Health Infrastructure

Clinical Services and Mental Health Building, Royal North Shore Hospital

Civil Concept Design Report

220977/80

Issue | August 2011

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Job number 220977/80

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Document Verification

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Job title		Clinical Services and Mental Health Building, Royal North Shore Hospital			**Job number** 220977/80
Document title		Civil Concept Design Report			**File reference**
Document ref		220977/80			
Revision	**Date**	**Filename**	Structural and Civil Concept Design Report - Issued 30-08-11.docx		
Issue	30/08/11	**Description**	Stand alone document		
			Prepared by	Checked by	Approved by
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		Filename			
		Description			
			Prepared by	Checked by	Approved by
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				Issue Document Verification with Document	✓

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Executive Summary

As part of the Royal North Shore Hospital redevelopment, Arup has been engaged by Health Infrastructure (HI) to provide consultancy services related to civil and traffic aspects for the proposed Clinical Services Building (CSB).

Three sites were initially proposed for the location of the CSB and as an outcome of the Masterplan and Value Management workshops, Zone 2, located at the corner of Westbourne Street and Herbert Street, was selected as the proposed site.

Arup has prepared this report based on the architectural plans received on 3rd August 2011. The summary of findings for traffic is presented in the Arup Transport Report, August 2011.

The previous allowable site area for the CSB was restricted by Red Road and Westbourne Street and would not be able to provide sufficient floor area to allow the Birthing Unit and Newborn Intensive Care Unit (NICU) to be located on the same floor level. The revised CSB concept includes the closure of the Northern end of Red Road so as to provide a large enough floor area to incorporate the Birthing Unit and NICU on the same floor level. This revised scheme also incorporates the Mental Health Unit (MHU) within the new CSB.

The redevelopment of the Royal North Shore Hospital will impact on the existing infrastructure. Preliminary investigations have been carried out to assess these impacts on the road network and the underground services (including stormwater) networks at the proposed location for the new CSB.

- Services information has been collated from the Acute Services Building (ASB) Public Private Partnership (PPP) documents and a Dial-Before-You-Dig (DBYD) search into a site layout plan. The findings show that the site east of Red Road contains a ø500mm water main which Sydney Water consider a critical asset. The site to the west of Red Road contains waste water / sewer and a ø500mm water main, which has been relocated as part of the PPP works other than these, the western part of the site is generally free of any regulatory services. Other services have been identified and shown on the services plans.
- Vehicular and pedestrian access to the new CSB is proposed from four separate access points which separate entry to the MHU and entry to the Womens, Childrens and Burns Unit (WCBU). There is also separate provision for public entry and ambulance entry.
  HI have requested that the WCBU drop off area accommodate two ambulance bays while the MHU drop off area will provide space for an Ambulance and a Police vehicle.
- Willoughby Council has confirmed that the volume of rainwater re-use proposed for the ASB cannot offset the requirement for On Site Detention (OSD) required for the CSB. Preliminary investigations also considered utilising the existing OSD tank in the ASB. However due to site constraints and high cost implications associated with this option, a standalone OSD has been recommended to be included within the CSB Plant room. Willoughby Councils standards require a minimum volume of 169m³ OSD however, in order to minimise the risk of downstream overland flooding a provision of 338m³ has been included in the proposed building.

1 Introduction

1.1 Project Background

Three zones were initially proposed for the location of the new CSB, as shown in Figure 1. Arup undertook a study to evaluate the civil and structural engineering constraints and opportunities for each of these sites. The results of this study are contained within the Arup Technical Memorandum dated 1st November 2010. As an outcome of the Masterplan Study, Masterplan Workshop and Value Management Workshop, Zone 2 (shown in blue in Figure 1) was selected as the proposed site. This is the area north of the new Acute Services Building (ASB), previously designated as the Mental Health Building as part of the PPP project. Zone 2 covers part of an area known as Precinct 7. Arup investigated some preliminary options for the proposed site based on the civil and engineering constraints and opportunities. These preliminary options can be found in the Arup Structural and Civil Feasibility Study, November 2010.

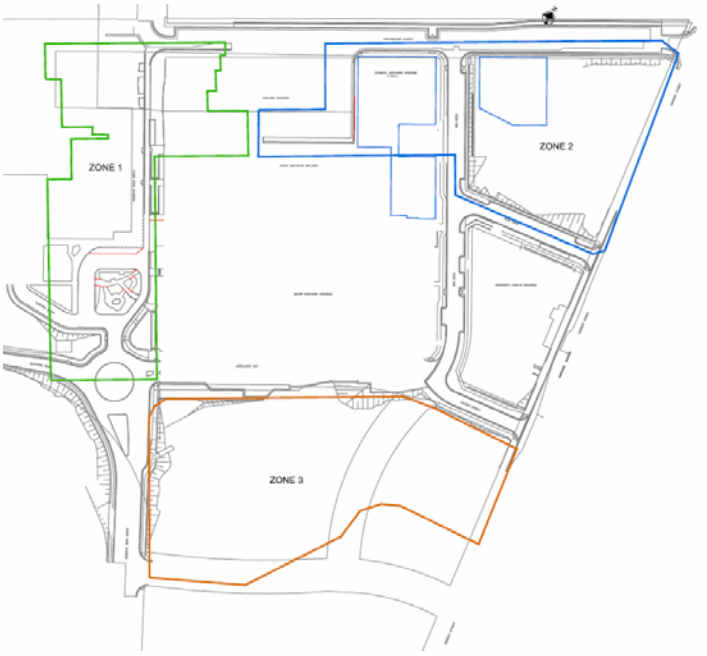

Figure 1 Proposed Site Locations

1.2 Description of Proposed Works

The building layout includes the Mental Health Unit (MHU) within the CSB and as a result, the CSB has four separate access points:

- Public access to Women's, Children's and Burns Units via Westbourne Street (level 2)
- Ambulance access to Women's, Children's and Burns Units via Westbourne Street (level 1)
- Ambulance and Police access to the Mental Health Unit via the Kolling Building Access Road (level 2)
- Public access to Mental Health Unit via Red Road (level 2)

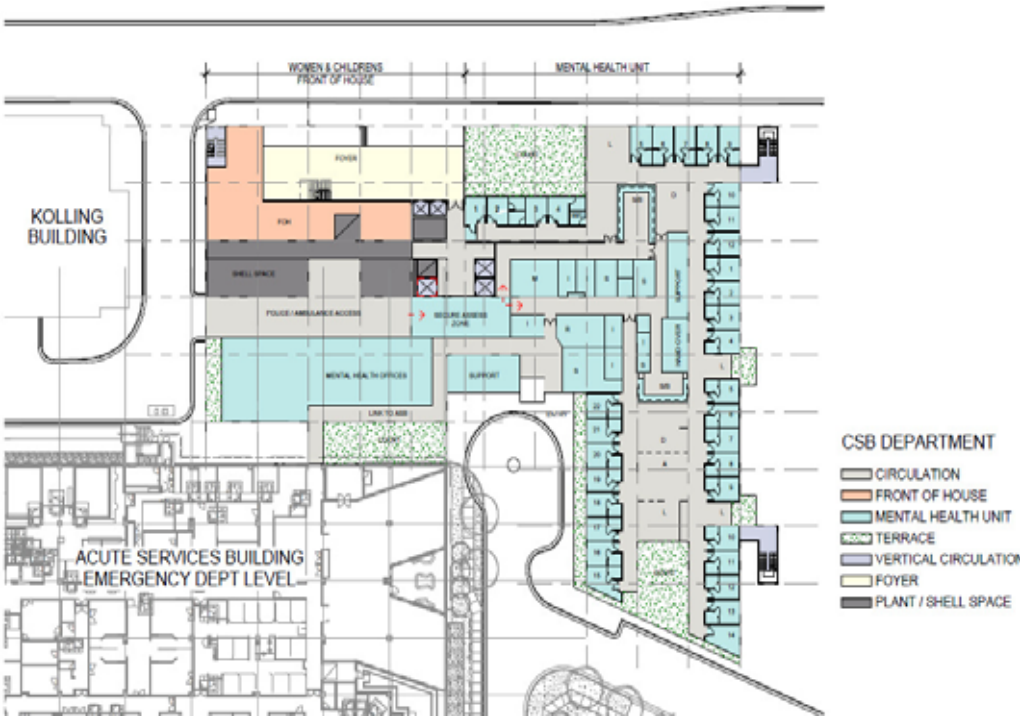

Figure 2 Proposed CSB Arrangement (Hassell, 2011)

1.3 Scope of Services

The report reviews the impacts of the proposed scheme (shown in Figure 2) of the CSB to Civil Engineering. More specifically, it considers:

- The impact on access points to the CSB and analysis of the turning paths for public and emergency access;
- Review of the services relocation due to the closure of Red Road;
- Review of the On Site Detention (OSD) requirements; and
- Assessment of implications of the new footprint on the existing stormwater network within Westbourne Street and Red Road.

2 Design Criteria

The concept design was developed in accordance with the following stakeholders' guidelines:

- Roads and Traffic Authority
- Australian Standards
- Willoughby Council
- Sydney Water
- Water Service Association of Australia

In addition, the development of the concept design was carried out based on the building footprint provided by Hassell Architects on 3rd August 2011.

3 Proposed Design

This section outlines the site options Hassell Option 3 concept, including impacts on existing services infrastructure, stormwater hydrology and surrounding road networks.

The concept design option has been developed in line with the development of the CSB layout. This report was prepared based on the concept architectural plans attached in Appendix A. For the proposed concept road works plan, refer to Appendix B.

3.1 Site Access and Egress

3.1.1 Access to the CSB

Access to the proposed site will be possible from four separate points;

- Public access to Women's, Children's and Burns Units via Westbourne Street (level 2);
- Ambulance access to Women's, Children's and Burns Units via Westbourne Street (level 1);
- Ambulance and Police access to the Mental Health Unit (MHU) via the Kolling Building Access Road (level 2); and
- Public access to Mental Health Unit via Red Road (level 2).

The public access from the multi-storey car park being constructed as part of the Acute Services Building (ASB) PPP development will be via level 3 of the ASB. This will remain as the main entrance to the CSB. A pedestrian access for the Women's, Children's and Burns Units (WCBU) will be via Westbourne Street on level 2 (ground floor). A separate pedestrian entrance to the MHU will be provided on the same level via Red Road. A 2.0m wide footpath has been recommended along the Westbourne Street and eastern side of Red Road along the drop off area, which would provide sufficient width for two wheelchairs to pass each other.

Ambulance and Police access to MHU will be via the Kolling Building Access Road. A separate ambulance access area for Women's, Children's and Burns patients will be provided from Westbourne Street level 1 and will accommodate two emergency/ambulance bays.

There is currently no provision for separate staff or visitor car parking in the vicinity of the new CSB, all parking will be in the new ASB car park. The CSB will provide maternity and paediatric facilities and it is therefore suggested that a number of the public parking spaces along Westbourne Street and/or Red Road be allocated for short term one hour parking to allow drop off to the WCBU entrance of the CSB.

3.1.2 Drop off Areas

Separate vehicle accesses for Women's, Children's and Burns Units and for Mental Health Unit are proposed in the revised building scheme.

3.1.2.1 Women's, Children's and Burns Units Drop off Area

There is no patient drop off area for Women's, Children's and Burns Units patients, however short term public parking is recommended along Westbourne Street. Emergency Ambulance access for Women's, Children's and Burns unit will be on level 1 via Westbourne Street (shown in Figure 2).

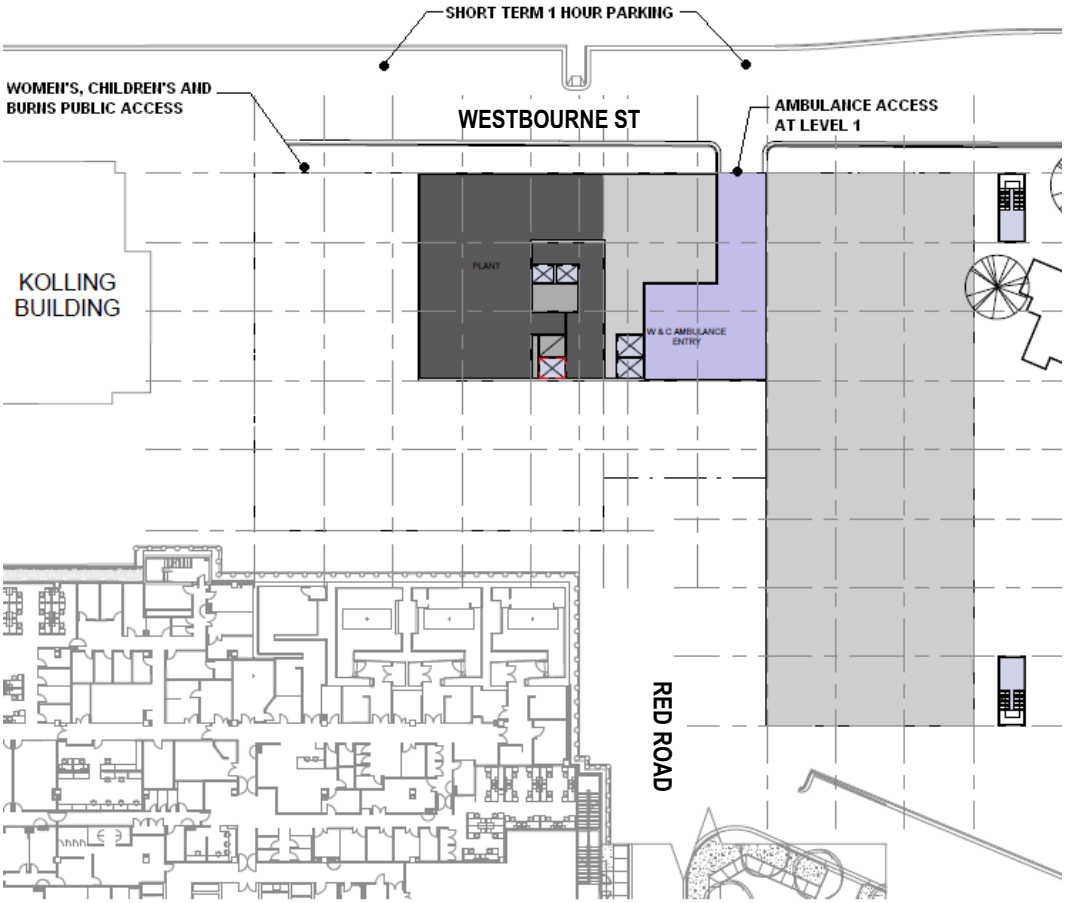

Figure 3 Women's, Children and Burns Units Public and Ambulance Access

3.1.2.2 Mental Health Unit Drop off Area

A roundabout will be introduced at the northern end of Red Road to provide a public drop off area for the Mental Health Unit (shown in Figure 3). Egress from the site is via Blue Road or Eileen Street. Two vehicle lay-by spaces have been included for short-term drop offs.

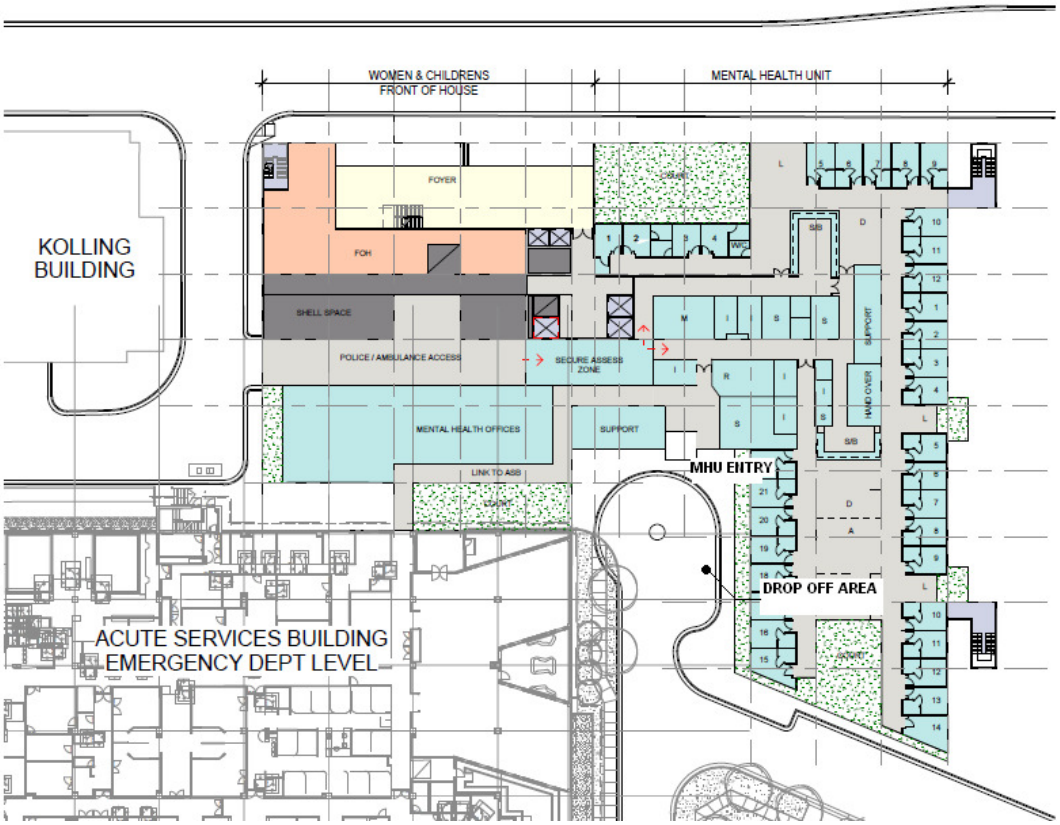

Figure 4 Mental Health Unit Drop-Off Area

3.1.3 Plant Room

A plant room has been retained on the level 1 (RL 84.80) with the entrance off Westbourne Street. Based on discussions with the various stakeholders, only pedestrian access is required to this plant room which will be through the WCBU ambulance entry.

In terms of safety, access to the plant room should be considered by the BCA Consultant and the Fire Consultant in the next phase of planning. Access (walking path) to the building exits should be within 20m from any location in the plant room. The location and number of the entry/exit is to be advised by the BCA and Fire Consultants in the next phase of planning.

3.1.4 Loading Dock

The inclusion of a loading dock within the CSB concept was investigated at the request of Health Infrastructure. Refer to the Arup Structural and Civil Feasibility Study, November 2010 for more details. It was determined not to include a standalone loading dock for the CSB, and that loading dock facilities will be shared with the ASB.

3.1.5 Fire Route

As part of the ASB development, access has been closed to through traffic along Reserve Road and as a result, Westbourne Street will become the main access for

the Fire Brigade. The closure of the northern end of Red Road does not impact the Fire Brigade access to the building via Westbourne Street.

Fire Brigade access along the remaining section of Red Road has been reviewed and since the CSB's links to ASB over Red Road are at levels 4 and 5, the minimum vertical clearance of 4.5m can be achieved.

3.2 Services

The services information is based on both the Dial Before You Dig (DBYD) search originally conducted in September 2010 and the hydraulic plans as received from the PPP contractor.

A DBYD enquiry was lodged and the information provided by the asset owners was reviewed. It should be noted that this check did not investigate any internal site services and the check was limited to regulatory services only.

Internal site service information was provided by the PPP contractor via the initial information received at the start-up of the project, and subsequent requests for more information as the need arose.

The DBYD services information in conjunction with the hydraulic plans as received from the PPP contractor have been combined with the site layout plan to provide an indicative services plan. It is important to note that at this concept stage, the services are schematically drawn and actual locations and depths of each service will need to be confirmed during detailed design and with survey prior to construction.

- Water – Two ø500mm water mains are located in Westbourne St and one ø500mm water main in Red Road, which then crosses into Precinct 7 and connects to Herbert St; all three mains are located within 4m to 6m wide easements.
  There is also a ø200mm water main in Westbourne St connecting into Red Road in a 3m easement. This main was upgraded from a ø100mm pipe to a ø200mm pipe as part of the ASB PPP works.

- Sewer – Sewer mains are located in Herbert Street. Sewer property connections are located along Blue Road and into Red Road then connecting to the Kolling building via the southern extent of the site.
  This main has previously been upgraded from a ø225mm pipe to a ø300mm pipe as part of the Acute Services Building works.
  The section of the sewer main running through the CSB site will require relocation to avoid piles and lift over run locations within the CSB.
  A second sewer main has been identified in Red road. Although its purpose and exact location are unclear, it appears to be a connection to the previously proposed mental health building, possibly via the ASB.

- Telecommunications – There are substantial telecommunications in Herbert Street, and minor telecommunications in all streets with the exception of Red Road and Blue Road where telecommunications have not been identified although they may have been installed. Refer to Norman Disney Young plans for further information.

- Gas – High pressure gas mains are located in Westbourne Street and Herbert Street.

- Electrical – Refer to the report prepared by Norman Disney Young.

The services review indicates that the proposed site east of Red Road contains a ø500mm water main which Sydney Water consider a critical asset. The site to the west of Red Road is free of regulatory services other than the waste water supplying the Kolling Building. The ø500 water main identified in the DBYD documentation as crossing through the previously proposed Mental Health building has been relocated outside of the site, and now runs along Westbourne Street and then down Red Road. The ø500 water main identified as crossing Precinct 7 has not been relocated, however this will be carried out as part of the CSB works.

Service connections to be made to the building include:

- A potable water service connection will be made from the northeast side of the building into the ø200mm water main in Westbourne Street; and
- A sewer service connection will be made from the western side of the building, adjacent to the Red Road roundabout. A second connection to the eastern side of the roundabout is possible if deemed necessary. The connection will be to the existing sewer main in Red Road.

Other works to be undertaken in response to the proposed footprint of the CSB along with the closure of Red Road are as follows:

The ø500mm water main identified in the DBYD documentation as crossing through the site has been relocated and now runs along Westbourne Street, Red Road and connects to Herbert Street via an easement through Precinct 7, refer to Figure 5 for details.

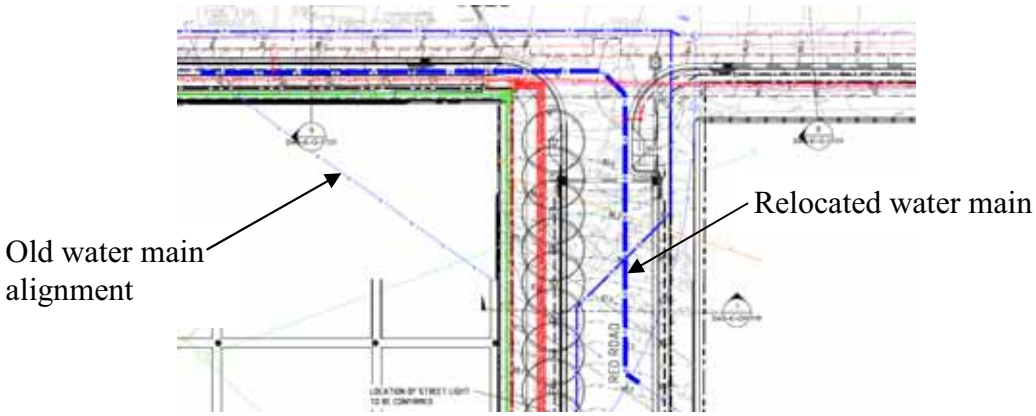

Figure 5 500mm diameter water main relocated as part of PPP works and shown on combined services plan DWG-IC-CI-01110 revision 05

The section of the ø500mm water main identified as currently crossing Precinct 7 has not currently been relocated. As part of the CSB construction it will be relocated along Red Road and into Blue Road to move it out of Precinct 7. This route has been determined by Health Infrastructure in conjunction with Theiss, refer to Figure 6 for details.

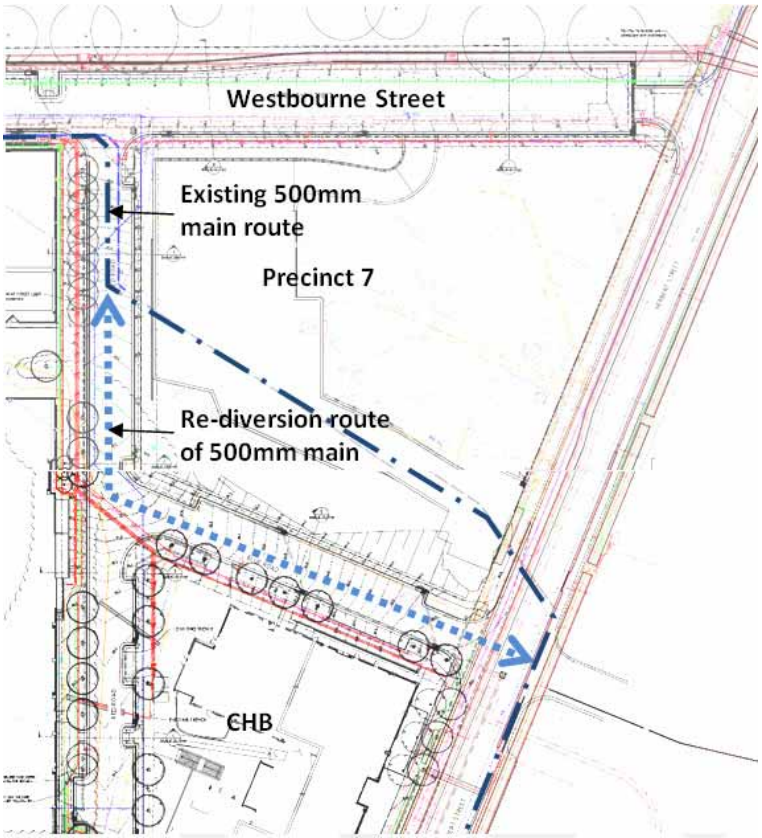

Figure 6 Health Infrastructure's 500mm Sydney water main diversion route as shown in "DRAFT NSW Health VR38 - Diversion of 500mm and 200mm water mains"- Refer to Appendix D

The section of ø500mm water main within the northern end of the previous alignment of Red Road is not to be relocated and will pass under the proposed CSB building footprint. Given that level 1 is to be lower than the existing surface of Red Road in some places, levels of the existing water mains will need to be confirmed and 'Build Over' approval will be required from Sydney Water. It is important to note that Sydney Water consider the ø500mm water main to be a critical asset and negotiations with Sydney Water will be required to gain approval to build over such an asset.

The sewer main running through the western side of the CSB site will require relocation to avoid the structural piles and the lift cores of the new building. The sewer running through the western side of the CSB site may require relocation to avoid the structural piles and the lift cores. This relocation will require further investigation and early consultation with Sydney Water in order to gain approval to build over the sewer main. Sydney Water may require some form of protection in order to give this approval, which will need to be determined during detail design, refer to Appendix C for Services Plans.

There is also a sewer main located under the eastern side of the CSB site, however no connections to this sewer can be identified and as such it is assumed to be redundant. Further investigation into the current status of this sewer main is to be undertaken during the detail design phase. An alternative route for the sewer main was briefly investigated. The route would be via Westbourne Street and connecting to the existing sewer main in Herbert Street. This route was determined to be unsuitable due to the cost implications of approximately 240m of

new sewer main and another 150m of existing main to be upsized from ø225 to ø300.

The sewer and potable water connection requirements are as outlined in Sydney Water's Section 73 feasibility letter received from the Water Service Coordinator, (WSC) Rose Atkins Rimmer, on 16 December 2010.

To summarise the letter, the CSB has permission to connect into the existing ø200mm water main in Westbourne Street. Building over the ø500mm water main in Precinct 7 is not permitted as part of this feasibility letter. For sewer connections, the existing ø225mm sewer mains in Herbert Street and Eileen Street must be upgraded to a ø300mm sewer main in order to meet capacity requirements. At least part of this upgrade has been undertaken as part of the ASB project, as referenced on drawing DWG-IC-HY-20001-05. Further investigations of exact upgrade extents are to be determined during detail design.

In particular, the feasibility letter specifies that the ø500mm water main located in Precinct 7 is not to be built over. The general requirements for the relocated ø500mm water main are a 6m easement and sufficient vertical clearance for maintenance access. It is important to note that approvals for this critical main may be complex and time consuming. Sydney Water should be contacted early in the subsequent design stages to ensure approval requirements are understood and met.

Approval for the 'Build Over' may still be refused by Sydney Water, given the need for access to the water main at any given time. If the 'Build Over' approval is not granted, the water main will have to be relocated so as to maintain clear vertical easements.

Sydney Water are also likely to require stringent protection and supervision during works to ensure the water main is sufficiently protected from vibrations and excess loads. During the detail design, Sydney Water should be advised of the intended loads on the water mains and gain their approval accordingly. This is likely to mean that no large loads such as crane footings can be placed within the easement.

Easements are identified as 6m for the ø500mm water main and 3m for the ø200mm water main. The exception to this is the ø500mm water main adjacent to the CSB site in Westbourne Street. This particular main has an easement of 4m as indicated in Sydney Water's approval letter granted to Thiess as part of the ASB service works. Thiess advised Arup of this approval verbally at the consultants' meeting on 2 February 2011.

Detail design of the connection from the CSB to the sewer and water mains will need to be signed off by a registered WSC prior to submission to Sydney Water for final approvals.

3.3 Stormwater

An enquiry within the Willoughby Council has identified the extents of the surrounding stormwater Council infrastructure. It is Council policy that the exact location of their infrastructure is confirmed on site as indicated by the text boxes within the Figure 7.

Figure 7 Extract from Council Stormwater Infrastructure Plan retrieved from council.

Willoughby Council's Flood Plain Management document suggest that the proposed CSB site is not located within the extents of inundation for mainstream (river) flooding and is also not identified as being at risk of overland flooding. However, the adjacent site at 2 Herbert Street is subject to overland flooding and the ASB development was required to provide OSD as part of the development prior to connecting to council's infrastructure.

An enquiry within Willoughby Council has confirmed that although rainwater re-use has been included as part of the CSB, the re-use volume cannot be used to reduce the OSD volume. Rather, Council encouraged that for this concept design stage that OSD is provided for 100% of the site area.

The volume of Site Storage Required (SSR) has been designed in accordance with Table 1 in Section 5 of Willoughby Council's Technical Standard 1 for On-Site Detention. The OSD requirements are dependent upon a Drainage zone map. The proposed CSB is located within Zone 3 which requires a storage volume of $3.8m^3/100m^2$.

The largest floor plan for the new CSB has an area of approximately $4448m^2$; therefore the volume of OSD required for the CSB is $169m^3$. The standalone OSD tank will be located in the plant room on level 1 as indicated in the Concept Stormwater Plan contained within Appendix E.

Careful consideration has been given to the level of the outfall from the OSD tank which needs to connect to the existing stormwater network. Therefore it is important that the OSD tank is located within the plant room on level 1 so that connection to the existing stormwater network can be achieved.The OSD tank will be connected to the existing Westbourne Street stormwater network. In previous discussions Willoughby Council has confirmed that this network is near capacity

and special consideration is required prior to connecting any new infrastructure to the network to alleviate impact of further inundation of the network.

In order to comply with this requirement not to exacerbate the existing overland flooding which occurs downstream and avoid upgrade work to the Council stormwater network, the volume of OSD to be provided for the concept design stage has been doubled to approximately 338m³.

The layout within the plant room including the OSD tank will need to be considered throughout the next stages of the design process. Specifically the OSD tank will require an approximate area of 164m² and will need to be located adjacent to the rainwater re-use tank so that overflow from the rainwater tank can flow into the OSD tank. The proposed stormwater design, refer to Appendix E, provides double the SSR which will allow an increased quantity of surface runoff to be detained in the tank.

The OSD tank connects to the existing network via a ø450mm stormwater pipe as indicated on the stormwater plan. This singular ø450mm overflow pipe has been provided to promote discharge from the OSD in both the low flow and overflow scenarios.

Further hydraulic modelling within the next design stages will confirm whether the capacity of the pipes on Westbourne Street upstream from the connection on Red Road will need to be increased and confirm the size of the proposed 450mm connection pipe. An orifice plate will also need be provided addition to an overflow weir. The size of the orifice plate and overflow weir will be designed to maximise the use of the OSD storage and to meet the permissible site discharge which will need to be agreed with council during the detailed design stage.

The subsoil system for the basement also may be required to drain into the OSD tank. The volumes of water from the sub soil system will be small and would not impact on the size of the OSD. The inclusion of sub soil runoff into the OSD tank however can have potential Water Quality impacts.

The groundwater sections of the previously issued Geotechnical reports have been reviewed and although it is not explicitly stated that there is contaminated water, this will need to be investigated and confirmed during the next stage of planning. Water quality measures will need to be incorporated into the design of the tank prior to discharge to the council network should contaminated groundwater be found.

Elements of the existing stormwater network will also be required to be modified or removed due to the removal of a portion of Red Road as indicated within the concept stormwater design plan found in Appendix E.

3.4 Soil and Water Management

The Soil and Water Management Plan (SWMP) is to be designed to the requirements set out within the Willoughby Councils Technical Standard 4 – Sediment and Erosion Control document and Landcom's Soil and Construction Manual, Volume 1 (Blue Book). The plan should detail particular erosion control devices such as a construction entry/exit shaker grid and filter fabric drops for stormwater inlets to mitigate against sediment laden runoff entering the

stormwater network. These measures aid to protect the quality of downstream water levels which aids in preserving aquatic life.

4 Conclusions

- The development of the new CSB on the proposed site (identified in Figure 1) has separate pedestrian and ambulance access locations for Mental Health Unit and Women's, Children's and Burns Unit patients.
- The vehicle drop off/entry area has been incorporated within the design for the MHU, which can be accessed from Red Road.
- The proposed footprint of the CSB will result in the relocation of part of the ø500mm water main as well as building over another section of the ø500mm water main. This will require co-ordination with and approval by Sydney Water.
- In terms of capacity, Sydney Water has approved connection to both the ø200mm water main in Westbourne street and the ø300mm sewer main in Herbert Street via the ASB property connection in Red Road.
- The ø200mm water main will be located under the building footprint and will also require build over approval. However, this water main should be less difficult to gain build over approval for.
- The proposed footprint of the CSB means the sewer main currently servicing the Kolling building may require relocation depending on the locations of piles and other structural components of the building.
- The proposed footprint of the CSB requires a volume of OSD to be provided and will require connection to the existing stormwater drainage network on Westbourne Street.
- Confirmation will need to be sought from Willoughby Council within detailed design to confirm whether the extra provision for OSD is sufficient to allow runoff from the development into the existing stormwater network.

Appendix A

Concept Architectural Plans