Barangaroo South Stage 1B

Phase 1 Stormwater Diversion Works Civil Engineering Report Modification to Temporary Works

NA50613044

Prepared for
Lendlease Building Pty Ltd

21 September 2016

Cardno
Shaping the Future

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1 Project Appreciation

1.1 Introduction

This Civil Engineering Report concerns proposed changes to the Phase 1 stormwater diversion works of the Barangaroo South Stage 1B development. Construction of new stormwater assets within Hickson Road footpath will be required due to the proposed construction of a four-level basement within Barangaroo South Stage 1B, which is currently being assessed under a separate State Significant Development Application (SSD 6960).

This report has been prepared to support a modification to the approved State Significant Development Application 5897 for the proposed Phase 1 stormwater diversion works. It summarises potential environmental impacts associated with the proposed works and measures to mitigate these impacts.

The subject of the modification is the position of the temporary stormwater line that forms part of the Phase 1 stormwater works. Under the layout currently approved as part of SSD 5897, the temporary stormwater line is designed to be fixed to the inside of the basement perimeter wall. The proposed modification proposes to locate the temporary stormwater line in the western footpath of Hickson Road.

1.2 Background

In order to accommodate remediation of the Stage 1B development site and construction of the proposed Stage 1B basement (both subject to separate applications), it is proposed to divert existing stormwater drainage that currently traverses the Barangaroo South Stage 1B site area to the south of the proposed Stage 1B basement and north of the recently constructed Stage 1A basement. The proposed stormwater diversion works will be constructed in two phases:

Phase 1: Construction of two sections of stormwater lines within the Barangaroo South Stage 1B development site (works approved under SSD 5897):

a. A permanent 1350mm diameter reinforced concrete pipe (RCP) which will be constructed between the eastern boundary of Stage 1B and an existing stormwater pit (Pit A6) within the development site (as approved under SSD 5897).

b. A temporary stormwater line, being one of the following two options:

   (i) The currently approved work under SSD 5897, being a polyethylene (PE) pipe that will generally be attached to and supported from the eastern perimeter retention wall (PRW); or

   (ii) A proposed alternative option, being polyvinyl chloride (PVC) stormwater pipes that would be installed within the western footpath of Hickson Road (the subject of this report and Section 96(2) application); and,

Phase 2: Construction of permanent stormwater pipes within the Hickson Road road reserve (the subject of a separate Part 5 application).

The proposed alternative design of the temporary Phase 1 works within the western Hickson Road footpath, which is the subject of this Section 96(2) application, is shown on drawing TP-020 contained within **Appendix A**.

1.3 Site Description

Barangaroo is located on the north-western edge of the Sydney Central Business District (CBD), bound 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 bounded to the south by a range of new development dominated by large CBD commercial tenants.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – Barangaroo Reserve, Central Barangaroo and Barangaroo South.

The site area for the proposed works is located within the Hickson Road road reserve and is adjacent to Stage 1B of the Barangaroo South development site as shown in **Figure 1-1**.

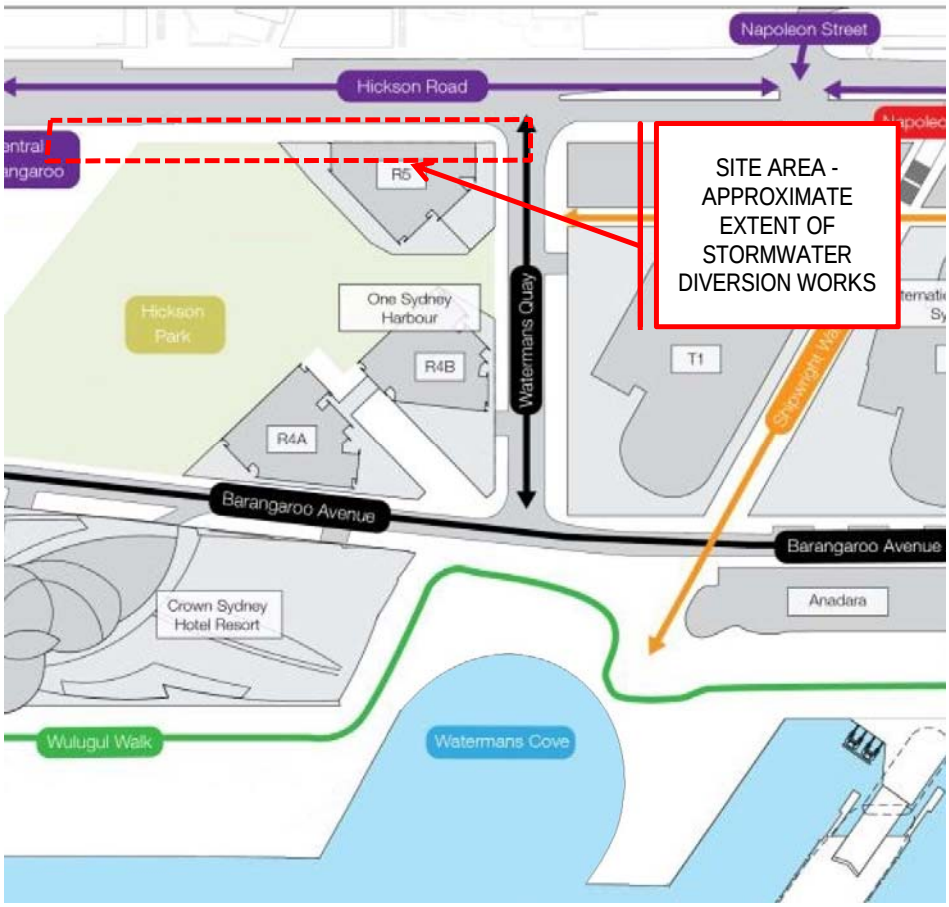

Figure 1-1 Phase 1 Stormwater Diversion Works Site Location Plan

1.4 Relevant Documents

The following reports and documents shall be read in conjunction with this report:

1. Site Survey Plan showing detail, level and services along Hickson Road (Rygate & Company, June 2016), contained in **Appendix B**.
2. *Barangaroo Stage 1B - Stormwater Drain; Assessment of Geotechnical Conditions – Revised Report* (Coffey Geotechnics, 8 May 2014).
3. *Barangaroo South Stage 1B Potholing and Service Investigation* (Christie Civil, undated).
4. *Barangaroo South Flood Study* (Ref No. 15-0132), (Cardno, March 2015).

2 Project Description

2.1 Existing Stormwater Assets

Located towards both the northern and southern extents of the Stage 1B site is a series of existing trunk stormwater drainage pipes currently under the ownership of Sydney Water, NSW Roads and Maritime Services (RMS) and City of Sydney Council. These pipes range from 300mm to 1200mm in diameter. Due to the alignment of these pipes being within the extent of the basement footprint, they will need to be diverted around the proposed Stage 1B basement, which will be constructed as part of the Barangaroo South development.

Sag points are present adjacent to 30 Hickson Road ('The Bond') and 38 Hickson Road. A significant surface water drainage catchment is present east of The Bond in the direction of Gas Lane and Jenkins Street (refer to drawing TP-050 included in **Appendix A**).

Background information gathered from discussion with Sydney Water suggests the estimated capacity of existing piped trunk drainage systems to be between the 2 and 5 year ARI storm events. As a comparison, Council's drainage design guidelines contained within the document titled *Sydney Streets Technical Specifications* (City of Sydney, 2015) specifies that minor drainage systems (i.e. pit and pipe networks) be designed for a 20 year ARI design storm.

2.2 Proposed Stormwater Drainage Design

A concept design for the proposed Stage 1B Phase 1 diversion has been submitted to the BDA and Sydney Water for their review and acceptance. Detailed design plans for the original alignment were subsequently prepared, submitted and approved by Sydney Water. Sydney Water's Job Specific Letter for the Phase 1 stormwater works is included in **Appendix C**.

The proposed finished ground levels within the Stage 1B development are such that the existing overland flow paths through the site will be obstructed. Therefore, the design of the proposed stormwater diversions as shown on the drawings contained in **Appendix A** is to provide a stormwater drainage network outside the Stage 1B site, with the specific purpose of providing an interim operation until such a time as the Phase 2 works are complete. This will include a pit and pipe network together with maintaining overland flow paths north along Hickson Road and towards Central Barangaroo. This network will include grated surface inlet pits in Hickson Road, which form part of the proposed Activity, to capture and divert overland flow around Stage 1B and ultimately into Darling Harbour.

The intent of the proposed stormwater diversion works is to manage the impact of the development on the external stormwater drainage network and to ensure no net increase in flood levels along Hickson Road. These impacts may arise due to the following design aspects of the Stage 1B development:

1. Raising the finished ground levels within Stage 1B by approximately 900mm to mitigate potential impacts associated with future sea level rise; and
2. The location of the Stage 1B basement conflicting with the alignment of existing stormwater assets that traverse the Stage 1B site.

Modifications to the detailed design and construction documentation will be subject to approval by Sydney Water.

2.3 Proposed Scope of Work

As shown on the drawings contained in **Appendix A**, the scope of the proposed Phase 1 stormwater diversion works will consist of the construction of approximately 66 metres of DN1350 RCP within the Stage 1B development site (to be owned by Sydney Water). This section is unchanged to the design documented in the drawings that form part of the current approval under SSD 5897:

2.3.1 Temporary Stormwater Diversion Option 1

The scope of temporary stormwater diversion work that is currently approved under SSD 5897 includes the following:

- Installation of approximately 40 metres of twin parallel DN630 PE pipes, which would be attached to and supported from the eastern PRW;
- Installation of approximately 80 metres of DN355 PE pipes, which would be attached to and supported from the eastern PRW;
- Construction of temporary stormwater junction pits within the extent of the remediation works.

2.3.2 Temporary Stormwater Diversion Option 2

This Section 96(2) application proposes an alternative option for the temporary stormwater diversion works, which would consist of the following work:

- Excavation for proposed stormwater pits, pipes and culverts, including demolition of part of the existing western footpath.
- Construction of stormwater pits, pipes and culverts, including:
    - Approximately 40 metres of DN900 PVC within the footpath on the western side of Hickson Road.
    - Approximately 81 metres of DN300 PVC within the footpath on the western side of Hickson Road.
    - Connection of a number of existing stormwater pits and pipes to the proposed stormwater diversion works, including a Sydney Water sewer overflow.
- Reinstatement of footpath along Hickson Road.

The intent of this Section 96(2) application is to seek approval for the scope of temporary stormwater diversion works described above as an alternative option to the currently approved scope of work.

3 Stormwater Drainage Design

3.1 External Catchments

Delineation of catchments that drain towards the Barangaroo South Stage 1B development site has been undertaken based on NSW Land & Property Information contour data, detailed ground survey, site inspections and ALS data. The external catchment area draining to the Stage 1B development site is approximately 5.3 ha. Drawing TP-050 contained in **Appendix A** presents the extent of external sub-catchment areas adjacent to Stage 1B. Details of the catchments are as follows:

a. **Catchment 1:** This catchment has a total area of approximately 2.83 ha that discharges into Gas Lane and Jenkins Street through a 600mm diameter pipe and a 750mm diameter pipe and then into an existing 1200mm diameter pipe that traverses the Stage 1B Residential development site prior to ultimately discharging directly into Darling Harbour.

b. **Catchment 2:** This catchment has a total area of approximately 2.29 ha that discharges into the existing Hickson Road stormwater drainage network prior to ultimately discharging into Darling Harbour through a series of varying diameter pipes traversing the Stage 1B Residential development site.

c. **Catchment 3:** This catchment has a total area of approximately 0.18 ha that discharges into the stormwater diversion works that were constructed within Hickson Road and Watermans Quay as part of the Stage 1A works, which included grated surface inlet pits on the southern side of Watermans Quay and 2x225mm diameter stormwater lines that connects to the existing 1800mm diameter stormwater line adjacent to Watermans Quay.

Flow in excess of the capacity of existing stormwater drainage infrastructure within Catchments 1 and 2 (which are external to Barangaroo South Stage 1B) discharge towards both the Stage 1B and Central Barangaroo sites as overland flow. As the proposed Stage 1B development will restrict the passage of overland flow from these external catchments through the Stage 1B site, infrastructure to capture and convey overland flow will be required in order to ensure no increase in overland flow towards Central Barangaroo as a result of the development of Stage 1B. This infrastructure is proposed to be constructed under the proposed Part 5 Activity, with temporary works constructed under the Part 4 activity.

3.2 Overland Flow and Flooding

3.2.1 Historical Flood Data

Detailed ground survey and site inspections have been used to define existing overland flow paths adjacent to Barangaroo South.

City of Sydney 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 have occurred within the bounds of Hickson Road adjacent to Barangaroo South.

Anecdotes from occupants of the commercial building at 30 Hickson Road (The Bond) and residential building at 38 Hickson Road suggest that in March 2006, flooding of the buildings occurred to a depth of approximately 20mm after over 100mm of rainfall fell in the Sydney CBD over a 24 hour period. This storm event was estimated to have had an average recurrence interval (ARI) of between 2 and 5 years.

3.2.2 Pre-Development Overland Flow Paths

Prominent overland flow paths adjacent to Stage 1B are described as follows:

a. **Catchment 1:**

   i. Overland flow splits at the intersection of Gas Lane and Jenkins Street with the majority of the flow diverting to the north between 30 Hickson Road (The Bond) and 34 Hickson Road, prior to entering the existing Hickson Road subsurface stormwater drainage network.

b. Catchment 2:

i. North and South on Hickson Road towards an existing low point generally located in front of "The Bond";

ii. North towards the Central Barangaroo development site; and

iii. Through the Stage 1B development site.

3.2.3 Impact of Proposed Stage 1B Development

The key changes to overland flow paths and effects on existing stormwater infrastructure as a result of the future development of the Stage 1B Public Domain will be 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 Stage 1B basement footprint;

b. The Sydney Harbour Foreshores and Waterways Area DCP 2005 requires that where seawalls are permitted, the top of the seawall should be 2.6 metres above the Zero Fort Denison Tide Gauge (ZFDTG), which is equivalent to 1.675 mAHD. In addition to the minimum seawall height, City of Sydney's *Interim Floodplain Management Policy* (May 2014) requires consideration of the potential impacts of climate change in the assessment of proposed development. Specifically, Council's Policy requires that allowances in the NSW Coastal Planning Guideline: Adapting to Sea Level Rise (August 2010, recently withdrawn from publication) be met, and that an allowance of 0.9 metre sea level rise (SLR) above 2009 mean sea level be considered. This allowance for SLR would require a minimum top of seawall level at 2.575 mAHD. The lowest ground level in Hickson Road adjacent to Stage 1B is approximately 2.40 mAHD, which is lower than the minimum top of seawall level.

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.

Considering existing levels on Hickson Road are lower than the proposed building FFL within the Stage 1B site, it has been proposed to divert overland flow that would have traversed the eastern site boundary of Stage 1B from Hickson Road into an upgraded pit and pipe network within Hickson Road and through the site. This upgraded pit and pipe network will connect to the approved Phase 1 stormwater drainage adjacent to the southern boundary of the Stage 1B development site. No changes to the proposed passage of overland flow to the north of the Stage 1B site (i.e. towards Central Barangaroo) are proposed.

3.3 Design Criteria

In consideration of the impacts of the proposed Stage 1B development on the conveyance of stormwater runoff from the external catchments to the east of Hickson Road, the proposed stormwater diversion works have been designed to meet the following criteria:

a. Ensure no net increase in flood levels along Hickson Road for events up to and including the 100 year ARI flood, particularly adjacent to existing buildings on the eastern side of Hickson Road and to the proposed Stage 1B development on the western side of Hickson Road.

b. Ensure no increase in overland flow north along Hickson Road and towards the future Central Barangaroo development site as a result of the Stage 1B development for events up to and including the 100 year ARI flood.

The required capacity of the proposed pit and pipe network has been determined based on outputs from DRAINS and TUFLOW modelling, the results of which are presented in the *Barangaroo South Flood Study* (Cardno, March 2015).

3.4 Design Standards

The proposed stormwater diversion works will be designed generally in accordance with the following standards and guidelines:

a. *Australian Rainfall and Runoff Volume 1 and 2, 1997*;

b. *NSW Floodplain Development Manual 2005*;

c. City of Sydney's *Interim Floodplain Management Policy* (May 2014);

d. City of Sydney's *Sydney Streets Technical Specifications*, in particular Section A4 (Drainage Design);

e. Any other applicable City of Sydney design standards, guidelines and policies;

f. Sydney Water's design requirements;

g. *Sydney Harbour Foreshores and Waterways Area Development Control Plan 2005*;

h. *AS3500 – Stormwater and Drainage Design codes*;

i. *AS3725 – Loads on Buried Concrete Pipes*;

4 Stormwater Drainage Construction

4.1 Construction Environmental Management Plan

It is understood a Construction Environmental Management Plan (CEMP) has been prepared by Lendlease Project Management and Construction (LLPMC) to document potential environmental impacts and mitigation measures associated with the proposed stormwater diversion works. In addition, the requirements of an agreed and approved Remediation Action Plan (RAP) will be implemented throughout the construction of the proposed temporary stormwater diversion works.

4.2 Erosion and Sediment Control

As part of the proposed works, erosion and sedimentation controls will be designed prior to commencement of construction works. All erosion and sediment control measures will be installed and maintained throughout the duration of construction works in accordance with *Managing Urban Stormwater - Soils & Construction Volume 1* (Landcom, 2004). The requirements for erosion and sediment control measures have been outlined in a CEMP for the proposed works.

Prior to any excavation commencing on site, all erosion and sediment control measures will need to be implemented. These measures shall generally include, as necessary:

- Installation of truck wash down facilities at entry and exit points associated with the extent of work;
- Installation of sediment fencing around disturbed areas, including any stockpiled topsoil; and
- Placement of geotextile bags filled with sand and/or gravel around and along existing and proposed catch drains and stormwater drainage pits;

All erosion and sediment control measures will be inspected at regular intervals to ensure they are operating as planned and intended.

In order to minimise the volume of polluted stormwater runoff generated by site works, stormwater within and adjacent to the extent of work will generally be managed by diverting clean rainfall and runoff from any disturbed areas. Measures that will be implemented to prevent the ingress of surface water runoff into excavation areas include bunds, silt fences and drainage diversions. Clean water will be diverted north along Hickson Road where it will discharge into one of the existing stormwater pits on Hickson Road that drain to existing stormwater lines that traverse the Central Barangaroo development site.

In accordance with the Remediation Action Plan (RAP) that will be implemented for the remediation of Hickson Road, the preferred hierarchy for management of water onsite is as follows:

- Minimising the volume of contaminated water during the works wherever possible by directing surface water away from excavations, depressions, pits and stockpiles by the construction of drainage works such as bunds and diversion drains. Sediment basin(s) may be employed as deemed necessary for the collection of surface water for maintenance of water quality and/or re-use;
- Recycling water, where possible, by reusing on site as dust suppression or for other site operations including wheel washing and truck washing subject to suitable treatment measures; and
- Discharging to the adjacent stormwater drainage network via overland flow or formal reticulation or to sewer, with or without treatment, will be as per regulatory guidelines and in accordance with the licensed discharge for the works.

Groundwater encountered during trench excavation will require management in conjunction with surface water management. Where required, groundwater control walls will be installed to minimise groundwater infiltration into excavations. Dewatering and control of groundwater seepages will also be required. Groundwater collected from the excavations will be transferred to an on-site water treatment plant that will be constructed as part of the Stage 1B basement works. Trade waste applications will be negotiated with Sydney Water as appropriate. If required, limited contaminated water may be disposed off-site with use of truck tankers. Handling and disposal of contaminated liquids will be addressed in the CEMP.

Surface and groundwater management structures will be frequently monitored in accordance with the CEMP for the proposed works.

4.3 Utility Service Coordination

The extent of works contains a number of existing utility services including stormwater pipes, water mains, sewerage lines, gas mains, telecommunication cables and conduits and in-ground electrical cables and conduits. Existing services are shown on drawing TP-020 included in **Appendix A**.

All service lines would be located and protected by barriers for the duration of the construction works and appropriately marked with the correct services tape.

Excavation near services would be performed with extreme care, using site personnel observing the excavation process to ensure no services are uncovered or damaged.

All duty of care as required by the utility authorities would be adhered to and the relevant authorities would be contacted prior to any construction activities taking place on site.

If any utility services are damaged during the works they would be reinstated or repaired in accordance with service authority requirements.

4.4 Tree Removal

An Arboricultural Impact Assessment has been prepared as part of State Significant Development Application SSD6960. This Assessment identifies the trees within Hickson Road to be retained and removed. Reference is made to this report for further information. No additional trees are proposed to be removed as part of this application.

4.5 Surface Restoration Works

The proposed works will involve demolition of existing footpaths and may involve demolition of some sections of kerb and gutter.

All road pavements and kerb and gutter will need to be reinstated in accordance with City of Sydney requirements.

5 Conclusion

This Civil Engineering Report has been prepared to support the proposed construction of Phase 1 stormwater diversion works within Hickson Road associated with the Barangaroo South Stage 1B development. It has been prepared to propose an additional option for the temporary stormwater diversion works, which would involve work within the footpath of Hickson Road as opposed to the currently approved alignment of the temporary stormwater line that would be attached to the perimeter retention wall.

The completed design of the proposed Phase 1 stormwater diversion works within Hickson Road will satisfy the design criteria of ensuring no adverse impact on stormwater characteristics within the area and will operate for the period until the Phase 2 stormwater works are completed.

Phase 1 Stormwater Diversion Works
Civil Engineering Report Modification
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APPENDIX A

DESIGN DRAWINGS

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PHASE 1 STORMWATER DIVERSION WORKS

(SUBJECT OF THIS REPORT AND PROPOSED PART 4 ACTIVITY)

NA50613044-TP-001 NOTES AND LEGENDS
NA50613044-TP-020 STORMWATER DIVERSION WORKS DRAINAGE PLAN SHEET 1
NA50613044-TP-030 STORMWATER AND EXISTING SERVICES LONGITUDINAL SECTION
NA50613044-TP-035 SITE CROSS SECTIONS
NA50613044-TP-050 CATCHMENT PLAN

A1

FILE LOCATION: NA50613044_Barangaroo Stage1B *DESIGNED:* PAK LAU *DRAFTED:* JOSHUA BEZZINA *VERIFIED:* MICHAEL HODGES *REVIEWED:* MICHAEL HODGES *APPROVED:* MICHAEL HODGES *ISSUED:* FEB 2015

DEVELOPER CONTRACT PLAN

EXISTING UNDERGROUND SERVICES NOTES

THE LOCATIONS OF UNDERGROUND SERVICES SHOWN IN THIS SET OF DRAWINGS HAVE BEEN PLOTTED FROM SURVEY INFORMATION AND SERVICE AUTHORITY INFORMATION . THE SERVICE INFORMATION HAS BEEN PREPARED ONLY TO SHOW THE APPROXIMATE POSITIONS OF ANY KNOWN SERVICES AND MAY NOT BE AS CONSTRUCTED OR ACCURATE.CARDNO CAN NOT GUARANTEE THAT THE SERVICES INFORMATION SHOWN ON THESE DRAWINGS ACCURATELY INDICATES THE PRESENCE OR ABSENCE OF SERVICES OR THEIR LOCATION AND WILL ACCEPT NO LIABILITY FOR INACCURACIES IN THE SERVICES INFORMATION SHOWN FROM ANY CAUSE WHATSOEVER.

CONTRACTORS SHALL TAKE DUE CARE WHEN EXCAVATING ONSITE INCLUDING HAND EXCAVATION WHERE NECESSARY.
CONTRACTORS ARE TO CONTACT THE RELEVANT SERVICE AUTHORITY PRIOR TO COMMENCEMENT OF EXCAVATION WORKS. CONTRACTORS ARE TO UNDERTAKE A SERVICES SEARCH, PRIOR TO COMMENCEMENT OF WORKS ON SITE. SEARCH RESULTS ARE TO BE KEPT ON SITE AT ALL TIMES.

TELSTRA - DUTY OF CARE NOTE

TELSTRA'S PLANS SHOW ONLY THE PRESENCE OF CABLES AND PLANT. THEY ONLY SHOW THEIR POSITION RELATIVE TO ROAD BOUNDARIES, PROPERTY FENCES ETC. AT THE TIME OF INSTALLATION AND TELSTRA DOES NOT WARRANT OR HOLD OUT THAT SUCH PLANS ARE ACCURATE THEREAFTER DUE TO CHANGES THAT MAY OCCUR OVER TIME. DO NOT ASSUME DEPTH OR ALIGNMENT OF CABLES OR PLANT AS THESE VARY SIGNIFICANTLY. THE CONTRACTOR HAS A DUTY OF CARE WHEN EXCAVATING NEAR TELSTRA CABLES AND PLANT.
BEFORE USING MACHINE EXCAVATORS TELSTRA PLANT MUST FIRST BE PHYSICALLY EXPOSED BY SOFT DIG POTHOLING TO IDENTIFY IT'S LOCATION TELSTRA WILL SEEK COMPENSATION FOR DAMAGES CAUSED TO IT'S PROPERTY AND LOSSES CAUSED TO TELSTRA AND IT'S CUSTOMERS.

SURVEY NOTES

THE EXISTING SITE CONDITIONS SHOWN ON THE FOLLOWING DRAWINGS HAVE BEEN INVESTIGATED BY RYGATE & COMPANY PTY. LIMITED, BEING REGISTERED SURVEYORS. EXISTING STORMWATER DRAINAGE SYSTEM ALIGNMENT AND LEVELS HAVE BEEN ADOPTED FROM THE SURVEY INFORMATION PROVIDED BY RYGATE & COMPANY PTY LTD AS INDICATED ON DRAWINGS 74878 SHEET 2 OF 6 AND SHEET 6 OF 6 DATED 6/7/2011. THE INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. CARDNO DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS.
SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT CARDNO. THE FOLLOWING NOTES HAVE BEEN TAKEN DIRECTLY FROM THE ORIGINAL SURVEY DOCUMENTS.

LEGEND

- ELECTRICITY PIT
- ELEC POLE WITH LIGHT
- ELECTRICITY POLE
- LIGHT POLE
- TRAFFIC SIGNAL
- GAS METER
- GAS VALVE
- POLE (UNSPECIFIED)
- PIT (UNSPECIFIED)
- MANHOLE (UNSPECIFIED)
- TELECOM PIT
- TELECOM PILLAR
- WATER METER
- WATER VALVE
- STOP VALVE
- HYDRANT
- STORMWATER GRATE
- STORMWATER MANHOLE
- STORMWATER PIT
- SEWER PIT
- SEWER MANHOLE
- SEWER MANHOLE
- BOLLARD
- SIGN

- E — UNDERGROUND ELECTRICITY
- E — OVERHEAD POWER LINES
- G — UNDERGROUND GAS
- S — UNDERGROUND SEWER
- UNDERGROUND STORMWATER PIPE
- SW — UNDERGROUND STORMWATER
- W — UNDERGROUND WATER SUPPLY
- T — TELECOMMUNICATIONS

EXISTING STORMWATER ASSET LEGEND

- SYDNEY WATER STORMWATER ASSET
- NSW ROAD AND MARITIME SERVICES
- CITY OF SYDNEY COUNCIL STORMWATER ASSET
- EXISTING ASSET TO BE REMOVED.

PROPOSED STORMWATER ASSET LEGEND

- PROPOSED PERMANENT SYDNEY WATER ASSET
- PROPOSED TEMPORARY STORMWATER ASSET
- PROPOSED CITY OF SYDNEY STORMWATER ASSET

GENERAL

1. ALL WORKS SHALL BE CONSTRUCTED TO THE SATISFACTION OF SYDNEY WATER.
2. 33Kv AND 11Kv ELECTRICAL CABLES EXIST WITHIN HICKSON ROAD. THE CONTRACTOR MUST UNDERTAKE A SERVICES SEARCH PRIOR TO COMMENCEMENT OF WORKS AND PREPARE A WORK METHOD STATEMENT DETAILING THE METHODOLOGY FOR WORKING ADJACENT TO AND UNDER EXISTING ELECTRICAL CABLES. EXTREME CARE SHALL BE USED DURING EXCAVATION WORKS INCLUDING IF CONSIDERED NECESSARY, LIMITED AREAS OF HAND EXCAVATION TO EXPOSE EXISTING CONDUITS AND ENCASEMENT TO ENSURE A SAFE WORK ENVIRONMENT.
3. MAJOR COMMUNICATIONS, WATER AND SEWER SERVICES EXIST WITHIN HICKSON ROAD. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND OR SUPPORTING STRUCTURES REQUIRED DURING CONSTRUCTION.
4. EXISTING SEWER AND WATER SERVICES TO BE ADJUSTED AND RELOCATED ARE SUBJECT TO A SEPARATE APPROVAL.
5. AT THE COMPLETION OF THE DRAINAGE WORKS, ALL DISTURBED ZONES INCLUDING ROAD PAVEMENTS, KERBS AND FOOTPATHS SHALL BE REINSTATED TO MATCH EXISTING ADJACENT MATERIALS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF ALL SERVICES TO BE RELOCATED, ADJUSTED OR PROTECTED.

EROSION AND SEDIMENT CONTROL NOTES

GENERAL INSTRUCTIONS

1. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CONTROL OF EROSION AND SEDIMENTATION TO THE SATISFACTION OF COUNCIL, ENVIRONMENTAL PROTECTION AUTHORITY (EPA), AND THE SUPERINTENDENT. TO THIS END, THE EROSION AND SEDIMENTATION CONTROLS SHOWN ON THE DRAWINGS SHALL ONLY BE USED AS A GUIDE BY THE CONTRACTOR, AND SHALL REPRESENT THE MINIMUM REQUIREMENT ONLY.

2. THE CONTRACTOR SHALL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS DOCUMENTED OR AS OTHERWISE DIRECTED BY THE SUPERINTENDENT.

3. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH

(a) LOCAL AUTHORITY REQUIREMENTS

(b) EPA REQUIREMENTS

(c) NSW DEPARTMENT OF HOUSING MANUAL "MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004.

4. MAINTAIN THE EROSION CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.

5. WHEN STORMWATER PITS ARE CONSTRUCTED, PREVENT SITE RUNOFF ENTERING UNLESS SEDIMENT FENCES ARE ERECTED AROUND PITS.

6. CONTRACTOR IS TO ENSURE ALL EROSION & SEDIMENT CONTROL DEVICES ARE MAINTAINED IN GOOD WORKING ORDER AND OPERATE EFFECTIVELY. REPAIRS AND OR MAINTENANCE SHALL BE UNDERTAKEN AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.

LAND DISTURBANCE

7. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE SHALL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:

(a) INSTALL A SEDIMENT FENCE ALONG THE BOUNDARIES REFER DETAIL.

(b) CONSTRUCT STABILISED CONSTRUCTION ENTRANCE TO LOCATION AS DETERMINED BY SUPERINTENDENT/ENGINEER. REFER DETAIL.

(c) UNDERTAKE SITE DEVELOPMENT WORKS IN ACCORDANCE WITH THE ENGINEERING PLANS. WHERE POSSIBLE, PHASE DEVELOPMENT SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF WORKABLE SIZE.

EROSION CONTROL

8. DURING WINDY WEATHER, LARGE, UNPROTECTED AREAS SHALL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.

9. FINAL SITE LANDSCAPING SHALL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 20 WORKING DAYS FROM COMPLETION OF CONSTRUCTION ACTIVITIES.

SEDIMENT CONTROL

10. STOCKPILES SHALL NOT BE LOCATED WITHIN 2 METRES OF HAZARD AREAS, INCLUDING LIKELY AREAS OF CONCENTRATED OR HIGH VELOCITY FLOWS SUCH AS WATERWAYS. WHERE THEY ARE BETWEEN 2 AND 5 METRES FROM SUCH AREAS, SPECIAL SEDIMENT CONTROL MEASURES SHOULD BE TAKEN TO MINIMISE POSSIBLE POLLUTION TO DOWNSLOPE WATERS, E.G. THROUGH INSTALLATION OF SEDIMENT FENCING.

11. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) SHALL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.

12. WATER SHALL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS IT IS RELATIVELY SEDIMENT FREE, I.E. THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED THROUGH AN APPROVED STRUCTURE.

OTHER MATTERS

13. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES SHALL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE REHABILITATED.

14. ACCEPTABLE RECEPTORS SHALL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER.

15. ANY EXISTING TREES WHICH FORM PART OF THE FINAL LANDSCAPING PLAN SHALL BE PROTECTED FROM CONSTRUCTION ACTIVITIES BY:

(a) PROTECTING THEM WITH BARRIER FENCING OR SIMILAR MATERIALS INSTALLED OUTSIDE THE DRIP LINE

(b) ENSURING THAT NOTHING IS NAILED TO THEM

(c) PROHIBITING PAVING, GRADING, SEDIMENT WASH OR PLACING OF STOCKPILES WITHIN THE DRIP LINE EXCEPT UNDER THE FOLLOWING CONDITIONS.

(I) ENCROACHMENT ONLY OCCURS ON ONE SIDE AND NO CLOSER TO THE TRUNK THAN EITHER 1.5 METRES OR HALF THE DISTANCE BETWEEN THE OUTER EDGE OF THE DRIP LINE AND THE TRUNK, WHICH EVER IS THE GREATER.

(II) A DRAINAGE SYSTEM THAT ALLOWS AIR AND WATER TO CIRCULATE THROUGH THE ROOT ZONE (E.G. A GRAVEL BED) IS PLACED UNDER ALL FILL LAYERS OF MORE THAN 300 MILLIMETRES DEPTH.

(III) CARE IS TAKEN NOT TO CUT ROOTS UNNECESSARILY NOR TO COMPACT THE SOIL AROUND THEM.

PERMANENT CONCRETE NOTES

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 CURRENT EDITION WITH AMENDMENTS, EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS.
2. CONCRETE QUALITY
ALL REQUIREMENTS OF THE CURRENT ACSE CONCRETE SPECIFICATION DOCUMENT 1 SHALL APPLY TO THE FORMWORK, REINFORCEMENT AND CONCRETE UNLESS NOTED OTHERWISE.
3. CONCRETE MIX: PRECAST CULVERT
   - CEMENT SHALL COMPLY WITH AS3972, TYPE GB SIMILAR TO BLUE CIRCLE MARINE CEMENT
   - SLAG CONTENT =65%
   - MINIMUM CHARACTERISTIC STRENGTH = 65MPa
   - MAXIMUM WATER / CEMENT RATIO = 0.33
   - MINIMUM CONTENT = 550kg/m^3
   - DRYING SHRINKAGE AT 56 DAYS NOT GREATER THAN 600 MICROSTRAIN IN ACCORDANCE WITH AS1012.13
   - MAXIMUM DIFFUSION COEFFICIENT 2.5 x 10_{-12} m^2/s
   - COVER 70mm INTERNAL AND 60mm EXTERNAL
4. CONCRETE MIX: CAST IN-SITU CONCRETE ELEMENT
   - CEMENT SHALL COMPLY WITH AS3972, TYPE GB SIMILAR TO BLUE CIRCLE MARINE CEMENT
   - SLAG CONTENT =65%
   - MINIMUM CHARACTERISTIC STRENGTH = 65MPa
   - MAXIMUM WATER / CEMENT RATIO = 0.33
   - MINIMUM CONTENT = 550kg/m^3
   - DRYING SHRINKAGE AT 56 DAYS NOT GREATER THAN 600 MICROSTRAIN IN ACCORDANCE WITH AS1012.13
   - MAXIMUM DIFFUSION COEFFICIENT 2.5 x 10 m^2/s
   - COVER 70mm INTERNAL AND EXTERNAL -12
5. NO ADMIXTURES SHALL BE USED IN CONCRETE UNLESS APPROVED IN WRITING BY CARDNO.
6. ALL REINFORCEMENT SHALL BE FIRMLY SUPPORTED ON MILD STEEL PLASTIC TIPPED CHAIRS, PLASTIC CHAIRS OR CONCRETE CHAIRS AT NOT GREATER THAN 1m CENTRES BOTH WAYS. BARS SHALL BE TIED AT ALTERNATE INTERSECTIONS.
7. THE FINISHED CONCRETE SHALL BE A DENSE HOMOGENEOUS MASS, COMPLETELY FILLING THE FORMWORK, THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS. ALL CONCRETE INCLUDING SLABS ON GROUND AND FOOTINGS SHALL BE COMPACTED AND CURED IN ACCORDANCE WITH SYDNEY WATER TECHNICAL SPECIFICATION (CIVIL WORKS) ITEM C3.11.
8. REINFORCEMENT SYMBOLS:
N DENOTES GRADE 450 N BARS TO AS 1302 GRADE N
R DENOTES 230 R HOT ROLLED PLAIN BARS TO AS 1302
SL DENOTES HARD-DRAWN WIRE REINFORCING FABRIC TO AS 1304
NUMBER OF BARS IN GROUP — BAR GRADE AND TYPE
17 N 20 250
NOMINAL BAR SIZE IN mm — SPACING IN mm THE FIGURE
FOLLOWING THE FABRIC SYMBOL SL IS THE REFERANCE NUMBER FOR FABRIC TO AS 1304.
9. FABRIC SHALL BE LAPPED IN ACCORDANCE WITH THE FOLLOWING DETAIL:
25 MIN — LAP TWO WIRES
10. CONCRETE TRIAL MIX AND QUALITY CONTROL DURING CONSTRUCTION TO BE IN ACCORDANCE WITH MAHAFFEY ASSOCIATES REPORT SR10184C
11. REINFORCEMENT TO BE PLAIN MILD STEEL FOR ALL ITEMS EXCEPT PRECAST CULVERT ELEMENTS. PRECAST CULVERT ELEMENT REINFORCEMENT TO BE GALVANISED MILD STEEL TO COATING DEPTH OF 84 MICRON AND MASS OF 600g/m2

SITEWORKS NOTES

1. ORIGIN OF LEVELS:- SYDNEY WATER DATUM +20m AHD.
2. CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORK. ANY DISCREPANCIES TO BE REPORTED TO CARDNO.
3. MAKE SMOOTH CONNECTION WITH EXISTING WORKS.
4. ALL TRENCHES SHALL BE BACKFILLED WITH SAND TO 300mm ABOVE PIPE. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH STABILISED SAND OR AN APPROVED GRANULAR MATERIAL COMPACTED IN 150mm LAYERS TO MINIMUM 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. (OR A DENSITY INDEX OF NOT LESS THAN 75).
5. ALL BASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH R.T.A. FORM 3051 AND COMPACTED TO MINIMUM 98% MODIFIED DENSITY IN ACCORDANCE WITH AS 1289 5.2.1
6. ALL SUB-BASE COURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH R.T.A. FORM 3051 TABLE 3051.1 AND COMPACTED TO MINIMUM 95% MODIFIED DENSITY IN ACCORDANCE WITH A.S 1289 5.2.1
7. AS AN ALTERNATIVE TO THE USE OF IGNEOUS ROCK AS A SUB-BASE MATERIAL IN (9) A CERTIFIED RECYCLED CONCRETE MATERIAL COMPLYING WITH R.T.A. FORM 3051 TABLE 3051.1 WILL BE CONSIDERED. SUBJECT TO MATERIAL SAMPLES AND APPROPRIATE CERTIFICATIONS BEING PROVIDED TO THE SATISFACTION OF CARDNO.
8. SHOULD THE CONTRACTOR WISH TO USE A RECYCLED PRODUCT THIS SHALL BE CLEARLY INDICATED IN THEIR TENDER AND THE PRICE DIFFERENCE BETWEEN AN IGNEOUS PRODUCT AND A RECYCLED PRODUCT SHALL BE CLEARLY INDICATED.
9. WHERE NOTED ON THE DRAWINGS THAT WORKS ARE TO BE CARRIED BY OTHERS, (eg. ADJUSTMENT OF SERVICES), THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CO-ORDINATION OF THESE WORKS.

STORMWATER DRAINAGE NOTES

1. MODELLING OF THE CATCHMENT HAS BEEN UNDERTAKEN USING DRAINS AND TuFLOW SOFTWARE. DESIGN CRITERIA 1:2 YEAR WITH 50% BLOCKAGE ON SAG INLETS.
2. UNLESS NOTED OTHERWISE ALL PIPES SHALL BE REINFORCED CONCRETE MARINE GRADE APPROVED SPIGOT AND SOCKET WITH RUBBER RING JOINTS.
3. PIPES TO BE INSTALLED TO TYPE HS3 SUPPORT IN ACCORDANCE WITH AS 3725 (1989) IN ALL CASES BACKFILL TRENCH WITH SAND TO 300mm ABOVE PIPE.
4. ALL INTERNAL WORKS WITHIN PROPERTY BOUNDARIES ARE TO COMPLY WITH THE REQUIREMENTS OF AS 3500 3.1 (1998) AND AS/NZS 3500 3.2 (1998).
5. WHERE SUBSOIL DRAINS PASS UNDER FLOOR SLABS AND VEHICULAR PAVEMENTS, UNSLOTTED uPVC SEWER GRADE PIPE IS TO BE USED.
6. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
7. GRATES AND COVERS SHALL CONFORM TO AS 3996.
8. AT ALL TIMES DURING CONSTRUCTION OF STORMWATER PITS, ADEQUATE SAFETY PROCEDURES SHALL BE TAKEN TO ENSURE AGAINST THE POSSIBILITY OF PERSONNEL FALLING DOWN PITS.
9. ALL EXISTING STORMWATER DRAINAGE LINES AND PITS THAT ARE TO REMAIN ARE TO BE INSPECTED AND CARDNO NOTIFIED OF ANY RECTIFICATION WORKS REQUIRED.
10. ALL EXISTING STORMWATER DRAINAGE LINES TO BE DISUSED SHALL BE REMOVED FROM SITE.
11. SYDNEY WATER APPROVED FLOW MANAGEMENT PLAN SHALL BE IN PLACE PRIOR TO CONNECTION AND DISCONNECTION FROM SYDNEY WATER ASSETS.

PIT SCHEDULE

TYPE	COVER	PIT NUMBER	
		TEMPORARY	PERMANENT
A	PRE-CAST STORMWATER JUNCTION PIT. PROVIDE CLASS 'C' CAST IRON COVER AND FRAME WITH CONCRETE INFILL.	A12	
B	STORMWATER JUNCTION PIT. PROVIDE CLASS 'D' CAST IRON COVER AND FRAME WITH CONCRETE INFILL.	A9	
C	STORMWATER JUNCTION PIT. OVER EXISTING STORMWATER PIPE. PROVIDE CLASS 'C' CAST IRON COVER AND FRAME WITH CONCRETE INFILL.		A1A
D	STORMWATER JUNCTION PIT. PROVIDE CLASS 'D' CAST IRON COVER AND FRAME WITH CONCRETE INFILL. (900x900)		A7
E	EXISTING STORMWATER JUNCTION PIT TO BE MODIFIED.		A6
F	PRECAST POLYMER CONCRETE STORMWATER JUNCTION PIT. ACO TYPE 66 (OR APPROVED EQUIVALENT) PROVIDE CLASS D DUCTILE IRON SOLID TOP COVER.	A11	
G	DIRECT CONNECTION TO EXISTING PIPE	A8. A10	
H	EXISTING BEND		A2, A3, A4, A5
J	EXISTING OUTLET TO REMAIN.		A1

ALL PIT COVERS TO BE LOCKABLE

DESIGN CRITERIA

1. ALL PERMANENT DRAINAGE WORKS SHALL HAVE A DESIGN LIFE OF 100 YEARS.
2. ALL PERMANENT PITS TO MEET REQUIREMENTS OF AS-4997
3. REINFORCEMENT EXPOSURE CLASSIFICATION - CLASS C2, IN ACCORDANCE WITH AS-4997.
4. REFER TO CONCRETE NOTES FOR REINFORCEMENT
5. DESIGN TRAFFIC LOADINGS T44/A14
6. WORKSHOP DRAWINGS OF PITS TO BE REVIEWED BY CARDNO ENGINEER PRIOR TO CONSTRUCTION.

NOTES

1. SURVEY PREPARED BY RYGATE & COMPANY PTY LTD
2. DESIGN & FINAL PLANS PREPARED BY: WSC: CARDNO NSW/ACT PTY LTD
LEVEL 1, 47 BURELLI STREET, WOLLONGONG, NSW 2500
FOR LEND LEASE 30 HICKSON ROAD, MILLERS POINT NSW 2000
(PH: 9236 6111)
3. THE PROPOSED WORKS DETAILED HEREON ARE TO BE CONSTRUCTED GENERALLY IN ACCORDANCE WITH THE SEWERAGE CODE OF AUSTRALIA, SYDNEY WATER EDITION (WSA 02-2002). THE CONTRACTOR MUST HAVE A COPY OF THIS DOCUMENT ON SITE AT ALL TIMES.
4. THE CONTRACTOR IS TO OBTAIN COUNCIL APPROVAL BEFORE EXCAVATING ADJACENT TO TREES AND TAKE ALL NECESSARY STEPS TO PROTECT TREES FROM DAMAGE.
5. THE CONSTRUCTOR SHALL SUBMIT A SAFE WORK PLAN TO THE WATER SERVICING COORDINATOR PRIOR TO COMMENCING THE WORKS.
6. THE CONSTRUCTOR SHALL SUBMIT AN ENVIRONMENTAL MANAGEMENT PLAN TO THE WATER SERVICING COORDINATOR TO COMMENCING THE WORKS.
7. MEASURES REQUIRED TO PROTECT THE ENVIRONMENT ARE DETAILED IN THE ENVIRONMENTAL IMPACT ASSESSMENT.
8. ALL STRUCTURES TO BE CONSTRUCTED TO PROPOSED FINISHED SURFACE LEVELS.
9. ALL LEVELS ELECTRONICALLY GENERATED. NO LEVEL BOOK AVAILABLE.
10. LOCATION OF SERVICES SHOWN ARE APPROXIMATE ONLY AND HAVE BEEN LOCATED FROM INFORMATION PROVIDED BY RELEVANT AUTHORITY & FIELD INVESTIGATIONS. THESE MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION WORK TAKING PLACE.
11. COMPACTION TESTS SHOULD BE UNDERTAKEN BY A 'NATA' REGISTERED ENGINEER TO SATISFY THE REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS.
12. NO STRUCTURES TO BE BUILT OVER SYDNEY WATER STORMWATER SYSTEM WITHOUT APPROVAL FROM SYDNEY WATER.
13. ✱ DENOTES: EXISTING STORMWATER DRAINAGE LINE TO BE ADJUSTED AND RECONNECTED TO PROPOSED TRUNK STORMWATER. CONTRACTOR TO CONFIRM SIZE, LOCATION AND INVERTS OF EXISTING STORMWATER LINES PRIOR TO CONSTRUCTION. RECONNECTIONS TO BE CARRIED OUT BY A LICENCE PLUMBER IN ACCORDANCE WITH AS3500 AND TO CITY OF SYDNEY COUNCIL STANDARDS. REFER DETAIL JUNCTION DETAIL.
14. TREE ROOT BARRIERS TO BE INSTALLED ADJACENT TO ANY TREE WHICH WILL HAVE A MATURE HEIGHT OF 10m OR MORE. THE ROOT BARRIER IS TO BE THE FULL DEPTH OF THE TRENCH AT A DISTANCE TO CLEAR THE MATURE TREES DRIP LINE.
15. EXISTING SECTIONS OF STORMWATER DRAINAGE LINE TO BE DECOMMISSIONED, DEMOLISHED OR SAND FILLED, SEALED AND LEFT IN-SITU AS SHOWN ON DRAWINGS.

ENVIRONMENTAL NOTES

E1. AREAS DOWNSLOPE OF CONSTRUCTION ACTIVITY ARE TO BE ADEQUATELY PROTECTED FROM SEDIMENT POLLUTION ETC. SILT TRAP DEVICES ARE TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITY, EFFECTIVELY MAINTAINED AND TO BE REMOVED ONLY AFTER THE AREA HAS BEEN SATISFACTORILY REVEGETATED.

E2. ALL STORMWATER GRATES, OPEN CHANNELS, SWALES, TABLE DRAINS, GULLIES ETC. DOWNSLOPE OF CONSTRUCTION ACTIVITY TO BE ADEQUATELY PROTECTED BY STRAWBALES WRAPPED IN GEOTEXTILE FABRIC OR GEOTEXTILE FENCE.

E3. THE EXTENT OF CLEARING OF VEGETATION IS TO BE KEPT TO AN ABSOLUTE MINIMUM NECESSARY TO EFFECT THE WORKS.

CONTRACTOR NOTES

C1. STREET SIGNS & PATHWAYS TO BE REPLACED IN ACCORDANCE WITH RMS & LOCAL AUTHORITY SPECIFICATIONS. TEMPORARY SIGNAGE TO BE INSTALLED WHERE EXISTING STREET/PATHWAYS SIGNS HAVE BEEN TEMPORARILY REMOVED AT THE CONTRACTORS EXPENSE. ANY DAMAGE TO EXISTING STREET SIGNS WILL BE REPAIRED OR REPLACED AT THE CONTRACTORS EXPENSE.

C2. ALL SERVICES SHOWN ARE INDICATIVE ONLY. THE CONTRACTOR MUST CONFIRM THE LOCATION OF ALL SERVICES PRIOR TO EXCAVATION.

C3. CONTRACTOR TO MAKE ALL APPLICATIONS, PROVIDE TRAFFIC CONTROL AND PAY COUNCILS ROAD OPENING FEES.

TECHNICAL SPECIFICATION

1. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH TECHNICAL SPECIFICATION 13-0272 PREPARED BY CARDNO (NOVEMBER 2013).

No.	AMENDMENT DESCRIPTION	BY	DATE
L	ISSUED TO SYDNEY WATER	A.M	18.05.16
K	ISSUED TO SYDNEY WATER	A.M	19.02.16
J	ISSUED TO SYDNEY WATER	A.M	23.12.15
H	ISSUED TO SYDNEY WATER	A.M	07.12.15
G	ISSUED TO SYDNEY WATER	A.M	24.11.15
F	ISSUED TO SYDNEY WATER	M.K.H	21.09.15
E	RE-ISSUED FOR APPROVAL	T.I.M	12.08.15
D	RE-ISSUED FOR APPROVAL	T.I.M	18.05.15
C	RE-ISSUED FOR APPROVAL	T.I.M	04.05.15
B	RE-ISSUED FOR APPROVAL	T.I.M	24.02.15
A	ISSUED FOR APPROVAL	M.K.H	07.11.13

PLAN DRAWN DATE: 19.02.16 VERSION: K SHEET 2 OF 12 SHEETS

NA50613044-TP-001 NOTES AND LEGENDS

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NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER.

U.B. DIRECTORY MAP 1 D14 (44TH ED.)

SHEET 2 OF 12 File No. N/A

SYDNEY WATER CORPORATION

CASE No. CN135412SW

CITY OF SYDNEY DRAINAGE
CITY AREA SWC 29
MARGARET STREET BRANCH 29N
& SUSSEX STREET NORTH BRANCH 29S

A1

FILE LOCATION: NA50613044_Barangaroo Stage1B *DESIGNED:* PAK LAU *DRAFTED:* JOSHUA BEZZINA *VERIFIED:* MICHAEL HODGES *REVIEWED:* MICHAEL HODGES *APPROVED:* MICHAEL HODGES *ISSUED:* FEB 2015

DEVELOPER CONTRACT PLAN

HICKSON ROAD

WATERMANS QUAY

300ø SEWER OVERFLOW

PROVIDE DIRECT CONNECTION TO EXISTING 225ø STORMWATER PIPE.

PROPOSED STAGE 1B PERIMETER RETENTION WALL

CONNECT EXISTING 300ø SEWER OVERFLOW TO TEMPORARY PIT A11.

300ø PIPELINE

CH 281.147

CH 280.724

CH 265.516

CH 264.986

E 333746.155
N 6251654.996

CH 252.492

225ø

A12

A11

A10

CONNECT EXISTING 225ø COUNCIL ASSET TO TEMPORARY PIT A12

E 333744.451
N 6251670.368

LINE A. (L.A)

300ø PIPELINE

750ø

CH 200.827

CH 199.776

A9

CONNECT EXISTING 750ø SYDNEY WATER ASSET TO TEMPORARY PIT A9

E 333753.313
N 6251590.463

900ø PIPELINE

225ø

CH 173.015

A8

A7

CH 160.743

E 333754.777
N 6251550.798

PROVIDE DIRECT CONNECTION TO EXISTING 225ø STORMWATER PIPE.

CH 159.518

EXISTING TEMPORARY ELECTRICAL KIOSK SUBSTATIONS TO BE REMOVED.

EXISTING STAGE 1A BASEMENT WALL

PROVIDE DIRECT CONNECTION TO EXISTING 1A STORMWATER DRAINAGE.

LINE A. (L.A) REFER SHEET 6 FOR LONGITUDINAL SECTION

PROPOSED STAGE 1B PERIMETER RETENTION WALL

EXISTING SYDNEY WATER STORMWATER TO BE REMOVED. (TYP)

EXISTING STORMWATER TO BE REMOVED. AS PART OF BULK EXCAVATION WORKS (TYP). (NOT PART OF THIS CONTRACT)

1200ø

EXISTING STORMWATER TO BE REMOVED AS PART OF BULK EXCAVATION WORKS (TYP). (NOT PART OF THIS CONTRACT)

EXISTING SYDNEY WATER STORMWATER ASSET TO BE REMOVED FROM PIT A6 TO A9 AT COMPLETION OF TEMPORARY DIVERSION

TEMPORARY FOOTPATH AND HOARDING TO BE REMOVED.

REFER TO SHEET 6 FOR PROPOSED STORMWATER LONGITUDINAL SECTION

RECONSTRUCT SOUTHERN WALL OF PIT A6. REFER SHEET 10 FOR DETAIL

A6

CH 96.0

CH 93.60

3/7

PROPOSED STORMWATER TO CONNECT INTO EXISTING PIT.

EXISTING SYDNEY WATER PIPE TO REMAIN

EXTENT OF EPA DECLARATION AREA N21122

No.	AMENDMENT DESCRIPTION	BY	DATE
K	ISSUED TO SYDNEY WATER	A.M	19.02.16
J	ISSUED TO SYDNEY WATER	A.M	23.12.15
H	ISSUED TO SYDNEY WATER	A.M	07.12.15
G	ISSUED TO SYDNEY WATER	A.M	24.11.15
F	ISSUED TO SYDNEY WATER	M.K.H	21.09.15
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D	RE-ISSUED FOR APPROVAL	T.I.M	18.05.15
C	RE-ISSUED FOR APPROVAL	T.I.M	04.05.15
B	RE-ISSUED FOR APPROVAL	T.I.M	24.02.15
A	ISSUED FOR APPROVAL	M.K.H	07.11.13
L	ISSUED TO SYDNEY WATER	A.M	16.05.16

0 5 10 15 20 25m
5 4 3 2 1
SCALE 1:250

FOR CONTINUATION REFER TO SHEET 5

NA50613044-TP-020 STORMWATER DIVERSION WORKS DRAINAGE PLAN SHEET 1

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NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER.

U.B. DIRECTORY . . . MAP 1 D14 (44TH ED.) . . .

SHEET . 4 . OF . 12 . File No. N/A

SYDNEY WATER CORPORATION

CASE No. CN135412SW

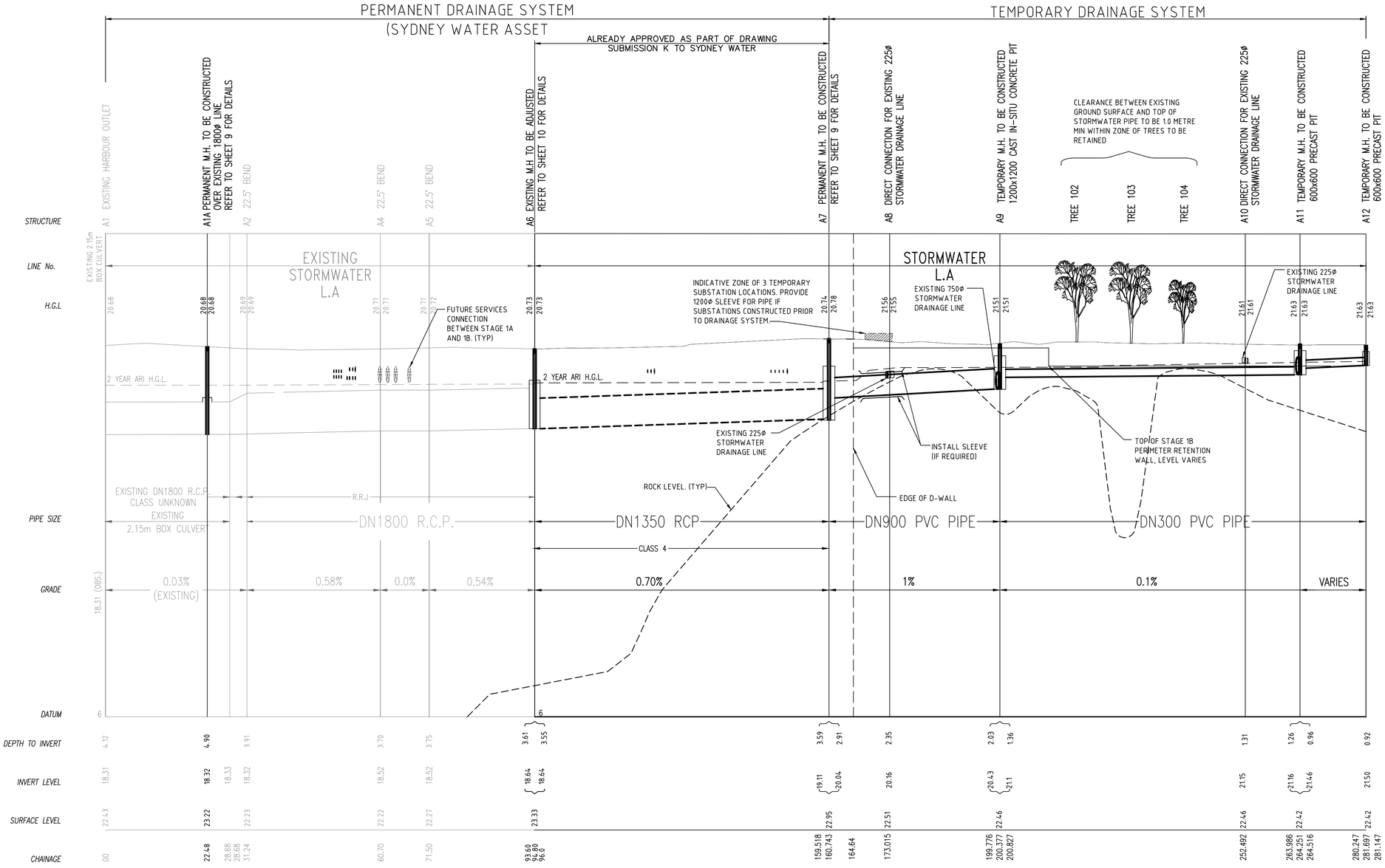
CITY OF SYDNEY DRAINAGE
CITY AREA SWC 29
MARGARET STREET BRANCH 29N
& SUSSEX STREET NORTH BRANCH 29S

PLAN DRAWN DATE: 19.02.16 VERSION: L SHEET 4 OF 12 SHEETS

A1

FILE LOCATION: NA50613044_Barangaroo Stage1B | DESIGNED: PAK LAU | DRAFTED: JOSHUA BEZZINA | VERIFIED: MICHAEL HODGES | REVIEWED: MICHAEL HODGES | APPROVED: MICHAEL HODGES | ISSUED: FEB 2015

DEVELOPER CONTRACT PLAN



NOTE:
1. EXISTING SERVICE LOCATIONS ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE CONFIRMED ON SITE BY THE CONTRACTOR.
2. EXCAVATION SHALL ONLY BE UNDER STRICT CAUTION TO AVOID CLASHES WITH UNKNOWN SERVICES. MIN)

ALL LEVELS REFER TO A PLANE 20m BELOW AUSTRALIAN HEIGHT DATUM

No.	AMENDMENT DESCRIPTION	BY	DATE
L	ISSUED TO SYDNEY WATER	A.M	16.05.16
K	ISSUED TO SYDNEY WATER	A.M	19.02.16
J	ISSUED TO SYDNEY WATER	A.M	23.12.15
H	ISSUED TO SYDNEY WATER	A.M	07.12.15
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E	RE-ISSUED FOR APPROVAL	T.I.M	12.08.15
D	RE-ISSUED FOR APPROVAL	T.I.M	18.05.15
C	RE-ISSUED FOR APPROVAL	T.I.M	04.05.15
B	RE-ISSUED FOR APPROVAL	T.I.M	24.02.15
A	ISSUED FOR APPROVAL	M.K.H	07.11.13

0 1 2 4 6 8 10m
SCALE 1:100 VERT @A1

0 10 20 30 40 50m
SCALE 1:500 HORI @A1

NA50613044-TP-030 STORMWATER AND EXISTING SERVICES LONGITUDINAL SECTION

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NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER.

U.B. DIRECTORY MAP 1 D14 (44TH ED.)

SHEET 6 OF 12 | File No. N/A

SYDNEY WATER CORPORATION

CASE No. CN135412SW

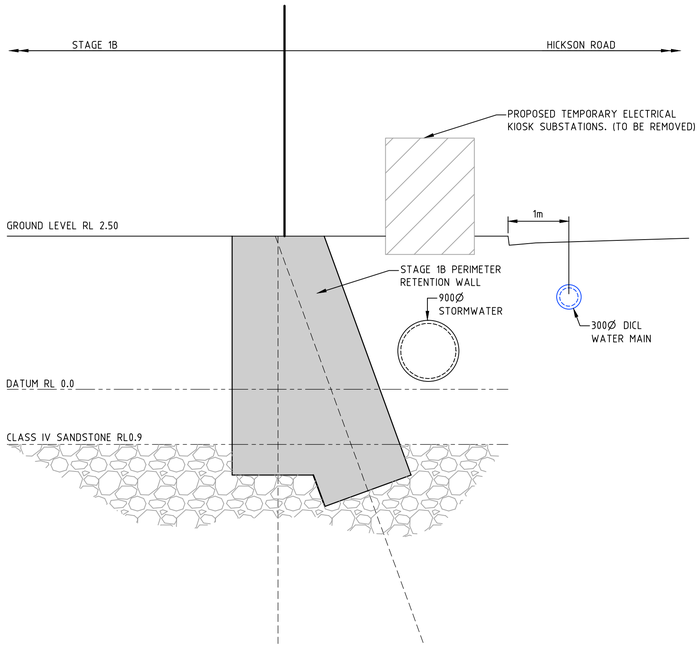
CITY OF SYDNEY DRAINAGE
CITY AREA SWC 29
MARGARET STREET BRANCH 29N
& SUSSEX STREET NORTH BRANCH 29S

PLAN DRAWN DATE: 19.02.16 VERSION: L SHEET 6 OF 12 SHEETS

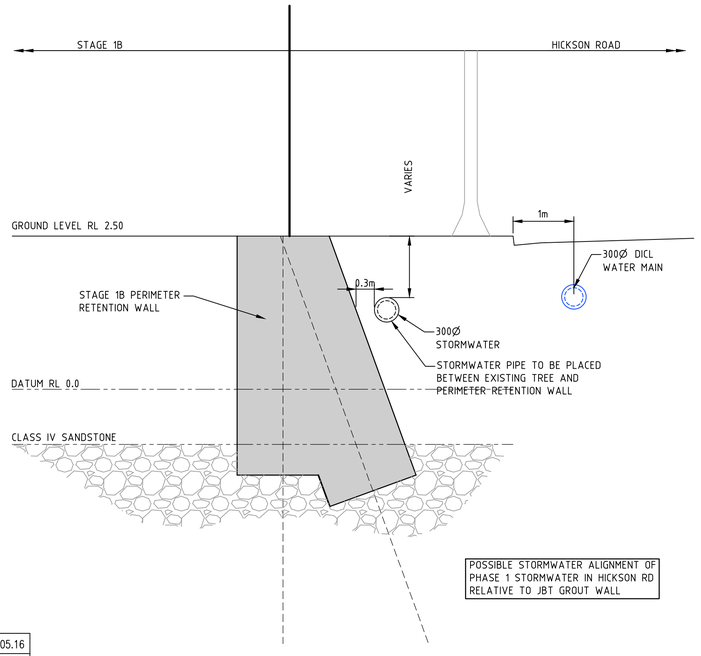
A1

FILE LOCATION: NA50613044_Barangaroo Stage1B *DESIGNED:* PAK LAU *DRAFTED:* JOSHUA BEZZINA *VERIFIED:* MICHAEL HODGES *REVIEWED:* MICHAEL HODGES *APPROVED:* MICHAEL HODGES *ISSUED:* FEB 2015

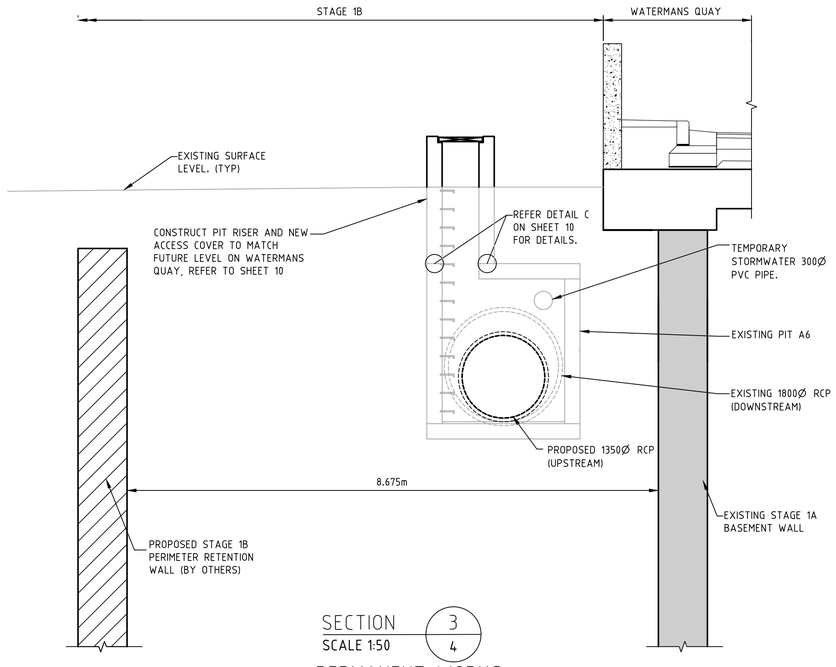
DEVELOPER CONTRACT PLAN



TYPICAL SECTION THROUGH 900Ø STORMWATER PIPE
SCALE 1:50



TYPICAL SECTION THROUGH 300Ø STORMWATER PIPE
SCALE 1:50



SECTION 3/4
SCALE 1:50
PERMANENT WORKS

No.	AMENDMENT DESCRIPTION	BY	DATE
L	ISSUED TO SYDNEY WATER	A.M	16.05.16
K	ISSUED TO SYDNEY WATER	A.M	19.02.16
J	ISSUED TO SYDNEY WATER	A.M	23.12.15
H	ISSUED TO SYDNEY WATER	A.M	07.12.15
G	ISSUED TO SYDNEY WATER	A.M	24.11.15
F	ISSUED TO SYDNEY WATER	M.K.H	21.09.15
E	RE-ISSUED FOR APPROVAL	T.I.M	12.08.15
D	RE-ISSUED FOR APPROVAL	T.I.M	20.05.15
C	RE-ISSUED FOR APPROVAL	T.I.M	18.05.15
B	RE-ISSUED FOR APPROVAL	T.I.M	24.02.15
A	ISSUED FOR APPROVAL	M.K.H	07.11.13

0 0.5 1 1.5 2m
SCALE 1:20 @A1

ALL LEVELS REFER TO A PLANE 20m BELOW AUSTRALIAN HEIGHT DATUM

NA50613044-TP-035 SITE CROSS SECTIONS SHEET 1

Cardno
Shaping the Future
ABN: 95 001 145 035
Level 9, The Forum, 203 Pacific Highway
St Leonards NSW Australia 2065
Phone (+61 2) 9496 7700 Fax (+61 2) 9439 5170
Email: Sydney@cardno.com.au Web: www.cardno.com.au

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER.

U.B. DIRECTORY MAP 1 D14 (44TH ED.)

SHEET 7 OF 12 File No. N/A

SYDNEY WATER CORPORATION

CASE No. CN135412SW

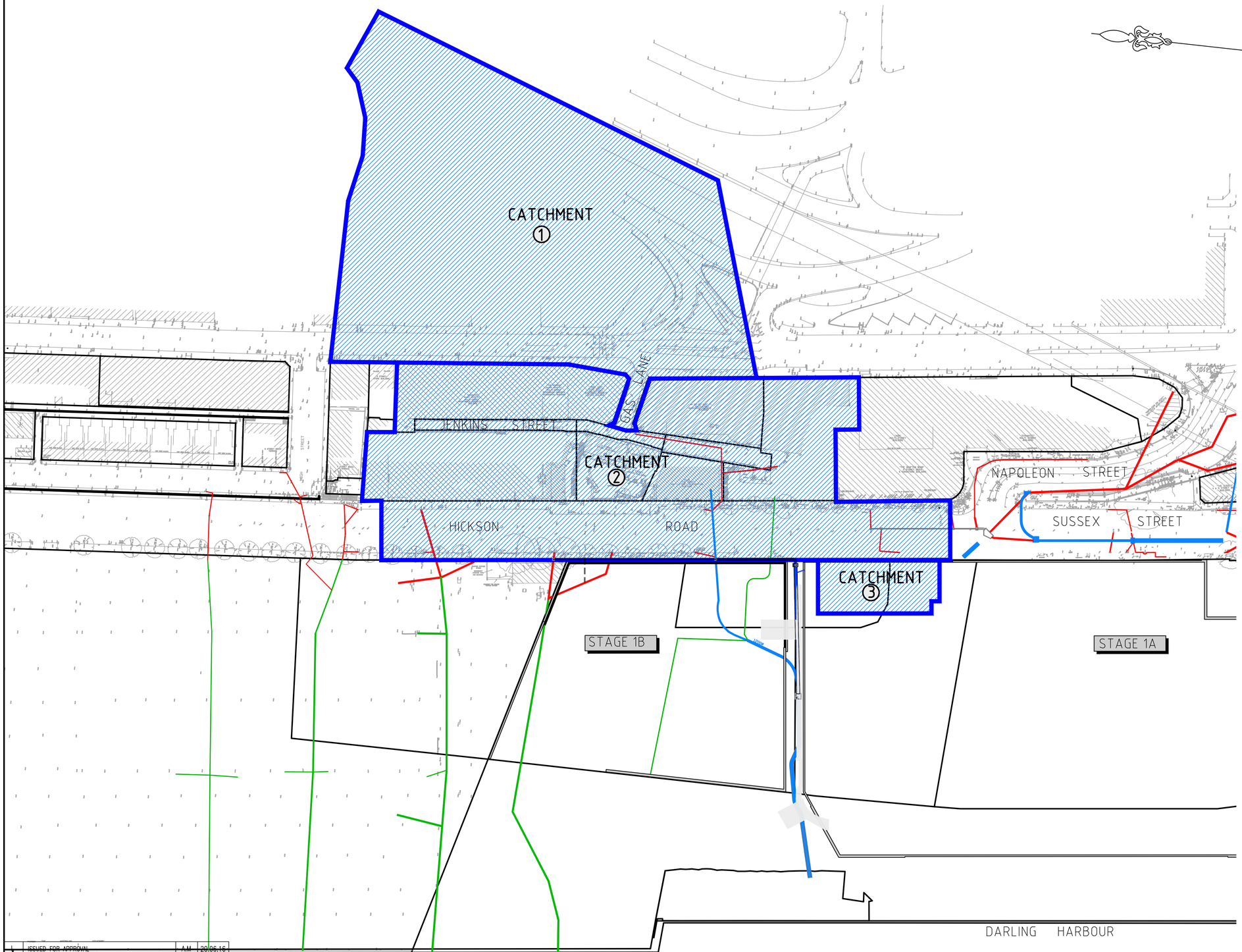
CITY OF SYDNEY DRAINAGE
CITY AREA SWC 29
MARGARET STREET BRANCH 29N
& SUSSEX STREET NORTH BRANCH 29S

PLAN DRAWN DATE: 19.02.16 VERSION: L SHEET 7 OF 12 SHEETS

A1

FILE LOCATION: NA50613044_Barangaroo Stage1B *DESIGNED:* PAK LAU *DRAFTED:* JOSHUA BEZZINA *VERIFIED:* MICHAEL HODGES *REVIEWED:* MICHAEL HODGES *APPROVED:* MICHAEL HODGES *ISSUED:* FEB 2015

DEVELOPER CONTRACT PLAN



LEGEND

EXISTING STORMWATER

- SW — SYDNEY WATER
- SW — CITY OF SYDNEY COUNCIL
- SW — NSW ROADS AND MARITIME SERVICES

CATCHMENTS

- STAGE 1B CATCHMENTS

STORMWATER DRAINAGE SUMMARY 1B

CATCHMENT No.	FLOW (100yr ARI) (m^3/s)	AREA (Ha)	DESCRIPTION
1	$Q_{100} = 2.35$	2.83	CATCHMENT DISCHARGES INTO GAS LANE THROUGH A Ø600 PIPE, THEN INTO AN EXISTING Ø1200 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.
2	$Q_{100} = 1.69$	2.29	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE AND THEN DRAINS TO EXISTING STORMWATER SYSTEM, THROUGH THE STAGE 1B AND BARANGAROO CENTRAL DEVELOPMENT SITES.
3	$Q_{100} = 0.20$	0.18	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE, THEN DRAINS TO EXISTING STORMWATER SYSTEM THROUGH THE STAGE 1B DEVELOPMENT SITE.

No.	AMENDMENT DESCRIPTION	BY	DATE
L	ISSUED FOR APPROVAL	A.M	20.06.16
K	ISSUED TO SYDNEY WATER	A.M	19.02.16
J	ISSUED TO SYDNEY WATER	A.M	23.12.15
H	ISSUED TO SYDNEY WATER	A.M	07.12.15
G	ISSUED TO SYDNEY WATER	A.M	24.11.15
F	ISSUED TO SYDNEY WATER	M.K.H	21.09.15
E	RE-ISSUED FOR APPROVAL	T.I.M	12.08.15
D	RE-ISSUED FOR APPROVAL	T.I.M	18.05.15
C	RE-ISSUED FOR APPROVAL	T.I.M	04.05.15
B	RE-ISSUED FOR APPROVAL	T.I.M	24.02.15
A	ISSUED FOR APPROVAL	M.K.H	07.11.13

0 20 40 60 80 100m

20 15 10 5

SCALE 1:1000

PLAN DRAWN DATE: 20.06.16 VERSION: L SHEET 11 OF 11 SHEETS

NA50613044-TP-050 CATCHMENT PLAN

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U.B. DIRECTORY MAP 1 D14 (44TH ED.)

SHEET 11 OF 11 File No. N/A

SYDNEY WATER CORPORATION

CASE No. CN135412SW

CITY OF SYDNEY DRAINAGE
CITY AREA SWC 29
MARGARET STREET BRANCH 29N
& SUSSEX STREET NORTH BRANCH 29S

Phase 1 Stormwater Diversion Works
Civil Engineering Report Modification
to Temporary Works

APPENDIX B

SITE SURVEY PLAN

Cardno
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KENT STREET

JENKINS STREET

HICKSON ROAD

NAPOLEON STREET

SUSSEX STREET

SHELLEY STREET

LINK STREET

DECCW
Declaration Area
N21122

Extent of Land Lease
(Millers Point) Development

SITE BOUNDARY EXTENDED
BMP-RSHP-A-P-3400-00.DWG

NOTE:
1. SURVEY INFORMATION BASED ON SURVEY BY RYGATE & COMPANY, DATED 18th OCTOBER 2010.
2. STAGE 1A STORMWATER DESIGN AS SHOWN IS BASED ON THE APPROVED DESIGN PREPARED BY CARDNO.
3. STAGE 1B TEMPORARY AND PERMANENT STORMWATER DESIGN IS BASED ON THE DESIGN PREPARED BY CARDNO

Phase 1 Stormwater Diversion Works
Civil Engineering Report Modification to Temporary Works

APPENDIX C

SYDNEY WATER
JOB SPECIFIC LETTER

Cardno
Shaping the Future

Case Number: 135412

11 March 2016

Lend Lease Millers Point Pty Ltd
c/-Cardno (NSW/ACT) Pty Ltd

Dear Sir/Madam

Property: **Hickson Road, Sydney (Barangaroo)**
Your Reference: **50613044-135412**
Plan Identification Number: 135412SW

Attached is the Storm Water Design Package for the location of works shown above. This package was received by Sydney Water and dated 19 February 2016/Version No. K. **You have indicated that this plan is for tendering purposes.** After you have engaged a Constructor and the following matters have been addressed, this plan can be used for construction. If there are any changes after tendering, you must give us the appropriate Project Variation documents.

Diversion of Stormwater Drainage

Sydney Water has no objection with the design plans for Barangaroo South Stage 1B-Phase 1 Stormwater Diversion Works (City Drainage Area 29) submitted by Cardno on behalf of Lend Lease.

This temporary works approval is granted based on previous conditions that the existing stormwater system capacity is being maintained and any stormwater operational and maintenance issues are addressed by Lend Lease during construction. In addition Lend Lease (Millers Point) Pty Limited and Lend Lease Project Management & Construction (Australia) Pty Limited must address the following:

- **Connection and disconnection of Stormwater Drainage**

Provide process and work statement documentation for disconnection of existing stormwater assets to ensure remaining stormwater assets are not damaged, they are in perfect working order to access, operate and maintain.

Backfilling
Notations should be provided on the plans for the backfilling of any redundant pipes particularly along Hickson Road to the required specification.

Clearly indicate how the temporary and permanent stormwater assets will be connected to Sydney Water stormwater assets, ensuring the permanent connections meet Sydney Water's **Asset Creation Process.**

- **Maintenance and Operations of temporary Stormwater Drainage**

Please disregard if the following has been completed. **Interim Operating Procedure (IOP)** where Lend Lease will own, operate and maintain the temporary stormwater assets and its impacts. Once Sydney Water's stormwater drainage system/assets are disconnected, Sydney Water will have no responsibility on the operations and maintenance of the temporary stormwater asset (particularly from Hickson Road to the outlet).
Sydney Water may resume to own, operate and maintain the permanent Stormwater Drainage system if it is constructed to Sydney Water's requirements.
Inform the WSC and Sydney Water of IOP date of commencement.

- **Risk Management Controls**

Provide results of risk management workshop with relevant design consultants, Water Servicing Coordinators and contractors to identify key risks and management controls relating to the temporary asset deviation proposals.

- **Emergency response plan**

Develop and implement an emergency response plan for the temporary and permanent deviations that ensures the safety of people and property in the event of the asset and/or embankment failing or flooding. This plan is to be developed and approved by the relevant authorities.

- **Sewer Overflow**

Due to the proposed disuse of sewer and request to connect the sewer into the Stormwater, a separate case is required to be lodged to carry out the proposed sewer works. Design will be required to be lodged as per Sydney Water's standards, following the usual process.

Your Inspection and Test Plan (ITP) has also been returned with this Design Plan so that it can be completed along with a Deed Poll for the Constructor to execute.

After you tell us who the approved Constructor is, lodge both the completed ITP and executed Deed Poll with Sydney Water, we will review them and then release your ITP. This will complete your Design Package and enable you to start construction.

For that package:

(a) The following costs will be invoiced to your Company at the finalisation of these works:

Contract Administration
This fee will be invoiced to your company at the current hourly rate of $139.05 (includes $12.64 GST). It is for time spent by the Development Services Officer during the design, construction and connection phases of this work.

Notes:

- **An invoice can be issued for the above costs before finalisation. However, if costs are incurred after that invoice we will charge you at finalisation.**
- **To obtain an invoice before finalisation, you must email the Sydney Water Case Manager.**
- **The Tax Invoice must be paid to Sydney Water within 30 days of being issued.**
- **You should tell your developer/applicant client of these Sydney Water costs**

before proceeding with this work.

(b) If Sydney Water needs additional site inspections, you will be invoiced at the current hourly rate at the completion of this work.

(c) At the finalisation of these works, and before we can issue the Section 73 Compliance Certificate or the release of the Security Bond, the Developer will need to pay any outstanding Developer (DSP) charges **directly to Sydney Water**. Remember that you need to obtain an invoice so these charges can be paid. The invoice can be obtained by contacting the Sydney Water Case Manager.

Connections

While connections to existing Sydney Water assets are generally at the end of construction, the constructor, in conjunction with the WSC, must review the design prior to commencement of works and identify all connections to Sydney Water's existing assets. All connections at any stage of construction must only proceed after obtaining the appropriate approval from Sydney Water.

(d) Before connection, the Generic Asset Hazards (detailed in Instructions to Water Servicing Coordinators (Major Works)) **must** be addressed in your Safe Work Plan and Environmental Management Plan.

The Generic Asset Hazards/Conditions - At the Point of Connection, listed in the Provider Instructions, **must** be addressed in your Safe Work Plan and Environmental Management Plan.

Remember that:

1. There are work environment hazards that include (but are not limited to) traffic and the closeness of other utility services;
2. All developers, constructors and individuals have an OH&S obligation and a duty of care when working near underground plant; and
3. Any person who destroys, damages or interferes with any Sydney Water asset is liable to compensate Sydney Water.

(a)

You need to implement Sydney Water's Health and Safety Procedure – Flow Management and Isolation of Hydraulic Assets (HSP-070) and submit, via email, a Flow Management Plan addressing any specific requirements provided by Sydney Water.

Submit your Stormwater Form 'A' FIFM requests via email address: wastewaterfifm@sydneywater.com.au

All Stormwater FIFM requests, enquiries, issues and correspondence are also to be submitted via the above email address.

Connection to Sydney Water's asset cannot be carried out prior to submission of a valid Inspection and Test Plan (ITP) and implementation of an approved Flow Management/Asset Isolation Plan.

(b) Extra hold points might be included in the ITP by Sydney Water when you lodge the Construction Commencement Notice.

Construction Commencement Sydney Water Contact

You must send your Construction Commencement Notice to Sydney Water's Developer Works Inspections team at Email: DeveloperConnectionsdwi@sydneywater.com.au as set down in the Instructions to Water Servicing Coordinators (Major Works).

END