GEOTECHNIQUE® PTY LTD

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Cabe Developments (NSW) Pty Ltd
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Attention: Mr S Diamond

Dear Sir

re **Proposed Mixed Use Development**
344 High Street, Penrith
Desk Top Study - Geotechnical Assessment

This report presents results of a desktop study for a proposed mixed use development at 344 High Street, Penrith, hereafter referred to as the site.

We understand that the proposed development at the site includes construction of a new building with seven storeys above the ground and one level of basement car park. The basement excavation is anticipated to be up to about 4.0m deep. A desk top study is required to provide preliminary geotechnical recommendations on the design of the proposed building.

Review of available information on geology relevant to the site indicates the following:

- Geological Map of Penrith (scale 1:100,000) indicates that the bedrock at the site is Bringelly Shale, belonging to the Wianamatta Group of rocks and comprising shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone and rare coal (Reference 1).
- Soil Landscape Map of Penrith (scale 1:100,000) indicates that the landscape at the site belongs to Blacktown Group, which is characterised with gently undulating rises on Wianamatta Group shales, with local relief to 30.0m, ground slope of less than 5 percent and broad rounded crests. The sub-surface soil within this landscape is likely to be up to 3.0m thick, moderately reactive, highly plastic and with poor drainage (Reference 2).
- Map showing Salinity Potential in Western Sydney indicates a moderate salinity potential across the site (Reference 3).
- Geotechnique Pty Ltd completed a geotechnical investigation for the Penrith CBR drainage upgrade and prepared a report (Reference 4). This investigation included drilling of boreholes at the corner of Castlereagh and Lethbridge Streets, Penrith, located about 185.0m south of the site. These boreholes indicated that the subsurface profile to the south of the site is likely to comprise a sequence of fill underlain by alluvium to depths exceeding 3.0m. Fill includes silty clay of medium to high plasticity and silty sand of fine to medium grained with some gravel and coarse grained sandy gravel. Alluvium is predominantly firm to stiff silty clay of medium to high plasticity but some ironstone was noted at depths exceeding 2.0m.

  Groundwater was not encountered up to borehole termination depth of 3.0m. This investigation also indicated that the soils up to depth of about 0.4m from existing ground surface are non-saline, soils within depth range of 0.4m to 1.0m are moderately saline and soils at depths exceeding 1.0m are very saline.

- Geotechnique Pty Ltd also completed a geotechnical investigation for a multiuse development at 304-306 High Street, Penrith, located about 170.0m east of the site, and prepared a report (Reference 5). This investigation included drilling of two boreholes to depths 12.0m from existing ground surface. These boreholes indicated that the subsurface profile to the south of the site is likely to comprise a sequence of fill and residual soils underlain by bedrock. Fill includes concrete slabs and medium to high plasticity clay and silty. Residual soil is predominantly high plasticity clay with some ironstone and shale fragments. Bedrock to borehole termination depths was shale. The depth to bedrock across the site is likely to vary from about 4.5m to 6.0m from existing ground surface.

  Groundwater level was not encountered up to depth of 6.0m. This investigation also indicates saline soils are unlikely to be of concern for the proposed development works.

Based on desk top study summarised above, it is our assessments that the subsurface profile across the proposed development site is likely to comprise a sequence of fill and residual soil underlain by shale bedrock. The depth to bedrock is likely to vary from about 5.0m to 6.0m from existing ground surface and the depth to groundwater level across the site is likely to be in excess of 4.0m from existing ground surface. Therefore, we provide following preliminary assessments and recommendations for design of the proposed building.

- It is anticipated that the basement excavation for the proposed development will be about 4.0m deep. Therefore, excavation works will be limited in soil (fill and residual soils). No rock excavation will be required. Therefore, it is our assessment that the basement excavation can be completed using conventional earthmoving equipment, such as excavators and dozers. As depth to groundwater is anticipated to be more than 4.0m, no major groundwater inflow is anticipated during basement excavation. Minor seepage, if any, can be handled with conventional sump and pump method.
- Excavation faces during and after basement excavation should be battered for stability or retained with engineered retaining structures. Recommended batter slopes for short term (temporary) stability is 1 vertical to 1.5 horizontal and that for long term (permanent) stability is 1 vertical to 2.5 horizontal. If basement excavations extend to site boundaries and/or adequate spaces are not available for battering of cut faces, the excavation faces should be retained by engineered retaining structures. Appropriate retaining structures for the proposed development will comprise contiguous pier walls or soldier pier walls with laggings or gravity walls or cantilever walls.
- Material at the base of about 4.0m deep, basement excavation is anticipated to be residual soils. Therefore, floor slabs for the proposed building may be constructed as ground bearing slabs on residual soils or suspended slabs supported by footings designed in accordance with recommendations provided in this report. We recommend a Modulus of Subgrade Reaction Value of 20.0kPa/mm for design of floor slabs.
- As bedrock is anticipated at shallow depths of 5.0m to 6.0m from ground surface and basement excavation would be up to about 4.0m deep, appropriate footings for the proposed building is likely to comprise shallow (pad or strip) footings founded in bedrock about 1.0m to 2.0m below the basement level or deep footings (bored piers, screw piles) socketed into the bedrock. Deep footings may be desirable if footings are required to withstand significant lateral and uplift loads. For preliminary design of shallow footings founded in bedrock about 1.0m to 2.0m below the basement level is 700kPa. Allowable bearing pressure may be increased to 1000kPa if deep footings are socketed at least 5.0m below basement level.

The assessments and recommendations presented in this report are based only on desk top study and therefore should be considered as preliminary only. Therefore, a detailed geotechnical investigation should be carried out to confirm these assessments and recommendations prior to detailed design of the proposed building.

If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

INDRA JWORCHAN
Principal Geotechnical Engineer

References

1. *Jones, D. C & Clark, N. c. (Editors), 1991. Geology of the Penrith, Geological Survey of NSW. Department of Mineral and Energy. 1:100,000 Map Sheet 9030, 202p*
2. *Soil Conservation Services of NSW, Soil Landscape Map of Penrith (Scale 1:100,000), Landscape series Sheet 9030, 1989.*
3. *Department of Infrastructure, Planning and Natural Resources, Salinity Potential in Western Sydney (Scale approximately 1:140,000), 2002*
4. *Geotechnique Pty Ltd, Geotechnical Investigation for proposed Penrith CBD Drainage Upgrade project, Report No 13362/1-AA dated 29 September 2015.*
5. *Geotechnique Pty Ltd, Geotechnical Investigation for proposed Mixed Use Development, 304-306 High Street, Penrith, Report No 13428/1-AA dated 16 April 2015.*