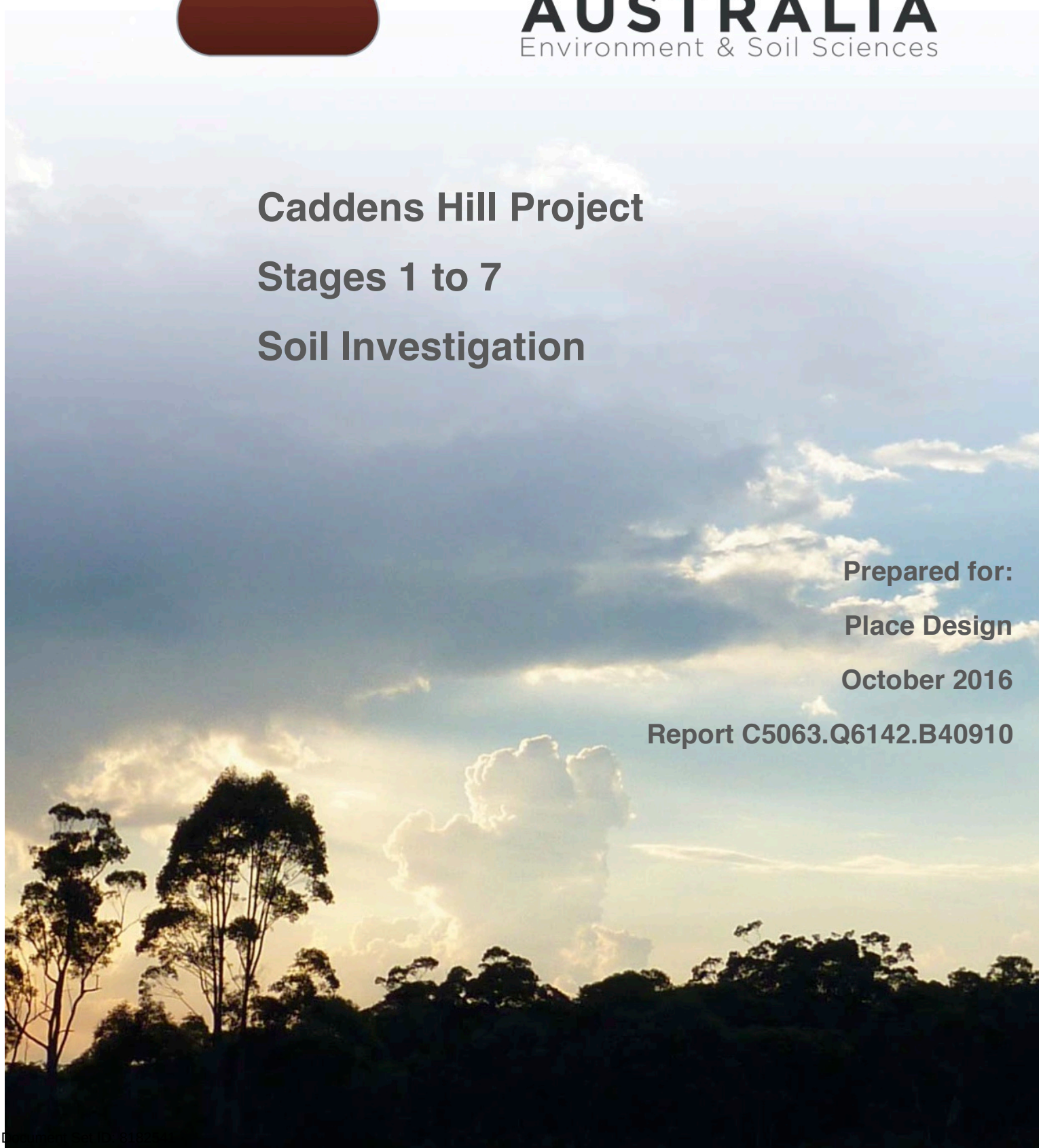
SESL AUSTRALIA
Environment & Soil Sciences

Caddens Hill Project

Stages 1 to 7

Soil Investigation



Prepared for:

Place Design

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Introduction

SESL Australia has been engaged by Place Design Group Pty Ltd (the Client) to undertake an on-site soil resource assessment at Caddens Hill – Stages 1 to 7 (the Site). The majority of the development works have not begun hence the soil has not been stripped and is still in-situ.

SESL understands that the topsoil will be used in the development site for multiple landscapes as listed:

1. Hill Top Park with turf grass and native plantings;
2. Street verges;
3. Wetland detention basins;
4. Entry statement areas and;
5. Sportsfields.

The objective of this assessment is to characterise the physical and chemical properties of the soil for the purpose of determining what soil amelioration is required for the different landscaping options. The soil from this landscape area is prone to waterlogging due to its high fines content therefore amelioration advise on the street verge plantings, wetlands and turf areas will be included to ensure compaction resulting in waterlogging doesn't become an issue.

The natural soil landscape is a combination of "South Creek" and "Luddenham" (Hazelton and Bannerman, 1990). This Luddenham soil landscape comprises of dark brown silty loam podsolics soils formed on Wianamatta Shales often associated with Minchinbury Sandstone. South Creek soils are formed on fine textured fluvial deposits associated with drainage lines and mostly show a deep profile of structured fine sandy clay loams overlying silty clay subsoils. They are associated with the floodplains of drainage networks of the Cumberland Plain. Both soil types are prone to waterlogging, flood hazards, permanently high water tables, erosion from water and surface movement. Luddenham soils are highly erodible and have hardsetting surfaces. South creek are often highly sodic in the subsoil and hence prone to undercutting and tunnel erosion.

This report provides advice on what soil amelioration is required for plant growth and the different landscapes options.

Methodology

The field assessment was carried out by Chantal Milner and Deanne Norris of SESL on Wednesday 5th October 2016.
Based on a discussion with Steven Holmes and Lingling Qiu from Place Design Pty Ltd it was decided that 13 locations would be selected for sampling from throughout the site. Exact locations were defined after a site walkover and assessing the differences in slope and topography. Samples were collected by hand auger to an average depth of 400mm so that the subsoil could also be assessed.

The collected samples were analysed for a range of soil chemistry properties. Soils were tested for pH, EC, exchangeable cations and plant available nutrients, organic matter and texture.

The pH, EC, exchangeable cations and plant available nutrients were all analysed utilising the Mehlich 3 extract. Mehlich 3 (M3) estimates plant availability of most macro- and micronutrients on soils acid to neutral pH using a dilute acid-fluoride-EDTA solution of pH 2.5. The method has shown to be well correlated to crop response to fertilizer phosphorus and applicable for the determination of extractable potassium, calcium, magnesium, sodium and micronutrients, such as manganese, iron, copper and zinc (Mehlich, 1984). Organic matter was assessed using dumus combustion to the ASTM D7573-09 method. Texture was determined using SESLs own procedure (SESL PM0003) which is based on Northcote (1992).

Field & Laboratory Results

Topsoil Physical and Chemical Properties

The soil showed evidence of a clay based material exposed to frequent waterlogging seen as mottling of bright oranges and reds. Mottling is the result of oxidation and reduction reactions due to waterlogging. The waterlogging is a result of the texture (sandy clay loam to light clay) of the material which is fine and has a high clay content which increases with depth. Mottling due to seasonal wetting and drying is typical of the low-lying soil of the Luddenham soil landscape.

Chemically he soil has slight to strong acidity with low salinity. The cation exchange is variable with some samples dominated by hydrogen or are highly magnesic and sodic, others are just magnesic or have a balanced cation exchange. Overall nutrients are low aside from manganese and magnesium. High manganese is indicative of waterlogging. Magnesium is generally prevalent in subsoils only and its presence in topsoil is consistent with a low-lying and intermittently waterlogged condition. Iron/manganese concretions (“shotgun pellets”) are common at the A/B boundary indicating intense wetting and drying cycles typical of the Eastern Australian climate. This is a result not only of extreme variations in rainfall but poor internal drainage of the soils.

The chemical and physical test results are presented in Appendix A. Table 1 summarises the topsoil chemical and physical test results.

Table 1. Topsoil (A-Horizon) chemical and physical analysis results.

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13
Sample Name	BH1 0-300	BH2	BH3 0-300	BH4 0-200	BH5 0-200	BH6 0-200	BH7 0-200	BH8 0-200	BH9 0-280	BH10 0-200	BH11 0-350	BH12 0-200	BH13 0-170
pH in H_2O	6.2	7.3	6.2	6.0	6.6	6.6	6.4	6.6	6.5	6.4	7.1	6.6	6.4
pH in $CaCl_2$	5.5	6.4	5.5	5.5	5.7	6.0	5.8	5.8	5.7	5.4	6.4	6.0	5.4
EC dSm	0.1	0.2	0.1	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Na mg/kg	23.5	377.	32.5	203	62.5	57.8	40	22.7	17.8	62.2	3	13.7	82.8
Cl mg/kg	30.7	223	26.8	207	25	40.8	77.4	36.6	40.1	45.6	43.4	46.1	46
Na % CEC	0.8	13.6	1.8	9.3	4.5	1.7	0.8	0.8	0.6	1.4	1.0	0.6	2.4
K % CEC	3.1	1.8	5.3	2.7	4.3	3.6	6.5	5.7	6.7	3.8	1.5	4.9	2.5
Ca % CEC	38.0	35.7	52.9	35.8	3	51.6	63.1	73.6	64.5	41.9	71.4	71.6	32.8
Mg % CEC	29.3	48.9	40.4	52.6	53.3	42.9	29.6	19.9	27.8	29.2	25.9	22.7	32.6
H % CEC	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.2	0.0	0.0	29.5
Al % CEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
eCEC meq/100g	12.9	12.1	7.6	9.5	6.0	14.6	20.9	13.2	13.2	18.8	16.8	10.9	14.8
NO_3 mg/kg	6.4	2.8	9.2	1.0	1.3	6.4	11	1.2	4.4	3.4	5.8	5.4	3.9
PO_4 mg/kg	6.0	7.9	21.6	3.0	2.8	5.3	42.7	6.5	4.8	4.1	54.	10.4	2.7
K mg/kg	158	85.5	158	103	103	203	529	294	344	283	97.8	208	143
SO4 mg/kg	11	8.7	12	10	7.9	8.9	12	8.5	7.7	8.5	5.7	7.8	11
Ca mg/kg	982	866	805	681	456	151	2643	1948	1707	1580	2403	1562	972
Mg mg/kg	460	718	373	607	389	761	752	320	446	666	529	301	586
Fe mg/kg	224	179	270	195	160	205	230	179	149	211	156	155	167

Mn mg/kg	182	268	156	84	267	100	54	290	99	137	219	270	60
Cu mg/kg	4.8	2.2	2.5	2.6	2.3	2.5	3.7	14	3.3	3.5	15	25	2.7
B mg/kg	0.4	0.3	0.3	0.3	0.3	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.3
Zn mg/kg	4.1	3.2	4.6	2.2	2.7	4.8	5.1	4.5	6.8	4.0	4.0	3.4	1.6
Organic matter	5.2	1.0	5.3	4.6	4.4	5.1	5.4	5.7	5.7	5.7	2.5	3.9	3.2
Texture	Clay Loam	Sandy Clay	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Clay Loam	Light Clay	Clay Loam	Clay Loam	Clay Loam	Sandy Clay Loam	Sandy Clay	Clay Loam
Infiltration Rate	Moderate	Slow	Moderate	Moderate	Moderate	Moderate	Slow	Moderate	Moderate	Moderate	Moderate	Slow	Moderate

- Please round all exchangeable mg/kg to no decimal places while you are still in xls. It is much more laborious in WORD.

Table 2. Subsoil (B-Horizon) chemical and physical analysis results.

Sample Number	**14**	**15**	**16**	**17**
Sample Name	BH3 300-400	BH4 250-400	BH12 200+	BH13 170+
pH in H_2O	6.6	6.5	6.8	7.1
pH in $CaCl_2$	5.1	6.1	5.9	6.0
EC dSm	0.1	0.7	0.0	0.1
Na mg/kg	268	731	23	195
Cl mg/kg	0.0	0.0	0.0	0.0
Na % CEC	7.5	18.9	0.7	5.0
K % CEC	0.6	0.9	2.3	1.4

Ca % CEC	19.4	23.9	74.3	45.0
Mg % CEC	44.2	56.0	22.5	48.7
H % CEC	28.3	0.0	0.0	0.0
Al % CEC	0.1	0.0	0.0	0.0
eCEC meq/100g	15.4	16.8	14.8	16.9
K mg/kg	36	58	134	94
Ca mg/kg	598	806	2202	1525
Mg mg/kg	828	1143	404	1001
Texture	Medium Clay	Light Medium Clay	Sandy Clay	Light Clay
Structure	Polyhedral	Polyhedral	Polyhedral	Polyhedral
Aggregate Strength	Pedal - Strong	Pedal - Moderate	Pedal - Moderate	Pedal - Strong
Permeability	Slow	Slow	Slow	Slow

As areas are to be developed sequentially in stages it is useful to classify each development stage by soil type into seven (7) discrete areas defined by the stage of work-

Stage 1 (Boreholes 11 and 12)

This sandy clay to sandy clay loam soil is slightly acidic in $CaCl_2$ with desirably low salinity, sodium and chloride levels. The cation exchange is balanced. The eCEC is moderate indicating that this soil holds onto nutrients well. Nutrients are low deficient aside from magnesium and manganese. This is indicative of soils that waterlog.
Organic matter = 2.5% (moderate) to 3.9% (high).
This soil type contain20-30% to 35-45% clay therefore have a slow permeability and a greater tendency for waterlogging.

Subsoil BH12

Subsoill is a sandy clay with a moderate polyhedral structure and slow permeability. It is moderately acidic with desirably low salinity and sodium. The cation exchange is close to being balanced. The eCEC is moderate.

Stage 2 (Borehole 5)

Soil is a sandy clay loam with moderate permeability. It is moderately acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic and slightly sodic. The eCEC is low.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is high at 4.4%

Stage 3 (Borehole 8)

Soil is a clay loam with moderate permeability. It is moderaely acidic with desirably low salinity, sodium and chloride. The cation exchange is balanced. The eCEC is moderate.
NPS are low and need boosting. Manganese is high as the result of waterlogging. Potassium is also high.
Organic matter is very high at 5.7%

Stage 4 (Boreholes 6 and 7)

BH6

Soil is a clay loam with moderate permeability. It is slightly acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic. The eCEC is moderate.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is high at 5.1%

BH7

Soil is a light clay with slow permeability. It is moderaely acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic. The eCEC is moderate.
N & P are marginal, sulphate is low. Manganese is high as the result of waterlogging. Potassium is also high.
Organic matter is very high at 5.4%

Stages 5 & 6 (Boreholes 9, 10 and 13)

Soil is a clay loam with moderate permeability. It is moderately to strongly acidic with desirably low salinity, sodium and chloride. The cation exchange is balanced in BH9 however BH10 and BH13 are dominated by hydrogen which explains the strong acidity. The eCEC is moderate indicating that the soils retain nutrients well.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is moderate (3.2%) to very high at 5.7%

BH13 Subsoill is a light clay with a strong polyhedral structure and slow permeability. It is slightly acidic with desirably low salinity and moderate sodium. The cation exchange is highly magnesic and sodic. The eCEC is moderate.

Stage 7 (Borehole 1 to Borehole 4)

Soil is a clay loam to sandy clay loam with moderate permeability. It is moderately to strongly acidic with desirably low salinity, sodium and chloride aside from BH2 and BH4 which have high sodium and chloride levels. The cation exchange is primarily magnesic and sodic aside from BH1 which is dominated by hydrogen which explains the strong acidity. BH1 and BH2 have a moderate eCEC indicating that the soils retain nutrients well however BH3 and BH4 have a low eCEC indicating poor nutrient holding capacity.
NPK, S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is low (1%) to very high at 5.3%

BH3 Subsoil is a medium clay with a strong polyhedral structure and slow permeability. It is strongly acidic with desirably low salinity and high sodium. The cation exchange is dominated by hydrogen which explains the acidity. It is also sodic and magnesic. The eCEC is moderate.

BH4 Subsoil is a light medium clay with a moderate polyhedral structure and slow permeability. It is slightly acidic with high salinity and very high sodium. The cation exchange is highly magnesic and sodic. The eCEC is moderate.

Discussion

The purpose of this investigation is to assess the soil conditions for reuse in the following areas of the development that are outlined in Table 3.

Table 3. Landscape types and the correlated development stage.

Development Stage	Landscape Type	Soil type required
1	Street verges and residential properties with general planting	Local soil
2	Street verges and residential properties with general planting	Local soil
3	Street verges and residential properties with general planting	Local soil
4	Hill Top Park, street verges and residential properties with general planting	Local soil
5 & 6	Detention basin x 2 and Street verges and residential properties with general planting	Local soil Imported loamy sand for detention basins.
7	Sportsfield and detention basin	Imported loamy sand for detention basins. Local soil or imported loamy sand for the sportsfield.

The performance of the soil is judged on its chemical and physical properties. Ideally a good performing soil for landscaping would have a neutral pH, low salinity, balanced cation exchange and moderate nutrients. Physically the permeability would be moderate for landscaping areas and rapid for sportsfields.

The best soils from this site, based on texture are fine sandy clay loams. Significant areas comprise sandy clay loam with 20-30% clay with low to moderate permeability. The next best soils are the clay loams. The least preferred soils are the light clays with 35-40% clay and slow permeability. Fortunately, the majority of the samples are sandy clay loams to clay loams.

Summary of issues to be addressed

In summary here are several issues that need to be addressed in order to improve and restore the soil for landscaping use:

- *Dispersion due to sodic and magnesic chemistry* – The magnesium and sodium salts can cause the soil surface to loose structure, harden, crust and as a result become dispersive. An application of gypsum will help correct the cation balance and flush out these salts.

- *Acidic pH*. As vegetation develops it acidifies its soil by depleting it of calcium. To counteract the soils becoming even more severely acidic we recommend lime additions to allow vegetation to develop properly.

- *High manganese levels*. Manganese levels range up to 290mg/kg. High manganese levels are indicative of waterlogging, which is further supported by the mottling which is apparent in most profiles.

- *Deficient nutrients* – The nutrient levels are extremely deficient in particular the macronutrients. The soil will need fertilization prior to planting to ensure the vegetation isn't hungry.

- *Potential compaction issues* in passive amenity turf and sportsfield areas. Import a loamy sand soil for the sportsfield areas. Refer to Appendix C – Active Turf Specification.

  Ensure adequate rooting volume for street trees – Due to the heavy nature of the subsoil tree root systems will be very dependant on lateral spread to provide adequate rooting volume. This is often limiting where infrastructure such as paths and kerbs limit lateral spread.

The main limitations for the restoration will be to improve the nutrition of the soil, reducing the acidity and improving the soil structure to prevent dispersion and hardsetting characteristics. The high clay content of the soil will cause compaction and waterlogging issues in the sportsfield areas unless a suitable soil is imported or drainage solutions are employed. Generally the soils can be expected to drain slowly hence choice of plantings should be adapted to periods of waterlogging.

Recommendations (for contractor use).

The following section is divided into 4 areas for contractor use:

1. Soil stripping process.
2. Stockpiling process.
3. Site subgrade preparation and treatment.
4. Topsoil Treatment Process.
5. Topsoil re-spreading for use in landscape.

Soil Stripping and Amelioration Process

Stripping and stockpiling of topsoil should occur immediately before bulk earthworks and be done in such a manner as to minimise erosion and sediment loss from site. Preparation is necessary to ensure that rubbish and foreign matter is minimised in the stripped soil. Stockpiles must be located in a convenient place away from any risk of running water and subject to suitable erosion control measures. They must be protected from contamination during the construction process and records kept of their location and type of soil, if any, they contain.

Table 4. Stripping process

Preparation:	• Clear all debris including demolition waste, timber, rubbish wire fences, rock, gravelled driveways etc. • Clear trees and shrub growth and slash if necessary. • Clear pasture and weed growth if heavy or otherwise a problem spray with a broad spectrum herbicide at manufacturers rates and allow 1–2 weeks to obtain kill before stripping.
Stripping:	• Avoid the inclusion of subsoil in topsoil stripping, adjust depth accordingly. Stop stripping if the more brightly coloured clay subsoil starts showing. • In areas of very heavy pasture growth remove the top 50mm of thatch and weed-seed bank and stockpile separately. • Strip topsoil to 200mm or to just above the clay subsoil.

1. Stockpiling Process

Stockpiling of topsoil should occur immediately before bulk earthworks and be done in such a manner as to minimise erosion and sediment loss from site. Preparation is necessary to ensure that rubbish and foreign matter is minimised in the stripped soil.

Stockpiles must be located in a convenient place away from any risk of running water and subject to suitable erosion control measures. They must be protected from contamination during the construction process and records kept of their location and type of soil.

- Locate stockpiles 5 m or more from concentrated water flows (including drainage lines, roadways).
- Locations should have less than 10% slope.
- Locate greater than 8 m from any retained trees.
- Protect upslope using diversion drains.
- Protect downslope sediment loss using sediment control structures (silt fencing or other approved method).
- Stockpiles must be no higher than 2 m but may be flat topped.
- Label stockpiles with origin and date.
- Protect stockpiles from waste and rubbish dumping and encroachment of works.
- If stockpiles are to be in place longer than 3 months, sow with a seasonally appropriate annual cover crop

2. Site subgrade preparation and treatment

Before laying topsoil, the following **subgrade treatment** must be applied to all finished subgrade areas:

1. Fair and trim to relative level to accommodate the required overall soil depths
2. Remove rocks > 50 mm diameter.
3. Remove rubbish such as construction generated waste, plastics, metals and glass.
4. Apply ameliorants according to the following schedule in Table 5 to ameliorate the subgrade.

Table 5. Subsoil treatments.

Landscape treatment	**Gypsum g/m^2**
All exposed subgrade (landscaping areas only)	400

5. Chisel, disc plough or use an excavator with a tyne attachment to loosen the subgrade and mix the ameliorants to 200 mm depth to incorporate.

Note: Use an excavator with a tyne or ripping blade for operations on the steeper batters or where access is difficult. Its imperative during the stripping that the process is carefully supervised to ensure that both weeds and subsoil are not included with the topsoil.

3. Topsoil Treatment Process

These soils are magnesic and sodic which are prone to dispersion therefore gypsum is needed to improve the structure of the soil. The majority of the nutrients require boosting therefore a NPK+TE compound fertiliser or straights are required for most soil areas. Soils are not overly acidic for general landscaping purposes.

Table 6. Schedule of amelioration requirements.

Landscape Type	Stage	Bore Hole	Fertiliser	Gypsum	Lime	Green Waste Compost
General planting	1	11 & 12	***Exotics*** $50g/m^2$ or $0.5kg/m^3$ of Pasture Boosta or similar. ***Natives*** $100g/m^2$ or $1kg/m^3$ of Bush Tucker or native fertiliser.	-	-	20L/m2 or 200L/m3
	2	5		-	-	
	3	8		-	-	
	4	6 & 7		$250g/m^2$ or $2.5kg/m^3$ of gypsum	-	
	5 & 6	9, 10 & 13		$200g/m^2$ or $2.0kg/m^3$ of gypsum	$200g/m^2$ or $2.0kg/m^3$ of lime	
Street Verges	1	11 & 12	$50g/m^2$ or $0.5kg/m^3$ of Nutricote Black or similar.	-	-	-
	2	5		-	-	
	3	8		-	-	
	4	6 & 7		$250g/m^2$ or $2.5kg/m^3$ of gypsum	-	
	5 & 6	9, 10 & 13		$200g/m^2$ or $2.0kg/m^3$ of gypsum	$200g/m^2$ or $2.0kg/m^3$ of lime	
Hill Top Park	4	6 & 7	***Exotics*** $50g/m^2$ or $0.5kg/m^3$ of Pasture Boosta or similar. ***Natives*** $100g/m^2$ or $1kg/m^3$ of Bush Tucker or native fertiliser.	$250g/m^2$ or $2.5kg/m^3$ of gypsum	-	20L/m2 or 200L/m3
Sportsfield	7	1, 2, 3 & 4	$50g/m^2$ or $0.5kg/m^3$ of Pasture Starter or similar. NB: May not be required for imported soil.	$300g/m^2$ or $3kg/m^3$ of gypsum for site soil only.	-	-

				NB: May not be required for imported soil.		
Detention Basin	5 & 6	9, 10 & 13	No fertiliser requirements in the imported filtration layer	250g/m^2 or 2.5kg/m^3 of gypsum for subsoil only		
	7	1, 2, 3 & 4				

(a) Exotics = Use a general purpose NPK+TE fertiliser such as Pasture Boosta for turf areas or Nutricote Black for tree plantings.
(b) Natives = Use a low P formulation such as Neutrog Bush Tucker, Patons Native Mix or Osmocote Low P slow release

4. Topsoil re-spreading for use in landscape.

The method of application that proves most economical is usually:

1. Spray weed growth on the soil stockpiles with a 1:50 dilution (or the manufacturers specification) of Roundup or other brand of Glyphosate concentrate and wait 2 weeks;
2. Remove excess rank weed growth;
3. Apply the ameliorants as specified in Table 6 either in bulk by the cubic metre as stockpiles are exploited or on a square meter basis to re-spread topsoils in-situ.;
4. If applying to re-spread topsoils incorporate ameliorants into the surface 150mm using chisel ploughs;
5. Leave in loose condition for planting, do not consolidate and ;
6. Alternatively, the soils fertilisers can be blended into the stockpiles using the m^3 application rate followed by thorough mixing.

Table 7. Recommended soil depths of topsoil (A-Horizon) and subsoil (B-Horizon).

Landscape Class	Topsoil Depth	Subsoil Depth
Turf areas	> 150mm	150mm
Shrubs/mass planting	250mm	200mm
Garden areas	250-300mm	200mm

Special Planting Situations

Street Trees

When discussing street trees there are a few main points that need to be addressed to ensure success of the plantings and to avoid any heaving due to the growth of tree roots.

1. Effective rooting volume of soil.
2. Tree species selection
3. Soil type and drainage systems
4. Use of structural soils or strata/silva cells.

1. Total effective rooting volume & tree species selection

The total soil volume is dependant on the tree size and as a rough guide should follow the below rooting volumes.

Small trees = 11.3m^3

Medium trees = 22.6m^3

Large trees = 34m^3

Depending on the interspacing between the trees the root system should be able to exploit the soil in a linear pattern therefore gaining further soil void space.

3. Soil type and drainage system

The site soil is primarily clay loam to a sandy clay loam therefore making this soil suitable for use as a filler media in structural soils (see below). Due to the heaviness of the soil a drainage system or at least a “u-pipe” aeration pipe at planting is advised to allow adequate ventilation.

4. Structural Soils or Strata/Silva Cells.

There are two main choices for the street trees which are to be planted in the street verges.

1. Structural soils
2. Strata cells

Both of these choices are designed for accommodating root systems underneath paved or sealed surface such as concrete or pavers. They could be used to improve rooting soil volumes for the trees by installing under the concrete or paved areas.

Structural support soils (SSS)

Structural soils are designed to form a basement for engineered structure such as roads, pavements and kerbing whilst also providing rooting volume for tree roots. Due to the high void space, they will permit root growth through the medium and also help distribute root pressures over a wider section of pavement, reducing or delaying pavement heaving by roots. The size of the aggregates or stone fraction determines how large the roots can grow before heaving occurs.

SSS is a two-part system comprised of a stone lattice for strength and structural support (load bearing) and filler soil to service the horticultural needs. The stone lattice provides structural stability through stone-to-stone contact, while also providing interconnected voids for root penetration, air and water movement. The system is engineered to maintain a high degree of porosity after installation and compaction. The intention is to 'suspend' the horticultural soil component of the blend between stones, which come together during compaction, producing a load-bearing, compacted stone lattice with uncompacted soil in the voids.

The ratio of filler soil to aggregate is the major consideration for achieving the engineering and horticultural objective. Thus the 'aggregate', 'filler soil' and blending ratio of the two need to be specified and carefully validated. Generally, it will be an amount of filler soil equal to half the void space of the compacted aggregate. Assuming the aggregate has a void space of 40%, it will be 10 parts aggregate by volume to 2 parts filler soil.

Important note: The total volume of SSS soil is determined by the volume of aggregate as adding filler soil does not increase the overall volume. Tree soil volume estimations must factor this into calculations for recommending soil volume.

Also note that SSS is only around 30% effective rooting volume so to gain one m^3 of rooting volume requires $3m^3$ of SSS.

Transport and placement of structural soils

Structural Soil must be a uniformly blended mixture of aggregate and filler soil and are prone to segregation during handling at the source and during transport. Particular care must be taken to ensure that all structural soil is thoroughly homogenised before placement and compaction. To assist this, and to prevent segregation, ensure that the mixture remains moist at all times during mixing transport, storage and placement.

Strata Cells or Silva Cells

Strata or Silva cells are likely to be a more expensive options however are the preferred choice when void space and soil volume is limited. The soil availability increases to 90% which means less space overall is required. However, a loam soil is best for use with these cells and the current site soil might have to be modified to meet this texture requirement.

Wetland Soils

It is essential that a highly permeable loamy sand medium is imported for use as the growing and filtration layer in biofiltration bed installations. It is recommended that a sand transition layer is installed below the filtration layer followed by a drainage layer i.e. 10mm aggregate installed below the transition layer.

Sportsfield Soils

The sandy clay loam soil is not recommended for use in the sportsfield areas. The heavy texture of the soil will lead to compaction and waterlogging issues. This can be overcome with the use of subsoil drainage combined with sand slit drainage to allow excess water to drain. Alternatively, and preferably, an imported soil that is suited to active high traffic areas is recommended. An 'Active high-traffic turf' specification has been included in Appendix C.

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ACT 2601

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VIC 3031

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Level 10
15 Green Square Cl
Fortitude Valley
QLD 4006

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NATA WORLD RECOGNISED ACCREDITATION
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The soil texture is predominantly a clay loam to sandy clay loam with 20% being a light clay. This is acceptable for passive amenity turf areas however not recommended for sportsfield activities. Importing 100mm of sand combined with sand slitting and sand grooving may need to be considered if local soil is to be used. Clay loams like this can be used but budgets must allow for retrofitting of sand slit drainage and sand grooving within 2 years of construction. This can be a way of defraying cost into the future but sand slit drainage needs to be renewed every 5-10 years and in the long term using a sandy sportsfield soil in the first place is lower cost.

Sand Slit Drainage

Sand slitting is the method of cutting narrow trenches that are backfilled with drainage pipes and sand using specialist equipment by a contractor. This is an effective method to improve drainage in compacted sportsfield soil and is usually combined with the installation of trunk drains and sand grooves to interconnect the subsoil drainage with the surface.

Sand Grooving

The technique involves cutting slots to 10mm wide to around 75-100mm depth at 300mm centres and backfilling these with sand thereby connecting the surface with the sand slit drains. It is installed by specialist contractors and can improve the drainage of otherwise unsuitable soils for 5-10 years depending on maintenance.

Summary

The soils are typical of the South Creek and Luddenham landscape, which are acidic, sodic and magnesic. This chemistry is hostile which is acceptable for Australian natives however for general landscaping the chemistry requires improvement to prevent the plants from hunger. The chemistry of the soil requires ameliorating with gypsum, lime and the relevant compound or straight fertiliser. Due to relatively high organic matter levels the use of imported compost is not considered necessary except for the higher quality landscape areas.

Due to the physical nature of the site soil, it is suitable for the following landscaping areas:

1. Hill Top Park with turf grass and native plantings;
2. Street verges and;
3. Entry statement areas.

The wetland detention basins and the sportsfield will require imported soil to meet the correct texture requirements for these landscapes. A specification has been provided for sportsfield soils.

In our opinion if our instructions are followed this soil will be acceptable for reuse at the Caddens Hill development project.

Please feel free to contact our office with any questions you may have.
Sincerely,

SESL Australia.

Chantal Milner
Soil Scientist

Simon Leake
Principal Soil Scientist

References

Bannerman, S.M. and Hazelton, P.A. (1990), *Soil Landscapes of the Penrith 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.

Mehlich, A. (1984) *Mehlich-3 soil test extractant: a modification of Mehlich-2 extractant*. Commun. Soil Sci. Plant Anal. 15(12):1409-1416.

Appendices

Appendix A: Laboratory Analysis

Appendix B: Site Map

Appendix C: Specification

Appendix D: Site Photos

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Appendix A
Laboratory Analysis

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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Batch N°: 40910 **Sample N°: 1** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

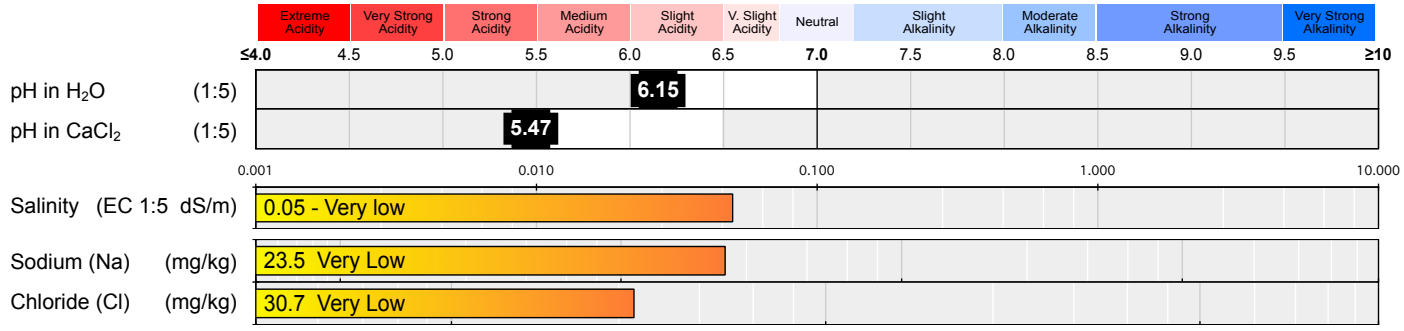
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH1 0-300**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a clay loam with moderate permeability. It is strongly acidic with desirably low salinity and sodium. The cation exchange is dominated by hydrogen which explains the acidity. The eCEC is moderate.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Orgnic matter is very high at 5.2%

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

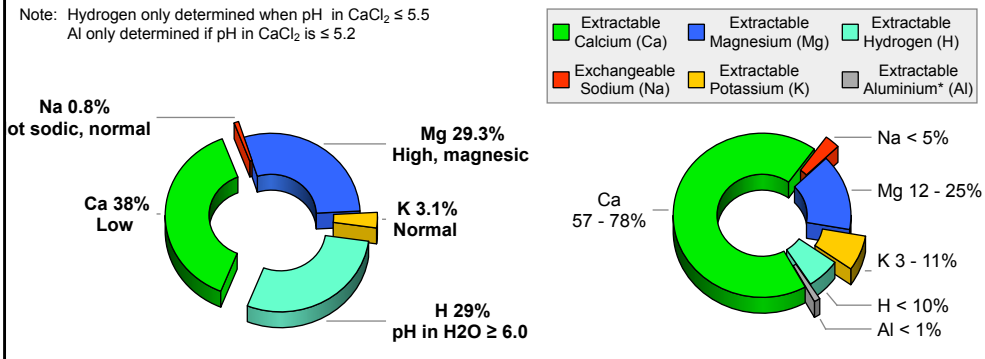
pH and ELECTRICAL CONDUCTIVITY



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	1.3	4.1 – 6.0
Comment: Calcium low		
Mg:K	9.5	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.05	< 0.07
Comment: Acceptable		
K:Na	4	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.10	0.40	4.90	3.79	3.74	

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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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.

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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Batch N°: 40910 **Sample N°: 1** **Date Received: 5/10/16** **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)	6.4		0.9	4	3.1
Phosphate-P (PO_4)	6		0.8	8.4	7.6
Potassium (K) †	158		21	34.8	13.8
Sulphate-S (SO_4)	11		1.5	9	7.5
Calcium (Ca) †	982		130.6	248	117.4
Magnesium (Mg) †	460		61.2	25.8	Drawdown
Iron (Fe)	224		29.8	73.4	43.6
Manganese (Mn) †	182		24.2	5.9	Drawdown
Zinc (Zn) †	4.1		0.5	0.7	0.2
Copper (Cu)	4.8		0.6	0.8	0.2
Boron (B) †	0.4		0.1	0.4	0.3

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%.

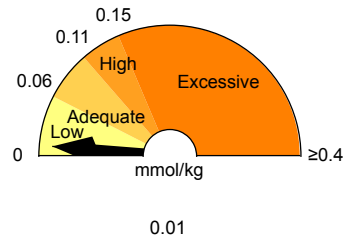
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.4**
Sum of Base Cations (meq/100g^{-1}):	**9.2**
Eff. Cation Exch. Capacity (eCEC):	**12.9**
Base Saturation (%):	**71.32**
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):	**436**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Clay Loam**
Colour:	**-**
Estimated clay content:	**25 - 35%**
Size:	**-**
Gravel content:	**Not gravelly**
Aggregate strength:	**-**
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.4**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3 – Very high**
Organic Matter (OM%): **5.2**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Batch N°: 40910 **Sample N°: 2** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

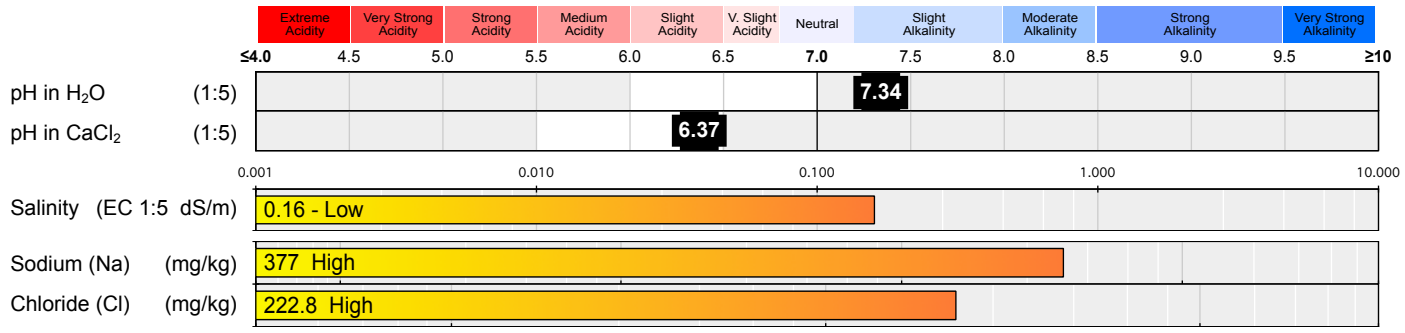
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH2**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a sandy clay with slow permeability. It is slighty acidic with low salinity and high sodium and chloride. The cation exchange is magnesic and sodic. The eCEC is moderate.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Orgnic matter is very low at 1%

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

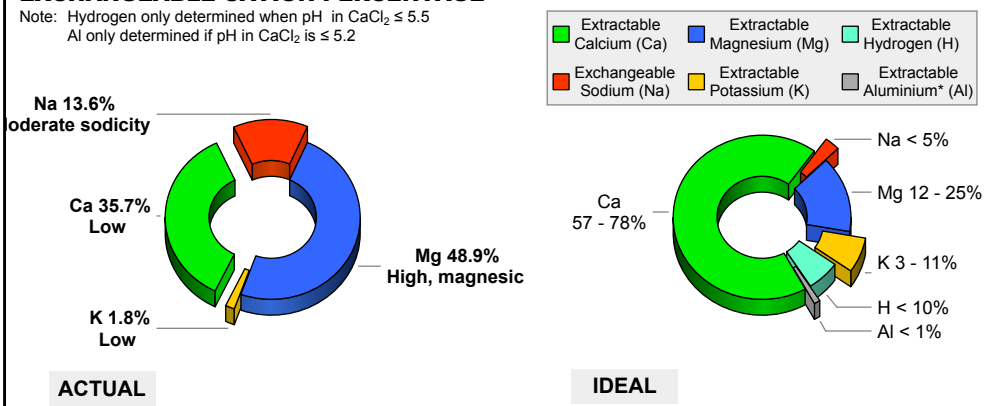
pH and ELECTRICAL CONDUCTIVITY



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	0.7	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	26.9	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	0.1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
1.64	0.22	4.32	5.91		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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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.

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Soil Chemistry Profile

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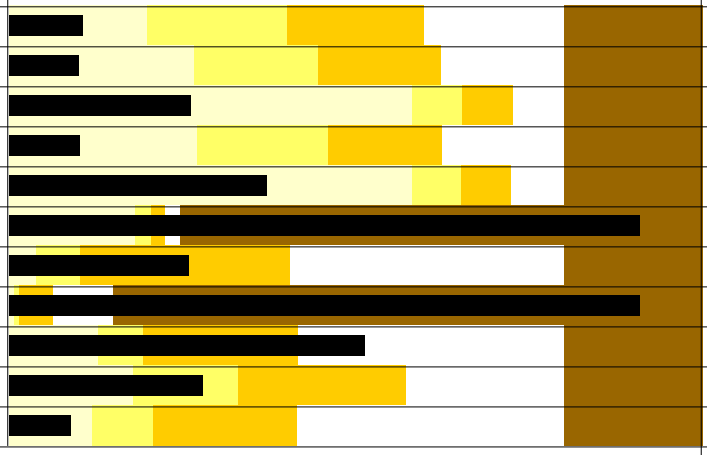
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 2** **Date Received: 5/10/16** **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)	2.8		0.4	4	3.6
Phosphate-P (PO_4)	7.9		1.1	8.4	7.3
Potassium (K) †	85.5		11.4	34.8	23.4
Sulphate-S (SO_4)	8.7		1.2	9	7.8
Calcium (Ca) †	866		115.2	248	132.8
Magnesium (Mg) †	718		95.5	25.8	Drawdown
Iron (Fe)	179		23.8	73.4	49.6
Manganese (Mn) †	268		35.6	5.9	Drawdown
Zinc (Zn) †	3.2		0.4	0.7	0.3
Copper (Cu)	2.2		0.3	0.8	0.5
Boron (B) †	0.3		0	0.4	0.4



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%.

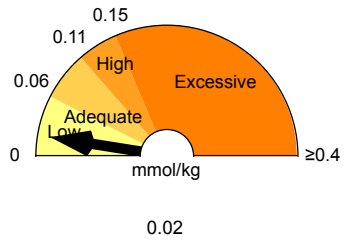
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



0.02

Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**12.1**
Eff. Cation Exch. Capacity (eCEC):	**12.1**
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):	**440**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Sandy Clay**
Colour:	-
Estimated clay content:	**35 - 45%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**1.4**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **0.6 – Very low**
Organic Matter (OM%): **1**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Batch N°: 40910 **Sample N°: 3** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

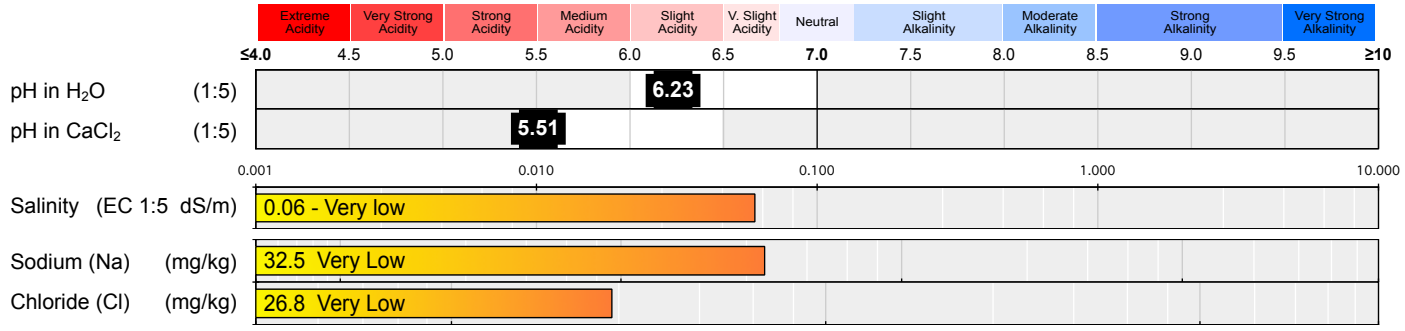
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH3 0-300**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a sandy clay loam with moderate permeability. It is moderately acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic. The eCEC is low.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Orgnic matter is very high at 5.3%

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

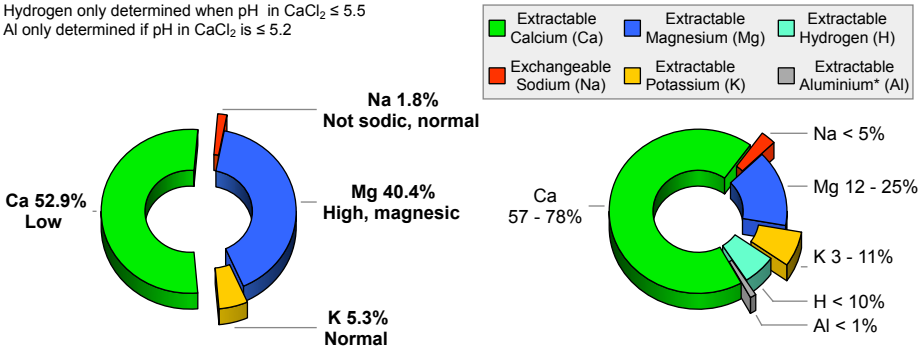
pH and ELECTRICAL CONDUCTIVITY



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	1.3	4.1 – 6.0
Comment: Calcium low		
Mg:K	7.7	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.06	< 0.07
Comment: Acceptable		
K:Na	2.9	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.14	0.40	4.02	3.07		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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Soil Chemistry Profile

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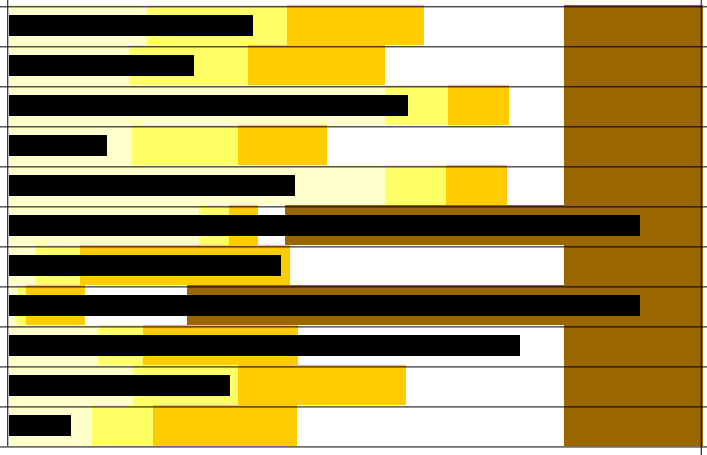
Batch N°: 40910 **Sample N°: 3** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

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)	9.2		1.2	4	2.8
Phosphate-P (PO_4)	21.6		2.9	8.4	5.5
Potassium (K) †	158		21	29.3	8.3
Sulphate-S (SO_4)	12		1.6	9	7.4
Calcium (Ca) †	805		107.1	208.3	101.2
Magnesium (Mg) †	373		49.6	21.7	Drawdown
Iron (Fe)	270		35.9	73.4	37.5
Manganese (Mn) †	156		20.7	5.9	Drawdown
Zinc (Zn) †	4.6		0.6	0.7	0.1
Copper (Cu)	2.5		0.3	0.8	0.5
Boron (B) †	0.3		0	0.4	0.4



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%.

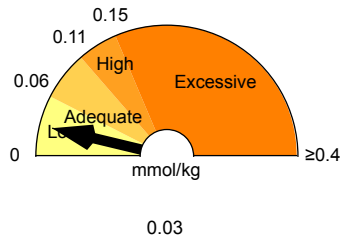
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



0.03

Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**7.6**
Eff. Cation Exch. Capacity (eCEC):	**7.6**
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):	**127**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Sandy Clay Loam**
Colour:	-
Estimated clay content:	**20 - 30%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.6**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3.1 – Very high**
Organic Matter (OM%): **5.3**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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°: 40910 **Sample N°: 4** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

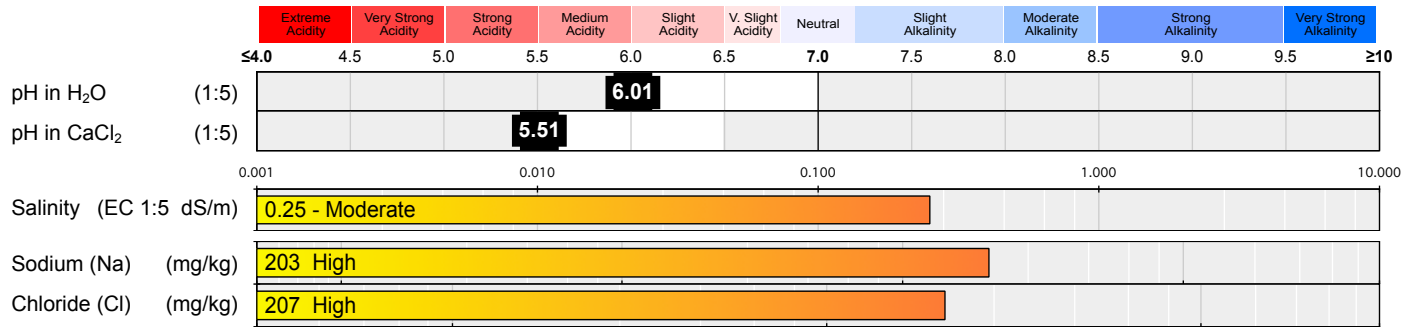
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH4 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a sandy clay loam with moderate permeability. It is moderaely acidic with moderate salinity and high sodium and chloride. The cation exchange is magnesic and sodic. The eCEC is low.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Orgnic matter is high at 4.6%

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

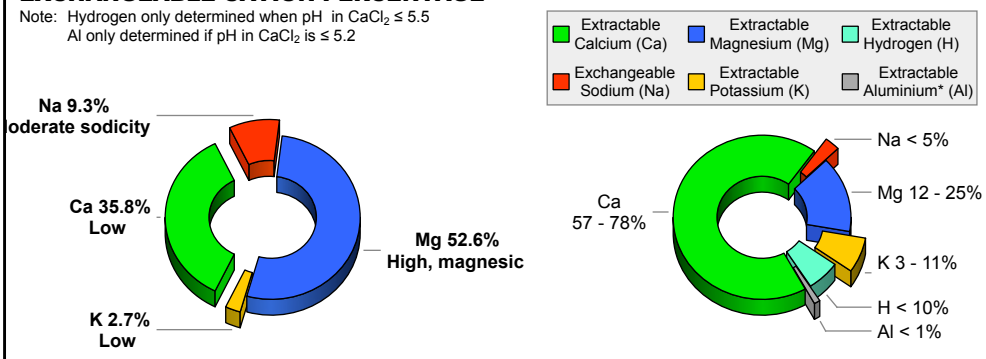
pH and ELECTRICAL CONDUCTIVITY



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	0.7	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	19.2	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.03	< 0.07
Comment: Acceptable		
K:Na	0.3	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.88	0.26	3.40	5.00		

SOLUBLE CATIONS (meq/100g)

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

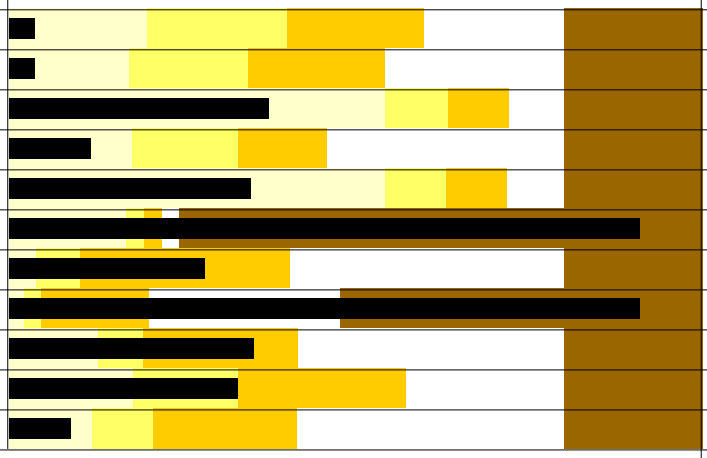
Mehlich 3 - Multi-nutrient Extractant

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

Batch N°: 40910 **Sample N°: 4** **Date Received: 5/10/16** **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)	0.97		0.1	4	3.9
Phosphate-P (PO_4)	3		0.4	8.4	8
Potassium (K) †	103		13.7	29.3	15.6
Sulphate-S (SO_4)	10		1.3	9	7.7
Calcium (Ca) †	681		90.6	208.3	117.7
Magnesium (Mg) †	607		80.7	21.7	Drawdown
Iron (Fe)	195		25.9	73.4	47.5
Manganese (Mn) †	84		11.2	5.9	Drawdown
Zinc (Zn) †	2.2		0.3	0.7	0.4
Copper (Cu)	2.6		0.3	0.8	0.5
Boron (B) †	0.3		0	0.4	0.4



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%.

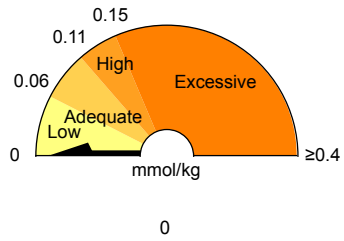
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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}):	**9.5**
Eff. Cation Exch. Capacity (eCEC):	**9.5**
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):	**345**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Sandy Clay Loam**
Colour:	-
Estimated clay content:	**20 - 30%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**2.4**

– Slightly saline. Growth on sensitive plant species is affected.

Organic Carbon (OC%)†: **2.7 – High**
Organic Matter (OM%): **4.6**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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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
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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 5** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

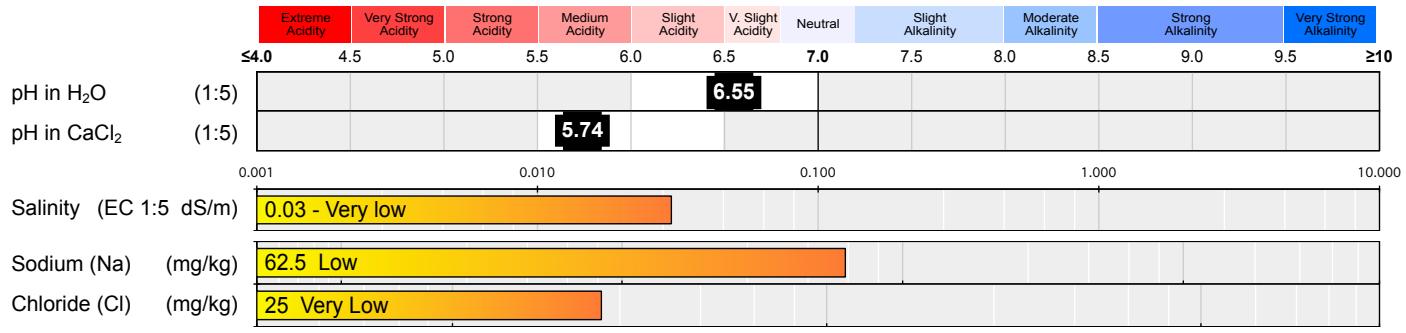
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH5 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a sandy clay loam with moderate permeability. It is moderaely acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic and slightly sodic. The eCEC is low.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is high at 4.4%

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

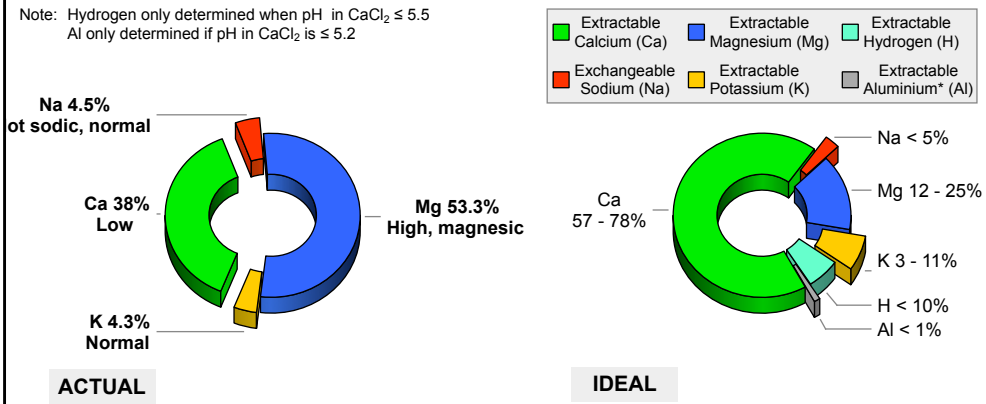
pH and ELECTRICAL CONDUCTIVITY



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	0.7	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	12.3	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.05	< 0.07
Comment: Acceptable		
K:Na	1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.27	0.26	2.28	3.20		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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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

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Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
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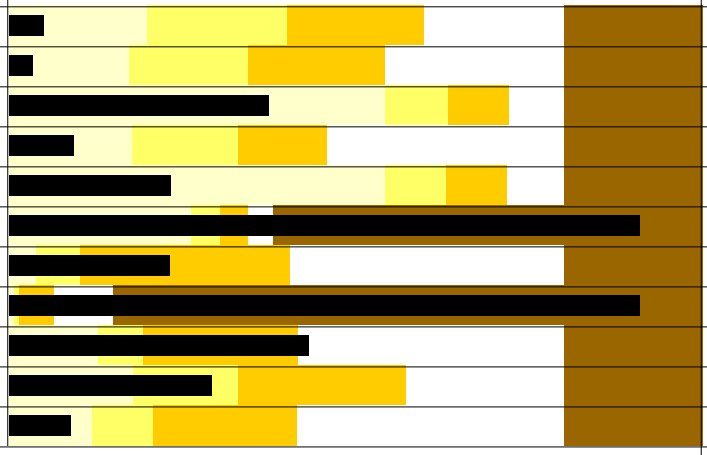
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 5** **Date Received: 5/10/16** **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)	1.3		0.2	4	3.8
Phosphate-P (PO_4)	2.8		0.4	8.4	8
Potassium (K) †	103		13.7	29.3	15.6
Sulphate-S (SO_4)	7.9		1.1	9	7.9
Calcium (Ca) †	456		60.6	208.3	147.7
Magnesium (Mg) †	389		51.7	21.7	Drawdown
Iron (Fe)	160		21.3	73.4	52.1
Manganese (Mn) †	267		35.5	5.9	Drawdown
Zinc (Zn) †	2.7		0.4	0.7	0.3
Copper (Cu)	2.3		0.3	0.8	0.5
Boron (B) †	0.3		0	0.4	0.4



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%.

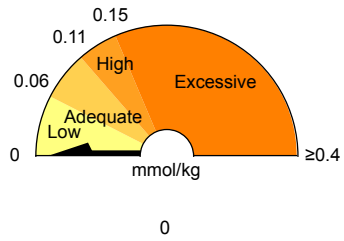
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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}):	6
Eff. Cation Exch. Capacity (eCEC):	6
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): **203**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	Sandy Clay Loam
Colour:	-
Estimated clay content:	20 - 30%
Size:	-
Gravel content:	Not gravelly
Aggregate strength:	-
Structural unit:	Did not test
Potential infiltration rate:	Moderate
Permeability (mm/hr):	Did not test
Calculated EC_{SE} (dS/m):	0.3

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **2.6 – High**

Organic Matter (OM%): **4.4**

Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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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Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 6** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

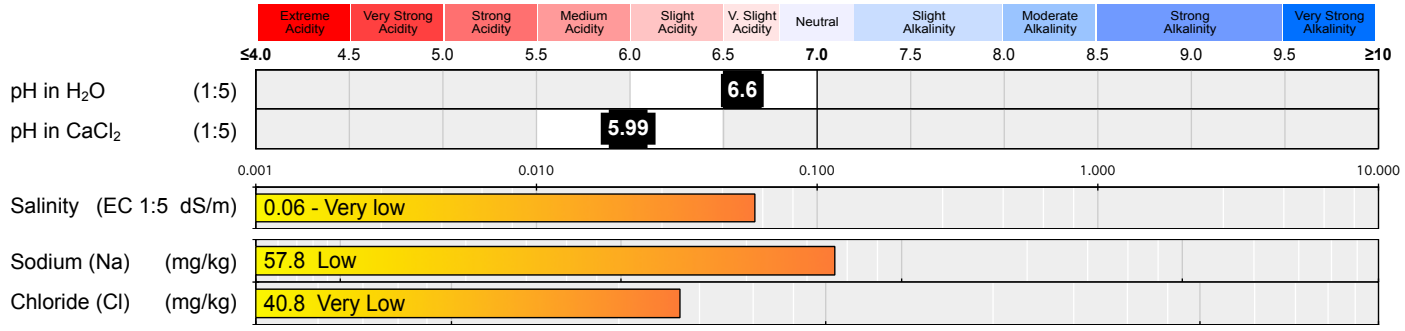
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH6 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a clay loam with moderate permeability. It is slightly acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic. The eCEC is moderate.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is high at 5.1%

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

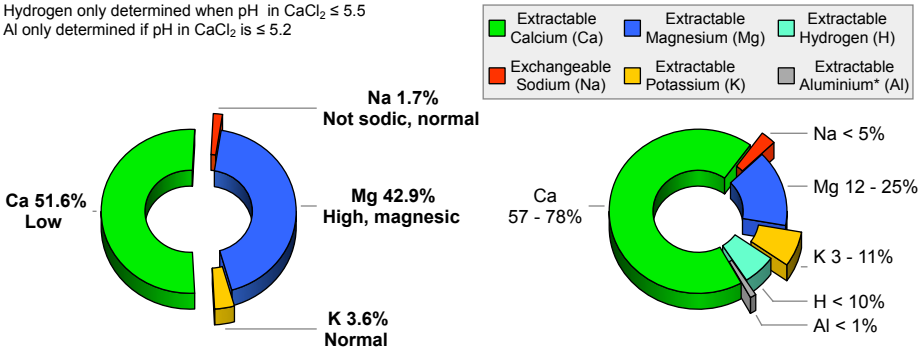
pH and ELECTRICAL CONDUCTIVITY



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	1.2	4.1 – 6.0
Comment: Calcium low		
Mg:K	12	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.04	< 0.07
Comment: Acceptable		
K:Na	2.1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.25	0.52	7.54	6.27		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

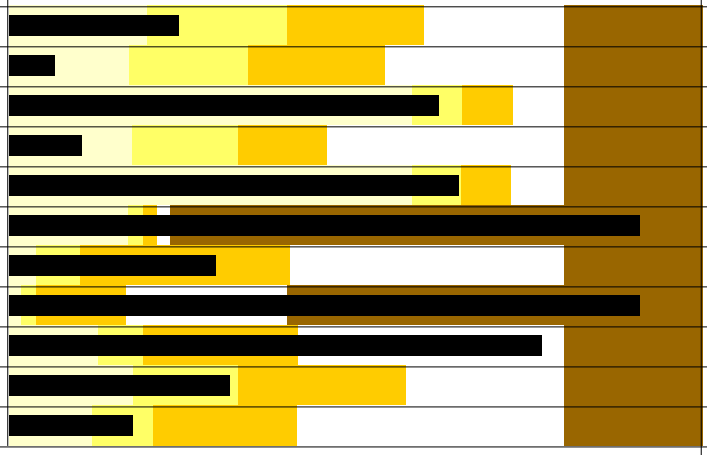
Mehlich 3 - Multi-nutrient Extractant

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°: 40910 **Sample N°: 6** **Date Received: 5/10/16** **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)	6.4		0.9	4	3.1
Phosphate-P (PO_4)	5.3		0.7	8.4	7.7
Potassium (K) †	203		27	34.8	7.8
Sulphate-S (SO_4)	8.9		1.2	9	7.8
Calcium (Ca) †	1510		200.8	248	47.2
Magnesium (Mg) †	761		101.2	25.8	Drawdown
Iron (Fe)	205		27.3	73.4	46.1
Manganese (Mn) †	100		13.3	5.9	Drawdown
Zinc (Zn) †	4.8		0.6	0.7	0.1
Copper (Cu)	2.5		0.3	0.8	0.5
Boron (B) †	0.6		0.1	0.4	0.3



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%.

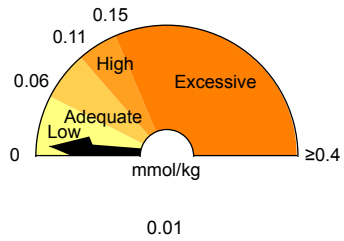
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**14.6**
Eff. Cation Exch. Capacity (eCEC):	**14.6**
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):	**265**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Clay Loam**
Colour:	-
Estimated clay content:	**25 - 35%**
Size:	-
Gravel content:	**Gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.5**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3 – Very high**
Organic Matter (OM%): **5.1**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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°: 40910 **Sample N°: 7** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

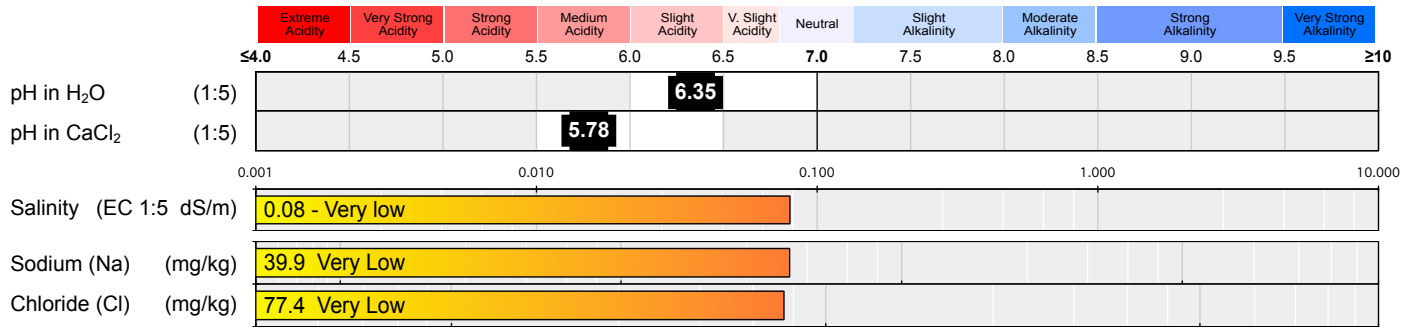
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH7 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a light clay with slow permeability. It is moderaely acidic with desirably low salinity, sodium and chloride. The cation exchange is magnesic. The eCEC is moderate.
N & P are marginal, sulphate is low. Manganese is high as the result of waterlogging. Potassium is also high.
Organic matter is very high at 5.4%

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

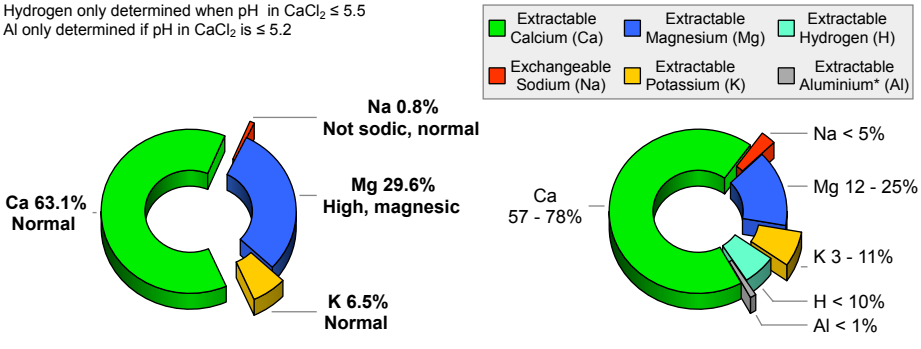
pH and ELECTRICAL CONDUCTIVITY



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	2.1	4.1 – 6.0
Comment: Calcium low		
Mg:K	4.6	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.07	< 0.07
Comment: High		
K:Na	7.9	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.17	1.35	13.19	6.19		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Mailing Address: PO Box 357, Pennant Hills NSW 1715
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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 7** **Date Received: 5/10/16** **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)	11		1.5	4	2.5
Phosphate-P (PO_4)	42.7		5.7	8.4	2.7
Potassium (K) †	529		70.4	46	Drawdown
Sulphate-S (SO_4)	12		1.6	9	7.4
Calcium (Ca) †	2643		351.5	327.7	Drawdown
Magnesium (Mg) †	752		100	34.2	Drawdown
Iron (Fe)	230		30.6	73.4	42.8
Manganese (Mn) †	54		7.2	5.9	Drawdown
Zinc (Zn) †	5.1		0.7	0.7	0
Copper (Cu)	3.7		0.5	0.8	0.3
Boron (B) †	0.5		0.1	0.4	0.3

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%.

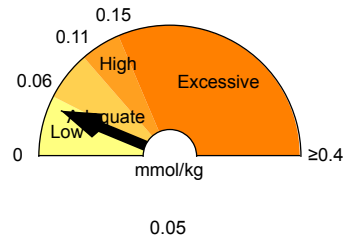
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**20.9**
Eff. Cation Exch. Capacity (eCEC):	**20.9**
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): **105**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Light Clay**
Colour:	-
Estimated clay content:	**35 - 40%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.7**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3.2 – Very high**
Organic Matter (OM%): **5.4**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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
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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 8** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

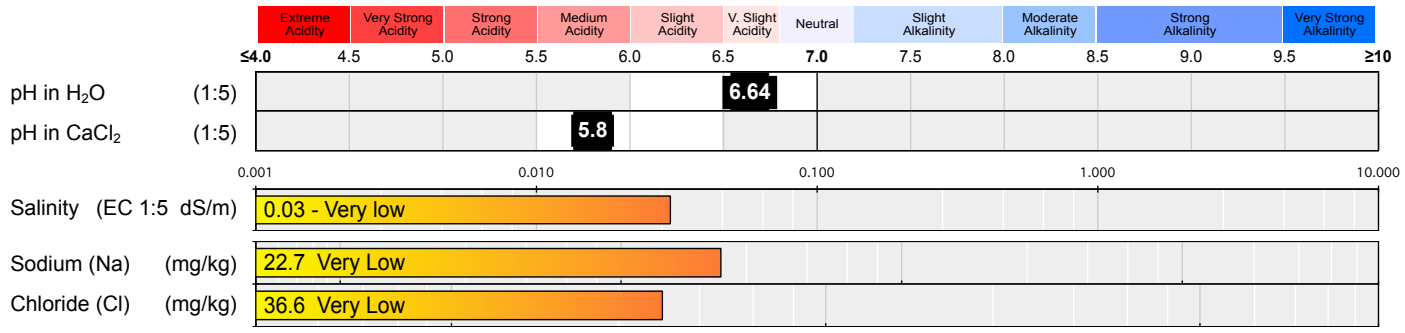
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH8 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a clay loam with moderate permeability. It is moderaely acidic with desirably low salinity, sodium and chloride. The cation exchange is balanced. The eCEC is moderate.
NPS are low and need boosting. Manganese is high as the result of waterlogging. Potassium is also high.
Organic matter is very high at 5.7%

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

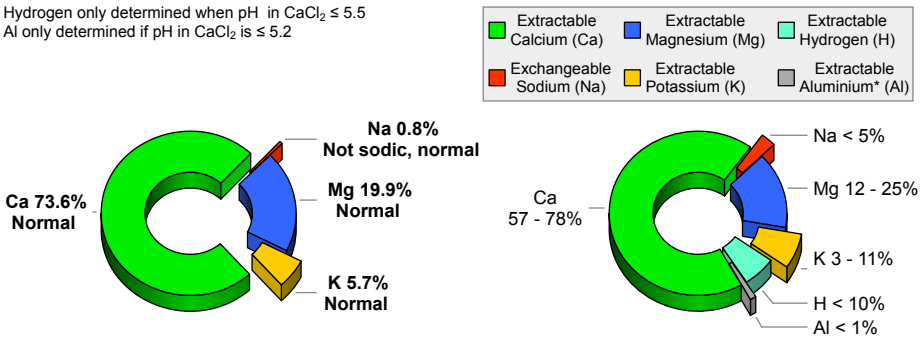
pH and ELECTRICAL CONDUCTIVITY



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	3.7	4.1 – 6.0
Comment: Calcium low		
Mg:K	3.5	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.06	< 0.07
Comment: Acceptable		
K:Na	7.5	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.10	0.75	9.72	2.63		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 8** **Date Received: 5/10/16** **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)	1.2		0.2	4	3.8
Phosphate-P (PO_4)	6.5		0.9	8.4	7.5
Potassium (K) †	294		39.1	34.8	Drawdown
Sulphate-S (SO_4)	8.5		1.1	9	7.9
Calcium (Ca) †	1948		259.1	248	Drawdown
Magnesium (Mg) †	320		42.6	25.8	Drawdown
Iron (Fe)	179		23.8	73.4	49.6
Manganese (Mn) †	290		38.6	5.9	Drawdown
Zinc (Zn) †	4.5		0.6	0.7	0.1
Copper (Cu)	14		1.9	0.8	Drawdown
Boron (B) †	0.6		0.1	0.4	0.3

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%.

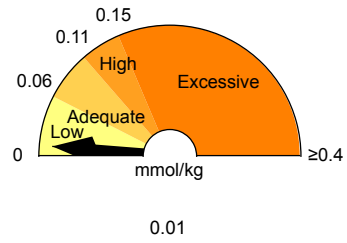
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**13.2**
Eff. Cation Exch. Capacity (eCEC):	**13.2**
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 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Clay Loam**
Colour:	-
Estimated clay content:	**25 - 35%**
Size:	-
Gravel content:	**Gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3.4 – Very high**
Organic Matter (OM%): **5.7**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

SESL AUSTRALIA
Environment & Soil Sciences

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Mailing Address: PO Box 357, Pennant Hills NSW 1715
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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 9** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

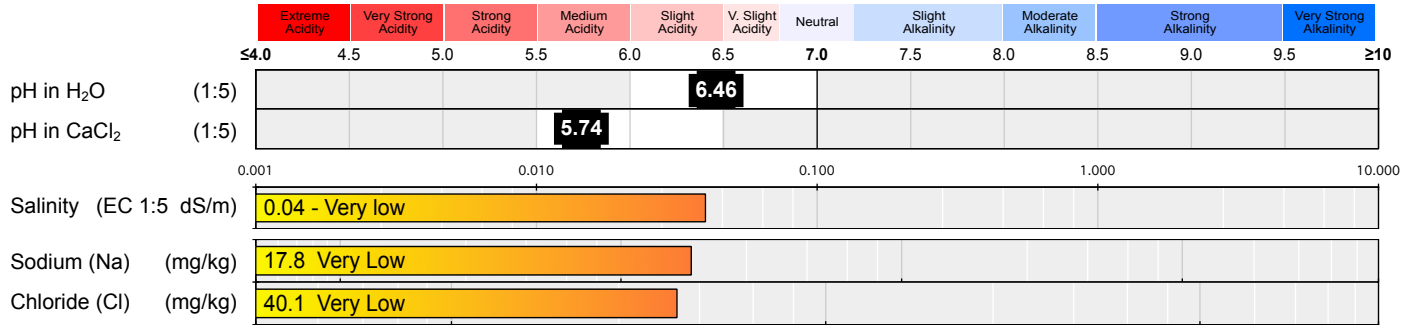
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH9 0-280**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a clay loam with moderate permeability. It is moderaely acidic with desirably low salinity, sodium and chloride. The cation exchange is balanced. The eCEC is moderate.
NPS are low and need boosting. Manganese is high as the result of waterlogging. Potassium is also high.
Organic matter is very high at 5.7%

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

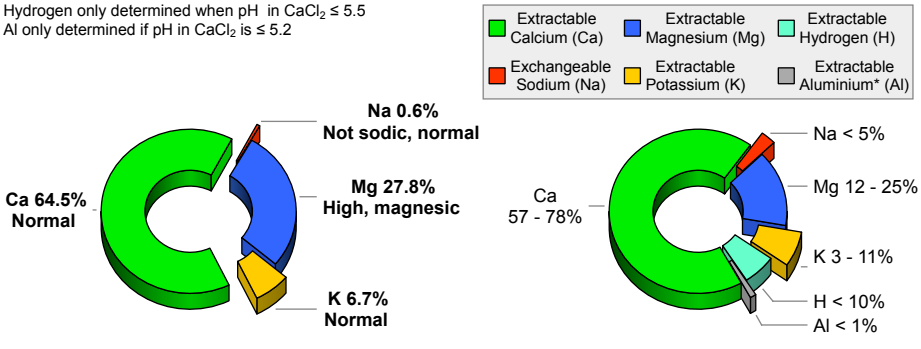
pH and ELECTRICAL CONDUCTIVITY



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	2.3	4.1 – 6.0
Comment: Calcium low		
Mg:K	4.2	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.07	< 0.07
Comment: High		
K:Na	11	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.08	0.88	8.52	3.67		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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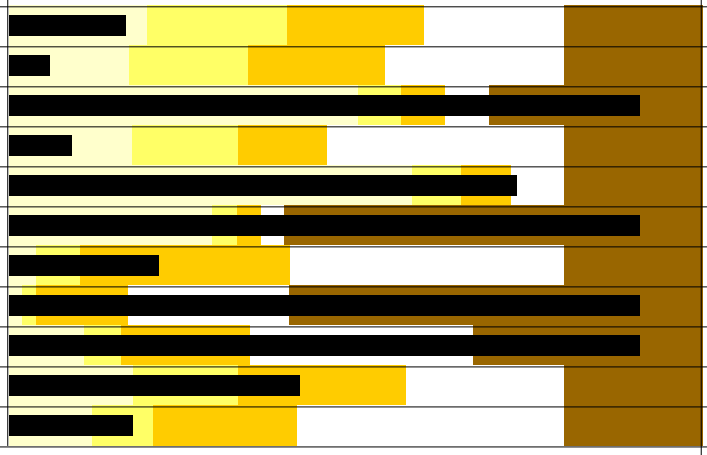
Batch N°: 40910 **Sample N°: 9** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

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)	4.4		0.6	4	3.4
Phosphate-P (PO_4)	4.8		0.6	8.4	7.8
Potassium (K) †	344		45.8	34.8	Drawdown
Sulphate-S (SO_4)	7.7		1	9	8
Calcium (Ca) †	1707		227	248	21
Magnesium (Mg) †	446		59.3	25.8	Drawdown
Iron (Fe)	149		19.8	73.4	53.6
Manganese (Mn) †	99		13.2	5.9	Drawdown
Zinc (Zn) †	6.8		0.9	0.7	Drawdown
Copper (Cu)	3.3		0.4	0.8	0.4
Boron (B) †	0.6		0.1	0.4	0.3



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%.

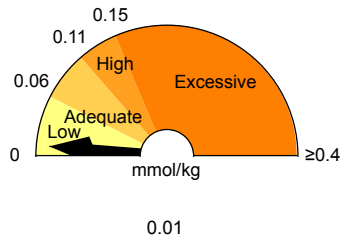
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



0.01

Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**13.2**
Eff. Cation Exch. Capacity (eCEC):	**13.2**
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):	**45**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Clay Loam**
Colour:	-
Estimated clay content:	**25 - 35%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3.4 – Very high**
Organic Matter (OM%): **5.7**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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°: 40910 **Sample N°: 10** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

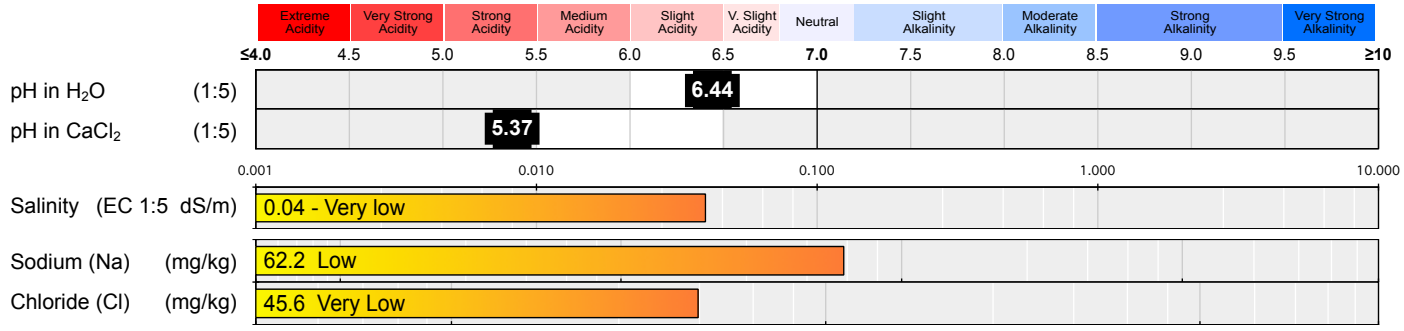
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH10 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a clay loam with moderate permeability. It is strongly acidic with desirably low salinity and sodium. The cation exchange is dominated by hydrogen which explains the acidity. It is also slightly magnesic. The eCEC is moderate.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Orgnic matter is very high at 5.7%

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

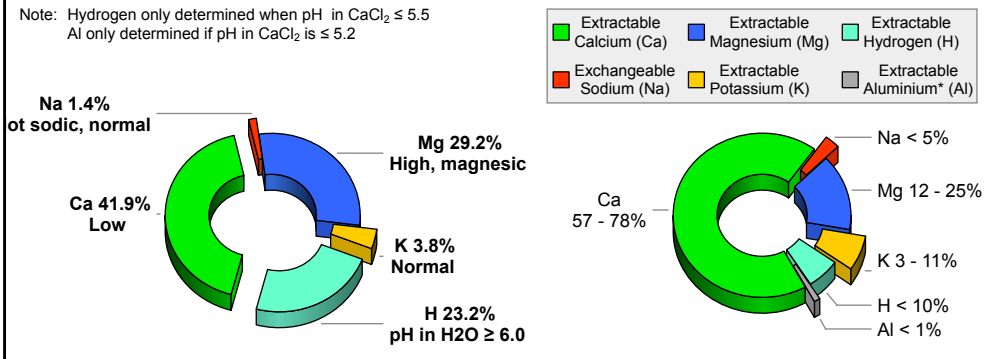
pH and ELECTRICAL CONDUCTIVITY



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	1.4	4.1 – 6.0
Comment: Calcium low		
Mg:K	7.6	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.05	< 0.07
Comment: Acceptable		
K:Na	2.7	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.27	0.72	7.88	5.48	4.37	

SOLUBLE CATIONS (meq/100g)

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

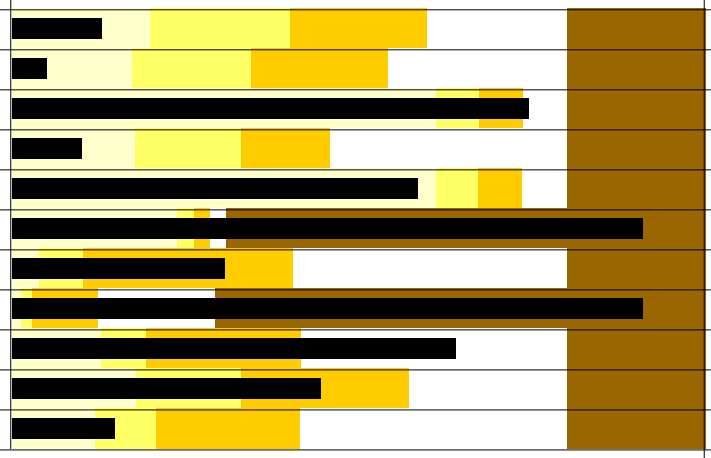
Mehlich 3 - Multi-nutrient Extractant

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

Batch N°: 40910 **Sample N°: 10** **Date Received: 5/10/16** **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)	3.4		0.5	4	3.5
Phosphate-P (PO_4)	4.1		0.5	8.4	7.9
Potassium (K) †	283		37.6	40.4	2.8
Sulphate-S (SO_4)	8.5		1.1	9	7.9
Calcium (Ca) †	1580		210.1	287.8	77.7
Magnesium (Mg) †	666		88.6	29.9	Drawdown
Iron (Fe)	211		28.1	73.4	45.3
Manganese (Mn) †	137		18.2	5.9	Drawdown
Zinc (Zn) †	4		0.5	0.7	0.2
Copper (Cu)	3.5		0.5	0.8	0.3
Boron (B) †	0.5		0.1	0.4	0.3



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%.

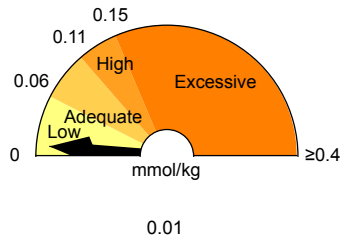
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.3**
Sum of Base Cations (meq/100g^{-1}):	**14.4**
Eff. Cation Exch. Capacity (eCEC):	**18.8**
Base Saturation (%):	**76.6**
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): **551**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Clay Loam**
Colour:	**-**
Estimated clay content:	**25 - 35%**
Size:	**-**
Gravel content:	**Not gravelly**
Aggregate strength:	**-**
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **3.4 – Very high**
Organic Matter (OM%): **5.7**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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

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.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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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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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 11** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

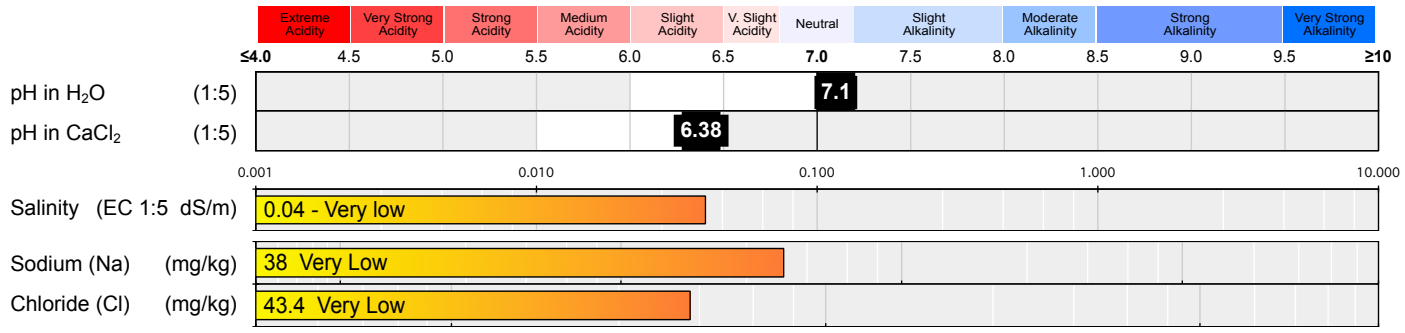
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH11 0-350**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a sandy clay loam with moderate permeability. It is slightly acidic with desirably low salinity, sodium and chloride. The cation exchange is balanced. The eCEC is moderate.
NPKS are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is moderate at 2.5%

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

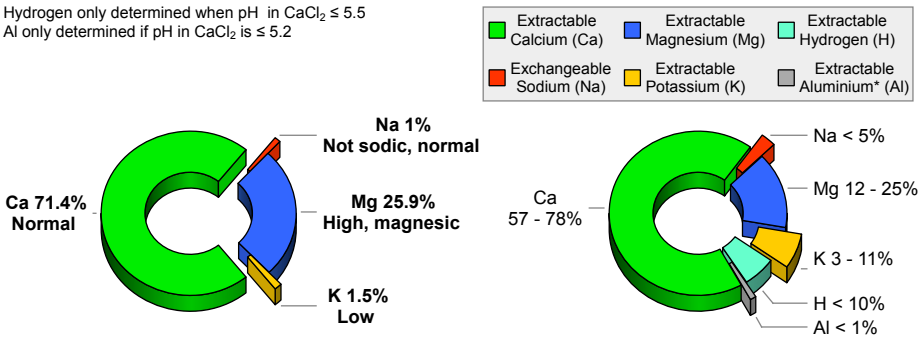
pH and ELECTRICAL CONDUCTIVITY



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	2.8	4.1 – 6.0
Comment: Calcium low		
Mg:K	17.4	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	1.5	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.17	0.25	11.99	4.36		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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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°: 40910 **Sample N°: 11** **Date Received: 5/10/16** **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)	5.8		0.8	4	3.2
Phosphate-P (PO_4)	54		7.2	8.4	1.2
Potassium (K) †	97.8		13	40.4	27.4
Sulphate-S (SO_4)	5.7		0.8	9	8.2
Calcium (Ca) †	2403		319.6	287.8	Drawdown
Magnesium (Mg) †	529		70.4	29.9	Drawdown
Iron (Fe)	156		20.7	73.4	52.7
Manganese (Mn) †	219		29.1	5.9	Drawdown
Zinc (Zn) †	4		0.5	0.7	0.2
Copper (Cu)	15		2	0.8	Drawdown
Boron (B) †	0.6		0.1	0.4	0.3

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%.

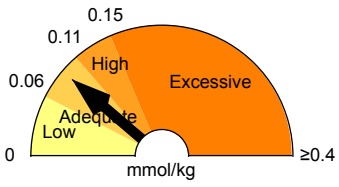
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



0.09

Adequate. Economic response to P unlikely. P application recommended maintaining current P level.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/$100g^{-1}$):	**16.8**
Eff. Cation Exch. Capacity (eCEC):	**16.8**
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 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Sandy Clay Loam**
Colour:	-
Estimated clay content:	**20 - 30%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.4**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **1.5 – Moderate**

Organic Matter (OM%): **2.5**

Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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
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Batch N°: 40910 **Sample N°: 12** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

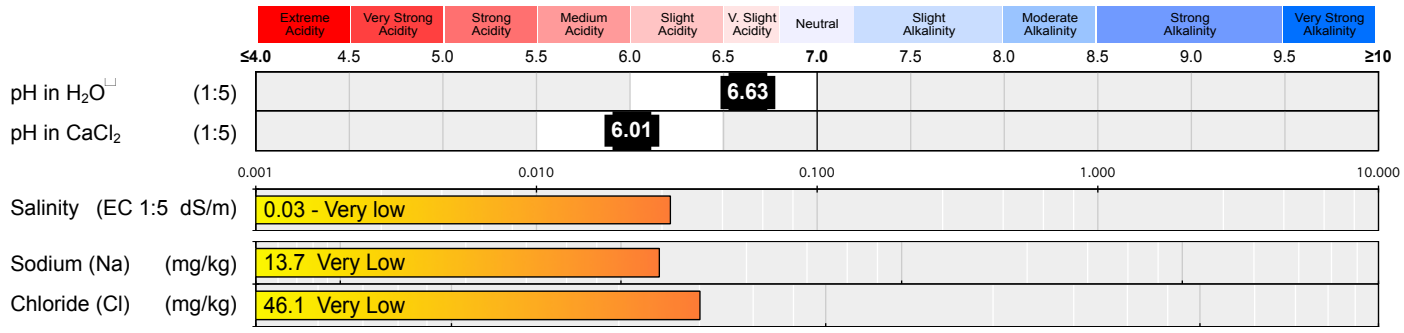
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH12 0-200**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a sandy clay with slow permeability. It is slightly acidic with desirably low salinity, sodium and chloride. The cation exchange is balanced. The eCEC is low.
NPK S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Organic matter is high at 3.9%

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

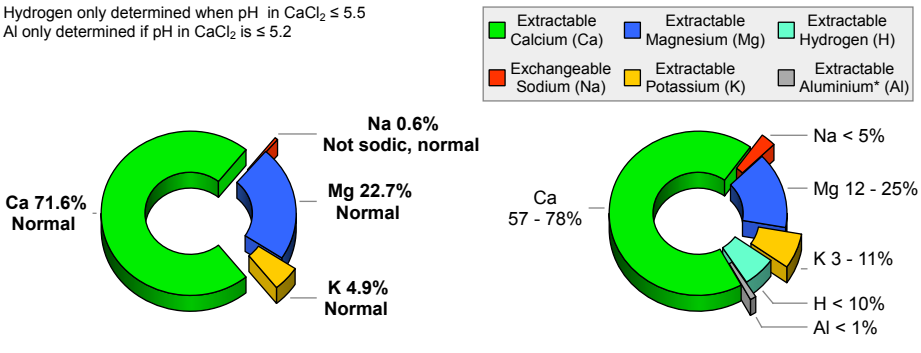
pH and ELECTRICAL CONDUCTIVITY



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	3.1	4.1 – 6.0
Comment: Calcium low		
Mg:K	4.7	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.05	< 0.07
Comment: Acceptable		
K:Na	8.8	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.06	0.53	7.80	2.48		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 12** **Date Received: 5/10/16** **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)	5.4		0.7	4	3.3
Phosphate-P (PO_4)	10.4		1.4	8.4	7
Potassium (K) †	208		27.7	34.8	7.1
Sulphate-S (SO_4)	7.8		1	9	8
Calcium (Ca) †	1562		207.7	248	40.3
Magnesium (Mg) †	301		40	25.8	Drawdown
Iron (Fe)	155		20.6	73.4	52.8
Manganese (Mn) †	270		35.9	5.9	Drawdown
Zinc (Zn) †	3.4		0.5	0.7	0.2
Copper (Cu)	25		3.3	0.8	Drawdown
Boron (B) †	0.5		0.1	0.4	0.3

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%.

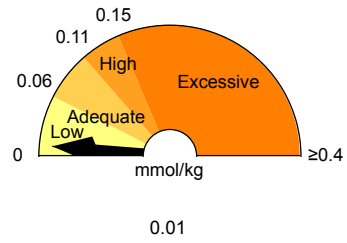
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/100g^{-1}):	**10.9**
Eff. Cation Exch. Capacity (eCEC):	**10.9**
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 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Sandy Clay**
Colour:	-
Estimated clay content:	**35 - 45%**
Size:	-
Gravel content:	**Not gravelly**
Aggregate strength:	-
Structural unit:	**Did not test**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **2.3 – High**
Organic Matter (OM%): **3.9**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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
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Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 13** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

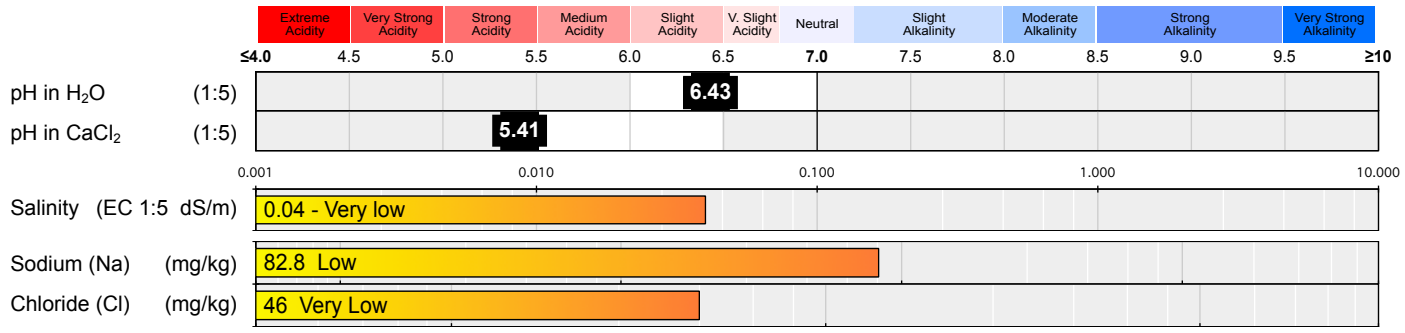
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH13 0-170**
Description: **Soil**
Test Type: **FSC, TOC_DC, Texture_SESL**

RECOMMENDATIONS

Soil is a clay loam with moderate permeability. It is strongly acidic with desirably low salinity and sodium. The cation exchange is dominated by hydrogen which explains the acidity. It is also slightly magnesic. The eCEC is moderate.
NPK,S and Ca are low and need boosting. Manganese is high as the result of waterlogging.
Orgnic matter is moderate at 3.2%

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

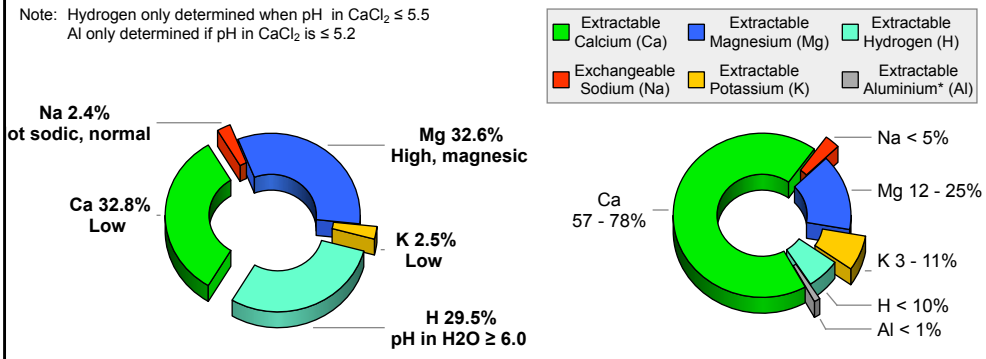
pH and ELECTRICAL CONDUCTIVITY



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	1	4.1 – 6.0
Comment: Calcium low		
Mg:K	13	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.04	< 0.07
Comment: Acceptable		
K:Na	1	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.36	0.37	4.85	4.82	4.37	

SOLUBLE CATIONS (meq/100g)

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.

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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
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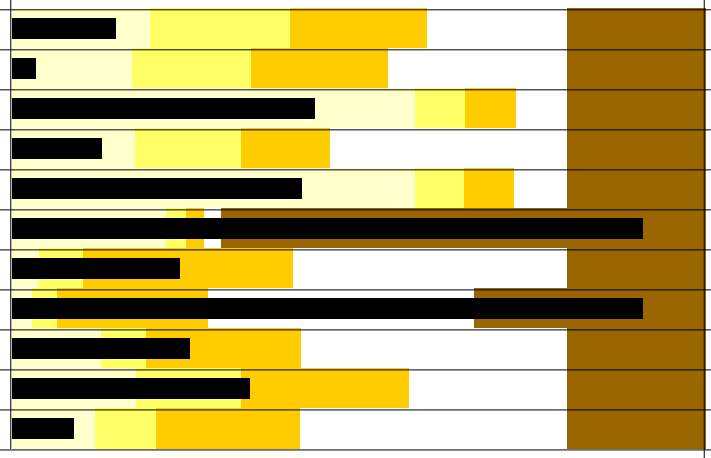
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 13** **Date Received: 5/10/16** **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)	3.9		0.5	4	3.5
Phosphate-P (PO_4)	2.7		0.4	8.4	8
Potassium (K) †	143		19	34.8	15.8
Sulphate-S (SO_4)	11		1.5	9	7.5
Calcium (Ca) †	972		129.3	248	118.7
Magnesium (Mg) †	586		77.9	25.8	Drawdown
Iron (Fe)	167		22.2	73.4	51.2
Manganese (Mn) †	60		8	5.9	Drawdown
Zinc (Zn) †	1.6		0.2	0.7	0.5
Copper (Cu)	2.7		0.4	0.8	0.4
Boron (B) †	0.3		0	0.4	0.4



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%.

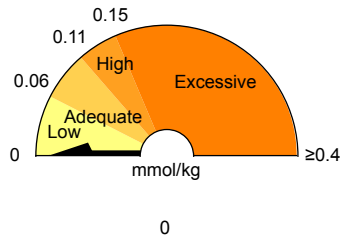
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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):	**7.3**
Sum of Base Cations (meq/100g^{-1}):	**10.4**
Eff. Cation Exch. Capacity (eCEC):	**14.8**
Base Saturation (%):	**70.27**
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):	**588**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Clay Loam**
Colour:	**-**
Estimated clay content:	**25 - 35%**
Size:	**-**
Gravel content:	**Gravelly**
Aggregate strength:	**-**
Structural unit:	**Did not test**
Potential infiltration rate:	**Moderate**
Permeability (mm/hr):	**Did not test**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

Organic Carbon (OC%)†: **1.9 – Moderate**
Organic Matter (OM%): **3.2**
Additional comments:

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Environment & Soil Sciences

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
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Batch N°: 40910 **Sample N°: 14** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

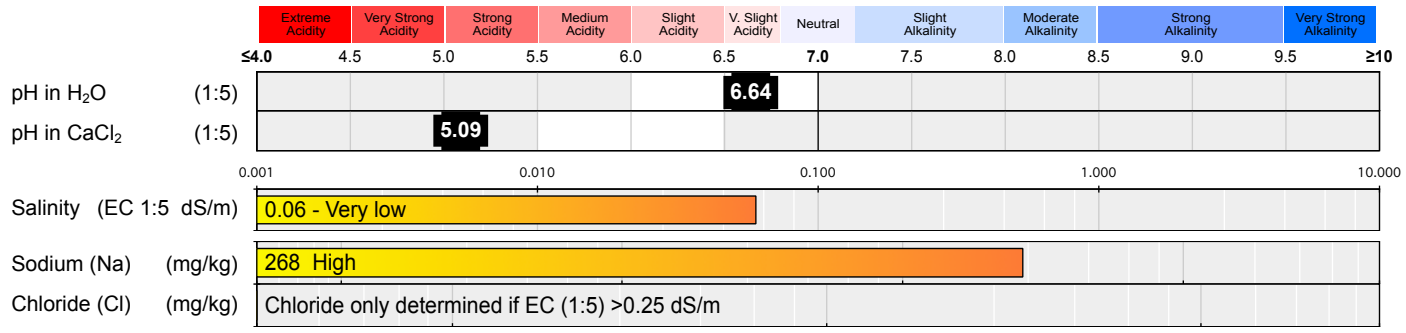
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH3 300-400**
Description: **Soil**
Test Type: **SSCP**

RECOMMENDATIONS

Subsoill is a medium clay with a strong polyhedral structure and slow permeability. It is strongly acidic with desirably low salinity and high sodium. The cation exchange is dominated by hydrogen which explains the acidity. It is also sodic and magnesic. The eCEC is moderate.

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

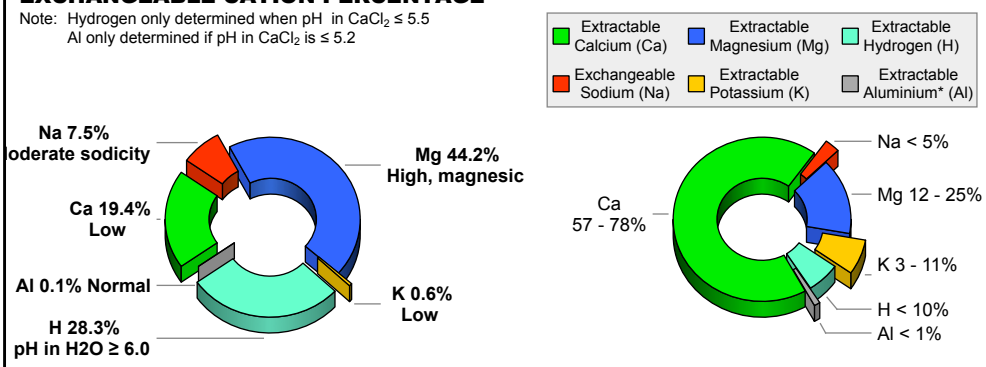
pH and ELECTRICAL CONDUCTIVITY



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	0.4	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	75.7	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 (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
1.16	0.09	2.98	6.81	4.36	0.01

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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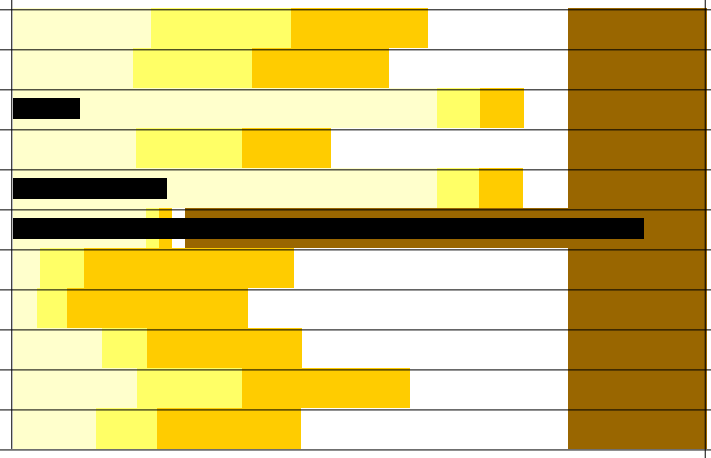
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 14** **Date Received: 5/10/16** **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)	-		-	4	Did not test
Phosphate-P (PO_4)	-		-	8.4	Did not test
Potassium (K) †	36.2		4.8	40.4	35.6
Sulphate-S (SO_4)	-		-	9	9
Calcium (Ca) †	598		79.5	287.8	208.3
Magnesium (Mg) †	828		110.1	29.9	Drawdown
Iron (Fe)	-		-	73.4	Did not test
Manganese (Mn) †	-		-	5.9	Did not test
Zinc (Zn) †	-		-	0.7	Did not test
Copper (Cu)	-		-	0.8	Did not test
Boron (B) †	-		-	0.4	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%.

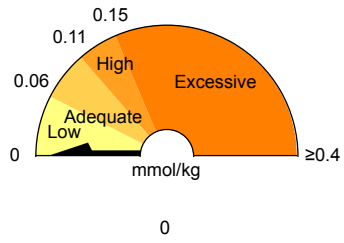
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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):	**7.3**
Sum of Base Cations (meq/100g^{-1}):	**11**
Eff. Cation Exch. Capacity (eCEC):	**15.4**
Base Saturation (%):	**71.43**
Exchangeable Acidity (meq/100g^{-1}):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate

– to achieve pH 6.0 (g/sqm):	**0**
– to neutralise Al (g/sqm):	**1**

Gypsum Application Rate

– to achieve 67.5% exch. Ca (g/sqm):	**849**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Medium Clay**
Colour:	**-**
Estimated clay content:	**40 - 55%**
Size:	**Medium (11 - 25mm)**
Gravel content:	**Gravelly**
Aggregate strength:	**Pedal - Strong**
Structural unit:	**Polyhedral**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**2.5 - 5**
Calculated EC_{SE} (dS/m):	**0.5**

– Non-saline. Salinity effects on plants are mostly negligible.

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

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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
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Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 15** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

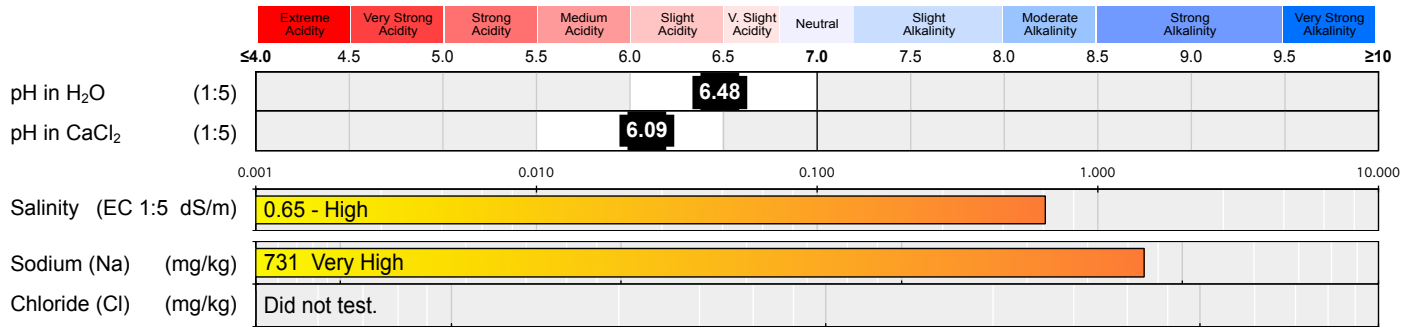
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH4 250-400**
Description: **Soil**
Test Type: **SSCP**

RECOMMENDATIONS

Subsoill is a light medium clay with a moderate polyhedral structure and slow permeability. It is slightly acidic with high salinity and very high sodium. The cation exchange is highly magnesic and sodic. The eCEC is moderate.

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

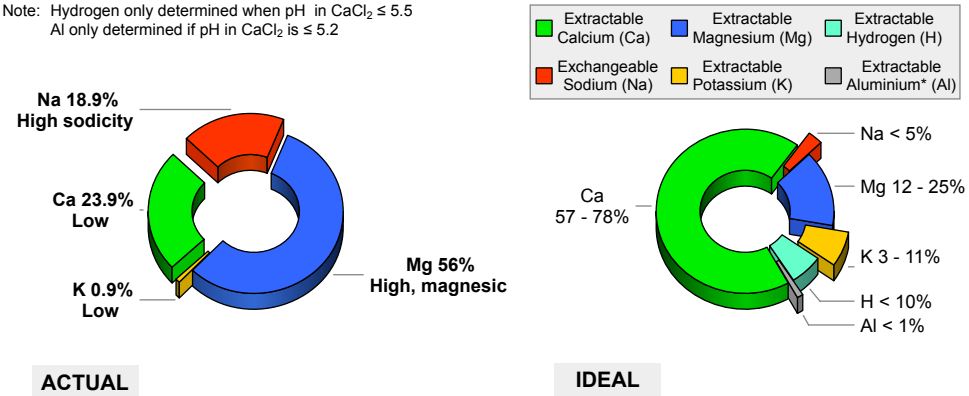
pH and ELECTRICAL CONDUCTIVITY



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	0.4	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	62.7	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.01	< 0.07
Comment: Acceptable		
K:Na	0	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
3.18	0.15	4.02	9.41		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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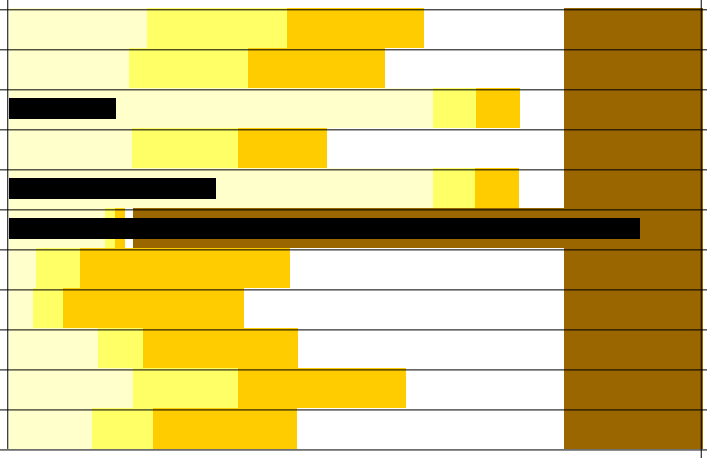
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 15** **Date Received: 5/10/16** **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)	-		-	4	Did not test
Phosphate-P (PO_4)	-		-	8.4	Did not test
Potassium (K) †	58.1		7.7	40.4	32.7
Sulphate-S (SO_4)	-		-	9	9
Calcium (Ca) †	806		107.2	287.8	180.6
Magnesium (Mg) †	1143		152	29.9	Drawdown
Iron (Fe)	-		-	73.4	Did not test
Manganese (Mn) †	-		-	5.9	Did not test
Zinc (Zn) †	-		-	0.7	Did not test
Copper (Cu)	-		-	0.8	Did not test
Boron (B) †	-		-	0.4	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%.

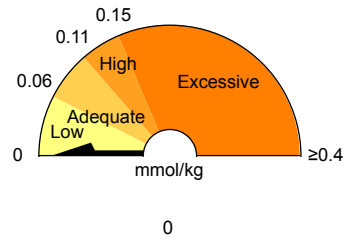
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (meq/$100g^{-1}$):	**16.8**
Eff. Cation Exch. Capacity (eCEC):	**16.8**
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): **838**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Light Medium Clay**
Colour:	-
Estimated clay content:	**40 - 45%**
Size:	**Fine (1 - 10mm)**
Gravel content:	**Not gravelly**
Aggregate strength:	**Pedal - Moderate**
Structural unit:	**Polyhedral**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**2.5 - 5**
Calculated EC_{SE} (dS/m):	**4.9**

– Moderate saline. Growth on many plant species is affected.

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

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

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°: 40910 **Sample N°: 16** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

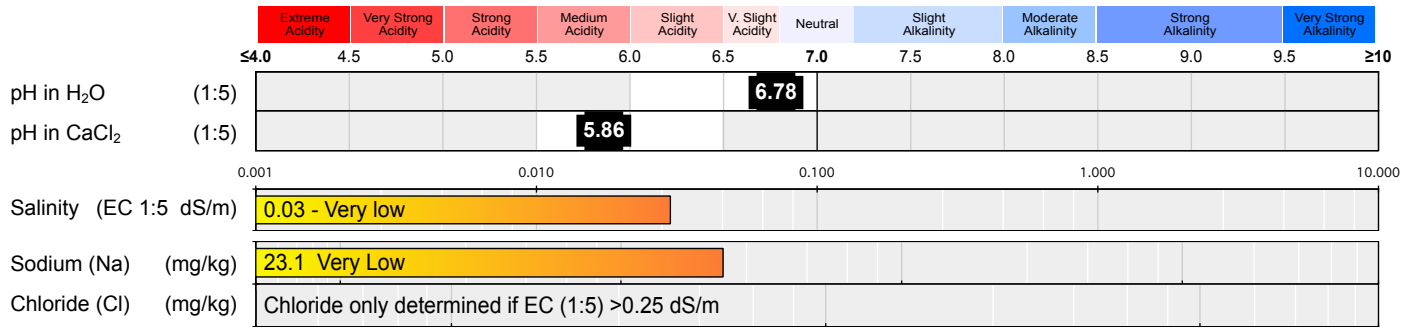
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH12 200+**
Description: **Soil**
Test Type: **SSCP**

RECOMMENDATIONS

Subsoill is a sandy clay with a moderate polyhedral structure and slow permeability. It is moderately acidic with desirably low salinity and sodium. The cation exchange is close to being balanced. The eCEC is moderate.

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

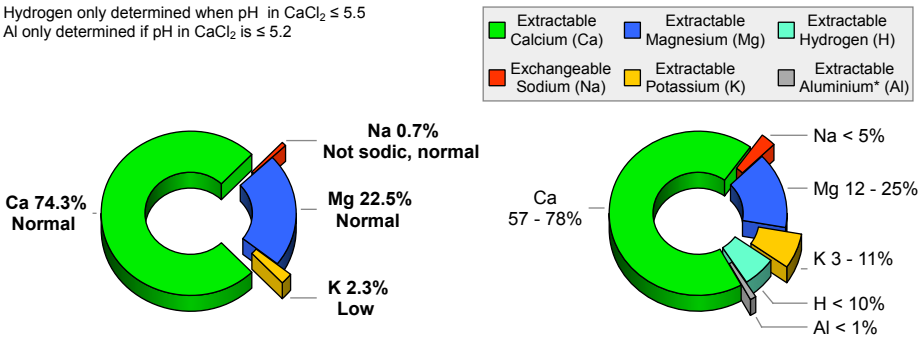
pH and ELECTRICAL CONDUCTIVITY



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	3.3	4.1 – 6.0
Comment: Calcium low		
Mg:K	9.8	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	3.4	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.10	0.34	10.99	3.33		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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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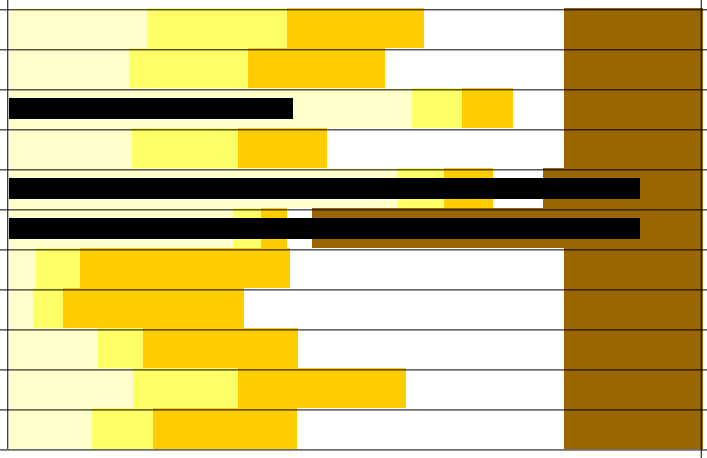
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 16** **Date Received: 5/10/16** **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)	-		-	4	Did not test
Phosphate-P (PO_4)	-		-	8.4	Did not test
Potassium (K) †	134		17.8	34.8	17
Sulphate-S (SO_4)	-		-	9	9
Calcium (Ca) †	2202		292.9	248	Drawdown
Magnesium (Mg) †	404		53.7	25.8	Drawdown
Iron (Fe)	-		-	73.4	Did not test
Manganese (Mn) †	-		-	5.9	Did not test
Zinc (Zn) †	-		-	0.7	Did not test
Copper (Cu)	-		-	0.8	Did not test
Boron (B) †	-		-	0.4	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%.

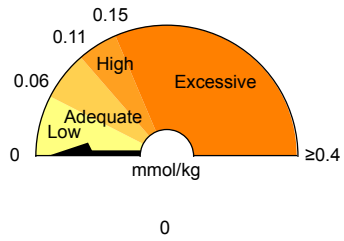
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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}):	**14.8**
Eff. Cation Exch. Capacity (eCEC):	**14.8**
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 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Sandy Clay**
Colour:	-
Estimated clay content:	**35 - 45%**
Size:	**Fine (1 - 10mm)**
Gravel content:	**Not gravelly**
Aggregate strength:	**Pedal - Moderate**
Structural unit:	**Polyhedral**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**2.5 - 5**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

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

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Environment & Soil Sciences

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Mailing Address: PO Box 357, Pennant Hills NSW 1715
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Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 17** **Date Received: 5/10/16** **Report Status:** ◉ Draft ○ Final

Client Name: **Place Design Group Pty Ltd**
Client Contact: **Lingling Qiu**
Client Job N°:
Client Order N°:
Address: **Level 1, 81 York St, Sydney NSW 2000**

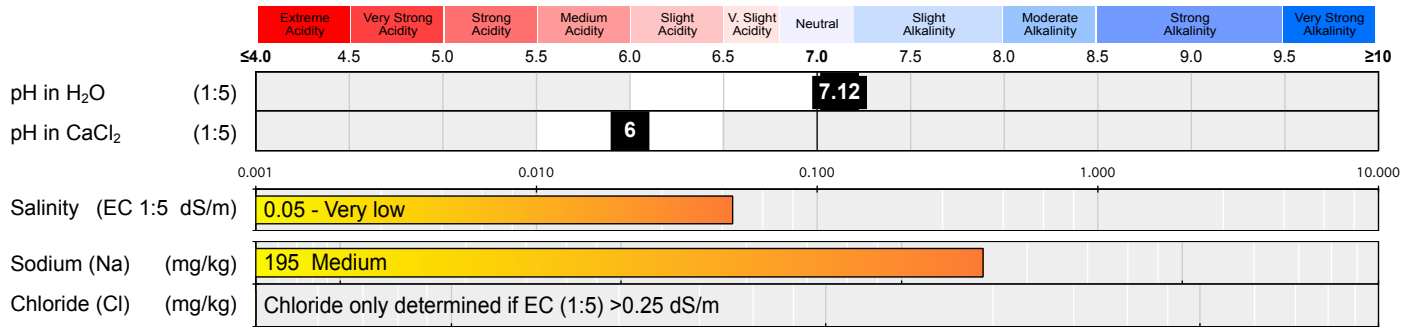
Project Name: **Caddens Hill Project (Stage 1 to 7)**
SESL Quote N°: **Q6142**
Sample Name: **BH13 170+**
Description: **Soil**
Test Type: **SSCP**

RECOMMENDATIONS

Subsoill is a light clay with a strong polyhedral structure and slow permeability. It is slightly acidic with desirably low salinity and moderate sodium. The cation exchange is highly magnesic and sodic. The eCEC is moderate.

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

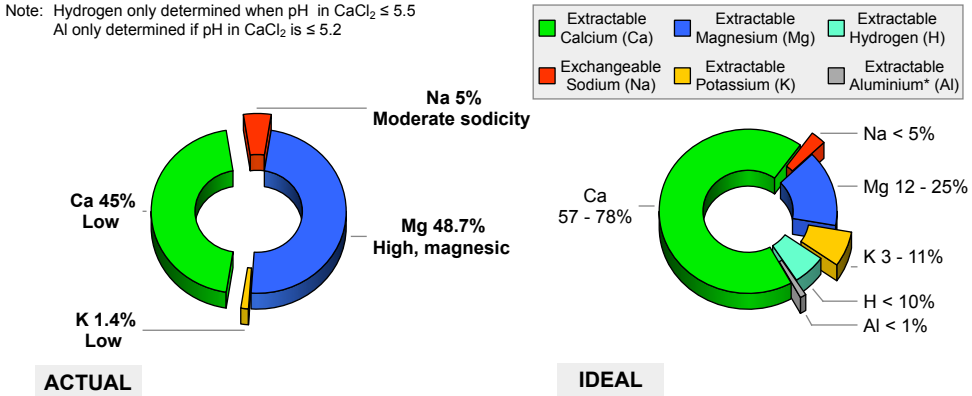
pH and ELECTRICAL CONDUCTIVITY



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	0.9	4.1 – 6.0
Comment: Potential Calcium deficiency		
Mg:K	34.3	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	0.3	N/A

Sodium Absorption Ratio: D.N.T.

EXCHANGEABLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:	H:	Al:
0.85	0.24	7.61	8.24		

SOLUBLE CATIONS (meq/100g)

Na:	K:	Ca:	Mg:

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
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Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 40910 **Sample N°: 17** **Date Received: 5/10/16** **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)	-		-	4	Did not test
Phosphate-P (PO_4)	-		-	8.4	Did not test
Potassium (K) †	94.3		12.5	40.4	27.9
Sulphate-S (SO_4)	-		-	9	9
Calcium (Ca) †	1525		202.8	287.8	85
Magnesium (Mg) †	1001		133.1	29.9	Drawdown
Iron (Fe)	-		-	73.4	Did not test
Manganese (Mn) †	-		-	5.9	Did not test
Zinc (Zn) †	-		-	0.7	Did not test
Copper (Cu)	-		-	0.8	Did not test
Boron (B) †	-		-	0.4	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%.

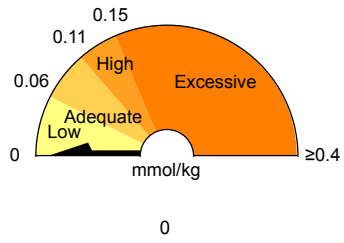
High
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2%.

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/$100g^{-1}$):	**16.9**
Eff. Cation Exch. Capacity (eCEC):	**16.9**
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): **435**

The CGAR is corrected for a soil depth of 100mm and any Lime addition to achieve pH 6.0.

Physical Description

Texture:	**Light Clay**
Colour:	-
Estimated clay content:	**35 - 40%**
Size:	**Medium (11 - 25mm)**
Gravel content:	**Not gravelly**
Aggregate strength:	**Pedal - Strong**
Structural unit:	**Polyhedral**
Potential infiltration rate:	**Slow**
Permeability (mm/hr):	**5 - 20**
Calculated EC_{SE} (dS/m):	**0.4**

– Non-saline. Salinity effects on plants are mostly negligible.

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

Consultant: Chantal Milner **Authorised Signatory: Simon Leake**

Date Report Generated 19/10/2016

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))

Appendix B
Site Map & Sample Locations

ABN 70 106 810 708
T 1300 30 40 80
F 1300 64 46 89
E info@sesl.com.au
W sesl.com.au

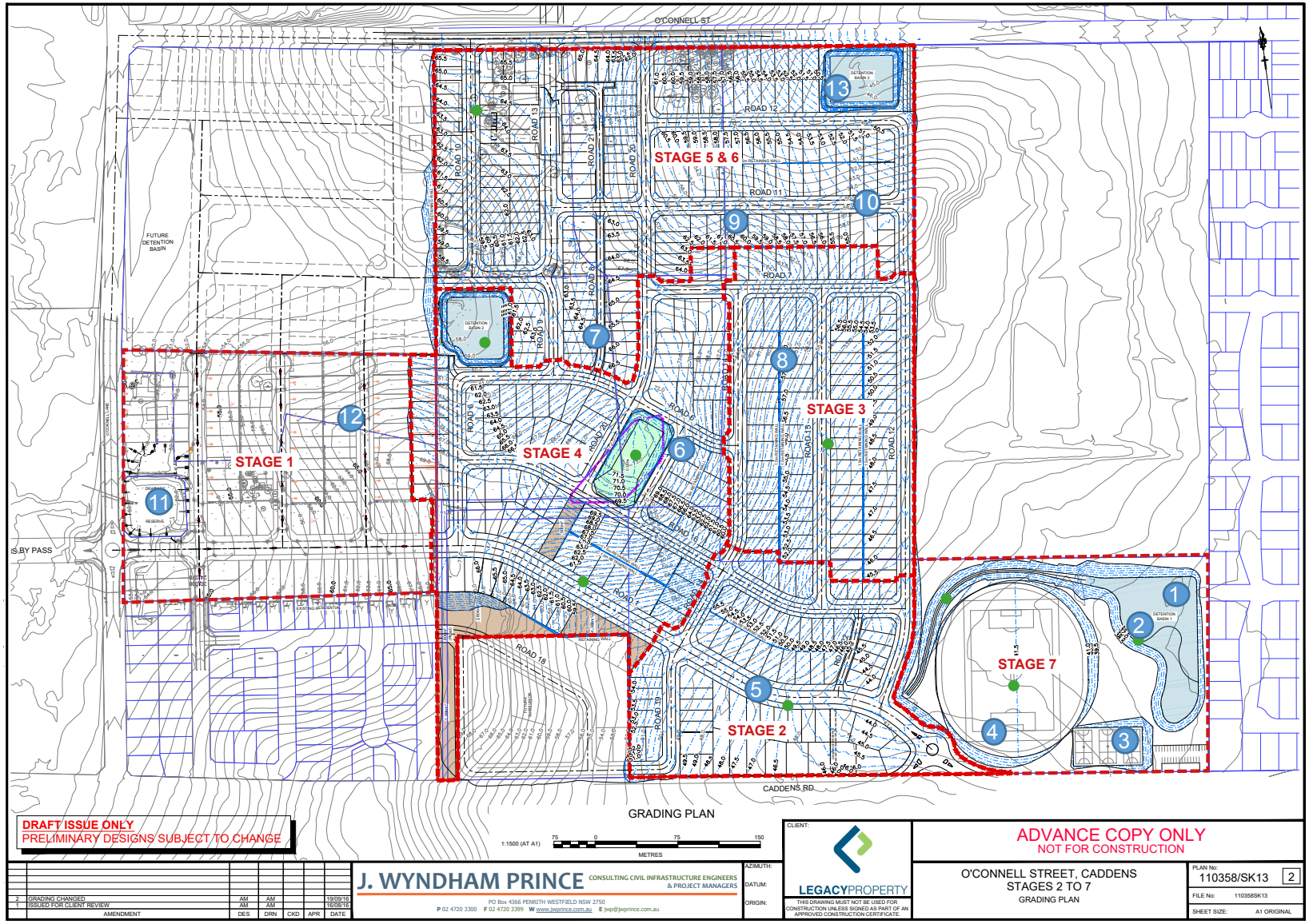
POST
PO Box 357
Pennant Hills
NSW 1715

LAB
16 Chilvers Rd
Thornleigh
NSW 2120

ACT
Level 5
7 London Cct
Canberra
ACT 2601

VIC
Level 1
88 Mt Alexander Rd
Flemington
VIC 3031

QLD
Level 10
15 Green Square Cl
Fortitude Valley
QLD 4006



GRADING PLAN

1:1500 (AT A1) 75 0 75 150 METRES

DRAFT ISSUE ONLY
PRELIMINARY DESIGNS SUBJECT TO CHANGE

	AMENDMENT	DES	DRN	CKD	APR	DATE
2	GRADING CHANGED	AM	AM			19/09/16
1	ISSUED FOR CLIENT REVIEW	AM	AM			16/08/16

J. WYNDHAM PRINCE CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS
PO Box 4366 PENRITH WESTFIELD NSW 2750
P 02 4720 3300 F 02 4720 3399 W www.jwprince.com.au E jwp@jwprince.com.au

AZIMUTH:
DATUM:
ORIGIN:

CLIENT: LEGACYPROPERTY

THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS PART OF AN APPROVED CONSTRUCTION CERTIFICATE

ADVANCE COPY ONLY
NOT FOR CONSTRUCTION

O'CONNELL STREET, CADDENS
STAGES 2 TO 7
GRADING PLAN

PLAN No: 110358/SK13 2
FILE No: 110358SK13
SHEET SIZE: A1 ORIGINAL

Appendix C
Active Turf Specification

ABN 70 106 810 708
T 1300 30 40 80
F 1300 64 46 89
E info@sesl.com.au
W sesl.com.au

POST
PO Box 357
Pennant Hills
NSW 1715

LAB
16 Chilvers Rd
Thornleigh
NSW 2120

ACT
Level 5
7 London Cct
Canberra
ACT 2601

VIC
Level 1
88 Mt Alexander Rd
Flemington
VIC 3031

QLD
Level 10
15 Green Square Cl
Fortitude Valley
QLD 4006

Specification: Active high-traffic turf

Part A. 'Fit-for-purpose' performance description

Generally, a sandy, well-drained 'turf underlay' topsoil mix designed to provide resistance to compaction, rapid drainage but with adequate water-holding capacity to sustain turf growth. The specification is not as rigorous as a full USGA premium grade playing field specification and is intended for moderate to high levels of use in competitive sports. The narrow fines specifications is considered important in meeting the shear strength Target range without risking undue compaction, but precedence will be given to meeting the shear strength and permeability test Target ranges.

Part B. Product specification (technical parameters)

Generally, the soil must be free of 'unwanted material' and must meet all the Target ranges of Tables 1.0 and 2.0.

Table 1.0. Physical properties particle size analysis

Property	Units	Target range	
2.0 mm (fine gravel)	% retained by mass	< 3	
1.0 mm (very coarse sand)		< 10	
0.5 mm (coarse sand)		10–30	
0.25 mm (medium sand)		20–40	40–70
0.1 mm (fine sand)		20–30	
0.05 (very fine sand)		< 15 (max 20% combined vfs, Si +Cl)	
0.002 mm (silt)		< 8 (Si + Clay combined 5–8%)	
< 0.002 mm (clay)		2–6	
Large particles		2–10 mm < 2% > 10 mm 0%	
Organic matter content	% w/w	2 to 5	
Permeability	mm/hour	50–200 (@ 16 drops by McIntyre Jakobsen)	
Wettability (AS 4419)	mm/hour	> 5	
Dispersibility in water		1 or 2	(AS4419) Category

Table 2.0. Chemical properties Property	Units	Target range
pH in water (1:5)	pH units	5.4–8.0
pH in $CaCl_2$ (1:5)	pH units	5.2–7.5
Electrical conductivity (1:5)	dS/m	< 0.5
Exchangeable Na percentage	% of ECEC	< 7
Exchangeable Ca/Mg ratio	Ratio	3–9
Available phosphorus Mehlich 3 Olsen	mg/kg	50–150 20–50
Available nitrogen (nitrate N + ammonium N)	mg/kg	30–100

Part C. Example components for the soil supplier

The following table outlines suggested components that may likely meet the physical Target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Example components (likely to meet the physical Target ranges of this specification		
Medium grade clean sand	60–80% by volume	e.g.. 7 parts washed sand/2 part sandy loam/1 part AS4454 compost.
Sandy loam soil or site soil	10–30% by volume	
Composted soil conditioner conforming with Australian Standard AS 4454	10% by volume	
Base level Target ranges for fertilisers (to be verified by laboratory testing and per agronomist's report)		
Lime and/or dolomite	2 kg/m^3 at mixing	
Balanced compound NPK turf starter fertiliser	2.9 $kg/100m^2$ after placement	
Minor and trace elements	300 g/m^3 at mixing	

For the purposes of tendering, the contractor must allow for the inclusion of the above soil amendments, but the specific amendments required must be verified by laboratory testing and agronomist recommendations.

Specification: Raingardens and stormwater filtration soils

Part A. 'Fit-for-purpose' performance description

A high permeability loamy sand medium for use as the growing and filtration layer in biofiltration bed installations. The specification is based on a modified version of 'Guidelines for filtration media in biofiltration systems' (FAWB 2009). The permeability Target ranges are quite strict and usually mean that naturally occurring materials will not meet the specifications and mixtures of sand with some soil are required. The FAWB recommendation is that only the surface 100 mm of filtration media must be fertilised to aid plant establishment.

The required properties of the drainage layer and transition layer (if needed) are also specified.

When considering variation more emphasis must be placed on compacted permeability than on strict adherence to particle distribution. In practice, hydrologists may define the permeability rate more closely than is specified here following hydraulic loading calculations.

Part B. Product specification (technical parameters)

Generally, the soil must be free of 'unwanted material' and must meet all the Target ranges of Tables 3.0 and 4.0. Where engineers have otherwise specified permeability that specification will over-ride permeability from Table 3.0.

Table 3.0. Physical properties

Property	Units	Target range	
Texture, preferred range	n/a	Loamy Sand	
Permeability	mm/h	100–300	
Particle size distribution			
2.0–3.35 mm fine gravel	% w/w	< 3	
1.0–2.0 mm coarse sand	% w/w	4–10	
0.25–1.0 mm medium & coarse sand	% w/w	40–60	
0.15–0.25 mm fine sand	% w/w	10–30	
0.05–0.15 mm very fine sand	% w/w	5–30	
< 0.05 mm silt plus clay	% w/w	< 3	

Table 4.0. Chemical properties		
Property	Units	Target range
pH (1:5 in water)	pH units	5.5–7.5
Electrical conductivity (1:5)	dS/m	< 1.2
Phosphorus (Olsen)	mg/kg	< 80
Total nitrogen	mg/kg	< 1000
Organic matter	% w/w	2–5

Chemical properties of the surface layer are not subject to performance specifications by FAWB.

A transition layer is only needed where the following criteria are not met:

• D15 (drainage layer) 5 × D85 (filtration media)

• D15 (drainage layer) = 5–20 × D15 (filtration media)

• D50 (drainage layer) < 25 × D50 (filtration media)

• D60 (drainage layer) < 10 × D10 (filtration media)

When a transition layer is needed ensure:

• D15 (transition layer) 5 × D85 (filtration media)

Do not use geotextile fabrics over drainage layer.

Part C. Example components for the soil supplier

The following table outlines suggested components that may likely meet the physical Target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Example suggested components for the surface layer

Loamy sand or sandy loam soil	< 20% v/v
Medium sand	70–80% v/v
Composted soil conditioner conforming with AS4454	10–20% v/v

Example base level Target ranges for fertilisers for the surface layer (to be verified by laboratory testing and per agronomist's report)

Organic fertiliser (e.g. poultry manure)	5 kg/m^3 or 500 g/m^2
Compound fertiliser NPK 16:4:14)	0.4 kg/m^3 or 40 g/m^2
Trace element mix	0.1 g/m^3 or 10 g/m^2
Superphosphate	0.2 g/m^3 or 20 g/m^2
Magnesium sulphate	0.3 g/m^3 or 30 g/m^2
Potassium sulphate	0.2 g/m^3 or 20 g/m^2

Example suggested components for the filtration layer

Loamy sand or sandy loam soil	< 20% v/v
Medium sand	70–80% v/v
Composted soil conditioner conforming with AS4454	10–20% v/v

Example suggested components for the transition layer

Medium sand	100% v/v

Example suggested components for the drainage layer

2–5 mm drainage gravel	100% v/v

For the purposes of tendering, the contractor must allow for the inclusion of the above soil amendments, but the specific amendments required must be verified by laboratory testing and agronomist recommendations.

Specification: Passive amenity turf (optional)

Part A. 'Fit-for-purpose' performance description

Generally, this requires a sandy loam 'turf underlay' topsoil mix designed to provide moderate resistance to compaction in public and other amenity turf areas subject moderate levels of pedestrian traffic. The specification is not suitable for active recreational areas and is not generally considered suitable for construction of playing fields, even with specific turf management practices to prevent compaction.

Part B. Product specification (technical parameters)

Generally the soil must be free of 'unwanted material' and must meet all the Target ranges of Tables 5.0 and 6.0.

Table 5.0. Physical properties particle size analysis

Property	Units	Target range	
2.0 mm (fine gravel)	% retained by mass	< 10	
1.0 mm (very coarse sand)		< 10	
0.5 mm (coarse sand)		10–30	
0.25 mm (medium sand)		20–40	30–50
0.1 mm (fine sand)		10–30	
0.05 (very fine sand)		5–15 (max 25% combined vfs, Si +Cl)	
0.002 mm (silt)		< 12 (Si + Clay combined) 5–10	
< 0.002 mm (clay)		3–8	
Large particles		2–20 mm = < 10% > 20 mm = 0%	
Organic matter content	% w/w	2 to 8	
Permeability	mm/hour	> 30 (@ 16 drops by McIntyre Jakobsen)	
Wettability (AS 4419)	mm/hour	> 5	
Dispersibility in water		1 or 2	(AS4419) Category

Table 6.0. Chemical properties			
Property		Units	Target range
pH in water (1:5)		pH units	5.4–8.0
pH in $CaCl_2$ (1:5)		pH units	5.2–7.5
Electrical conductivity (1:5)		dS/m	< 0.5
Exchangeable Na percentage		% of ECEC	< 7
Exchangeable Ca/Mg ratio		Ratio	3–9
Available phosphorus Mehlich 3 Olsen		mg/kg	50–150 20–50
Available nitrogen (nitrate N + ammonium N)		mg/kg	30–100

Part C. Example components for the soil supplier

The following table outlines suggested components that may likely meet the physical Target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Example components (likely to meet the physical Target ranges of this specification		
Medium-coarse grade washed sand	30–50% by volume	e.g. 5 parts washed sand/4 parts site soil loam/1 part AS4454 compost.
Sandy loam soil or site soil	40–60% by volume	
Composted soil conditioner conforming with AS4454	10% by volume	
Base level Target ranges for fertilisers (to be verified by laboratory testing and per agronomist's report)		
Lime and/or dolomite	2 kg/m^3 at mixing	
Balanced compound NPK turf starter fertiliser	0.5 kg/m^3 or 50 g/m^2 after placement	
Minor and trace elements	300 g/m^3 at mixing	

For the purposes of tendering, the contractor must allow for the inclusion of the above soil amendments, but the specific amendments required m

Appendix D
Site Photos

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88 Mt Alexander Rd
Flemington
VIC 3031

QLD
Level 10
15 Green Square Cl
Fortitude Valley
QLD 4006

Photo 1. BH 1 - Medium brown sandy clay loam. Site of proposed detention basin.

Photo 2. BH 5 - Medium brown sandy clay loam with orange-brown light clay subsoil. Mid-slope.

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Photo 3. Well structured medium brown clay loam. Bright red medium clay subsoil. Top of hill.

Photo 4. BH 8 – Sandy clay loam. Sample taken from top of hill near fence line.

Photo 5. BH13 – medium brown sandy clay loam.