

## 4.7 Recommendations

Geotechnical recommendations for the development site are provided below in Table 7.

Table 7: Geotechnical recommendations.

Recommendation	Description
Further Testing	We recommend that further soil penetration testing is completed at the detailed design stage. We also recommend that rock coring is completed to a level below the deepest excavation level and that rock strength testing is completed at detailed design stage. This will also allow groundwater levels to be confirmed (if the water table is contacted during drilling/coring).
Footings	All footings, particularly those in soil materials, should be excavated, inspected and poured with minimal delay. All footings should be free from all loose or softened materials prior to pouring. If water ponds in the base of the footings, they should be pumped dry and then re-excavated to remove all loose and softened materials. If a delay in pouring is anticipated, we recommend that a blinding layer of at least 50 mm concrete be placed to protect the base of the footing excavation.
Sediment and Erosion Control	Appropriate design and construction methods shall be required during site works to minimise erosion and provide sediment control. In particular, any stockpiled soil will require erosion control measures.
Soil Excavation	Any excavations resulting in a permanent batter slope exceeding 0.75 m in height should be supported by suitably designed and installed retaining or shoring structures. Alternatively, soil overburden may be excavated without structural supports but with a batter slope of 1 (vertical): 2 (horizontal).
Fill Placement	<p>All fill exceeding 0.75 m in height should be supported by suitably designed and installed retaining or shoring structures or designed with a maximum batter slope of 1 (vertical): 2 (horizontal).</p> <p>Engineered fill is to be free from organic materials, other contaminants and deleterious substances and have a maximum particle size not exceeding 40 mm.</p> <p>Engineered fill should be placed in layers of a maximum of 150-200 mm loose thickness and compacted (as specified herein). For sandy materials, a minimum ID of 75 % should be achieved, which can be reduced to 70 % in landscaped areas. For clayey soils (eg. including weathered sandstone), engineered fill should be compacted to at least 98 % SMDD, which can be reduced to 95 % SMDD in landscaped areas.</p>
Rock Excavation	<p>Based on the Cardno Forbes Rigby rock excavation plan (Attachment A – sheet 5), maximum rock excavation is approximately 10.7 m below the existing rock level and is required for the Illawarra International Hospital located in the south west of the site.</p> <p>Excavations into fresh bedrock (if necessary) may be made near vertical (8V:1H). We expect based on local geology that rock strength will increase with depth.</p>

	For excavation into the first say 1 m of rock, it is considered that this material is likely to be rippable. Excavation below this level is likely to require the attachment of a rock hammer. Further testing will be required to confirm these estimates.
Retaining Structures	Any retaining structures to be constructed as part of site works are to be backfilled with suitable free-draining materials and include suitable drainage measures, such as a geotextile enclosed 100 mm agricultural pipe, to redirect water that may collect behind the retaining walls.
Vibrations	Vibrations created during excavation works are to be minimised to reduce potential impacts on the neighbouring properties. Recommended maximum levels of ground vibration (as per AS 2187.2, 1993, Appendix J) are 10 mm/s PPV (peak particle velocity) at the site boundary or at closer retained site structures.
Groundwater	<p>Given that permanent groundwater is estimated to exist within the siltstone rock at a level of approximately 14-16 mAHD and maximum excavation is to approximately 28 mAHD, it is unlikely that excavation works will come into contact with groundwater.</p> <p>Ephemeral groundwater flows may be encountered and should be dealt with as prescribed in the stormwater section of this table. If permanent groundwater is encountered then site works are to cease immediately and a geotechnical engineer is to inspect/document groundwater conditions and determine the need for further management.</p>
Stormwater	A potential exists for stormwater flows to enter excavation areas during site works. All surface runoff should be diverted away from excavation areas where possible. Stormwater is unlikely to be contaminated and therefore any water required to be pumped out of excavation areas may be discharged through a coarse filter cloth fence then allowed to flow across and off the site.

## 4.8 Monitoring Program

To ensure site stability, prevent any adverse geotechnical impacts and reduce the risk of sediment transport off-site due to erosion during site works, we recommend the following be monitored regularly (daily or otherwise):

- Seepage rates from any excavated soil/ rock interface;
- Sedimentation downslope of excavated areas during and after rainfall events; and
- All sediment erosion control structures – for functioning condition and removal of built-up spoil.

## 4.9 Contingency Plan

In the event that the proposed development works cause an adverse impact on overall site stability or on neighbouring properties, works shall cease immediately. The nature of the impact shall be documented and the reason(s) for the adverse impact investigated. This might