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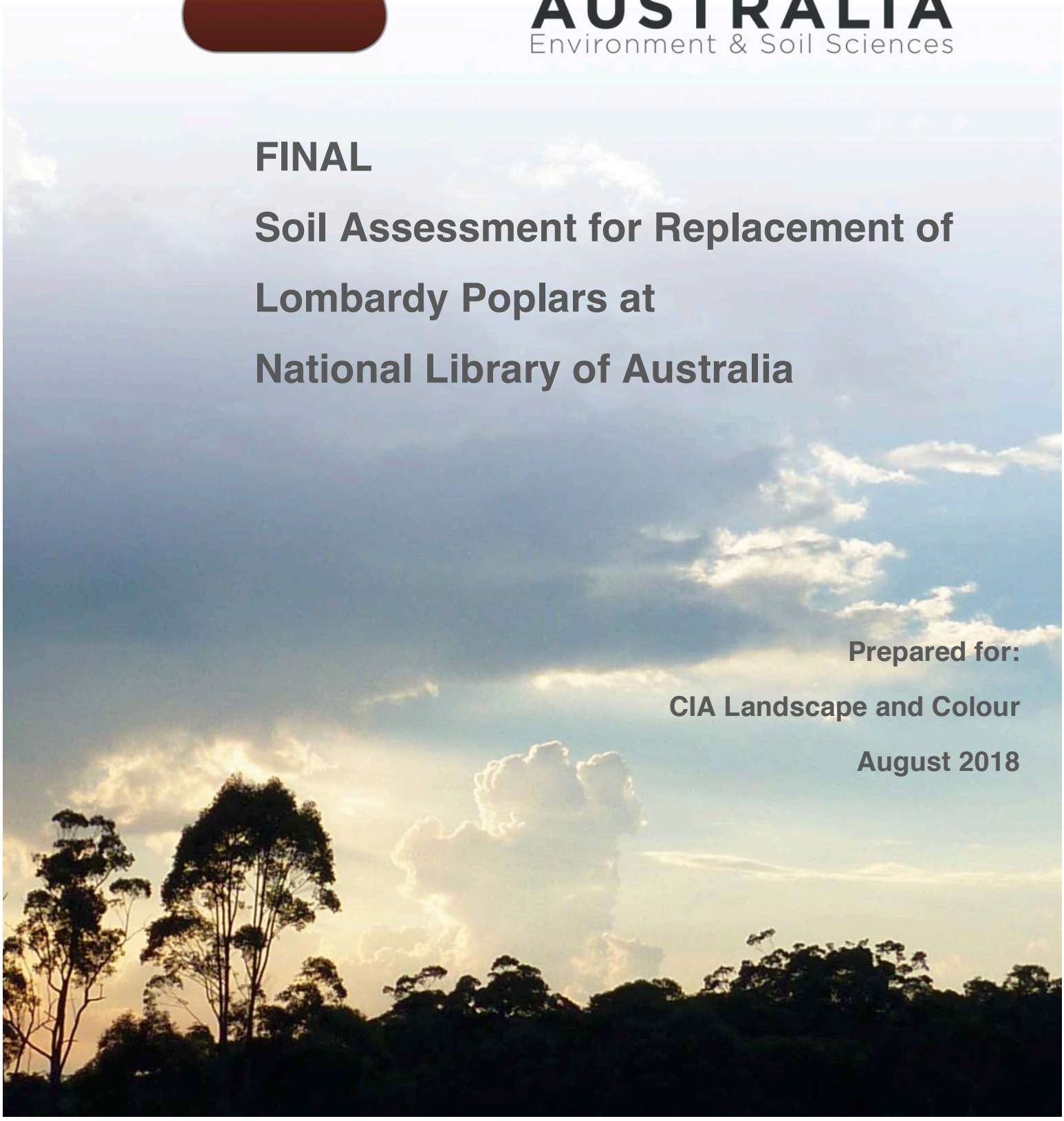
FINAL

Soil Assessment for Replacement of Lombardy Poplars at National Library of Australia



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10/08/2018

CIA Landscapes and Colour,
36 Mildura Street,
Fyshwick ACT 2609

Attention: Catherine Barrow Via email: Catherine@cialanddscapes.com

Dear Catherine,

Re: Soil Assessment for Replacement of Lombardy Poplars at National Library of Australia

1. Introduction and Objectives

SESL Australia Pty Ltd (SESL) has been commissioned by CIA Landscapes and Colour (CIA) to conduct a soil assessment for the replacement of Lombardy Poplar trees at the National Library of Australia (NLA – the site) located at Barton (parliamentary triangle) for the National Capital Authority (NCA). The forecourt of the NLA contains 44 Lombardy Poplars that contribute to a significant cultural landscape within the parliamentary zone in Canberra. In recent years, the deteriorating conditions of the poplars has created concerns for the NCA, and therefore has engaged CIA to design and manage the replacement.

As part of the tree replacement program, a soil assessment is required to complement the removal and replacement of the trees. The objectives of this assessment are:

- Characterise the chemical and physical properties of site soil;
- Determine the soil resource available on-site in the existing forecourts that can be reused on-site for the tree replacement program.
- Identify the potential constraints from the existing trees and soil condition that may impact the tree replacement program.
- Prescribe planting and soil improvement strategies to address the constraints identified, and to ensure successful replacement of the trees.
- Develop a site-specific soil specification for the importation of topsoil as topsoil backfill for the new trees as a quality control measure.

This report outlines the findings of the limited soil assessment conducted by SESL. Site assessment was conducted by Douglas Partners on 24th July 2018, with site inspection and soil sampling undertaken by Douglas Partners, and soil samples provided to SESL for laboratory assessment.

2. Proposed Tree Replacement Program

The proposed tree replacement program on-site will involve:

- Removing the existing trees;
- Strip existing grass and topsoil on-site, up to 400 mm below ground.
- Treat subgrade material with gypsum, followed by ripping the subgrade or imported fill.
- Planting of new trees on the two terraces of the forecourt (approximately 11 trees per row, with two rows on each terrace). Each terrace covers an area of approximately 1,500m^2.
- Reinstatement of turf on the terraces, with proposed species of tall fescues and Kentucky blue grass (irrigated turf).

The current tree species on-site are Lombardy Poplar. At the time of assessment, the replacement tree species is not finalised. SESL was advised by NCA that the proposed species shall reinstate the cultural landscape in the area, and emphasise the NLA and its east-west axis.

NCA advised that the selected species shall resemble similar features to the site, with advanced trees of columnar shape. At this stage the species under consideration as advised by NCA and CIA are:

- Lombardy Poplar (*Populus nigra 'Italica'*)
- English Oak (*Quercus robur 'Fastigiata'*)

SESL notes Lombardy Poplar is currently listed as a pest plant under the *Pest Plants and Animals (Pest Plants) Declaration 2015 (ACT),* and the planting of Lombardy Poplars in the ACT is prohibited.

NCA advised that due to presence of Lombardy Poplars roots and rootless across the site and within site topsoil, the topsoil on-site will not be used as topsoil backfill for the new trees due to concern of remaining rootlets establishing on-site. Topsoil for the new trees will either be imported, or reuse of A2 horizon materials on-site (if suitable), with site-won topsoil either reused on-site for turf establishment, or disposed off-site.

3. Soil Landscape

The soil in this area is within the Williamsdale soil landscape groups according to the *Soil Landscape of the Canberra 1:100 000 Sheet Report (Jenkins 2000)*. The description of the soil landscape group and its associated documented soil limitation is shown in Table 1. SESL notes however the forecourt of the NLA where the existing Lombardy Poplars are currently located, is planted on raised grounds (terraces), with topsoil likely consisting of imported materials.

Table 1 – Soil Landscape Type

Soil Landscape Type	Soil Description & Limitation
Williamsdale	Soils: Topsoil consists of brownish black to brown to black loam to sandy loam (A1 horizon), with underlying dull yellowish brown sandy clay to clay loam subsoil (A2 horizon). Limitations: • Low fertility and acidic topsoil. • Low fertility and strongly acidic subsoils. • High erodibility subsoil. • Low permeability subsoil. • Seasonal waterlogging.

4. Analysis Plan

Site assessment was undertaken by Douglas Partners on 24th July 2018, with eight locations (boreholes) inspected (see Appendix B: Site Map). SESL attended site to review the soil samples collected by Douglas Partners, and selected topsoil and subsoil samples for analysis.

The samples selected for analysis are:

Table 2 – Stockpile and sample details

Forecourt	Boreholes Constructed	Samples for Analysis	Analysis
Northern Forecourt	BH1 BH2 BH3 BH4	BH1 0 – 0.15 m BH1 0.35 – 0.5 m BH3 0 – 0.1 m BH4 0 – 0.1m BH4 0.3 – 0.5 m	Topsoil chemical and physical properties Subsoil chemical properties Topsoil chemical and physical properties Topsoil chemical and physical properties Subsoil chemical properties
Southern Forecourt	BH5 BH6 BH7 BH8	BH7 0 – 0.1m BH7 0.8 – 1.0 m BH8 0.1 – 0.2 m	Topsoil chemical and physical properties Limited physical properties Topsoil chemical and physical properties

The samples above were analysed for chemical properties and basic physical analysis at SESL's NATA (NATA #15633) accredited analytical laboratory for the following:

- Topsoil chemical properties – pH in water (H_2O), pH in calcium chloride ($CaCl_2$), electrical conductivity, nutrients: nitrate, phosphate, potassium, sulfate, calcium, magnesium, cation exchange properties; trace elements: iron, manganese, zinc, copper, boron; organic carbon, organic matter content.
- Subsoil chemical properties – pH in water (H_2O), pH in calcium chloride ($CaCl_2$), electrical conductivity, nutrients: nitrate, phosphate, potassium, calcium, magnesium, cation exchange properties;
- Topsoil physical properties – soil texture, structure, estimated infiltration rate, aggregate strength, estimated clay content and estimated permeability.
- Limited physical properties – pH in water (H_2O), pH in calcium chloride ($CaCl_2$), electrical conductivity and saturated hydraulic conductivity.

In addition to the analysis above, all topsoil and subsoil samples were composited respectively and analysed for saturated hydraulic conductivity to determine the soils' permeability under compaction.

5. Soil Profile

Based on the site assessment conducted by Douglas Partners, the borehole logs indicated the following soil profile observations on-site (see Appendix B: Borelogs):

- Topsoil depths range from 0.15 m to 0.3 m, comprising of dark brown sandy silty clay and gravelly sandy clay, with abundant grass and tree rootlets.
- Subsoil underlying topsoil range from 0.15 m to 0.85 m, comprising of grey brown sandy clayey materials, with pale yellow brown silty clayey gravel materials, with siltstone fragments.
- Horizon C comprised of yellow grey brown siltstone materials, starting from 0.55 m to 0.8 m, with varying degree of weathered stone.

6. Laboratory Results Summary

Table 3 – Summary of Laboratory Results (see Appendix C)

Borehole Location	Laboratory Results
BH1 Topsoil (0 – 0.15 m)	• Soil is slightly alkaline in water and neutral in $CaCl_2$, with low salinity; • Cation exchange is relatively balanced, with slightly low potassium, and high cation exchange capacity; • Low nutrient levels of nitrate and sulfate; • Elevated levels of phosphorus, potassium, calcium, magnesium and zinc; • Very high organic carbon and organic matter content; • Soil is a fine sandy loam material; and • Saturated hydraulic conductivity data showed good permeability under low and light compaction, with acceptable permeability under heavy compaction.
Subsoil (0.35 – 0.5 m)	• Soil is moderately alkaline in water and slightly alkaline in $CaCl_2$, with moderate salinity; • Cation exchange is moderately sodic, with low potassium, and moderate cation exchange capacity; • Low nutrient levels of nitrate and potassium; • Elevated levels of magnesium; • Soil is a sandy clay loam material; and • Saturated hydraulic conductivity data showed good permeability under low and light compaction, with significantly reduced permeability (poor drainage) under heavy compaction.
BH3 Topsoil (0 – 0.1 m)	• Soil is neutral in water and very slightly acidic in $CaCl_2$, with low salinity; • Cation exchange is calcic, with high cation exchange capacity; • Low nutrient levels of nitrate, sulfur and copper; • Elevated levels of phosphate, potassium, calcium, manganese and zinc; • Very high organic carbon and organic matter content; • Soil is a fine sandy loam; and • Saturated hydraulic conductivity data showed that good permeability under low and light compaction, with acceptable permeability under heavy compaction.
BH4 Topsoil (0 – 0.1 m)	• Soil is very slightly acidic in water and slightly acidic in $CaCl_2$, with low salinity; • Cation exchange is calcic, with moderate cation exchange capacity; • Low nutrient levels of nitrate, potassium, sulfur, copper and boron; • Elevated levels of phosphate, calcium, magnesium and zinc; • Very high organic carbon and organic matter content; • Soil is a fine sandy clay loam; and • Saturated hydraulic conductivity data showed good permeability under low and light compaction, with acceptable permeability under heavy compaction.

Borehole Location	Laboratory Results
Subsoil (0.3 – 0.5 m)	• Soil is neutral in water and very slightly acidic in $CaCl_2$, with very low salinity; • Cation exchange is relatively balance, with low potassium, and low cation exchange capacity; • Low nutrient levels of nitrate, phosphate, potassium and calcium; • Elevated levels of magnesium; • Soil is a light sandy clay loam material; and • Saturated hydraulic conductivity data showed good permeability under low and light compaction, with significantly reduced permeability (poor drainage) under heavy compaction.
BH7 Topsoil (0 – 0.1 m)	• Soil is slightly alkaline in water and neutral in $CaCl_2$, with moderate salinity; • Cation exchange is relatively balance, with moderate cation exchange capacity; • Elevated levels nutrients for nitrate, phosphate, potassium, sulfur, calcium, magnesium, manganese and zinc; • Moderate organic carbon and organic matter content; • Soil is a fine sandy clay loam; and • Saturated hydraulic conductivity data showed good permeability under low and light compaction, with acceptable permeability under heavy compaction.
Horizon C: siltstone (0.8 – 1.0 m)	• Materials is strongly alkaline in water and moderately alkaline in $CaCl_2$, with moderate salinity; and • Saturated hydraulic conductivity data showed very good permeability under low compaction, with significantly reduced permeability (poor drainage) under light and heavy compaction.
BH8 Topsoil (0.1 – 0.2 m)	• Soil is moderately alkaline in water and slightly alkaline in $CaCl_2$, with low salinity; • Cation exchange is calcic, with moderate cation exchange capacity; • Low nutrient levels of nitrate and copper; • Elevated levels of potassium, calcium, magnesium, manganese and zinc; • Very high organic carbon and organic matter content; • Soil is a fine sandy clay loam; and • Saturated hydraulic conductivity data showed good permeability under low and light compaction, with acceptable permeability under heavy compaction.

7. Discussion

Based on the results above, SESL notes the following:

- Topsoil materials from both sites were generally calcic and alkaline, uncharacteristic of the typical Canberra topsoil of acidic and magnesic soils (see Table 1). This indicates the topsoil may have been amended with lime (based on soil pH).
- Topsoils are predominantly low in nitrate except for one location (BH7). This suggests the site topsoils are likely suffering from nitrogen deficiency.
- The high organic carbon and phosphate indicates composted organics are likely to have been applied to site topsoil.
- Some topsoils showed elevated manganese, indicating a possibility of seasonal waterlogging, likely during colder dry months.
- Topsoils and subsoils primarily show moderate to high cation exchange capacity, except for subsoil of BH4, indicating generally good nutrient retention capacity.
- Topsoils show reasonable draining under heavy compaction.
- The elevated zinc content may be due to the addition of organic materials. However, the zinc concentration is not considered to pose plant growth concerns for the proposed landscape development.

8. Soil Improvement Program

Based on the soil results and proposed planting, recommendations on soil treatment and planting for the site are shown in Table 4.

Table 4 – Soil Improvement Program

Planting	Soil treatment / Planting Advice
1. Advanced tree planting	• The topsoil on-site can be can be made suitable to be used as topsoil backfill for the advanced tree planting with amelioration. However, SESL notes NCA is concerned about residual rootlets in the topsoil which may pose a risk of regrowth of the former Lombardy Poplars. A soil specification to guide the importation of topsoil to site is provided in Appendix A. Based on limited data of subsoil analysed (2 samples), SESL does not consider the A2 horizon materials to be suitable for reuse as topsoil backfill for the trees, due to increased clay content and low permeability of the subsoil. • In the event the topsoil is to be considered for reuse on-site, SESL recommends the following: o Screen the topsoil to remove roots (i.e. 25 mm trommel); this can be conducted concurrently with incorporation of fertiliser into topsoil. SESL notes the cost for screening the materials may be significant, due to small volume of material (approximately 900 m^3 of topsoil). However, in comparison to cost associated with importing topsoil and removing site-won topsoil off-site for disposal, this option should be considered. o Apply 200 g/m^3 of sulfate of ammonia to improve nitrogen and sulfur concentration. o Apply 20 mm of composted green waste fines to surface soil, prior to mulching. o Mulch layer should be no more than 75 mm thick, and shall be at least 100 mm away from the collar of the tree trunk. o Apply multi-purpose slow release fertiliser 6 months after planting at 50 g/m^2 as a long term maintenance. • SESL notes NCA will be considering the application of mycorrhizal fungi to topsoil to stimulate microbial activity within the soil, and improve over all soil nutrient and water holding capacity. • SESL notes subgrade treatment with gypsum will be undertaken, including ripping of subgrade to 300 mm depth, prior to backfilling with topsoil. Based on the limited subsoil data obtained (2 samples analysed from depth of 0.35 – 0.5 m), gypsum application is not required due to sufficient exchangeable calcium content. Excess gypsum will cause an influx of salt, increasing salinity and pH of the soil unnecessarily.

Planting	Soil treatment / Planting Advice
2. Irrigated Turf	• The topsoil on-site can be can be made suitable to be used as topsoil backfill for the reinstatement of turf on-site. However, SESL notes NCA is concern of the residual rootlets in the topsoil, posing risk for regrowth of the former Lombardy Poplar on-site and may not be using the topsoil on-site. • In the event the topsoil is to be considered for reuse on-site, SESL recommends the following: o Screen the topsoil to remove rootlets (i.e. 25 mm trommel). o Apply 200 g/m^3 of sulfate of ammonia to improve nitrogen and sulfur concentration.

Please note the following overall site recommendations:

- Attention to subsoil drainage and aeration of the tree transplant material is recommended. Advanced trees, with their deep roots, are vulnerable to transplant shock due to anoxia in the deep subsoil. Anoxia can be caused by planting into low permeability top- or sub-soils. Planting techniques and strategies must be adapted to ensure good aeration is maintained and to ensure rapid establishment of newly planted stock. SESL notes subsoil drainage will be installed at the border of the terraces, however we recommend that drainage be extended throughout the treesscape to connect with the border drainage. The low permeability of the subsoil indicates a risk of waterlogging in wet conditions and given the significance of the planting, in-ground drainage will constitute a valuable investment.
- Both Lombardy Poplars and English Oak prefer humus rich and moist soils, therefore sufficient irrigation is important, particularly during early establishment stage.
- The screening of site-won topsoil can be conducted concurrently doing treatment, removing large residual roots of the Lombardy Poplars. Residual rootlets can be treated in-situ where observed on spread topsoil via herbicide application (localised / spot application). This option may be considered, factoring costs associated with importing topsoil and disposing site-won topsoil, and for sustainability purposes.z
- Adequate soil quality validation to ensure the quality of topsoil to be supplied to site is required. Proposed imported topsoil shall be analysed for compliance against the specification provided (Appendix A), and certified compliant by a suitably qualified professional prior to site installation. Validation shall also be conducted on ameliorated site-won topsoil. Validation requirements are set out in the soil specifications (see Appendix A).

- Amelioration of topsoil and subsoil should be undertaken at a time appropriate to the development works of the site – a minimum of 3 weeks prior to plant installation.

- SESL notes that subsoils may be subjected to poor permeability under compaction, and the proposed work involve ripping of subsoils prior to topsoil backfill. To prevent heavy compaction and potential permeability and drainage issues following spreading of topsoil, SESL recommends the following:
    - Conduct spreading of topsoil near the end of the works on-site, to avoid unnecessary compaction whilst the rest of the works on site are being carried out;
    - It is vital that no compaction should be allowed on the terrace, otherwise the soil treatment undertaken will fail, particularly on the newly installed turf.
    - Avoid driving on spread topsoil material especially if wet;
    - If trafficking of the site is unavoidable, provision should be made to de-compact the site subsoil and / or topsoil before seeding of the turf.

9. Conclusion

Based on information provided by the CIA and NCA, and results obtained, soil improvement is vital to the tree replacement at the NLA, while preserving the significant cultural landscape in the parliamentary triangle. SESL is pleased to present this report and recommendations. Please do not hesitate to contact us with any questions or clarifications.

SESL AUSTRALIA

Declan McDonald

Senior Soil Scientist
& Certified Professional Soil Scientist #S01444

Kelly Lee

Soil Scientist

Appendices

Appendix A: Soil Specification for Topsoil Backfill for Advanced Tree Planting

Appendix B: Sampling Map and Borelogs provided by Douglas Partners

Appendix C: SESL Soil Laboratory Reports

References

- SESL Australia, Report #48921
- Douglas Partners (2018) Borehole Logs and Borehole Investigation Sampling Map for National Library Poplar Replacement Project (Ref: 94037)
- NCA (2018) Draft Landscape Final Sketch Plan for Removal and Replacement of Lombardy Poplars at National Library of Australia
- *Pest Plants and Animals (Pest Plants) Declaration 2015 (ACT)*
- *Standard Specification for Urban Infrastructure Works – Section 9 Landscape (2009 ACT Government)*
- *Soil Landscape of the Canberra 1:100 000 Sheet Report (Jenkins 2000)*

Limitations

SESL has provided consulting services for this project based on information provided by CIA Landscapes and Colour, Douglas Partners and National Capital Authority, and as outlined in our discussions. SESL Australia Pty Limited (SESL) does not make any representation or warranty that the conclusions in this report will be applicable in the future as there may be changes in the condition of the materials covered in this assessment, applicable legislation or other factors that would affect the conclusions contained in this report.

SESL has used a degree of skill and care ordinarily exercised by reputable members of our profession practicing in the same or similar locality. SESL's assessment is based on the result of samples provided to SESL, and information provided. Neither SESL, nor any other reputable consultant, can provide unqualified warranties.

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Appendix A

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Specification 1: Standard Topsoil Backfill for Advanced Trees (Exotic species)

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

A suitable topsoil backfill for mass planting of advanced exotic trees should comprise of sandy loam or clay loam and sandy clay loam materials. Soil material shall have a good nutrient concentration and is not subject to compaction by pedestrian or other traffic.

This specification is designed based on utilising amended site-won topsoil, or for imported topsoil.

Part B. Product specification (technical parameters)

The soil shall be free of foreign contaminants (eg. plastics, glass, metal etc) and meet all the performance criteria listed in Table 1. Where variations from these target ranges occur (i.e. non-compliance) refer to Specification 7.

Table 1 – Physical and Chemical Properties Performance Criteria for Topsoil Backfill for Advanced Tree Planting

Physical properties	Units	Performance Criteria
Texture, preferred range	n/a	Sandy loam to clay loam to sandy clay loam
Hydraulic conductivity / Permeability (@ 16 drops by McIntyre Jakobsen)	mm/hr	> 20
Wettability	minutes	> 5
Organic matter content	% dry weight basis	3 – 6
Chemical properties	**Units**	**Target Range**
pH in water (1:5) standard range	pH units	5.8 – 7.0
pH in $CaCl_2$ (1:5) standard range	pH units	5.5 – 6.5
Electrical conductivity (1:5)	dS/m	< 0.5
Phosphorus	mg/kg	30 – 75
Available Nitrogen (Nitrate – N + Ammonium – N)	mg/kg	25 – 75
Sodium (Na)	% of ECEC	< 6
Potassium (K)	% of ECEC	3 – 10
Calcium (Ca)	% of ECEC	60 – 80
Exchangeable Magnesium (Mg)	% of ECEC	15 – 25
Exchangeable Aluminium (Al)	% of ECEC	< 2
Exchangeable Ca/Mg ratio	Ratio	3 – 7

Part C. Example components for the soil supplier

The following table outlines the fertiliser treatment designed to meet the performance criterial of this soil specification. Note: this is **not** part of the product specification. This treatment is based on using site-won topsoil. **Imported materials shall require a different fertiliser treatment** to comply with the specification.

Table 2 – Example Soil Type Composition and Soil Treatment

Soil specifications	Soil type composition	Fertiliser treatment
Standard topsoil backfill for advanced trees – exotic species	• 100% by volume site-won topsoil or sandy loam soil.	At mixing: • Add 200 g/m^3 of sulfate of ammonia, or equivalent. • Apply 20 mm of composted green waste fines to surface soil, prior to mulching. • Apply multi-purpose slow release fertiliser 50 g/m^2 6 months after planting.

For the purposes of tendering, the contractor shall allow for the inclusion of the above soil amendments. However, the specific amendments required shall be verified by laboratory testing and soil scientist's recommendations (see Specification 2).

HOLD POINT 1	
Process Held:	Completion of *Topsoil Backfill for Advanced Tree Planting* initial compliance certification.
Submission Details:	Initial soil analysis with sample provided by supplier or contractor demonstrated soil analysis results compliant with *Topsoil Backfill for Advanced Tree Planting*. Sample analysed shall include topsoil improvement as recommended in specification.
Release of Hold Point:	Submission of laboratory test certificates to superintendent together with suppliers, contractors or independent soil scientist report certifying compliance or fit for purpose including acceptance of any non-compliance with or without conditions.

HOLD POINT 2	
Process Held:	Supply of *Topsoil Backfill for Advanced Tree Planting.*
Submission Details:	At least (3) working days prior to supply of *Topsoil Backfill for Advanced Tree Planting* the Contractor shall provide certificate(s) from a NATA registered or approved non NATA laboratory for physical and chemical analysis. Certificates are to be certified compliant or fit for purpose by a soil scientist, including acceptance of any non-compliance with or without conditions.
Release of Hold Point:	The superintendent shall examine the submitted documentation prior to authorising the release of the Hold Point.

HOLD POINT 3	
Process held:	Compliance failure of *Topsoil Backfill for Advanced Tree Planting* during ongoing compliance certification.
Submission Details:	A corrective procedures specification from a qualified soil scientist for soil corrective amendments to enable compliance with *Topsoil Backfill for Advanced Tree Planting* .
Release of Hold Point:	Submission of laboratory test certificates to superintendent together with an independent soil scientist report certifying the corrective procedure has resulted in compliance or fit for purpose including acceptance of any non-compliance with or without conditions. The superintendent shall examine the submitted documentation prior to authorising the release of the Hold Point.

Specification 2: Quality Assurance and Control

The contractor shall use analytical testing to verify compliance with the Product Specification.

Part A. Initial compliance certification

Before any soil installation, the contractor or soil manufacturer shall submit samples of trial blends to an accredited testing laboratory to determine compliance with specifications (see Table 1). The trial blend shall be based on available test information on components and, if necessary, employ a soil scientist for advice.

Submit trial samples to the testing laboratory, allowing sufficient time for testing and re-formulation in the case of failure to satisfy the performance criteria. Once compliant, a test certificate clearly stating compliance with the applicable criteria shall be presented to the site supervisor or quality officer.

Note: Alternative test methodologies shall be accepted if certified as compliant by an independent expert agronomist or soil scientist.

Non-compliance shall automatically generate the first **Hold point 1**. No soil shall be installed until initial compliance certification has been demonstrated.

Manufacturer's product representation: For imported soils from manufacturers, a 'product representation' document produced by the supplier may be accepted as a compliance certificate if:

- It is an off-the-shelf product line, not a custom mix;
- A representative test certificate is available and is acceptably recent (within 6 months);
- The testing covers all the criteria in the performance specification; and
- The manufacturer's quality assurance system is certified by an external certifying organisation.

Part B. Record keeping (initial compliance)

Growing media initial compliance certification records shall be kept in a readily available format that provides for traceability of purchase and location on site. Each compliance certification for all the product specifications used on site shall be identified by date, quantity to be supplied and a copy of the formulation used to reach compliance.

The contractor shall submit samples of blended soils or imported soil mixes at regular intervals (based on volume of materials as shown in Table 9) during construction for the purposes of demonstrating continued compliance as part of quality control.

Part C. Test Submissions

For Hold Point 1, contractor or supplier shall submit representative samples of ~5 kg of each product specification, packed and labelled to indicate the source and the specification to be met. The samples shall be taken in a representative manner.

For Hold Point 2 and 3, representative samples shall be collected by a qualified soil scientist in accordance to *Section 9 Landscape: Standard Specification for Urban Infrastructure Works (TAMS 2002).*

The contractor shall refer to the testing frequencies indicated in Table 3.

Table 3 – Outline of the required testing frequency to achieve compliance testing. Samples shall be tested to the performance criteria indicated in the product specification.

Soil Types Specification	Material	Minimum quality control test frequency
Topsoil Backfill for Advanced Tree Planting	Standard topsoil backfill for advanced tree planting.	1 per 500 m^3

Note: A minimum of three samples shall be certified for compliance for each type of material. Where the delivery is less than the stated quality control testing frequency, the initial compliance certification certificate shall be deemed to demonstrate compliance.

Part D. Analysis

All testing as required by the product specifications shall be arranged by the contractor, and carried out by an accredited soil testing laboratory. All test results records shall be made available to the superintendent or quality officer.

Hold point 1. The test certificate shall be accompanied by a statement of compliance from a qualified soil scientist.

Compliance certificates shall state the material is compliant, with laboratory results attached confirming the compliance. In the case of minor non-compliance, a clear statement shall be obtained from a qualified soil scientist waiving the non-compliance, and certifying the sample is compliant or fit for purpose, with or without conditions.

Part E. Non-compliance

In the case of significant non-compliance, **Hold Point 3** shall occur.

Hold point 3. In the event that quality control samples show substantial non-compliance from the approved performance target ranges, the supplier shall demonstrate compliance for any future loads. This may require re-formulation or alteration to existing formulations and shall require the advice of a soil scientist, making adjustments to mixing ratios, additives and procedures to achieve compliance.

Part F. Record keeping

Growing media construction and quality control compliance records shall be kept in a readily available format that provides traceability of purchase and placement on site. Each batch of soil shall be identified by date of manufacture, quantity and a corresponding test result and shall match the date of materials delivery, and where the material was placed.

SESL AUSTRALIA PTY LIMITED

Declan McDonald
Senior Soil Scientist & CPSS #S01444

Kelly Lee
Soil Scientist

LIMITATIONS:

SESL has provided consulting services for this project based on information provided by CIA Landscapes and Colour, Douglas Partners and National Capital Authority, and as outlined in our discussions. SESL Australia Pty Limited (SESL) does not make any representation or warranty that the conclusions in this report will be applicable in the future as there may be changes in the condition of the materials covered in this assessment, applicable legislation or other factors that would affect the conclusions contained in this report.

SESL has used a degree of skill and care ordinarily exercised by reputable members of our profession practicing in the same or similar locality. SESL's assessment is based on the result of samples provided to SESL, and information provided. Neither SESL, nor any other reputable consultant, can provide unqualified warranties.

This report and associated documentation and the information herein have been prepared solely for the use of the CIA Landscapes and Colour, and National Capital Authority. Any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuring liability resulting from use of the report by third parties cannot be transferred to SESL.

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In addition to the above limitations, SESL's terms and conditions apply to this and all works undertaken by SESL. A copy of SESL's current terms and conditions are provided in the following web link: http://sesl.com.au/terms-and-conditions/.

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QLD Level 10, 15 Green Square Cl, Fortitude Valley QLD 4006

SESL AUSTRALIA
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Appendix B

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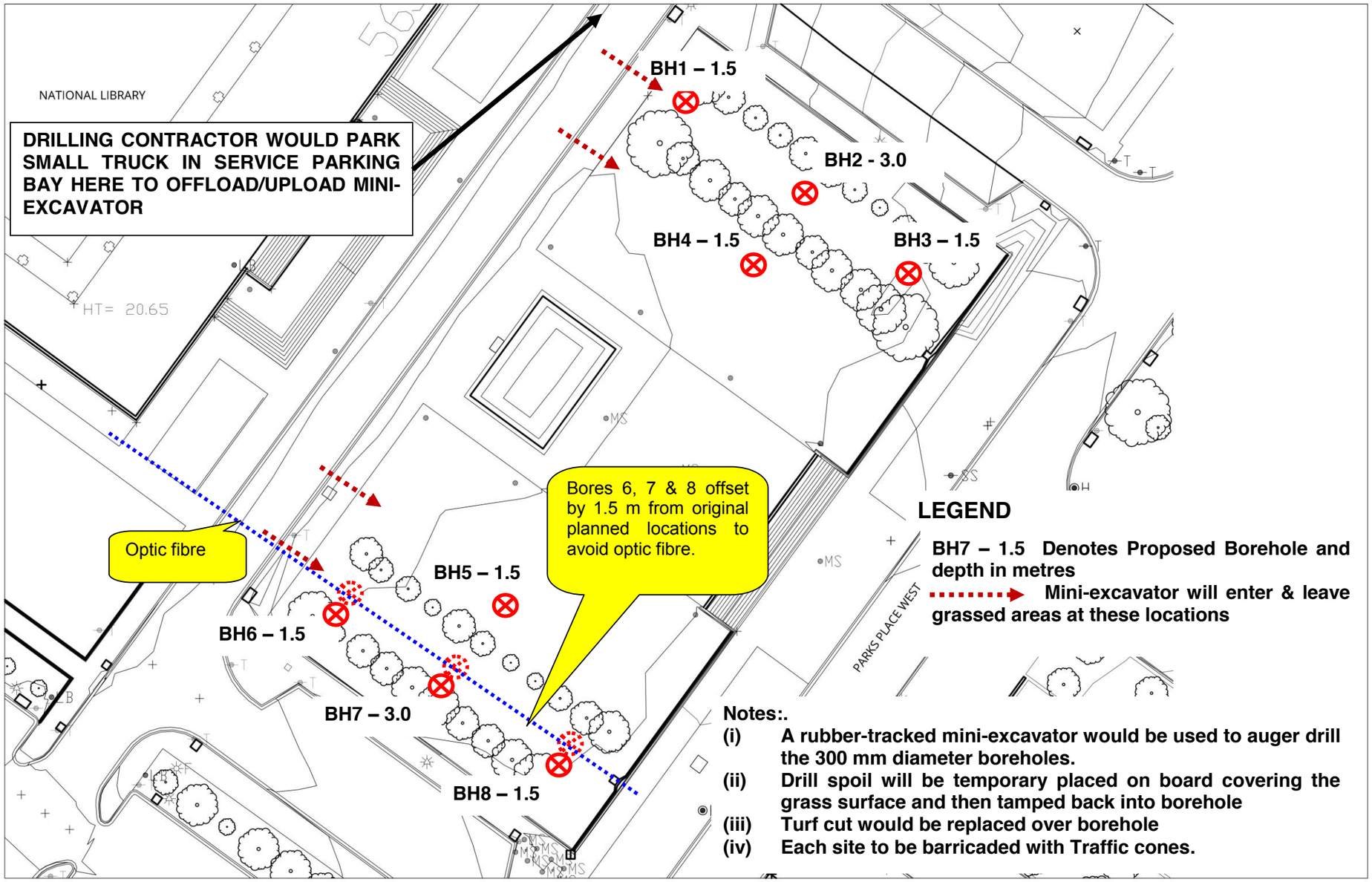

REVISION	DATE	AMENDMENT	DRAWN	CHECKED	APPROVED
X	XX.XX.XX	X	X	X	X

SCALE A1

Cia landscapes + colour
36 Mildura Street Fyshwick ACT 2609
Po Box 75 Red Hill ACT 2603
cialandscapesandcolour.com.au
+61 02 6232 6582 / +61 04 1728 9042

CLIENT
NATIONAL CAPITAL AUTHORITY

DRAWING TITLE	LANDSCAPE PLAN
DRAWING USE	FOR INFORMATION
PROJECT	NLA POPLAR REPLACEMENT, BL 5 S 27 PARKS
PROJECT NUMBER	18_004
DWG NO	L.300
REVISION	DRAFT

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Cia Landscapes + Colour		
OFFICE:	Canberra	DRAWN BY:	GER
SCALE:	NTS	DATE:	18/7/18

TITLE: **Proposed Investigation Borehole Locations**
Forecourt Redevelopment
National Library of Australia

PROJECT No:	94037.00
DRAWING No:	P1
REVISION:	C

BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.4 AHD
EASTING: 693736.4
NORTHING: 6091963.3
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.0	TOPSOIL FILLING-hard, dark brown sandy silty clay, low plasticity, numerous grass rootlets and trace tree roots up to 40mm thick, dry to moist		D	0.0				
	0.15				0.15				
	0.3	FILLING-dense, grey brown sandy clayey gravel, siltstone fragments to 60mm size, low plasticity , fine to coarse grained, dry to moist		D	0.35				
	0.55				0.5				
		SILTSTONE-medium strength, highly to moderately weathered, yellow grey brown, fine grained siltstone, dry							
				D	0.8				
1	1.0	-from 1.0m, medium to high strength, moderately weathered			1.0				1
	1.25	Bore discontinued at 1.25m -refusal							
562									
2									2
561									
3									3
560									
4									4
559									

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.2 AHD
EASTING: 693749.1
NORTHING: 6091951.9
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.0	TOPSOIL FILLING-hard, dark brown sandy silty clay, low plasticity, numerous grass roots, dry to moist		D	0.0 0.1				
	0.3	FILLING-dense, grey brown silty clayey gravel, angular siltstone/shale fragments to 50mm size, low plasticity, dry		D	0.4 0.5				
	0.55	SILTSTONE-medium strength, highly to moderately weathered, yellow brown, very fine grained, dry		D	0.55 0.75				
562	1								1
	1.5	Bore discontinued at 1.5m -hard augering							
561	2								2
560	3								3
559	4								4

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.1 AHD
EASTING: 693761.6
NORTHING: 6091942.3
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.0	TOPSOIL FILLING-hard, dark brown sandy silty clay, low plasticity, numerous grass roots, dry to moist		D	0.0				
				D	0.15				
		-from 0.2m, tree roots			0.25				
	0.3	FILLING-medium dense to dense, pale yellow brown silty clayey gravel, angular siltstone fragments up to 60mm in size, low plasticity, moist							
				D	0.5				
					0.65				
	0.85	SILTSTONE-low to medium strength, highly to moderately weathered, yellow brown, fine grained, dry							
562	1			B	1.0				1
	1.5	Bore discontinued at 1.5m			1.5				
		-limit of investigation							
561	2								2
560	3								3
559	4								4

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.3 AHD
EASTING: 693743.7
NORTHING: 6091944.8
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.3	TOPSOIL FILLING-hard, dark brown sandy silty clay with numerous rootlets and tree roots to 40mm size, dry to moist		D	0.0 0.1 0.15				
				D	0.25				
	0.6	FILLING-dense, grey brown sandy clayey gravel with rounded to angular siltstone/shale/igneous gravel to 60mm size, low plasticity, fine to coarse grained sand with some tree roots, dry to moist		D	0.3 0.5				
562	1	SILTSTONE-low strength, highly weathered, yellow brown, very fine grained, dry to moist -from 0.9m, low to medium strength, highly to moderately weathered, dry		D	0.65 0.8				1
	1.5	Bore discontinued at 1.5m -limit of investigation							
561	2								2
560	3								3
559	4								4

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.3 AHD
EASTING: 693714.3
NORTHING: 6091904.8
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.2	TOPSOIL FILLING-hard, dark brown sandy silty clay with abundant rootlets and roots, dry to moist		D	0.1				
		FILLING-dense, grey brown sandy clayey gravel, rounded to sub angular gravel to 60mm size including igneous/sandstone/shale, low plasticity, fine to coarse grained, dry to moist		D	0.2 0.25				
	0.7				0.4				
562	1	SILTSTONE-low to medium strength, highly to moderately weathered, yellow brown, dry -from 0.9m, medium strength, highly to moderately weathered, yellow grey							1
	1.5	Bore discontinued at 1.5m -limit of investigation							
561	2								2
	3								3
560	4								4
559									

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.5 AHD
EASTING: 693691.6
NORTHING: 6091905.9
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.2	TOPSOIL FILLING-hard, dark brown sandy silty clay, low plasticity, some fine to medium grained sand, numerous grass and tree roots, dry to moist		D	0.0 0.1				
		FILLING-hard, grey brown yellow brown sandy clayey gravel, sub rounded to angular siltstone/shale/igneous gravel to 40mm size, low plasticity, fine to coarse grained sand, some tree roots, moist		D	0.3 0.5				
	0.7	SILTSTONE-very low to low strength, extremely to highly weathered, yellow brown, very fine grained, dry to moist							
562	1.5	Bore discontinued at 1.5m -limit of investigation							
561									
560									
559									

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.3 AHD
EASTING: 693706
NORTHING: 6091894.1
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.15	TOPSOIL FILLING-hard, dark brown silty clay/sandy silty clay, low plasticity, some fine sand, numerous fine tree roots, dry to moist		D	0.0 0.1 0.2				
		FILLING-dense,grey brown sandy clayey gravel with rounded siltstone/sandstone angular/sub angular to 50mm gravel, low plasticity, fine to coarse grained sand, dry		D					
	0.6	SILTSTONE-very low strength, extremely to highly weathered, yellow brown, very fine grained, dry to moist			0.6				
				D	0.8 1.0				
562	1	-from 1.2m, low strength, highly weathered, dry							1
	2								2
561	2.5	Bore discontinued at 2.5m -hard augering							
	3								3
560									
	4								4
559									

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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BOREHOLE LOG

CLIENT: Cia Landscapes + Colour
PROJECT: National Library Poplar Replacement Project
LOCATION: Parkes Place, West Barton

SURFACE LEVEL: 563.1 AHD
EASTING: 693718.4
NORTHING: 6091885
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 94037.00
DATE: 24/7/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
563	0.2	TOPSOIL FILLING-hard, dark brown gravelly sandy clay, low plasticity, fine to coarse grained sand, various gravel to 30mm in size, numerous fine tree rots, dry to moist		D	0.1				
	0.35	FILLING-dense, grey brown sandy clayey gravel, siltstone/shale gravel to 40mm in size, low plasticity, fine to coarse grained, with some fine tree roots, dry to moist		D	0.2				
		FILLING-dense, pale yellow brown silty clayey gravel, angular fragments to 75mm size, low plasticity, dry			0.3				
	0.8	SILTSTONE-very low strength, extremely to highly weathered, pale yellow brown, very fine grained, dry to moist							
562	1								1
	1.5	Bore discontinued at 1.5m -limit of investigation							
561	2								2
560	3								3
559	4								4

RIG: Kubota KX057-4 mini-excavator DRILLER: Muddy's Contracting LOGGED: APH/GER CASING:
TYPE OF BORING: 300mm auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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SESL AUSTRALIA
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Appendix C

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QLD Level 10, 15 Green Square Cl, Fortitude Valley QLD 4006

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

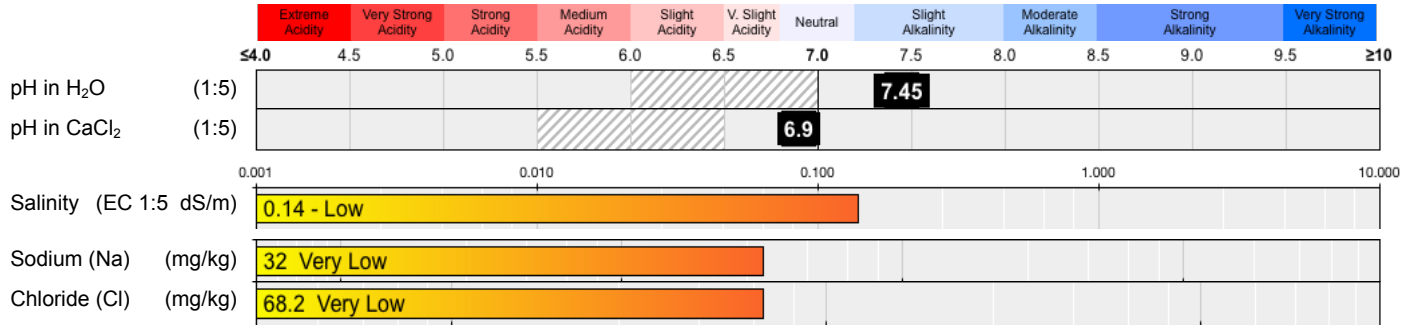
Batch N°: 48921 | **Sample N°: 1** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name: **Cia Landscape and Colour**
Client Contact: **Briar Champness Lal**
Client Order N°:
Address: **Red Hill ACT 2603**

Project Name: **Removal and Replacement of Lombardy Poplars at National**
SESL Quote N°: **Q8187R02**
Sample Name: **BH1 (0-0.15m)**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

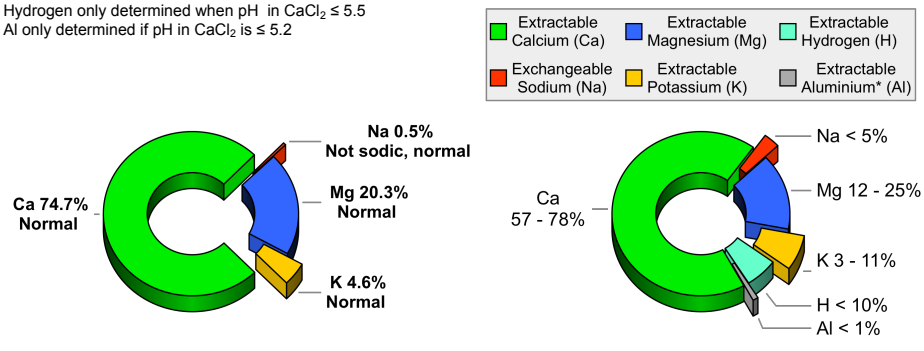
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	3.7	4.1 – 6.0
Comment: Calcium low		
Mg:K	4.4	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.05	< 0.07
Comment: Acceptable		
K:Na	8.9	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.14	1.24	20.17	5.49		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

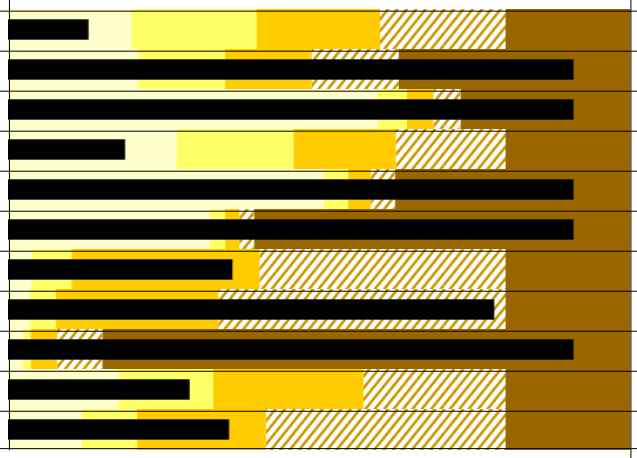
Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 1** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	3.4		0.9	8	7.1
Phosphorus (P)	mg P/kg	91.2		24.3	16.8	Drawdown
Potassium (K)	mg/kg	485		129	103.2	Drawdown
Sulphur (S)	mg S/kg	16		4.3	18.1	13.8
Calcium (Ca)	mg/kg	4040		1074.6	735	Drawdown
Magnesium (Mg)	mg/kg	667		177.4	76.9	Drawdown
Iron (Fe)	mg/kg	249		66.2	146.8	80.6
Manganese (Mn)	mg/kg	43		11.4	11.7	0.3
Zinc (Zn)	mg/kg	30		8	1.3	Drawdown
Copper (Cu)	mg/kg	2.3		0.6	1.7	1.1
Boron (B)	mg/kg	1.2		0.3	0.7	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 %.

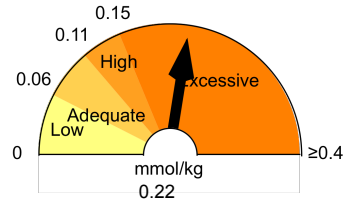
Marginal — Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

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 effective amelioration depth.

Phosphorus Saturation Index



Excessive. Exceeds environmental threshold. Implement improved P management to reduce potential for nonpoint P pollution.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	27
Eff. Cation Exch. Capacity (eCEC):	27
Base Saturation (%):	100
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0:	0
– to neutralise Al:	-

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Loam Fine Sandy**
Estimated clay content:	**25%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Organic**
Calculated EC_{SE} (dS/m):	**1.3**

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

Munsell Colour:	-
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Rapid**
Est. Permeability Class (mm/hr):	**20 - 60**
Additional comments:	

Organic Carbon (OC %):	**Very High - 7.9**
Organic Matter (OM %):	**17.4**
Est. Field Capacity (% water):	**28**
Est. Permanent Wilting Point (% water):	**12**
Est. Plant Available Water (% water):	**16**
Est. Plant Available Water (mm/m):	**160**

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
pH (1:5 $CaCl_2$) - SESL CM0002; Rayment & Lyons 4B4-2011
EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
Chloride - Rayment & Lyons 5A2a-2011
Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure* - "Murphy" (1991), Colour- "Munsell" (2000))

*Structure analysed in the laboratory is conducted on a disturbed sample, therefore is only a representation of the macro-structures that may be present in the field, which provide an indication of the soil physical characteristics and behaviours that may exist.

A member of the Australian Soil and Plant Analysis Council (ASPAC)
This laboratory participates in, and is awarded certification based on results of the scores returned in, ASPAC inter-laboratory proficiency rounds. For detailed current certification status and for more information on the ASPAC inter-laboratory proficiency testing programs, see the ASPAC website: http://www.aspac-australasia.com

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

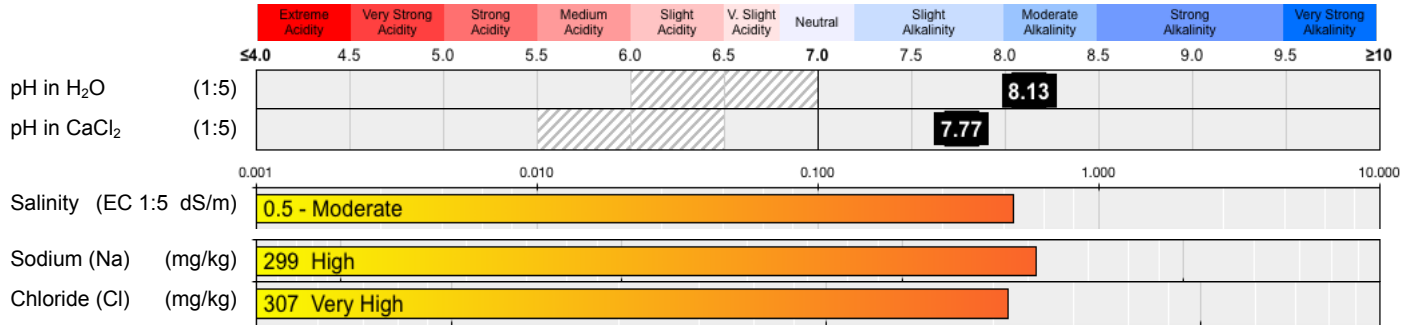
Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 2** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Cia Landscape and Colour**	Project Name:	**Removal and Replacement of Lombardy Poplars at National**
		SESL Quote N°:	**Q8187R02**
Client Contact:	**Briar Champness Lal**	Sample Name:	**BH1 (0.35-0.5m)**
Client Order N°:		Description:	**Soil**
Address:		Test Type:	**SSCP, P_M3, NO3_Sol**
	Red Hill ACT 2603		

RECOMMENDATIONS

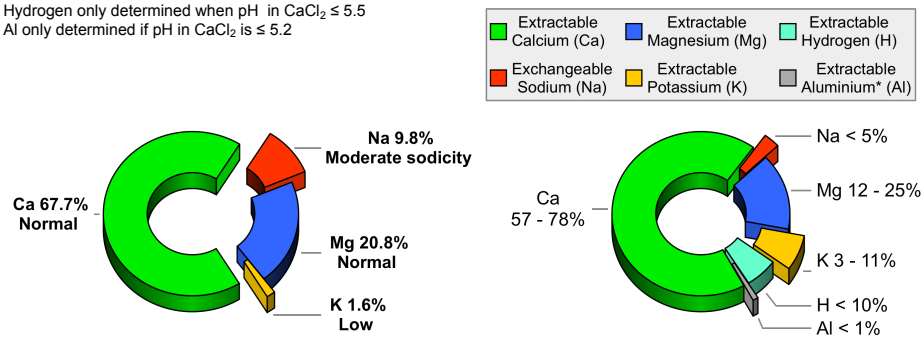
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**3.3**	4.1 – 6.0
Comment: Calcium low		
Mg:K	**13.2**	2.6 – 5.0
Comment: Potential Potassium deficiency		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**0.2**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
1.30	0.21	9.01	2.77		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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Batch N°: 48921 | **Sample N°: 2** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	0.11		0	8	8
Phosphorus (P)	mg P/kg	40		10.6	16.8	6.2
Potassium (K)	mg/kg	81.1		21.6	69.7	48.1
Sulphur (S)	mg S/kg	-		-	18.1	18.1
Calcium (Ca)	mg/kg	1810		481.5	496.1	14.6
Magnesium (Mg)	mg/kg	337		89.6	51.6	Drawdown
Iron (Fe)	mg/kg	-		-	146.8	Did not test
Manganese (Mn)	mg/kg	-		-	11.7	Did not test
Zinc (Zn)	mg/kg	-		-	1.3	Did not test
Copper (Cu)	mg/kg	-		-	1.7	Did not test
Boron (B)	mg/kg	-		-	0.7	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 %.

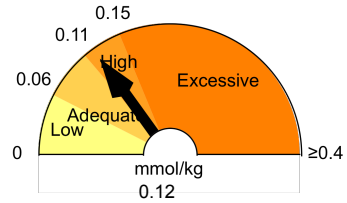
Marginal — Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

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 effective amelioration depth.

Phosphorus Saturation Index



High. Soil P will not limit plant growth. No P recommended this season.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**13.3**
Eff. Cation Exch. Capacity (eCEC):	**13.3**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sandy Clay Loam**	Munsell Colour:	-	Organic Carbon (OC %):	-
Estimated clay content:	**20 - 30%**	Structure Size:	**Fine (1 - 10mm)**	Organic Matter (OM %):	-
Tactually gravelly:	**Gravelly**	Structural Organisation:	**Pedal - Weak**	Est. Field Capacity (% water):	**26**
Tactually organic:	**Not Organic**	Structural Unit:	**Granular**	Est. Permanent Wilting Point (% water):	**15**
Calculated EC_{SE} (dS/m):	**4.8**	Potential infiltration rate:	**Moderate**	Est. Plant Available Water (% water):	**11**
– Moderate saline. Growth on many plant species is affected.		Est. Permeability Class (mm/hr):	**5 - 20**	Est. Plant Available Water (mm/m):	**110**
		Additional comments:			

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
pH (1:5 $CaCl_2$) - SESL CM0002; Rayment & Lyons 4B4-2011
EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
Chloride - Rayment & Lyons 5A2a-2011
Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure* - "Murphy" (1991), Colour- "Munsell" (2000))

*Structure analysed in the laboratory is conducted on a disturbed sample, therefore is only a representation of the macro-structures that may be present in the field, which provide an indication of the soil physical characteristics and behaviours that may exist.

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

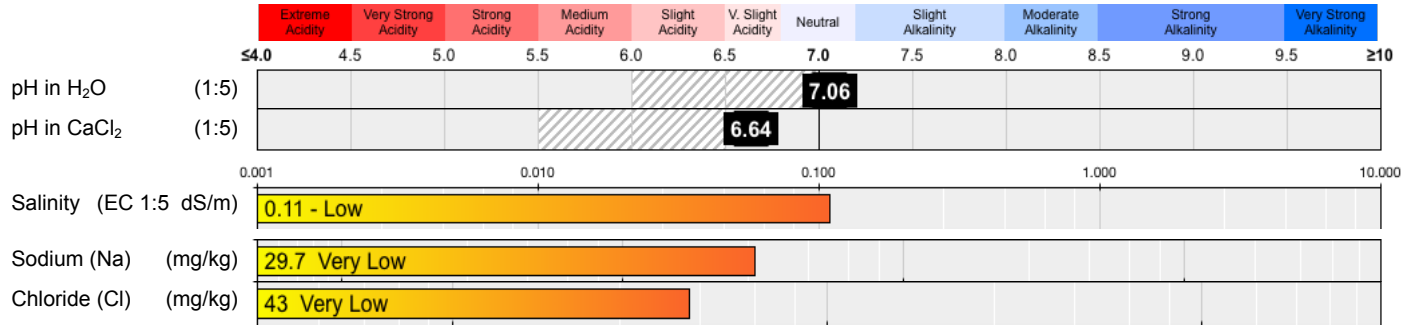
Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 3** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Cia Landscape and Colour**	Project Name:	**Removal and Replacement of Lombardy Poplars at National**
		SESL Quote N°:	**Q8187R02**
Client Contact:	**Briar Champness Lal**	Sample Name:	**BH3 (0.0-0.1m)**
Client Order N°:		Description:	**Soil**
Address:		Test Type:	**FSC_Plus**
	Red Hill ACT 2603		

RECOMMENDATIONS

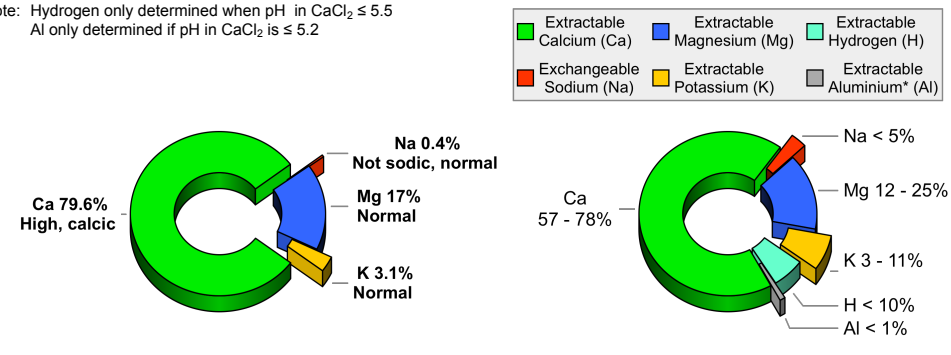
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**4.7**	4.1 – 6.0
Comment: Balanced		
Mg:K	**5.5**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.03**	< 0.07
Comment: Acceptable		
K:Na	**7.9**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.13	1.03	26.43	5.63		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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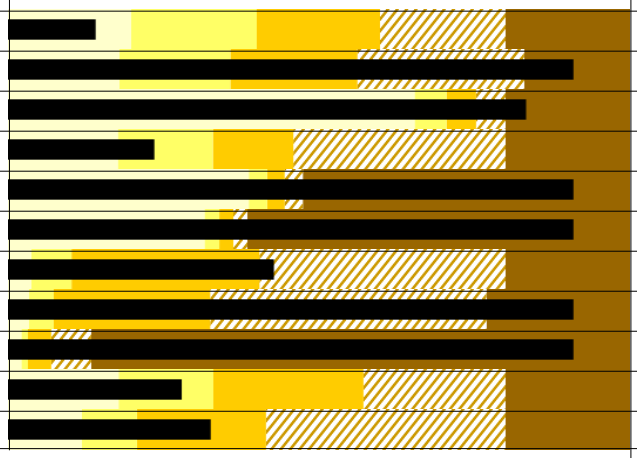
Batch N°: 48921 | **Sample N°: 3** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	3.7		1	8	7
Phosphorus (P)	mg P/kg	71.2		18.9	16.8	Drawdown
Potassium (K)	mg/kg	404		107.5	103.2	Drawdown
Sulphur (S)	mg S/kg	20		5.3	18.1	12.8
Calcium (Ca)	mg/kg	5300		1409.8	735	Drawdown
Magnesium (Mg)	mg/kg	685		182.2	76.9	Drawdown
Iron (Fe)	mg/kg	295		78.5	146.8	68.3
Manganese (Mn)	mg/kg	52		13.8	11.7	Drawdown
Zinc (Zn)	mg/kg	34		9	1.3	Drawdown
Copper (Cu)	mg/kg	2.2		0.6	1.7	1.1
Boron (B)	mg/kg	1.1		0.3	0.7	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 %.

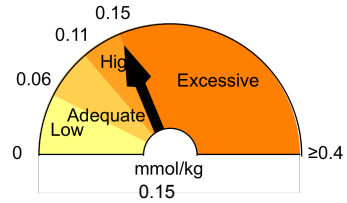
Marginal
Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

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 effective amelioration depth.

Phosphorus Saturation Index



Excessive. Exceeds environmental threshold. Implement improved P management to reduce potential for nonpoint P pollution.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**33.2**
Eff. Cation Exch. Capacity (eCEC):	**33.2**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Loam Fine Sandy**	Munsell Colour:	-	Organic Carbon (OC %):	**Very High - 5.3**
Estimated clay content:	**25%**	Structure Size:	**Fine (1 - 10mm)**	Organic Matter (OM %):	**11.6**
Tactually gravelly:	**Not gravelly**	Structural Organisation:	**Pedal - Weak**	Est. Field Capacity (% water):	**28**
Tactually organic:	**Not Organic**	Structural Unit:	**Crumb**	Est. Permanent Wilting Point (% water):	**12**
Calculated EC_{SE} (dS/m):	**1**	Potential infiltration rate:	**Rapid**	Est. Plant Available Water (% water):	**16**
– Non-saline. Salinity effects on plants are mostly negligible.		Est. Permeability Class (mm/hr):	**20 - 60**	Est. Plant Available Water (mm/m):	**160**
		Additional comments:			

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
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EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
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Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
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

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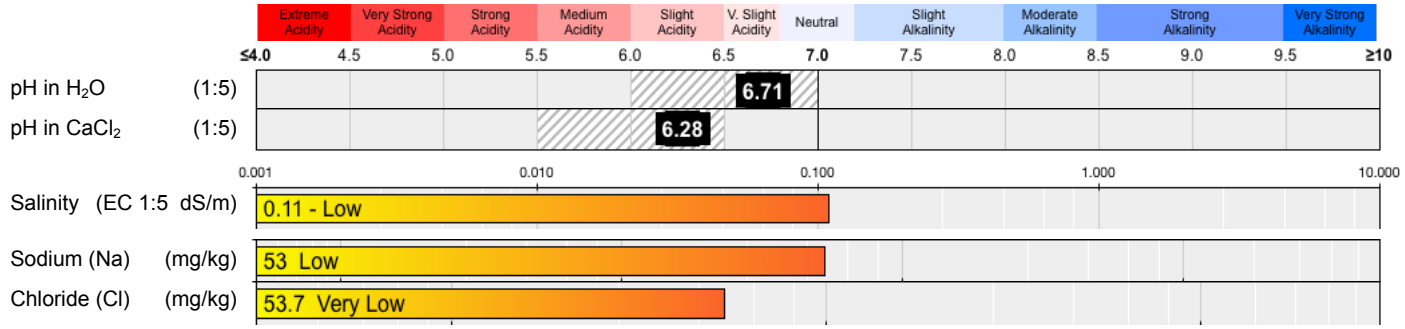
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 4** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Cia Landscape and Colour**	Project Name:	**Removal and Replacement of Lombardy Poplars at National**
		SESL Quote N°:	**Q8187R02**
Client Contact:	**Briar Champness Lal**	Sample Name:	**BH4 (0.0-0.1m)**
Client Order N°:		Description:	**Soil**
Address:		Test Type:	**FSC_Plus**
	Red Hill ACT 2603		

RECOMMENDATIONS

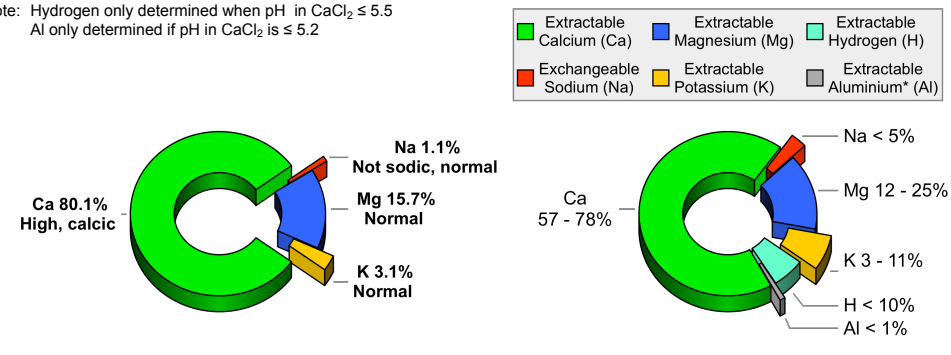
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**5.1**	4.1 – 6.0
Comment: Balanced		
Mg:K	**5.1**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.03**	< 0.07
Comment: Acceptable		
K:Na	**2.8**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.23	0.65	16.98	3.34		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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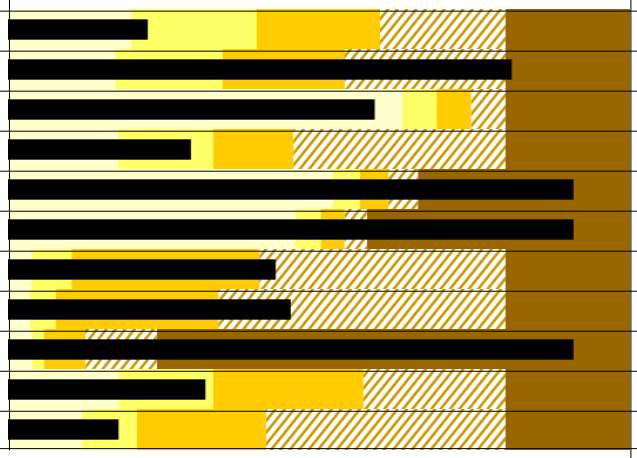
Batch N°: 48921 | **Sample N°: 4** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	5.9		1.6	8	6.4
Phosphorus (P)	mg P/kg	65.8		17.5	16.8	Drawdown
Potassium (K)	mg/kg	255		67.8	92	24.2
Sulphur (S)	mg S/kg	25		6.7	18.1	11.4
Calcium (Ca)	mg/kg	3400		904.4	655.4	Drawdown
Magnesium (Mg)	mg/kg	405		107.7	68.4	Drawdown
Iron (Fe)	mg/kg	297		79	146.8	67.8
Manganese (Mn)	mg/kg	25		6.7	11.7	5
Zinc (Zn)	mg/kg	19		5.1	1.3	Drawdown
Copper (Cu)	mg/kg	2.5		0.7	1.7	1
Boron (B)	mg/kg	0.6		0.2	0.7	0.5



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 %.

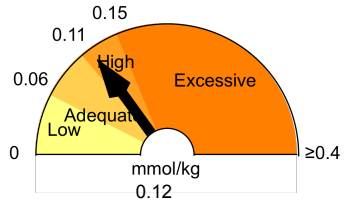
Marginal — Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

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 effective amelioration depth.

Phosphorus Saturation Index



High. Soil P will not limit plant growth. No P recommended this season.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**21.2**
Eff. Cation Exch. Capacity (eCEC):	**21.2**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)

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

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Fine Sandy Clay Loam**	Munsell Colour:	-	Organic Carbon (OC %):	**Very High - 5.4**
Estimated clay content:	**20 - 30%**	Structure Size:	**Fine (1 - 10mm)**	Organic Matter (OM %):	**12**
Tactually gravelly:	**Not gravelly**	Structural Organisation:	**Pedal - Weak**	Est. Field Capacity (% water):	**28**
Tactually organic:	**Not Organic**	Structural Unit:	**Crumb**	Est. Permanent Wilting Point (% water):	**15**
Calculated EC_{SE} (dS/m):	**0.9**	Potential infiltration rate:	**Moderate**	Est. Plant Available Water (% water):	**13**
– Non-saline. Salinity effects on plants are mostly negligible.		Est. Permeability Class (mm/hr):	**5 - 20**	Est. Plant Available Water (mm/m):	**130**
		Additional comments:			

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
pH (1:5 $CaCl_2$) - SESL CM0002; Rayment & Lyons 4B4-2011
EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
Chloride - Rayment & Lyons 5A2a-2011
Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure* - "Murphy" (1991), Colour- "Munsell" (2000))

*Structure analysed in the laboratory is conducted on a disturbed sample, therefore is only a representation of the macro-structures that may be present in the field, which provide an indication of the soil physical characteristics and behaviours that may exist.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

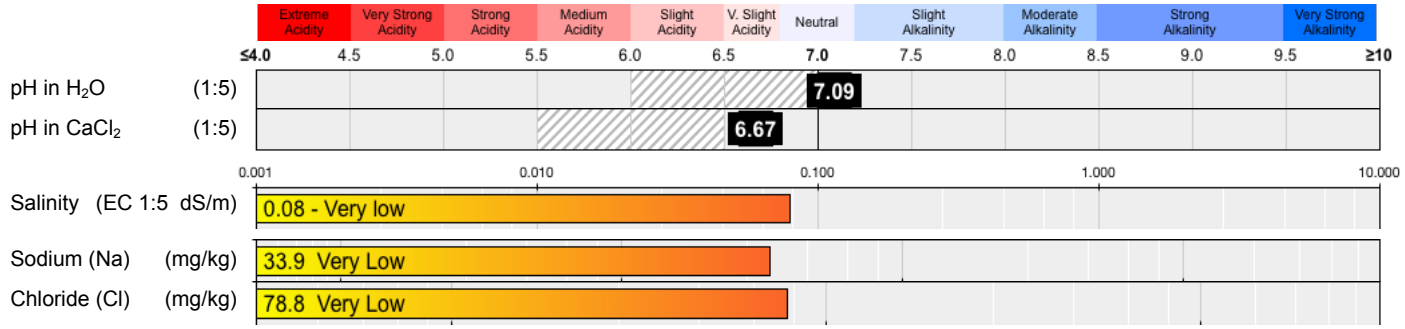
Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 5** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Cia Landscape and Colour**	Project Name:	**Removal and Replacement of Lombardy Poplars at National**
		SESL Quote N°:	**Q8187R02**
Client Contact:	**Briar Champness Lal**	Sample Name:	**BH4 (0.3-0.5m)**
Client Order N°:		Description:	**Soil**
Address:		Test Type:	**SSCP, P_M3, NO3_Sol**
	Red Hill ACT 2603		

RECOMMENDATIONS

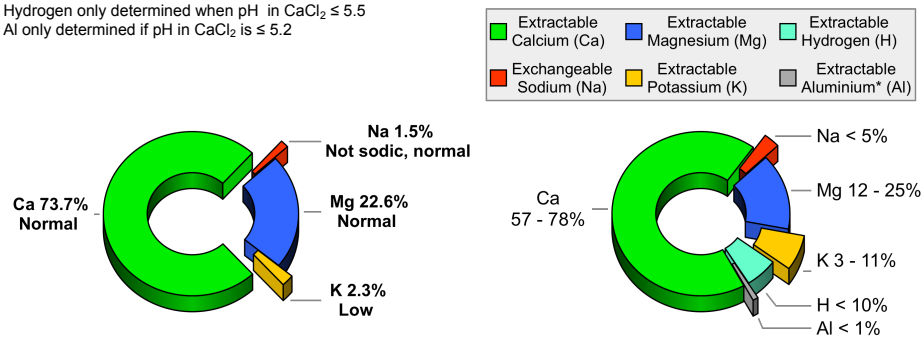
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**3.3**	4.1 – 6.0
Comment: Calcium low		
Mg:K	**10**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**1.5**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.15	0.23	7.52	2.30		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

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°: 48921 | **Sample N°: 5** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	3.7		1	8	7
Phosphorus (P)	mg P/kg	14		3.7	16.8	13.1
Potassium (K)	mg/kg	91.2		24.3	69.7	45.4
Sulphur (S)	mg S/kg	-		-	18.1	18.1
Calcium (Ca)	mg/kg	1510		401.7	496.1	94.4
Magnesium (Mg)	mg/kg	280		74.5	51.6	Drawdown
Iron (Fe)	mg/kg	-		-	146.8	Did not test
Manganese (Mn)	mg/kg	-		-	11.7	Did not test
Zinc (Zn)	mg/kg	-		-	1.3	Did not test
Copper (Cu)	mg/kg	-		-	1.7	Did not test
Boron (B)	mg/kg	-		-	0.7	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 %.

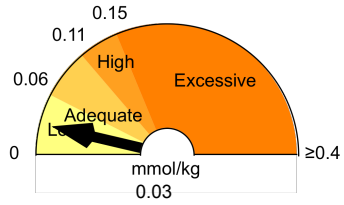
High — The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

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 effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**10.2**
Eff. Cation Exch. Capacity (eCEC):	**10.2**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**

– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)

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

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Light Sandy Clay Loam**	Munsell Colour:	-	Organic Carbon (OC %):	-
Estimated clay content:	**25%**	Structure Size:	**Fine (1 - 10mm)**	Organic Matter (OM %):	-
Tactually gravelly:	**Gravelly**	Structural Organisation:	**Pedal - Weak**	Est. Field Capacity (% water):	**26**
Tactually organic:	**Not Organic**	Structural Unit:	**Crumb**	Est. Permanent Wilting Point (% water):	**12**
Calculated EC_{SE} (dS/m):	**0.8**	Potential infiltration rate:	**Rapid**	Est. Plant Available Water (% water):	**14**
– Non-saline. Salinity effects on plants are mostly negligible.		Est. Permeability Class (mm/hr):	**>120**	Est. Plant Available Water (mm/m):	**140**
		Additional comments:			

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
pH (1:5 $CaCl_2$) - SESL CM0002; Rayment & Lyons 4B4-2011
EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
Chloride - Rayment & Lyons 5A2a-2011
Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure* - "Murphy" (1991), Colour- "Munsell" (2000))

*Structure analysed in the laboratory is conducted on a disturbed sample, therefore is only a representation of the macro-structures that may be present in the field, which provide an indication of the soil physical characteristics and behaviours that may exist.

SESL AUSTRALIA
Environment & Soil Sciences

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

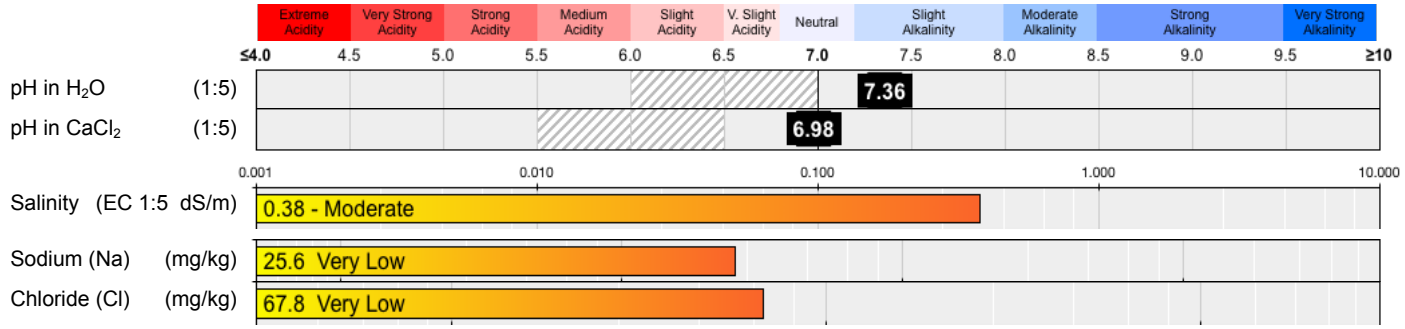
Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 6** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Cia Landscape and Colour**	Project Name:	**Removal and Replacement of Lombardy Poplars at National**
		SESL Quote N°:	**Q8187R02**
Client Contact:	**Briar Champness Lal**	Sample Name:	**BH7 (0.0-0.1m)**
Client Order N°:		Description:	**Soil**
Address:		Test Type:	**FSC_Plus**
	Red Hill ACT 2603		

RECOMMENDATIONS

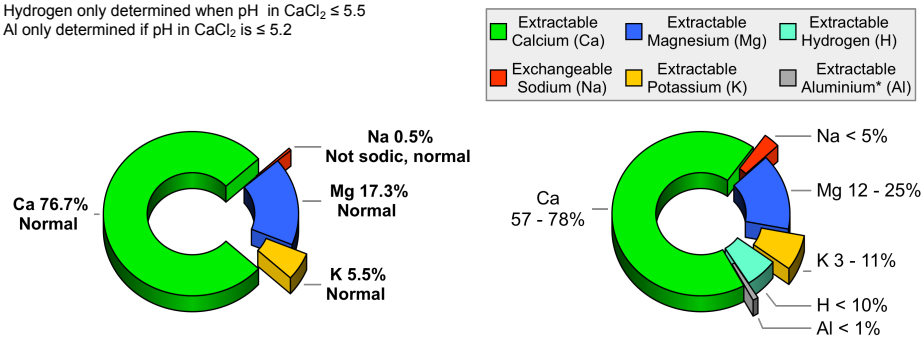
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**4.4**	4.1 – 6.0
Comment: Balanced		
Mg:K	**3.1**	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	**0.06**	< 0.07
Comment: Acceptable		
K:Na	**10.4**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.11	1.14	15.80	3.57		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

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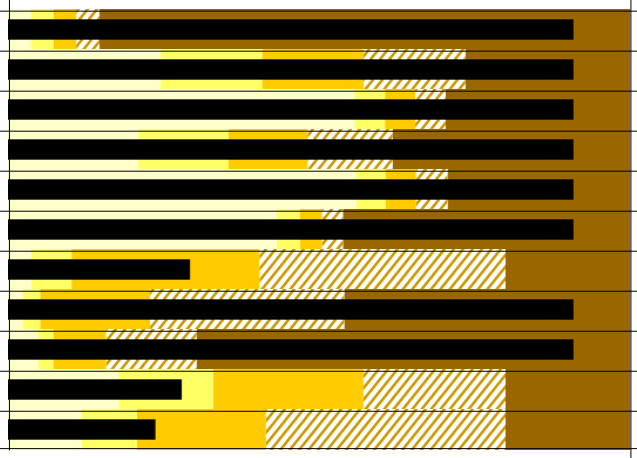
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 48921 | **Sample N°: 6** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	130		34.6	8	Maintenance
Phosphorus (P)	mg P/kg	77.9		20.7	16.8	Drawdown
Potassium (K)	mg/kg	447		118.9	92	Drawdown
Sulphur (S)	mg S/kg	100		26.6	18.1	Drawdown
Calcium (Ca)	mg/kg	3170		843.2	655.4	Drawdown
Magnesium (Mg)	mg/kg	434		115.4	68.4	Drawdown
Iron (Fe)	mg/kg	202		53.7	146.8	93.1
Manganese (Mn)	mg/kg	74		19.7	11.7	Drawdown
Zinc (Zn)	mg/kg	15		4	1.3	Drawdown
Copper (Cu)	mg/kg	2.2		0.6	1.7	1.1
Boron (B)	mg/kg	0.8		0.2	0.7	0.5



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 %.

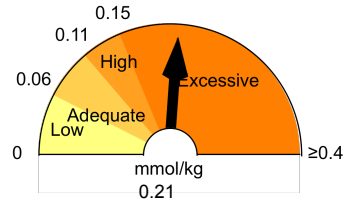
Marginal — Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

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 effective amelioration depth.

Phosphorus Saturation Index



Excessive. Exceeds environmental threshold. Implement improved P management to reduce potential for nonpoint P pollution.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**20.6**
Eff. Cation Exch. Capacity (eCEC):	**20.6**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Fine Sandy Clay Loam**	Munsell Colour:	-	Organic Carbon (OC %):	**Moderate - 2**
Estimated clay content:	**20 - 30%**	Structure Size:	**Fine (1 - 10mm)**	Organic Matter (OM %):	**4.5**
Tactually gravelly:	**Gravelly**	Structural Organisation:	**Pedal - Moderate**	Est. Field Capacity (% water):	**28**
Tactually organic:	**Not Organic**	Structural Unit:	**Crumb**	Est. Permanent Wilting Point (% water):	**15**
Calculated EC_{SE} (dS/m):	**3.3**	Potential infiltration rate:	**Moderate**	Est. Plant Available Water (% water):	**13**
– Slightly saline. Growth on sensitive plant species is affected.		Est. Permeability Class (mm/hr):	**20 - 60**	Est. Plant Available Water (mm/m):	**130**
		Additional comments:			

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
pH (1:5 $CaCl_2$) - SESL CM0002; Rayment & Lyons 4B4-2011
EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
Chloride - Rayment & Lyons 5A2a-2011
Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure* - "Murphy" (1991), Colour- "Munsell" (2000))

*Structure analysed in the laboratory is conducted on a disturbed sample, therefore is only a representation of the macro-structures that may be present in the field, which provide an indication of the soil physical characteristics and behaviours that may exist.

A member of the Australian Soil and Plant Analysis Council (ASPAC)
This laboratory participates in, and is awarded certification based on results of the scores returned in, ASPAC inter-laboratory proficiency rounds. For detailed current certification status and for more information on the ASPAC inter-laboratory proficiency testing programs, see the ASPAC website: http://www.aspac-australasia.com

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

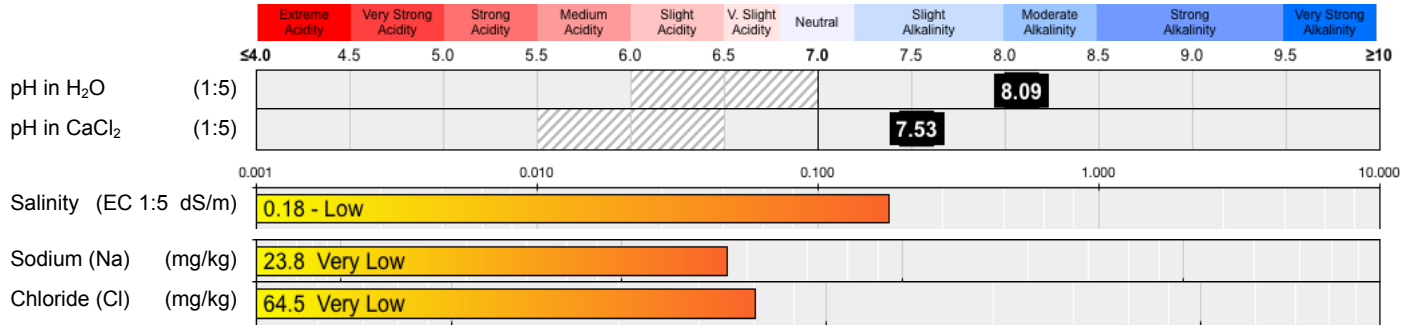
Batch N°: 48921 | **Sample N°: 8** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

Client Name: **Cia Landscape and Colour**
Client Contact: **Briar Champness Lal**
Client Order N°:
Address: **Red Hill ACT 2603**

Project Name: **Removal and Replacement of Lombardy Poplars at National**
SESL Quote N°: **Q8187R02**
Sample Name: **BH8 (0.1-0.2m)**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

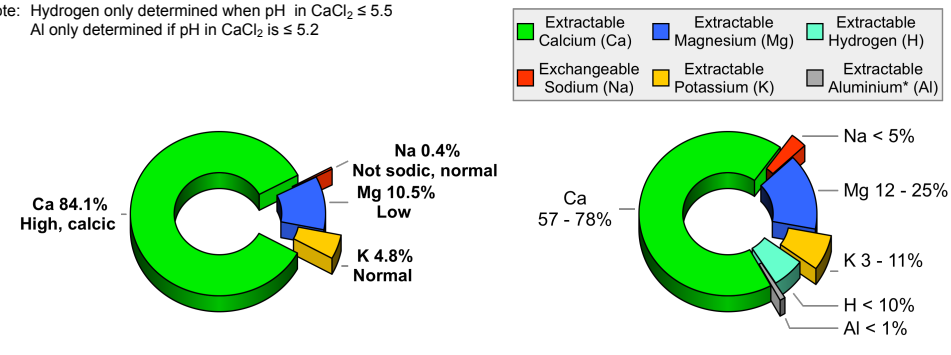
pH and ELECTRICAL CONDUCTIVITY



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) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	8	4.1 – 6.0
Comment: Magnesium low		
Mg:K	2.2	2.6 – 5.0
Comment: Magnesium low		
K/(Ca+Mg)	0.05	< 0.07
Comment: Acceptable		
K:Na	11.6	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.10	1.16	20.43	2.56		

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.

The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

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Soil Chemistry Profile

Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
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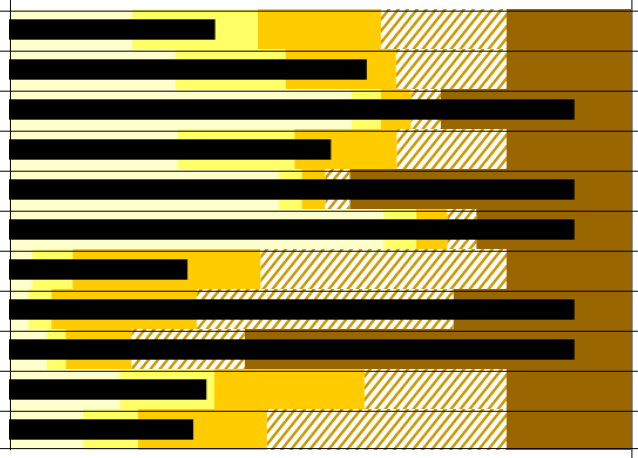
Batch N°: 48921 | **Sample N°: 8** | **Date Received: 26/7/18** | **Report Status:** ○ Draft ◉ Final

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ○ 100 ○ 150 ◉ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	8.7		2.3	8	5.7
Phosphorus (P)	mg P/kg	45.3		12	16.8	4.8
Potassium (K)	mg/kg	453		120.5	92	Drawdown
Sulphur (S)	mg S/kg	44		11.7	18.1	6.4
Calcium (Ca)	mg/kg	4090		1087.9	655.4	Drawdown
Magnesium (Mg)	mg/kg	311		82.7	68.4	Drawdown
Iron (Fe)	mg/kg	198		52.7	146.8	94.1
Manganese (Mn)	mg/kg	56		14.9	11.7	Drawdown
Zinc (Zn)	mg/kg	12		3.2	1.3	Drawdown
Copper (Cu)	mg/kg	2.5		0.7	1.7	1
Boron (B)	mg/kg	1		0.3	0.7	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 %.

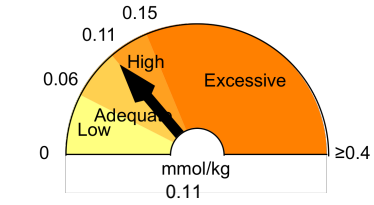
Marginal — Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

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 effective amelioration depth.

Phosphorus Saturation Index



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

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**24.3**
Eff. Cation Exch. Capacity (eCEC):	**24.3**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (200 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Fine Sandy Clay Loam**	Munsell Colour:	-	Organic Carbon (OC %):	**Very High - 5.2**
Estimated clay content:	**20 - 30%**	Structure Size:	**Fine (1 - 10mm)**	Organic Matter (OM %):	**11.4**
Tactually gravelly:	**Gravelly**	Structural Organisation:	**Pedal - Weak**	Est. Field Capacity (% water):	**28**
Tactually organic:	**Not Organic**	Structural Unit:	**Crumb**	Est. Permanent Wilting Point (% water):	**15**
Calculated EC_{SE} (dS/m):	**1.5**	Potential infiltration rate:	**Moderate**	Est. Plant Available Water (% water):	**13**
– Non-saline. Salinity effects on plants are mostly negligible.		Est. Permeability Class (mm/hr):	**5 - 20**	Est. Plant Available Water (mm/m):	**130**
		Additional comments:			

Date Report Generated 8/08/2018

Consultant: Kelly Lee

Authorised Signatory: Declan McDonald

METHOD REFERENCES:
pH (1:5 H_2O) - SESL CM0002; Rayment & Lyons 4A1-2011
pH (1:5 $CaCl_2$) - SESL CM0002; Rayment & Lyons 4B4-2011
EC (1:5) - SESL CM0001; Rayment & Lyons 3A1-2011
Chloride - Rayment & Lyons 5A2a-2011
Nitrate - Rayment & Lyons 7B1a-2011
Aluminium - SESL CM0007; Rayment & Lyons 15A1-2011
P, K, S, Ca, Mg, Na, Fe, Mn, Zn, Cu, B - SESL CM0007; Rayment & Lyons 18F1-2011
Buffer pH and Hydrogen - SSSA Methods of Soil Analysis 2007, Pt 3, Ch 17; Adams-Evans (1962)
Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure* - "Murphy" (1991), Colour- "Munsell" (2000))

*Structure analysed in the laboratory is conducted on a disturbed sample, therefore is only a representation of the macro-structures that may be present in the field, which provide an indication of the soil physical characteristics and behaviours that may exist.

6 Point Hydraulic Conductivity

SESL AUSTRALIA
Environment & Soil Sciences

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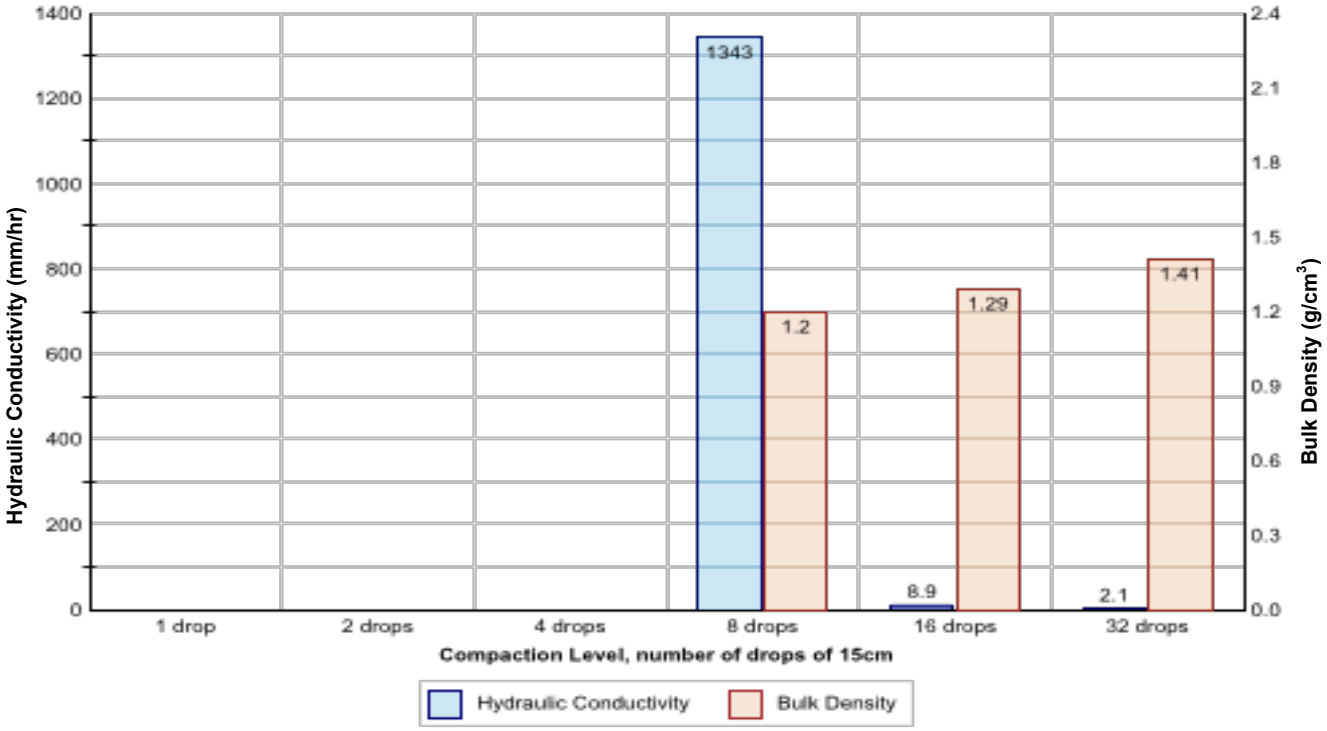
Batch N°: 48921 | **Sample N°: 7** | **Date Received: 26/7/18** | **Report Status:** ◉ Draft ○ Final

Client Name: **Cia Landscape and Colour**
Client Contact: **Briar Champness Lal**
Client Order N°:
Address: **Red Hill ACT 2603**

Project Name: **Removal and Replacement of Lombardy Poplars at National**
SESL Quote N°: **Q8187R02**
Sample Name: **BH7 (0.8-1.0m)**
Description: **Soil**
Test Type: **Prep_All, HC3, pHEC_S**

SATURATED HYDRAULIC CONDUCTIVITY (Ksat) AND BULK DENSITY



SUMMARY AND RECOMMENDATIONS

pH in water: 8.79

pH in calcium chloride: 8.18

Electrical conductivity: 0.21 dS/m

METHOD REFERENCES:
Saturated Hydraulic Conductivity and Bulk Density:
SESL Laboratory Manual 4.15. derived from McIntyre, K, & Jakobsen, B, *Drainage for Sportsturf and Horticulture* (1998).

NOTES:
This test method covers the standard procedures and related calculations for determining the saturated hydraulic conductivity under conditions of a falling head of water, and bulk density of turf growing media for sportsfields, and other highly trafficked turf areas. Bulk density is defined as the mass of a unit volume of dry soil. Generally as a soil is compacted, bulk density increases because pore space is reduced. Typical bulk densities for clay and silt loam soils range from 1.0 g/cm^3 to 1.5 g/cm^3, while the bulk density of sand-based soils range from 1.3 g/cm^3 to 1.8 g/cm^3. At the upper end of these ranges, the bulk density may inhibit root penetration. In comparison, the USGA recommendation for bulk density of putting greens is 1.2 g/cm^3 to 1.6 g/cm^3.
This sample was tested as received and comments pertain only to the sample shown.
SESL is not responsible for the accuracy of this test methods and makes no claims about the ability to predict performance in actual use.

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Consultant:
Kelly Lee

Authorised Signatory:
Declan McDonald

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6 Point Hydraulic Conductivity

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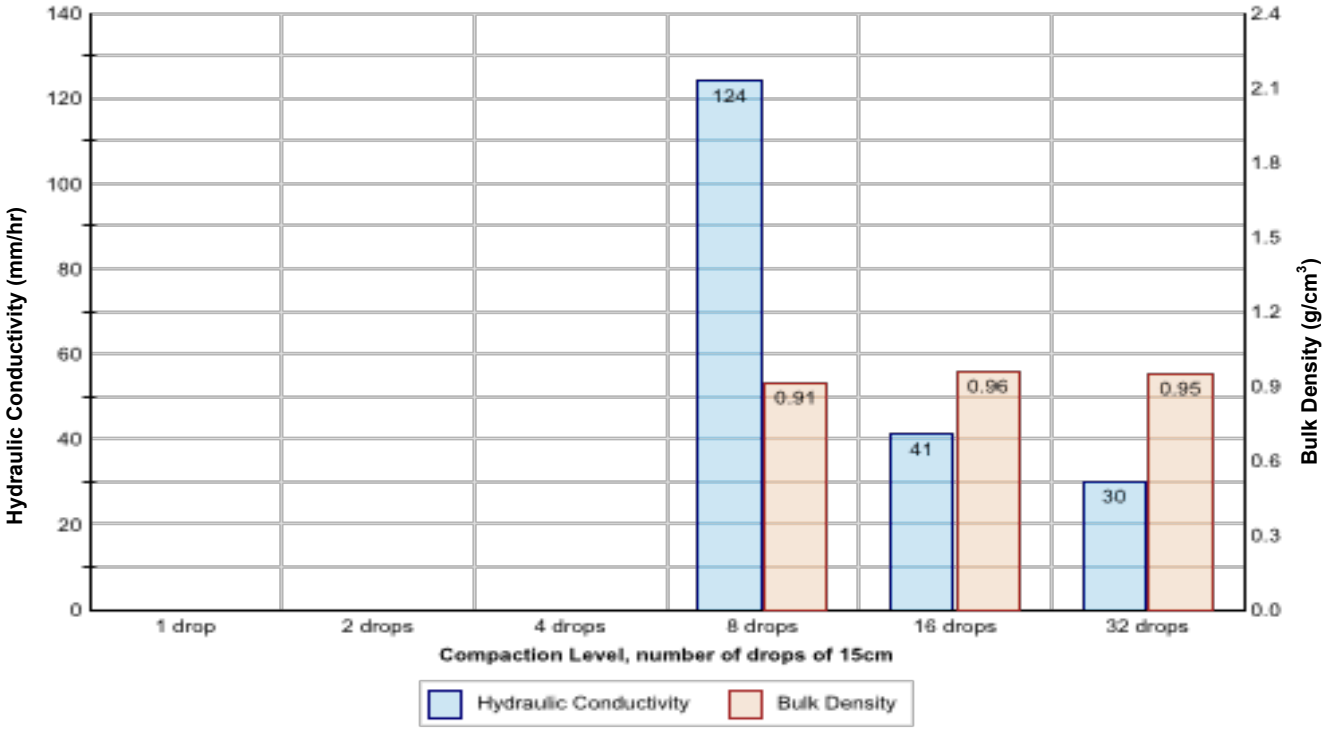
Batch N°: 48921 | **Sample N°: 9** | **Date Received: 26/7/18** | **Report Status:** ◉ Draft ○ Final

Client Name: **Cia Landscape and Colour**
Client Contact: **Briar Champness Lal**
Client Order N°:
Address: **Red Hill ACT 2603**

Project Name: **Removal and Replacement of Lombardy Poplars at National**
SESL Quote N°: **Q8187R02**
Sample Name: **Composite Topsosil (S1,S3,S4,S6,S8)**
Description: **Soil**
Test Type: **HC3**

SATURATED HYDRAULIC CONDUCTIVITY (Ksat) AND BULK DENSITY



SUMMARY AND RECOMMENDATIONS

Consultant:

Kelly Lee

Authorised Signatory:

Declan McDonald

Date Report Generated
8/08/2018

METHOD REFERENCES:
Saturated Hydraulic Conductivity and Bulk Density:
SESL Laboratory Manual 4.15. derived from McIntyre, K, & Jakobsen, B, *Drainage for Sportsturf and Horticulture* (1998).

NOTES:
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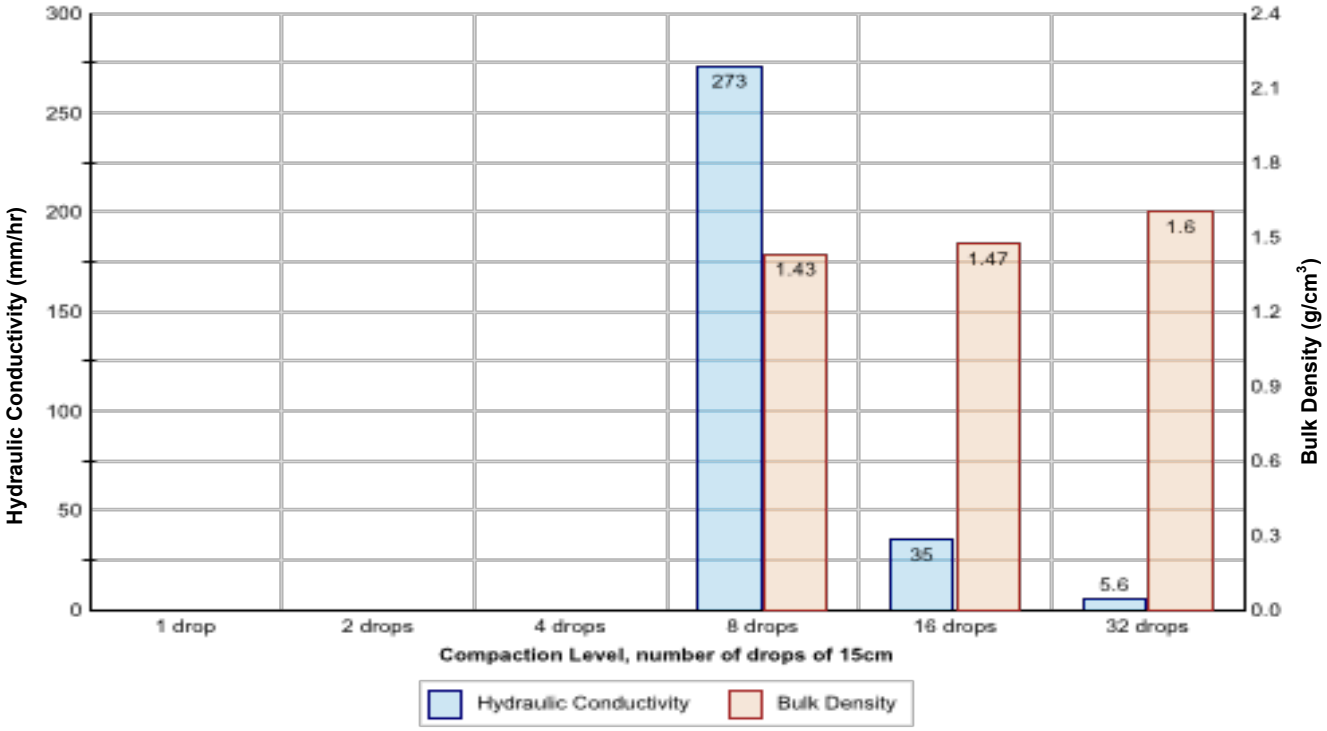
Batch N°: 48921 | **Sample N°: 10** | **Date Received: 26/7/18** | **Report Status:** ◉ Draft ○ Final

Client Name: **Cia Landscape and Colour**
Client Contact: **Briar Champness Lal**
Client Order N°:
Address: **Red Hill ACT 2603**

Project Name: **Removal and Replacement of Lombardy Poplars at National**
SESL Quote N°: **Q8187R02**
Sample Name: **Composite Subsosil (S2, S5)**
Description: **Soil**
Test Type: **HC3**

SATURATED HYDRAULIC CONDUCTIVITY (Ksat) AND BULK DENSITY



SUMMARY AND RECOMMENDATIONS

METHOD REFERENCES:
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