

**PRELIMINARY GEOTECHNICAL  
ASSESSMENT FOR SSDA5**

**SYDNEY INTERNATIONAL CONVENTION  
EXHIBITION AND ENTERTAINMENT  
PRECINCT (SICEEP) “THE HAYMARKET”**

**SOUTH WEST PLOT**

Lend Lease

GEOTLCOV24303AG-AO  
29 May 2013

29 May 2013

Lend Lease  
The Bond  
30 Hickson Road,  
MILLERS POINT, NSW 2000

**Attention: Ben Bacon**

Dear Ben,

**RE: Preliminary Geotechnical Assessment for SSDA5**

**Sydney International Convention Exhibition and Entertainment Precinct (SICEEP) "The Haymarket"**

**South West Plot**

Coffey Geotechnics is pleased to present the results of our Preliminary Geotechnical Assessment for the Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) "The Haymarket" SSDA5 (South West Plot).

If you have any questions related to the report, or we can be of further assistance, please contact the undersigned on (02) 9406 1000.

For and on behalf of Coffey Geotechnics Pty Ltd



**Dan Butterworth**

Engineering Geologist

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1 electronic copy to Lend Lease

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Appendix B: Preliminary Geotechnical Assessment (ref: GEOTLCOV24303AG-AD, dated 6 March 2013)

## 1 INTRODUCTION

This geotechnical report supports a State Significant Development (SSD) Development Application (DA) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The Application (referred to as SSDA 5) follows the submission of a staged SSD DA (SSDA 2) submitted in March 2013 to the Department of Planning and Infrastructure that set out a Concept Proposal for a new mixed use residential neighbourhood at Darling Harbour known as 'The Haymarket'. The Haymarket forms part of the Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) Project, which will deliver Australia's global city with new world class convention, exhibition and entertainment facilities and support the NSW Government's goal to "make NSW number one again".

More specifically this subsequent DA seeks approval for mixed use development within the South West development plot of The Haymarket and associated public domain works. The DA has been prepared and structured to be consistent with the Concept Proposal DA.

## 2 OVERVIEW OF PROPOSED DEVELOPMENT

The proposal relates to a detailed ('Stage 2') DA for a mixed use residential development in the South West Plot of The Haymarket together with associated public domain works. The Haymarket Site is to be developed for a mix of residential and non-residential uses, including but not limited to residential buildings, commercial, retail, community and open space. The South West Plot is one of six development plots identified in the Concept Proposal DA.

Under the Concept Proposal DA, the South-West Plot will accommodate a mixed use podium and three residential buildings (SW1, SW2, and SW3) above and within the podium structure. More specifically, this SSD DA seeks approval for the following components of the development:

- Staged demolition of existing site improvements, including the existing Sydney Entertainment Centre (SEC), Entertainment car park, and part of the pedestrian footbridge connected to the Entertainment car park;
- Associated tree removal and planting;
- Construction and use of a five storey mixed use podium, including:
  - Retail and IQ Hub floor space and residential lobbies on Ground Level;
  - Above ground parking; and
  - Residential apartments.
- Construction and use of three residential buildings above podium:
- Public domain improvements, including:
  - Provision (part) of a new north-south pedestrian connection (known as the Boulevard) eventually linking Quay Street to Darling Harbour;
  - Provision (part) of a new east-west pedestrian laneway (known as Dickson's Lane) linking Darling Drive to the Boulevard; and
  - Upgrade of Hay Street (part) to provide for a pedestrian share way; and
  - Modification of retained pedestrian footbridge and provision of lift and stair access to the Goods Line.

- Provision of vehicle access to the development from Hay Street;
- Landscaping works and communal facilities to the podium roof level; and
- Extension and augmentation of physical infrastructure / utilities as required.

### 3 BACKGROUND

The NSW Government considers that a precinct-wide renewal and expansion of the existing convention, exhibition and entertainment centre facilities at Darling Harbour is required, and is committed to Sydney reclaiming its position on centre stage for hosting world-class events with the creation of the Sydney International Convention, Exhibition and Entertainment Precinct.

Following an extensive and rigorous Expressions of Interest and Request for Proposals process, a consortium comprising AEG Ogden, Lend Lease, Capella Capital and Spotless was announced by the NSW Government in December 2012 as the preferred proponent to transform Darling Harbour and create the new Sydney International Convention, Exhibition and Entertainment Precinct.

Key features of the Preferred Master Plan include:

- Delivering world-class convention, exhibition and entertainment facilities, including:
  - Up to 40,000m<sup>2</sup> exhibition space;
  - Over 8,000m<sup>2</sup> of meeting rooms space, across 40 rooms;
  - Overall convention space capacity for more than 12,000 people;
  - A ballroom capable of accommodating 2,000 people; and
  - A premium, red-carpet entertainment facility with a capacity of 8,000 persons.
- Providing up to 900 hotel rooms in a hotel complex at the northern end of the precinct.
- A vibrant and authentic new neighbourhood at the southern end of the precinct, called 'The Haymarket', including apartments, student accommodation, shops, cafes and restaurants.
- Renewed and upgraded public domain that has been increased by a hectare, including an outdoor event space for up to 27,000 people at an expanded Tumbalong Park.
- Improved pedestrian connections linking to the proposed Goods Line drawing people between Central, Chinatown and Cockle Bay Wharf as well as east-west between Ultimo/Pymont and the City.

On 21 March 2013 a critical step in realising the NSW Government's vision for the SICEEP Project was made, with the lodgement of the first two SSD DAs with the Department of Planning and Infrastructure. The key components of these proposals are outlined below.

#### ▪ **Public Private Partnership SSD DA (SSD 12\_5752)**

The Public-Private Partnership (PPP) SSD DA (SSDA 1) includes the core facilities of the SICEEP Project, comprising the new, integrated and world-class convention, exhibition and entertainment facilities along with ancillary commercial premises and public domain upgrades.

#### ▪ **The Haymarket Concept Proposal (SSD 13\_5878)**

The Haymarket Concept Proposal SSD DA (SSDA 2) establishes the vision and planning and development framework which will be the basis for the consent authority to assess detailed development proposals within the Haymarket Site.

More specifically the Stage 1 Concept Proposal seeks approval for the following key components and development parameters:

- Staged demolition of existing site improvements, including the existing Sydney Entertainment Centre (SEC), Entertainment Centre Car Park, and part of the pedestrian footbridge connected to the Entertainment car park and associated tree removal;
- A network of streets, lanes, open space areas and through-site links generally as shown on the Public Domain Concept Proposal, to facilitate reintegration of the site into the wider urban context and connection with the broader SICEEP Site;
- Street layouts;
- Development plot sizes, development plot separation, building envelopes (maximum height in RLs), building separation, building depths, building alignments and a benchmark for natural ventilation and solar provision for the precinct;
- Land uses across the site, including residential and non-residential uses;
- A maximum total gross floor area (GFA) across The Haymarket Site of 197,236m<sup>2</sup> for the mixed use development (excluding ancillary above ground car parking), comprising of:
  - A maximum of 49,545m<sup>2</sup> non-residential GFA; and
  - A maximum of 147,691m<sup>2</sup> residential GFA;
- Above ground parking including public car parking;
- Residential car parking rates to be utilised in the subsequent detailed (Stage 2) Development Applications, being:
  - Zero spaces per studio apartment;
  - Maximum one space per two one bedroom apartments;
  - Maximum one space per one bedroom + study apartment, plus one additional space per five apartments;
  - Maximum one space per two bedroom apartment, plus one additional space per five apartments; and
  - Maximum two spaces per 3+ bedroom apartment.
- Design Guidelines to guide future development and the public domain; and
- A remediation strategy.

This report has been prepared to support a detailed Stage 2 SSD DA for mixed use development and associated public domain works within The Haymarket (SSDA 5), consistent with the Concept Proposal SSDA 2.

## 4 SITE DESCRIPTION

The SICEEP Site is located within Darling Harbour. Darling Harbour is a 60 Ha waterfront precinct on the south-western edge of the Sydney Central Business District that provides a mix of functions including recreational, tourist, entertainment and business.

With an area of approximately 20 Ha, the SICEEP Site is generally bound by the Light Rail Line to the west, Harbourside shopping centre and Cockle Bay to the north, Darling Quarter, the Chinese Garden and Harbour Street to the east, and Hay Street to the south (refer to **Figure 1**).

The Haymarket Site is:

- Located in the south of the SICEEP Site, within the northern portion of the suburb of Haymarket;
- Bounded by the Powerhouse Museum to the west, the Pier Street overpass and Little Pier Street to the north, Harbour Street to the east, and Hay Street to the south; and
- Irregular in shape and occupies an area of approximately 43,807m<sup>2</sup>.





**Figure 1 – Aerial Photograph of the SICEEP Site**

The Concept Proposal DA provides for six separate development plots across the Haymarket Site (refer to **Figure 2**):

1. North Plot;
2. North East Plot;
3. South East Plot;
4. South West Plot;
5. North West Plot; and
6. Western Plot (Darling Drive).

The Application Site area relates to the South West Plot (Site 4) and surrounds as detailed within the architectural and landscape plans submitted in support of the DA.



**Figure 2 – Concept Proposal Development Plots**

## 5 PLANNING APPROVALS STRATEGY

The SICEEP Project will result in the lodgement of numerous SSD DAs for the various components of the redevelopment project. SSD DAs have already been lodged for the PPP component of the SICEEP Project (comprising the convention centre, exhibition centre, entertainment facility and ancillary commercial premises and associated public domain upgrades), and the Stage 1 Concept Proposal for The Haymarket. Separate 'Stage 2' SSD DAs for the development of the North West Plot (Site 5) and the Western Plot (Darling Drive) (Site 6) and associated public domain works will be lodged concurrently with this application. Future applications will be lodged for the Hotel complex, and the remaining development plots of The Haymarket Site.



## 6 PRELIMINARY GEOTECHNICAL MODEL

Coffey has previously completed a Preliminary Geotechnical Assessment to support a Stage 1 Development Application (SSDA2) for the overall Haymarket Precinct development (refer report ref: GEOTLCOV24303AG-AD, dated 6 March 2013). This report is presented as Appendix B.

Based on the results of our above Preliminary Geotechnical Assessment, the geotechnical constraints for developments within the South West Plot are expected to broadly comprise those associated with the following main subsurface features:

- Variable fill in terms of nature and thickness;
- An in-filled palaeochannel, incised into the Sandstone bedrock and orientated roughly north/south;
- Influence zone of an igneous dyke intrusion through the sandstone bedrock, striking north west/south east located just off the north east corner of the plot; and
- High groundwater levels.

The material infilling the palaeochannel that has been incised in the Sandstone bedrock comprises man-made fill and alluvium / estuarine deposits. Based on the available borehole information, an overview of the respective subsurface strata is presented in our previous geotechnical assessment report (refer Appendix B). The South West Plot is located towards the western extent of an in-filled palaeochannel resulting in a variable bedrock profile with depth to bedrock typically increasing towards the eastern plot boundary as shown on the inferred top of rock contour plan presented as Appendix A. The inferred location of the igneous dyke is presented within our previous geotechnical assessment report (Ref: GEOTLCOV24303AG-AD) together with a discussion of associated perceived engineering constraints and recommendations.

Table 1 below presents a summary of the depths of occurrence and thickness of each geotechnical unit of relevance to the South West Plot area based on the findings of previous investigations by Coffey and others.

**Table 1 – Depth of Occurrence and Thickness of Geotechnical Units**

Unit	Material / Origin	Depth to Top of Unit (m)	Thickness of Unit (m)	Elevation at Top of Unit (mAHD)
1	Fill	0	0.7 to 2.7	2.4 to 3.3
2	Alluvium/Estuarine	0.7 to 2.7	5.5 to 11.5 (Where proven)	1.5 to -0.5
3	Residual Soil	8 to 11.5	Up to 1.5 (where observed)	-3.5 to -3.7 (where observed)
4a	Sandstone Bedrock	9 to 12.7	Unproven	-5 to -11.2

Groundwater was observed during previous investigations at between about 3m to 3.5m depth.

## 7 PRELIMINARY DISCUSSION AND RECOMMENDATIONS

Based on the findings of our geotechnical assessment, and experience on similar projects, the proposed developments associated with the South West Plot are considered feasible from a geotechnical perspective. The proposed developments should present a low risk to surrounding structures provided appropriate additional site investigation, design assessments, and construction monitoring normally associated with this type of development are carried out on the assumption that a piled footing design is adopted to transfer the building loads to the underlying bedrock.

For preliminary advice pertaining to the above identified geotechnical site constraints for the proposed development, reference should be made to the relevant parts of our Preliminary Geotechnical Assessment Report (ref: GEOTLCOV24303AG-AD, dated 6 March 2013) attached as Appendix B.

For and on behalf of Coffey Geotechnics Pty Ltd



Dan Butterworth

**Engineering Geologist**

## 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.

## 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.

# Appendix A



## **Inferred Top of Rock Contours**






revision

description	drawn	approved	date



Scale (metres) 1:1000

drawn	DB / AW
approved	-
date	22 / 04 / 13
scale	AS SHOWN
original size	A3



client: LEND LEASE	
project: SYDNEY INTERNATIONAL CONVENTION EXHIBITION AND ENTERTAINMENT PRECINCT (SICEEP) 'THE HAYMARKET', STAGE 2 DA - SSDA4	
title: INFERRED TOP OF ROCK CONTOURS	
project no: GEOTLCOV24303AG-AG	figure no: APPENDIX A

# Appendix B

## **Preliminary Geotechnical Assessment Report**

**PRELIMINARY GEOTECHNICAL  
ASSESSMENT  
'THE HAYMARKET'  
STAGE 1 DEVELOPMENT  
APPLICATION (DA) – SSDA2  
(SICEEP)**

GEOTLCOV24303AG-AD  
6 March 2013

6 March 2013

Lend Lease  
The Bond  
30 Hickson Road,  
MILLERS POINT, NSW 2000

**Attention: Warwick Bowyer**

Dear Sir,

**RE: Preliminary Geotechnical Assessment**

**Sydney International Convention Exhibition and Entertainment Precinct (SICEEP)**

**“The Haymarket” Stage 1 Development Application (DA) – SSDA2**

Coffey Geotechnics Pty Ltd (Coffey) is pleased to present the results of a geotechnical assessment carried out for the proposed Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP), southern precinct “The Haymarket” Stage 1 Development Application (DA) – SSDA2 in the following report.

Coffey understands that “The Haymarket” development is to include a mix of land uses including commercial office, residential; including student accommodation, retail and public open space. Residential podium and tower forms (up to 40 storeys) are proposed. Generally, car parking is proposed to be above grade within the podium. New infrastructure services (including diversions and augmentations) will be provided to service new developments. In addition, it is likely that excavation works associated with remediation and archaeological works will also be required.

Coffey Geotechnics has assessed the proposed development scheme in the context of the existing geotechnical conditions on the site and concludes that the site is suitable for its intended use.

While the site contains a number of geotechnical challenges including the presence of The Great Sydney Dyke, a high groundwater table, acid sulphate soils and rock at depth, Coffey is satisfied that these challenges can be adequately addressed through the utilisation of industry standard design and construction techniques and practices.

If you have any questions regarding our report please contact the undersigned on 9406 1000.

For and on behalf of Coffey Geotechnics Pty Ltd



**Dan Butterworth**

Engineering Geologist

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Figure 5: Section B-B, Inferred Geological Conditions

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## 1 INTRODUCTION

At the request of Lend Lease, Coffey Geotechnics Pty Ltd (Coffey) has carried out a preliminary geotechnical assessment for the proposed Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP), southern precinct 'The Haymarket' Stage 1 Development Application (DA) – SSDA2. The objectives of the geotechnical assessment include:

- Development of a preliminary geotechnical model for the site based on site investigations carried out by Coffey, or information gathered by others for previous investigations;
- Assessment of the proposed development scheme in the context of the geotechnical conditions on the site and confirm that the site is, or can be made suitable for its intended use; and
- Provide preliminary assessment and recommendations for the following aspects in context of the proposed development(s) scheme:
  - Excavation conditions and support requirements;
  - Suitable building footing types and preliminary geotechnical parameters;
  - Groundwater conditions and dewatering requirements;
  - Expected soil aggressivity to buried structural elements;
  - Contingency planning for unexpected finds during works (both groundwater and soil);
  - Expected seismic design parameters; and
  - Presence of the Great Sydney Dyke and likely management requirements/considerations.

A contamination assessment and acid sulphate soils management plan are being carried out by Coffey concurrently with this assessment and will be reported separately.

## 2 PROJECT OVERVIEW

### 2.1 General

This report supports a State Significant Development Application (SSD 12\_5752) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Application seeks approval for the establishment of building envelopes and design parameters for a new neighbourhood and a community hub (referred to as The Haymarket) as part of the Sydney international convention, exhibition and entertainment precinct (SICEEP Project) at Darling Harbour.

The project will develop The Haymarket into one of Sydney's most innovative residential and working districts. Through the delivery of the overall project, Darling Harbour will also become home to Australia's largest convention and exhibition facilities, Sydney's largest red carpet entertainment venue, and a hotel complex of up to 900 rooms. The SICEEP Project importantly forms a critical element of the NSW Government's aspiration to "make NSW number one again".

## 2.2 Background

The existing convention, exhibition and entertainment centre facilities at Darling Harbour were constructed in the 1980s and have provided an excellent service for Sydney and NSW. The facilities however have limitations in their ability to service the contemporary exhibition and convention industry which has led to a loss in events being held in Sydney. The NSW Government considers that a precinct-wide renewal and expansion is necessary and is accordingly committed to Sydney reclaiming its position on centre stage for hosting world-class events with the creation of the Sydney international convention, exhibition and entertainment precinct.

Following an extensive and rigorous Expressions of Interest and Request for Proposals process, Darling Harbour Live (formerly known as 'Destination Sydney' - a consortium comprising AEG Ogden, Lend Lease, Capella Capital and Spotless) was announced by the NSW Government in December 2012 as the preferred proponent to transform Darling Harbour and create the new Sydney international convention, exhibition and entertainment Precinct.

Key features of the Darling Harbour Live Preferred Master Plan include:

- Delivering world-class convention, exhibition and entertainment facilities, including:
  - Up to 40,000m<sup>2</sup> exhibition space;
  - Over 8,000m<sup>2</sup> of meeting rooms space, across 40 rooms;
  - Overall convention space capacity for more than 12,000 people;
  - A ballroom capable of accommodating 2,000 people; and
  - A premium, red-carpet entertainment facility with a capacity of 8,000 persons.
- Providing up to 900 hotel rooms in a hotel complex at the northern end of the precinct.
- A vibrant and authentic new neighbourhood at the southern end of the precinct, called 'The Haymarket', home to an IQ Hub focused on the creative industries and high-tech businesses, apartments, student accommodation, shops, cafes and restaurants.
- Renewed and upgraded public domain, including an outdoor event space for up to 25,000 people at an expanded Tumbalong Park.
- Improved pedestrian connections linking to the proposed Ultimo Pedestrian Network drawing people between Central, Chinatown and Cockle Bay Wharf as well as east-west between Ultimo/Pymont and the City.

## 2.3 Site Description

The SICEEP Site is located within a 60 hectare waterfront precinct on the south-western edge of the Sydney Central Business District known as Darling Harbour that provides a mix of functions including recreational, tourist, entertainment and business. With an area of approximately 20 hectares, the SICEEP Site is generally bound by the Light Rail Line to the west, Harbourside Shopping Centre and Cockle Bay to the north, Darling Quarter, the Chinese Garden and Harbour Street to the east, and Hay Street to the south.

The SICEEP Site has been divided into three distinct redevelopment areas (from north to south) – Bayside, Darling Central and The Haymarket. The Application Site area relates to The Haymarket as shown below.



## 2.4 Planning Approvals Strategy

In response to separate contractual agreements with the NSW Government and staging requirements, Lend Lease (Haymarket) Pty Ltd is proposing to submit a number of separate development applications for key elements of the overall Project.

This staged development application involves the establishment of building envelopes and design parameters for a new neighbourhood and a community hub (The Haymarket) within the southern part of the SICEEP Site. Detailed development applications will accordingly follow, seeking approval for specific aspects of The Haymarket in accordance with the approved staged development application.



Separate development applications will be lodged for the PPP component of the SICEEP Project (comprising the convention centre, exhibition centre, entertainment facility and associated public domain upgrades) and Hotel complex. An overview of the preferred masterplan is provided below.



### **3 THE HAYMARKET SITE AND PROPOSED DEVELOPMENT**

Figure 1 shows "The Haymarket" site footprint which comprises an area of approximately 6 hectares, located towards the southern end of Darling Harbour, Sydney. The irregularly shaped site is bound by Harbour Street to the east, Pier Street Overpass to the north and Hay Street to the west. A light rail corridor forms the western site boundary.

The site is currently occupied by the Sydney Entertainment Centre (SEC) towards the eastern site boundary with a multi storey car park, Darling Drive road alignment and monorail line towards the western boundary.

Coffey understands that "The Haymarket" development is to include a mix of land uses including commercial office, residential including student accommodation, retail and public open space. Residential podium and tower forms (up to 40 storeys) are proposed. Generally, car parking is proposed to be above grade within the podium. New infrastructure services (including diversions and augmentations) will be provided to service new developments.

An outline of the proposed development footprint(s) is shown in Figure 1.

Based on review of the indicative architectural design drawings supplied by Lend Lease, the proposed development will not have deep basements, with excavation expected to be limited to half basement, footing excavations and for underground services installation. In addition, it is likely that excavation works associated with remediation and archaeological works will also be required.

Buildings are expected to generally be founded on piles.

### **4 DESK STUDY INFORMATION**

#### **4.1 Geology and Site History**

Based on Macquarie's Map of 1822, the site is located over what was originally known as Cockle Bay. The bay and its tributaries extended almost 1km inland from the southern boundary of the present harbour. The present shoreline has been formed progressively by infilling since the 1820's. The fill deposits are underlain by slope wash and alluvial deposits, which are underlain by residual soil and Hawkesbury Sandstone bedrock of the Triassic Age.

After reclamation in the 1820's, factory buildings and roadways were developed progressively within the site. In the 1930's, most of the site was demolished to allow construction of a council depot. In 1949, the site was redeveloped into City Markets No.4. Subsequently in the 1980's, the City Market structures were demolished and the site was redeveloped with a multi-storey car park and the Sydney Entertainment Centre. Further details on historical land use of the site can be found in our environmental desk study report GEOTLCOV24303AA-AC, dated 13 July 2011.

An igneous dyke known as "The Great Sydney Dyke" intrudes the Hawkesbury Sandstone through the site in a northwest to southeast direction. The GPO fault zone with associated sub parallel shear zones is inferred to be present within the site, striking approximately north east/south west.

#### **4.2 Previous Geotechnical Investigations**

Coffey has extensive existing geotechnical information within the site and immediate environs. This includes site investigations carried out by Coffey and information gathered by others for previous

projects. Borehole data from the references listed in Table 1 was used to assess the geotechnical/geological conditions of the site.

**Table 1 – Results of Previous Investigations Used in Preparation of this Report**

Ref No.	Description of Previous Project
R1	Department of Main Roads, "North Western Expressway Project", 1971*
R2	Coffey & Partners Pty Ltd, "Haymarket Redevelopment – Report on Preliminary Foundation Investigation", May 1978 (S6063-AA)
R3	Coffey & Partners Pty Ltd, "Haymarket Redevelopment – Parking Station Foundation Investigation", July 1979 (S6269-AB)
R4	Coffey & Partners Pty Ltd, "Proposed Haymarket Carpark – Additional Foundation Investigation", June 1980 (S6269/2-AA)
R5	Arup Geotechnics, "Darling Harbour Redevelopment – Site Investigation Report", November 1984
R6	Coffey & Partners Pty Ltd, "Darling Harbour Development Maritime Structures Geotechnical Investigation Zones 1 to 6" May 1985 (S7559/1-AE)*
R7	Coffey & Partners Pty Ltd, "Darling Harbour Development Project Convention Centre – Geotechnical Investigation" June 1985 (S7559/3-AD)
R8	Arup Geotechnics, "Darling Harbour Development Western Boulevard – Site Investigation Report", December 1985
R9	Coffey & Partners Pty Ltd, "Darling Harbour Light Monorail Geotechnical Investigation", May 1986 (S7769/1-AG)
R10	Coffey & Partners Pty Ltd, "Studio City Development – Geotechnical investigation", July 1988 (S8283/1-AH)
R11	City of Sydney, City Engineer's Department, "William Henry Street Bridge – Eastern Approach", July 1967
R12	Coffey Geosciences Pty Ltd, "Geotechnical Investigation Proposed Multi-storey Development – Bullecourt Place, Ultimo", December 2001 (S21012/1-AS)
R13	Arup Geotechnics, "Darling Harbour Development – Western Boulevard Sewer Tunnel", December 1985
R14	Coffey & Partners Pty Ltd, "Merino Central Two Project, Pyrmont – Geotechnical Investigation", November 1986 (S7960/1-AC)
R15	Jeffery and Katauskas Pty Ltd, "Geotechnical Investigation Proposed Refurbishment of Woolstores", April 1986
R16	Arup Geotechnics, "Darling Harbour Development – Pier Street, Harbour/Day Streets" April 1986
R17	Coffey Geotechnics Pty Ltd, "Sydney International Convention and Entertainment Centre – Geotechnical Investigation Report", August 2011 (GEOTLCOV24303AA-AE)
R18	Coffey Geotechnics Pty Ltd, "Proposed Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP)", May 2012 (GEOTLCOV24303AC-AD)
R19	Coffey Environments Pty Ltd, "Supplementary Site Investigation – Sydney International Conference, Exhibition and Entertainment Precinct, Darling Harbour" August 2012 (GEOTLCOV24303AD-AA)

Ref No.	Description of Previous Project
R20	Coffey Environments Pty Ltd, "Supplementary Site Investigation: Factual Report – Sydney International Conference, Exhibition and Entertainment Precinct, Darling Harbour" January 2013 (GEOTLCOV24303AF_R0-01a)

## 5 PRELIMINARY GEOTECHNICAL MODEL

The geotechnical conditions at the site are complex, comprising the following main features:

- Variable fill;
- An in-filled palaeochannel, incised into the Sandstone bedrock and orientated roughly north/south;
- An igneous dyke intrusion through the Sandstone bedrock, striking north west/south east;
- Sheared zones and joints in the Sandstone bedrock, associated with the 'GPO' Fault regionally mapped as striking north north east/south south west beyond the eastern site boundary; and
- High groundwater levels.

### 5.1 General Soil and Rock Profiles

The material infilling the palaeochannel that has been incised in the Sandstone bedrock comprises man-made fill and alluvium / estuarine deposits. Based on the available borehole information, an overview of the respective subsurface strata is presented in Table 2, with material types divided into geotechnical units for the purposes of this report.

**Table 2 – Overview of Subsurface Conditions and Geotechnical Units**

Unit	Material Description
1	<p>Fill – comprising heterogeneous mixtures of sand, sandy gravel, clay and sandy clay/silt with cobbles and occasional boulder sized rock fragments. Concrete and Asphalt materials were encountered at shallow depths at most of the borehole locations.</p> <p>The density/consistency of the fill is variable, and may range from loose to dense or very soft to stiff. Due to its variability and likely non-uniform placement procedure, it would be classified as "uncontrolled fill".</p>
2	Alluvium and Estuarine Deposits – comprising clayey sands and clays with occasional shell layers and organic matters. These materials range from very loose to medium dense or very soft to very stiff in consistency. Some of the underlying residual soil (Unit 3) may have been disturbed and mixed within the alluvium.
3	Residual Soil – derived from weathering of the underlying sandstone rock, and generally comprising clayey sand or sandy clay having stiff consistency. In many places, however, this unit is relatively thin or absent due to the geological erosion process.
4	Bedrock – comprising Sandstone ranging from extremely weathered to fresh with low to medium strength shale bands (up to 1.2m thick). This unit has been subdivided based on strength, fracturing, and defects in accordance with Pells et al (1998) as follows:

Unit	Material Description
	<ul style="list-style-type: none"> <li>4a – Class V and Class IV Sandstone</li> <li>4b – Class III Sandstone</li> <li>4c – Class II Sandstone or better</li> </ul> <p>Class V Sandstone is extremely low to low strength with significant amounts of defects while Class II Sandstone or better is generally medium and high rock strength with limited defects.</p> <p>It should be noted that the buried bedrock surface is likely to vary as a series of sub-horizontal benches and sub-vertical cliff lines, in a similar fashion to the variations in level that can be observed on the Sydney harbour foreshores.</p>
5A	Clay – comprising high plasticity clay derived from completely weathered dyke material. This unit is found within the dyke to significant depths as recorded in the past investigations. This material was not encountered during the current investigations.
5B	Dolerite – highly weathered to fresh dyke material found within the dyke shown in Figure 2 from observations made during previous investigations.

Note: Rock classified in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech. Jnl, Dec 1998.

Table 3 presents a summary of the depths of occurrence and thickness of each geotechnical unit observed at the site based on the findings of previous investigations by Coffey and others.

**Table 3 – Depth of Occurrence and Thickness of Geotechnical Units**

Unit	Material / Origin	Depth to Top of Unit (m)	Thickness of Unit (m)	Elevation at Top of Unit (mAHD)
1	Fill	0	0.4 to 4.5	2.4 to 3.8
2	Alluvium/Estuarine	0.4 to 6.5	1.5 to 14.5 (Where proven)	1.2 to -1.5
3	Residual Soil	4.6 to 9.8	0.4 to 4.2	-1.8 to -11.7
4a	Class V and IV Sandstone	5.6 to 13.3	0.1 to 3	-3.2 to -13.2
4b	Class III Sandstone	7.2 to 20.8	4.8 to >9.6	-3.9 to -15.8
4c	Class II Sandstone or better	12.9 to 23.5	Not Proven	-12.2 to -20.8

Note: Rock classified in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech. Jnl, Dec 1998.



Based on the information obtained from past investigations referenced in Section 3, Coffey has inferred subsurface contours for the base of fill / top of alluvial deposits (Figure 2) and top of extremely weathered/highly weathered bedrock (Class V and Class IV) (Figure 3).

The inferred rock contours indicate a highly irregular rock profile to be present, particularly at the northern part of the site and the centreline of the inferred palaeochannel. The difference in rock level is expected to be about 14m across the width of The Haymarket site footprint, deepening from the western edge and the eastern edge towards middle of the site.

Three cross sections have been drawn through the site and are presented as Figure 4 to Figure 6.

## **5.2 Igneous Dyke**

The approximate location of the igneous intrusion known as the 'Great Sydney Dyke' is shown on Figure 2 and Figure 3. The dyke comprises extremely weathered dolerite with stiff clay properties to depths of between about RL-16m to RL-24m. Below these depths better quality dolerite is likely to occur.

Based on available previous borehole information, the dyke was found to have a width ranging from about 3m to 8m, with an average width of typically 4.5m. It should be noted that the dyke may thin, thicken, side step or branch. The location and shape of dyke as presented on Figure 2 and Figure 3 should be taken as approximate only.

The sandstone/dyke interface is expected to be vertical to sub vertical. Typically sandstone on either side of dyke is altered and fractured by the intrusion.

Information gathered during a web search (source: development application documents for City West Cable Tunnel project) indicates that the dyke was observed in excavations near the corner of Thomas Street and Hay Street and that seepage flow from within the surrounding sandstone was highly saline, with iron, manganese and sulphate. It is also suggested in these documents that it is likely that the dyke zone is connected to groundwater in the Darling Harbour sediments.

## **5.3 Fault and Shear Zones**

Besides the dyke, shear zones and isolated joints sub parallel to the GPO fault zone are also inferred to be present within the site. The approximate known location of the main GPO fault zone extends from the Circular Quay area to the intersection of Bathurst Street and Harbour Street (i.e. about 400m north of site) with an approximate strike of NNE. The approximate inferred alignment of the GPO fault zone is shown in Figure 2 and Figure 3.

## **5.4 Groundwater**

The results of monitoring undertaken during previous investigations indicate groundwater levels to be between RL1.7m and RL-1.3m. No discernible influence of tidal levels within Cockle Bay to the north and groundwater levels at The Haymarket site was noted over the course of the monitoring.

Groundwater is likely to be encountered within the Unit 2 Alluvium and the Unit 1 Fill that has been placed to raise site levels from what was probably low lying swampy ground. Groundwater may also be encountered within the bedrock in joints and bedding partings.

## **6 PRELIMINARY DISCUSSION AND RECOMMENDATIONS**

Based on the findings of our geotechnical assessment, and experience on similar projects, the proposed development is considered feasible from a geotechnical perspective. The proposed development should present a low risk to surrounding structures provided appropriate additional site investigation, design assessments, and construction monitoring normally associated with this type of development are carried out.

### **6.1 Excavations**

#### **6.1.1 Excavation Conditions**

Based on the architectural concept drawings supplied by Lend Lease, the proposed development will not have deep basements, with excavation expected to be limited to half basement, footing excavations and for underground services installation. Such excavations are therefore expected to be within Unit 1 Fill and Unit 2 Alluvium/Estuarine Deposits. The proposed buildings are generally expected to be founded on piles.

#### **6.1.2 Bulk Excavation Batter Slopes**

The stability of excavations in Unit 1 Fill will be influenced by the presence of the underlying low strength Unit 2 soils (even if Unit 1 fill is replaced by Engineered Fill) and groundwater. As a result there will be a significant risk of excavation instability if relatively steep temporary batter slopes are adopted without site specific investigation and geotechnical input during both design and construction. For preliminary design we recommend the following temporary batters and shoring:

- Above the Groundwater Table, Excavations in Unit 1 or Engineered Fill: flatter than 2H:1V; and
- Below the Groundwater Table or into Unit 2 Soils: adopt shoring.

Instability due to bottom heave is not anticipated for shallow excavations. However, further assessment should be carried out for deeper excavations if proposed.

#### **6.1.3 Excavation Support Requirements**

Depending on project requirements for a sufficiently watertight, and/or stiff retention system the following options could be considered.

- Driven sheet piles;
- Contiguous pile wall; or
- Secant pile wall.

For a sheet piled wall, overlapping or interlocking sheets would be vibrated or driven into the ground around the proposed basement perimeter prior to excavation. The steel sheet piles could be used to provide formwork for the permanent basement walls, but this would preclude their recovery. Sheet piles would likely refuse on the weathered bedrock, and groundwater seepage would be expected to occur through the clutches and toe of the wall.

Contiguous pile walls may be practicable where the fill or natural soils are cohesive and excavations do not extend to significant depth below the groundwater table. Contiguous pile walls are not watertight

because of the installation tolerance of the piles. It may be difficult to achieve a watertight permanent wall where contiguous piles are adopted.

Secant piling involves drilling “soft” piles using low strength concrete at centres of 1.5 pile diameters. Normal strength “hard” piles are then drilled between, cutting into the soft piles to form a relatively water tight seal. Unless bored carefully, secant piles can deviate off vertical centre during installation creating gaps between the piles and result in groundwater seepage and ground loss.

For the preliminary design of retaining walls the parameters in Table 4 should be adopted.

**Table 4: Preliminary Retaining Wall Design Parameters**

Unit	Description	Bulk Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Friction Angle (degree)
1	Fill	20	0	30
2	Alluvium/Estuarine	18	0	26
3 & 5A	Residual Soil/weathered dyke	20	5	28
4a	Class V and IV Sandstone	21	30	35

Retaining walls should be designed for appropriate hydrostatic and surcharge loads.

Where cantilevered walls are not practicable, lateral stability could be provided by anchors installed progressively as the excavation proceeds. Anchors may need to be installed beneath adjacent properties and would need the permission of adjacent property owners. Where installation of anchors is not practicable, internal strutting or bracing may be required to provide lateral stability.

Excavations associated with installation of utilities are expected to be relatively shallow. Where it is not practicable to adopt temporary batters as recommended in Section 6.1.2 above due to land take restrictions, or where excavations are below standing groundwater levels; lateral excavation support should be provided using a temporary shoring box, internal strutting or similar.

#### 6.1.4 Groundwater Conditions

Where excavations are proposed to extend below standing groundwater levels, extensive dewatering of the alluvial soils is not desirable as this could lead to consolidation settlement of the fill and alluvium and may need special permits to discharge off site. Cut-off walls will be required during excavation works and the final basement walls should be designed as tanked to maintain standing groundwater levels and prevent groundwater ingress into the basement.

Where excavations for the purpose of utilities, remediation and archaeological works are to extend below standing groundwater levels, localised dewatering will be required. Where inflow rates are relatively low and cohesive soils are encountered, sump and pump techniques may be practicable. However, where higher inflow rates occur, installation and operation of drilled wells or jetted spear points around the excavation perimeter would be required.

The detailed assessment and design of groundwater management is beyond the scope of this report and should be addressed by a hydrogeological investigation.

### **6.1.5 Excavation Induced Ground Movements**

Walls retaining soil strength material will laterally deflect up to 1% of the retained height, depending on the stiffness of the retaining wall system.

The potentially damaging effects of stress redistribution in the vicinity of excavations should be assessed as part of the detailed design. Lateral displacements of retaining walls due to stress redistribution may also result in settlement. For preliminary assessment of impacts we recommend that potential settlement be assumed to be equal to predicted lateral displacements. Typically, ground movements (lateral displacement and settlement) are greatest at the excavation face and decrease to negligible values at a distance of up to 3 times the excavation depth.

For preliminary impact assessment purposes the above guidelines on displacements may be used. If such movements cannot be tolerated for sensitive features, then retaining walls should be designed for higher earth pressures. Depending on the specific retention system, basement excavation details and the nature of adjacent structures, a more detailed analysis will be required. Coffey has specialist capability in applying numerical modelling techniques to the estimation of ground movements.

## **6.2 Building Foundations**

### **6.2.1 Expected Arrangements and Issues**

The Haymarket is understood to comprise construction of various multi-storey buildings expected to be between 4 storeys and 40 storeys as shown on Figure 1.

Based on the nature of subsurface conditions; comprising a variable thickness of fill and alluvial/estuarine soils, we expect that footings for this development may comprise cased bored piles or continuous flight auger (CFA) piles socketed into the underlying sandstone bedrock, or pad/strip footings where rock is shallow.

Stress relief effects due to the palaeochannel formation process are likely to have caused opening and weathering of defects (bedding planes and joints). Therefore, poor foundation conditions may occur near the current rock surface level. Depending on the proposed bulk excavation level relative to the current rock level, significant clay seams may be encountered and these may affect both bearing capacity and settlement of pad footings.

Difficulties in construction of deep piles at SEC have been reported (e.g. Malcom D.J., 1997) when the dyke is in contact with recent marine and alluvial sediments. An indurated sandstone or ironstone capping layer at the boundary of recent sediments and the underlying, lower strength, dyke could pose construction difficulties for driven piles. Possible difficulties to cased bored and CFA piling include drilling in very strong Dolerite/altered Sandstone (i.e. Sandstone could be significantly altered to a distance of several meters on either side of dyke), collapse of dyke material and management of groundwater.

As mentioned in previous sections, the igneous dyke may thin, thicken, sidestep or branch. Foundation construction difficulties may occur if the dyke is encountered at previously unknown locations. Geotechnical verification during construction will be required to mitigate the risks associated with the potentially complex foundation conditions. In the vicinity of the Dyke, column loads need to be

supported on reinforced beams spanning the dyke and founded on the adjacent sandstone. Depending on the proximity of the footings and the condition of the sandstone which may have been adversely affected by the dyke material, it may be necessary to reduce rock design parameters.

### 6.2.2 Preliminary Foundation Design

Design end bearing pressures and shaft adhesion for piled foundations are provided in Table 5 for both Limit State and Working Stress design methods. Where Limit State design parameters are used, a geotechnical strength reduction factor  $\Phi_g$  of 0.75 should be applied and the Serviceability Limit State deflections should be checked using the elastic properties presented in Table 5.

If piles are required to resist uplift, the shaft adhesion values in Table 5 should be reduced by a factor of 0.7, in addition to adopting a  $\Phi_g$  value of 0.6. A cone pull out check should also be carried out assuming a cone angle of 70°.

The allowable end bearing pressures provided in Table 5 are based on a settlement criterion of up to 1% of the pile diameter. Ultimate capacities (for better quality rocks) are significantly higher, however, can only be mobilised under large settlements. Use of limit state design of piles using ultimate capacities, appropriate reduction factors and settlement calculations is likely to allow higher load capacities to be adopted.

**Table 5 – Preliminary Design Parameters for Footings and Bored Piles**

Unit	Working Stress Design Values <sup>(1)</sup>		Limit State Design Values <sup>(2)</sup>		
	Allowable End Bearing Pressures (MPa) <sup>3</sup>	Allowable Shaft Adhesion <sup>3,4</sup> (kPa)	Ultimate End Bearing (MPa) <sup>3</sup>	Ultimate Shaft Adhesion <sup>3,4</sup> (kPa)	Elastic Modulus (MPa)
3 (Residual Soil)	-	-	-	-	40
4a (Class V and IV Sandstone)	1 to 3.5	75 to 150	3 to 10	150 to 250	100
4b (Class III Sandstone)	5 to 6	500 to 600	20 to 40	800 to 1,000	1000
4c (Class II Sandstone or better)	8 to 12	800 to 1,200	60 to 120	1,500 to 2,000	1500

(1) Structure specific assessments should be carried out to assess design values, particularly if the values at the upper end

of the ranges provided are to be adopted.

- (2) These values are based on Pells et al. (1998), for presumptive settlement limits of up to 1% footing width or pile diameter. Higher design values may be possible based on first principle engineering design (refer to limit state design values) and appropriate settlement and differential settlement assessment.
- (3) Design values for specific structures should be selected from within the ranges provided in the table depending on factors such as rock quality, particularly rock strength. Lower values than the ranges provided in the table may apply for shear / fracture affected zones adjacent to the dyke. Appropriate values should be confirmed by additional investigation and with construction stage verification by a geotechnical engineer.
- (4) Shaft Adhesion should be ignored for pad or strip footings.

The values in Table 5 assume that an appropriate level of foundation verification and testing is carried out. This may include additional cored boreholes both at the design and construction phase to assess the variability in rock quality. Pile load testing may be required; particularly if relatively high shaft adhesion and end bearing values are adopted.

### 6.3 Contingency Planning

Subsurface conditions at the site are expected to be highly variable in terms of unit thickness/material type and consistency. Based on the expected variable nature of subsurface conditions, some form of contingency planning is recommended should adverse conditions be encountered such as soft soils and/or higher groundwater levels than those observed during previous investigations at the site.

Contingency planning should include allowance for items such as:

- Importation of granular fill for construction of access roads and temporary working platforms for heavy plant such as cranes and piling rigs;
- Removal and replacement of existing fill where required;
- Shoring and dewatering of excavations where groundwater / soft saturated soils are encountered;
- Permissions for discharge of water to stormwater where dewatering is required;
- Permissions from adjacent property owner(s) where anchoring of excavations is required; and
- Redesign of footings to accommodate variable ground conditions associated with features such as the Great Sydney Dyke or the GPO fault zone joint swarm.

### 6.4 Soil Aggressivity

The majority of chemical test results from previous investigations at the site indicate “non-aggressive” to “mildly aggressive” conditions for buried concrete and steel structural elements when assessed in accordance with AS 2159-2009. However, a number of chemical test results would classify as “mildly aggressive” to “severely aggressive” based on resistivity values.

Further soils and groundwater aggressivity testing should be carried out at the site to allow greater site coverage and better understanding of chemical conditions to assist detailed design.

Acid sulphate soils have been encountered on sites within the Darling Harbour area. An acid sulphate soils management plan is being carried out by Coffey concurrently with this assessment and will be reported separately.

## 6.5 Seismic Design

Based on our interpretation of site conditions and review of AS1170.4-2007, we recommend the following parameters be adopted for seismic design:

- Seismic Hazard Factor (Z) 0.08
- Sub-Soil Class  $C_e$

## 6.6 Conclusion

Coffey understands that "The Haymarket" development is to include a mix of land uses including commercial office, residential including student accommodation, retail and public open space. Residential podium and tower forms (up to 40 storeys) are proposed. Generally, car parking is proposed to be above grade within the podium. New infrastructure services (including diversions and augmentations) will be provided to service new developments. In addition, it is likely that additional excavation works associated with remediation and archaeological works will also be required.

Coffey has assessed the proposed development scheme in the context of the existing geotechnical conditions on the site and have concluded that the site is suitable for its intended use.

While the site contains a number of geotechnical challenges including the presence of The Great Sydney Dyke, high groundwater table, acid sulphate soils and rock at depth, Coffey is satisfied that these challenges can be adequately addressed through the utilisation of industry standard design and construction techniques and practices.

## 6.7 Limitations and Further Geotechnical Investigations

The preliminary geotechnical assessment and recommendations presented in this report are based on a desk study of previous investigations by Coffey and others. Ground conditions can vary over relatively short distances and site specific investigation for the various individual structures for the development and construction stage geotechnical assessments should be undertaken to manage geotechnical risk.

The attached document entitled "Important Information about your Coffey Report" provides additional information on the uses and limitations of this report.

For and on behalf of Coffey Geotechnics Pty Ltd



**Dan Butterworth**

Engineering Geologist



## 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.

## 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



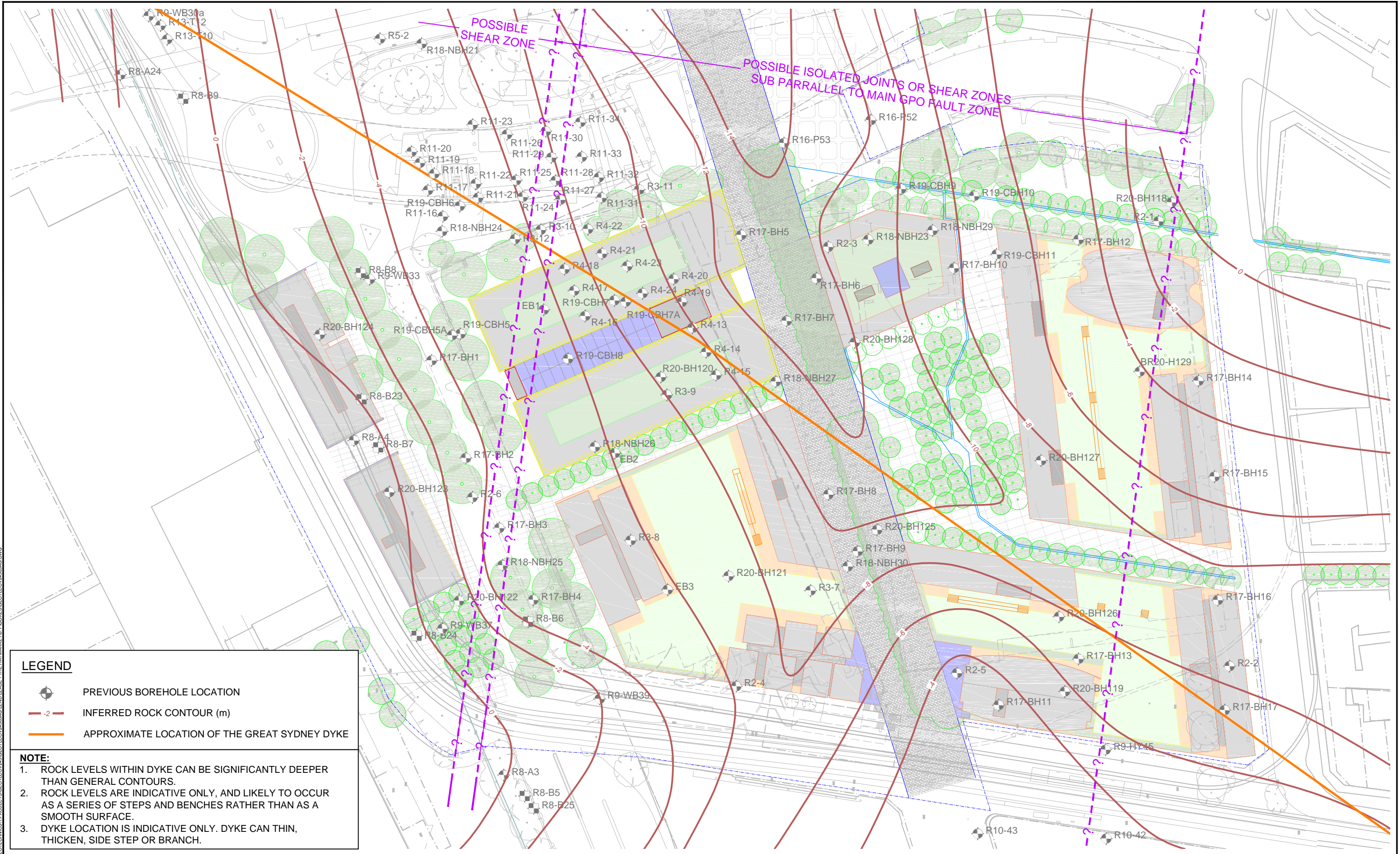











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LEGEND

-  PREVIOUS BOREHOLE LOCATION
-  -2 INFERRED ROCK CONTOUR (m)
-  APPROXIMATE LOCATION OF THE GREAT SYDNEY DYKE

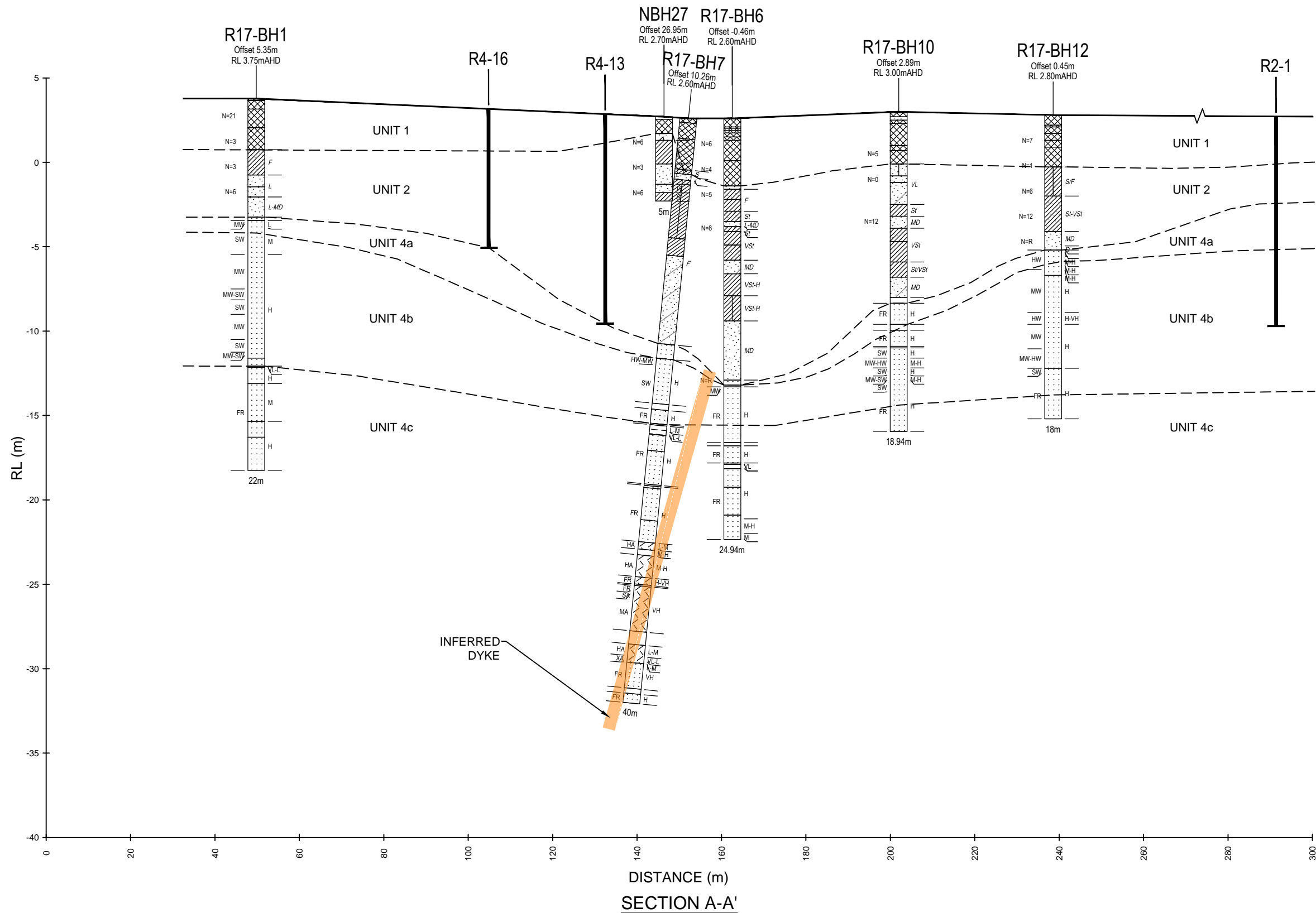
NOTE:




- ROCK LEVELS WITHIN DYKE CAN BE SIGNIFICANTLY DEEPER THAN GENERAL CONTOURS.
- ROCK LEVELS ARE INDICATIVE ONLY, AND LIKELY TO OCCUR AS A SERIES OF STEPS AND BENCHES RATHER THAN AS A SMOOTH SURFACE.
- DYKE LOCATION IS INDICATIVE ONLY. DYKE CAN THIN, THICKEN, SIDE STEP OR BRANCH.

revision	description	drawn	approved	date	<div></div> <div></div> <div>Scale (metres) 1:1000</div>	drawn	DB / AW	 <div>coffey geotechnics SPECIALISTS MANAGING THE EARTH</div>	client: LEND LEASE	
						approved	PJW		project: SYDNEY INTERNATIONAL CONVENTION EXHIBITION AND ENTERTAINMENT PRECINCT (SICEEP) 'THE HAYMARKET' - STAGE 1 DA-SSDA2	
						date	26 / 02 / 13		title: INFERRED TOP OF ROCK CONTOURS (UNIT 4a - CLASS V & IV SANDSTONE)	
						scale	AS SHOWN		project no: GEOTLCOV24303AG	figure no: FIGURE 3
						original size	A3			



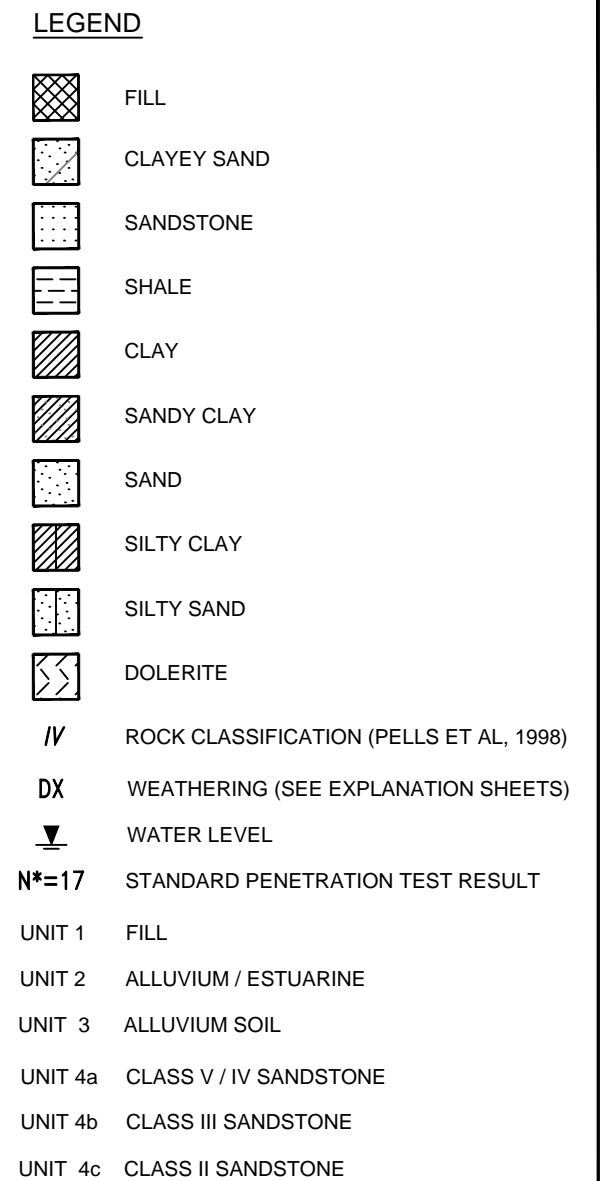
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revision	description				drawn	approved	date	<div>                           Scale (metres) 1:1000                 </div>	drawn	DB / AW		client: LEND LEASE	
									approved	PJW		project: SYDNEY INTERNATIONAL CONVENTION EXHIBITION AND ENTERTAINMENT PRECINCT (SICEEP) 'THE HAYMARKET' - STAGE 1 DA-SSDA2	
									date	26 / 02 / 13		title: SECTION A-A' INFERRED GEOLOGICAL CONDITIONS	
									scale	AS SHOWN		project no: GEOTLCOV24303AG	figure no: FIGURE 4
									original size	A3			







revision	description	drawn	approved	date	 <p>Scale (metres) 1:1000</p>	drawn	DB / AW		client: LEND LEASE	
						approved	PJW		project: SYDNEY INTERNATIONAL CONVENTION EXHIBITION AND ENTERTAINMENT PRECINCT (SICEEP) 'THE HAYMARKET' - STAGE 1 DA-SSDA2	
						date	26 / 02 / 13		title: SECTION C-C' INFERRED GEOLOGICAL CONDITIONS	
						scale	AS SHOWN		project no: GEOTLCOV24303AG figure no: FIGURE 6	
						original size	A3			

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