

Geotechnical

North Penrith – Stage 3B

Assessment Report

Summary

Objectives

The objectives of this assessment are to ascertain the existing ground and groundwater conditions at the site to determine the suitability of the site for the proposed land uses and to recommend any further assessment, investigation and/or courses of action to be taken during construction.

Method

The assessment is based on a review of previous site investigations reports.

The findings were:

- the site is underlain by naturally occurring soils with engineering properties favourable for residential, commercial and industrial construction;
- the soils at the site do not exhibit characteristics suggestive of significant dryland salinity. The erosion hazard is assessed as Moderate Risk due to the presence of erodible soils, requiring appropriate management controls;
- the salinity hazard of the soils at the site can be readily managed by designing and implementing a Soil and Water Salinity Management Plan;
- development of the site would require site works for construction of roads, placement of fill and construction of retention structures along the perimeter of the site;
- there is no risk of slope instability;
- shallow and deep footings would both be feasible;
- the majority of the soils on the site may be re-used by means of excavation and filling (with additional assessment to determine any possible presence of possible unsuitable material).

The geotechnical constraints that might be associated with the development are:

- in some areas the presence of uncontrolled fill that might not be suitable;
- drilling for piling construction below depths of about 5 to 8m might encounter groundwater.
- drilling for pile construction might encounter sandy gravel alluvium at depths of 4 to 5m below surface levels.

Conclusions

There are no known constraints that might impact on development and construction.

The site is suitable for residential development

Recommendations

The recommendations for development of the Stage 3B area of North Penrith are:

1. **Soil and Water Salinity Management Plan.** The Construction Environmental Management Plan (CEMP) is to include a site-specific Soil and Water Salinity Management Plan. The Plan is to be implemented throughout the construction works under the responsibility of the Principal Contractor.
2. **Detailed geotechnical investigations to support the detailed design and construction.** Further targeted investigations will be required to confirm the detailed design, including ascertaining the suitability of soils for re-use on the site.
3. **Geotechnical assessment of imported fill material.** The CEMP is to include measures to ensure imported fill is suitable for the intended use on site.

Contents

Summary	1
Objectives	1
Method	1
Conclusions	2
Recommendations	2
1. Objectives of the Assessment	4
Director-General's Requirements	4
Proposed Development	4
Objectives	4
Geotechnical Model	4
2. Site Analysis	6
Summary Site Description	6
Site Geology	6
Site Salinity	6
Site Hydrogeology	7
Groundwater	7
3. Methods & Results	7
Methods	8
Results	8
4. Assessment	10
Assessment Summary	10
Geotechnical Constraints	10
Recommendations	10
5. References	12
Appendix 1: Staging Plan	13

1. Objectives of the Assessment

The Director-General Requirements for Stage 3B development contain specific key requirements relating to geotechnical matters.

The Stage 3B development will be residential and also comprise commercial or employment uses under the 'opportunity site'.

The primary objectives of the assessment are to determine the suitability of the site for the proposed land uses and to recommend any further assessment, investigation and/ or courses of action to be taken during construction.

Director-General's Requirements

This report was prepared to respond to the Director-General Requirements (DGR) regarding geotechnical matters for the Stage 3B (SSD 5349) at the North Penrith site.

Proposed Development

The Stage 3B development will comprise residential development and possibly commercial or employment areas.

The development incorporates site preparation, roads and utilities infrastructure and lot forming works. It does not extend to the construction of the residential units.

Objectives

The objectives of this geotechnical assessment are to:

- provide information on the site conditions (by way of a geotechnical model) and consider geotechnical, salinity and other issues;
- assess the suitability of the site for the proposed land uses;
- identify any constraints for development;
- recommend any further assessments or investigations and/or the courses of action to be taken during construction.

Geotechnical Model

The objectives of the model are to determine:

- sub-surface conditions across the entire site and the impact of the development on those conditions;
- the effects (either positive or negative) those conditions might have on the proposed development.

Included in the sub-surface conditions considerations are:

- variations in sub-surface conditions;
- groundwater table;
- salinity of soils and groundwater;
- erodible soils;
- soft and loose soils;
- reactive soils.

2. Site Analysis

Stage 3B comprises about 2.4 hectares (ha) of vacant land in the central section of the 40ha previously identified as a Defence Facility former Defence site at North Penrith.

Stage 3B is generally underlain by clays, loams and sand of variable proportions, which are Quaternary fluvial deposits, with low to moderate potential for groundwater movement.

The North Penrith site, including Stage 3B, is located in a 'Moderate Salinity Potential' area.

The development has no requirement for extraction of groundwater.

Summary Site Description

The site comprises about 2.4ha of vacant land and is located between:

- Stage 2B to the north and north-east;
- A commuter car park to the south;
- Stage 3A to the south-east ;
- Access lane to Penrith Railway Station to the west.

Stage 3B is shown on the attached Staging Plan. The site was previously part of a large Defence facility. On deeming the facility surplus to requirements, the Department of Defence demolished all structures within Stage 3B. Some of the internal road network remains.

Site Geology

The site for Stage 3B is generally underlain by fluvial deposits. These deposits are known as:

- The Richmond Group (in accordance with the Landscape maps), which is Quaternary terrace of the Nepean River, generally relatively flat (slopes less than 1%) with local relief to 3m for splays and levees. Sub-surface soils in this landscape comprise clay, loam and sand. The landscape is susceptible to high erosion on terrace edges and minor localised flooding.
- The Cranebrook Formation (in accordance with the Geological maps) which comprises Quaternary fluvial deposits consisting of cobbles and gravel in silty sandy or clayey matrix. The depth to the gravel bed may vary across the site from 3m to 5m.

Site Salinity

The Salinity Potential in Western Sydney Map indicates that the site is located in a 'Moderate Salinity Potential' area.

Site Hydrogeology

Site surface run-off generally flows to the north and north-west.

Groundwater

Stage 3B, which is underlain by fluvial deposits, has low to moderate potential for groundwater, which is likely to flow in a north to north-westerly direction. Groundwater levels in monitoring wells installed along the Mobil depot are in the order of 6 – 7m.

These aquifers could have a high hydraulic conductivity of more 2E-5 m/sec.

It is also understood that the development has no requirement for extraction of groundwater.

3. Methods & Results

Assessment based on review of reports for the numerous previous investigations at the site.

The outcomes of these investigations used to establish geotechnical and hydrogeology models.

Methods

The methodology for the assessment was based on understanding and considering the numerous previous investigations at the site. Refer to the reports listed in Section 5.

These investigations included:

- drilling boreholes across the site to depths in the order of 5m;
- excavation of shallow test pits across the site to depths in the order of 3m;
- recovery of representative samples from different soil strata;
- monitoring groundwater levels using PVC open standpipes installed in some of the boreholes;
- testing the soils using insitu methods such as the Standard Penetration Test;
- laboratory testing of selected soil samples to determine classification and general properties and characteristics.

Results

The results for the geotechnical model, including from laboratory testing, are summarised as follows.

- possible shallow filling comprising silty and clayey sands. This fill generally comprised materials gained from on-site excavations and is underlain by naturally occurring sandy and clayey alluvium soils, overlying sandy gravel.
- laboratory testing generally indicated medium plasticity clays with a moderate swelling capacity

The results for the salinity model are summarised as follows.

- laboratory testing indicated that the near surface soil horizons (to depths of 500mm) generally exhibit a low salinity hazard. The underlying naturally occurring clays exhibit a low to moderate salinity hazard;
- soils are likely to be erodible.

The results for the hydrology and hydrogeology model are summarised as follows.

- site surface run-off is generally diverted to the north and north-west. Stage 3B is considered to be well drained;
- groundwater in Stage 3B is situated within probable relatively low permeability clays at depths in the range of 6m to 7m from surface levels. These aquifers could have a high hydraulic conductivity of more $2E-5$ m/sec.
- groundwater underlying the site appears to flow in a north to north-westerly direction;
- groundwater does not appear to rise significantly following heavy rainfall so as to become a potential hazard for rising salinity.

4. Assessment

From a geotechnical perspective the site is suitable for development as proposed.

Assessment Summary

It is concluded that:

- the site is underlain by naturally occurring soils suitable for residential construction;
- the soils at the site do not exhibit characteristics suggestive of significant dryland salinity. The erosion hazard is assessed as Moderate Risk due to the presence of erodible soils, requiring appropriate management controls;
- the salinity hazard of the soils at the site can be readily managed by designing and implementing a Soil and Water Salinity Management Plan;
- the site may receive fill to raise levels and/or to construct retaining walls along the site boundaries, if required;
- there is no risk of slope instability;
- shallow and deep footings would both be feasible;
- the majority of the soils in the site may be re-used by means of excavation and filling (with additional assessment to determine any possible unsuitable material subject to appropriate environmental supervision during construction).

Geotechnical Constraints

The geotechnical constraints that might be associated with the development are;

- in some areas the presence of uncontrolled fill that might not be suitable;
- drilling for pile construction below depths of about 5 to 8m might encounter groundwater.
- drilling for pile construction might encounter sandy gravel alluvium at depths of 4 to 5m below surface levels.

Recommendations

1. Soil and Water Salinity Management Plan. The Construction Environmental Management Plan (CEMP) is to include a site-specific Soil and Water Salinity Management Plan. The Plan is to be implemented throughout the construction works under the responsibility of the Principal Contractor.
2. Detailed geotechnical investigations to support the detailed design and construction. Further targeted investigations will be required to confirm the detailed design, including ascertaining the suitability of soils for re-use on the site.

3. Geotechnical assessment of imported fill material. The CEMP is to include measures to ensure imported fill is suitable for the intended use on site.

Conduct detailed investigations to support design and construction of possible retaining structures.

Imported fill should be of similar characteristics to the soils on site; be classified as VENM and placed in accordance with design specifications.

Implement a Soil and Water Salinity Management Plan.

5. References

Reports etc., referenced for this geotechnical and groundwater assessment

#	Originator	Date	Description
1	CMPS&F/ Rust PPK	May 1998	Geotechnical Study, Contamination Assessment & Remediation Strategy - Phase 1 Site History, Preliminary Sampling and Work Plan
2	CMPS&F/ Rust PPK	Sept 1998	Geotechnical Study, Contamination Assessment & Remediation Strategy - Phase 2, Volume 1
3	CMPS&F/ Rust PPK	Sept 1998 (847) pages	Geotechnical Study, Contamination Assessment & Remediation Strategy - Phase 2, Volume 2 Appendices
4	Egis Consulting	April 1999	Preliminary Geotechnical
5	Egis Consulting	Feb 2002	Salinity Study
6	Egis Consulting	Oct / Nov 2002	Data Summary Report
7	Geotechnique Pty Ltd	April 2009	Geotechnical & Contamination Advice
8	Geotechnique Pty Ltd	June 2012	Groundwater Assessment
9	Geotechnique Pty Ltd	July 2009	Geotechnical Investigation

Appendix 1: Staging Plan

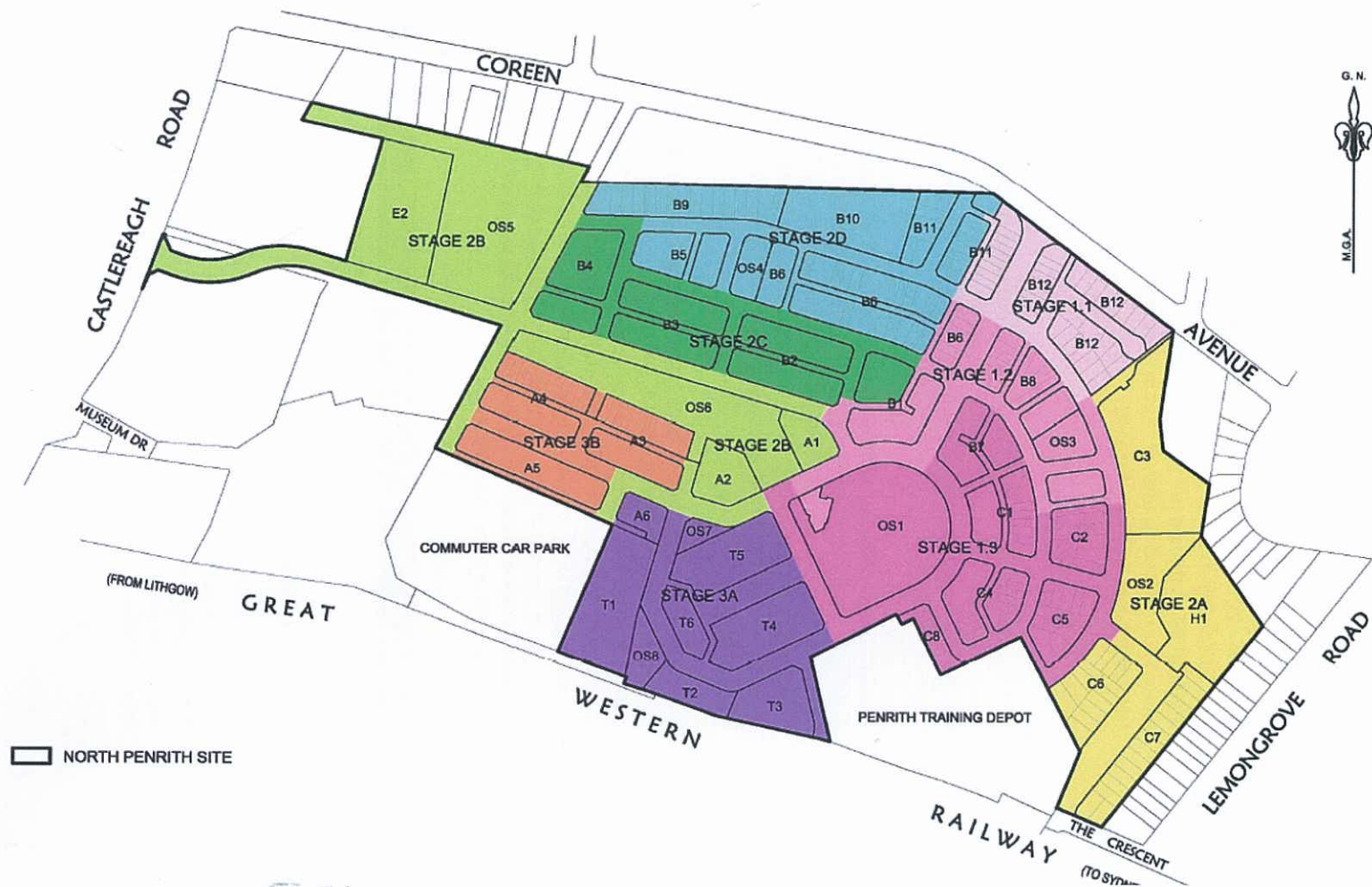


Figure 5 – North Penrith Revised Staging Plan