



7 August 2019

Hayball
11-17 Buckingham Street
Surry Hills NSW 2010
Attn: Gosia Sum

Ref: L9966s

Dear Gosia,

Preliminary salinity assessment for proposed development works at Young High School Campbell Street, Young NSW 2594

1. Background

Development works are proposed for Young High School, Campbell Street, Young NSW. Upgrades and new buildings are proposed for the development. Assessment of possible salinity is required as part of the design process.

2. Scope

Undertake a preliminary investigation of the area for indicators of urban salinity.

3. Location

The investigation area is located at Young High School, Campbell Street, Young NSW. The investigation area is approximately 2.8 hectares in area.

The site is located within Hilltops Council area.

4. Groundwater and soil salinity investigation

The groundwater and soil salinity investigation comprised a desktop study, field assessment and soil analysis. The desktop study included a review of soil landscape maps, hydro-geological landscapes and groundwater databases. An inspection of the site was undertaken on 12 July 2019. Six boreholes were drilled to a depth of 3.0m and information was collected on the surface conditions and vegetation.

The field assessment included detailed profile descriptions and soil analysis from one borehole drilled on-site. The soil and landscape information collected provided an adequate description of the physical processes on the site to enable salinity issues to be identified and managed.

5. Site condition and surrounding environment

5.1 Land-use

The site is currently Young High School. The site predominantly contains buildings and infrastructure with grassed areas. Large eucalyptus trees and deciduous trees are scattered throughout the site.

Review of the Young LEP (2010) indicates the site is not mapped as a salinity risk area.

5.2 Topography

The site is located on a mid-slope. Aspect is predominantly north and slopes are very gently inclined and less than 5%. Elevation ranges between 444 and 452 metres above sea level. No groundwater seepage or discharge areas were observed on the site.

No bare areas were observed on-site.

5.3 Soils and geology

The natural soil profile consists of sandy silt topsoil over yellowish brown to red sandy clay and greyish yellow fine gravelly clay.

The site is located within the Young Soil Landscape (Espade, 2019). The soil landscape consists of red dermosols (euchrozems), red kandosols (red earths) and red chromosols on mid to upper slopes and crests. Yellow and brown chromosols are found on lower slopes and yellow solodic soils are found along drainage lines. Salinity outbreaks have occurred in drainage depressions and on lower slopes.

The geological unit is Silurian Young Formation granodiorite, often porphyritic in quartz, plagioclase and more rarely K-feldspar and biotite. Colluvium and alluvium derived from these materials occur on lower slopes.

5.4 Surface water

No dams or drainage lines are located within the proposed investigation area. Surface water flows north into the local storm water system.

5.5 Groundwater

There was no evidence of seasonal groundwater identified to the drilling depth of 3m.

A search of the Water NSW groundwater database located nine bores within 500m of the site (Table 1). The bores are used for recreational, monitoring and domestic purposes. Standing water levels were located from a depth of 3.22m and water bearing zones were recorded from a depth of 18.3m in granite.

Table 1. Groundwater bores located within 500m of the site

Bore record No. (Figure 8)	Eastings	Northings	Drilled / Completed depth (m)	Salinity description	Water bearing zones (m)	Standing water level (m)	Purpose
GW704941	618882	6201821	170	-	135	20	Recreational
GW702209	618850	6202262	115	-	68	-	Domestic recreational
GW700417	618900	6201738	54.5	-	36.6	20	Domestic
GW067213	619108	6202160	20	-	-	-	Domestic
GW700529	618881	6202322	9.65	-	-	3.22	Monitoring bore
GW027648	619349	6202103	48.8	Good	18.3	4.60	Recreation
GW092309	618399	6202151	1.5	-	-	-	Monitoring bore
GW702684	618417	6201481	139	-	120	32	Domestic
GW700527	618810	6201354	28.11	-	-	-	Monitoring bore

6. Groundwater and soil salinity investigation

Six boreholes were constructed with a truck mounted EVH drilling rig with solid auger on 12 July 2019 to provide information on the soil profiles. The boreholes were constructed to a depth of 3.0m.

The soil profile was described for colour, texture and moisture. Soil samples were collected from one borehole at 500mm intervals. The sampling is expected to provide an adequate description of subsoil salinity conditions. Soil samples were analysed for pH, electrical conductivity, dispersion, colour and texture.

Soil electrical conductivity (EC) results of the 1:5 (soil:water suspension) were converted to saturated extracts (ECe). EC values are converted to ECe by using a multiplier factor (Charman and Murphy 1991), which is dependent on the soil texture (Table 2). Saline soils are defined as those with an electrical conductivity (ECe) greater than 4 dS/m (Charman and Murphy, 2001). Soil salinity ratings and effects on plant growth are presented in Table 3.

Table 2. ECe texture based conversion factors (Charman and Murphy 2001)

Soil texture	Conversion factor
Loamy sand, clayey sand, sand	23
Sandy loam, fine sandy loam, light sandy clay loam	14
Loam, loam fine sandy, silt loam, sandy clay loam	9.5
Clay loam, silty clay loam, fine sandy clay loam	8.6
Sandy clay, silty clay, light clay	7.5
Light medium clay, medium clay, heavy clay	5.8

Table 3. Soil salinity ratings based on ECe readings

Salinity rating	ECe (dS/m)*	Effects on Plants
Non saline (NS)	0-2	Salinity effects negligible
Slightly saline (SS)	2-4	Very salt sensitive plant growth restricted
Moderately saline (MS)	4-8	Salt sensitive plant growth restricted
Highly saline (HS)	8-16	Only salt tolerant plants unaffected
Extremely saline (ES)	>16	Only extremely tolerant plants unaffected

*ECe - Electrical conductivity of a saturated extract

Soil with ECe below 2 dS/m will have negligible effects on plant growth and soil stability. Soil with ECe of between 2 and 4 dS/m may restrict very salt sensitive plant growth. Soil with ECe between 4 and 8 dS/m will restrict the growth of salt sensitive plants.

Samples were analysed for dispersion using the Emerson aggregate test. Table 4 details the eight dispersion classes.

Table 4. Emerson dispersion classes

Class	Description
1	Highly dispersive (slakes, complete dispersion)
2	Moderately dispersive, slakes, some dispersion
3	Slightly dispersive, slakes, some dispersion after remoulding
4	Non-dispersive, slakes, carbonate or gypsum present
5	Non-dispersive, slakes, dispersion in shaken suspension
6	Non-dispersive, slakes, flocculates in shaken suspension
7	Non-dispersive, no slaking, swells in water
8	Non-dispersive, no slaking, does not swell in water

7 Results

7.1 Site overview

The site is Young High School comprising buildings and landscaped areas consisting of lawns with trees and gardens. Aspect is predominantly north and slopes are very gently inclined and less than 5%. No groundwater seepage or discharge areas were observed on the site.

There was no evidence of seasonal groundwater identified to the drilling depth of 3m. Bores in the locality are used for recreational, monitoring and domestic purposes. Standing water levels were located from a depth of 4.6m and water bearing zones were recorded from a depth of 18.3m in granite.

Hydrogeological mapping has not been undertaken in the area.

The site is located within the Young Soil Landscape (Espade, 2019). The soil landscape consists of red dermosols (euchrozems), red kandosols (red earths) and red chromosols on mid to upper slopes and crests. Yellow and brown chromosols are found on lower slopes and yellow solodic soils are found along drainage lines. Salinity outbreaks have occurred in drainage depressions and on lower slopes.

7.2 Soil characteristics

7.2.1 Texture and colour

The natural soil profile consists of brown sandy clay loam topsoil over strong brown to yellowish brown sandy clay and greyish yellow gravelly sandy clay.

Table 5. Soil colour, texture, pH, EC, ECe and emerson aggregate test

Borehole No - depth (mm)	Soil colour	Soil texture	pH	EC1:5	ECe (dS/m)	Emerson aggregate test
4-0-100	Brown	Sandy clay loam	6.8	0.06	0.57	5
4-500	Strong brown	Sandy clay	7.6	0.05	0.38	2
4-1000	Strong brown	Sandy clay	7.4	0.01	0.08	5
4-1500	Yellowish brown	Sandy clay	7.3	0.12	0.90	5
4-2000	Yellowish brown	Sandy clay	7.4	0.11	0.83	5
4-2500	Greyish yellow	Gravelly sandy clay	7.5	0.08	0.60	2
4-3000	Greyish yellow	Gravelly sandy clay	7.3	0.09	0.68	3

7.2.2 Salinity (electrical conductivity)

All samples were determined to be non-saline (Table 5).

7.2.3 pH

The pH was neutral throughout the soil profile (Table 5).

7.2.4 Emerson aggregate test

Topsoil on the site was non-dispersive and subsoil was moderately to non-dispersive (Table 5).

7.2.5 Indicators of salinity

Indicators	Present	Comments
Salt crystals	No	No salt crystals were found on site
Vegetation indicators	No	No salt tolerant vegetation was identified on site
Die back	No	No vegetation die back was identified on site
Effects on infrastructure	No	No evidence of salts
Bare areas	No	No bare areas were identified on-site

8 Conclusions

The site is Young High School comprising buildings and landscaped areas consisting of lawns with trees and gardens. No groundwater seepage or discharge areas were observed on the site. There was no evidence of seasonal groundwater identified from the drilling depth of 3m

Standing water levels of groundwater was located from a depth of 4.6m and water bearing zones from a depth of 18.3m in granite.

The natural soil profile consists of brown sandy clay loam topsoil over strong brown to yellowish brown sandy clay and greyish yellow gravelly sandy clay. All soil samples collected were non-saline.

No impact on groundwater and changed groundwater levels is expected from the development if recommendations are adopted. The development will not impact on quantity or quality of both unconfined and confined aquifers.

9 Recommendations

The development water and soil design should include:

- Promote water sensitive design of site and gardens
- Water captured from hard surfaces should stored in tanks or be piped off-site to local stormwater infrastructure to minimise infiltration
- Earthworks comprising cut should be minimised

Regards

Greg Madafiglio CEnvP
Senior environmental scientist

Appendices

Appendix 1: Report limitations and intellectual property

Appendix 2: Locality map

Appendix 3: Site plan and borehole locations

10. Reference

Charman PE and Murphy BW (2001) *Soils: Their Properties and Management* (Oxford University Press, South Melbourne)

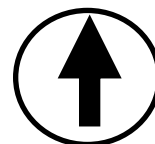
Environment.nsw.gov.au, '*Espade | NSW Environment & Heritage*' Version 2. N.p., 2015. Web. 18 July 2019.

Appendix 1: Report limitations and intellectual property

This report has been prepared for the use of the client to achieve the objectives given the clients requirements. The level of confidence of the conclusion reached is governed by the scope of the investigation and the availability and quality of existing data. Where limitations or uncertainties are known, they are identified in the report. No liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been predicted using the scope of the investigation and the information obtained.

The investigation identifies the actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing is interpreted by geologists, engineers or scientists who then render an opinion about overall conditions, the nature and extent of likely impacts of the proposed development, and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, and no sub surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock or time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. It is thus import to understand the limitations of the investigation and recognise that we are not responsible for these limitations.

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Investigation area

Appendix 2. Locality map

Young High School, Campbell Street, Young NSW

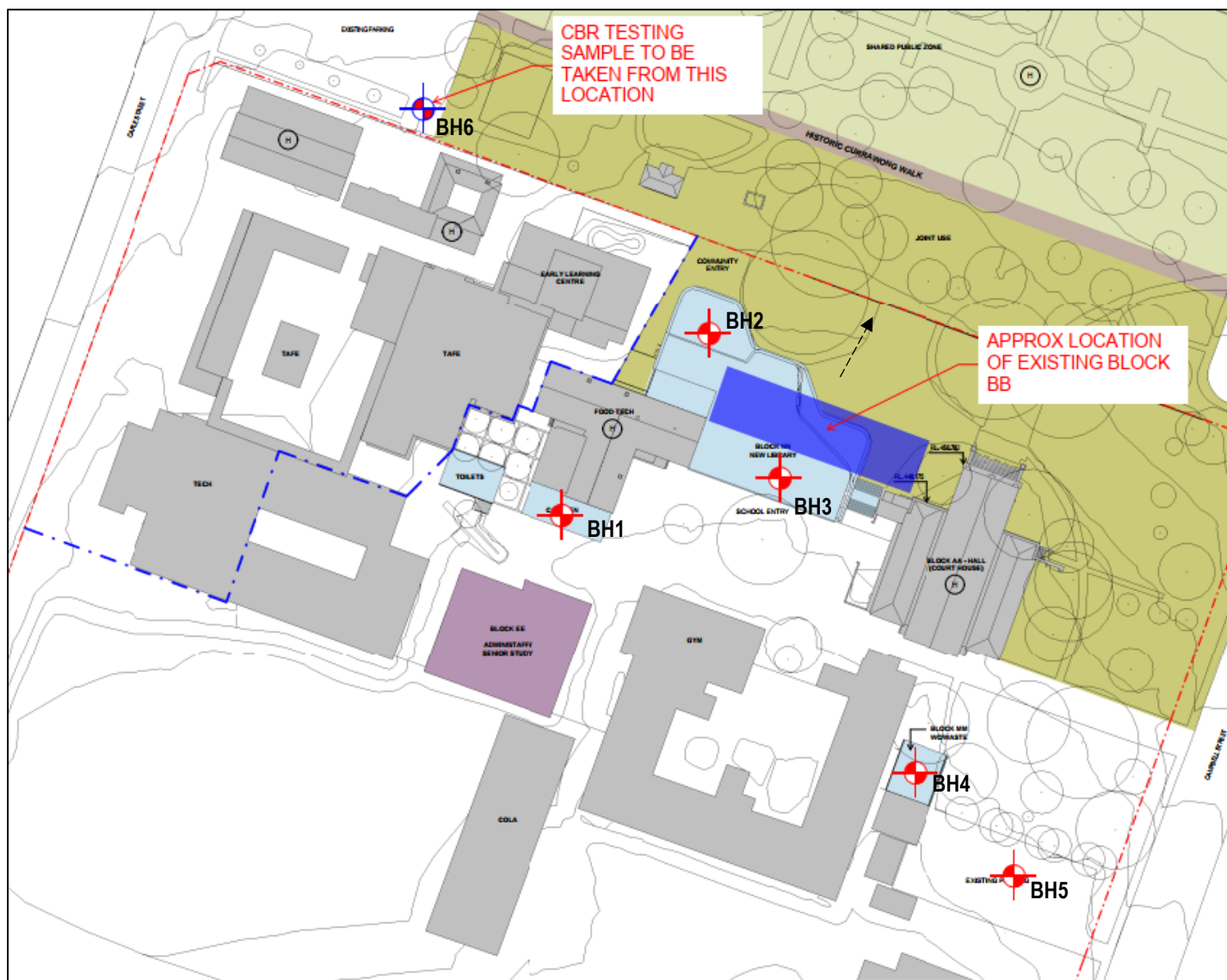
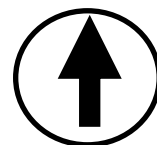


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Legend



Borehole locations



Slope

Appendix 3. Site plan and borehole locations

Young High School, Campbell Street, Young NSW



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Drawn by:
Northrop

Date: 18/07/2019