WERRINGTON, NSW
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TEST LOCATIONS

drawn: DJ	job no.: 4064
date: 17.2.17	
checked: MAG	fig: 2 / issue: A
scale: 1:1250 A4	

APPENDIX A

Important Information about your Geotechnical Report

Important Information about your Geotechnical Report

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client and Asset Geotechnical Engineering Pty Ltd ("Asset"), for the specific site investigated. The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

The report should not be used if there have been changes to the project, without first consulting with Asset to assess if the report's recommendations are still valid. Asset does not accept responsibility for problems that occur due to project changes if they are not consulted.

RELIANCE ON DATA

Asset has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. Asset has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, Asset will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Asset.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behavior with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

Therefore, the recommendations in the report can only be regarded as preliminary. Asset should be retained during the project implementation to assess if the report's recommendations are valid and whether or not changes should be considered as the project proceeds.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. Asset should be kept appraised of any such events, and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that Asset be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

This report is the subject of copyright and shall not be reproduced either totally or in part without the express permission of this Company. Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. Asset assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Asset or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

DATA MUST NOT BE SEPARATED FROM THE REPORT

The report as a whole presents the site assessment, and must not be copied in part or altered in any way.

Logs, figures, drawings, test results etc. included in our reports are developed by professionals based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

PARTIAL USE OF REPORT

Where the recommendations of the report are only partially followed, there may be significant implications for the project and could lead to problems. Consult Asset if you are not intending to follow all of the report recommendations, to assess what the implications could be. Asset does not accept responsibility for problems that develop where the report recommendations have only been partially followed if they have not been consulted.

OTHER LIMITATIONS

Asset will not be liable to update or revise the report to take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.

APPENDIX B

Soil & Rock Explanation Sheets
Borehole Logs

Soil and Rock Explanation Sheets (1 of 2)

LOG ABBREVIATIONS AND NOTES

METHOD

borehole logs		excavation logs	
AS	auger screw *	NE	natural excavation
AD	auger drill *	HE	hand excavation
RR	roller / tricone	BH	backhoe bucket
W	washbore	EX	excavator bucket
CT	cable tool	DZ	dozer blade
HA	hand auger	R	ripper tooth
D	diatube		
B	blade / blank bit		
V	V-bit		
T	TC-bit		

* bit shown by suffix e.g. ADV

coring
NMLC, NQ, PQ, HQ

SUPPORT

borehole logs		*excavation logs*	
N	nil	N	nil
M	mud	S	shoring
C	casing	B	benched
NQ	NQ rods		

CORE—LIFT

casing installed

barrel withdrawn

NOTES, SAMPLES, TESTS

D	disturbed
B	bulk disturbed
U50	thin-walled sample, 50mm diameter
HP	hand penetrometer (kPa)
SV	shear vane test (kPa)
DCP	dynamic cone penetrometer (blows per 100mm penetration)
SPT	standard penetration test
N*	SPT value (blows per 300mm) * denotes sample taken
Nc	SPT with solid cone
R	refusal of DCP or SPT

USCS SYMBOLS

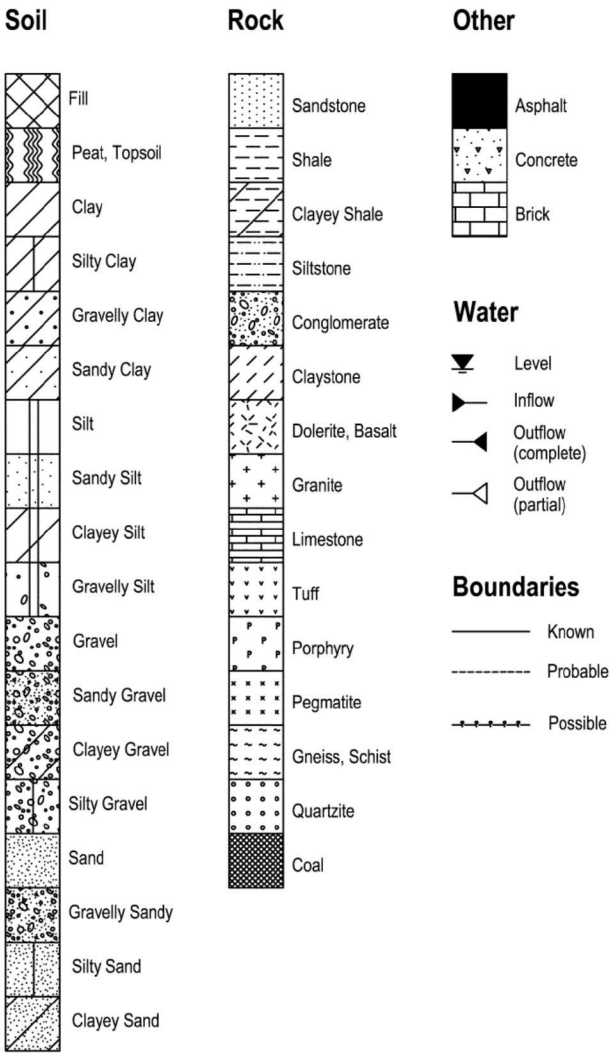
GW	Well graded gravels and gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
GM	Silty gravels, gravel-sand-silt mixtures.
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well graded sands and gravelly sands, little or no fines.
SP	Poorly graded sands and gravelly sands, little or no fines.
SM	Silty sand, sand-silt mixtures.
SC	Clayey sand, sand-clay mixtures.
ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
OL	Organic silts and organic silty clays of low plasticity.
MH	Inorganic silts of high plasticity.
CH	Inorganic clays of high plasticity.
OH	Organic clays of medium to high plasticity.
PT	Peat muck and other highly organic soils.

MOISTURE CONDITION

D	dry
M	moist
W	wet
Wp	plastic limit
Wl	liquid limit

CONSISTENCY		DENSITY INDEX	
VS	very soft	VL	very loose
S	soft	L	loose
F	firm	MD	medium dense
St	stiff	D	dense
VSt	very stiff	VD	very dense
H	hard		
Fb	friable		

GRAPHIC LOG



WEATHERING

XW	extremely weathered
HW	highly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

STRENGTH

EL	extremely low
VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

RQD (%)

= sum of intact core pieces > 2 x diameter / total length of section being evaluated x 100

DEFECTS:

type		*coating*	
JT	joint	cl	clean
PT	parting	st	stained
SZ	shear zone	ve	veneer
SM	seam	co	coating

shape		*roughness*	
pl	planar	po	polished
cu	curved	sl	slickensided
un	undulating	sm	smooth
st	stepped	ro	rough
ir	irregular	vr	very rough

inclination
measured above axis and perpendicular to core

Soil and Rock Explanation Sheets (2 of 2)

AS1726-1993

Soils and rock are described in the following terms, which are broadly in accordance with AS1726-1993.

SOIL

MOISTURE CONDITION

Term	Description
Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Un-cemented granular soils run freely through the hand.
Moist	Feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist, but with free water forming on hands when handled.

Moisture content of cohesive soils may also be described in relation to plastic limit (W_P) or liquid limit (W_L) [>> much greater than, > greater than, < less than, << much less than].

CONSISTENCY OF COHESIVE SOILS

Term	Su (kPa)	Term	Su (kPa)
Very soft	< 12	Very Stiff	100 – 200
Soft	12 – 25	Hard	> 200
Firm	25 – 50	Friable	–
Stiff	50 – 100		

DENSITY OF GRANULAR SOILS

Term	Density Index (%)	Term	Density Index (%)
Very Loose	< 15	Dense	65 – 85
Loose	15 – 35	Very Dense	>85
Medium Dense	35 – 65		

PARTICLE SIZE

Name	Subdivision	Size (mm)
Boulders		> 200
Cobbles		63 – 200
Gravel	coarse	20 – 63
	medium	6 – 20
	fine	2.36 – 6
Sand	coarse	0.6 – 2.36
	medium	0.2 – 0.6
	fine	0.075 – 0.2
Silt & Clay		< 0.075

MINOR COMPONENTS

Term	Proportion by Mass:	
	coarse grained	*fine grained*
Trace	= 5%	= 15%
Some	5 – 2%	15 – 30%

SOIL ZONING

Layers	Continuous exposures.
Lenses	Discontinuous layers of lenticular shape.
Pockets	Irregular inclusions of different material.

SOIL CEMENTING

Weakly	Easily broken up by hand.
Moderately	Effort is required to break up the soil by hand.

USCS SYMBOLS

Symbol	Description
GW	Well graded gravels and gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
GM	Silty gravels, gravel-sand-silt mixtures.
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CH	Inorganic clays of high plasticity.
OH	Organic clays of medium to high plasticity.
PT	Peat muck and other highly organic soils.

ROCK

SEDIMENTARY ROCK TYPE DEFINITIONS

Rock Type	Definition (more than 50% of rock consists of .....)
Conglomerate	... gravel sized (>2mm) fragments.
Sandstone	... sand sized (0.06 to 2mm) grains.
Siltstone	... silt sized (<0.06mm) particles, rock is not laminated.
Claystone	... clay, rock is not laminated.
Shale	... silt or clay sized particles, rock is laminated.

LAYERING

Term	Description
Massive	No layering apparent.
Poorly Developed	Layering just visible. Little effect on properties.
Well Developed	Layering distinct. Rock breaks more easily parallel to layering.

STRUCTURE

Term	Spacing (mm)	Term	Spacing
Thinly laminated	<6	Medium bedded	200 – 600
Laminated	6 – 20	Thickly bedded	600 – 2,000
Very thinly bedded	20 – 60	Very thickly bedded	> 2,000
Thinly bedded	60 – 200		

STRENGTH (NOTE: Is50 = Point Load Strength Index)

Term	Is50 (MPa)	Term	Is50 (MPa)
Extremely Low	<0.03	High	1.0 – 3.0
Very low	0.03 – 0.1	Very High	3.0 – 10.0
Low	0.1 – 0.3	Extremely High	>10.0
Medium	0.3 – 1.0		

WEATHERING

Term	Description
Residual Soil	Soil derived from weathering of rock; the mass structure and substance fabric are no longer evident.
Extremely	Rock is weathered to the extent that it has soil properties (either disintegrates or can be remoulded). Fabric of original rock is still visible.
Highly	Rock strength usually highly changed by weathering; rock may be highly discoloured.
Moderately	Rock strength usually moderately changed by weathering; rock may be moderately discoloured.
Slightly	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	Rock shows no signs of decomposition or staining.

DEFECT DESCRIPTION

Type	
Joint	A surface or crack across which the rock has little or no tensile strength. May be open or closed.
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering/bedding. May be open or closed.
Sheared Zone	Zone of rock substance with roughly parallel, near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects.
Seam	Seam with deposited soil (infill), extremely weathered insitu rock (XW), or disoriented usually angular fragments of the host rock (crushed).
Shape	
Planar	Consistent orientation.
Curved	Gradual change in orientation.
Undulating	Wavy surface.
Stepped	One or more well defined steps.
Irregular	Many sharp changes in orientation.
Roughness	
Polished	Shiny smooth surface.
Slickensided	Grooved or striated surface, usually polished.
Smooth	Smooth to touch. Few or no surface irregularities.
Rough	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper.
Very Rough	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper.
Coating	
Clean	No visible coating or discolouring.
Stained	No visible coating but surfaces are discolored.
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Coating	Visible coating =1mm thick. Thicker soil material described as seam.

Borehole Log

BH no:	**BH1**
sheet:	1 of 1
job no.:	4064

client:	SLR Consulting	**started:**	17.2.2017
principal:		**finished:**	17.2.2017
project:	Geotechnical Investigation and Salinity Assessment	**logged:**	DJ
location:	1 Water Street, Werrington,NSW	**checked:**	MAG
equipment:	Hand auger	**RL surface:**	25.88 m approx.
diameter:	100mm **inclination:** -90° **bearing:** --- **E:** **N:**	**datum:**	AHD

drilling information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material description (soil type: plasticity or particle characteristics, colour, secondary and minor components.)	moisture condition	consistency/ density index	hand penetrometer kPa (100 200 300 400)	structure and additional observations
HA		None observed					CH	CLAY, medium to high plasticity, brown, traces of fine to medium grained sand and fine to medium grained subangular gravel, traces of organic matter (twigs, rootlets and root fibres).	D	St-VSt		Topsoil/residual.
				25.5	0.3		CH	As above, but no organic matter present, traces of ironstone inclusions and ironstaining observed.	D	St-VSt		Residual
					0.5						× 150	
				25.0								
					1.0							
					1.1		CH	As above, but brown mottled grey-red.	D-M	F-St		
											× 125	
				24.5								
					1.4			Borehole No: BH1 terminated at 1.4m				
					1.5							
				24.0								
					2.0							
				23.5								
					2.5							
				23.0								
					3.0							

4064 LOGS.GPJ 28/2/17

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED — Borehole Log - Revision 10

Borehole Log

BH no:	**BH2**
sheet:	1 of 1
job no.:	4064

client:	SLR Consulting	**started:**	17.2.2017
principal:		**finished:**	17.2.2017
project:	Geotechnical Investigation and Salinity Assessment	**logged:**	DJ
location:	1 Water Street, Werrington,NSW	**checked:**	MAG
equipment:	Hand auger	**RL surface:**	26.31 m approx.
diameter:	100mm **inclination:** -90° **bearing:** --- **E:** **N:**	**datum:**	AHD

drilling information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material description (soil type: plasticity or particle characteristics, colour, secondary and minor components.)	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
HA		None observed					CH	CLAY, medium to high plasticity, brown to dark brown, traces of fine to medium grained sand and fine to medium grained subangular to subrounded gravel, traces of organic matter (twigs, rootlets, grass and root fibres).	D			Topsoil/residual
				26.0	0.2		CH	As above, but no organic matter present.	D	St-VSt		Residual
					0.5							
				25.5	0.8		CH	As above, but low to medium plasticity, noticeably moister soil.	M (<<Wp)	S-F	× 50	
					1.0							
				25.0	1.5							
					1.5			Borehole No: BH2 terminated at 1.5m				
				24.5	2.0							
				24.0	2.5							
				23.5	3.0							

4064 LOGS.GPJ 28/2/17

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED — Borehole Log - Revision 10

Asset Geotechnical Engineering Pty Ltd A: 2.05 / 56 Delhi Road, North Ryde NSW 2113 P: 02 9878 6005 W: assetgeo.com.au

Borehole Log

BH no:	**BH3**
sheet:	1 of 1
job no.:	4064

client:	SLR Consulting	**started:**	17.2.2017
principal:		**finished:**	17.2.2017
project:	Geotechnical Investigation and Salinity Assessment	**logged:**	DJ
location:	1 Water Street, Werrington,NSW	**checked:**	MAG
equipment:	Hand auger	**RL surface:**	26.77 m approx.
diameter:	100mm **inclination:** -90° **bearing:** --- **E:** **N:**	**datum:**	AHD

drilling information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material description (soil type: plasticity or particle characteristics, colour, secondary and minor components.)	moisture condition	consistency/ density index	hand penetrometer kPa (100 200 300 400)	structure and additional observations
HA		None observed		26.5	0.0		CH	CLAY, high plasticity, brown, traces of fine to medium grained sand and fine to medium grained subangular gravel, traces of organic matter (twigs, rootlets and root fibres).	D	St-VSt		Topsoil/residual
					0.3		CH	As above, but no organic matter present, traces of ironstone inclusions.	D	St-VSt		Residual
				26.0	0.5							
					1.0						× 150	
				25.5	1.2			Borehole No: BH3 terminated at 1.2m				
					1.5							
				25.0								
					2.0							
				24.5								
					2.5							
				24.0								
					3.0							

4064 LOGS.GPJ 28/2/17

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED — Borehole Log - Revision 10

Borehole Log

BH no:	**BH4**
sheet:	1 of 1
job no.:	4064

client:	SLR Consulting	**started:**	17.2.2017
principal:		**finished:**	17.2.2017
project:	Geotechnical Investigation and Salinity Assessment	**logged:**	DJ
location:	1 Water Street, Werrington,NSW	**checked:**	MAG
equipment:	Hand auger	**RL surface:**	25.83 m approx.
diameter:	100mm **inclination:** -90° **bearing:** --- **E:** **N:**	**datum:**	AHD

drilling information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material description (soil type: plasticity or particle characteristics, colour, secondary and minor components.)	moisture condition	consistency/ density index	hand penetrometer kPa (100 200 300 400)	structure and additional observations
HA		None observed		25.5			CH	CLAY, medium to high plasticity, brown, traces of fine to medium grained sand and fine to medium grained subangular gravel, traces of organic matter (twigs, rootlets and root fibres).	D	F-St		Topsoil/residual
					0.4		CH	As above, but no organic matter present.	D-M	St-VSt		Residual
				25.0	0.5							
					1.0						× 150	
				24.5	1.3			Borehole No: BH4 terminated at 1.3m				
					1.5							
				24.0								
					2.0							
				23.5								
					2.5							
				23.0								
					3.0							

4064 LOGS.GPJ 28/2/17

Asset Geotechnical Engineering Pty Ltd A: 2.05 / 56 Delhi Road, North Ryde NSW 2113 P: 02 9878 6005 W: assetgeo.com.au

APPENDIX C

Laboratory Test Results

Corrosion & Scaling Assessment:
Soil Reporting Profile

SESL AUSTRALIA
Environment & Soil Sciences

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 42347 **Sample N°: 1** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

Client Name:	**Asset Geotechnical**	Project Name:	**Ref: 4064 - 1 Water St Werrington**
Client Contact:	**Denny Jacob**	SESL Quote N°:	
Client Job N°:		Sample Name:	**BH1 (0-0.2m)**
Client Order N°:		Description:	**Soil**
Address:	**Suite2.05/56 Delhi Rd North Ryde NSW 2113**	Test Type:	**USAWS**

TEST		RESULT	COMMENTS
pH in water (1:5)		8	Moderate alkalinity
EC mS/cm (1:5)		0.12	Low
Texture Class		-	Did not test
Soil Condition Class (Permeability)		-	Did not test
SOLUBLE ANION ANALYSIS			
Sulphate (1:5)	$mgSO_4$ / kg	80	Low (non to mildly aggressive)
Chloride (1:5)	mgCl / kg	670	Low (non-aggressive)
* Resistivity Ω.	m	20.47	Moderate (non to mildly aggressive)

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

Recommendations by SESL Australia not requested.

pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998);
Resistivity, AS1289.4.4.1:1997, **Texture** - PM0003 (Texture- "Northcote" (1992))

Date Report Generated
27/02/2017

Consultant: Michelle Murphy

Authorised Signatory: Ryan Jacka

Corrosion & Scaling Assessment:
Soil Reporting Profile

SESL AUSTRALIA
Environment & Soil Sciences

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
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Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 42347 **Sample N°: 2** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

Client Name:	**Asset Geotechnical**	Project Name:	**Ref: 4064 - 1 Water St Werrington**
Client Contact:	**Denny Jacob**	SESL Quote N°:	
Client Job N°:		Sample Name:	**BH2 (0-0.2m)**
Client Order N°:		Description:	**Soil**
Address:	**Suite2.05/56 Delhi Rd North Ryde NSW 2113**	Test Type:	**USAWS**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.4	Slight alkalinity
EC mS/cm (1:5)	0.08	Very low
Texture Class	-	Did not test
Soil Condition Class (Permeability)	-	Did not test
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg	40	Low (non to mildly aggressive)
Chloride (1:5) mgCl / kg	260	Low (non-aggressive)
* Resistivity Ω. m	20.57	Moderate (non to mildly aggressive)

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

Recommendations by SESL Australia not requested.

pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998);
Resistivity, AS1289.4.4.1:1997, **Texture** - PM0003 (Texture- "Northcote" (1992))

Date Report Generated
27/02/2017

Consultant: Michelle Murphy

Authorised Signatory: Ryan Jacka

Corrosion & Scaling Assessment:
Soil Reporting Profile

SESL AUSTRALIA
Environment & Soil Sciences

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Batch N°: 42347 **Sample N°: 3** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

Client Name:	**Asset Geotechnical**	Project Name:	**Ref: 4064 - 1 Water St Werrington**
Client Contact:	**Denny Jacob**	SESL Quote N°:	
Client Job N°:		Sample Name:	**BH3 (0.3-0.4m)**
Client Order N°:		Description:	**Soil**
Address:	**Suite2.05/56 Delhi Rd North Ryde NSW 2113**	Test Type:	**USAWS**

TEST		RESULT	COMMENTS
pH in water (1:5)		7.3	Slight alkalinity
EC mS/cm (1:5)		0.1	Very low
Texture Class		-	Did not test
Soil Condition Class (Permeability)		-	Did not test
SOLUBLE ANION ANALYSIS			
Sulphate (1:5)	$mgSO_4$ / kg	20	Low (non to mildly aggressive)
Chloride (1:5)	mgCl / kg	860	Low (non-aggressive)
* Resistivity Ω. m		23.75	Moderate (non to mildly aggressive)

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

Recommendations by SESL Australia not requested.

pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998);
Resistivity, AS1289.4.4.1:1997, **Texture** - PM0003 (Texture- "Northcote" (1992))

Date Report Generated
27/02/2017

Consultant: Michelle Murphy

Authorised Signatory: Ryan Jacka

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

SESL AUSTRALIA
Environment & Soil Sciences

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
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Batch N°: 42347 **Sample N°: 1** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

Client Name: **Asset Geotechnical**
Client Contact: **Denny Jacob**
Client Job N°:
Client Order N°:
Address: **Suite2.05/56 Delhi Rd North Ryde NSW 2113**

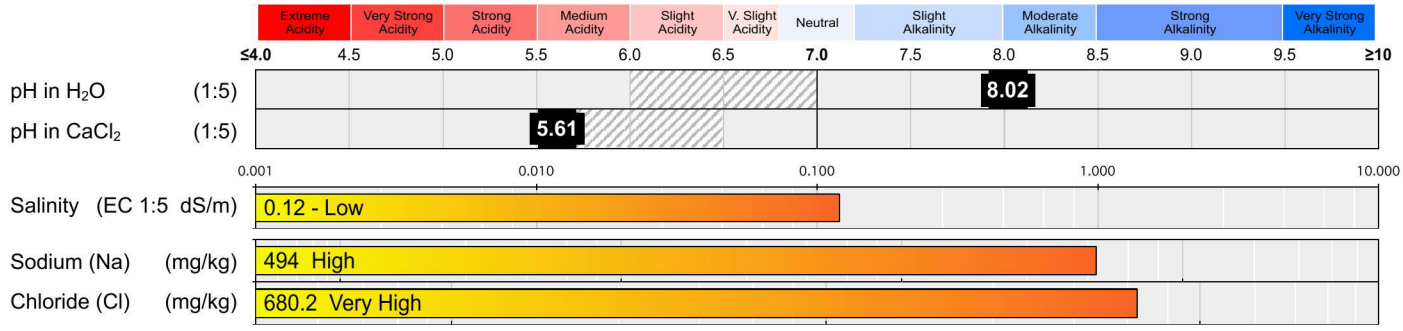
Project Name: **Ref: 4064 - 1 Water St Werrington**
SESL Quote N°:
Sample Name: **BH1 (0-0.2m)**
Description: **Soil**
Test Type: **USAWS**

RECOMMENDATIONS

Recommendations by SESL Australia not requested.

SOIL SAMPLE DEPTH (mm): ○ 100 ○ 150 ○ 200 **FERTILITY RATING:** ○ Low ○ Moderate ○ High

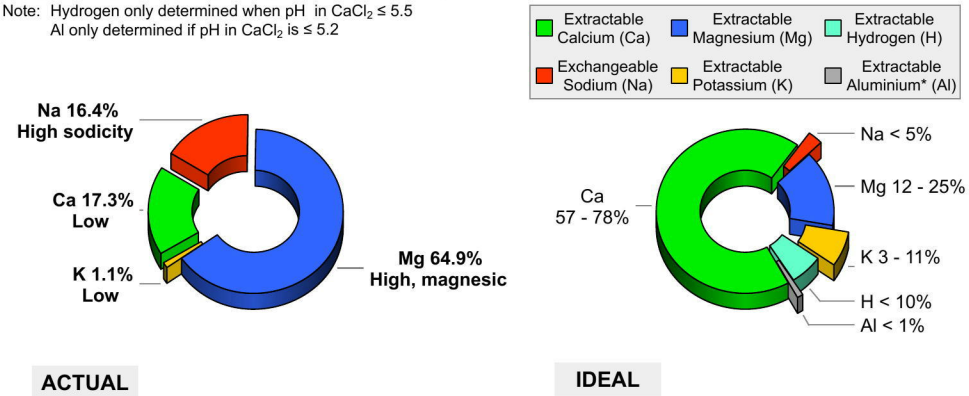
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

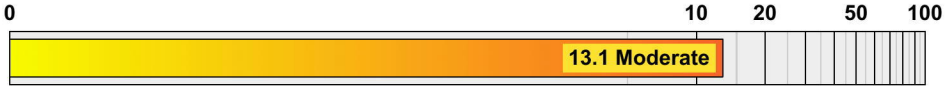
EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



ACTUAL IDEAL

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	0.3	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	56.7	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.01	< 0.07
Comment: Acceptable		
K:Na	0.1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS cmol(+)/kg

Na:	K:	Ca:	Mg:	H:	Al:
2.15	0.15	2.26	8.50		

SOLUBLE CATIONS cmol(+)/kg

Na:	K:	Ca:	Mg:

ASPAC

A member of the Australasian Soil and Plant Analysis Council
† This laboratory has been awarded a Certificate of Proficiency for specific soil and plant tissue analyses by the Australasian Soil and Plant Analysis Council (ASPAC). Tests for which proficiency has been demonstrated are highlighted in this report.

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
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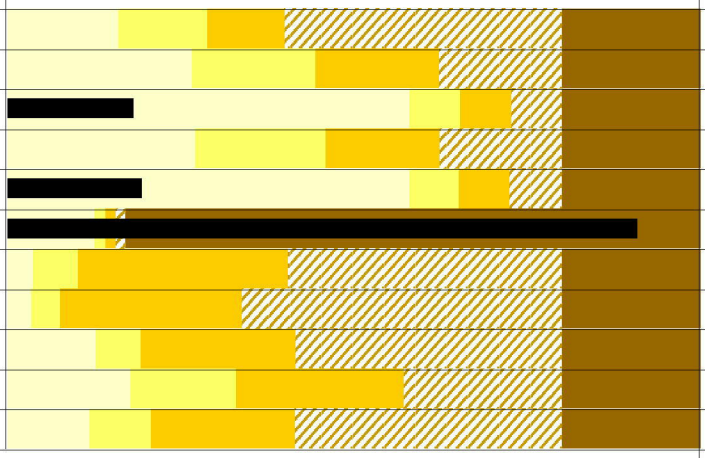
Web: www.sesl.com.au

Batch N°: 42347 **Sample N°: 1** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

Major Nutrients	Result (mg/kg)	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	-		-	-	Did not test
Phosphate-P (PO_4)	-		-	12.6	Did not test
Potassium (K) †	59.6		11.9	52.3	40.4
Sulphate-S (SO_4)	-		-	13.6	13.6
Calcium (Ca) †	452		90.2	372.1	281.9
Magnesium (Mg) †	1033		206.1	38.7	Drawdown
Iron (Fe)	-		-	110.1	Did not test
Manganese (Mn) †	-		-	8.8	Did not test
Zinc (Zn) †	-		-	1	Did not test
Copper (Cu)	-		-	1.3	Did not test
Boron (B) †	-		-	0.5	Did not test



Explanation of graph ranges:

Very Low
Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90%.

Low
Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90%.

Marginal
Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60%.

Adequate
Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30%.

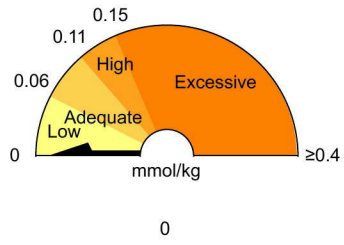
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.

• g/sqm measurements are based on soil bulk density of 1.33 tonne/m^3 and selected soil depth.

Phosphorus Saturation Index



0

Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**13.1**
Eff. Cation Exch. Capacity (eCEC):	**13.1**
Base Saturation (%):	**100**
Exchangeable Acidity (meq/100g^{-1}):	-
Exchangeable Acidity (%):	-

Lime Application Rate

– to achieve pH 6.0 (g/sqm):	**0**
– to neutralise Al (g/sqm):	-

Gypsum Application Rate

– to achieve 67.5% exch. Ca (g/sqm): **0**

The CGAR is corrected for a soil depth of mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	-
Colour:	-
Estimated clay content:	**Did not test**
Size:	-
Gravel content:	-
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Did not test**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	-

Requires EC and Soil Texture result.

Organic Carbon (OC%)†: **Did not test**
Organic Matter (OM%): -
Additional comments:

Consultant: Michelle Murphy

Authorised Signatory: Ryan Jacka

Date Report Generated 27/02/2017

METHOD REFERENCES:
pH (1:5 H_2O) - Rayment & Higginson (1992) 4A1,
pH (1:5 $CaCl_2$) - Rayment & Higginson (1992) 4B1,
EC (1:5) - Rayment & Higginson (1992) 3A1,
Chloride - Rayment & Higginson (1992) 5A2,
Nitrate - Rayment & Higginson (1992) 7B1
Aluminium - SESL in-house,
PO_4, K, SO_4, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - Mehlich 3 (1984),
Buffer pH and Hydrogen - Adams-Evans (1972)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

ASPAC

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† This laboratory has been awarded a Certificate of Proficiency for specific soil and plant tissue analyses by the Australasian Soil and Plant Analysis Council (ASPAC). Tests for which proficiency has been demonstrated are highlighted in this report.

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 42347 **Sample N°: 2** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

Client Name: **Asset Geotechnical**
Client Contact: **Denny Jacob**
Client Job N°:
Client Order N°:
Address: **Suite2.05/56 Delhi Rd North Ryde NSW 2113**

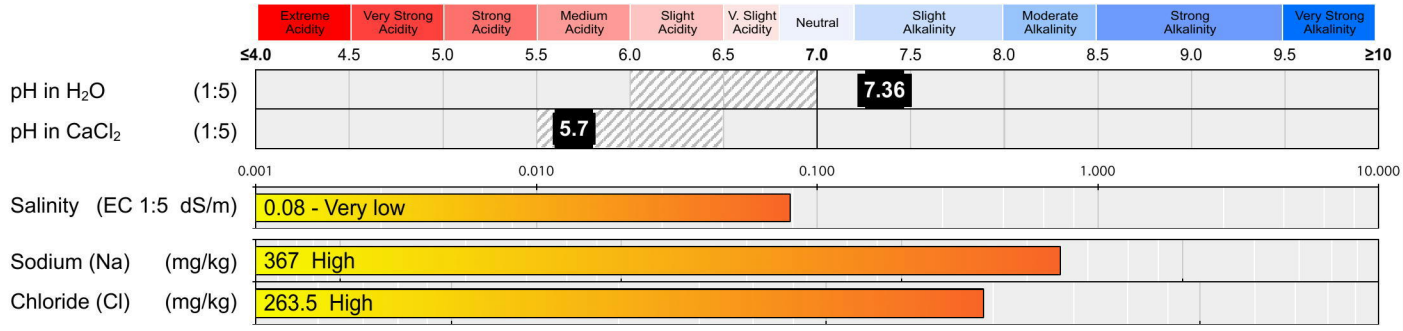
Project Name: **Ref: 4064 - 1 Water St Werrington**
SESL Quote N°:
Sample Name: **BH2 (0-0.2m)**
Description: **Soil**
Test Type: **USAWS**

RECOMMENDATIONS

Recommendations by SESL Australia not requested.

SOIL SAMPLE DEPTH (mm): ○ 100 ○ 150 ○ 200 **FERTILITY RATING:** ○ Low ○ Moderate ○ High

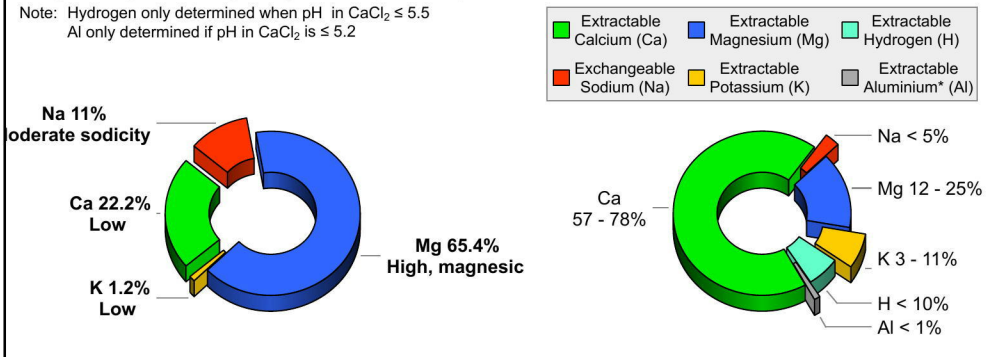
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	0.3	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	55.8	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.01	< 0.07
Comment: Acceptable		
K:Na	0.1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS cmol(+)/kg

Na:	K:	Ca:	Mg:	H:	Al:
1.59	0.17	3.22	9.49		

SOLUBLE CATIONS cmol(+)/kg

Na:	K:	Ca:	Mg:

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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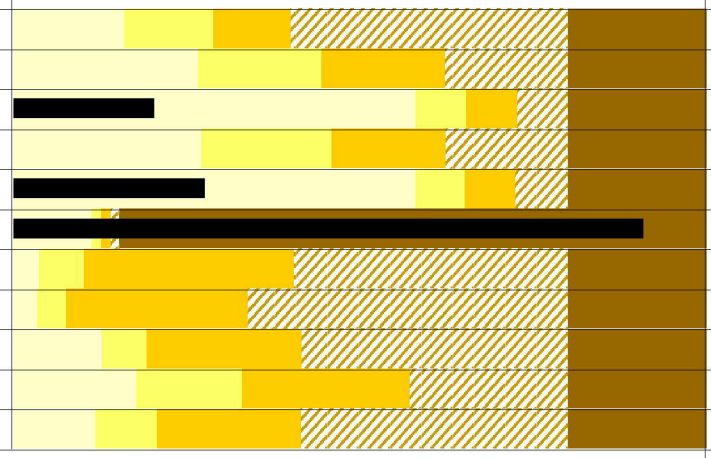
Batch N°: 42347 **Sample N°: 2** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

Major Nutrients	Result (mg/kg)	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	-		-	-	Did not test
Phosphate-P (PO_4)	-		-	12.6	Did not test
Potassium (K) †	66.6		13.3	52.3	39
Sulphate-S (SO_4)	-		-	13.6	13.6
Calcium (Ca) †	644		128.5	372.1	243.6
Magnesium (Mg) †	1153		230	38.7	Drawdown
Iron (Fe)	-		-	110.1	Did not test
Manganese (Mn) †	-		-	8.8	Did not test
Zinc (Zn) †	-		-	1	Did not test
Copper (Cu)	-		-	1.3	Did not test
Boron (B) †	-		-	0.5	Did not test



Explanation of graph ranges:

Very Low
Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90%.

Low
Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90%.

Marginal
Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60%.

Adequate
Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30%.

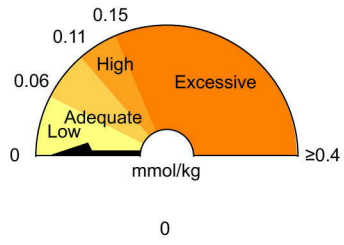
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.

• g/sqm measurements are based on soil bulk density of 1.33 tonne/m^3 and selected soil depth.

Phosphorus Saturation Index



0

Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**14.5**
Eff. Cation Exch. Capacity (eCEC):	**14.5**
Base Saturation (%):	**100**
Exchangeable Acidity (meq/100g^{-1}):	-
Exchangeable Acidity (%):	-

Lime Application Rate

– to achieve pH 6.0 (g/sqm):	**0**
– to neutralise Al (g/sqm):	-

Gypsum Application Rate

– to achieve 67.5% exch. Ca (g/sqm): **0**

The CGAR is corrected for a soil depth of mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	-
Colour:	-
Estimated clay content:	**Did not test**
Size:	-
Gravel content:	-
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Did not test**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	-

Requires EC and Soil Texture result.

Organic Carbon (OC%)†: **Did not test**
Organic Matter (OM%): -
Additional comments:

Consultant: Michelle Murphy

Authorised Signatory: Ryan Jacka

Date Report Generated 27/02/2017

METHOD REFERENCES:
pH (1:5 H_2O) - Rayment & Higginson (1992) 4A1,
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PO_4, K, SO_4, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - Mehlich 3 (1984),
Buffer pH and Hydrogen - Adams-Evans (1972)
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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

SESL AUSTRALIA
Environment & Soil Sciences

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 42347 **Sample N°: 3** **Date Received: 20/2/17** **Report Status:** ○ Draft ◉ Final

Client Name: **Asset Geotechnical**
Client Contact: **Denny Jacob**
Client Job N°:
Client Order N°:
Address: **Suite2.05/56 Delhi Rd North Ryde NSW 2113**

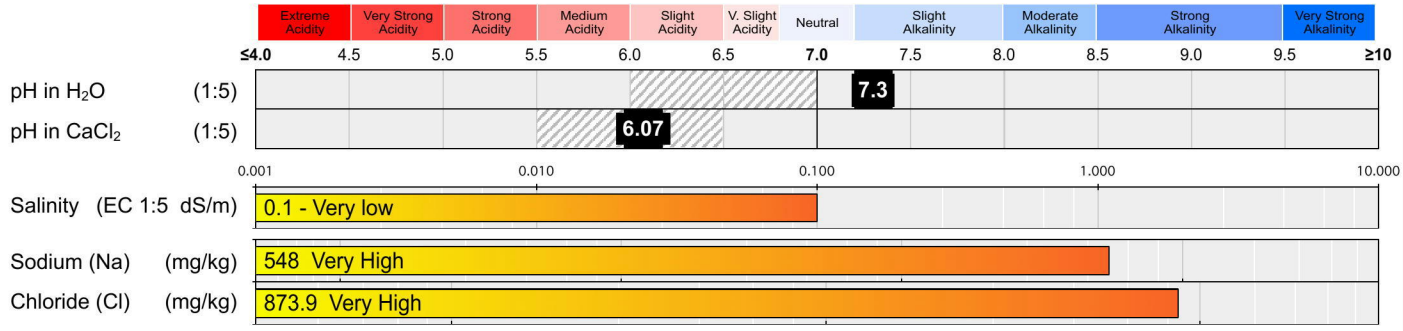
Project Name: **Ref: 4064 - 1 Water St Werrington**
SESL Quote N°:
Sample Name: **BH3 (0.3-0.4m)**
Description: **Soil**
Test Type: **USAWS**

RECOMMENDATIONS

Recommendations by SESL Australia not requested.

SOIL SAMPLE DEPTH (mm): ○ 100 ○ 150 ○ 200 **FERTILITY RATING:** ○ Low ○ Moderate ○ High

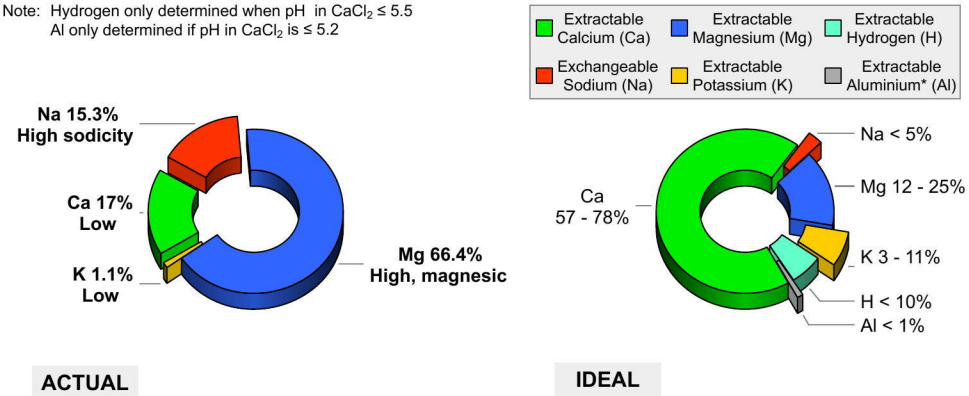
pH and ELECTRICAL CONDUCTIVITY



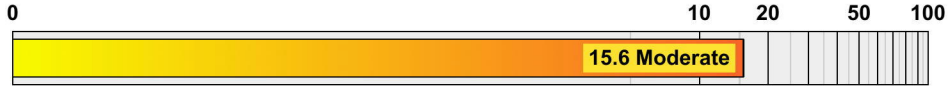
CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	0.3	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	61	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.01	< 0.07
Comment: Acceptable		
K:Na	0.1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS cmol(+)/kg

Na:	K:	Ca:	Mg:	H:	Al:
2.38	0.17	2.65	10.36		

SOLUBLE CATIONS cmol(+)/kg

Na:	K:	Ca:	Mg:

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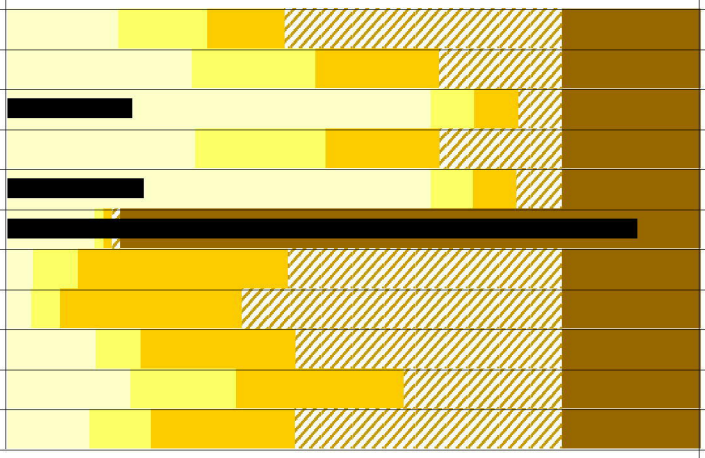
PLANT AVAILABLE NUTRIENTS

Major Nutrients	Result (mg/kg)	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	-		-	-	Did not test
Phosphate-P (PO_4)	-		-	12.6	Did not test
Potassium (K) †	68.4		13.6	60.6	47
Sulphate-S (SO_4)	-		-	13.6	13.6
Calcium (Ca) †	532		106.1	431.7	325.6
Magnesium (Mg) †	1259		251.2	44.9	Drawdown
Iron (Fe)	-		-	110.1	Did not test
Manganese (Mn) †	-		-	8.8	Did not test
Zinc (Zn) †	-		-	1	Did not test
Copper (Cu)	-		-	1.3	Did not test
Boron (B) †	-		-	0.5	Did not test



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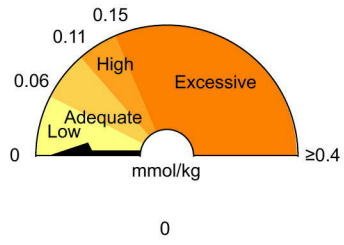

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