University of Sydney

Centre for Obesity, Diabetes and Cardio Vascular Disease

Infrastructure Services Review

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November 2009

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Contents

Appendices

Executive Summary

This report has been produced in response to the Director Generals Part 3a Planning requirements for the construction of the new Centre for Obesity, Diabetes and Cardio Vascular Disease building (CODCD) on the University of Sydney Camperdown Campus. It addresses the following aspects,

- The extent of the statutory infrastructure in the vicinity of the new CODCD building,
- The impact the new building's footprint on the routes of this infrastructure,
- The potential loads the development will have on the surrounding infrastructure,
- The implications of the relocation, realignment or augmentation of the effected services, and
- Potential effects on the storm water systems in the area and overland flow management

The report's findings indicate that there are a number of critical infrastructure services that are affected and will require to be relocated around the new development including the extinguishment of easements.

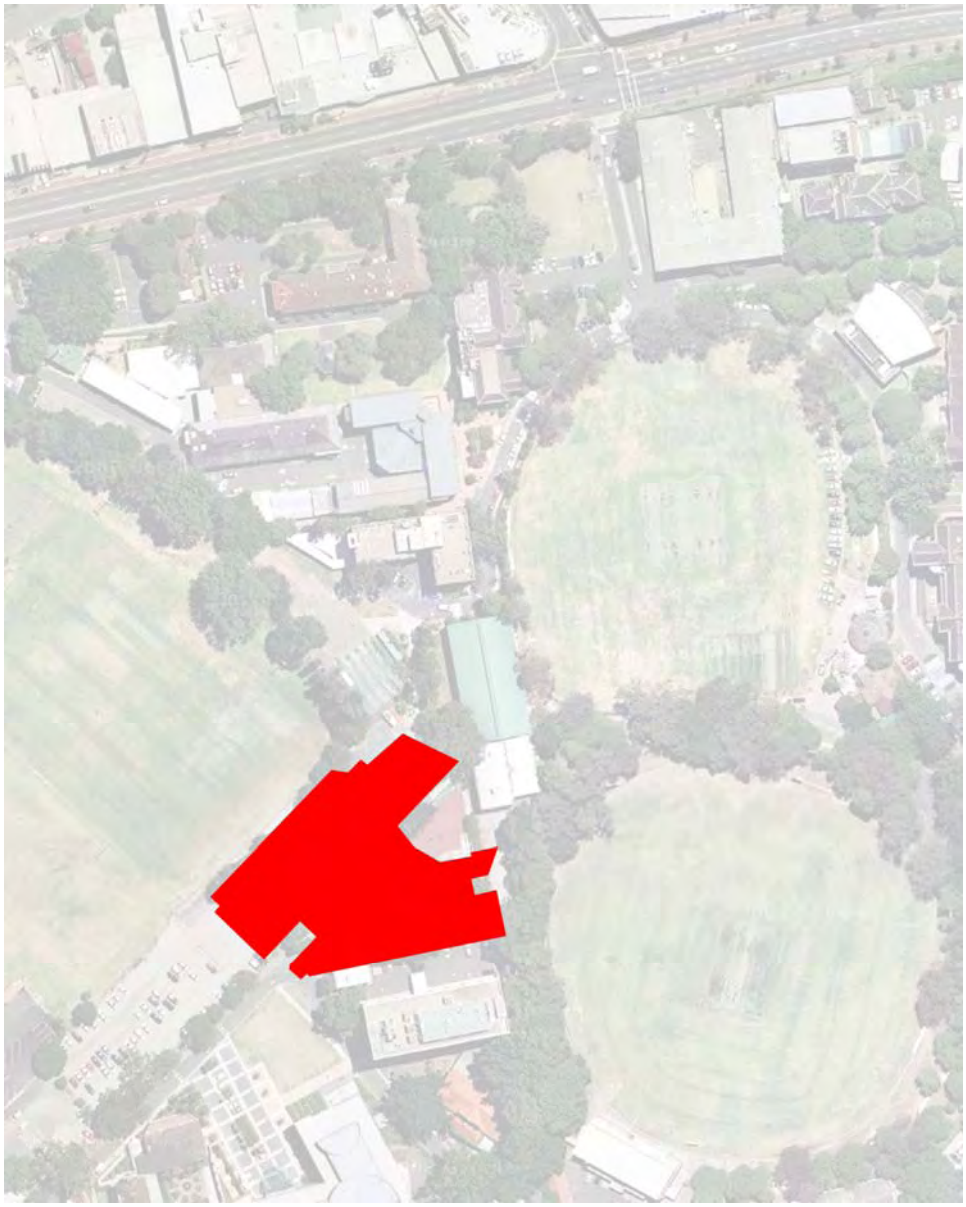
The next step for the development will be the progression and finalisation of these easements in parallel to the design of the new infrastructure.

1 Existing Infrastructure

1.1 Introduction

The existing site utilities have been captured from information received from the University of Sydney. This information has been assessed and passed on to the land surveyor who has been tasked with confirming the presence of the various utilities on site. In addition, the surveyor has been tasked with marking the layout of the utilities on site.

We have assessed the impacts of the latest planning layouts from Hassell on these utilities. We have based our assessment on the Architectural Level B1 Basement Plan (SK-102_01) dated 29th October 2009 and Architectural Section A-A (SK-200_01) dated 27th October 2009 (Refer to Appendix B). The following diagram places this footprint approximately on site.



At the time of writing this report, the surveyor has completed his field activities and preliminary feedback suggests that the site services generally correlate with the University's records. Refer to Appendix A for surveyed services layout overlayed onto Hassell's proposed basement layout plan.

In parallel with the production of this infrastructure report Steensen Varming have undertaken a study on environmentally sustainable design for the services systems within the CODCD building and issued a report, “Sustainable Design and Building Services Project Application” report. Steensen Varming has advised the following key sustainability issues have been addressed in this report.

- *Key operating priorities of the building that include high outside demand, energy intensive functions and operational 24 hour based loads have been targeted to achieve design outcomes that deliver in a multifunctional sense significant reductions in energy and water demand when compared to traditional approaches.*
- *The result is an elegant sustainable outcome for the University, the building and the building users and the local community and sets a new benchmark for research facilities of this nature.*
- *Secondary to these key achievements is a suite of initiatives captured by the project specific rating tool that has been developed to ensure all relevant environmental credit indices from both local and international rating tools are captured.*
    - *Geothermal Heat Exchanger*
    - *Tempered Make-up Air (low energy systems)*
    - *Trigeneration/ District Energy System*
    - *Daylight Access*
    - *Hybrid Displacement ventilation to office areas*
    - *Double Skin Facade*
    - *Night Purge*
    - *Building Specific Rating Tool*
    - *Water Efficiency Measures (from Warren Smith and Ptns – Roof Rainwater Collection including Façade Rainwater Capture, HDPE Pipework, Efficient Fixtures and Fittings, Landscape Irrigation, Water Efficient Urinals, Solar Hot Water, Fire Services Test Water, Stormwater Pollution Control Devices, Water & Energy Metering*
    - *Other Passive Energy Efficient Measures (insulation, thermal mass, fenestration)*
    - *Other Active Energy Efficient Measures (heat recovery, efficient equipment selection, use of relief air, adaptability, reticulation routes, possible thermal storage, lighting)*
    - *Sustainable Materials*

1.2 Potable Water

1.2.1 Existing Configuration

Our records show that the site is traversed by a 1050 dia steel pipe, refer to Appendix A for locations. This pipe generally runs in an east – west direction and is in a 9.145m wide easement. The pipe is a Sydney Water Corporation asset and is disconnected.

We have confirmed the above with Sydney Water Corporation.

1.2.2 Required Alterations

Being disconnected, we propose that the easement be extinguished and the pipe be exposed and removed over the footprint of the proposed Stage 1 development. The exposed ends will need to be flanged and capped to limit ingress of soils etc.

Arup have commenced discussions with a Water Servicing Coordinator with a view to moving this extinguishment forward.

Following discussion with Sydney Water they have reported back the following;

> *Thanks for your inquiry regarding the cancellation of a Sydney water easement over a redundant/disconnected 1050mm water main running through the grounds of Sydney University. From my quick investigation your assumptions seem to be correct. What would be needed to allow group Property to sign off on the extinguishment of the easement is:*
>
> *1/ Written confirmation from Sydney Water's operational people that in fact the main has been disconnected & is no longer required by them. I believe that the operational person for this area is David Cantlon.*
>
> *2/ An indication of willingness on behalf of your client to sign a "Deed of Transfer & Indemnity" to take over ownership of the pipe in question.*
>
> *3/ The forwarding of the above documentation to Group Property's Transaction Manager, Mark Rowley, for his consideration as to whether or not compensation for the easement's surrender is to be considered.*
>
> *4/ The lodgement of a "Transfer Releasing Easement" form at the LPI duly authorised by both parties. The lodgement fee to be met by your client.*
>
> *I would not anticipate a very long time frame at all for this action to take place provided that the Sydney Water operational advice confirms that the easement can be released.*
>
> *- Robyn Hoffmann, MetroWater, 12 November 2009*

Sydney Water has confirmed that the easement can be extinguished and Deed of Transfer for this easement is currently being lodge with Sydney Water Corporation.

1.2.3 Capability

There are only a limited number of water supplies directly to the CODCD site and all are insufficient to support the new 55,000m^2 development. Final water use figures will be developed by the building designers however preliminary calculations have been undertaken to assess the likely building requirements. These calculations identify the following approximate loads on the local infrastructure.

Total Building water requirements- 150kl per day

Cooling Tower Use- 52kl per day

Potential WC flush requirements- 39kl per day

Assuming the building incorporates rain water harvesting a collection potential of approximately 800kl per month exists. The cooling tower and WC flushing requirements are in excess of this at 1,820kl per month based upon a 5 day, four week month.

The building's low grade use consumptions are far in excess of the rainwater collection potential and subtracting the low grade collection from the overall monthly water requirements of 3,000kl yields a potable demand of 2,200kl per month or on average 110kl per day.

Sydney Water has a 450mm dia main running below one of the ovals and down Western Avenue. A Sydney Water pressure enquiry shows this main running at a pressure of approximately 45m head.

The new CODCD building will require approximately 110kL of potable water per day. It is proposed to serve the new precinct from a connection to this main as detailed below.

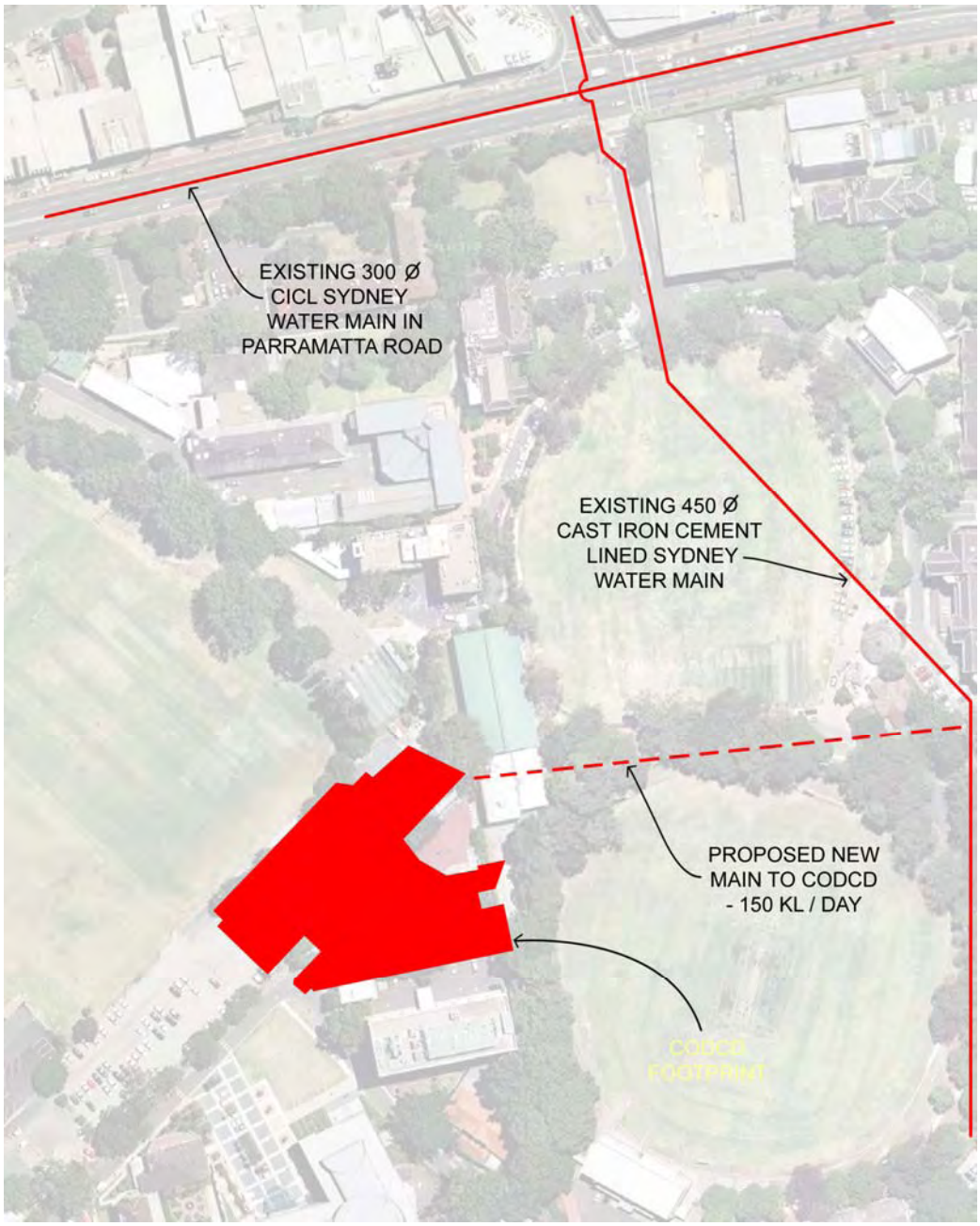


Figure 1 Proposed Water Main Connection

1.3 Electricity Supply

1.3.1 General

This section summarises the investigation process undertaken to assess the existing high voltage electrical infrastructure with a view to ascertaining its capacity and suitability to supply the proposed development.

It goes onto also outline the investigations carried out to obtain new high voltage feed infrastructure to support the proposed development loads.

1.3.2 Existing High Voltage Distribution System

Energy Australia has advised that the electrical infrastructure within the University of Sydney campus is distributed around site via high voltage underground cables originating from various Energy Australia zone substations.

Any of the existing high voltage cabling identified in the sketch in Appendix A, which is impacted by the proposed development, will need to be relocated to a suitable location to meet Energy Australia requirements.

Energy Australia has advised that there is insufficient capacity within the existing electrical infrastructure to meet the needs of the proposed development; hence new high voltage infrastructure will need to be obtained for the proposed development.

1.3.3 New High Voltage Infrastructure and Substations

The electrical designers for the building, Steensen Varming, have calculated the electrical maximum demand for the new proposed 55,000m2 development as 5.2MVA. The development will therefore require two internal chamber substations to support the development loads.

We have discussed the high voltage supply options with Energy Australia and there are two options available to supply the development.

We note that there are environmentally sustainable design initiatives being investigated for the development such as trigeneration systems and photovoltaic's as outlined in Steensen Varming's sustainable design report. These sustainable initiatives will not impact the sizing of the HV infrastructure for the site. However, we assume that Steensen Varming would have accounted for an energy efficient building when calculating the maximum demand for the building. The infrastructure for the building has been sized based on Steensen Varming's maximum demand calculations.

1.3.3.1 Option 1 – Energy Australia zone substation upgrade

The Energy Australia zone substation located on the corner of Layton and Purkis St, Camperdown, which is currently feeding the University's Camperdown campus, will be upgraded for additional electrical capacity by 2012. New 11kV feeders from this zone substation can be reticulated to the substations within the development, as illustrated in figure 2.

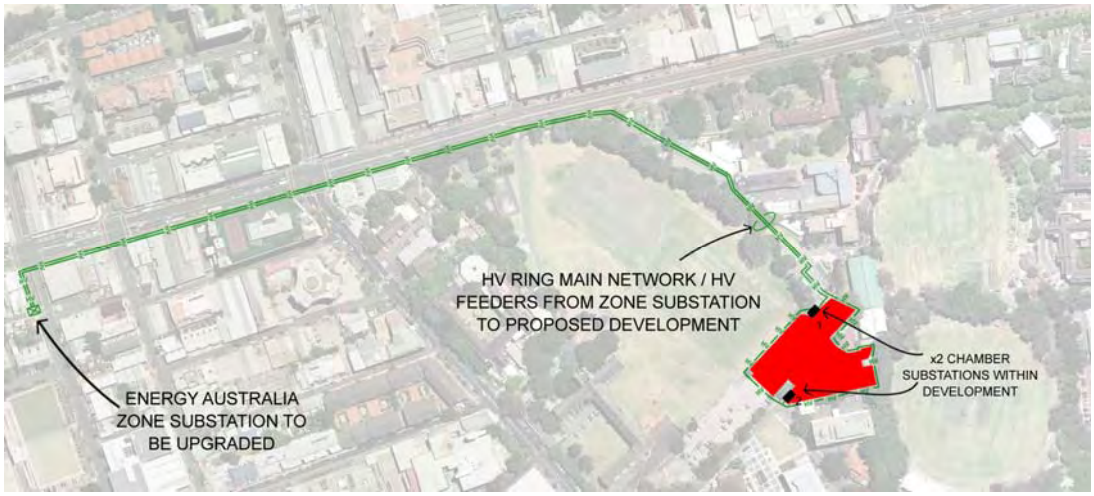


Figure 2 Proposed high voltage reticulation from the upgraded Energy Australia zone substation to the chamber substations within the development

1.3.3.2 Option 2 - Potential Wider Upgrades

To cater for the overall master planning for the University and due to the number of potential developments within the University requiring new electrical infrastructure, a new private zone substation has been considered be implemented on the University's campus to serve various buildings in the university. The new potential private zone substation will be approximately 60MVA in capacity, and will require a minimum of 5 years to implement. Timing to implement the private zone substation will need to be finalised with Energy Australia.

A suitable location to accommodate the private zone substation will need to be identified by the University.

1.4 Gas Supply

1.4.1 Existing Configuration

The site is traversed by an existing 150 diameter gas main (1050kPa); refer to Appendix A for locations.

The gas pipe is an AGL asset which is currently routed directly below the proposed new CODCD building footprint.

1.4.2 Required Alterations

The gas main will require relocation in order to accommodate the new development. Approximately 130m of new steel pipe will need to be laid to reroute the gas main around the northern and western perimeters of the basement structure.

This work will be designed and constructed by AGL who have advised that they require a lead time of approximately 4 months. Costs will need to be borne by the University of Sydney and have been estimated at $200k to $400k at this stage.

1.4.3 Capability

Initial load estimates for the building identify a peak load requirement of approximately 460m3/hr for the CODCD building.

The gas main is a high pressure main and when rerouted will have sufficient capacity to service the new CODCD development.

A new connection will be made to the relocated pipe to supply the new CODCD building. The following diagram identifies this proposed new connection to the 450mm dia main traversing the site.

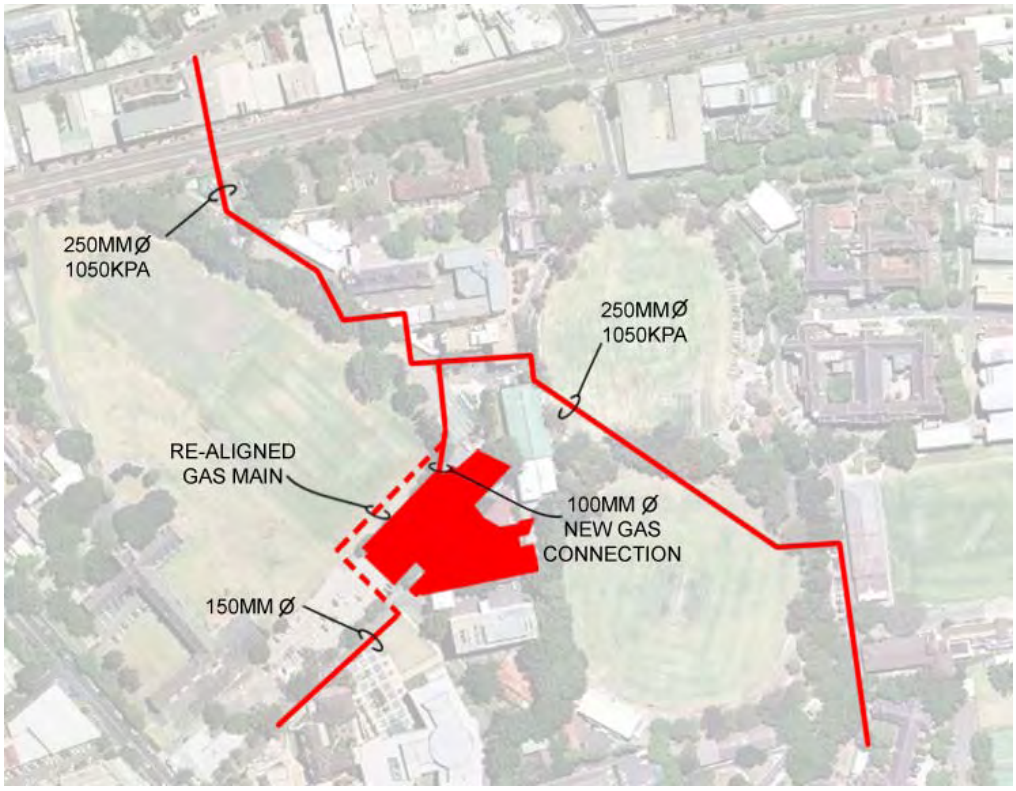


Figure 3 Proposed re-routed gas supply and new connection

1.5 Stormwater

1.5.1 Existing Configuration

The proposed development clashes with two existing stormwater pipes. A large 1050 diameter concrete pipe runs in a north – south direction in the eastern side of the basement footprint and will need to be relocated.

A smaller stormwater feeder of unknown diameter traverses the site in a north-easterly direction.

The larger stormwater asset belongs to Sydney Water and we have engaged Sydney Water in preliminary discussions to date. Smaller stormwater pipes are owned by the University or City of Sydney Council.

1.5.2 Required Alterations

The major stormwater pipe (1050 dia) will need to be rerouted around the eastern side of the basement structure, for the full length of the development. We believe that this will be a feasible solution and Sydney Water has confirmed their acceptance in principle of this solution and require layouts for review and approval (Refer to consultation meeting minutes in Appendix D)

Sydney Water has raised the possibility that an easement may need to be created over the deviated asset.

Smaller pipes will be demolished during the construction of the proposed basement and re-routed as new stormwater infrastructure with the development. Refer to the below figure.

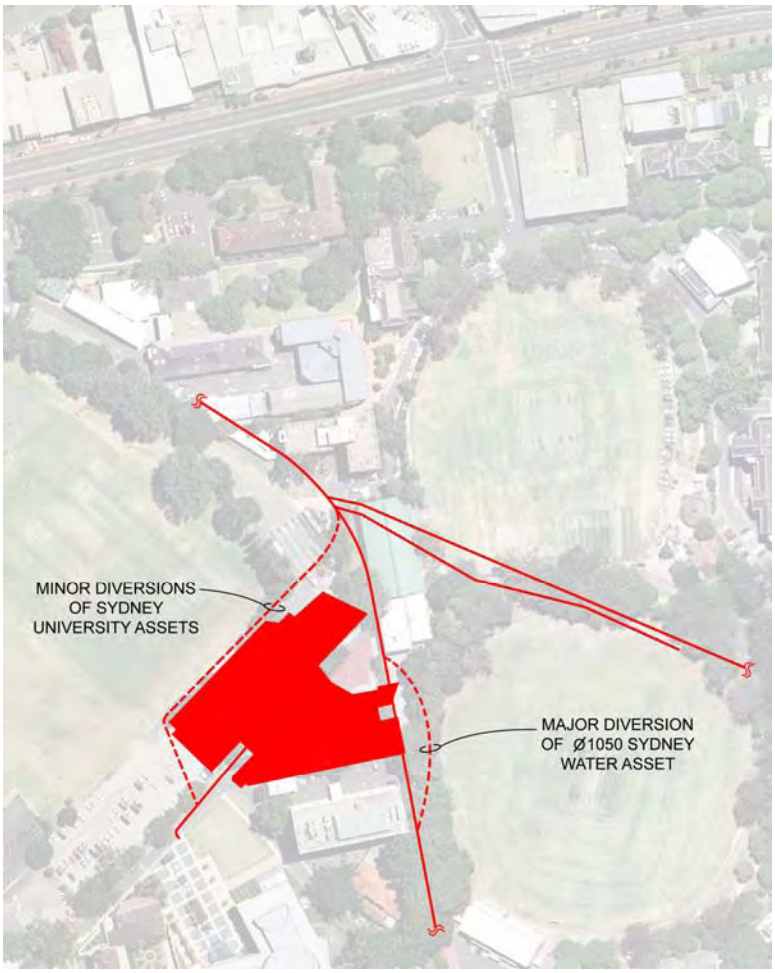


Figure 4 Stormwater Drainage

1.5.3 Capability

Stormwater from the proposed development will be directed to the rerouted Sydney Water's 1050mm diameter stormwater pipe on the eastern side of the development.

Sydney Water has confirmed that the permissible site discharge for building developments on the West Camperdown catchment will be dependent on the capabilities of the down stream systems and the area of land being developed.

Sydney Water has provided estimates for the Permissible Site Discharge and On Site Detention volumes as follows,

0% Existing Impervious*	
Percent Impervious Proposed	100%
On-Site Storage:	46.81m³ per 1000m² of total development site
Maximum Permissible Site Discharge	16.80L/s per 1000m² of total development site
50% Existing Impervious	
Percent Impervious Proposed	100%
On-Site Storage:	36.82m³ per 1000m² of total development site
Maximum Permissible Site Discharge	21.21L/s per 1000m² of total development site
100% Existing Impervious	
Percent Impervious Proposed	100%
On-Site Storage:	28.44m³ per 1000m² of total development site
Maximum Permissible Site Discharge	25.63L/s per 1000m² of total development site

* The percentage of 'existing impervious' refers to the permeability of a development site prior to the development. Based on OSD requirements, a site which is currently 'soft landscaped' will require more OSD volume than one which is current 'hard landscaped' (impervious).

Best practice Storm Water Quality measures will be required for the developments on the precinct to satisfy Sydney Water requirements; these are as listed below;

Stormwater Runoff

Treat run off to the NSW EPA draft best practice guidelines;

- 80% reduction in total suspended solids
- 45% reduction in Total Phosphorous
- 45% reduction in Total Nitrogen

Reuse Measures

Maximising the reuse of roof water and storm water runoff through the implementation of integrated water cycle management in order to reduce the impact upon potable infrastructure and reductions in the above pollutant loads.

Sydney Water encourages the maximisation of rainwater reuse by allowing offsets in OSD volumes. For every 100m3 of rainwater tank introduced a 50m3 reduction in OSD volume can be achieved. Sydney Water cap this reduction at 50% meaning a 300m3 OSD tank can be reduced in volume by a maximum of 150m3, to achieve this reduction rainwater reuse tank volume has to be 300m3 or greater.

Suspended solids and Nutrient load reduction

Suspended solids reduction will be effected by in building first flush diverters and external Gross Pollutant Traps (GPTs).

Nutrient reductions will be affected by the in building reuse of rainwater and the routing of the external catchments through swales and bio retention elements within the drainage schemes.

Typically swales will require areas up to 4% of the urban catchment however this total area can be reduced to 1% where bio-retention systems are provided. The architectural concepts for the precinct will incorporate surface storage and bio-retention elements.

The existing No.1 Oval is a significant natural surface detention structure. The review of flood issues analysis within Section 2 discusses detention for the precinct and overland flows. This analysis supports the use of the Oval as gross OSD however the maximum use of in building rainwater reuse and OSD is encouraged.

OSD Estimations

The on site detention for the new CODCD building will be heavily dependent on the footprint of the building and extent of rainwater harvesting undertaken. The design of the development is in its' very early stages and will seek to provide 55,000m2 of accommodation. The preliminary drawings from the Architects suggest a floor plate of up to approximately 10,000m2 gross.

The final rainwater harvesting and OSD design will be undertaken as part of the detailed design of the building however preliminary evaluations indicate the following as a potential harvesting and OSD requirement based upon the above Sydney Water Corporation requirements.

RW Harvesting volume- 78,000litres

OSD Volume No RW Harvesting- 284,000litres

OSD Volume with RW Harvesting offset- 245,000litres.

It is expected that these storage volume be accommodated within the new development.

1.6 Sewer

1.6.1 Existing Configuration

Our records show there to be an existing 150 dia / 225 dia sewer to the north of the proposed development and discharging in a westerly direction. The sewer is a Sydney Water asset.

1.6.2 Required Alterations

The sewer will not require relocation to accommodate the new development.

1.6.3 Capability

The new CODCD building will be constructed with a lettable area of 55,000m2. The detailed design of the sanitary systems within the building are yet to be developed and will be heavily dependent on the space planning of the laboratories, population and usage profiles.

A preliminary estimate of the buildings population and number of sanitary fittings has yielded a peak discharge to sewer of approximately 21l/s.

The 225 dia sewer main to the north has a carrying capacity of between 32l/s and 40l/s dependant on the installed gradient. Whilst diversity can be applied to the contributing developments which will mean the overall load seen by the sewer can be reduced it is unlikely that the 225 dia sewer has adequate capacity to accommodate the CODCD building and wider planned development areas without augmentation.

It is recommended that early in the next stage a Water Services Coordinator be appointed to review the extent of the likely upgrades. This assessment is likely to require a hydraulic “MOUSE” model assessment in order to evaluate the peaks across the greater catchment contributing to this sewer.

The detailed design of the augmentation required for the CODCD project will need to be developed in parallel with the detailed design of the buildings however preliminary estimates suggest the 225dia line will need to be increased to 300dia.

This augmentation requirement will need to be discussed and reviewed with Sydney Water during detailed design.

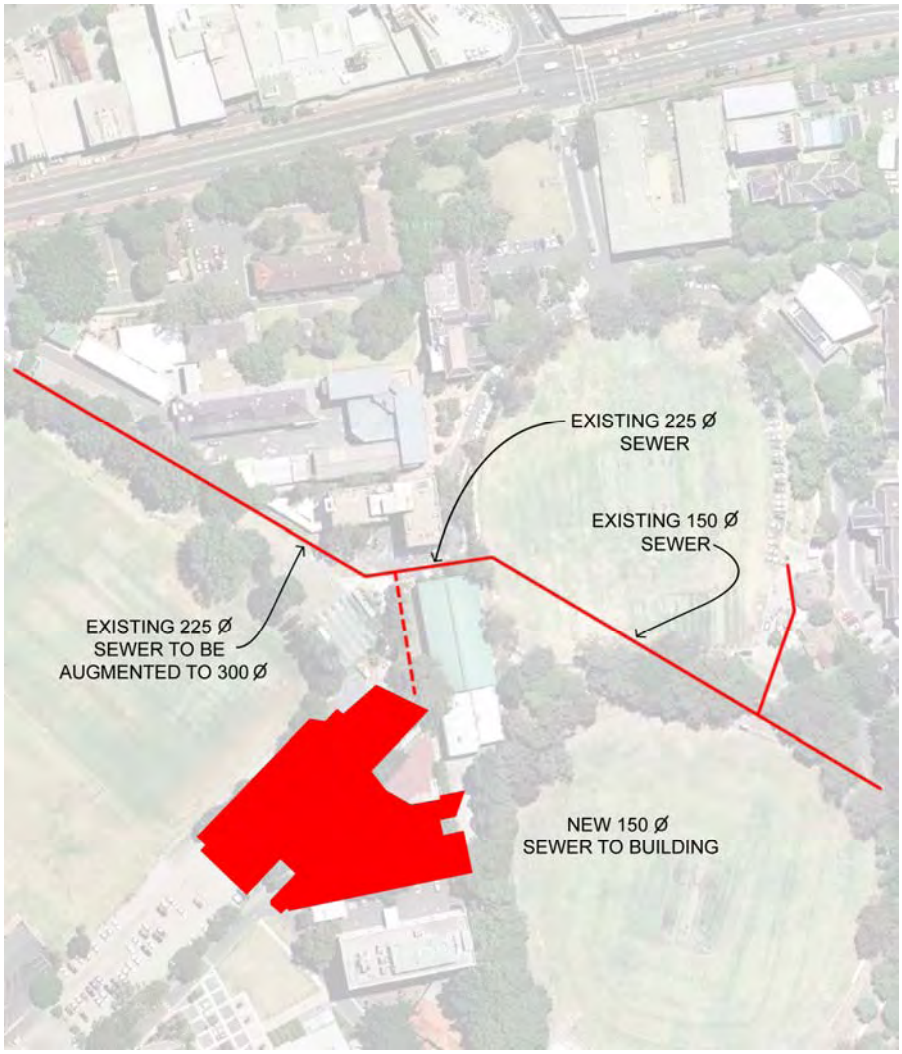


Figure 5 Proposes Sewer Connection

1.7 Communications

1.7.1 Existing Configuration

The proposed development will clash with two underground cable trenches that traverse St Johns oval refer to Appendix A. These routes contain University of Sydney owned optic fibre cables that connect the University buildings around the oval and across Parramatta Road to the main network hubs on the Camperdown Campus. The exact location has been traced by Hard and Forester Surveyors (refer to Appendix A).

The proposed development will also dissect two microwave links which are currently connecting the Camperdown campus to remote Campuses in Rozelle and Western Sydney.

1.7.2 Required Alterations

The optic fibre connections are essential to maintain redundancy in the University of Sydney's IT network. Accordingly, these connections must be replicated in adjacent routes prior to any excavation or foundation constructions taking place. New cable routes shall be designed to maintain the network resilience and availability. The IT department has preferred contractors to carry out this work.

Depending of the height of the proposed development the microwave links may need to be re-aligned.

1.7.3 Capability

The new development will require connection to the University IT network, as well as requiring telecommunications carrier connections. Cable routes and entry points shall be designed to connect the new development to the nearest network hub.

We have been advised that the IT network has adequate spare capacity to accommodate the new development.

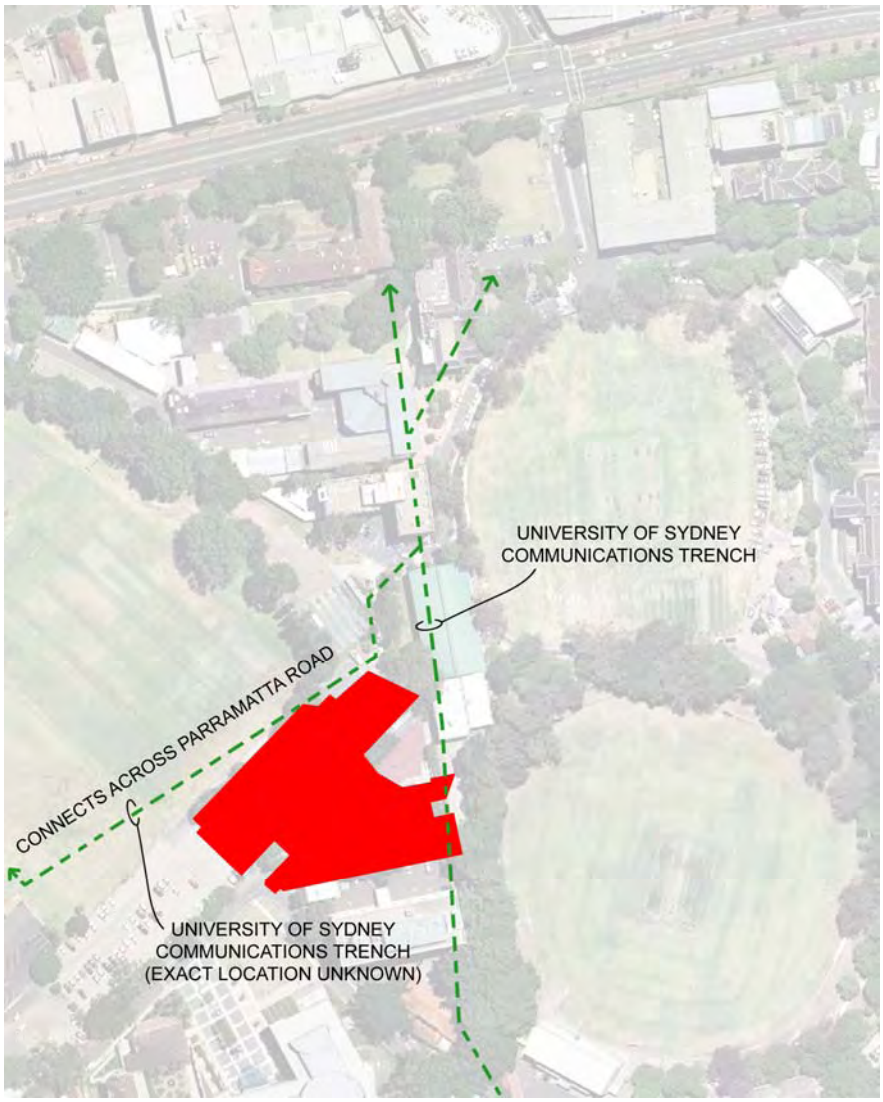


Figure 6 Communications Infrastructure

2 Review of Potential Flooding Issues

2.1 Introduction

A key component in the planning and design of a new development is the assessment and, where required, mitigation of flooding issues. This review of potential flooding issues at the CODCD is in support of the Part 3a submission to be submitted by University of Sydney and aims to outline design constraints and considerations as they relate to flooding issues.

This review provides preliminary analysis of the major overland flows and comments on whether these flows impact on the development proposal and other key considerations.

2.2 Site Description

2.2.1 Location

The site is located to the north west of the Camperdown Campus of the University of Sydney on John Hopkins Drive; accessed from Missenden Road. It is bounded by large sporting ovals (No 1 Oval to the north east, No. 2 Oval to the south east and St Johns Oval to the north west), Royal Prince Alfred Hospital grounds to the south west and the University's Veterinary Campus to the north. The site is currently occupied by University buildings (HK Ward Gymnasium and Missenden Psych Unit) which will be demolished to facilitate construction of the development.

2.2.2 Proposed Development

The proposed development consists of the construction of two main buildings and the refurbishment of an existing building to the south (Centenary Institute). The main building will have an interconnected, two level basement with ramped entries from the south and north.

Please refer to Hassell Architectural plans and sections in Appendix B

2.3 Reference Data

Reference has been made to the following plans and documents in preparing this interim report.

- Topographical map – Lands Department Spatial Information Exchange portal.
- 1:2000 Orthophoto maps – Leichhardt U0945-62 and U0945-64, First edition 1980.
- Sydney Water Corporation Trunk Drainage diagrams – Johnston Creek Catchment (Appendix F).
- Site topographical survey supplied by University of Sydney; survey-full_BOUND Model.dwg (Appendix G for extract of survey)
- Hassell Architectural Plans and Sections
- Australian Rainfall and Runoff, Volume 1, 1997 and Volume 2, 1987

2.4 Description of Hydraulic Features

2.4.1 Existing Hydrologic and Hydraulic Features

The following observations have been made from a review of Leichhardt orthophoto maps, Lands Department topographical information and Sydney Water Corporation trunk main diagrams. These details include:

- The catchment area upstream of the site is approximately 52 ha and consists of mainly urban development. Refer to Appendix C for Catchment Plan.
- There are significant areas of grassed sporting fields in the vicinity of the site (No 1 Oval to the north east, No. 2 Oval to the south east and St Johns Oval to the north west).

- Oval No. 1's surface levels are approximately 2-2.5m below the existing levels for the development. The upstream catchment overland flows drain to this lowpoint.
- With reference to Sydney Water's trunk drainage diagrams; the drainage infrastructure downstream of the site has limited capacity (i.e. up to 5 year ARI). Therefore a large proportion of the flows from a 100 year ARI event (i.e. assumed design storm event) will either flow overland or be conveyed by the upgraded, upstream pipe network to the catchment's localised lowpoint – Oval No. 1
- There is a raised section between Oval No. 1 and Oval No.2. This section is RL23.0 approx and therefore traps overland flows from the upstream catchment in Oval No. 1 area.

2.4.2 Hydrologic and Hydraulic Features Resulting from Proposed Development

Based on Hassell's Architectural Plans and Sections, it is not envisaged that the existing site levels will not be significantly modified. As such Oval No. 1 will continue to act as a trapped lowpoint for the catchment.

Any deviation of Sydney Water Corporation's assets (i.e. trunk stormwater drainage) should consider the upgrade of the infrastructure to cater for the 100 year ARI flows. This upgrade will not directly assist in the drainage of the catchment until such time as the under capacity downstream network is upgraded by Sydney Water.

The existing and future developments have a similar impervious type surfacing therefore there will be little increase in runoff associated with the development. Despite this, Sydney Water has specified onsite detention requirements for the development (refer to Section 1.5.3) that will be incorporated, where appropriate, into the detailed design.

Site grading is to be developed in the detailed design phase. This grading is to provide for safe overland flow routes for local catchment flows around the site. Any existing localised overland flow routes that will not be maintained as a consequence of the new development will be deviated to ensure that there flow levels around the development site are within acceptable limits.

2.5 Flood Level Estimation

2.5.1 Methodology and Assumptions

In estimating the flood levels around the development, we have adopted the following simplified approach and incorporated the following assumptions in our calculations:

- The volume of overland flow arriving at the catchment's lowpoint (i.e. Oval no. 1) has been estimated using a simplified Rational Method approximation of total flow from the 52ha upstream catchment multiplied by the corresponding storm duration.
- The Rational Method was estimated from the following expression CxIxA where:

C = appropriate runoff coefficients for the catchment (C=1 for 90% fraction impervious, 100 year ARI)

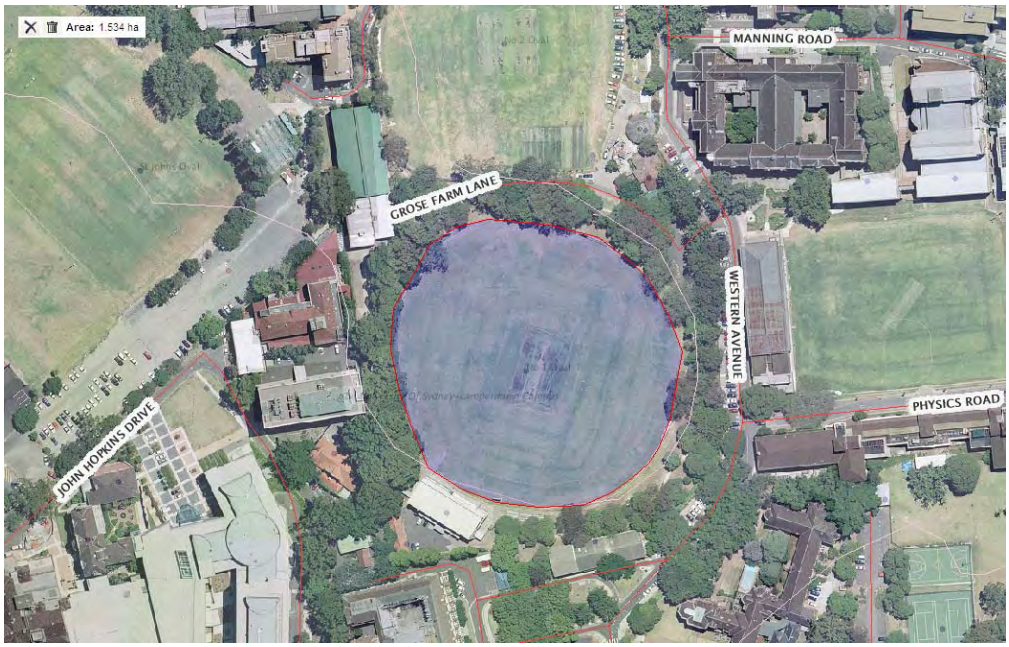
I = intensity (relative to each duration)

A = catchment area

Durations over a range of storm events from 5 mins to 72 hours were considered

- The rate of discharge from the trapped lowpoint is assumed to be via Sydney Water's trunk drainage system. With reference to Sydney Water's capacity estimate for section just down stream of the confluence of the three trunk main branches (i.e. 6.96 m³/s).
- Estimation of the flooding effects has been undertaken for the 1 in 100 year flood event only.

- The storage volume of Oval no. 1 has been estimated based on the plan area of the oval as 1.53ha, highlighted below. It is a conservative estimate of volume as it ignores the increase in plan area/volume with depth.



Source: Department of Lands

- At this stage it is assumed that there will be no overtopping of the mound that separates Oval no.1 and Oval no. 2. This assumption will be reviewed upon finalisation of site regrading, but it is envisaged that the current ground levels will be maintained.
- Rainfall Intensity data for the site has been approximated using Bureau of Meteorology's Rainfall IFD Data System. Refer to Appendix E
- The average RL for Oval no. 1 has been assumed as RL20.4. This value is conservative as it is in the upper range for RLs listed in Sydney University supplied survey (refer to Appendix G)

2.6 Results

2.6.1 Flooding Depth Oval no. 1

The table below outlines the estimation of flooding level in Oval no. 1 over a range of storm events

Duration		Overland Flow				Pipe Capacity				
time (hrs)	time (mins)	C	I (mm/ hr)	A (ha)	Volume: In (m3)	Q m3/s (SYDNEY WATER estimate)	Volume: Out (m3)	Net Volume	Depth	Water level - Oval 1 (RL)
	5	1	266	52	11,527	6.96	2088	9439	0.6	21.0
	30	1	160	52	41,600	6.96	12528	29072	1.9	22.3
1	60	1	92.8	52	48,256	6.96	25056	23200	1.5	21.9
2	120	1	60.8	52	63,232	6.96	50112	13120	0.9	21.3
3	180	1	46.6	52	72,696	6.96	75168	0	0.0	20.4
6	360	1	29.3	52	91,416	6.96	150336	0	0.0	20.4
12	720	1	18.6	52	116,064	6.96	300672	0	0.0	20.4
24	1440	1	12.1	52	151,008	6.96	601344	0	0.0	20.4
48	2880	1	7.81	52	194,938	6.96	1202688	0	0.0	20.4
72	4320	1	5.81	52	217,526	6.96	1804032	0	0.0	20.4

2.7 Conclusion

It is assumed that the general flood planning levels required by City of Sydney is the 100 year ARI flood level plus 0.5m minimum freeboard. With reference to the flood level estimated in the Table in Section 3.6.1, the minimum level for habitable floor levels as well as entrances to underground facilities (e.g. car parks) should be set higher than RL22.8m.

This design level, together with assessment of localised overland flow paths around the proposed buildings is to be reviewed in detail once site gradings have been finalised for the development.

In considering the wider catchment flooding issue, the mound between Ovals 1 and 2 has overriding control of the flood level in Oval no.1. An alternate approach to setting building and facility levels is to consider the water level with weir flow over this mound.