MOTT MACDONALD

Burwood North Precinct Masterplan

Geotechnical Study

December 2022

Updated Baseline Report

DRAFT

Acknowledgment of Country

We recognise the Darug Wallamatta People as the Traditional Custodians of this land that is being masterplanned. We respect their enduring cultural and spiritual connections to the land and waters, and celebrate their knowledge, kinship and values.

We acknowledge that these connections, to the land and waters, have existed for millennia and will continue into the future. We respect the Elders who have gone before, together with those of today for their guidance on our shared journey.

We recognise that we are, and always will be, on Aboriginal land.

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Geotechnical Desktop Study Report

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Contents

1 Introduction

This report provides a high-level review of the currently identified geotechnical risks for the proposed Burwood North Precinct. Information for this geotechnical assessment has been gathered from a desk top review of publicly available data online.

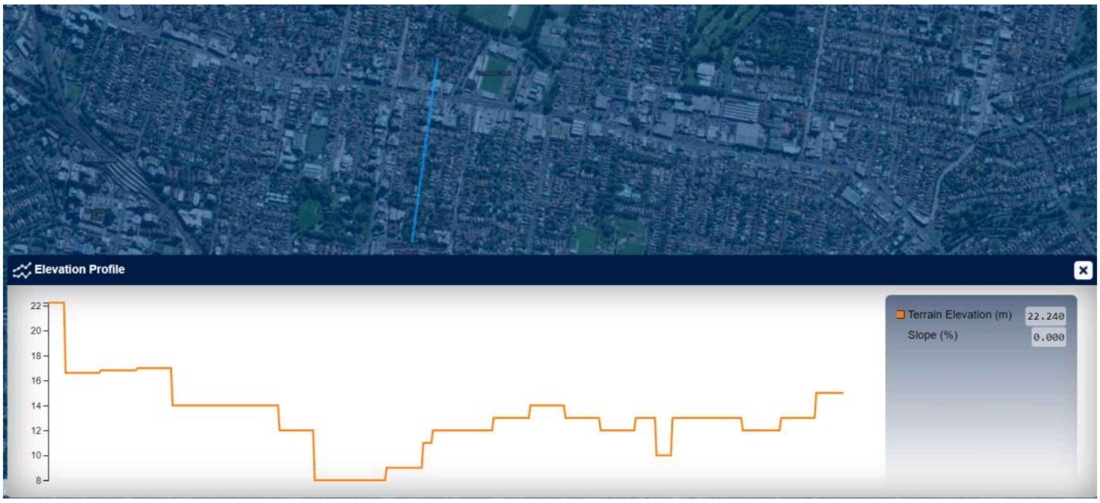
The masterplan for the Burwood North Precinct covers an area from Burwood Park and Wilga Street in the south to the proposed Burwood North Metro Station in the north and extending from Shaftesbury Road in the east to Grantham Street to the west. At completion the precinct will strengthen the thriving business and retail centre for the surrounding community.

This report aims to identify major geotechnical opportunities and constraints which can then inform future stages of design and construction.

2 Topography

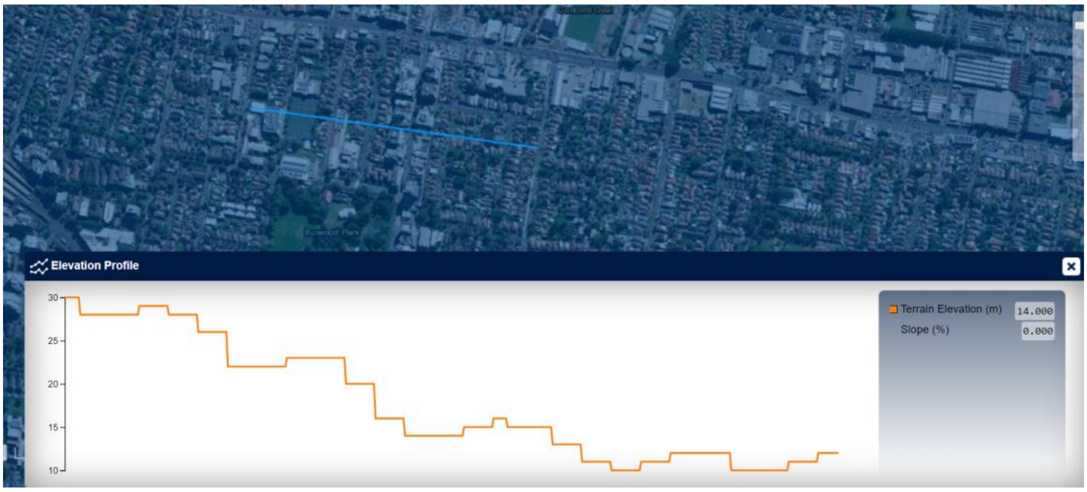
A general review of the regional topography in ELVIS (Figure 2.1 & Figure 2.2) shows lows of around 10m Australian Height Datum (AHD) to the east of the study area, increasing in elevation towards the south to 22mAHD and a maximum of 30mAHD towards the west.

Figure 2.1: Indicative topographic change (From south to north)



Source: ELVIS [Accessed: 09 November 2022]

Figure 2.2: Indicative topographic change (From west to east)



Source: ELVIS [Accessed: 09 November 2022]

3 Geology

The Burwood North study area lies within the geological region known as the Sydney Basin. This comprises a structural and topographic basin extending from Batemans Bay in the south, Lithgow to the west, and Raymond Terrace to the north.

NSW Seamless Geology Data Package (accessed via MinView) shows the area is underlain by Ashfield Shale of the Wianamatta Group (Figure 3.1), described as ‘black to light grey shale and laminite’. Ashfield Shale is thought to have been deposited in a lacustrine to brackish or shallow marine environment during the Middle Triassic period (247.2 – 237 million years ago). It generally consists of dark grey to black, sideritic claystone and siltstone and laminated fine-grained sandstone and siltstone. The siderite is described as abundant and oxidised to limonite in weathered rock. It is therefore not present in surface rocks. It also forms hard ‘iron-stone’ bands, recorded as up to 300mm thick.

Alluvial valley deposits are shown overlying the Ashfield Shale on the eastern portion of the study area (Figure 3.1) and appear to follow the path of a now buried/infilled creek bed in a general north-south orientation. These deposits are described in MinView as ‘silt, clay (fluvially deposited) lithic to quartz-lithic sand, gravel’.

Fill, or ‘anthropogenic deposits’ can be expected across the study area related to existing and previous site developments and construction.

Figure 3.1: Geology of study area

Source: NSW Seamless Geology Data Package, [Accessed: 22 November 2022]

4 Hydrogeology

The hydrogeology of the study area and wider area can be characterised by shallow groundwater (located within the fill/alluvium deposits) following the topography and travelling towards St. Lukes Canal (approximately 130m east of the study area).

Groundwater within the Ashfield Shale may be interacting with the M4 WestConnex tunnel, which runs through the study area. Deeper groundwater within the Ashfield Shale may not be hydraulically connected to groundwater within the alluvium due to the fine-grained sediments and clay minerals of the Ashfield Shale restricting vertical movement of groundwater.

Shallow groundwater is more likely to preferentially flow horizontally through the fill/alluvium than vertically into the Ashfield Shale. Some vertical movement of shallow groundwater into the Ashfield Shale may occur.

5 Previous investigations

Three geotechnical investigations (GI) within 500m of the site boundary were identified using MinView (2022) and are summarised below, additional investigation information has been requested from Sydney Metro and will be incorporated into this assessment when provided.

Findings from investigations undertaken for the Montrose Child Protection Unit, completed by Public Works, are summarised in Table 5.1. The investigations consisted of three test pits between 0.8m and 2.1m depth and were completed approximately 280m northeast of the Burwood study area. This investigation is closest to the alluvial deposits and the soil encountered was generally moist with possible groundwater or perched water encountered in one of the test pits.

Table 5.1: Subsurface profile summary from Montrose Child Protection Unit

Material	Description	Depth to top (mbgl)	Thickness (m)
Fill	Mix of silt, sand and clay in differing amounts, light to dark brown, very loose, moist, with organic matter and bricks	0.0	0.4 – 0.9
Silty clay/ clayey silt	Red-brown, with some fine gravel, moist, firm to very stiff (increasing strength with depth)	0.4 – 0.9	0.8 – 1.7
Shale	Grey, highly weathered, very weak, with brown ironstone gravels	2.1 and greater	Not confirmed

Source: Public Works Department. (1988) Geotechnical Investigation Montrose Child Protection Unit

Investigations for OTEN College, Strathfield, completed by Arup, are summarised in Table 5.2. The investigation consisted of seven boreholes between 6.4m and 9.4m depth and were completed approximately 350m southwest of the site boundary, with no groundwater encountered during this investigation.

Table 5.2: Subsurface profile summary from OTEN College Strathfield

Material	Description	Depth to top (mbgl)	Thickness (m)
Fill	Reinforced concrete, road base, clayey topsoil with shale gravel present	0.0	0.0 – 1.0
Silty clay	Medium plasticity, light grey, orange-brown, shale gravel present, soft to very stiff (increasing strength with depth)	0.0 – 1.0	1.0 – 2.7
Shale	Light orange-brown to grey, slightly to highly weathered (improving with depth), very low to medium strength, Class IV-II (improving with depth), horizontal bedding	1.4 – 3.0	Not confirmed

Source: Arup Geotechnics. (1993) Geotechnical Investigation Oten College, Strathfield

Investigations for Lucas Gardens School, New Hydrotherapy Pool, completed by Public Works, are summarised in Table 5.3. The investigation consisted of seven boreholes between 3.2m and 4.5m depth and were completed approximately 450m northeast of the site boundary, with moist soil observed and no groundwater encountered.

Table 5.3: Subsurface profile summary from Lucas Gardens Hydrotherapy

Material	Description	Depth to top (mbgl)	Thickness (m)
Fill	Bitumen, mix of silt, sand and clay in differing amounts, dark grey/brown, loose, moist, with organic matter, pieces of broken glass.	0.0	0.4 – 1.3
Silty clay	Orange-brown, moist, stiff, trace ironstone gravel	0.4 – 1.3	0.0 – 1.5
Shale	Light grey with brown, extremely to highly weathered (improving with depth), extremely to very weak	1.3-1.9	Not confirmed

Source: NSW Public Works – Project Management. (2012) Geotechnical Investigation Lucas Garden School for Specific Purposes, New Hydrotherapy Pool

Based on the available data, these three investigations (spread up to 1700m apart) encountered similar conditions, potentially indicating a general consistency, although it should be noted that any investigation can only confirm conditions in its immediate vicinity and may not be representative of the full range of conditions present.

These investigations consisted of three test pits and 13 boreholes in total. Fill was observed in layers up to 1.3m thick, which were generally underlain by silty clay (potentially residual soils of the Ashfield Shale) up to 2.6m thick. Below the silty clay layer Ashfield Shale rock was encountered at a shallow depth of 1.4m to 3.0m. In general, the rock encountered was initially extremely weathered with very low strength, the rock was observed to increase in strength and decrease in weathering with depth. It should be noted little is known about the depth of the alluvial deposits and the existence of perched groundwater.

6 Potential impacts

The following sections discussed the potential impacts and considerations of the ground conditions on the development of the master plan.

6.1 Overview

The currently limited available historical investigations indicate generally shallow depths to rock (<5m below ground level). At shallow depths the rock is likely to be low strength and highly weathered and can generally be expected to become less weathered and increase in strength with increasing depth.

No information has been found to indicate the depth, extent, or composition of the mapped alluvial valley deposits. Alluvial deposits can be associated with deeper soils and greater weathering of rock. This may impact the design of any excavation and retention systems for basements/underground works and the depth and size of foundations. Appropriate investigations, including boreholes through the alluvium and underlying rock will provide further information prior to site redevelopment in this area.

The alluvial deposits may also be associated with shallow groundwater perched above a deeper groundwater aquifer within the Ashfield Shale.

6.2 Foundations

Foundations for new structures are likely to be formed within the rock. For small, light structures of 1-2 storeys this may include shallow pad or strip foundations founded at shallow depths at/near the top of the rock. With increasing size and height buildings will require larger foundations likely to include bored piles into more competent material.

6.3 Basements/excavations

Any excavations for basements/underground works are anticipated to encounter existing fill/topsoil, alluvium (where present) and residual soils before continuing through weathered Ashfield Shale and progressively through less weathered, stronger rock. For deeper basement excavations, medium strength and higher strength rock is likely to be encountered which may require ripping or breaking.

To complete the excavation for basements, a retaining system is likely be required, given the space constraints are requirement to protect adjacent existing structures from excessive ground movement. Where alluvium is present, soils are likely to be normally consolidated and lower in strength than the underlying rocks and likely to require more robust retention systems, including the need to manage greater potential groundwater inflows.

Where large groundwater inflows are anticipated, diaphragm or secant pile walls may be required to provide sufficient seal from the surrounding groundwater. By isolating the excavation from groundwater inflows, this a) limits the need for groundwater pumping and potentially expensive offsite disposal and b) helps to protect adjacent structures from damage caused by dewatering induced ground settlement.

6.3.1 Retention systems

For excavation of basements in built-up areas generally a retention system consisting of piles, and anchors or props are required to allow excavation and construction below existing ground level. In rock in Sydney, where groundwater is not present, or flows can be managed by sump pumping this often involves soldier pile walls with shotcrete infill. This is a well-understood and developed solution in the Sydney area. Where high groundwater flows are anticipated alternative support options include secant piles or diaphragm walls.

For deep supported excavations temporary anchors or props are often employed to limit movement and reduce the risk of damage to surrounding structures. Anchors, while relatively easy to install and widely used in Sydney, may extend beyond the site boundaries and require additional land acquisition, agreements and/or easements for installation. Props provide an alternative, typically spanning between two facing retaining structures. While props remove the need for anchors extending outside the site boundaries, they can limit the working area within the excavation and need careful sequencing for placing and removal.

6.4 Groundwater

Generally, the Ashfield Shale is anticipated to be low permeability however open joints/fractures may allow for water inflow. Groundwater inflow can also be anticipated in the alluvial deposits, with a higher inflow potential from the sand layers. The rate of flow is dependent on the material type, frequency of discontinuities and connectivity of fractures.

It should be noted there is little information on groundwater levels in the area. Groundwater inflow and potential for long-term groundwater drawdown for drained basement structures may impact the ground movement and associated risks to third party infrastructure. Risk of high groundwater inflows require deeper retaining walls to cut-off any groundwater seepage into basements and may require construction of tension piles to resist uplift due to hydrostatic pressures.

6.5 Ground movement

Ground movements are expected to be of lower risk due to the presence of shallow rock, allowing for higher strength materials for foundations. Ground movement may damage existing/adjacent structures by affecting the settlement of footings. Situations which may induce settlement and deformation are dewatering and excavation without appropriate shoring.

For most sound buildings such movements may cause cracks and aesthetic damage. However, heritage structures may be subject to stricter movement criteria which may limit excavation depths/zones in their vicinity which should be considered as designs are developed.

7 Risks and opportunities

The table below summarises the risks and opportunities identified in this first stage desk study. These will be updated as move information becomes available (eg Sydney Metro West GI data) and the masterplan evolves.

At this stage in the masterplan development, this desk study has not identified ground risks that would unduly limit or constrain development in the area. It is recommended that project specific geotechnical investigations are scoped and undertaken as part of any future development applications to inform foundation/excavation design requirements and appropriately categorise ground risk for each development proposal as this desk study can only provide an overview of the mapped available data.

Table 7.1: Risks and opportunities

Type	Item	Description
Opportunity	Shallow rock encountered	Shallow foundations may be provided for lighter structures. The stiff rock may also require less temporary support during construction, eg fewer props, less stiff walls.
Risk	Uncontrolled fill	Uncontrolled fill from historical site uses may result in a poor, variable and inconsistent founding material. Risk can be managed by founding structures below this layer.
Risk	Deep soils/weathered material within alluvial valley	Depth, extent and composition of alluvial soils and weathering profile of underlying rock is currently unknown with no historical data recorded on publicly available records. Risk can be managed through investigation prior to construction and design of appropriate foundation/retaining structures.
Risk	Groundwater	Groundwater inflows and levels can impact design of retention systems and basement waterproofing systems. Risk can be managed at design though appropriate investigation and groundwater monitoring.

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