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SPECIALISTS MANAGING THE EARTH

50 YEARS
AN EXTRAORDINARY JOURNEY

ASSESSMENT OF GROUNDWATER IMPACTS - DISCOVERY POINT DEVELOPMENT - WOLLI CREEK

Australand

GEOTLCOV24013AA-AB
11 June 2010

Coffey Geotechnics Pty Ltd ABN 93 056 929 483
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CONTENTS

1 INTRODUCTION

This report presents an assessment of groundwater impacts arising from a Part 3A Concept Plan for the Discovery Point development at Wolli Creek. The Discovery Point development at Wolli Creek is located on the southern bank of the Cooks River between the Princess Highway to the east and Illawarra Railway line to the west.

The proposed development will consist of construction of buildings to the north and south of Wolli Creek station.

This report responds to geotechnical and groundwater aspects in relation to the following Director General's Requirements:

> *The EA shall address any impacts upon the groundwater resources, and when impacts are identified, provide contingency measures to remediate, reduce or manage potential impacts*
>
> and
>
> *The EA shall provide and assessment of any flood risk on site in consideration of any relevant provisions of the NSW Floodplain Development Manual (2005) including potential effects of climate change, sea level rise and an increase in rainfall intensity.*
>
> and
>
> *The EA must address planning provisions applying to the site, including permissibility and the provisions of all plans and policies contained in "Development Near Rail Corridors and Busy Roads – Interim Guideline"*

1.1 Site Description

Figure 1 shows the proposed site plan (based on Bates Smart architectural drawing DA2-100 Rev A). The building sites shown on Figure 1 as Greenbank, Verge and Vine have been completed. The proposed development will consist of Building 1B, Building 1C and Buildings 2 to 14 as shown on Figure 1. These are located to the north and south of Wolli Creek Station. There will be a zone of deep soil planting in a Neighbourhood Park surrounded by Building 1B and Building 1C and Buildings 2 to 5.

The new buildings south of Wolli Creek station (Buildings 1B, 3, 4, 5, and 14) will have a common basement at approximately 1.8mAHD. Buildings to the north of Wolli Creek station (Buildings 6 to 13) will have a common basement with floor level in the range 1.8mAHD to 2.0mAHD. The common basements at 1.8mAHD and between 1.8mAHD and 2.0mAHD will be the lowest floor levels for Buildings 1B and Buildings 3 to 14. The lowest floor level for Buildings 1C and 2 will be at -3.7mAHD. In addition, the existing basement attached to Verge and Vine will be extended to lower levels. This extended basement will be protected against groundwater ingress by a diaphragm wall which was constructed as part of the Verge project. This diaphragm wall incorporates the basement of Building 1C and 2.

1.2 Geotechnical and Hydrogeological Setting

The Sydney geological map (1:100,000 scale) shows the Discovery Point site is underlain by Hawkesbury Sandstone and this has been confirmed in the numerous geotechnical investigations carried out in relation to the development and for design and construction of the Wolli Creek station.

Drawings S20325/1-2 and S2035/1-9 (taken from Coffey Geosciences Report S20325/1-AP of August 2003 and reproduced in Appendix A) show interpreted geotechnical cross-sections through the site at the locations indicated in Figure 1. Background investigations have shown the presence of a deeply incised palaeochannel within the sandstone beneath the south-western portion of the Discovery Point site and is considered to be the original channel for Wolli Creek and possibly the Cooks River. The palaeochannel is likely to have formed in the geological past during periods of low sea level. Elevated rock levels are present in the elevated ground at the south of the development area near Princess Highway. To the north of the development area in the vicinity of Buildings 8 to 13 the top of sandstone has been identified to be between -10mAHD and -20mAHD (see Drawing S2035/1-9 from report S23035/5-AP).

The sediments infilling the palaeochannel comprise interbedded alluvial sands and clays and estuarine muds. The interbedded sands within the soil profile provide pathways for lateral groundwater movement.

Recharge to the groundwater system is via rainfall infiltration. Groundwater is shallow (typically less than 2m below existing ground surface) and flows toward the Cooks River. In the vicinity of the Cooks River groundwater levels will be comparable to river level and immediately adjacent to the river (say within 40m) some tidal variation in groundwater level may occur in response to tidal variation in river level.

The Coffey (2003) report noted groundwater levels in boreholes within the bounds of the Concept Plan to a maximum RL 1.5m AHD south of the Wolli Creek railway station, and to a maximum 1.15m AHD north of the railway station. However, long-term monitoring of long-term groundwater levels should be undertaken for detailed design of basements, as groundwater levels can be higher in response to rainfall events.

Variation in groundwater level in response to rainfall and changes in the water level in Cooks River due to tidal effects, sea level rise or flood routing can be expected.

1.3 Existing Groundwater Users

Coffey carried out a search of the Office of Water registered groundwater bore database. This search revealed that the nearest registered bores were some 1km to the west of the Discovery Point development and were registered for the purpose of groundwater monitoring. The nearest registered bores are two shallow bores designated GW105580 and GW107753. The bores were registered on behalf of the Department of Housing and State Rail. Records for these bores taken from the Office of Water database are included in Appendix B.

2 SEA LEVEL RISE AND CLIMATE CHANGE

Background changes in groundwater level which would result from global climate change and sea level rise were considered separately from groundwater changes due to the development. Climate change has the potential to influence groundwater levels through changes in sea level and changes in precipitation. For the Discovery Point development the conditions for 2050 were assessed as this is understood to correspond to the project design life. Changes in sea level influence groundwater levels along the coastal and estuarine shores while changes in rainfall have the potential to alter the rate of groundwater recharge and hence influence groundwater levels.

2.1 Sea Level Rise

A NSW Government Policy Statement published by NSW Department of Environment, Climate Change and Water (2009) sets out projections of sea level rise by 40cm by 2050 compared with 1990 mean sea levels and by 90cm in 2100. It is noted in the policy that higher sea level rises are possible. Rise in sea level will lead to:

- Increased or permanent tidal inundation of land by seawater
- Recession of beach and dune system
- Changes in the way tides behave within estuaries
- Saltwater extending further upstream in estuaries
- Higher saline water tables in coastal areas and
- Increased coastal flood levels due to a reduced ability to effectively drain low-lying coastal areas.

For the Discovery Point development the relevant change would be that, in the absence of mitigating factors, groundwater levels would rise by an amount approximately equal to the amount of sea level rise projected as 0.4m by 2050 as nominated in the NSW Government Policy Statement.

2.2 Changes to Precipitation

Groundwater level in the vicinity of the development will respond to rainfall. The presence of impervious structures associated with the building footprints and paved surfaces will reduce the rate of rainfall infiltration to the groundwater system within the development area. This is not expected to have a major influence on groundwater levels as infiltration outside the development area acts over a much larger catchment and therefore has a more dominant influence on groundwater level than infiltration at the site.

CSIRO in their Climate Change in Australia Technical Report (Watterson *et al*, 2007) predict a reduction in annual median precipitation in the Sydney region. CSIRO best estimates predict a reduction in annual median precipitation of between 2 and 5% by 2030 and between 5 and 10% by 2070 compared with 1961 to 1990 records. The 99^{th} percentile daily precipitation intensity is predicted to change by between -1 to 2% by 2050. This provides an indication of the potential increase in rainfall for extreme rainfall events.

As these predictions indicate an expectation of lower annual rainfall, the rate of rainfall infiltration recharge to the groundwater system in the vicinity of the development is expected to reduce over the life of the project. The influence of this would be that average groundwater gradients toward the Cooks River may reduce over time, potentially by 5 to 10% in line with reductions in average annual precipitation.

Based on the above discussion it is assessed that changes to precipitation associated with future climate change would not result in increase in groundwater levels at the site.

2.3 Changes to Floodwater Levels in Cooks River

Groundwater levels in land adjacent to the Cooks River will respond to changes in water level in the river. Changes in river level will occur due to tide and in response to increased river flows associated

with high rainfall events. The groundwater level changes associated with such changes in river levels diminish with distance from the river. Flood modelling by Parson Brinkerhoff (2010) provided an assessment of water level changes within the Cooks River under a flood event including allowance for 20% increase in rainfall intensity associated with climate change and incorporating the effects of sea level rise. This analysis indicated that, for a one in one hundred year recurrence event, increase in water level by 1.1m above prevailing water levels would occur in Cooks River with water levels elevated for a period of several hours.

The groundwater impacts of this event were assessed using analytical expressions described by Edelman (1972). The transmissivity and storage coefficient of the soil profile was assessed based on the material descriptions set out in the geotechnical sections provided in Appendix A. A transmissivity value of $50m^2/d$ was adopted allowing a permeability of 5m/d for the sandy units of the profile and up to 10m of sand within the soil profile. This is considered a reasonable expectation for the interpreted geotechnical profiles. A storage coefficient of 0.01 associated with movement of the water table was adopted. This is considered a reasonable value for sandy soils subject to groundwater movement over a duration of the order of several hours. A groundwater rise in response to flooding of approximately 0.75 m was assessed for a distance of 10m from the river bank. Lesser groundwater level rise would occur at greater distances. For structures closer than 10m to the assessed extent of flooding it is recommended that for detailed design groundwater levels be taken as rising to the full flood level.

It is recommended that these impacts are taken into account in detailed design of basement slabs and walls. Groundwater changes of this magnitude can readily be addressed in the detailed design of basement walls and slabs. Monitoring of groundwater levels during construction is recommended to check design parameters.

3 ASSESSMENT OF POTENTIAL IMPACTS

3.1 Groundwater Impacts

The development will involve the construction of buildings with basements. Basement levels for the proposed buildings with the exception of Buildings 1C and 2 will have the lowest slab level at 1.8mAHD or higher. This level is comparable to the highest groundwater level of 2.1mAHD recorded in site piezometers and construction of these buildings is therefore not expected to have a measureable influence on groundwater levels.

The existing diaphragm wall encompassing the basements of Building 1C, Building 2, Verge, Vine and Greenbank will act to prevent groundwater flow which might have otherwise occurred over the area occupied by these basements. The areas enclosed by the diaphragm wall are in an area where sandstone bedrock levels are comparatively shallow on the fringe of the palaeochannel identified in geotechnical investigations of the site. As a result the impacts on groundwater flow associated with construction of this diaphragm wall are considered unlikely to have a measureable influence on groundwater levels in the vicinity of the site. Any changes to groundwater levels associated with this cut off wall would be localised and minor.

A survey of Office of Water records for registered groundwater bores has revealed that the nearest registered bores are approximately 1km from the site and these bores are used for monitoring purposes. As groundwater level changes associated with the construction of the diaphragm wall surrounding the basements of Building1C and Building 2, Verge, Vine and Greenbank will be minor it is assessed that the development would not affect groundwater use from registered groundwater bores.

For design purposes it is recommended that allowance for groundwater pressures associated with flood levels be taken into account in future project applications for design of basement slabs and retaining walls. During flood events which result in floodwater impoundment, groundwater levels can be expected to rise to be equal to the floodwater level. This expectation will be taken into account in the future detailed design of basement structures (typically addressed through concrete thickness and reinforcement design and drainage).

3.2 Excavation, Earthworks and Construction Related Impacts

The NSW Department of Planning (2008) have produced an interim guideline for *Development near rail corridors and busy roads: Interim Guideline*. Section 6 of this guideline discusses excavation which involves penetration of the ground to a depth of at least 2m within 25m of a rail corridor and notes that the consent authority must not consent to the development without consultation with the rail authority. Buildings 2, 4, 5, 6, 10, 11, 12, 13 and 14 will involve basement excavation within 25m of the rail corridor for the Wolli Creek station. Foundation excavations for these buildings will not involve significant areas of excavation below about 1.5mAHD. This may, in places, involve excavation of more than 2m below existing ground levels. In addition, trenches for installation of drainage measures or other services within 25m of the rail corridor may involve excavation more than 2m below existing ground levels.

Good construction practice would be employed with service trenches shored as appropriate during construction and basement excavations battered or shored to respond to the local requirements. By following good practice it is assessed that such excavations would not impact on the geotechnical performance of railway structures. This will be considered in future project applications.

4 CONCLUSIONS AND RECOMMENDATIONS

Based on the conditions identified in earlier geotechnical studies it is assessed that the proposed development will not cause measureable changes to groundwater levels except possible minor localised changes in response to the construction of the diaphragm wall surrounding Building 1C, 2, Verge, Vine and Greenbank. These minor influences on groundwater level would not affect groundwater users. The nearest registered groundwater bores are approximately 1km from the site.

Groundwater level changes from the following effects have been taken into account in the concept design:

- Existing groundwater levels recorded during geotechnical investigations
- Groundwater level rise of 0.4m associated with sea level rise to 2050
- Groundwater level rise of a further 1.1m within 10m of predicted water line of Cooks River associated with passage of floodwater down Cooks River
- Groundwater rise to the level of impounded floodwater on site.

Monitoring of groundwater levels during future construction will be implemented to check design parameters.

No adverse impacts of a geotechnical nature upon structures within the rail corridors are expected provided good practice is employed for basement excavation batters and shoring and provided good practice is employed for service trenching.

The following Director General's Requirements are addressed in this report:

> *The EA shall address any impacts upon the groundwater resources, and when impacts are identified, provide contingency measures to remediate, reduce or manage potential impacts*
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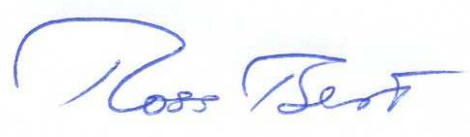
> and
>
> *The EA shall provide and assessment of any flood risk on site in consideration of any relevant provisions of the NSW Floodplain Development Manual (2005) including potential effects of climate change, sea level rise and an increase in rainfall intensity.*
>
> and
>
> *The EA must address planning provisions applying to the site, including permissibility and the provisions of all plans and policies contained in "Development Near Rail Corridors and Busy Roads – Interim Guideline"*

The assessment described in this report is based upon background materials presented in the nominated reference sources.

For and on behalf of Coffey Geotechnics Pty Ltd



Ross Best

Senior Principal

REFERENCES

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Department of Environment, Climate Change and Water NSW (2009) *NSW Seal Level Rise Policy Statement.*

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Watterson I, Whetton P, Timbal B, Power S, Arblaster J and McInnes K (2007) *Chapter 5 Regional Climate Change Projections.* In climate Change in Australia, Technical Report 2007 CSIRO, Australia. ISBN 9781921232947.

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Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

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Important information about your **Coffey** Report

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.
Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

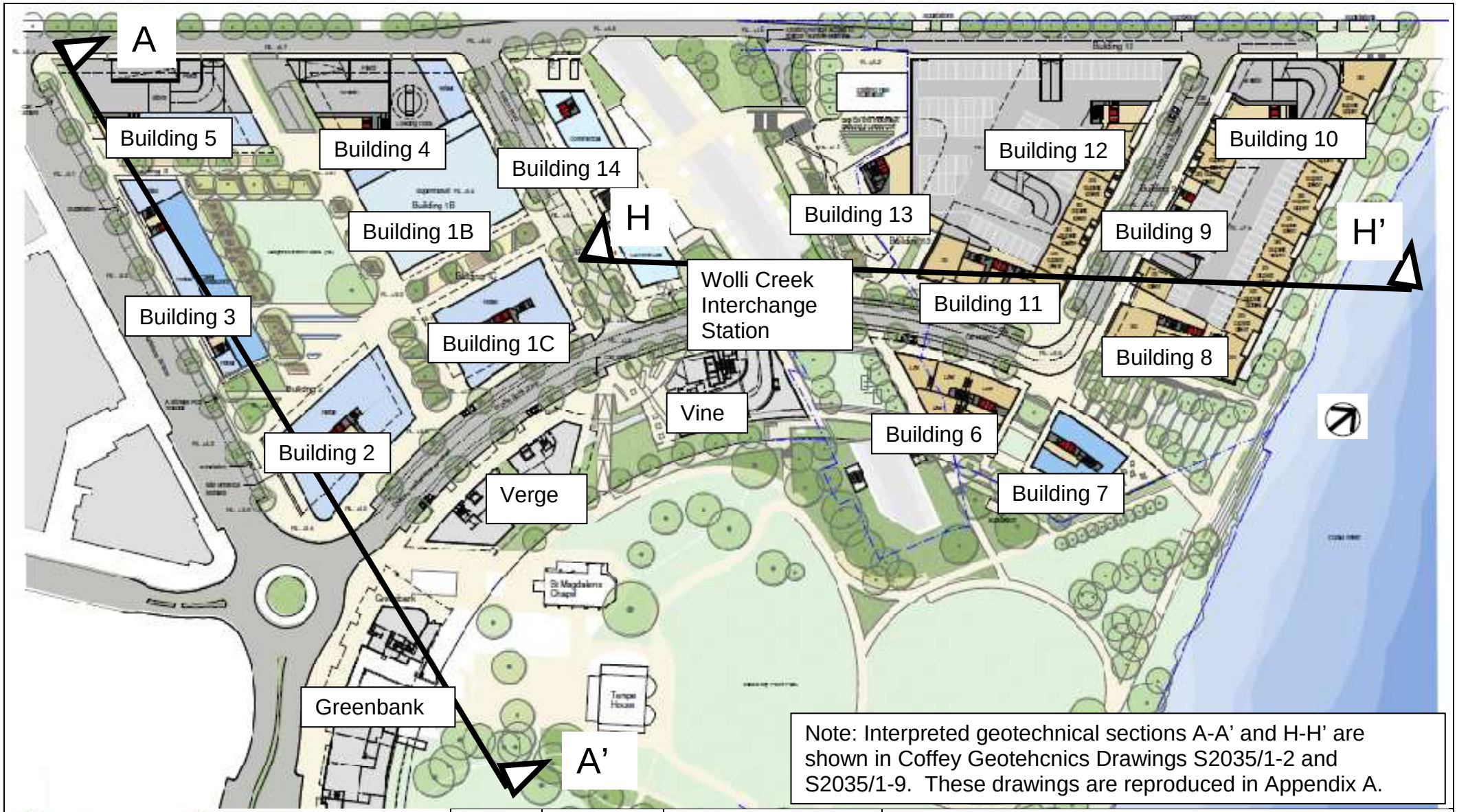
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures



Residential
Residential Lobby
Retail
Supermarket
Cafe/Restaurant
RHPP
Commercial
Carpark / Plant
Neighbourhood Park
Existing Building

Based on BatesSmart Drawing DA2-100 Rev 7 of 14 May 2010

drawn	**RJB**
approved	**RJB**
date	**20 April 2010**
scale	**1:1500 @A4**
original size	**A3**

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client: **AUSTRALAND**

project: **DISCOVERY POINT CONCEPT PLAN WOLLI CREEK**

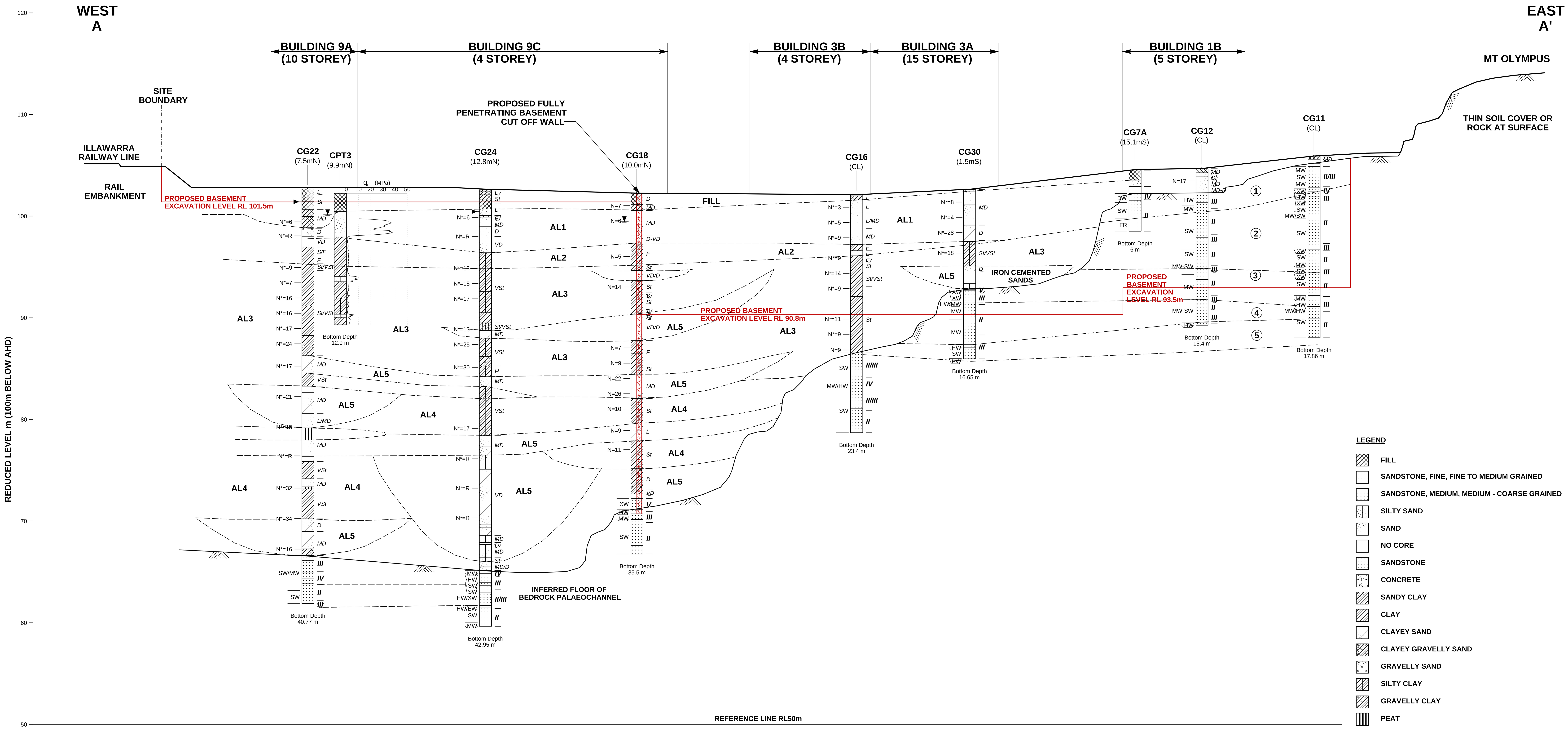
title: **Plan of Proposed Development**

project no: **GEOTLCOV24013AA-AB**

figure no: **FIGURE 1**

Appendix A

Coffey Geosciences Pty Ltd Drawings S2035/1-3 and S2035/1-10



NOTE: SECTION VERTICALLY EXAGGERATED TWO FOLD

LEGEND

- FILL
- SANDSTONE, FINE, FINE TO MEDIUM GRAINED
- SANDSTONE, MEDIUM, MEDIUM - COARSE GRAINED
- SILTY SAND
- SAND
- NO CORE
- SANDSTONE
- CONCRETE
- SANDY CLAY
- CLAY
- CLAYEY SAND
- CLAYEY GRAVELLY SAND
- GRAVELLY SAND
- SILTY CLAY
- GRAVELLY CLAY
- PEAT
- CLAYEY SANDY GRAVEL
- CLAYEY SILT
- SILTY SANDY CLAY
- PEATY SAND
- APPROXIMATE TOP OF WEATHERED BEDROCK
- MD, D — SOIL DENSITY / CONSISTENCY (SEE EXPLANATION SHEETS)
- IV — ROCK CLASSIFICATION (PELLS ET AL, 1998)
- DX — WEATHERING (SEE EXPLANATION SHEETS)
- q_c (MPa) — PIEZOCONE TEST RESULT
- WATER LEVEL
- N*=17 — STANDARD PENETRATION TEST RESULT

SOIL GEOTECHNICAL AND ROCK STRATIGRAPHIC UNITS

SOIL GEOTECHNICAL UNITS

GEOTECHNICAL UNIT	SOIL TYPE	PREDOMINANT COLOUR	CONSISTENCY / DENSITY
FILL	MAN PLACED MUDS	BROWN, GREY	LOOSE TO MEDIUM DENSE
EST	ESTUARINE MUDS	DARK GREY	VERY LOOSE TO LOOSE
AL1	ALLUVIUAL SAND SHEET	GREY	LOOSE TO MEDIUM DENSE OVER DENSE / VERY DENSE
AL2	UPPER ALLUVIAL CLAYS	GREY	SOFT TO FIRM
AL3	MID LEVEL ALLUVIAL CLAYS	GREY, ORANGE, RED	STIFF TO VERY STIFF (SOME FIRM)
AL4	DEEPER MIXED ALLUVIUM	DARK GREY	STIFF TO VERY STIFF (SOME FIRM - CONTAINS PEAT LAYERS)
AL5	ALLUVIAL CHANNEL SANDS	GREY	MEDIUM DENSE TO VERY DENSE (CONTAINS PEAT LAYERS)

ROCK STRATIGRAPHIC UNITS

STRATIGRAPHIC UNIT	SANDSTONE UNIT DESCRIPTIONS	TYPICAL ROCK MASS CLASSIFICATION FOR UNIT
①	UPPER WEATHERED CAPPING UNIT FOR MT OLYMPUS	CLASS I TO III
②	MEDIUM GRAINED WITH INDISTINCT BEDDING	CLASS II & III
③	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS II & III (SOME IV)
④	MEDIUM GRAINED, MASSIVE	CLASS II (LESSER III)
⑤	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS IV TO III (LESSER II)
⑥	MEDIUM GRAINED, MASSIVE	CLASS I TO III
⑦	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS III
⑧	INTERBEDDED SILTSTONE & SANDSTONE, FINE TO MEDIUM GRAINED	CLASS II & III
⑨	MEDIUM GRAINED, INDISTINCT BEDDING	CLASS I & II
⑩	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS II & III

4 0 20
Horizontal Scale (m)

Coffey Geosciences Pty Ltd ACN 056 335 516 | Geotechnical | **Resources** | Environmental | **Technical** | Project Management

Drawn	CJP/SW	ROBERT BIRD & PARTNERS PTY LTD AUSTRALAND INTERCITI (DISCOVERY POINT) LUSTY STREET, ARNCLIFFE GEOTECHNICAL SECTION A-A'	Drawing No. **S20325/5-3**
Approved	CJP		
Date	15/8/03		
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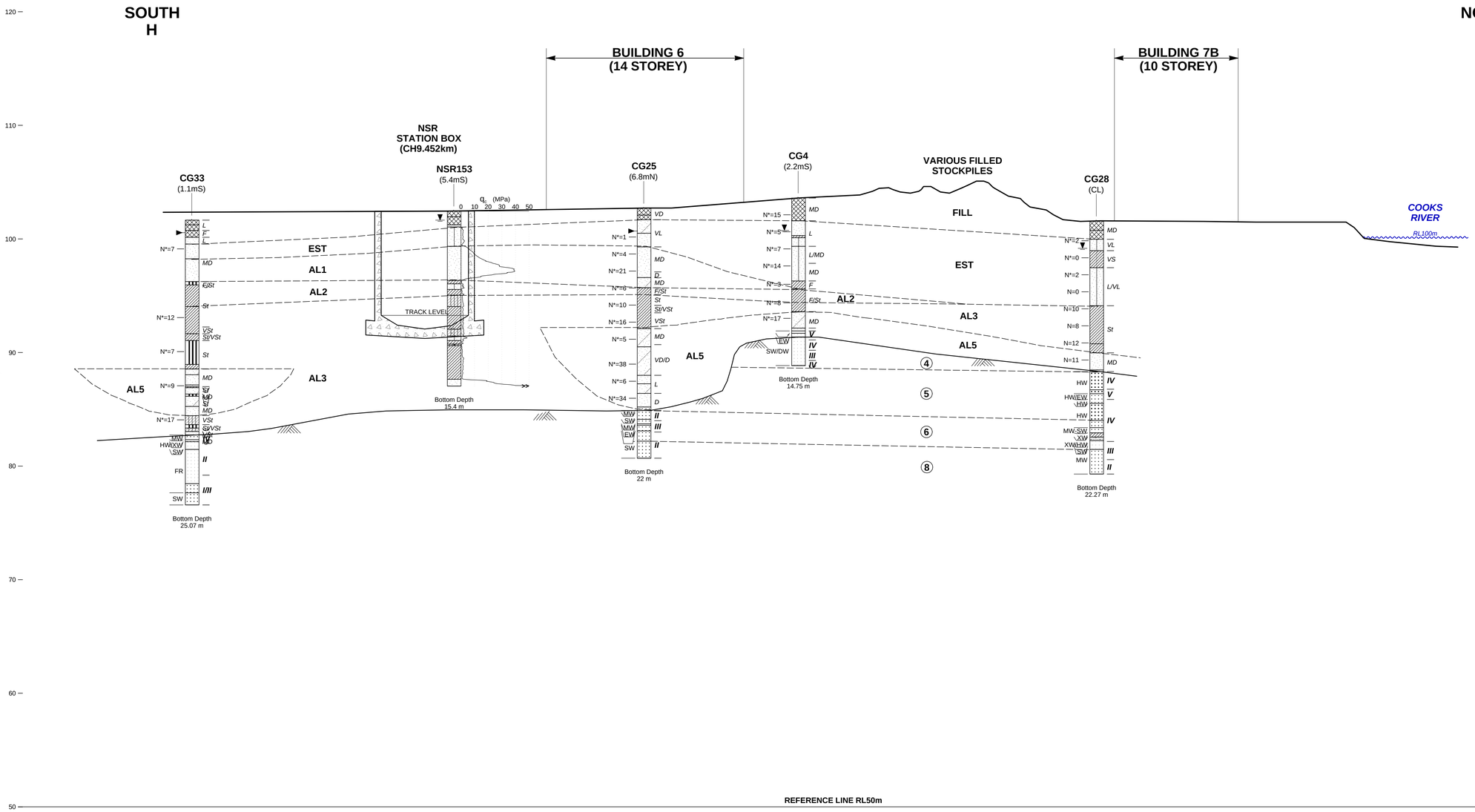

NOTE: SECTION VERTICALLY EXAGGERATED TWO FOLD

Horizontal Scale (m)

4 0 20

SOIL GEOTECHNICAL AND ROCK STRATIGRAPHIC UNITS

SOIL GEOTECHNICAL UNITS

GEOTECHNICAL UNIT	SOIL TYPE	PREDOMINANT COLOUR	CONSISTENCY / DENSITY
FILL	MAN PLACED MUDS	BROWN, GREY	LOOSE TO MEDIUM DENSE
EST	ESTUARINE MUDS	DARK GREY	VERY LOOSE TO LOOSE
AL1	ALLUVIAL SAND SHEET	GREY	LOOSE TO MEDIUM DENSE OVER DENSE / VERY DENSE
AL2	UPPER ALLUVIAL CLAYS	GREY	SOFT TO FIRM
AL3	MID LEVEL ALLUVIAL CLAYS	GREY, ORANGE, RED	STIFF TO VERY STIFF (SOME FIRM)
AL4	DEEPER MIXED ALLUVIUM	DARK GREY	STIFF TO VERY STIFF (SOME FIRM - CONTAINS PEAT LAYERS)
AL5	ALLUVIAL CHANNEL SANDS	GREY	MEDIUM DENSE TO VERY DENSE (CONTAINS PEAT LAYERS)

ROCK STRATIGRAPHIC UNITS

STRATIGRAPHIC UNIT	SANDSTONE UNIT DESCRIPTIONS	TYPICAL ROCK MASS CLASSIFICATION FOR UNIT
①	UPPER WEATHERED CAPPING UNIT FOR MT OLYMPUS	CLASS I TO III
②	MEDIUM GRAINED WITH INDISTINCT BEDDING	CLASS II & III
③	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS II & III (SOME IV)
④	MEDIUM GRAINED, MASSIVE	CLASS II (LESSER III)
⑤	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS IV TO III (LESSER II)
⑥	MEDIUM GRAINED, MASSIVE	CLASS I TO III
⑦	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS III
⑧	INTERBEDDED SILTSTONE & SANDSTONE, FINE TO MEDIUM GRAINED	CLASS II & III
⑨	MEDIUM GRAINED, INDISTINCT BEDDING	CLASS I & II
⑩	MEDIUM & COARSE GRAINED, MORE WEATHERED	CLASS II & III

LEGEND

- FILL
- CLAYEY SAND
- SAND
- SANDY CLAY
- SANDSTONE, MEDIUM, MEDIUM - COARSE GRAINED
- SHALE
- SILTY SAND
- SILTY SANDY CLAY
- SANDSTONE
- SANDSTONE, COARSE GRAINED
- CLAY
- INTERLAMINATED SILTSTONE & SANDSTONE
- SANDSTONE, FINE, FINE TO MEDIUM GRAINED
- PEAT
- CLAYEY SILT
- NO CORE
- PEATY CLAY
- APPROXIMATE TOP OF WEATHERED BEDROCK
- *MD, D* SOIL DENSITY / CONSISTENCY (SEE EXPLANATION SHEETS)
- *IV* ROCK CLASSIFICATION (PELLS ET AL, 1998)
- DX WEATHERING (SEE EXPLANATION SHEETS)
- q_c (MPa) PIEZOCONE TEST RESULT
- WATER LEVEL
- N*=17 STANDARD PENETRATION TEST RESULT

Coffey Geosciences Pty Ltd ACN 056 335 516 | Geotechnical | **Resources** | Environmental | **Technical** | Project Management

Drawn	CJP/SW
Approved	CJP
Date	15/8/05
Scale	1:400H 1:200V @A1 SHEET

ROBERT BIRD & PARTNERS PTY LTD
AUSTRALAND
INTERCITI (DISCOVERY POINT)
LUSTY STREET, ARNCLIFFE
GEOTECHNICAL SECTION H-H'

Drawing No. S20325/5-10

Job No. S20325/5

A4_S20325-5.DP1 COFFEY.DOT 05/09/03

Appendix B

Bore Registration Records – GW105580 and GW107753

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, April 16, 2010

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW105580

Works Details (top)

GROUNDWATER NUMBER	GW105580
LIC-NUM	10BL162515
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Auger
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2003-11-17
FINAL-DEPTH (metres)	3.50
DRILLED-DEPTH (metres)	3.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	DEPT OF HOUSING
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	1.40
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6244162.00
EASTING	328812.00
LATITUDE	33 55' 45"
LONGITUDE	151 8' 53"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 838229

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 838229

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	3.50	100			Auger
1	1	Casing	PVC Class 18	-0.67	1.00	50			Screwed; Seated on Bottom
1	1	Opening	Screen	1.00	3.50	50			PVC Class 18
1		Annulus	(Unknown)	0.00	0.00				Graded; GS: 1-2mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
1.40	3.50	2.10		1.40					

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.20	1.20	FILL:GRAVELLY SANDY CLAY		
1.20	2.00	0.80	SANDY CLAY		
2.00	3.00	1.00	SANDY CLAY		
3.00	3.50	0.50	SANDY CLAY		

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources

(DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Friday, April 16, 2010

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW107753

Works Details (top)

GROUNDWATER NUMBER	GW107753
LIC-NUM	10BL165616
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Rotary
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2005-10-04
FINAL-DEPTH (metres)	5.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	STATE RAIL CORPORATION
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	1.30
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6244219.00
EASTING	328820.00
LATITUDE	33 55' 43"
LONGITUDE	151 8' 53"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 563180

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 563180

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	85			Rotary
1	1	Casing	PVC Class 12	0.00	5.00	41			C: .1-.4m; Screwed; Seated on Bottom
1	1	Opening	Screen	0.50	5.00	41			PVC Class 12; A: .4mm; Screwed
1		Annulus	(Unknown)	0.00	0.00				Graded; GS: .5-5mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
1.30	5.00	3.70		1.30					

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.30	1.30	FILL,SAND ASH,GRAVEL AND CLAY		
1.30	3.50	2.20	SANDY CLAY GREY &SAND LENSES		
3.50	3.80	0.30	CLAY BROWN		
3.80	4.90	1.10	SANDY CLAY,GREY,& LENSES		
4.90	6.00	1.10	SAND,LIGHT,GREY,M/GRAIN		

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