Stormwater Concept Plan

Barangaroo South – MOD8 Planning Submission (MP06_0162 MOD8)

NA50613044

Prepared for
Lend Lease Building Pty Ltd

March 2015

Cardno
Shaping the Future

Document Information

Prepared for	Lend Lease Building Pty Ltd
Project Name	Barangaroo South – MOD8 Planning Submission (MP06_0162 MOD8)
File Reference	13-0186 MOD8 Stormwater Concept Plan_07.docx
Job Reference	NA50613044
Date	March 2015

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Document Control

Version	Date	Author	Author Initials	Reviewer	Reviewer Initials
01	29/08/13	D Williamson	DW	Michael Hodges	MKH
02	01/10/13	D Williamson	DW	Michael Hodges	MKH
03	02/09/14	P Lau/R Andrew	PL/RA	Michael Hodges	MKH
04	11/09/14	P Lau/R Andrew	PL/RA	Michael Hodges	MKH
05	25/09/14	P Lau/R Andrew	PL/RA	Michael Hodges	MKH
06	09/10/14	P Lau/R Andrew	PL/RA	Michael Hodges	MKH
07	11/03/15	P Lau/R Andrew	PL/RA	Michael Hodges	MKH

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1 Project Appreciation

1.1 Introduction

This report supports a modification to Concept Plan (MP06_0162) submitted to the Minister for Planning and Infrastructure pursuant to Section 75W of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The proposed application is the outcome of negotiations between Lend Lease and the NSW Government, including the Barangaroo Delivery Authority, to relocate the approved landmark hotel building site from a pier over Sydney Harbour to a location on land elsewhere on the Barangaroo South site. It also incorporates a number of consequent and related changes to the urban design guidelines that are required to maintain an appropriate built form and public domain outcome for the Barangaroo South site.

1.2 Background

The 22 hectare Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – Headland Park, Barangaroo Stage 2 (also known as Barangaroo Central) and Barangaroo Stage 1 (herein after referred to as Barangaroo South).

Lend Lease was successfully appointed as the preferred proponent to develop Barangaroo South on 20 December 2009.

1.3 Overview of Proposed Modification

The proposed modification to the Concept Plan seeks to:

- Relocate the landmark building (Block Y) from the harbour onto the land in the Barangaroo South site in front of the existing Blocks 4A, B and C;
- Revise the layout of Blocks 4A-C;
- Amend the size and location of the Southern Cove and public domain;
- Redistribute the GFA, public domain and land uses across development blocks 1-3, 4A-C, X and Y;
- Increase the maximum GFA on the site to provide for additional GFA within the hotel building and redistribution of land uses;
- Increase the height of the buildings within modified 'Block 4' and the relocated Block Y; and
- Amend the conditions of the Concept Approval to reflect the modifications to development.

It is also proposed to amend Part 12 of Schedule 3 of the Major Development SEPP to reconcile the SEPP with the modifications to the Concept Plan, including amending the location of the RE1 and B4 Mixed Use zone boundaries. Refer to Appendix C for Modification No. 8 Block Plan.

1.4 Purpose of this Report

This report has been prepared to accompany the Project Application for the MOD8 planning submission at Barangaroo South.

1.5 Planning History & Framework

On 9 February 2007 the Minister approved a Concept Plan for the site and on 12 October 2007 the land was rezoned to facilitate its redevelopment. The Approved Concept Plan allowed for a mixed use development involving a maximum of 388,300m^2 of gross floor area (GFA) contained within 8 blocks on a total site area of 22 hectares.

Modification No. 1 was approved in September 2007 which corrected a number of minor typographical errors.

On 25 February 2009 the Minister approved Modification No. 2 to the Concept Plan. The Approved Concept Plan as modified allowed for a mixed use development involving a maximum of 508,300m^2 of gross floor area (GFA) contained within 8 blocks on a total site area of 22 hectares.

On 11 November 2009 the Minister approved Modification No. 3 to the Concept Plan to allow for a modified design for the Headland Park and Northern Cove. The Approved Concept Plan as modified allows for a mixed use development involving a maximum of 489,500m^2 of gross floor area (GFA) across Barangaroo as a whole.

On 16 December 2010 the Minister approved Modification No. 4 to the Barangaroo Concept Plan. The Approved Concept Plan as modified allows for approximately 563,965m^2 gross floor area (GFA) of mixed use development across the entire Barangaroo site.

MOD5 amendment to the approved concept plan was submitted and withdrawn.

On 25 March 2014 the Minister approved Modification No. 6 to the Concept Plan to allow an adjustment to the alignment of Globe Street.

On 14 April 2014 the Minister approved Modification No. 7 to allow a concrete batching plant to operate on the site for the construction of Barangaroo South. The approved Concept Plan (Mod 7) is for a mixed use development involving a maximum of 563,965sqm gross floor area (GFA), and approximately 11 hectares of new public open space/public domain, including an approximate 2.2km public foreshore promenade. The Concept Plan includes built form design principles, maximum building heights and GFA for each development block.

1.6 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District. It 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 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, Barangaroo Central and Barangaroo South. Concept Plan (Mod 8) relates to Barangaroo South only as shown in **Figure 1-1**.

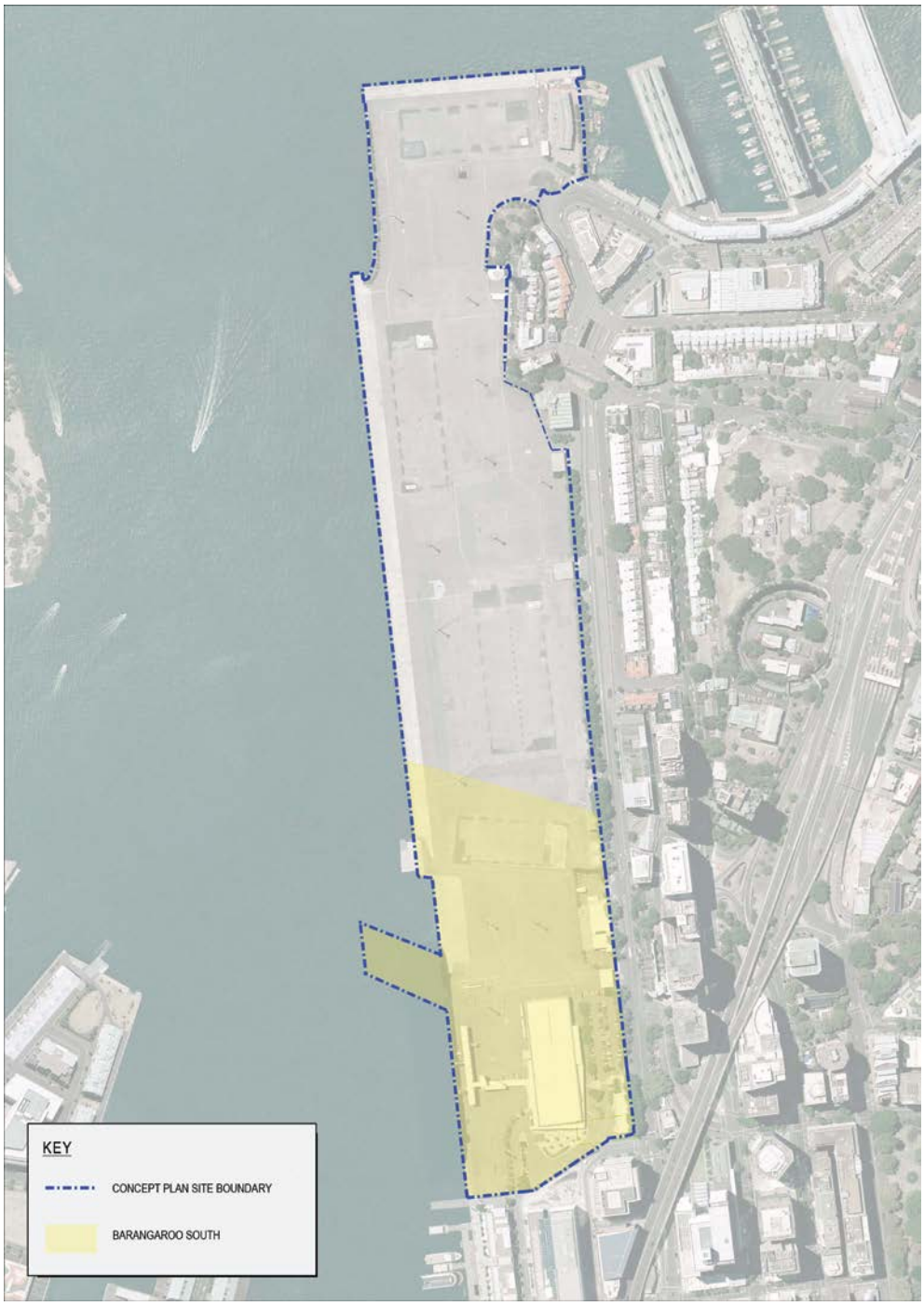

Figure 1-1 Indicative Site Boundary for Barangaroo South

2 Data Compilation

2.1 Topographic Survey

Airborne Laser Scanning (ALS) was undertaken by AAM-Hatch. Generally the accuracy of ALS data is ±0.15m to one standard deviation on hard surfaces.

2.2 Ground Survey

A detailed field survey of the proposed development site, Hickson Road, Sussex Street and Shelley Street was undertaken by Rygate & Company. The ground survey and ALS data have been used to analyse existing overland flow paths.

2.3 Site Inspection

Site inspections were undertaken by Cardno on 21 April 2011 to confirm site and catchment features. The site visits provided the opportunity to identify street drainage features, identify the catchment boundaries and visually identify potential flooding areas within the catchments.

2.4 GIS data

The following Geographic Information System (GIS) data was provided by Cardno's GIS team and Sydney Water's asset database system for this study:

a. Cadastre for the catchment area;

b. Topographic map with 2m contours;

c. Aerial images; and

d. Hydra plans featuring Sydney Water's stormwater infrastructure.

3 Integrated Water Strategy

The principal water strategy system has not changed significantly from Modification No. 4. The current proposed water strategy is to achieve a positive water balance based on exporting recycled water from the site to the same quantity of potable water used.

This objective will be achieved through a site wide approach that focuses on:

a. Potable water demand reduction including:

- Commitment to achieve a reduction in potable water consumption compared to a standard practice development;
- Onsite waste water treatment and water recycling.

b. Water balance modelling including:

- Review of potential sources of water;
- sewer mining;
- Assessment of appropriate treatment measures; and
- Further development of existing conceptual water balance model; refer to **Figure 3-1**.

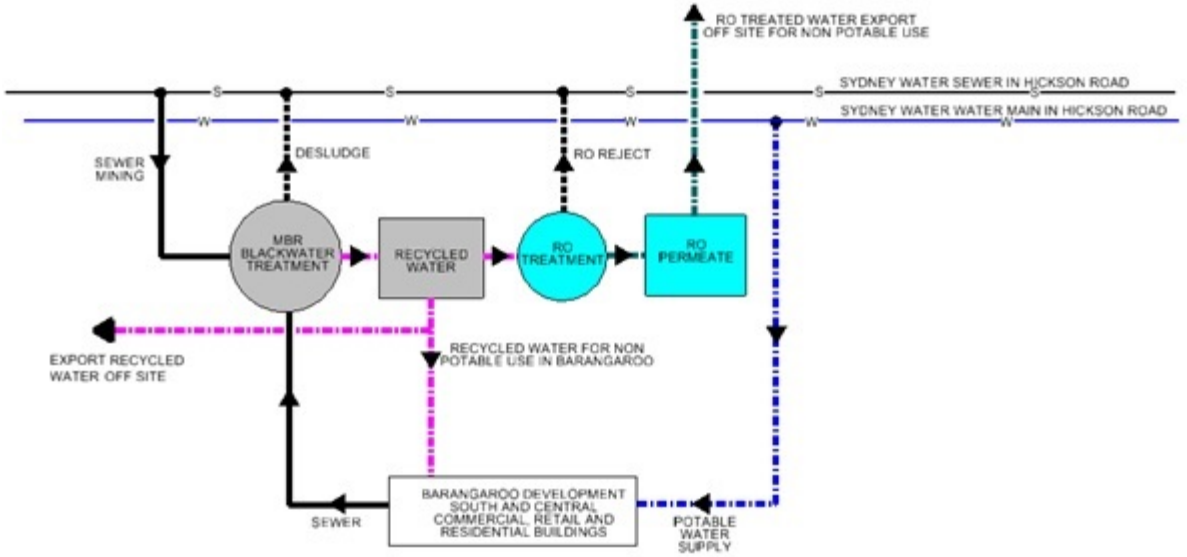

Figure 3-1 Barangaroo South – Waste Water, Potable and Recycled Water flow diagram

Further development of this strategy will occur through detailed design and Water Balance modelling. Methods of stormwater drainage and treatment are discussed in the Building Services Report supporting the application.

4 Stormwater Drainage

4.1 External Catchments

Delineation of external catchments within Modification No. 4 was based on Department of Lands contour data. Detailed ground survey, site inspections and ALS data have been utilised to refine external catchments for Modification No. 8. The interpretation of higher detailed information has resulted in changes to external catchments between Modification No. 4 and Modification No. 8 as detailed below.

4.1.1 External Catchments – Stage 1A

The external catchment area draining to the Stage 1A development site is approximately 13.3ha. Drawing SK014 in **Appendix A** details external sub-catchment areas and nominated discharge locations. Details of the catchments are as follows:

i. **Catchment 1:** This catchment has an area of approximately 6.5ha which discharges to an existing 900mm diameter pipe in Hickson Road connecting to an existing 1500/1650mm diameter pipe which runs in a North West direction through the site. This pipe is joined by a 1200mm stormwater drainage pipe traversing Stage 1B Residential, ultimately discharging to Darling Harbour via an 1800mm diameter stormwater pipe and box culvert.

ii. **Catchment 2:** This catchment has an area of approximately 4.1ha which discharges to the drainage network under Erskine Street before ultimately discharging to Darling Harbour. The overland flow travels to the north along Sussex Street to the low point in front of the Barangaroo development site.

iii. **Catchment 3:** Connects to an existing 1200mm diameter pipe along Sussex Street before turning into Shelley Street, ultimately discharging to Darling Harbour adjacent to Bungalow 8.

iv. **Catchment 4:** Connects to existing drainage within Shelley and Lime Streets, ultimately discharging to Darling Harbour adjacent to Bungalow 8.

4.1.2 External Catchments – Stage 1B Residential

The external catchment area draining to the Stage 1B Residential development site is approximately 5.28ha. Drawing SK014 in **Appendix A** details external sub-catchment areas and nominated discharge locations. Details of the catchments are as follows:

a. **Catchment 9:** This catchment has a total contributing area of approximately 2.83ha which discharges into Gas Lane and Jenkins Street through a 600mm diameter pipe and then into an existing 1200mm diameter pipe which traverses the Stage 1B Residential development site prior to ultimately discharging directly into Darling Harbour.

b. **Catchment 10:** This catchment has a total contributing area of approximately 2.29ha which discharges into the existing Hickson Road inground stormwater drainage network prior to ultimately discharging into Darling Harbour through a series of varying diameter pipes traversing the Stage 1B Residential development site.

4.2 Internal Catchments

Changes in Concept Plan between Modification No. 4, Modification No. 6 and Modification No. 8 have resulted in adjustment to the internal catchment plan. Based on Modification No. 8 Concept Plan the development site will be divided into separate sub-catchments as a result of internal roads and open space. The combined sub-catchments total approximately 6.39ha and will discharge into Darling Harbour.

4.2.1 Internal Catchments – Stage 1A

Stage 1A is bordered by proposed Globe Street to the north, Sussex Street to the east, future Shelley Street to the south and Darling Harbour to the west. It consists of ten new buildings including the three high rise towers, internal street and public domain areas to provide access to buildings, wharves and foreshore harbour.

A two level basement car park and loading dock will be located underneath the buildings. The total catchment area for Stage 1A is approximately 4.1ha.

Drawings SK014 and SK016 indicate there are approximately 0.6ha of catchment area fronting Hickson Road and Sussex Street discharges into the proposed external drainage system; ultimately discharging to Darling Harbour via the proposed network along Shelley Street.

a. **Catchments 5 and 6** drain to the Stage 1A external stormwater drainage network.

b. **Catchment 11** drains to the Stage 1B Residential external stormwater drainage network.

4.2.2 Internal Catchments – Stage 1B Residential

Stage 1B Residential is bordered by the future development of Barangaroo Central to the north, Hickson Road to the east, proposed Globe Street to the south and Darling Harbour to the west. The proposed development includes three residential towers and public domain areas to provide access to the buildings. The total catchment area for Stage 1B Residential is approximately 2.4ha.

As shown on Drawing SK014 and SK017, Catchment 12 has a catchment area of approximately 0.2ha. This catchment drains to the proposed Stage 1B Residential external stormwater drainage system; ultimately discharging to Darling Harbour via the proposed network along Globe Street.

4.2.3 Internal Catchments – Stage 1B Hotel

Stage 1B Hotel is located between Stage 1B Residential and Darling Harbour. The proposed development includes a high-rise hotel tower. The total catchment area for Stage 1B Hotel is approximately 0.6ha and will be connected to an existing 600mm diameter pipe to the northwest corner of the site before discharging to Darling Harbour.

Drawing SK017 in **Appendix A** provide details of sub-catchment areas and nominated discharge locations.

4.3 Overland Flows and Flooding

4.3.1 Historic Flood Data

Detailed ground survey and site inspections undertaken post-Modification No. 4 and Modification No. 6 documentation have been used to refine existing overland flow paths. The interpretation of this information has resulted in changes to overland flows and flooding between Modification No. 4, Modification No. 6 and Modification No. 8; as detailed below.

The City of Sydney Council has confirmed that there is no available historical flood data for the Barangaroo site or the external catchments to the site; however localised flooding is known to occur within the bounds of Hickson Road.

4.3.2 Existing Overland Flow Paths – Stage 1A

The most prominent overland flow paths are generally:

i. **Catchment 1 and 3:**

   1. South along Kent Street to the junction with Napoleon Street;
   2. West along Napoleon Street;
   3. South along Hickson Road to the existing low point approximately 50 metres north of the Sussex Hotel; and
   4. Through the development site.

ii. **Catchment 2:**

   1. West on Erskine Street; and
   2. North on Sussex Street to the existing low point approximately 50 metres north of the Sussex Hotel.

iii. **Catchment 4:**

1. North along Shelley Street and Lime Street to the existing low point adjacent to the property boundary within Lime Street, near Bungalow 8; and
2. Through the corridor between the development boundary and Bungalow 8 to Darling Harbour.

iv. **Catchment 5, 6 and 11:**

1. West through the site; discharging into Darling Harbour.

4.3.3 Existing Overland Flow Paths – Stage 1B Residential

The most prominent overland flow paths are generally:

i. **Catchment 9:**

1. Overland flow splits at the intersection of Gas Lane and Jenkins Street with the majority of the flow diverting to the north between 30 the Bond Building and 34 Hickson Road; entering the existing Hickson Road inground stormwater drainage network.

ii. **Catchments 10:**

1. North and South on Hickson Road towards an existing low point generally located in front of "The Bond"; and
2. Through the development site.

ii. **Catchment 12:**

1. West through the site; discharging into Darling Harbour.

4.4 Internal Stormwater Drainage

Changes to the Concept Plan from Approved Modification No. 4, Modification No. 6, additional detailed survey information and stakeholder consultation have resulted in adjustments to the proposed stormwater drainage design criteria and strategy. Current proposed internal stormwater drainage strategy and variances from Modification No. 4 and Modification No. 6 are identified below.

4.4.1 Design Criteria

The stormwater network is proposed to be designed to provide:

a. Low flows directed through water quality measures;
b. Internal site piped drainage for major storm event flows (1 in 100 year); and
c. Safe overland flow paths to convey emergency overland flows.

4.4.2 Design Standards

The stormwater drainage network will be designed generally in accordance with the Modification No. 4 standards and guidelines the following design standards:

a. Water Sensitive Urban Design (WSUD) best practice currently:
   - 90% Gross Pollutants (GP);
   - 85% Total Suspended Solids (TSS);
   - 65% Total Phosphorous (TP); and
   - 45% Total Nitrogen (TN).

b. Emi-5 Stormwater Green Stars (2 points):

- 1.5 year ARI post development peak flows not exceeding 1.5 year ARI pre-development peaks flows;
- 90% GP;
- 80% TSS;
- 60% TP;
- 45% TN; and
- 90% Free Oils.

The more onerous target reductions from each of the above design requirements shall be achieved.

4.4.3 Stormwater Internal Drainage Strategy

Modification No. 4 internal drainage strategy was based on conveying 20 year ARI flows within the pit and pipe network and 100 year ARI flows as overland flow. Current drainage strategy is for conveyance of all flows up to and including the 100 year ARI storm within the pit and pipe network for Stages 1A and 1B. The current internal drainage strategy is outlined below.

The stormwater treatment train incorporates WSUD principles to remove Total TSS, TN and TP. The treatment train may consist of tree pits and roof gardens (bio-retention system), gross pollutant traps (Rocla CDS) and membrane filtration (e.g. Humes Jellyfish units).

4.4.3.1 Stage 1A

The Stage 1A internal stormwater trunk drainage network includes culverts that will be constructed above the ground plane structural slabs underneath the proposed streets and pedestrian walkways. Low flows will be diverted to stormwater treatment devices via a splitter pit before discharging into Darling Harbour. The stormwater treatment for this network includes a configuration of gross pollutant traps (GPTs) and tertiary treatment units to achieve the water quality objectives. Tree pits with sand filter media may be located along Globe Street and the waterfront promenade to treat stormwater from the source.

Roof Gardens are likely to be proposed at the top of buildings H2 and C2 to treat stormwater runoff before discharging to Hickson Road drainage network.

Refer to **Appendix B** for Barangaroo Masterplan South Concept Plan.

4.4.3.2 Stage 1B

Modification No. 4 proposed stormwater provided for a future connection to Central Parkland. The current proposed stormwater concept does not incorporate a connection to Headland Park or Central Parklands; however this is not precluded subject to services investigation.

The Stage 1B Residential internal stormwater drainage network will connect to the existing 1800mm diameter pipe located under the proposed Globe Street, between Stage 1A and Stage 1B Residential. This network will collect flows from the proposed residential buildings (R4a, R4b and R5), public domain area, Lime Street and Globe Street. Treatable flows will be diverted to a GPT and tertiary treatment units. The existing 1800mm pipe outlets into Darling Harbour and will remain.

The proposed stormwater treatment train for Stage 1B Residential will generally consists of sand filtration system underneath the proposed landscape area between R4a, R4b and R5, a GPT and tertiary treatment unit(s). The waterfront promenade in front of the Stage 1B Hotel site will consist of tree pits to treat the stormwater runoff before discharging into Darling Harbour.

There have been a number of options investigated to understand the minimum requirements to achieve the water quality objectives with different treatment systems.

Refer to **Appendix B** for Barangaroo Masterplan South Concept Plan.

4.4.3.3 Stage 1B Hotel

The proposed Stage 1B Hotel stormwater drainage network will capture flows from the proposed buildings via downpipes ultimately connecting to an existing 600mm diameter stormwater pipe in the north-west corner of the site. The stormwater treatment train for the area may consist of:

- Rainwater tank to capture rainwater for no- potable usage such as irrigation; and
- Bio-retention system for the future terraces.

A tertiary treatment unit will be proposed to enhance the water quality to meet the water quality objectives before discharging to the existing stormwater network.

4.5 External Stormwater Drainage

Modification No. 4 and Modification No. 6 documentation regarding external stormwater drainage broadly described existing drainage lines within the proximity of the proposed site. Detailed ground survey and site inspections have allowed for a detailed assessment of existing stormwater drainage network as documented below.

4.5.1 Existing External Stormwater Network

The existing stormwater network is characterised by a series of in ground piped stormwater systems (typically between 300mm to 1800mm in diameter) draining Hickson Road and other external catchments through the Barangaroo site directly to the Harbour. Refer **Figure 4-1** for overview. SK013 contained in **Appendix A** provides additional information.

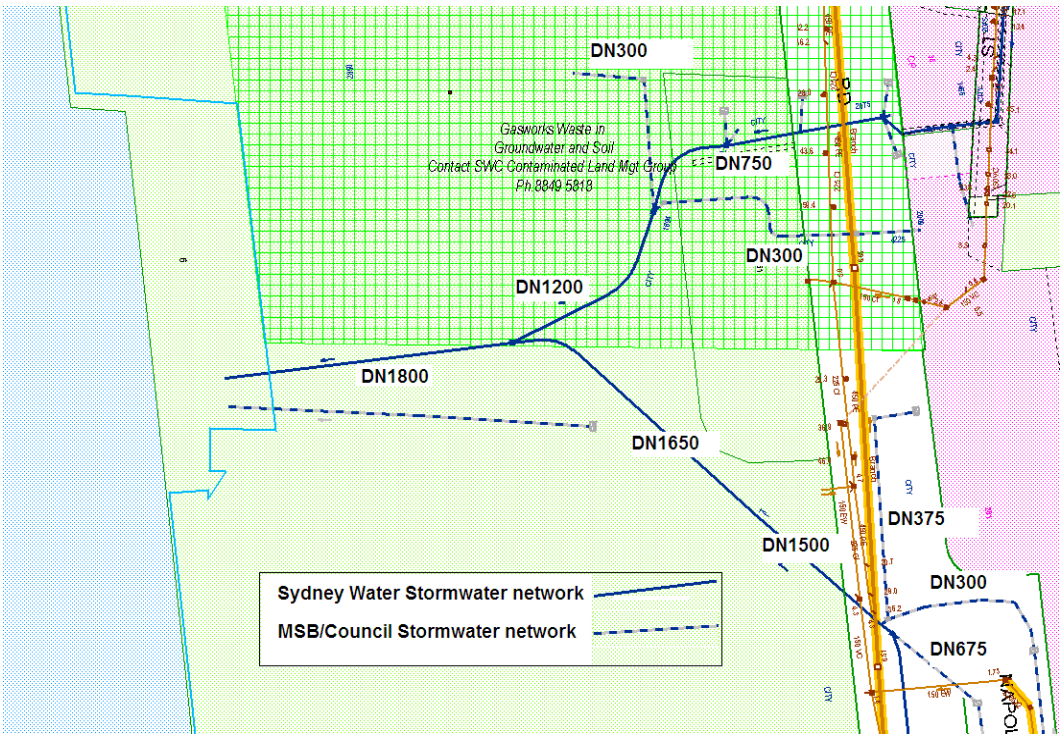

Figure 4-1 Existing Stormwater Network Before Development Work

4.5.2 Proposed External Stormwater Strategy

Diversion of the existing stormwater assets traversing the Barangaroo South site has been considered and is currently under discussion with Sydney Water Corporation and the Barangaroo Delivery Authority (acting as the Roads Authority for Hickson Road). These works include the following main components:

a. Stage 1A Deviation Works: A concrete pipe and box culvert diversion to the south with 100 year ARI capacity to improve existing flooding to Hickson Road in the vicinity of the Sussex Hotel. This has been completed.

b. Stage 1B Deviation Works to be designed to allow progress of proposed remediation and basement construction works. The design to be coordinated with Sydney Water and the City of Sydney Council.

At the date of this report, the Stage 1A permanent diversion is complete. Concept design for Stage 1B diversion has been submitted to BDA and Sydney Water Corporation (Sydney Water). As part of the requirements from Sydney Water, a Gross Pollutant Trap will be installed to provide primary stormwater treatment to enhance the water quality.

The design for Stage 1A permanent and concept design for Stage 1B are shown on SK015 in **Appendix A**.

4.5.3 Proposed External Stormwater Water Quality Improvement

It is proposed to install GPT within the piped drainage system upstream of the development site with the aim of improving water quality at the discharge point to Darling Harbour. The location of the GPTs will be subject to future detailed design.

4.6 Overland Flows and Flooding

4.6.1 Impact of Proposed Development

The key changes to overland flow paths and effects on existing stormwater infrastructure are as follows:

a. The existing stormwater pipes for the external catchment that traverse the site are to be relocated due to the conflict with the basement footprint;

b. A harbour highest astronomical high tide water level of RL 1.975 has been forecasted for the year 2100. An allowance for surge of 600mm gives a minimum site level of 2.575 at the foreshore area, refer Figure 4-2;

c. Stage 1A has been set with a promenade height of RL 2.90. This allows for a grade to be achieved across the site from a building FFL of 3.3-3.5. It is envisaged that Stage 1B will adopt a similar strategy in order to integrate with Stage 1A.

d. The proposed site levels preclude overland flow through the development from existing low points in Hickson Road; and

e. Considering existing levels on Hickson Road, it has been proposed to relocate the overland flow route from the existing low point to a new flow path north of the proposed development site and then into the Harbour.

4.6.2 Stage 1A

The newly completed external stormwater drainage network for Stage 1A has been designed to convey the 100 year ARI flows from the external catchments due to the changes in overland flow paths outlined in 4.5.1.

Capture pits have been designed along Hickson Road to capture and divert overland flows to the external stormwater drainage network. Capture pit locations are subject to the design of Hickson Road, BDA and Council approval.

At the date of this report the trunk Sydney Water drainage deviation is complete and operational. The capture pits in front of the Sussex Hotel will have a capacity to capture the 100 year ARI overland flow along Hickson Road and are currently under construction.

4.6.3 Stage 1B

The proposed Stage 1B development will block the existing overland flow paths through the site. The current conceptual design is to provide a stormwater drainage network including a capture pit in Hickson Road to capture and divert the overland flow around the development site and discharge to Darling Harbour. There will be overland flow north along Hickson Road, limited to the capacity of the road corridor.

The intent of this network is to manage the impact of the development as contemplated by the Concept Plan (Mod 8) on the external stormwater drainage network. Therefore the network will be designed to maintain existing flood levels along Hickson Road to ensure no net adverse flooding impact on the adjacent properties.

Detailed design will be subject to Sydney Water and City of Sydney coordination.

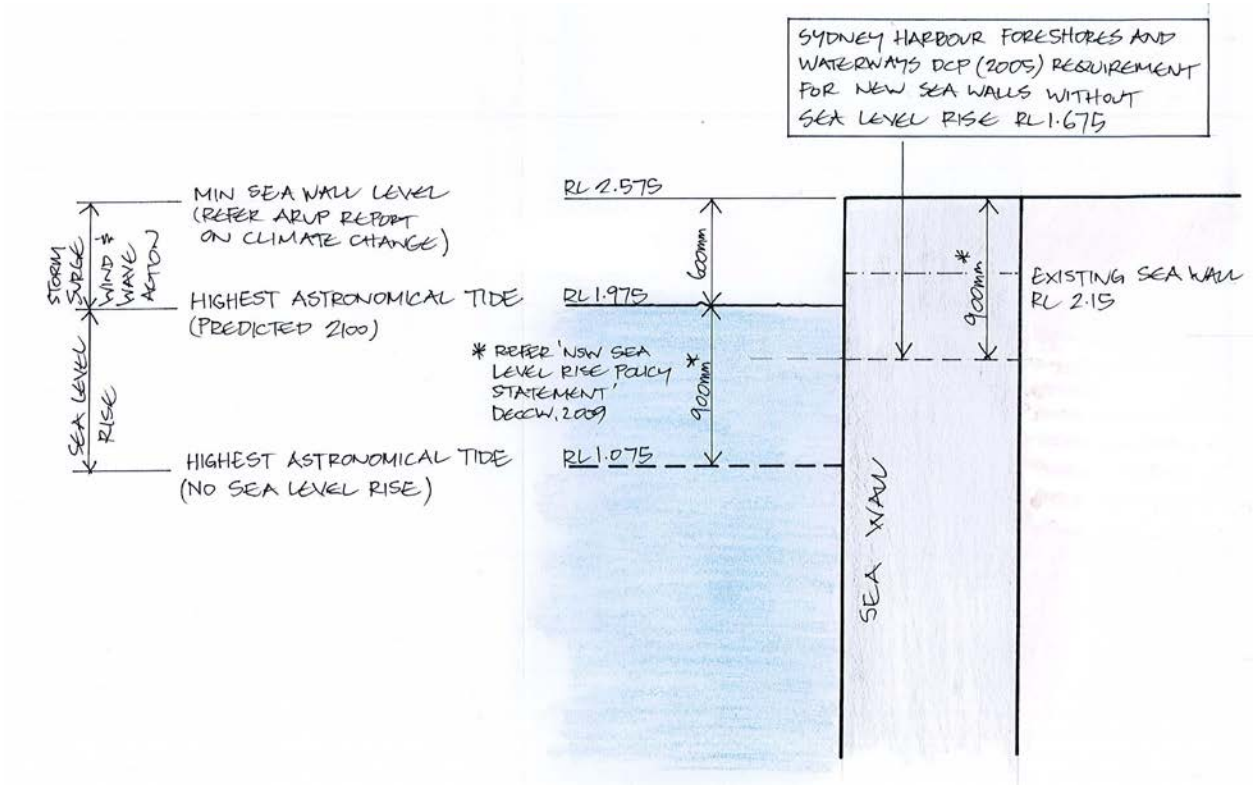

Figure 4-2 Predicted Sea Level Rise

**All Levels to Australian Height Datum – AHD

5 Climate Change Preparedness

The risk and likely magnitude of climate change induced sea level rise is addressed in detail in the Climate Change and Sea Level Rise Report prepared by Arup - "*Public Domain (Stage 1A) Planning Application Climate Change and Sea Level Rise Report*" dated 18 December 2013.

The above report projects that climate change induces sea level rise will result in an increase in global mean sea level of between 0.26m and 2m by 2100.

It is likely that in the coming years, the existing local drainage systems in the area surrounding the development will reduce in capacity and effectiveness as the outlets to the harbour become increasingly submerged.

These risks are addressed at this stage through:

a. Locating site based stormwater discharge points at a high level within the new sea wall to allow gravity flow of the run-off to the Harbour;

b. Design of stormwater transport systems to incorporate partial inundation from tide flows;

c. Specification of materials to marine grade to prevent accelerated degradation;

d. Raising the harbour side of Hickson Road to cater for sea level rise;

e. Use of tidal flaps on stormwater discharge points; and

f. Provision of overland flow paths should the discharge point become obstructed.

It is also noted that the recommended minimum seawall level for the proposed Barangaroo South development is RL 2.5mAHD.

5.1 Changes to Climate Change Preparedness from MOD 4

Changes to the Concept Plan from approved Modification No. 4 have not altered the preparedness of climate change.

6 Building Floor Levels

Modification No. 4 documentation did not address building floor levels. Current design strategy for minimum floor levels within the proposed development site is driven by three factors:

a. Tie in to existing and proposed levels surround the development site;

b. Future Harbour water levels; and

c. Overland flow from upstream catchments.

6.1 Minimum Building Floor Levels

Main building floor levels are driven primarily by future harbour water levels. As discussed above, the future harbour level is predicted to rise to RL1.975 by the year 2100. It is recommended that the proposed seawall be constructed at RL2.575 to allow 600mm freeboard for each of storm surge and wave action.

As per **Section 4.3.3**, the internal roof, podium and internal road drainage network will be designed for the 1:100 year event. To ensure that an emergency overland flow path exists for internal areas, it is proposed to grade the surface at 0.25% from the top of the proposed new seawall. Based on a freeboard of 200mm and local emergency flow depth of 100mm this would result in a floor level of RL3.35.

Stage 1A includes a sea wall with a minimum height of 2.5mAHD, graduating incrementally to the site level of 3.4mAHD. This minimum height is:

- Greater than the current 1 in 100 year event (1.432mAHD) for Sydney Harbour plus an additional 0.9m to accommodate mean sea level rise (2.335mAHD);
- Equivalent to the current Sydney Harbour Foreshores DCP (1.675mAHD) plus an additional 0.9m (2.575mAHD); and
- Able to be incrementally increased in the future to respond to actual demonstrated sea level changes.

It is recommended that minimum floor levels for future main buildings should be set at RL3.35, though an appropriate relationship with existing buildings in Stage 1A must also be achieved.

6.2 Changes to Minimum Building Floor Levels from MOD 4

Changes to the Concept Plan from approved Modification No. 4 have not altered the strategy for minimum building floor levels.

7 Erosion and Sediment Control

7.1 Construction Phase

Post-Modification No. 4 documentation; various Environmental Construction and Site Management Plan (ECSMP) have been prepared for development within Stage 1A of Barangaroo South. It is anticipated that these documents will be used to inform and guide the ECSMP documentation required for remaining buildings and site areas. Existing documentation prepared for the Stage 1A component will inform management plans for the future development of Stage 1B Residential and 1B Hotel of Barangaroo South.

To support the Barangaroo South works, it is proposed to implement erosion and sediment controls that meet all relevant authority and best practice requirements.

7.2 Changes to Erosion and Sediment Control from MOD 4

Changes to the Concept Plan from approved Modification No. 4 have not altered the strategy for erosion and sediment control.

8 Water & Stormwater Management Plan

8.1 Plan Details

Lend Lease commits to the preparation of a detailed Water and Stormwater Management Plan that addresses the specific water quality and water monitoring matters. The Water and Stormwater Management Plan will include the following information.

8.2 Construction Phase

The water and stormwater management control measures proposed to be utilised during the construction phase are to be discussed in detail in the Environmental Construction and Site Management Plan.

To support the Barangaroo South works, it is proposed to implement controls that meet all relevant authority and best practice requirements including:

8.2.1 Water Volumes

a. Water volume management;

b. Anticipated volumes of water generated on-site including potential volumes of groundwater and stormwater discharges;

c. Volume of wastewater to be treated on site;

d. Volume of recycling/reuse;

e. Volume to be discharged to sewer; and

f. Volume to be sewer mined from existing stormwater main.

8.2.2 Water Monitoring

a. Criteria for nominating areas and different sources of site water as clean or contaminated;

b. Water monitoring protocols and decision criteria for whether site water will be directed to stormwater, a waste water treatment plant, to sewer or to a liquid waste facility;

c. Water discharge criteria and monitoring frequency for parameters listed in the 'Water Quality Monitoring Requirements' document prepared as part of the Environmental Assessment;

d. An initial more intensive monitoring program for sediment basins, stormwater discharges, reused water and ambient waters to help determine potential water quality impacts and ongoing monitoring protocols;

e. Specific discharge and monitoring points for on-site generated water including collected groundwater seepage into excavations, sediment basins for clean or contaminated areas, discharge points to stormwater drains, and confirmation of ambient monitoring locations in Darling Harbour and Johnstons Bay;

f. Suitability of chosen reference site(s) based on turbidity data from a proposed monitoring program;

g. Consideration of tidal currents, circulation patterns in Darling Harbour and the position of stormwater discharge points with regard to the positioning of monitoring location(s) outside the turbidity (silt) curtain. The location will not be a fixed point so that it can account for potential plume movement under different conditions. Alternatively, more than one location may be needed; and

h. The development of criteria for wastewater discharges that would trigger a review of water management systems. These criteria will trigger operational responses that help in ensuring licence conditions are not exceeded. It is noted that this element may fall under approval of the site recycled water/treatment devices and may be separated from the Concept Approval.

8.2.3 Stormwater and Sediment Controls

a. A detailed description of measures for stormwater and sediment control for specific locations on the site; and

b. Silt curtain arrangements for the protection of Darling Harbour as a secondary protection control.

8.2.4 Construction Operational Procedures

a. An operational plan detailing how contaminated water and sediment control systems will be implemented, operated and maintained;

b. A description of the operation and maintenance of environmental protection structures such as (not limited to) silt curtains, bunding and filtration systems, dewatering plant and methodology etc.; and

c. Details of the prevention of contaminated water being discharged to Darling Harbour.

8.2.5 Wastewater and Effluent Reuse on site

a. Criteria for wastewater or effluent reuse for either contaminated or clean sources of water;

b. Management practices for reuse of treated wastewater from contaminated areas; and

c. As above, it is noted that this element may fall under separate approval of the site recycled water/treatment devices and may be separated from the Concept Approval.

8.3 Changes to Water & Stormwater Management Plan from MOD 4

Changes to the Concept Plan from approved Modification No. 4 have not altered the strategy for the water and stormwater management plan.

9 Conclusion

This report has been prepared to describe the stormwater management strategy for the Barangaroo South development to accompany the Section 75W Modification to the Barangaroo Concept Plan (Modification No. 8). The strategy includes maximising stormwater reuse via:

- Water quality and WSUD measures;
- Recycled water treatment; and
- Diversion of major event external storm flows around the development site.

The completed design will aim to result in no adverse impact on surrounding neighbours or public spaces due to adjusted overland flow paths around the Barangaroo South development. Details are to be developed and integrated into the ground plane design and detailed in the design development phase.

The concept derived within Modification No. 4 has not changed for Modification No. 6 and the proposed Modification No. 8 as identified within this report.

The climate change induced sea level rise predicted for 2100 poses a risk to the effectiveness of the existing local stormwater drainage system in the Barangaroo area. However, the proposed diversion seeks to improve the capacity and allow for future climate change driven increases in Harbour water levels.

Lend Lease commits to entering into the necessary arrangements and obtaining the necessary approvals for water supply, sewer and stormwater connections from the relevant authorities, as required. Relevant external agents, for example a Water Servicing Coordinator, will be appointed as required.

Barangaroo South – MOD8 Planning Submission (MP06_0162 MOD8)

A

APPENDIX A – CONCEPT DRAWINGS

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JENKINS STREET
GAS LANE
HICKSON ROAD
NAPOLEON STREET
SUSSEX STREET
SHELLEY LANE
SHELLEY STREET
NORTHERN CONNECTOR ROAD
GLOBE STREET
CITY WALK
UNION WALK
TRANSPORT PLACE
LIME STREET
STAGE 1B RESIDENTIAL
STAGE 1A
STAGE 1B HOTEL
R1
R4
R5
R7
R8
R9
H1
C3
C4
C5
DARLING HARBOUR

LEGEND
- SW SYDNEY WATER
- SW MARITIME SERVICES BOARD
- SW CITY OF SYDNEY COUNCIL

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Key Plan

Rev.	Item	Revision Description	Date
2		ISSUED FOR INFORMATION ONLY	01.09.14
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Graham W James | Principal Architect
RAIA NSW ARB 4000
ABN 87 000 098 162
Consultant:

Principal: Lend Lease
Developer — Lend Lease
Project Management & Construction — Lend Lease
Design — Lend Lease
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Millers Point NSW 2000 www.lendlease.com

Project: BARANGAROO SOUTH
MP

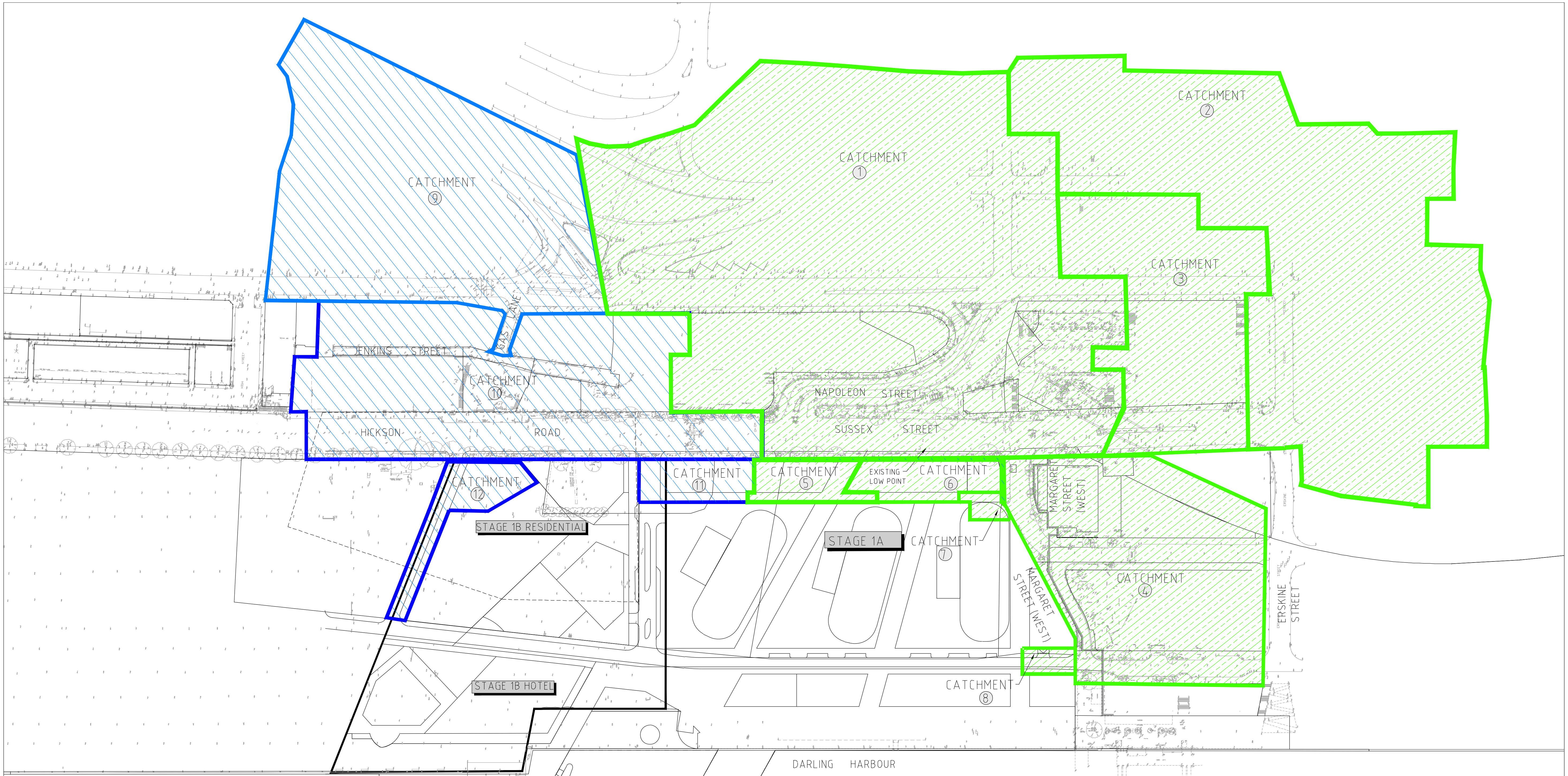
TITLE: SERVICES PLAN PRE COMMENCEMENT

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:500 FOR INFORMATION ONLY

Project No.	Site No. Drawing No.	Revision
161939	NA50613044 - SK013	02

B1



LEGEND

EXISTING STORMWATER

- SYDNEY WATER
- CITY OF SYDNEY COUNCIL
- MARITIME SERVICES BOARD

CATCHMENTS

- 1A CATCHMENTS
- 1B CATCHMENTS

STORMWATER DRAINAGE SUMMARY 1A

CATCHMENT No.	FLOW (100yr ARI) (m^3/s)	AREA (Ha)	DESCRIPTION
1	Q_{100} = 3.35	6.47	CATCHMENT DISCHARGES TO EXISTING LOW POINT WITHIN SUSSEX STREET AND THEN CONVEYED TO DARLING HARBOUR VIA PROPOSED STORMWATER CULVERT.
2	Q_{100} = 0.73	4.12	CATCHMENT DISCHARGES TO EXISTING DRAINAGE NETWORK ALONG ERSKINE STREET, OVERLAND FLOWS DISCHARGE THROUGH CATCHMENT 4 TO EXISTING LOW POINT WITHIN SUSSEX STREET.
3	Q_{100} = 2.34	4.79	NORTHERN CATCHMENT DISCHARGES TO 750Φ STOMRWATER PIPE VIA HICKSON ROAD, THEN INTO STORMWATER CULVERT THROUGH DEVELOPMENT SITE.
4	Q_{100} = 0.92	1.80	CATCHMENT DISCHARGES TO PROPOSED STORMWATER CULVERT AND OVERLAND FLOWS DISCHARGE DIRECTLY TO DARLING HARBOUR.

STORMWATER DRAINAGE SUMMARY 1A

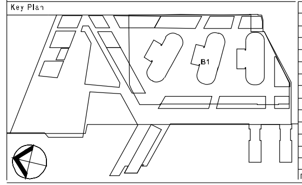
CATCHMENT No.	FLOW (100yr ARI) (m^3/s)	AREA (Ha)	DESCRIPTION
5	Q_{100} = 1.19	0.17	INTERNAL CATCHMENT DISCHARGES TO PROPOSED STORMWATER CULVERT AND THEN CONVEY TO DARLING HARBOUR.
6	Q_{100} = 0.256	0.21	INTERNAL CATCHMENT DISCHARGES TO PROPOSED STORMWATER CULVERT AND THEN CONVEY TO DARLING HARBOUR.
7	Q_{100} = 0.072	0.11	INTERNAL CATCHMENT DISCHARGES TO PROPOSED STORMWATER CULVERT AND THEN CONVEY TO DARLING HARBOUR.
8	Q_{100} = 0.038	0.05	INTERNAL CATCHMENT DISCHARGES TO PROPOSED STORMWATER CULVERT AND THEN CONVEY TO DARLING HARBOUR.

STORMWATER DRAINAGE SUMMARY 1B

CATCHMENT No.	FLOW (100yr ARI) (m^3/s)	AREA (Ha)	DESCRIPTION
9	Q_{100} = 2.35	2.83	CATCHMENT DISCHARGES INTO GAS LANE THROUGH A Φ600 PIPE, THEN INTO AN EXISTING Φ1200 PIPE THROUGH THE STAGE 1B DEVELOPMENT SITE DIRECTLY INTO DARLING HARBOUR. OVERLAND FLOW SPLITS AT THE INTERSECTION OF GAS LANE AND JENKINS STREET AND DISCHARGES INTO HICKSON ROAD DRAINAGE.
10	Q_{100} = 1.69	2.29	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE AND THEN DRAINS TO EXISTING STORMWATER SYSTEM, THROUGH THE STAGE 1B DEVELOPMENT SITE.
11	Q_{100} = 0.2	0.182	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE, THEN DRAINS TO EXISTING STORMWATER SYSTEM THROUGH THE STAGE 1B DEVELOPMENT SITE.
12	Q_{100} = 0.2	0.236	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE, THEN DRAINS TO EXISTING STORMWATER SYSTEM THROUGH THE STAGE 1B DEVELOPMENT SITE.

0 20 40 60 80 100m
20 15 10 5
SCALE 1:1000

Key Plan



Rev.	Item	Revision Description	Date
3		ISSUED FOR INFORMATION ONLY	01.09.14
2		ISSUED FOR INFORMATION ONLY	03.09.13
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Design	Lend Lease

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Project: BARANGAROO SOUTH

MP

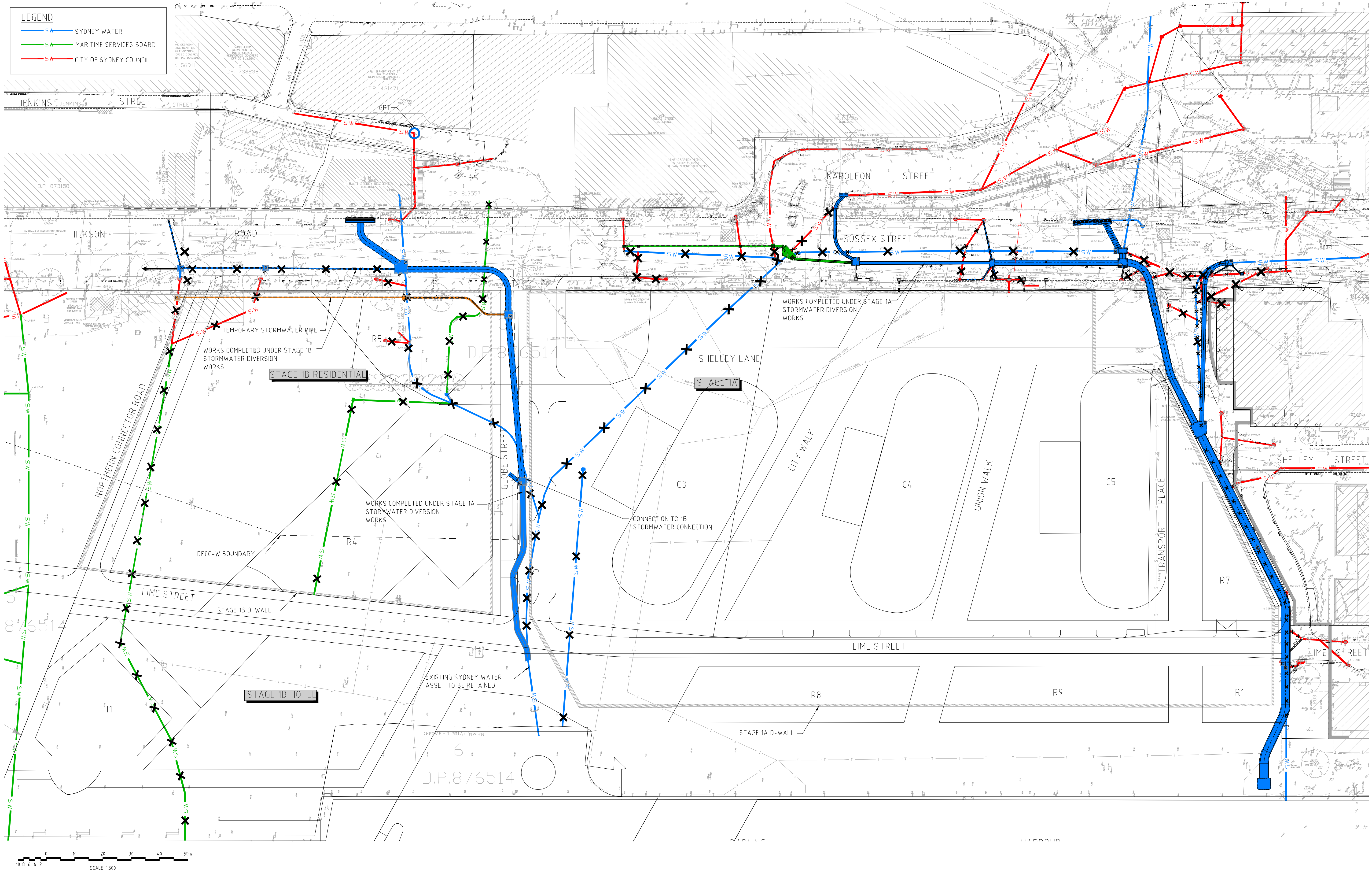
Title: EXTERNAL CATCHMENT PLAN-STAGES 1A AND 1B

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:1000 FOR INFORMATION ONLY

Project No.	Site No. Drawing No.	Revision
161939	NA50613044 - SK014	03

B1



Key Plan

B1

Rev.	Item	Revision Description	Date
5		ISSUED FOR INFORMATION ONLY	16.09.14
4		ISSUED FOR INFORMATION ONLY	12.09.14
3		ISSUED FOR INFORMATION ONLY	10.09.14
2		ISSUED FOR INFORMATION ONLY	01.09.14
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Project: BARANGAROO SOUTH

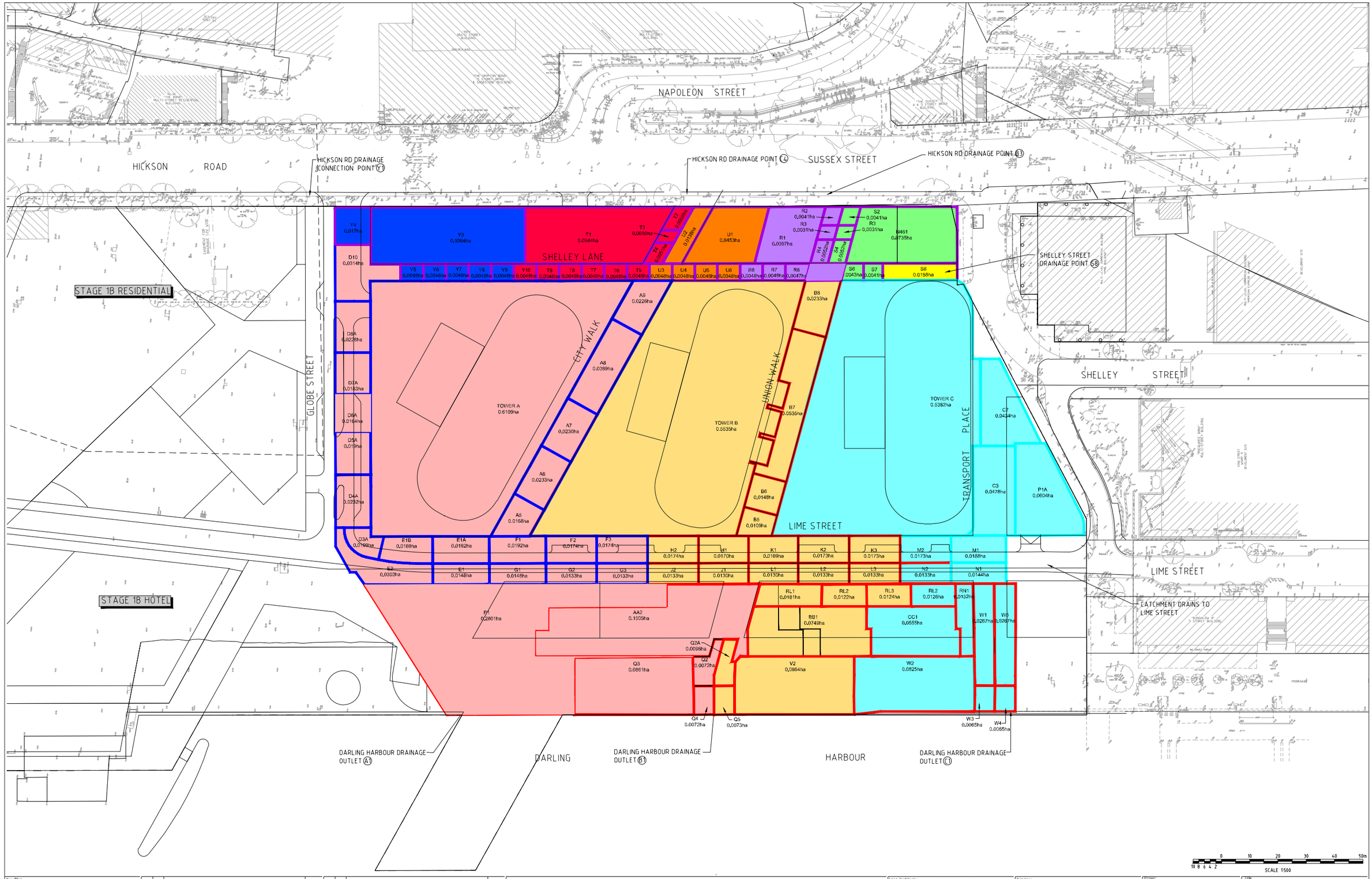
MP

Title: STAGES 1A CONSTRUCTED AND 1B CONCEPT STORMWATER DIVERSIONS

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:500 FOR INFORMATION ONLY

Project No.	Site No. Drawing No.	Revision
161939	NA50613044 - SK015	05



Key Plan

Rev.	Item	Revision Description	Date
2		ISSUED FOR INFORMATION ONLY	01.09.14
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Project: BARANGAROO SOUTH

MP

Title: STAGE 1A INTERNAL CATCHMENT PLAN

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:500 FOR INFORMATION ONLY

Project No.	Site No.	Drawing No.	Revision
161939	NA50613044	SK016	02

B1

LEGEND

CATCHMENT 1 AREA 0.693ha	CATCHMENT 6 AREA 0.300ha
CATCHMENT 2 AREA 0.336ha	CATCHMENT 7 AREA 0.113ha
CATCHMENT 3 AREA 0.169ha	CATCHMENT 8 AREA 0.253ha
CATCHMENT 4 AREA 0.272ha	CATCHMENT 9 AREA 0.176ha
CATCHMENT 5 AREA 0.108ha	CATCHMENT 10 AREA 0.414ha

JENKINS STREET
GAS LANE
HICKSON ROAD
NAPOLEON STREET
SUSSEX STREET
GLOBE STREET
LIME STREET
NORTHERN CONNECTOR ROAD
1B BASEMENT WALL
1B HOTEL BASEMENT WALL
1A BASEMENT WALL
WATERFRONT PROMENADE
DARLING HARBOUR
PROPOSED STAGE 1B EXTERNAL DRAINAGE (TYP)
STAGE 1A
STAGE 1B RESIDENTIAL
CONCEPT STAGE 1B INTERNAL DRAINAGE (TYP)
STAGE 1B HOTEL
STAGE 1B INTERNAL DRAINAGE TO CONNECT INTO EXISTING STORMWATER DRAINAGE NETWORK.
BARANGAROO SOUTH STAGE 1C
BARANGAROO SOUTH STAGE 1B
BARANGAROO SOUTH STAGE 1A
R5
R4
H1
R8
C3
C4
FLOW

SCALE 1:500

Key Plan

Rev.	Item	Revision Description	Date
2		ISSUED FOR INFORMATION ONLY	01.09.14
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Design	Lend Lease

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Project: BARANGAROO SOUTH

MP

Title: STAGE 1B INTERNAL CATCHMENT PLAN

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:500 FOR INFORMATION ONLY

Project No.	Site No. Drawing No.	Revision
161939	NA50613044 - SK017	02

B1

NAPOLEON STREET

HICKSON ROAD

CONNECTION TO SYDNEY WATER DRAINAGE NETWORK

SUSSEX STREET

SHELLEY LANE

R5

STAGE 1B RESIDENTIAL

STAGE 1A

CITY WALK

C3

C4

UNION WALK

C5

TRANSPORT PLACE

SHELLEY STREET

GLOBE STREET

R4

R7

LIME STREET

STAGE 1B D-WALL

LIME STREET

STAGE 1B HOTEL

STAGE 1A D-WALL

R8

R9

R1

CONNECTION TO DARLING HARBOUR

CONNECTION TO DARLING HARBOUR

CONNECTION TO DARLING HARBOUR

DARLING HARBOUR

0 10 20 30 40 50m

10 8 6 4 2

SCALE 1:500

Key Plan

Rev.	Item	Revision Description	Date
2		ISSUED FOR INFORMATION ONLY	01.09.14
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Consultant

Principal: Lend Lease

Developer	Lend Lease
Project Management & Construction	Lend Lease
Design	Lend Lease

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Project: BARANGAROO SOUTH

MP

Title: STAGE 1A INTERNAL STORMWATER DRAINAGE

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:500 FOR INFORMATION ONLY

Project No.	Site No. / Drawing No.	Revision
161939	NA50613044 - SK133	02

B1

NAPOLEON STREET

HICKSON ROAD

CONNECTION TO HICKSON ROAD DRAINAGE NETWORK

HICKSON ROAD DRAINAGE NETWORK

STAGE 1B RESIDENTIAL

R5

SHELLEY LANE

STAGE 1A

NORTHERN CONNECTOR ROAD

GLOBE STREET

CITY WALK

UNION WALK

C3

C4

R4

LIME STREET

CONNECTION TO EXISTING 1800Φ SYDNEY WATER DRAINAGE SYSTEM

STAGE 1B D-WALL

STAGE 1A D-WALL

H1

STAGE 1B HOTEL

R8

EXISTING 600Φ CONNECTION TO DARLING HARBOUR

DARLING

0 10 20 30 40 50m

SCALE 1:500

Key Plan

Rev.	Item	Revision Description	Date
4		ISSUED FOR INFORMATION ONLY	16.09.14
3		ISSUED FOR INFORMATION ONLY	10.09.14
2		ISSUED FOR INFORMATION ONLY	01.09.14
1		ISSUED FOR INFORMATION ONLY	02.09.13

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Consultant: 30 The Bond 30 Hickson Road, Millers Point NSW 2000, www.lendlease.com
Principal: Lend Lease — Developer: Lend Lease; Project Management & Construction: Lend Lease; Design: Lend Lease

Project: BARANGAROO SOUTH

MP

Title: STAGE 1B CONCEPT INTERNAL STORMWATER DRAINAGE

Drawn By	Designed	Checked	Approved By	Date
JB	DW	MKH	MKH	SEP'13

Scale: 1:500 FOR INFORMATION ONLY

Project No.	Site No. Drawing No.	Revision
161939	NA50613044 - SK134	04

B1

Barangaroo South – MOD8 Planning Submission (MP06_0162 MOD8)

B

APPENDIX B – BARANGAROO MASTERPLAN SOUTH CONCEPT PLAN

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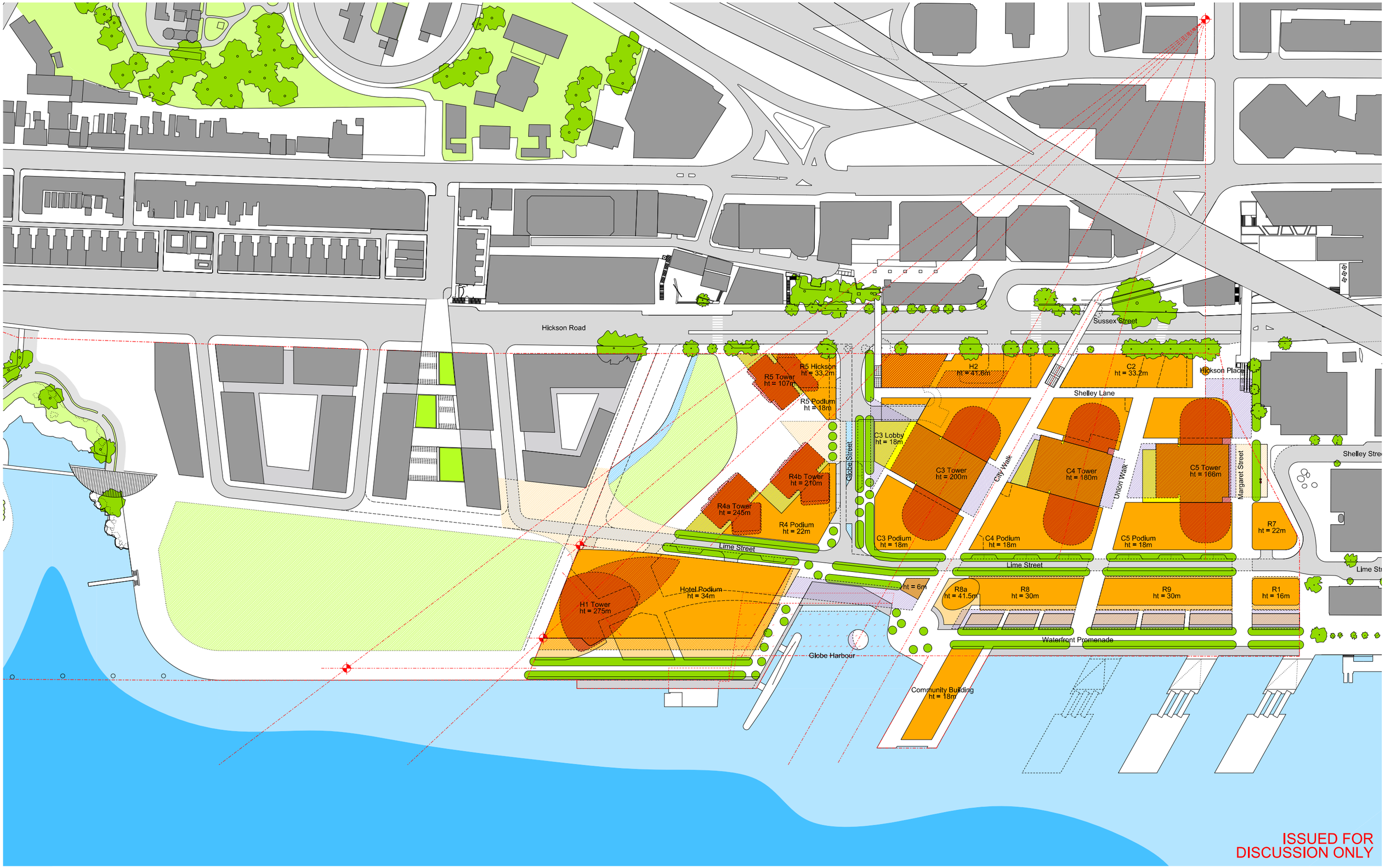

date	revision	date	revision	date	revision	date	revision
13.08.13	D Information for BDA Endorsement	30.09.13	G R4/5 lobby outlines amended	15.10.13	K Masterplan amended	01.11.13	N Globe Street amended
29.08.13	E Information for BDA Endorsement	03.10.13	H Plan amended for approval	16.10.13	L Globe Street + Site Boundary Amended	14.02.14	P Hotel vehicle entry, terrace + balconies amended
19.09.13	F Residential + Globe St amended for approval	10.10.13	J Plan amended for approval	30.10.13	M Masterplan amended	15.02.14	R Hotel truck entry + boundary road provision amended

legend

BUILDING MASS
- Low-Level Building
- Ground Level Outline/Undercut
- Low-Level Balcony/Overhang
- Indicative High-Rise Lobby
- High-Rise Building
- High-Rise Balcony

LANDSCAPE
- Canopy/Pavilion Shelter
- Public Pause/Interpretive Space
- Licensed Terrace Space
- Parkland Landscape
- Water Treatment Landscape
- Indicative Planting Zones

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facsimile +61 (0) 2 9253 5666

Barangaroo Masterplan South Concept Plan

DRAWING TITLE
Barangaroo South Master Plan Diagram

SIZE	SCALE	SKETCH NUMBER	REVISION	DATE
A1	1:1000	BMP-DSK-M8-00-01	R	19-06-2013

Barangaroo South – MOD8 Planning Submission (MP06_0162 MOD8)

C

APPENDIX C – MODIFICATION NO. 8 BLOCK PLAN

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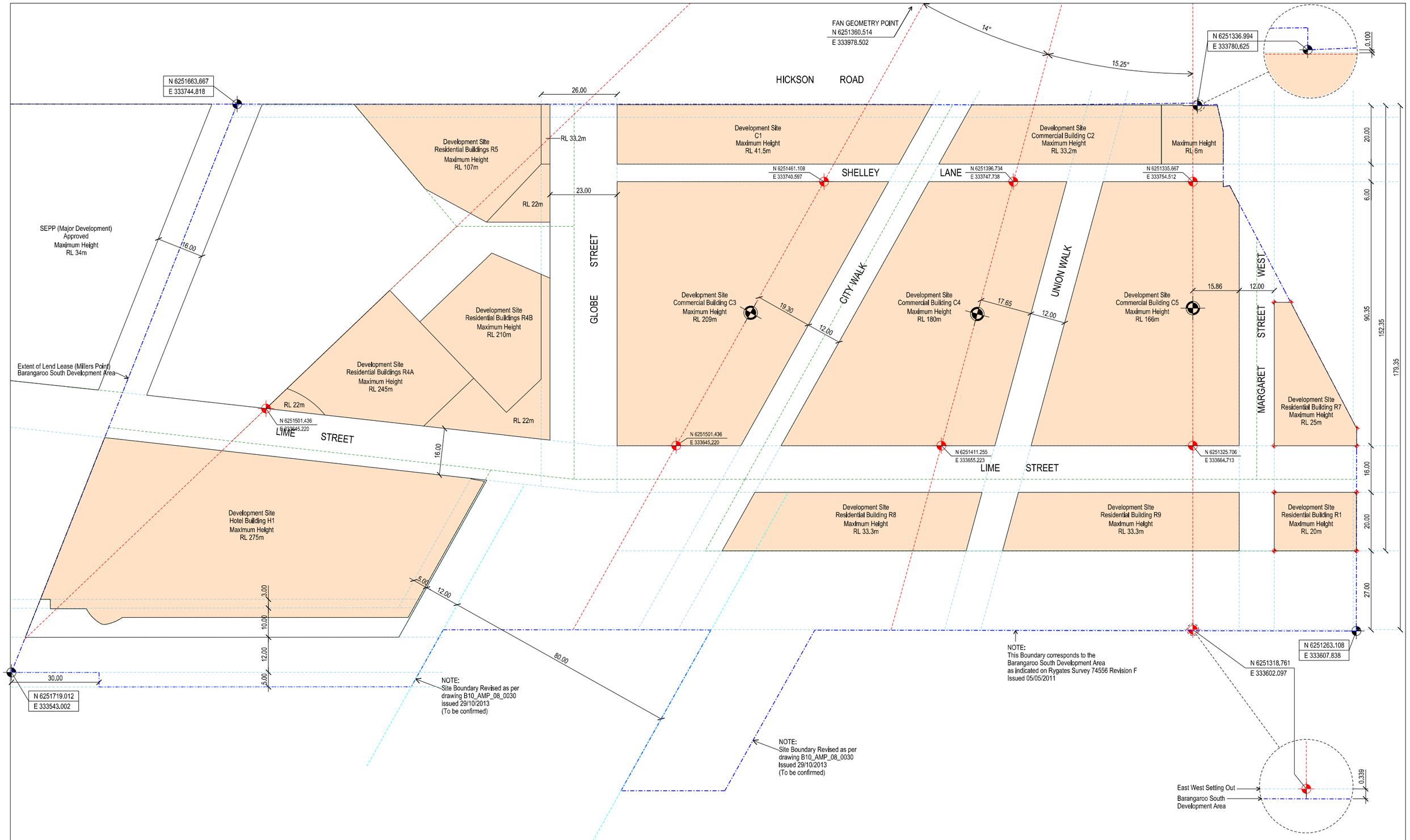

Key Plan

Rev.	Item	Revision Description	Date
	04	ISSUED FOR INFORMATION	18.03.14
	03	ISSUED FOR INFORMATION	16.08.12
	02	ISSUED FOR CONSTRUCTION	16.12.11
	01	ISSUE FOR REVIEW BY PM&C	11.11.11
	00	PRELIMINARY ISSUE	21.10.11

SITE SETOUT LEGEND

- MGA CO-ORDINATE
- RYGATES MGA CO-ORDINATE
- BUILDING CENTROID
- FAN GEOMETRY
- BARANGAROO SOUTH DEVELOPMENT AREA, AS INDICATED ON RYGATES SURVEY 74556 REVISION F ISSUED 05/05/2011

SITE SETOUT NOTES

- COLUMN CENTRES DENOTE BASEMENT COLUMNS
- TOLERANCES AND SETBACKS TO BE ALLOWED FOR WHEN SETTING OUT THE PODIUM FACADES
- PODIUM SETOUT MAY VARY TO DEVELOPMENT SITE SETOUT
- SITE BOUNDARY BASED ON RYGATES SURVEY 74556_REV-F 2011-05-05
- DEVELOPMENT SITES BASED ON RSHP DRAWING B10DD8800150
- TOWER GRID PARALLEL TO FAN GEOMETRY
- ON-STREET PARKING INDICATIVE ONLY

- ***"BUILDING HEIGHT*** (OR ***HEIGHT OF BUILDING***) IS DEFINED AS THE VERTICAL DISTANCE BETWEEN GROUND LEVEL (EXISTING) AND THE HIGHEST POINT OF THE BUILDING, INCLUDING PLANT AND LIFT OVERRUNS, BUT EXCLUDING COMMUNICATION DEVICES, ANTENNAE, SATELLITE DISHES, MASTS, FLAGPOLES, CHIMNEYS, FLUES AND THE LIKE." (AS DEFINED BY NSW LEGISLATION PRINCIPAL LEP)
- **DSB** - DEVELOPMENT SITE BOUNDARY

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Collaborating Architects: Lend Lease — Graham W Jones | Principal Architect FRAIA NSW ARB 4005
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Project Management & Construction — Lend Lease
Design — Lend Lease
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Millers Point NSW 2000
www.lendlease.com

Project: BARANGAROO SOUTH

MP

Title: STAGE 1A + 1B DEVELOPMENT SITES SETTING OUT

Drawn By	Date	Purpose	Approved By	Date
PV	21.10.11	DESIGN		

SCALE 1:500 @ B1 (0, 25, 1:200)

Project No.	Site No.	Drawing No.	Revision
161010	B10	AD0000002	04

B1

If this drawing is printed or plotted at a size other than B1- DO NOT SCALE DIMENSIONS FROM DRAWING. Always take figured dimensions in preference to scaling.