

Our Ref NA50613044-15-0105 (V5)
Contact Tim Michel

2nd August 2016

Lend Lease Building Pty Ltd
Level 4, 30 The Bond
30 Hickson Road
MILLERS POINT NSW 2000

Attention: Mr. Dez Wong

Dear Dez,

ONE SYDNEY HARBOUR

**RESIDENTIAL BUILDING R4A
STATE SIGNIFICANT DEVELOPMENT APPLICATION (SSD 6964)
STORMWATER MANAGEMENT AND INFRASTRUCTURE SERVICING**

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9
The Forum
203 Pacific Highway
St. Leonards NSW 2065

P.O. Box 19
St Leonards NSW 1590
Australia

Phone: +61 2 9496 7700
Fax: +61 2 9439 5170

www.cardno.com.au

1. Introduction

This report supports a State Significant Development Application (SSD 6964) submitted to the Minister for Planning pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Development Application (DA) seeks approval for construction of a residential flat building (known as Residential Building R4A) and associated works at Barangaroo South as described in the Overview of Proposed Development section of this report.

2. Overview of Proposed Development

The Residential Building R4A DA seeks approval for the construction and use of a 72 storey residential flat building comprising 327 apartments, ground floor retail, the allocation of car parking, services, plant and storage within the Stage 1B Basement (subject of a separate concurrent DA), and the construction of ancillary landscaping and temporary public domain.

Approval for the construction of Residential Building R4A's core to ground level and associated plant and services within the basement is being sought as part of the concurrent Stage 1B Basement DA (SSD 6960) and do not form part of this DA.

3. Site Location

Barangaroo is located on the north-western edge of the Sydney Central Business District and is bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east, and a range of new development dominated by large CBD commercial tenants to the south.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – the Headland Park, Central Barangaroo and Barangaroo South (Stage 1).

The R4A DA Site area is located within Stage 1B of Barangaroo South as shown in **Figure 3.1**. The DA Site is located on land generally known and identified in the approved Concept Plan as Block 4A.

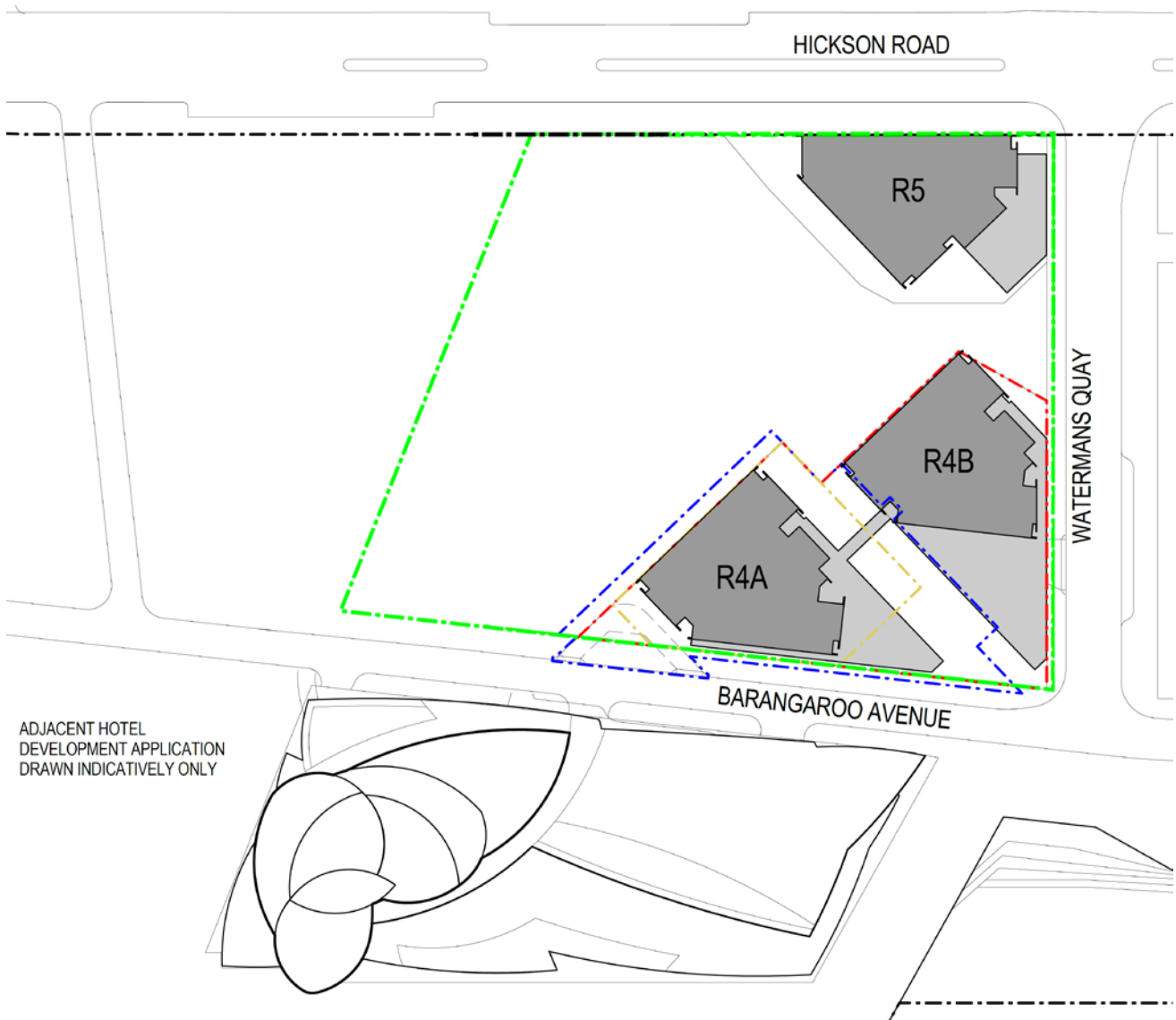


Figure 3.1: R4A Residential Building Development Application Site Location Plan

4. Related Documents

The following reports shall be read in conjunction with this document:

1. Stage 1B Basement Stormwater Management and Infrastructure Servicing Strategy CS7000, Revision 06, dated 17 April 2015, prepared by Cardno;
2. Barangaroo South Flood Study CS7300 (15-0132), Revision 1, dated February 2015, prepared by Cardno;
3. Site Servicing Strategy (11-0321), Revision K, dated March 2013, prepared by Cardno.

5. Relevant SEARs

This report has been prepared to address the following Secretary's Environmental Assessment Requirements (SEARs) for SSD 6964:

13. Infrastructure Provision

- *Detail any infrastructure proposed to service the development and demonstrate that the site can be suitably serviced.*
- *Detail the existing infrastructure on-site, and identify any possible impacts on infrastructure arising from construction of the proposed works.*
- *Where the proposed works affect existing infrastructure, the application should detail any mitigation works proposed, including service relocations.*

16. Water, Drainage, Stormwater and Groundwater

- *Prepare a Stormwater and Drainage Assessment to assess the impacts of the proposal on surface and groundwater hydrology and quality.*
- *Identify appropriate water quality management measures focussing on the management of the impacts from the proposed works on Sydney Harbour.*
- *Prepare an Integrated Water Management Plan. This should include stormwater and wastewater management, including any re-use and disposal requirements, demonstration of water sensitive urban design and any water conservation measures.*
- *The applicant shall provide information on the required water and wastewater services and any augmentation of Sydney Water infrastructure that may be required for the proposed development.*

6. Infrastructure Provision

This report addresses the provision of trunk utility infrastructure required to service the proposed Building R4A. In-building service reticulation is addressed in a separate report (Lend Lease, 2015).

All utility infrastructure connections and infrastructure to service Building R4A including potable and non-potable water, sewerage, gas, electricity and telecommunications will be provided as part of the Stage 1B Basement Car Parking SSDA Development Application (SSD 6960). The proposed infrastructure will also have sufficient capacity to service other development within Stage 1B including R4B, R5 and the adjacent hotel development.

A summary of the proposed trunk infrastructure provision to R4A is presented below:

- **Potable Water:** A new 250mm diameter ring main will be constructed within Stage 1B and connected to an existing 300mm diameter main in Hickson Road.
- **Non-Potable Water:** The Barangaroo South Recycled Water Treatment Plant (RWTP) will supply non-potable water to Stage 1B via one or more mains that will be constructed between the Stage 1A and Stage 1B Basements. All non-potable water infrastructure servicing R4A will be contained within the Stage 1B Basement.
- **Sewerage:** Connection to the Barangaroo South RWTP will be made via a network of sewerage mains within the Stage 1B and Stage 1A basements. No additional or new connection to Sydney Water's sewerage system will be required to service R4A.
- **Gas:** A new low pressure gas main will be constructed above the Stage 1B Basement and will connect to an existing 110mm low pressure gas main in Hickson Road.
- **Electricity:** A private network of cabling and substations will be established within Stage 1B to service R4A. These will be serviced from Ausgrid's City North zone substation.

- **Telecommunications:** A lead-in connection will be made to Stage 1B from Hickson Road. Allowance will be made within Stage 1B for a primary telecommunications service provider with capacity for up to two (2) additional future service providers.

7. Water, Drainage, Stormwater and Groundwater

7.1 Integrated Water Management

Barangaroo South will include an integrated water management system that will take into account all facets of the water cycle to provide services that maximise social, economic and environmental benefits associated with water management within the development.

A schematic showing the proposed integrated water cycle within Barangaroo South is presented in **Figure 2**.

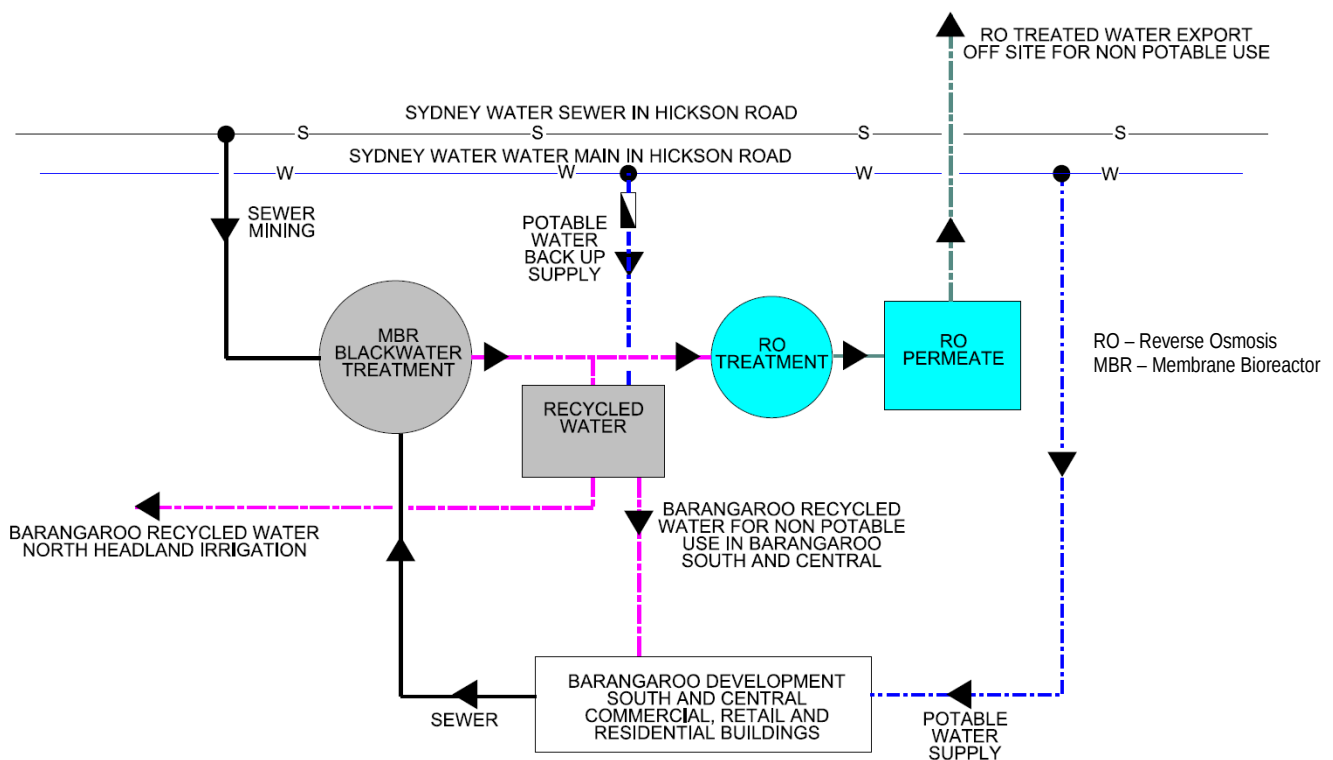


Figure 7.1: Barangaroo South Integrated Water Management flow diagram

Further development of the integrated water management system for Stage 1B will occur through detailed design of the development, including all residential buildings within Stage 1B and the surrounding public domain.

Where practical, stormwater harvesting may be incorporated into the Stage 1B site water balance for supply of non-potable water for irrigation of podium level gardens within the R4A building.

7.2 Potable Water

Sydney Water is the primary potable water supplier for the Barangaroo South development through an existing DN300 pipe running along Hickson Road.

The potable water reticulation network to which Building R4A will connect is being provided as part of the Basement Infrastructure works and will be located above the structural slab. The reticulation network will

consist of a 250 mm diameter ring main along Watermans Quay, Barangaroo Avenue and Barton Street. The water network will be provided in accordance with Sydney Water requirements.

7.3 Stormwater Drainage

7.3.1 R4A Building Drainage

It is proposed to capture and convey rainwater from roof and podium areas through conventional gutters, roof top drainage outlets and associated downpipes. Detailed design will be undertaken by the building hydraulic consultant and coordinated to allow connection to the trunk stormwater drainage within Barangaroo Avenue and Watermans Quay that is incorporated in the scope of work under the Stage 1B Basement DA (SSD 6960).

The location of downpipe connections and stormwater drainage to service R4A is subject to detailed design. An indicative schematic showing potential downpipe locations and connection points to the proposed Stage 1B local drainage system is presented in **Figure 7.2**.

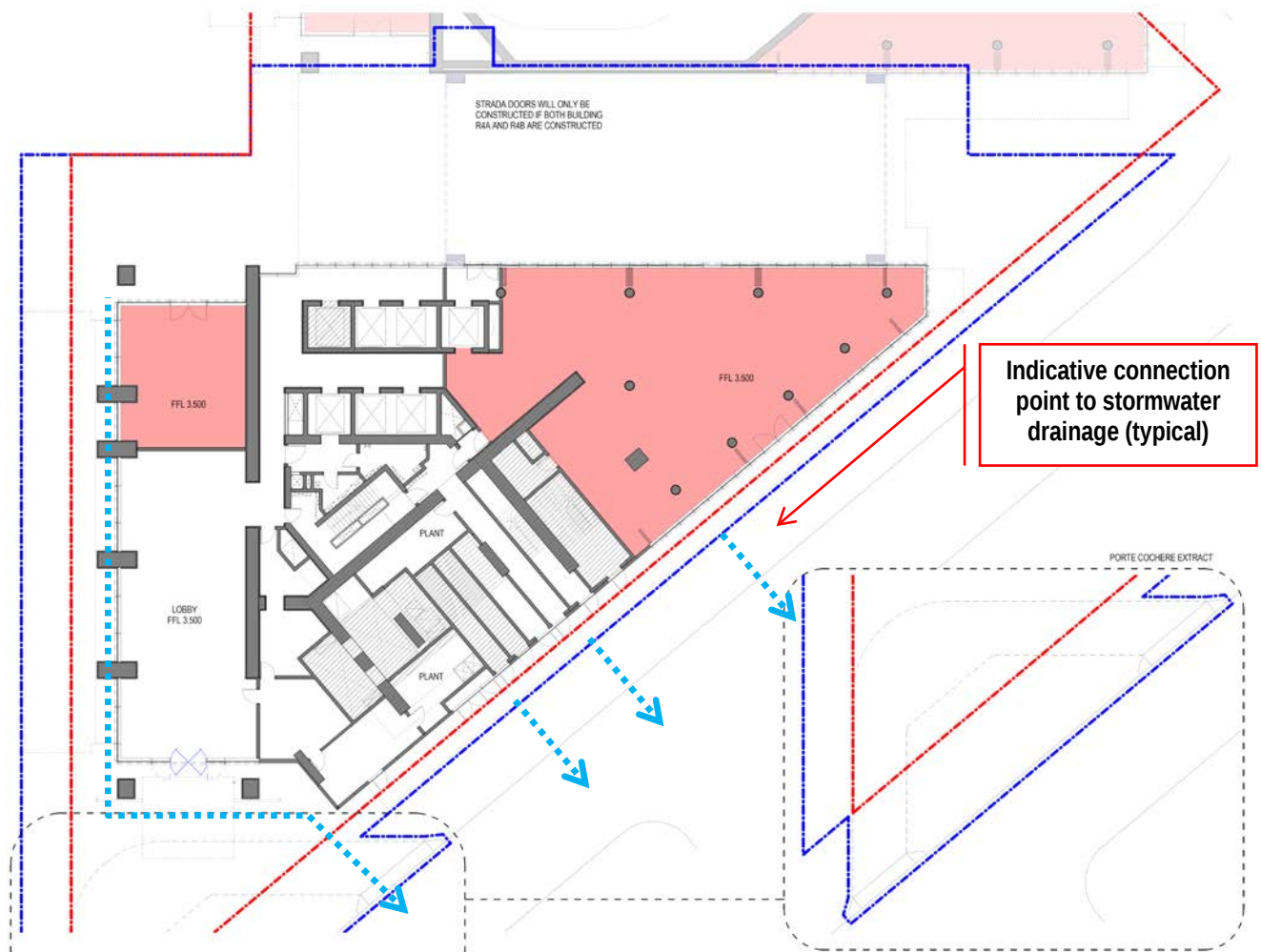


Figure 7.2: Indicative location of connections to Stage 1B internal drainage

We confirm that there will be capacity within the street drainage system for Building R4A and there will be no physical impact on, or detrimental impact on the operation of, existing infrastructure as a result of the development.

7.3.2 External Stormwater Drainage

External stormwater drainage infrastructure will be subject to separate approvals. A summary of the external stormwater drainage is presented below.

Diversion of the existing stormwater assets traversing the Barangaroo South site has been considered as part of the Block 4 Remediation DA (SSD 5897) and the Stage 1B Basement Application (SSD 6960). Diversion of existing Sydney Water assets are subject to approval by Sydney Water in consultation with the Barangaroo Delivery Authority (BDA), Transport for NSW and NSW Roads and Maritime Services (RMS). The proposed stormwater diversion works will include a new trunk line within Watermans Quay, which will be constructed above or adjacent to the Stage 1B Basement structure and will ultimately discharge to Darling Harbour. The proposed diversion works will improve the conveyance capacity of the external drainage network and will be designed such that there will be no adverse flood impact within Hickson Road or the adjacent Barangaroo Central development site. This diversion will also cater for predicted future harbour water level increases due to climate change, generally in accordance with currently relevant NSW Government and City of Sydney policies.

Modelling has shown that no overland flows from the external catchments are expected to drain through the site in storm events up to and including the 100 year ARI event (refer to Barangaroo South Flood Study prepared by Cardno dated February 2015).

7.3.3 Internal Stormwater Drainage

Internal stormwater drainage infrastructure will be subject to separate approvals. A summary of the internal stormwater drainage is presented below.

The stormwater network for Stage 1B of Barangaroo South is designed to provide:

- Low flows directed through water quality management measures (nominally up to a 3 month ARI event) including gross pollutant trap and stormwater filter; and
- Internal site drainage with sufficient capacity to capture and convey all storm events up to and including the 100 year ARI, with allowance for 50% blockage on all sag pits.

The stormwater drainage network has been designed generally in accordance with the following standards and guidelines:

- *Australian Rainfall and Runoff Volume 1 and 2, 1997*;
- *NSW Floodplain Development Manual 2005*;
- *City of Sydney Interim Floodplain Management Policy (May 2014)*;
- *City of Sydney Sydney Streets Technical Specifications*;
- *AS3500 – Stormwater and Drainage Design codes*;
- *AS3725 – Loads on Buried Concrete Pipes*;
- *Managing Urban Stormwater – Soils and Construction Volume 1* ('The Blue Book'), 4th edition, (Landcom, 2004); and
- *Water Sensitive Urban Design; Book 1 – Policy* (Landcom, 2009), which is considered current best-practice for stormwater management in NSW and suggests the following targets for reduction of pollutant mean annual load:
 - o 85% for Total Suspended Solids (TSS)
 - o 65% for Total Phosphorus (TP)
 - o 45% for Total Nitrogen (TN).

The design for stormwater conveyance and quality would not preclude future transfer of the drainage network to City of Sydney Council.

All rainwater falling on roads or public domain areas will be collected via a combination of traditional stormwater capture devices and water quality measures such as gross pollutant traps and proprietary tertiary filters, prior to discharge to Darling Harbour. There is no requirement for on-site detention (OSD) as the Barangaroo South site is adjacent to the Harbour and at the outlet from the catchment where attenuation would normally have little impact on upper catchment flows.

The trunk drainage system will consist of prefabricated concrete box culverts or concrete pipes installed above the basement structural slab. This system will serve as a connection point to the Building R4A drainage systems as well as catering for surface flows from the Public Domain. All trunk drainage works will be subject to Construction Certificate Application covered under the Stage 1B Basement Car Parking Application (SSD 6960).

The Barangaroo South stormwater quality management strategy incorporates water sensitive urban design (WSUD) measures that have been developed to meet the following pollutant reduction targets:

Water Quality Parameter	BDA Obligation % Reduction	City of Sydney DCP % Reduction
Total Suspended Solids (TSS)	80	85
Total Phosphorus (TP)	45	65
Total Nitrogen (TN)	45	45
Gross Pollutants	3 Months ARI	90 (> 5mm)

The City of Sydney Development Control Plan reduction targets are consistent with current best practices adopted by UrbanGrowth NSW (formerly Landcom) for urban developments. The marginally higher phosphorus and suspended solids targets are however relevant for more sensitive receiving waters.

The stormwater quality management strategy will consist of the following measures to achieve the required pollutant reductions:

- Approximately 30 tree pits will be provided along Barangaroo Avenue and Watermans Quay. Stormwater will drain to the filter media via a series of openings in the kerb at the sag locations along the street. Stormwater will be treated through the filter media and drained back to the trunk drainage system above the structural slab.
- A below ground Gross Pollutants Trap (GPT) is proposed at the downstream end of the drainage system prior to discharging to Darling Harbour. This GPT will provide primary stormwater treatment to remove litter, vegetative matter, free oils, grease and coarse sediments.
- In addition to the 'at source' treatment system an end of line proprietary system is proposed to achieve the pollutant reductions targets. A proprietary stormwater filtration device, similar to that proposed as part of the Barangaroo South Stage 1A Public Domain, will provide tertiary stormwater treatment including removal of Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

8. Conclusion

This report addresses the provision of infrastructure and water management issues relating to the proposed residential building R4A, as required under SSD 6964.

On the basis of the works proposed under the Stage 1B Basement DA (SSD 6960) and under SSD 6964, the development site can be suitably serviced. Any impacts associated with construction of the proposed works will be suitably mitigated through a range of measures, including temporary service provision where required.

Based on the content of previous reports prepared for the proposed basement within Stage 1B of the Barangaroo South development, adequate stormwater infrastructure to service the R4A development site has been incorporated into the base design.

Yours Sincerely



Tim Michel
Civil Engineer
for **Cardno**

Reviewed by



Michael Hodges
Civil Design Manager – Urban Infrastructure