

Geotechnical

North Penrith – Stages 2B & 2C

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 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;

- on 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.

Conclusions

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

The site is suitable for general development.

Recommendations

The recommendations for development of Stages 2B & 2C 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 and determining the most suitable impervious lining for the wetland and canal.
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.

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1. Objectives of the Assessment

The Director-General Requirements for Stages 2B & 2C development contain specific key requirements relating to geotechnical matters.

The Stages 2B & 2C development will comprise wetlands/canal, commercial and residential development.

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 Stages 2B & 2C (SSD 5346) at the North Penrith site.

Proposed Development

The development will comprise the following;

- Stage 2B; A central open space area comprising a canal water feature and wetland, two super lots for residential development and an industrial lot.
- Stage 2C; solely residential development.

The development incorporates excavation for construction of the wetland/canal, site preparation, roads and utilities infrastructure and lot forming works. It does not extend to the construction of the built form on the proposed commercial development.

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;
- consider the potential for the proposed wetland/canal to impact groundwater;
- 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) these 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

Stages 2B & 2C comprise approximately 11.5 hectares (ha) of vacant land, located in the far west section of the 40ha previously identified as a Defence Facility former Defence site at North Penrith.

Stages 2B & 2C are 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 Stages 2B & 2C, is located in a 'Moderate Salinity Potential' area.

The development has no requirement for extraction of groundwater.

Summary Site Description

The combined stages comprise 11.5 ha of vacant land located on opposite sides of an access to Penrith Railway Station. The site is located between;

- An industrial development to the north of Stage 2B
- Stage 2D is located to the north of Stage 2C
- Stages 3A, 3B & The Great Western Railway line are located to the far south;
- Stage 1 development to the east;

Stages 2B & 2C are 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 Stages 2B & 2C.

Site Geology

The site for Stages 2B & 2C 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 could 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

Stage 2C Site surface run-off is generally diverted to the north and north-west.

The Site for Stage 2B was selected to divert the surface run-off from the development through the proposed canal central water feature and two large pipes (below the road) to the wetlands located on the western section of the stage.

Groundwater

Stages 2B & 2C, which are underlain by fluvial deposits, have 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.

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 excavations elsewhere on the site.
- laboratory testing generally indicated low to medium plasticity clays with a low to moderate swelling capacity.
- insitu clays may not be suitable for rendering the canal central water feature and the deep water section of the wetland. However, residual clays from the eastern section of the North Penrith (Stage 2A) site may be suitable, subject to detailed geotechnical testing. Imported clays may be substituted subject to detailed geotechnical testing.
- high density polyethylene (HDPE) liners or geosynthetic clay liner (GCL) may be considered for rendering the canal.

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 generally flows west to north-west.
- groundwater in Stages 2B & 2C is situated within probable relatively low permeability clays at depths in the range of 6m to 7m from surface levels.
- groundwater underlying the site appears to flow in a north to north-westerly direction;
- groundwater is not expected to influence the design and construction of the wetlands/canal. However, it should be noted that local aquifers might exist. These aquifers could have a high hydraulic conductivity of more 2×10^{-5} m/sec.
- 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 residential development and construction of the proposed water feature and wetland/wetlands/canal as proposed.

Assessment Summary

It is concluded that:

- the site is underlain by naturally occurring soils suitable for 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 during construction;
- the salinity hazard of the soils at the site can be readily managed by designing and implementing a Soil and Water Salinity Management Plan during construction;
- the assessed depth of groundwater indicates that construction of the wetland and canal/water feature should not intersect with natural groundwater. In any event, the wetland and canal water feature will be constructed with a suitable impervious lining to avoid any interaction between these waterbodies and groundwater;
- 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 materials 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.

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 and determining the most suitable impervious lining for the wetland and canal.
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.

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

Appendix 1: Staging Plan

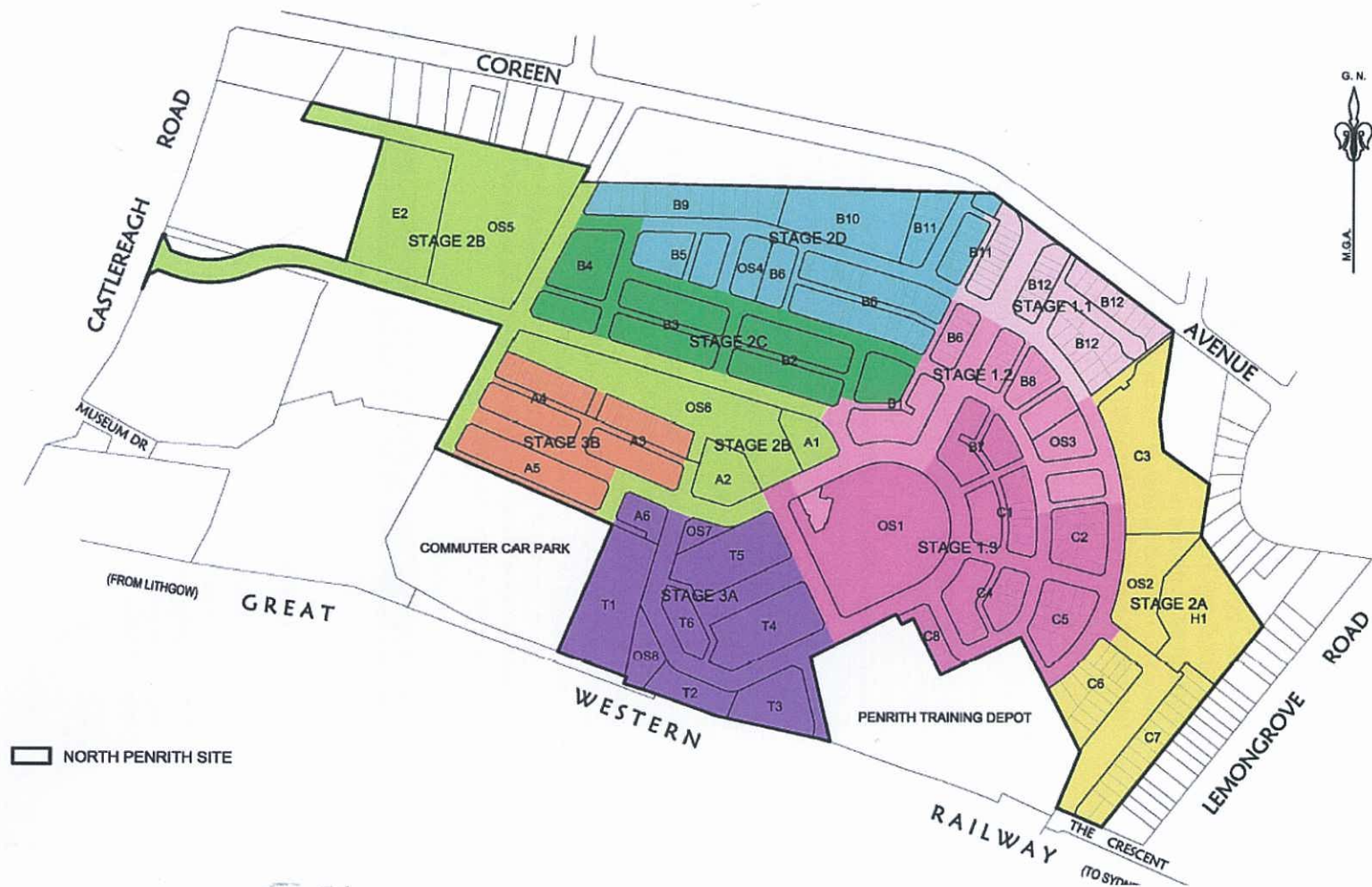


Figure 5 – North Penrith Revised Staging Plan