APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Applicant:	Minister for Health and Wellbeing
Development Number:	292/V004/19 App 4236
Nature of Development:	Construction of an extension to the Clinical Emergency Department, (including ambulance access area), Emergency Administration and Short Stay Mental Health Unit associated with Lyell McEwin Hospital
Type of development:	State Agency Development
Zone / Policy Area:	Suburban Activity Node Zone and Lyell McEwin Health Node Policy Area 23
Subject Land:	Lot 1, Hayward Road, Elizabeth Vale (Allotment 1, FP126908: CT 6171 Folio 913).
Contact Officer:	Sarah Elding
Phone Number:	08 7109 7006
Start Date:	24 July 2019
Close Date:	21 August 2019
During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders Street, Adelaide during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).	

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered, faxed or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this pdf document.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapadmin@sa.gov.au
Fax Number: (08) 8303 0753

Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

SECTION 49 – STATE AGENCY DEVELOPMENT

Notice is hereby given that an application has been made by the **Minister for Health** to construct a three level extension to the existing Clinical Emergency Department, (including ambulance access area), Emergency Administration and Short Stay Mental Health Unit associated with the Lyell McEwin Hospital. **Development Number 292/V004/19.**

The subject land is situated within the existing Lyell McEwin Hospital complex, with the Emergency Department located on Oldham Road, Elizabeth Vale, (being Allotment 1, FP126908: CT 6171 Folio 913).

The development site is located within the Suburban Activity Node Zone and Lyell McEwin Health Node Policy Area 23 of the Playford Council Development Plan (Consolidated 27 June 2017).

The application may be examined during normal office hours at the office of the State Commission Assessment Panel, Level 5, 50 Flinders Street, Adelaide and at the office of Playford Council Civic Centre, 10 Playford Boulevard, Elizabeth. Application documentation may also be viewed on the State Commission Assessment Panel (SCAP) website: www.saplanningcommission.sa.gov.au/scap/public_notices.

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide 5001 by **NO LATER THAN 21 August 2019.** Submissions can also be emailed to: scapreps@sa.gov.au

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the SCAP to further explain the representation.

Submissions may be made available for public inspection.

Should you wish to discuss the application and the public notification procedure please contact **Sarah Elding** on **(08) 7109 7006.**

Alison Gill
SECRETARY
STATE COMMISSION ASSESSMENT PANEL

W108

www.sa.gov.au

W108
21x2 (63mm)
Adelaide Advertiser
North Messenger
Wednesday 24 July 2019
APPROVAL REQUIRED BY 10AM FRIDAY 19 JULY 2019

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	Minister for Health and Wellbeing
Development Number:	292/V004/19 App 4236
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Contact Officer:	Sarah Elding
Phone Number:	08 7109 7006
Close Date:	21 August 2019

My name:_____

My phone number: _____

PRIMARY METHOD(s) OF CONTACT: Email address: _____

Postal address:_____

_____Postcode_____

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are:
- [ ] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is .....Postcode.....

The specific aspects of the application to which I make comment on are: .....

.....

.....

.....

.....

.....

.....

I
- [ ] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission

(Please tick one)

by
- [ ] appearing personally
- [ ] being represented by the following person : .....

(Cross out whichever does not apply)

Date: ..... Signature: .....

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 or scapadmin@sa.gov.au

SECTION 49 & 49A – CROWN DEVELOPMENT
DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: City of Playford

APPLICANT: Minister for Health

ADDRESS: Citi Centre Building, 11 Hindmarsh Square Adelaide

CROWN AGENCY: SA Health

FOR OFFICE USE

DEVELOPMENT No: _____

PREVIOUS DEVELOPMENT No: _____

DATE RECEIVED: / /

CONTACT PERSON FOR FURTHER INFORMATION

Name: Scott Suter

Telephone: 84311144 [work] 0414 324 409 [Ah]

Fax: _____ [work] _____ [Ah]

Email: ssuter@cheesman.com.au

☐ Complying	Decision: _____
☐ Merit	Type: _____
☐ Public Notification	Finalised: / /
☐ Referrals	

NOTE TO APPLICANTS:

(1) All sections of this form must be completed. The site of the development must be accurately identified and the nature of the proposal adequately described. If the expected development cost of this Section 49 or Section 49A application exceeds $100,000 (excl. fit-out) or the development involves the division of land (with the creation of additional allotments) it will be subject to those fees as outlined in Item 1 of Schedule 6 of the *Development Regulations 2008*. Proposals over $4 million (excl. fit-out) will be subject to public notification and advertising fees.
(2) Three copies of the application should also be provided.

	Decision required	Fees	Receipt No	Date
Planning:				
Land Division:				
Additional:				
Minister's Approval				

EXISTING USE: Lyell McEwin Hospital

DESCRIPTION OF PROPOSED DEVELOPMENT: 3 level extension to the existing hospital comprising ground level Clinical Emergency Department Expansion, Level 2 Emergency Administration, Level 3 8 bed Short Stay Mental Health Unit and associated civil works to provide dedicate patient drop off zones and ambulance access.

LOCATION OF PROPOSED DEVELOPMENT: Lyell McEwin Hospital

House No: _____ Lot No: ____ Street: Haydown Road Town/Suburb: Elizabeth Vale

Section No [full/part] _____ Hundred: _____ Volume: 5231 Folio: 323

Section No [full/part] _____ Hundred: _____ Volume: _____ Folio: _____

LAND DIVISION:

Site Area [m²] _____ Reserve Area [m²] _____ No of existing allotments _____

Number of additional allotments [excluding road and reserve]: _____ Lease: YES ☐ NO ☐

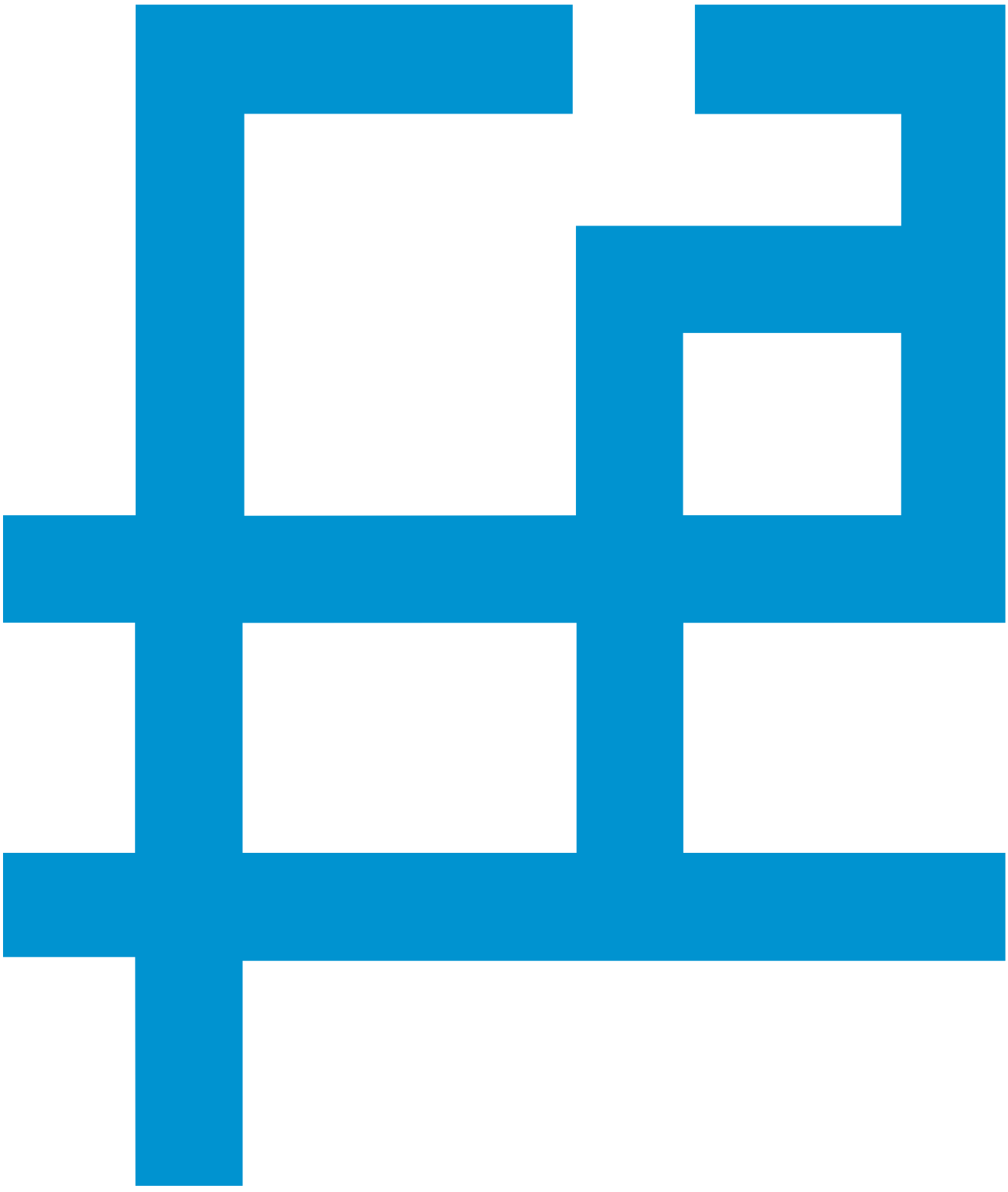
DEVELOPMENT COST [do not include any fit-out costs]: $ 58M

POWERLINE SETBACKS: Pursuant to Schedule 5 (2a)(1) of the *Development Regulations 2008*, if this application is for a building it will be forwarded to the Office of the Technical Regulator for comment unless the applicant provides a declaration to confirm that the building meets the required setback distances from existing powerlines. The declaration form and further information on electricity infrastructure and clearance distances can be downloaded from the DPLG website (www.dac.sa.gov.au).

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the *Development Act 1993*.

SIGNATURE: _____ Dated: 20/5/2019

Cheesman Architects



Cheesman Architects

LYELL McEWIN HOSPITAL
EMERGENCY DEPARTMENT REDEVELOPMENT
CONCEPT DESIGN REPORT

Prepared for
Department Of Transport Planning and Infrastructure &
Department Of Health and Ageing

17192
May 2019

Contents

Appendices

A	SA Health Project Brief for both the Emergency Department and the Short Stay Mental Health Unit
B	City of Playford Concept Plan Map
C	Aerial View
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E	Development Plan
F	Development Perspective View
G	IGRAT ESD Plan
H	Structural, Civil and Stormwater Management Report
J	Traffic Engineering & Transport Report
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L	Preliminary Programme
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1. EXECUTIVE SUMMARY

The Lyell McEwin Hospital is one of Adelaide's three main tertiary hospitals, serving the northern metropolitan areas and northern country South Australia. Population modelling of these areas indicate that there will be a significant increase in population over the next few decades in this catchment zone, resulting in a dramatic rise in the number of emergency presentations expected at the Lyell McEwin Hospital. This increase in demand will be more than double the number of presentations the current facility was designed to accommodate.

In 2017 the State Budget approved the redevelopment of the Lyell McEwin Hospital Emergency Department to increase capacity to meet both the current and future accommodation shortfalls. This project represents the second of 2 phases of work for the redevelopment, the first being some minor internal refurbishments which is now complete.

The project scope as described in the brief from DPTI is contained by APPENDIX A of this document.
A concept proposal which was developed in conjunction with the lead agency and the end users was included in this brief which detailed the project deliverables as;

- The provision of approximately 2800sqm of additional floor area
- Level 1 (ground) - addition to the existing Emergency Department clinical spaces
- Level 2 - new emergency administration accommodation and central plant
- An 8 bed Short Stay Mental Health Unit. (This was added as an amendment to the Request For Tender)

During the Concept Design Phase it became clear that the project would have both a direct and indirect impact on existing site car parking that would need to be addressed. The footprint of the proposed new build would displace approximately 81 existing car park spaces and as per the advice received from the Traffic Consultant, would generate an additional demand of 115 spaces.

Following the above advice, the client directed the team to investigate how the project could best accommodate the 196 carparks spaces (displaced and generated) and the final agreed solution was for an extension to the existing Multi-deck Carpark. This component of the works is detailed in a separate Concept Design Report and Approval Application.

The budget for this project inclusive of the Multi-deck Carpark is $58.09M (exc. GST). Construction is currently being targeted to commence on site in early 2020 with Practical Completion being achieved in mid-2022.

2. PROJECT TEAM

Project Risk Manager:	DPTI
Lead Agency	Department of Health and Ageing (SA Health)
End User Representative:	Northern Adelaide Local Health Network (NALHN)
End User Representative:	Lyell McEwin Hospital (LMH)
Architect Health Planner Interior Design Masterplanning	Cheesman Architects in Association with STH (Perth)
Landscape Architecture	TBC
Cost Manager:	Rider Levett Bucknall
Engineering Services	Bestec
Structural & Civil	Wallbridge Gilbert Aztec
Acoustics	Bestec
Traffic Engineering	Frank Siow and Associates
EDA	D2

3. SCOPE

DEVELOPMENT SCOPE OVERVIEW

The specific purpose of this project is to provide;

- An Emergency Department with sufficient accommodation to meet the projected throughput of the Hospital to 2030
- A Short Stay Mental Health Unit for Preliminary assessments of patients that present with mental health issues to the Emergency Department.

The brief, as provided by SA Health consists of the following key elements:

Emergency Department - Clinical

The major redevelopment of the Lyell McEwin Hospital Emergency Department will result in expanded and reconfigured areas providing the following functional areas;

- Additional Resuscitation Triage and Reception capabilities.
- Dedicated ambulance arrival for patient transfers.
- Dedicated Paediatric Assessment and Treatment Spaces.
- Short Stay and quick assessment capabilities
- Acute and Discharge facilities.
- Support facilities
- Relocated Bulk Decontamination Services

Emergency Department – Support and Administration Spaces

The current Emergency Department Support and Administration spaces are currently spread throughout the existing hospital with poor spatial relationships with the existing and proposed Emergency Department Clinical Space. It is therefore proposed that this project will deliver new Administration Spaces dedicated for use by the Emergency Department within close proximity of the Clinical floor. This will provide for;

- Open Workstations to be used as hot desks
- Enclosed offices for departmental heads
- Education facilities
- Support and staff spaces and withdrawal areas.

Short Stay Mental Health Unit

The development of a new 8 bed Short Stay Mental Health Unit will provide a purpose built facility for Mental Health patients requiring short stay assessment after presenting at the Emergency Department. This will be a more suitable environment for mental health patients and staff with the facility to include;

- 8 off patient bedrooms
- Ensuite facilities
- Dining and Lounge spaces
- Staff workstations and consultant rooms
- Appropriate landscaping and screening.

The original approved Project Brief and subsequent additional Short Stay Mental Health Unit information is contained by **APPENDIX A** of this document.

4. EXISTING FACILITIES

SITE

The planned facility is located on the existing campus of the Lyell McEwin Hospital (LMH) Acute Hospital campus. Refer to **Appendix C** for an aerial view of the current campus.

Site Address

Lyell McEwin Hospital, Haydown Road, Elizabeth Vale, South Australia, 5112

Site Title

Volume 5231 Folio 323
Allotment 4 Deposited Plan 71485
In the area named Elizabeth Vale
Hundred Munno Parra

Title Area

Total: approximately 8.5 Ha

Development Plan Zoning

The proposed development site is located within the City of Playford

Under the City of Playford Development Plan the proposed development is within a zone designated 'Suburban Activity Node Zone' and is further specifically defined as 'The Lyell McEwin Health Node Policy Area'

The proposed development comprises an extension to the existing Lyell McEwin public hospital which is consistent with the objectives of The City of Playford Development Plan. A copy of the 'Concept Plan Map Play/33' from the City of Playford Development Plan is attached within **Appendix B.**

EXISTING SITE CONDITIONS & DEVELOPMENT

The site of the Lyell McEwin Hospital is bounded by John Rice Avenue, Haydown Road, Oldham Road and Trembath Road Elizabeth Vale. The site is presently entirely utilised as a Healthcare campus for The Lyell McEwin Hospital encompassing acute and primary health services and associated community outreach service hub functions. All of the proposed new works will be located within the existing site.

TOPOGRAPHY & VEGETATION

The proposed site topography has a consistent fall from the existing buildings to the site boundary to north with a total difference in levels of approximately 1.2m and is largely paved and used as parking and road networks. Current vegetation in the area is minimal and has been poorly maintained over the years. As a result, a lot of the vegetation planted in nature strips, traffic islands and within the main carpark plaza, originally planted to provide shade and lessen the effects of radiant heat from the predominantly paved area, has died.

EXISTING SITE DEVELOPMENT

The Lyell McEwin Hospital is one of the three major hospitals in the state providing acute services. It has been designed as a post-disaster facility and has the ability to operate in complete 'island' mode for several days.

The majority of existing campus development is dominated by one and two storey buildings stretching over the vast majority of the site with the exceptions of a 5.5 level multi-deck car park located on the western edge of the site and a helipad located on top of the inpatient building to the southern side (Adjacent John Rice Avenue)

The vast majority of people visiting the site do so by private vehicle with carparking accommodated in the 1200 space multi-deck carpark, the on-grade carpark plaza located to the north of the main entry on Oldham Road, and in the surrounding street network and off-site parking facilities in the immediate surrounds. One of the current offsite parking facilities currently provided by SA Health is serviced by a driverless shuttle that ferries staff and visitors to the front door of the hospital. The site is also well serviced by Public Transport with bus stops currently located on both John Rice Avenue and Haydown Road with a 'super stop' / bus exchange planned for the latter. The site also currently provides a secure, undercover, 120 space bike store and end of trip facilities.

There are currently three main entries to the hospital being;

- The entry of Oldham Road. This represents the main entry to the buildings and it's foyer contains the reception, volunteers and wayfinding services, a transit lounge and a privately run café. This entry is well serviced by an undercover patient drop off and pick up zone, the plaza carpark, nearby bus stops, taxi stands and the driverless shuttle bus from the offsite parking facility.
- The original main entry off Haydown road. This entry takes visitors directly to the main entry off Oldham Road and the services provide therein. This entry acts as a pedestrian link to the retail and private parking facilities provided on the opposite side of Haydown Road. The previous stage of work on the Lyell McEwin Hospital Site provided extensive landscaping and public art in this zone resulting in an inviting and well used space.
- The Women's Health entry off Trembath Road. This entry provides direct public and emergency access to the Women's Health and Birthing Suites of the Hospital. It also provides convenient access from the existing Multi-deck Car Park and is serviced by a Volunteers/ wayfinding greeting point.

HAZARDOUS MATERIALS AND CONDITIONS

Hazardous Materials and Conditions - Contamination

Assessment of the site history and a desktop assessment of the physical evidence from recent developments completed by the current project team in the proximity of the proposed new development area indicates minimum likelihood of site contamination. Following the engagement of the Managing Contractor, test bores will be carried out to confirm these assumptions. Standard industry monitoring and management requirements will be implemented during the construction process.

HERITAGE

Places of Historical Significance

A review of the City of Playford Development Plan historical register indicates that there are no items of local or state historical significance on the site of the proposed works or on adjacent sites.

5. CONCEPT PROPOSAL

PROPOSED OBJECTIVES

The proposed development aims to create an Emergency Department capable of meeting both current and projected demand. This function will be supported by the provision of a Short Stay Mental Health unit (the relationship of these two departments will be expanded upon in subsequent sections of this report). These expanded services are critical for the hospital in meeting their developed 'Model of Care'.

The new facility will continue to operate 24 hours a day/7 days a week to both public, staff/ ambulance during and post construction.

The proposed development's intended use is consistent with the planning objectives of the City of Playford Development Plan for the site.

MASTERPLANNING

During the Concept Design Stage of this project it become evident that the site had outgrown the masterplan developed for the site during the previous stages and as such the Consultant Team embarked on a process of examining how the proposed works would impact the current and possible future service delivery and development opportunities for the site. This process included a review of the following areas;

- Current Site Limitations/ constraints
    - As discussed in earlier sections of this report, the current hospital footprint has grown across the vast majority of the site with predominately single and double storey construction. As a result, there is very little undeveloped open space left.
    - The previous stage of works completed on site included a provision of a helipad on the southern site boundary. This siting was determined by examining the preferred flightpaths of emergency helicopters which dictated that under normal operating conditions, the service would not fly over the existing hospital or residential properties, but down the main arterial road being John Rice Avenue. All future developments on the site would need to consider the flightpath angles required during take-off and landing. A review of these flightpaths indicated that the further north you go the taller you are able to build, which coincides with the largest under developed portion of the site being the main plaza carpark and the portion of land on the north eastern corner of the site.
    - Carparking on site is currently stretched to capacity. As the site has developed and spread across the site, and the level of patronage has increased in line with population growth of the catchment zone, the ability for the public to access convenient carparking in close proximity to the main entry has been placed under pressure.
    - As the services on site have grown, opportunities for inbound departments to expand in the future whilst maintaining critical inter-departmental relationships will be strained.
    - Site access and circulation will come under increased pressure as the number of visitors to the site increase. One conflict noted which is critical to the current project is that of public and ambulance access to the Emergency Department entry where the current access requires the paths of travel of these presentations to cross.

The above review led the team to develop a masterplan to help inform the team on the siting of the current proposed project, and what possible opportunities might exist in the future. It should be noted that this masterplan has not been endorsed by the client, but was carried out to help inform the project team on the site opportunities and limitations and how they related to the current project. A separate masterplan is currently being developed by the Northern Adelaide Local Health Network.

A copy of the developed masterplan is included in **Appendix D** but in summary it illustrates the following opportunities;

- The two most recently completed buildings were provided with the structural ability and concrete 'lids' to enable the provision of additional floors in the future. These include the Inpatient Building adjacent to John Rice Avenue and the Women's Health building adjacent to the Multi-deck Car Park.
- The Multi-deck Carpark could potentially accommodate an additional floor with upgrades to its current structure. This carpark could also extend north over the current access driveways.
- The construction of hospital buildings come at high cost per square metre as driven by their high service demands and post disaster requirements. By relocating all non-clinical functions such as administration, research and education to a building located in the north western corner of the site, 'expensive' floor space within the existing hospital is freed to up to allow existing clinical departments to expand.
- To help address public access to the site a proposed transport hub has been shown on the north eastern corner of the site. This would allow for a ground floor double height space accommodating patient drop off, pedestrian access, a bus super stop/ exchange, taxi stands and a patient transport lounge. On the upper levels a multi-deck carpark could be provided for the use of the public. By concentrating all visitor access to this corner of the site, the facilities currently provided within the existing main entry could be easily accessed, undercover and would be in close proximity (an important point when considering the health of the majority of people visiting a hospital).
  An exception to this would be the Women's Health Entry. Given the current location of this department and the fact that it is well served by the adjacent multi-deck carpark and a dedicated patient drop off zone, it is proposed that this entry point would be maintained, with dedicated parking spaces provided in the existing carpark.
- By providing the above mentioned 'Transport Hub' the existing on grade plaza carpark could be developed to provide additional space for outpatient services or the expansion of existing departments. The attached masterplan illustrates;
  - A two-storey podium consisting of outpatient services and expansion zones for the existing emergency department and operating theatres
  - Two towers over the podium could be provided for additional inpatient accommodation which would be in close proximity for visitors, the operating theatres and the emergency department.

The team used the above master planning exercise to 'road-test' the project brief and siting of the proposed ED expansion and Short Stay Mental Health Unit and made the following observations and recommendations.

- The briefed plan continued with the site precedence of constructing largely single/ double storey buildings. The result of which limits future potential development opportunities, noting the difficulty that would be encountered if construction needed to occur over an operational Emergency Department.
- The plan showed the new works extending across the front of the existing main entry. This would essentially screen the entry to the hospital making wayfinding for a first time visitor difficult.
- There existed a conflict between ambulance and public access to not only the emergency department but to the main entry. This could result in significant delays to patient access to life saving services and would heighten the risk for onsite vehicular and pedestrian accidents.
- The remaining un-developed land was disjointed with poor physical relationships to existing departments. This would leave future developments isolated and difficult to access.
- The existing main carpark plaza was greatly impacted on limiting the number of spaces available.

Following the above review, the team explored more than 7 siting options for the extension to the existing Emergency Department and the provision of the new Short Stay Mental Health Unit. The final agreed solution is provided in **Appendix E** but in summary it addressed the following masterplan concerns;

- Accommodated the entire proposed scope of work in a new three storey building north of the existing Emergency Department. This reduced footprint frees up future potential development opportunities.
- The Emergency Department Clinical services are accommodated on the ground floor enabling efficient connections to the existing Emergency Department whilst maintaining inter-departmental relationships.

- The Emergency Department Administration support services are provided on the second storey and are connected to the clinical department via two vertical transportation nodes offering direct access to the heart of the department to reduce staff response times.
- The Short Stay Mental Health Department is located on the third storey which affords the bedrooms access to light, views and natural ventilation, all principles recognised as important when accommodating mental health clients. Critical relationships between the Short Stay Mental Health Unit and the Clinical Emergency Department services are via two lifts delivering clients to the reception/ triage spaces.
- The ambulances have been provided with a dedicated hardstand and patient drop off zone with direct access to the Emergency Department Triage/Reception point.
- Public access to the Emergency Department Triage/Reception point is via a dedicated roadway with patient set down areas. This access occurs without the need to cross the path of ambulance presentations.
- Visual and physical access to the hospital main entry remains unobstructed with improved accessibility for disabled visitors and pedestrians.
- Continuous undercover pedestrian movement paths are provided from the existing main entry to the Emergency department entry.
- The entry to the Emergency Department is clearly visible from the entire existing entry plaza, which is important for first time visitors to the site.
- Staff interconnection routes are provided to all three levels of the development for hotel services and staff movements via a controlled external corridor.
- Vehicular access to the existing Mental Health Saliport is maintained
- Opportunities for the provision of landscaped screens between the public entry plaza and the dedicated ambulance zone are provided
- The maximum number of existing carparks in close proximity to the main entry to the hospital are maintained.

PROPOSED CONCEPT ELEMENTS

Emergency Department - Clinical Expansion

A ground floor extension of approximately 1900m2 and internal refurbishment of approximately 700m2 including:

- New Reception/ Waiting/ Triage Area, new Resuscitation Suite, and a new Paediatric Ward.
- Refurbished zones to provide additional “See and Treat” Services and an expansion of the Acute Cubicle Treatment zones.
- Total Provision of 75 Treatment Spaces.
- New dedicated Ambulance access and parking for ten bariatric sized vehicles, six of which will be under cover (with the ability to expand the cover over all ten vehicles in the future)
- Eight dedicated emergency vehicle parks. (other than ambulance parking)
- Provision of a new Bulk Decontamination Unit under the proposed ambulance cover.
- New dedicated access road and drop-off zones for public emergency access.
- New ramped access and manoeuvring space to the existing Mental Health Saliport.
- New dedicated external corridor for the delivery of hotel services, patient movement and emergency access.

Emergency Department – Administration Accommodation

A new Level 2 of approximately 670m2 providing accommodation for Emergency Department Administration and Support Services:

- Approximately 30 off open workstations to provide hot desk accommodation for Emergency Department Staff.
- 3 off dedicated enclosed offices for Departmental Heads.
- Tutorial and education spaces including lecture rooms and a simulation laboratory
- Staff and withdrawal spaces
- Accommodation for overnight “on-call” doctors.

- Support spaces.
- Two external staircase and lifts to provide direct and immediate access to both the ground floor clinical spaces and the level 3 Short Stay Mental Health Unit.

Short Stay Mental Health Unit

A new Level 3 build of approximately 800m2 to accommodate the 8 Bed Short Stay Mental Health comprising:

- 8 Bedrooms with shared Ensuites. One of the eight rooms to be provided with a dedicated, directly accessible ensuite to be used for either isolation or disabled clients.;
- 4 off Consultation Rooms for both on and offsite clients.
- Dining and lounge zones.
- An internal light court offering both sheltered and open spaces.
- Public waiting zones and facilities.
- Staff and support services.
- Two external staircases and lifts to provide direct access for both staff and visitors to the ground level Emergency Department and Entry Lobby.

Other Works

- Modifications and augmentation to existing engineering services and site infrastructure as required to support the refurbished existing built form.
- New engineering services accommodated within a screened level 2 plantroom to serve the new build components of the project.
- New central communications room to serve the entire project located on level 2.
- New soft and hard landscaping to general environs of the new buildings to enhance amenity and wellbeing of staff, patients and visitors and to provide 'green' screening to sensitive patient transfer/ ambulance spaces from the public.
- Temporary works as required to facilitate contained, safe and effective construction of the planned works with minimal disruption and inconvenience to neighbouring functions on the hospital site and the nearby area.

FUNCTIONAL RELATIONSHIPS

Access

As discussed previously, access to the proposed new Emergency Department has been provided by three distinct paths.

- To the north of the proposed development a dedicated ambulance access road and patient drop off zone has been provided, allowing for direct patient transfer under cover to the triage zone.
- Public access to the entry is via a vehicular ring road providing undercover setdown points adjacent the Emergency Department entry. Pedestrian access is accommodated via a continuous covered walkway between the hospital main entry and the Emergency Department.
- Hotel services, patient transfers and staff movement is via an enclosed circulation corridor to the north of the building with automated lock down doors in the event ambulance patient transfers are in progress.

Intra-departmental Relationships

The clinical ground floor emergency department has been developed following multiple End User Workgroup meetings and the interrogation of their adopted 'Model of Care'. Starting from the reception point there is a logical sequence of clinical zones radiating outwards in line with the clinicians 'Model of Care' and the various possible client pathways. Generally speaking the patient will arrive by one of two main routes being a public presentation or an ambulance transfer. Both will be triaged and then filtered down several pathways depending on the level of care required.

Inter-departmental Relationships

The siting of both the Emergency Department and the Short Stay Mental Health Unit has been done with careful consideration of their inter-departmental relationships.

Emergency Department;

- Requires direct and clear access from the Resuscitation Zone to the existing Medical Imaging Department
- Clear access to the existing Operating Theatres (OT) on the floor over needed to be planned. To that end the planning has left the centrally located dedicated lift to the OT and has ensured that it is easily accessible from all points on the floor.
- The relationship to the hospital main entry foyer and its associated support services was obviously important and therefore a clear and protected route has been provided.
- The administration services of the ED have been located on the second floor directly over the clinical space served by two vertical transportation nodes providing quick movement between the two in the event of emergency staff calls.
- The Short Stay Mental Health Unit (SSMHU) acts as an interim step between the Emergency Department (ED) and the existing Mental Health Unit (MHU). When the Mental Health status of a presentation to the ED is unclear the SSMHU is utilised for a period of observation. To that end this unit needs to be in close proximity to the ED and the MHU to facilitate patient transfers. By locating this unit on level 3 directly above the ED, patient movement can occur quickly and efficiently whilst supporting staff movements between the three zones.

ARCHITECTURAL FORM & MATERIALS

Architectural Form & Materials

The proposed new building, detailed on the attached drawings, comprises a three-level building sited on the northern side of the existing Emergency Department. The new building will look to continue with the palette of materials and forms established on site and in particular that of the existing main entry adjacent to the development but reinterpret them in a more contemporary architectural expression**. Refer to Appendix F** for a Perspective view of the new works.

The current entry plaza is dominated by the built form of the existing main entry. An exoskeleton framed form supports both the main entry statement, expressed as a vivid yellow beam supporting glazed signage with super graphics, and external covered walkways and verandahs. This entry framework then gives way to a double height glazed foyer with elongated horizontal fenestration reflecting the light weight cladding panels used throughout the rest of the predominate built form. The main entry is currently framed on the eastern side by a double height red brick blade wall, a material that is also used throughout the site to demarcate vertical transportation nodes and was also used in the original 1980's building stock still present site.

The new building continues with the above themes to help blend the new development into the existing fabric of the site whilst clearly identifying the entry of the Emergency Building. This has been done by exaggerating the horizontal cladding and window fenestration of the existing adjacent buildings, and expressing them as full width bands of GRC panels and high performance tinted windows. These bands extrude from the junction with the existing main entry and terminate at a new vertical stair node clad in red brick masonry. This masonry not only completes the framing of the built form when viewed from the entry plaza with that of the original blade wall but also looks to help highlight the new entry to the Emergency Department. The horizontal expression of the building is also reinforced by several tiers of projecting planes that provide shading to the external walls and access opportunities for cleaning and building maintenance.

Starting from the main entry to the hospital to that of the Emergency Department is a new covered walkway that continues the idea of the yellow entry statement but has reinterpreted this a red horizontal band that flares open over the ED entry. This helps advertise the entrance to new visitors to the site and provides a signage opportunity to the building. This covered way also continues with the existing colonnade of the original building, highlighting the pedestrian link between the two.

LANDSCAPING

Given the parameters of this project and the interface requirements with the building's perimeter for the essential delivery of service, opportunities for landscaping will be limited. The main opportunities that the team will explore will be the parcel of land between the public carpark plaza and that of the ambulance set down area. The project team will look to use this area to not only address the level differences between the two areas but, along with a masonry wall, screen the two by providing a continuous stand of trees and low level plantings. This green line will also complete the framing of the entry plaza and help highlight the continuous pedestrian loop encircling the entire entry plaza.

It is also proposed that the team will revisit the trees and landscaping planted in the carpark plaza during the previous stages of work and look to replace dead trees and vegetation with more suitable robust varieties that tolerate neglect.

ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD)

The South Australian Government Department of Health and Ageing has a demonstrated commitment to the incorporation of industry-leading ESD principles in health building design and construction.

The government of South Australia was an early financial partner of the Green Building Council of Australia (GBCA) for the development of a 'Greenstar' design rating tool for health buildings in Australia.

Recently completed projects at FMC, Noarlunga, TQEH, Modbury and Lyell McEwin Hospital sites are amongst the greenest health facilities in Australia in terms of construction and on-going operation. Previous projects at FMC and Noarlunga were the first two health developments to achieve a national 5 star Green Star rating in Australia while the Inpatient Building at LMH achieved an unprecedented 6 star rating As-Built rating representing world leadership in design and construction.

In recent times SA Health has developed its own IGRAT (Inhouse Green Rating Assessment Tool) for rating health buildings which builds upon the GBCA tool experience to achieve higher relevant outcomes which far exceed regulatory and standard industry practice levels.

The proposed development at LMH has been designed and will be constructed and operated to exceed the requirements of a 5 star IGRAT rating.

Compliance with mandatory ESD Policies

As part of the IGRAT process, the project will conform with all mandatory polices including:

- That the principles contained in the DPTI ESD Guide-note 'Planning, Design & Delivery' and 'Environmentally Sustainable Building Materials -Selection' have been delivered to the extent relevant & practical.
- Solar PV System: That a minimum 5 kWh Solar Photovoltaic system has been provided as per the Solar Panel for Government Funded Building Projects policy.
- Solar Hot Water: A minimum 60% annual contribution gas boosted Solar Hot Water service for domestic hot water is provided to service any additional domestic hot water demand generated by the project
- HVAC Life-Cycle Analysis: That a minimum of 4 different Heating Ventilation & Air-conditioning (HVAC) options are subject to a comprehensive Life-cycle analysis utilising the SA Health HVAC LCA template.
- Energy Efficiency: Use energy modelling to confirm that the proposed design will consume at least 40% less greenhouse gas emissions than a Benchmark Building built to the minimum standards contained in the Building Code of Australia.
- Rainwater Re-use: That to the extent practice rainwater has been captured off all new-build roof space. And that the associated tanks are sized to enable maximum sensible reuse; providing that a suitable end use such as toilet flushing and landscape irrigation can be identified.
- Process Water Re-use: That active consideration has been given to collecting and reusing any waste water from major water consuming equipment/processes such as reverse osmosis, equipment cooling waste water, sterilisation, HVAC waste water and fire services test water.
- High Efficiency Plumbing Fixtures: That the tapware and showerheads selected are in compliance with the Water Efficient Outlets in Government Buildings Policy effective form July 1 2011. This policy requires that unless contradicted for clinical reasons, showerheads have a flow rate not exceeding 6.0 - 7.5 litres per minute (currently 4 star WELS rating) and basin and sink taps with a flow rate not exceeding 4.5 - 6.0 litres per minute (the current 5 star WELS rating).

Design Approach - General

The importance and benefits of incorporating ESD principles into the new facility design, construction and operation are understood and this is a key design parameter for the new facilities It is recognised that providing a facility with good environmental qualities will provide a positive environment and workplace for staff, patients and occupants supporting better healthcare outcomes and improved wellbeing. Similarly, it is appreciated that a facility that consumes less energy, reduces waste and encourages reuse of resources will provide benefits in reduced operational costs and environmental impact.

High levels of ESD strategies will be incorporated into the design, construction and operation of the new health facilities being delivered. Using the IGRAT approach and previous like-project experience there are a range of initiatives that have been incorporated into the design of this building.

In addition several recent projects delivered for SA Health have developed and incorporated ESD measures significantly contributing to improving the environmental qualities, reducing consumption of resources and energy during construction and operation and reducing environmental impact overall. The valuable lessons and benefits of previous projects will be considered as part of an evidence-based design process.

Built form

Building envelope design has a significant impact on the functionality and performance of the building. Building orientation and form design affects the amount of day light permissible through the space and a high performance building envelope reduces the energy consumed by the building's heating, ventilating and air conditioning system to maintain the comfort level within a space.

The following initiatives are proposed:-

- orientation of the new build and the inclusion of courtyards to the Mental Health Short Stay Unit will allow excellent management of sunlight with penetration of sunlight to overnight beds and offices whilst allowing effective shading of windows.
- Shading to glazing through shade structures and building form to minimise heat gain during summer and maximise winter warmth.
- highly insulated building envelope elements – roof, walls and windows are used to all new construction to minimise energy demand by the new buildings.
- low-E glass and double glazed systems to windows to further assist in limiting energy transfer and wastage through the windows whilst maintaining desirable views and natural light levels.

Future proofing and adaptability

The following design measures will be incorporated to support increased adaptability and changes of use with minimised impact during the building design life:

- Use of 'universal' building footprints and structural systems for the building that are flexible and compatible with multiple clinical functions to support change of use during the building design life
- Configuration of engineering services within the buildings to support changes of function and layout during the building design life
- Incorporation of highly accessible and flexible engineering spaces and backbone systems to support changes of use and incorporation of changing technology
- Insulation and engineering making provision for potential increases in adverse weather conditions including higher temperatures during the building design life

Management

The implementation of effective management and operation protocols in a building reduces the impact the building has on the environment throughout its lifecycle. The following initiatives aim to promote the adoption of environmental principles from project inception, design, construction and handover, to commissioning, tuning and operation of the building and its systems:

- performing comprehensive commissioning and building tuning will ensure the completed building operates as intended by the original design. Building tuning process is carried out over a minimum span of 12 months where the performance of the building will be monitored quarterly and reviewed 6 monthly. A full review will be carried out 12 months after practical completion. This process is necessary to ensure optimum occupant comfort and reduced carbon emission through effective use of energy
- implementing an environment management plan to effectively manage construction waste, air, water and noise pollution
- developing of a building user's guide to ensure that users are aware of the building features and the effective operation of engineering systems.

Indoor environment quality

This project aims to improve general indoor environmental quality through the following proposed initiatives:

- minimisation of building occupant exposure to Volatile Organic Compounds (VOC) within the indoor environment through careful selection of appropriate materials with minimal off-gassing properties. VOCs are organic chemical compound which can vaporise easily at room temperature which will affect indoor air quality
- increase in outdoor air provision into the air conditioning system to improve indoor air quality, occupant comfort level and well being
- facade design that encourages a high level of day light into non clinical spaces while mitigating solar glare which causes occupant discomfort by the use of external shading and user-controlled blinds. Studies have shown that a high level of day lighting can improve the well-being of the occupants
- improved occupant thermal comfort through the use of better air conditioning and facade design
- Use of building materials and considered design to insulate the building interior from undesirable noise levels from engineering plant, adjacent roads etc and achieve desirable internal noise levels. The level of internal noise has been recognised by the World Health Organisation as a health hazard which can influence occupant satisfaction and wellbeing.

Energy efficiency initiatives

The following initiatives are proposed:-

- highly insulated building envelope materials to minimise energy demand by minimising conductive heat loss and heat gain to the external environment
- optimised glazing design with shading to minimise energy demand by minimising radiative heat gain in summer and maximising radiative heat gain in winter whilst maintaining external views and daylight access
- solar thermal hot water generation system designed to meet a significant percentage of the domestic hot water demand from a renewable source of energy.
- highly efficient air conditioning systems incorporating Variable Air Volume (VAV) type air handling systems to minimise fan energy consumption, economy cycle systems to enable free cooling when ambient conditions are suitable and air to air heat recovery systems to provide free pre-cooling/heating of outside air from building exhaust systems
- a minimum of 5kW single phase grid connected photovoltaic (PV) cell system reduce building's utility supplied energy consumption in accordance with Government policy
- The roof structure and other relevant infrastructure will be constructed to enable the future installation of additional photovoltaic solar panels
- energy efficient lighting systems comprising high efficacy T5 and LED luminaires, switched zoning areas, high frequency ballasts and the ability to incorporate daylight compensation controls
- motion detection technology to control lighting within low occupancy rooms.

Monitoring and targeting

The building services plant and equipment associated with the development will be controlled and monitored by the existing automated Building Management System (BMS).

Transport

The project team has worked with the Council to determine the preferred location for a bus superstop with the aim of improving public transport amenity and usage for the hospital and adjacent facilities.

Water

The following initiatives aim to manage and reduce the consumption of potable water in the new build:

- water efficient sanitary and tapware fixtures in accordance with "Water Efficient Outlet in Government Buildings Policy" with evidence from the water efficiency labelling scheme
- rainwater harvesting and storage system for landscape irrigation and toilet flushing
- landscape design incorporating plants requiring minimal water after establishment.

Materials

The following initiatives aim to reduce the environmental impact of this development:-

- dedicated recycling waste storage areas for collection of waste to be transported to the hospital's central waste sorting facility to encourage recycling and thereby reducing the amount of waste going to landfill
- materials sourced from certified environmentally-responsible sources
- materials with recycled content to minimise the use of virgin materials
- materials which are durable and have minimal maintenance and repair requirements.

Ecology

The development will enhance the existing ecological value of the site through consolidation of landscaping zones and the use of indigenous plants selected to improve habitat

Emissions

Emissions from buildings have a significant impact on the environment. Typical building emissions are stormwater run-off, waste water to sewer and ozone depleting compounds.

The development of major site infrastructure requires management of waste water generated from buildings. It is intended that stormwater run-off will be harvested into storage tanks to minimise waste water run-off.

The following initiatives are proposed for this project:

- refrigerant with zero Ozone Depleting Potential (ODP) in accordance with the Australian Refrigeration and Air-conditioning Code of Good Practise or AIRAH Refrigerant Selection Guide 2003
- insulation with zero ODP in both its composition and manufacture
- water efficient fixtures to reduce wastewater discharge into the sewerage system
- avoiding the generation of light sources which are directed towards the sky and spill into area surrounding the site to reduce light pollution.

ESD Concept Design IGRAT Management Plans

Detailed concept design reports have been prepared detailing the intended design and construction strategies to achieve the required IGRAT rating for each project component. Please refer **Appendix G** of this document which contains a copy of the current IGRAT Green Plans for each of the key project elements.

ENGINEERING SOLUTION

Mechanical Services

The existing Mechanical Services systems, namely chiller sets and boilers are currently at maximum capacity and do not have the capacity to serve the proposed Emergency Department expansion. A new thermal plant is proposed to serve the extension area with the existing plant to serve refurbished area of the development, noting the existing installation is not compliant with the requirements of an IL4 building.

The existing Medical gas systems have the capacity to serve the proposed expansion, noting however the existing installation and the associated reticulated pipework is not compliant with the requirements of an IL4 building.

Electrical Services

The existing Electrical Services reticulation system has sufficient capacity to serve the proposed development. A new electrical supply is to be established from the existing Main Switchboard (MSB.7) located in Building A to serve a new main distribution board in the proposed emergency extension. The new electrical supply and main distribution board will have sufficient capacity to serve both the extension and existing refurbished area of the development.

Reticulating the electrical supply from MSB.7 will ensure that the emergency department will be connected to the most recently installed electrical infrastructure on the site with sufficient generator back-up power provided via the existing 2 off 1500 kVA generators.

Providing a new electrical supply from MSB.7 to serve the entire emergency department will remove the associated electrical demand of the existing emergency department on the existing Transformer (TF.2) and Main Switchboard (MSB.2A) infrastructure, inherently provide future spare capacity.

IIS Services

The existing IIS Services fibre optic backbone cabling reticulation serving the entire hospital emanates from both the existing Communications Cabinet (CC.S00) (primary link) located in the main data centre and the existing Communications Cabinet (CC.S28) (secondary link) located in the communications room adjacent the existing emergency department waiting area.

The existing Communications Cabinet (CC.S28) is currently located within the proposed refurbishment area. As such, all associated equipment and cable terminations are required to be relocated

It is proposed that a new emergency department main communications room will be established as part of the emergency department extension located at Level 2, with new fibre optic backbone cabling from both existing CC.S00 and CC.S28. Satellite communications cabinets will be established to within the extension and refurbished area of the development with fibre optic backbone cable connection to the new emergency department main communications room.

Hydraulic Services

Sewer Drainage

- The existing sewer system has the capacity to accept the additional inflow from the proposed development. However, this additional load will reach the capacity of the sewer drainage and any further development will require significant upgrade of the sewer disposal system.

Water Reticulation

- There is sufficient capacity within the existing cold water to service the new area, however, this will reach the limit of the existing cold water capacity.

Gas Supply

- There is insufficient natural gas to provide for the proposed new Mechanical Services plant and the new domestic hot water plant. A new gas meter from the Oldham Road gas main will be provided.

Fire Protection Services

- The existing Fire Protection Services has the capacity to serve the proposed new works. Alterations are required to divert the underground fire main so that it does not remain below the proposed building footprint.

BUILDING ENGINEERING SERVICES – NEW BUILDING SERVICES PROVISIONS

Mechanical and Medical Gas Services

Provision of new chilled and heating water plant within a Level 2 plantroom on the new Emergency Department extension to provide capacity for the new build Emergency Department only.

New chilled and heating hot water plant will be provided with N+1 redundancy. The heating hot water boiler will also be provided with both gas and diesel burners.

Existing thermal plant and air handling plant to be retained to serve the renovated sections of the existing Emergency Department. The current is not installed to comply with the requirement of IL4 building.

Existing Medical gas systems (oxygen, suction and medical breathing air) is available within the existing building and is suitable for extension to the new building. The current is not installed to comply with the requirement of IL4 building.

Included works as follows:

- Air conditioning thermal plant to be located within the Level 2 Plantroom Area comprising chiller sets, cooling towers, primary and secondary chilled water pumps, condenser water pumps, Mechanical Services switchboard, water treatment systems, heating hot water pumps and boilers.
- Provision of gas detection systems to thermal plantrooms.
- Air conditioning comprising individual variable air volume air handling units with high efficiency motors to serve functional and/or thermal zones of the respective new hospital facilities.
- Alteration, modification and upgrading of existing Mechanical Services systems to suit amended areas.
- Economy cycle systems associated with major air conditioning systems serving the respective hospital facilities.
- Mechanical exhaust system to service the ensuites, toilets, bathrooms, switchrooms, workshops, utility areas and areas nominated within Australian Standard 1668 - Part 2.
- Provision of new medical gas outlets, gas panels, medical gas alarm panels and valve boxes for suction, medical air and oxygen to all new areas in accordance with Australian Standard 2896 - 1991 - Medical Gas Systems - Installation and Testing of Non Flammable Medical Gas Pipeline systems.
- Provision of new medical gas outlets and medical gas alarm panels to existing area where they are currently non-compliant with the current Australian Standard 2896 - 1991 - Medical Gas Systems - Installation and Testing of Non Flammable Medical Gas Pipeline systems.
- Piping systems associated with the above systems including medical, chilled and heating hot water connection between new thermal plantroom and the various new areas.

- Air distribution systems including filters, motorised fire and smoke dampers and the like associated with the above systems.
- Electrical Services associated with the above systems.
- Controls associated with the above systems incorporating a Building Management System interfacing the Mechanical Services systems to the Intelligent Integrated Services.

Electrical and Intelligent Integrated Engineering (IIS) Services

Electrical Services

The Electrical Services are summarised as follows:

- Staged disconnection and making safe the electrical services within existing buildings in preparation for demolition and refurbishment.
- Provision of new electrical supply from the existing Main Switchboard (MSB.7) to a new emergency department main distribution board.
- Provision of a new emergency department main distribution board located within the emergency department extension area incorporating capacity to serve both the extension and refurbished areas of the development.
- Distribution switchboards (essential and non-essential) throughout the new and refurbished buildings to serve each functional area.
- Low voltage essential services sub-mains to the lifts with facility for lift operation in the event of normal power failure.
- Rack mounted 20 kVA Uninterruptible Power Supply (UPS) System to support ICT services and critical nurses station
- Power Supplies for Mechanical, Hydraulic and Fire Protection Services Switchboards and equipment.
- General and special power services as required for dedicated functional areas, including "body-protected" and "cardiac-protected" areas as required to new and refurbished areas.
- Lighting installation throughout incorporating LED luminaires in accordance with Australian Standards as follows:-
- General building interior - Australian Standard 1680 - Interior Lighting Parts 1 and 2.
- Circulation spaces - Australian Standard 1680.2.1 - Interior Lighting for Circulation Spaces and Other General Areas.
- Internal Medical Observation - Australian Standard 1765 - Artificial Lighting for Clinical Observation.
- Self contained emergency and exit luminaires to Australian Standard/New Zealand 2293 - Emergency Evacuation Lighting in Buildings, using single point systems.
- External lighting to revised carpark, roadway and ambulance bays in accordance with Australian/New Zealand Standard 1158 – External Lighting.
- RCD protection to all GPO’s and lighting circuits to all new and refurbished areas.

Intelligent Integrated Services

The IIS services are summarised as follows:

- Provision of new 24 core OM4 fibre optic backbone cable from the existing Communications Cabinet (CC.S00) to the new emergency department main communications room established within the emergency department extension area.
- Provision of new 24 core OM4 fibre optic backbone cable from the existing Communications Cabinet (CC.S28) to the new emergency department main communications room established within the emergency department extension area.
- Provision of new satellite communications cabinets within the extension and refurbished area of the development, incorporating a 12 core OM4 fibre optic backbone cable from the new emergency department main communications room.

- Integrated voice and data structural backbone cabling and facility (horizontal) cabling throughout new and refurbished areas comprising Category 6A cabling, PDS frames, cabinets, terminations and outlets.
- Upgrade of the existing electronic security system from Challenger V8 to Challenger V10 including 8Meg IUM.
- Extensions to the existing security access control and monitoring system throughout new and refurbished existing areas.
- Extension to the existing nurse call system throughout all new and refurbished existing areas.
- Access provisions for carpark operations control equipment.

Hydraulic Services

New Buildings on the site will be connected to the existing main in-ground reticulation system

Domestic water will be sourced from new SA Water domestic water connections from Grand junction Road. Water will be reticulated under mains pressure to all buildings
Natural gas for the site will be provided from new APA Group gas meter located at the Oldham Road Boundary and will be reticulated in ground to all building

Hot water will be generated utilising local gas fired hot water utilising a flow and return system with Thermostatic mixing valves provided.

The Hydraulic Services are summarised as follows:

- Demolition of existing redundant Hydraulic Services.
- Termination of existing redundant drainage and water reticulation systems.
- Diversion of existing services below extent of new building footprint
- Relocation of existing Bulk decontamination facility services where appropriate to new location to suit the new Bulk Decontamination facility
- New holding tank and dedicated waste for new single decontamination facility
- Sanitary plumbing, drainage and vent.
- Domestic hot and cold water reticulation extended from existing supply to work within existing buildings.
- New domestic hot and cold-water reticulation from new connections.
- New domestic hot water plant for additional new buildings.
- Mechanical Services and Fire Protection Services drainage provisions.
- Supply and installation of inset type stainless steel sinks.
- Supply and installation of stainless-steel dirty utility room combination pan sink and flushing bowl
- New sanitary fixtures and tapware to new and refurbished areas to match existing selections including electronic tapware to all new clinical basins and anti-ligature fittings to MHU.
- Downpipes to new building areas, from underside of roof level to ground level, for disposal by civil contractor.
- Roof drainage outlets to the new external plant area.

Fire Protection Services

The Fire Protection services are summarised as follows:

- Provision of a new underground fire main located to avoid pipework running under the new building work.
- Provision of branches from the underground fire main into the new fire stairs.
- Provision of a new fire hydrant risers within each of the fire stairs with fire hydrant outlets located at each floor level.
- Provision of new automatic fire sprinklers above and below the ceiling in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Ambulance parking area, the Level 2 Administration Area and the Level 2 enclosed Plant room area.
- Provision of anti-ligature sprinkler heads below the ceiling in the level 3 Mental Health Ward. Standard sprinklers will be used in the ceiling space, the lift lobby and the stair lobby.
- Alterations to the existing fire sprinklers in the Acute Zones, the See and Treat area and the existing Support area.

- Provision of new fire sprinkler control valve sets to be located in the northern fire stair on level 1, 2 and 3.
- Provision of new fire hose reels in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Level 2 Administration Area and the Level 2 enclosed Plant room area. The fire hose reels located on the Mental Health floor will be located outside the secure area adjacent each fire stair.
- Alterations to the existing fire hose reels in the Acute Zones, the See and Treat area and the existing Support area.
- Provision of new fire smoke detectors in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Level 2 Administration Area and the Level 2 enclosed Plant room area.
- Provision of new Aspirated Smoke detection systems to the bedrooms of the Mental Health ward. zoned to cover 4 bedrooms maximum per unit. The control units are proposed to be located within the cleaners rooms and be surface mounted on the walls. The room sampling points are to be the anti-ligature type. Smoke detection throughout the remainder of the floor would be from standard smoke detection heads protected with metal anti-ligature covers. No covers are proposed outside the secure area.
- Provision of new manual call points in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Level 2 Administration Area and the Level 2 enclosed Plant room area and the Mental Health Ward. The mental health ward manual call points are to be located outside the secure area.
- Alterations to the existing manual call points in the Acute Zones, the See and Treat area and the existing Support area.
- Provision of new mimic fire panels to each nurses station in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Ambulance parking area and the Mental Health Ward.
- Alterations to the existing mimic fire panels in the Acute Zones, the See and Treat area and the existing Support area.
- Provision of new red/amber strobe lights in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Ambulance parking area, the Level 2 Administration Area and the Level 2 enclosed Plant room area and the Mental Health Ward.
- Alterations to the existing red/amber strobe lights in the Acute Zones, the See and Treat area and the existing Support area.
- Provision of new EWIS speakers in the Resuscitation area, the Reception/Triage/Waiting area, the Paediatric area, the Ambulance parking area, the Level 2 Administration Area and the Level 2 enclosed Plant room area and the Mental Health Ward. The Mental Health Ward are the recessed ceiling type and not anti-ligature.
- Alterations to the existing EWIS speakers in the Acute Zones, the See and Treat area and the existing Support area.
- Provision of additional and relocation of existing portable fire extinguishers to suit the proposed extension and refurbishment.

Lift Services

The Lift Services are summarised as follows:

- 2 off machine-room-less traction type lifts of43 passenger/3200 kg capacity to serve 3 levels.
- Lift car dimensions to match existing bed/passenger lifts in other parts of the facility.
- Lift car superstructure comprising steel frame and finishes to architects selection.
- Fitments within the lift cars to comply with the intent of Australian Standard 1735 - Part 12 Facilities for Persons with Disabilities.
- Facilities for emergency hospital call on all lift landings.
- Supply and connection of automatic emergency dialling telephone system within lift cars.
- Interface with the building security system.
- Provision for Warden Intercom Points (WIP) within designated emergency lifts.

Pneumatic Tube System

- Stations (3 off) including inlets and outlets, spare carriers and storage, basket, audible and illuminated indication to serve the new emergency department.
- Diverter stations, pneumatic tubes.

Central Vacuum Cleaning Services

- Provision of additional Central Vacuum Cleaning outlets extended from the existing services to provide CVC outlets in accordance with the established site principles

BUILDING SERVICES - POST DISASTER PROVISIONS

The intent is for the Building Emergency Services is to follow the established principles for the site in respect of IL4 post disaster and continuity of operation requirements.

Mechanical Services

The proposed new thermal (chillers, cooling towers, boilers pumps etc) and air handling plant to serve the Emergency Services expansion will be arranged and installed to comply with the post disaster provisions. These systems will be installed to serve new build portion of the Emergency Services expansion only. The existing thermal plant and air handling plant will be utilised to serve the proposed refurbishment of the current Emergency Department noting the current installation does not comply IL4 post disaster requirements.

Medical Gases

The medical gas systems will be extended from the existing bulk oxygen tank, suction plant and medical breathing air compressors to serve the expansion. Therefore, there will be no additional works, however the current installation does not comply IL4 post disaster requirements.

Electrical Services

The electrical supply will be extended from the recently existing Main Switchboard (MSB.7) installed within Building A which incorporates connection to the 2 off 1500kVA back-up diesel generators, hence no additional upgrade required.

Domestic Cold Water Supply

The cold water supply will be extended from the existing site storage tank/pump system, hence no additional upgrade required.

Domestic Hot Water Supply

The new domestic hot water plant would be supplied with either a dual-fuel burner system utilising standard diesel as an alternative fuel source (should the natural gas supply be lost), or alternatively utilise the heating water boilers as a heating source for domestic hot water via heat exchange system.

Natural Gas

As the external gas supply is not guaranteed the service will be set up so alternation to gas supply, being diesel fuel, can be utilised in the event of loss of natural gas.

Fire Protection Services

The fire protection services will be extended from the existing site water storage tank and pump system, hence no additional upgrade required.

BUILDING SERVICES - SEISMIC RESTRAINT AND IL 4 PROVISIONS

The new building and the associated refurbished area will be provided with services restraint and plant and equipment certified to Importance Level (IL 4) for continued operation post seismic event.

In relation to the specific post disaster provision, the following existing established system will be extended to the new build area:-

- Electrical Services - reticulated Electrical Services supply from the existing Building A generator system.
- Domestic Cold Water - reticulated from the existing cold water storage tank supply.
- Fire Protection Services - reticulated from the existing site fire water storage tank system.
- Heating Water - provision of dual-fuel system to the boilers to maintain supply.

BUILDING SERVICES – ESD PROVISIONS

It is intended to carry forward the established LMH site ESD principles on as practical given budgetary limitation. Specifically these are:-

- Consideration to capturing rainwater from the new roof areas and utilise within the existing water reticulation system.
- Use of high efficiency luminaires.
- Sub-metering of Electrical and Hydraulic Services.
- Economy cycle systems.
- Water cooled chillers.
- Primary and secondary chilled and heating water pumping systems.
- Increased chilled water temperature difference.
- Thermally and functionally zoned variable air volume air handling systems
- High efficiency motors.

BUILDING ENGINEERING SERVICES - AUTHORITIES, APPROVALS AND COMPLIANCE

SA Power Networks

Upgrade to the existing high voltage supply to the site will be required. A formal application to SA Power Networks will be submitted following finalisation of the additional estimated maximum demand and final requirements have been determined. SAPN will then have 60 business days to provide a firm quotation for the works.

Office of the Technical Regulator (OTR)

The OTR will provide approval for the Plumbing design and reticulation systems once the design is complete.

South Australian Metropolitan Fire Service (SAMFS)

The SAMFS will provide comment on the Fire Protection Services design once is complete, witness the fie contractor commissioning tests and undertake commissioning hydrant flow testing.

WORK HEALTH SAFETY (SAFETY IN DESIGN)

The consideration of safety and security matters associated with the proposed development will be managed in accordance with the established process utilised by SA Health to manage its responsibilities to its staff and the general public. This process encompasses both internal review by hospital and departmental security and WHS staff and design processes conforming to the Work Health Safety Act requirements.

SAHealth and LMH Site Security Review

The proposed LMH development is an extension to an existing operational hospital which has established safety and security procedures and measures which have been developed to suit the demonstrated risk profile of the site and which are monitored and reviewed as part of ongoing operations. The SA Health Asset services unit delivering the project includes internal professional security staff that will undertake independent reviews of proposed new projects with respect to security and safety considerations. This process may encompass engagement of external security consultants.

WHS Safety Process

In parallel the design, construction and operation of the new facilities are subject to the requirements of the Work Health Safety Act which came into effect in January 2013.

The detailed design, construction and operation of the new development will be delivered in accordance with the specific requirements stipulated by the WHS Act. This encompasses previous 'safe design' practices in combination with the integration of stakeholder consultation, operational policies and formal risk assessments. The regulations stipulate and require close consultation with key stakeholders which will include site and departmental security staff, WHS (OWH&S) and Infection Control staff, management, clinical and user group representatives in the identification of risks and appropriate control measures which encompass both facility and operational procedure elements.

The consideration of safety and risk issues for the LMH project in the manner stipulated by the WHS Act will enable safety risk control measures to integrate both facility design and operational procedures working in unison. As a consequence the identified measures will be consistent with the intended ongoing operation of the LMH site including integration with existing systems.

The development of the WHS Safety report will include participation by the Managing Contractor prior to commencement of construction with respect to specific construction safety considerations.

The WHS Act regulations include a requirement for a final safety report prior to construction which will be subject to review by the SA Health Asset Services staff before being endorsed. This report is progressively developed through the design process and forms a vital interface between the facility delivery process and hospital operational responsibilities.

An example of the Safety Report developed and delivered during the recent James Nash House Redevelopment project with a very similar risk profile to the proposed development is attached in **Appendix K** of this document for reference

STRUCTURAL & CIVIL

Structural & Civil Engineering Solutions

Please refer **Appendix H** of this document for reports detailing the proposed structural and civil engineering solutions for each of the project components including seismic design to meet post-disaster performance requirements.

Stormwater Management

A Site Stormwater Management Plan report has been prepared by Wallbridge Gilbert Aztec Engineers which details the proposed stormwater works associated with the proposed development and is contained by **Appendix H** of this document.

Traffic

The proposed development will displace and generate additional parking requirements on site of approximately 190 parks. As such an extension to the existing Multideck Car Park building has been planned that will provide 205 parks. These works have been detailed within a separate Concept Design Report/ Application.

A Traffic Consultant was engaged to review not only the parking requirements but also the ability for the local road network to cater for any additional demand. A copy of the Traffic Report generated as a result of this review is included in the **Appendix J** which has concluded that the existing road network has more than adequate capacity.

STAGING & CONSTRUCTION CONSIDERATIONS

The proposed development is to occur whilst the existing facility is still operational and will therefore necessitate the construction to be staged. The proposed staging has been designed to ensure that at no point is there a loss in the number of treatment spaces available to the Emergency Department. Following the appointment of the Managing Contractor the staging will be reviewed but it is currently planned as follow;

Early Works

- This stage of works will provide temporary access to the existing Emergency Department Waiting and Triage areas and provide a dedicated hardstand and covered zone from ambulance patient transfers.

Stage 1

- This stage represents the new build component of the works.
- At the completion of this stage the Entry, Reception, Triage, Resuscitation and Paediatric Clinical Spaces will be built.
- The Level 2 Administration, Support and Plant will be complete
- The Level 3 Short Stay Mental Helath will be complete
- The civil and landscaping works will be complete
- The covered ambulance hardstand and access to the Mental Health Hardstand will be constructed.

Stage 2

- The original Resuscitation Treatment spaces will be deconstructed and a Handover room and support spaces constructed.
- The new Paediatric ward will be finished with the provision of additional storage rooms and a Procedure Room

Stage 3

- The department functions replicated in the new build to be deconstructed namely the existing waiting, reception, triage, toilets and paediatric spcaes.
- New undifferientiaed acute treatment spaces and staff bases constructed.
- New See and Treat department constructed.

COST ESTIMATE

A separate detailed cost report has been prepared by Rider Levett Bucknall.

6. PROGRAMME

The predicted date for commencement of construction of the new facility is approximately January 2020, with Practical Completion being achieved in mid-2022.

A preliminary programme developed prior to engagement of a Managing Contractor is contained in **Appendix L** of this document.

APPENDIX A

SA HEALTH BRIEF FOR BOTH THE EMERGENCY DEAPRTMENT AND THE SHORT STAY MENTAL HEALTH UNIT

Project Brief

Project and Client Information

Project Name:	**Lyell McEwin Hospital (LMH) - Emergency Department Redevelopment: Phase 2 – Major Expansion Works**
Asset/ Site Address:	Haydown Road, Elizabeth Vale
Asset Number:	
Agency	Department of Health and Ageing (DHA)
Lead Agency Representative:	Peter Fitzsimmons
End User Representative:	Mandy Ross, Commissioning Coordinator, LMH
Key Stakeholders:	Northern Adelaide Local Health Network – Executive LMH Emergency Department (ED) Clinical Staff

Brief Prepared By:

Name	Peter Fitzsimmons
Position	Projects Team Leader
Agency & Business Unit	Infrastructure, Department of Health and Ageing
Contact	Peter.fitzsimmons@health.sa.gov.au

Date	15/09/17
Signature	Peter Fitzsimmons

Approving Officer:

Name	Tim Packer
Position	Director, Capital Projects
Agency & Business Unit	Infrastructure, Department of Health and Ageing
Contact	tim.packer@health.sa.gov.au

Date	15/09/17
Signature	

Project Objectives

Services required	☐ Brief Development ☐ Master Plan/ Scoping Study ☐ Feasibility Study/ Planning Study	☐ Concept Report (Part 1) ☒ Full Services (Parts 1,2,3) ☐ Other, Describe:
SAMIS numbers of affected buildings		
Project Description	The 2017 State Budget approved $52.5 million for the redevelopment of the Lyell McEwin Hospital Emergency Department from 2017 - 2021. Planning for the redevelopment is scheduled for 2017-18, with works anticipated to commence in 2018. In advance of the overall LMH Emergency Department project commencing, a smaller package of enabling works is now progressing as a separate project ("Phase 1 - Enabling Works"), specifically to refurbishment the existing Administration and Staff Support area to create a new Acute Treatment Unit (ATU) to provide in the order of 14 treatment cubicles. This project brief is to facilitate the procurement of the overall **Phase 2 – Major Expansion Works** design team to assist DHA / NALHN in establishing a detailed project brief for the remainder of the project; and proceeding with design services including necessary approvals. The major redevelopment of the Lyell McEwin Hospital Emergency Department will result in expanded and reconfigured areas such as: Resuscitation, Ambulance Drop-Off, Paediatric Assessment; Short Stay and Quick Assessment; and Acute and Discharge facilities. These new facilities will be in place at the completion of the redevelopment in mid-2021. For the basis of the budget submission, it was anticipated that the refurbishment extent would be in the order of 2,550m2, new build in the order of 2,600m2, undercover area / bulk decontamination unit in the order of 650m2 for a preliminary accommodation total of 5,800m2 (inclusive of the Phase 1 – Enabling Works already underway). The preliminary accommodation requirement will require testing to ensure the new facilities can be efficiently provided, without resulting in significant knock-on's to car parking, infrastructure, circulation / connectivity and the like.	
Project Drivers and Purpose	The overall redevelopment of the LMH Emergency Department is planned to be undertaken over the next four years, 2017-2021. Procurement of a Lead Professional Services contractor to undertake design services is planned for the second half of 2017, with construction works due to commence in 2018. The redevelopment requires carefully considered staging and decanting, as the LMH Emergency Department will be required to remain operational throughout the redevelopment. Service continuity planning will be critical. Noting the timeframe involved in the redevelopment, the Department of Health and Ageing has progressed with DPTI, the delivery of an early package of works (as Phase 1) to increase the LMH Emergency Department capacity and throughput ahead of the 2018 Flu Season, when patient activity peaks. The LMH Emergency Department's activity has increased from 35,000 presentations in 2006 to over 70,000 presentations in 2016. At peak activity, the LMH Emergency department is in excess of 100% of its capacity. *Due to the similarities of the LMH ED Redevelopment – Phase 2 Major Expansion Works and the Modbury Hospital Emergency Extended Care Unit, it is requested that a common Lead PSC / Design Team be engaged to deliver both projects.*	

Project Budget	$52.5 Million (inclusive of Phase 1: Enabling Works already in progress). Current RLB Cost Estimate is $52.5 Million (excluding GST) as attached. The current approved project expenditure for Phase 1: Enabling works and NALHN Redevelopment Staffing is as follows: Design / Construction Fitout: $3,400,000 NALHN Decanting / MW: $ 250,000 Specialist Medical Equipment: $ 280,000 NALHN Staffing: $1,240,000 (For the full LMH Project) TOTAL: $5,170,000 **This leaves a budget of $47,330,000 to deliver the Phase 2: Major Expansion Works.** ***Note: the project budget includes FFE allowances, Principal's Contingency, ICT and decanting. This is to be taken into account when establishing fee benchmarks / fee matrix.
Required program dates	**Completion by mid-2021**
Critical Dates and Required Approvals	**Completion by mid-2021**
Project Staging	Phase 1: In progress (Enabling Phase). Phase 2: Part 1 – New-build Construction Phase. Part 2 – Internal Fitout Phase (staged). It is anticipated that a more detailed staging program will be established with NALHN during the Concept Design phase.
Current Program phase	☐ Brief development ☐ Project Allocated ☒ Planning ☐ Concept ☐ Design ☐ Documentation ☐ Tender ☐ Construction ☐ Review ☐ Other, describe

Background Information

General Background	The Lyell McEwin Hospital is, along with the Royal Adelaide Hospital and Flinders Medical Centre, one South Australia's three major tertiary Hospitals. The Lyell McEwin Hospital has undergone a series of major redevelopments over the past decade at a cost of over $300 million. The Lyell McEwin Hospital serves the northern metropolitan area of Adelaide and northern country South Australia. Population growth in these areas, in particular the northern metropolitan area, over the past decade has seen an almost of doubling of activity in the Hospital's Emergency Department. This activity is projected to continue to increase annually to at least 2032. In early 2017, DHA developed a feasibility option to redevelop and expanded the

	Lyell McEwin Hospital Emergency Department. This information was submitted to the Department of Treasury and Finance resulting in an approved project budget of $52.5 million being announced in the 2017 State Budget. Pressure on the Lyell McEwin Hospital Emergency Department requires an immediate increase in capacity. The Phase 1 - Enabling Works were approved by the Minister for Health on 8 September 2017 to bring forward a small section of the overall redevelopment as a separate exercise increasing the capacity by 15 Treatment Cubicles by the Winter of 2018 (by end of May 2018). DPTI has recently sought a tender from a Design Team and Cost Manager to expedite the Phase 1 – Enabling Works. This strategy will assist the Lyell McEwin Hospital Emergency Department: • in alleviating the pressure generate by peak and above-peak demand, currently already experienced and expected to be greater again in 2018; • in providing staging and decanting capacity during the major redevelopment works post 2018; and • in providing facilities that in the first instance will operate as an Acute Treatment Unit, but will be redesignated as the Discharge Unit in the eventual redevelopment project to be completed in mid-2021.
Government Targets/ ESD Performance	Works need to comply with the SA Health IGRAT Refurbishment / New Construction Tool. The LMH has been progressively redeveloped with outstanding ESD outcomes (including the first GBCA
Agency Standards	Australian Health Facility Guidelines SA Health Security and ICT policies SA Health IGRAT SA Health Medical Gases Policy SA Health Infrastructure – Project Completion / Space Data Requirements
Hazardous Materials	Nil known (check Asbestos Register)
Heritage	N/A
Existing Buildings and Information	Previous LMH Stage A / B / C project documents.
Relevant Information and Advice	Feasibility Study by Cheesman Architects Feasibility Cost Estimate by Rider Levett Bucknall.

Site Information, Access and Car parking

Site Information	
Operational Hours	The LMH Emergency Department operates on a 24/7 basis. Works are expected to be undertaken during normal working hours with some exceptions for significantly disruptive tasks.
Site Access, Security	Site access will be managed by onsite security. Contractors will need to undertake induction prior to commencement. Security clearance at DCSI level required by all workers.

Car parking	Loss of onsite car parking is to be minimised. Car parking on site is limited and is on a user-pay basis. On-street car parking is limited and monitored closely by local council.

External Requirements

External Requirements	The final solution will need to efficiently manage (and minimise) the loss of on ground public car parking.
Engineering Requirements	Services engineering input is to be required.
Future Requirements	The project will need to consider the future implications (and possible integration) of a new Mental Health Short Stay Unit (MHSSU) adjacent the Emergency Department. The MHSSU is a clinical priority for NALHN, however it is unfunded at this time.

Accommodation Requirements

Schedule of Accommodation	An indicative Schedule of Accommodation is included within this document. It will be necessary to establish an accurate Schedule of Accommodation (reflecting the preferred mix of new-build and refurbishment works) during the Concept Design phase.
Design Criteria	As per Australian Health Facility Guidelines (AHFG's), HPU300 Emergency Unit. https://aushfg-prod-com-au.s3.amazonaws.com/HPU_B.0300_6_0.pdf It is essential that compliance with the AHFG's is managed and achieved by the Design Team, with any variances only considered by exception; and following DHA approval.
End User Groups	LMH Emergency Department Clinicians will form an advisory work group.
Engineering Requirements	Full range of engineering services required.
Internal or Fitout Requirements	To be determined
Other Specialist Requirements	To be determined
Future Requirements	To be determined
Other Considerations	DHA / NALHN are currently reviewing recent work completed on Predictive Simulation Analytics to determine if this technology and analytics would be beneficial in the space and operating planning phase. Allowance within the Concept Phase to collaborate with these activities is to be made.

Project Team – Professional Services Contractors

Lead Professional Service Contractor shall be	☒ Architect ☐ Engineer ☐ Project Manager ☐ Other, describe:

Professional Service Contractors required

☐ Architect	☒ Engineers
☒ Planner – Health**	☒ Civil/ Structural (for courtyard infill)
☐ Surveyor	☒ Hydraulics
☒ Geotechnical	☒ Mechanical
☐ Access	☒ Electrical
☒ BCA/ Certifier	☐ Lighting
☒ Landscape	☒ Vertical Transportation
☒ Interior	☒ Cost Manager
☒ Traffic/ Transport	☒ Other, describe:
☐ Heritage	****Experienced Health Planner + ED Clinical Expertise required**
☐ Irrigation	

Specialised Services Required

SERVICE	Information Available	Service Required	Comments
SITE DEFINITION			
Contamination testing	☐	☒	
Car parking onsite/off site	☐	☒	
ENGINEERING SERVICES			
Electrical capacity investigation	☒	☒	
Electrical distribution condition	☒	☒	
Underground services survey	☐	☒	
Fire services investigation	☒	☒	
Gas and Medical provision	☒	☒	
IT Data /Telephone distribution	☒	☒	
Water supply/rain water/RO Plant	☐	☒	
Stormwater disposal	☒	☒	
Other waste disposal issues	☐	☐	
BUILDING			
Building Condition Assessment	☒	☐	
Seismic Assessment	☒	☒	
WHS Issues Safety in Design - SID	☒	☒	
Acoustic issues	☐	☒	
Disability Access	☐	☒	

	Any known joint use agreements	☐	☐	N/A
Engagement PSCs				
Preferred procurement method	Due to preliminary level of briefing information prepared to date, the engagement of a Design Team (with Health Planning expertise) to help define and establish the brief is required. It is anticipated that the Design Team will continue throughout all phases of the Design phase from brief development to construction completion. Due to the staged nature of construction works in a fully operating, 24/7 clinical environment, a flexible, collaborative Contract arrangement is essential to deliver the construction works. Engaging a common Design Team and Cost Manager to manage the Lyell McEwin Hospital – Emergency Department – Phase 2: Major Expansion Works and Modbury Hospital – Emergency Extended Care Unit ($9.175 million) is expected to deliver efficiencies in stakeholder engagement, design processes, administration and communication. It will also enable a high level of coordination across NALHN in the necessary staging and decanting activities, which are required to ensure that sufficient emergency department capacity is provided across the Local Health Network.			

Communications, Quality and Risk Assessment

Communication and Protocol	What is the preferred consultative model for end users and other stakeholders? ☐ **Directive** (Direction Given) ☐ **Informative** (Stakeholder comments considered) ☐ **Iterative** (Input Sought) ☒ **Collaborative** (Work together to agree the preferred method)	
Client Contacts	In the absence of the lead agency representatives, who do we contact for:**Day to Day Issues: Mario Viskic, Redevelopment Manager, NALHN** **Management Issues: Mandy Ross, Commissioning Coordinator, NALHN**	
Quality Management Plan Required?	Requires formal Risk Assessment and Quality Management Plan to ensure service continuity during works period.	
Identified Risks	Refer to attached Risk Assessment.	
Management	If you had to trade off amongst the following four management areas, list the priority order from 1 to 4.	
	Area	**Priority**
	Scope Management	4
	Time Management	1

	Cost Management	3
	Quality Management	2
Post Construction Review	Indicate the requirements for Review Post-Construction and Review Post-Occupancy Evaluation : ☒ **Combined Review** Post-Construction and Post-Occupancy Evaluation at 3 months ☒ **Separate Reviews** A review for Post-Construction at 3 months, A review for Post-Occupancy Evaluation at 12 months	

Other

BIM	What level of Building Information Modelling is required? ☒ Project Specific (BIM Required) ☐ Core BIM (Minimum Level Required) ☐ N/A, Not Suited to BIM
WHS	Has a risk assessment report been undertaken? ☐ Yes (attach) ☒ No (refer to guide note for details on how to prepare register)

Attachments

- ☐ Certificate of Title
- ☒ Building Feasibility Staging
- ☐ SAMIS Room Reports
- ☐ Hazardous Materials Reports
- ☐ Work Health Safety Risk Register
- ☒ Accommodation- Schedule of Areas
- ☒ Other; Specify: Rider Levett Bucknall Cost Estimate

Accommodation – 'Indicative' Schedule of Areas

1.0 Undercroft Verandah - SAAS				
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
	Ambulance parking	6	15	90
Existing facilities to be retained				
	Nil			
Existing Facilities to be replaced				
	Ambulance Set-down	2	15	30
Additional facilities required				
	Ambulance Set-down	8	15	120
	Parking	0	15	0
	Circulation			300
	Completed Total m^2			**450**
2.0 Resuscitation				**439**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
	Treatment Room/Plaster Room	1	27	27
Existing facilities to be retained				
	Nil			
Existing Facilities to be replaced				
1.0.01	Decontamination Shower	1	12	12
1.0.02A	Pathology	1	5	5
1.0.03	Relatives Room	1	16	16
1.0.04	Visitors WC	1	3	3
1.0.05	Viewing/Holding	1	17	17
1.0.06	Resuscitation Room 2	1	30	30
1.0.06A	Control	1	7	7
1.0.07	Resuscitation Room 1	1	30	30
1.0.13	Dirty Utility	1	13	13
	Equipment Bay	1	4	4
1.0.99	Store	1	14	14
	Total m^2			**151**
Additional facilities required				
	Resuscitation Treatment Room	2	30	60
	Bariatric Resuscitation Room	1	40	40

	Control Room	2	7	14
	Decontamination Room	1	10	10
	Clean Utility	1	13	13
	Dirty Utility additional area	1	10	10
	Linen Bay	1	4	4
	Sub-Total m^2			151
	Circulation		46%	69
	Total m^2			**220**
3.0 Patient reception/Triage				**424**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
1.0.87	Assess/Triage	1	18	18
1.0.91	Doctors Office	1	10	10
Existing facilities to be retained				
	Nil			
Existing Facilities to be replaced				
1.0.82	Female WC	1	13	13
1.0.83	Accessible WC	1	5	5
1.0.86	Staff WC	1	2	2
1.0.88	Male WC	1	13	13
1.0.89	Clerical	1	16	16
1.0.90	Entry Lobby/Reception	1	45	45
1.0.93	Waiting - Adult	1	42	42
1.0.94	Public Entry Air-lock	1	13	13
1.0.95	Orderlies office	1	13	13
1.0.96	Ambulance Entry Lobby	1	30	30
1.0.98	Triage staff base	1	23	23
	Total m^2			**215**
Additional Facilities				
	Cubicles/Bays	6	9	54
	Photocopier/Printer Room	1	9	9
	Breast Feeding Room	1	6	6
	Treatment Rooms	2	14	28
	Security	1	14	14
	Handwash Bay	1	2	2
	Equipment Bay	1	8	8
	Sub-Total m^2			121
	Circulation		26%	32
	Total m^2			**153**

4.0 Sort Area				**177**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Additional Facilities				
	Cubicles/Bays	7	12	84
	Bariatric bay	1	16	16
	Staff Hub	1	20	20
	Handwash bay	1	2	2
	Equipment bay	1	4	4
	Accessible WC	1	5	5
	Total m^2			131
	Circulation		35%	46
	Total m^2			**177**
5.0 See and Treat Area				**147**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Additional Facilities				
	Cubicles/Beds	3	12	36
	Treatment Rooms	3	14	42
	Assessment Seats	4	6	24
	Handwash Bay	1	2	2
	Accessible WC	1	5	5
	Sub-Total m^2			109
	Circulation		35%	38
	Total m^2			**147**
6.0 Paediatric Area				**481**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
1.0.70	Observation	1	10	10
Existing facilities to be retained				
	Nil			
Existing Facilities to be replaced				
1.0.69	Paediatric bed bays 26, 35-37	4	10	40
1.0.73	Observation 29-30	2	10	20
1.073A	Ensuite	1	6	6
1.073B	Isolation	1	13	13
1.0.74	Observation 31-33	3	10	30
1.0.75	Assisted shower & WC	1	6	6
1.0.76	Beverage/Pantry	1	9	9

1.0.77	Staff WC	1	4	4
1.0.78	Play Area	1	15	15
1.0.79	Children's Wait	1	17	17
1.0.80	Paediatric WC	1	5	5
1.0.81	Baby change	1	8	8
	Total m^2			**173**
Additional Facilities				
	Staff Hub	1	50	50
	Treatment/Resuscitation Room	1	30	30
	Pharmacy Room	1	10	10
	Toilet - Unisex	1	4	4
	Toilet - Accessible	1	6	6
	Store Room	1	12	12
	Additional Children's Wait	1	25	25
	Handwash Bay	1	2	2
	Sub-Total m^2			139
	Circulation		54%	75
	Total m^2			**214**
7.0 Acute Cubicles - Hot Zone (Admit)				**787**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
1.0.84	**Eye Exam**	**1**	**13**	**13**
	Total m^2			**13**
Existing facilities to be retained				
1.0.14	Pharmacy	1	8	8
1.0.19	Treatment cubicles 7, 8, 9	3	12	36
1.0.27	Treatment cubicles 10,11, 12	3	13	39
1.0.28	Nurse Base	1	65	65
	Total m^2			**148**
Existing Facilities to be replaced				
1.0.16	Assisted WC	1	6	6
1.0.17	Treatment Cubicles 1-4	4	16	64
1.0.18	Cardiac Cubicles 5 & 6	2	12	24
	Total m^2			**94**
Additional Facilities				
	Staff Hub	1	55	55
	Cubicles	13	12	156
	Toilet - Unisex	1	3	3
	Pharmacy Room/Clean Utility	1	10	10
	Handwash Bay	1	2	2

	Equipment Bay	1	4	4
	Sub-Total m^2			230
	Circulation		67%	153
	Total m^2			383
8.0 Acute Cubicles - Hot Zone (Discharge)				**752**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
	Nil			
Existing facilities to be retained				
1.0.50	Treatment Room	1	14	14
1.0.51	Treatment Cubicle 13	1	8	8
1.0.52	Treatment Cubicle 17	1	9	9
1.0.53	Treatment Cubicles 19-22	3	10	30
1.0.54	Gynae	1	14	14
1.0.56	Ward Clerk	1	15	15
1.0.57	Staff Base	1	38	38
1.0.61	Seclusion Room	1	13	13
1.0.62	Interview	1	15	15
1.0.64	Ensuite	1	4	4
1.0.65	Ensuite	1	4	4
1.0.66	Observation/Gynae	1	12	12
	Total m^2			**176**
Existing Facilities to be replaced				
1.0.52	Treatment Cubicles 15 & 16	2	9	18
	Total m^2			**18**
Additional Facilities				
	Staff Hub	1	40	40
	Cubicles	15	12	180
	Toilet - Unisex	1	3	3
	Pharmacy Room/Clean Utility	1	10	10
	Handwash Bay	1	2	2
	Equipment Bay	1	4	4
	Sub-Total m^2			239
	Circulation		74%	176
	Total m^2			**415**
9.0 Short Stay Unit (EECU) - Cold Zone				**588**
Room No.	**Room/Function**	**No.**	**Net m2**	**Total m2**
Existing facilities not required				
	Conrad's Chat Room	1	36	36

	Total m^2			**36**
Existing facilities to be retained				
	Store	1	10	10
	Sub-wait	1	24	24
	Consulting Office	1	14	14
	Dirty Utility	1	10	10
	Store	1	4	4
	Safe Ensuite	1	6	6
	1 Bed Respiratory Isolation Ward	1	16	16
	Ante Room	1	10	10
	1 Bed Ward	1	14	14
	2 Bed Ward	1	23	23
	1 Bed Ward	1	13	13
	1 Bed Ward	1	13	13
	Duty Station	1	14	14
	Patient Assisted Ensuite	1	7	7
	Clean Utility	1	10	10
	Lounge/servery	1	22	22
	Cleaner	1	3	3
	Staff Shower/WC	1	13	13
	Total m^2			**226**
Existing Facilities to be replaced				
	2 Bed Ward	1	23	23
	Total m^2			**23**
Additional Facilities				
	Cubicles - Bed	11	12	132
	Anteroom	2	5	10
	Ensuite	2	6	12
	Treatment Rooms	2	14	28
	Patient Toilet/Shower	1	8	8
	Staff Hub	1	10	10
	Handwash Bay	3	2	6
	Equipment Bay	1	4	4
	Sub-Total m^2			210
	Circulation		28%	59
	Total m^2			**269**
10.0 Shared facilities				**170**
Room No.	Room/Function	No.	Net m2	Total m2
Existing facilities to be retained				
1.0.11	Cleaners	1	4	4
1.0.12	Staff WC	1	3	3
1.0.22	Dirty Utility	1	12	12

1.0.24	Equipment Store	1	51	51
1.0.25	Clean Utility	1	12	12
1.0.67A	Dumb Waiter	1	4	4
	Total m^2			**86**
Additional facilities				
	Cleaners	1	4	4
	Staff WC	1	3	3
	Dirty Utility	1	12	12
	Clean Utility	1	12	12
	Sub-Total m^2			31
	Circulation		45%	14
	Total m^2			**45**
11.0 Administration and Staff Facilities (Second Floor)				**792**
Room No.	Room/Function	No.	Net m2	Total m2
Existing facilities to be demolished				
1.0.31	Director's Office	1	14	14
1.0.32	Clinical Manager's Office	1	13	13
1.0.33	Registrars Office	1	12	12
1.0.34	Specialists	1	36	36
1.0.37	Administration Office	1	12	12
1.0.38	Secretary	1	12	12
1.0.39	Waiting Room	1	8	8
1.0.40	IT	1	9	9
1.0.43	Registrars Office	1	14	14
1.0.44	Clinical Nurses/Nurse Educators Office	1	31	31
1.0.45	Tutorial	1	34	34
1.0.46	Female Shr/WC	1	14	14
1.0.47	Female Change	1	20	20
1.0.48	Male Change/Shr/WC	1	21	21
1.0.49	Staff Tea Room/Lounge	1	35	35
	Courtyard	1	37	37
	Total m^2			**322**
New Build Facilities				
	Reception Area	1	18	18
	Photocopier/Printer room	1	9	9
	Workroom - 4 workstations	13	20	260
	Office	3	10	30
	Meeting Room	2	12	24
	Tutorial Room	1	80	80
	Showers/Toilets/Lockers - Female	1	30	30
	Showers/Toilets/Lockers - Male	1	30	30
	Kitchen/Tea Room	1	100	100

	Lounge	1	12	12
	Lift Access/Stairwell	1	45	45
	On-call Room	1	10	10
	Simulation Laboratory	1	25	25
	Sub-Total m^2			673
	Circulation		18%	119
	Total m^2			**792**

Note: The SOA is indicative only. Grossing factors and other allowances are to be considered.

Project Brief

Project and Client Information

Project Name:	**Lyell McEwin Hospital (LMH) – Mental Health Short Stay Unit (MHSSU)**
Asset/ Site Address:	Haydown Road, Elizabeth Vale
Asset Number:	27.01
Agency	Department for Health and Wellbeing
Lead Agency Representative:	Melissa Nozza
End User Representative:	Mandy Ross NALHN Commissioning Coordinator & Project Lead
Key Stakeholders:	Northern Adelaide Local Health Network – Executive LMH Mental Health Clinical Staff

Brief Prepared By:

Name	Melissa Nozza
Position	Projects Team Leader, Capital Projects
Agency & Business Unit	Infrastructure, Department for Health and Wellbeing
Contact	Melissa.Nozza2@sa.gov.au

Date	4/9/2018
Signature	MNozza

Approving Officer:

Name	Tim Packer
Position	Director, Capital Projects
Agency & Business Unit	Infrastructure, Department for Health and Wellbeing
Contact	Tim.Packer@sa.gov.au

Date	4/09/18
Signature	

Project Objectives

Services required	☒ Brief Development ☐ Master Plan/ Scoping Study ☐ Feasibility Study/ Planning Study	☒ Concept Report (Part 1) ☐ Full Services (Parts 1,2,3) ☐ Other, Describe:
SAMIS numbers of affected buildings	27.01.01	
Project Description	The scope of this project consists of a new purpose designed and built MHSSU at the LMH within a total project budget of $5.5 million excluding GST. The development of a new 8 bed MHSSU at the LMH will provide a purpose designed and built facility for mental health patients requiring short stay assessment after presenting at the ED. This will provide a more suitable environment for mental health patients and staff with the facility to include: • 8 patient bedrooms; • Toilet and shower amenities; • Dining, lounge and activity space; • An enclosed internal courtyard; • Staff workstations and consulting offices; and • Appropriate landscaping and screening to provide privacy from the broader site.	
Project Drivers and Purpose	The project purpose is to design and construct a new dedicated 8 bed MHSSU at the LMH. The MHSSU will be located adjacent to the proposed Emergency Department (ED) Redevelopment project. The primary benefit will enable an assessment on the most appropriate care option for mental health related presentations to the LMH ED, be that admission, discharge or transfer. Clinical practice shows that slightly longer assessments than would normally occur in the ED can often result in the transfer to community based care, removing the need for inpatient admission into the Hospital. The secondary benefit of this proposal will be improved patient flow for emergency presentations to the LMH ED with better availability / accessibility of assessment space resulting from patients being transferred to the MHSSU where appropriate. The delivery of the MHSSU will contribute to patient satisfaction by: • Providing short term accommodation in a facility suitable for acute assessment of mental health presentations. • Enabling a slightly longer period of assessment than would normally be possible in an ED environment, which avoids the need for inpatient admission and which ensures the mobilisation of community based services for care at home. • Providing separation of mental health presentations from general emergency presentations, benefiting both patient groups.	

Project Budget

A total budget for the delivery of the MHSSU is $5.5 million (ex GST).
A preliminary cost breakdown is shown below:

Building Works	
Building Works	$2,918,766
External Works	$234,234
Sub-Total – Building Works	**$3,153,000**
Other	
Design Development Contingency	$175,000
Builder Preliminaries	$475,000
Builder Margin	$175,000
Fittings, Furniture and Equipment	$215,000
Construction Contingency	$325,000
Escalation Allowance	$80,000
DPTI Fees and Disbursements	$225,000
Professional Fees	$550,000
LMH Project Management Fees	$50,000
ICT & AV	$60,000
Statutory Fees	$17,000
Sub-Total - Other	**$2,347,000**
Total	**$5,500,000**

Required program dates

The program is proposed to run concurrently with the LMH Emergency Department Expansion - Phase 2.

ACTIVITY	TIMEFRAME
Brief Development	August 2018
Design Team Update of Fees	September 2018
Concept Design Phase	Sept 2018 to Nov 2018
Design Development Phase	Nov 2018 to July 2019
Managing Contractor Tender Call	Nov 2018 to Feb 2019
Construction Phase	Aug 2019 to Dec 2021

Critical Dates and Required Approvals

Normal approval processes apply and completion is anticipated by end 2021, in line with the LMH Emergency Department Redevelopment Project.

Project Staging

It is anticipated that a detailed staging program will be established in consultation with NALHN during the Concept Design Phase.

Current Program Phase

☒ **Brief development**	☐ Documentation
☐ Project Allocated	☐ Tender
☐ Planning	☐ Construction
☐ Concept	☐ Review
☐ Design	☐ Other, describe

Background Information

General Background	The LMH opened in 1959 and is now, along with the Royal Adelaide Hospital and Flinders Medical Centre, one South Australia's three major tertiary Hospitals. The LMH has undergone a series of major redevelopments over the past decade at a cost of over $300 million. The LMH serves the northern metropolitan area of Adelaide and northern country South Australia. Population growth in these areas, in particular the northern metropolitan area, over the past decade has seen an almost of doubling of activity in the Hospital's Emergency Department. This activity is projected to continue to increase annually to at least 2032. The specialty services provided at the LMH include emergency medicine, endocrinology, gastroenterology, intensive care unit, obstetrics, paediatric medicine, orthopaedic surgery and psychiatry.
Government Targets/ ESD Performance	Works need to comply with the SA Health IGRAT Refurbishment / New Construction Tool and DPTI ESD initiatives.
Agency Standards	Australian Health Facility Guidelines SA Health Security and ICT policies SA Health IGRAT SA Health Medical Gases Policy SA Health Infrastructure – Project Completion / Space Data Requirements DPTI BIM – Project Specific Requirements
Hazardous Materials	Nil known (check Asbestos Register)
Heritage	N/A
Existing Buildings and Information	Previous LMH Stage A / B / C project documents.
Relevant Information and Advice	Documentation undertaken by Wiltshire + Swain is to be used as the basis of the design and brief (see attached).

Site Information, Access and Car parking

Site Information	LMH is located at Haydown Road Elizabeth Vale, South Australia.
Operational Hours	LMH Emergency Department operates 24/7 basis. Works are expected to be undertaken during normal working hours with some exceptions for significantly disruptive tasks.
Site Access, Security	Site access will be managed by onsite security. Contractors will need to undertake induction prior to commencement. Security clearance at DCSI level required by all workers.
Car parking	Loss of onsite car parking is to be minimised. Car parking on site is limited and is on a user-pay basis. On-street car parking is limited and monitored closely by local Council.

External Requirements

External Requirements	The final solution will need to efficiently manage (and minimise) the loss of on ground public car parking.
Engineering Requirements	Full range of engineering services is required.
Future Requirements	Nil known at this stage.

Accommodation Requirements

Schedule of Accommodation

A preliminary Area Schedule has been established in consultation with NALHN Stakeholders (including Executive staff) as shown below. This is to be read in conjunction with the documentation prepared by Wilshire + Swain.

Room Function	No.	Net m2	Total m2	Comments
Entry Foyer /Lobby	1	15	15	
Mental Health Consulting Room - Standard	2	12	24	Duel Egress
Treatment Room	1	18	18	Includes Examination couch
Public Toilet	1	6	6	Disabled, Unisex, as per AS1428.2
Waiting Area	1	40	40	10-12 People
Communication Room	1	10	10	
Sub-Total			113	
Circulation @ 35%			40	
TOTAL Entry			153	
NURSING UNIT - 8 BED				
Single Bedroom – access to Shared Ensuite	1	16	16	Disabled, as per AS1428.2
Shared Ensuite accessible (WC & Shower)	1	8	8	Disabled, as per AS1428.2
Single Bedroom - standard	7	14	98	One bedroom with direct access to dedicated ensuite
Ensuite / Shared (WC & Shower)	3	5	15	Shared Corridor Access
Linen Store	1	2	2	Lockable Linen Trolley Cupboard
Staff Handwashing	3	1	3	Tamper resistant clinical handwashing basin
Dining Activity	1	30	30	Design for observation - Seating 2 x 4 = 8
Servery / Beverage	1	6	6	Assume Bev Bay Only with Pre-plated meals
Lounge /Activity	2	12	24	Acoustic separation between noisy and quiet spaces
Staff Counter Base	1	12	12	Open Base for 2 Staff, Good Observation of Patient areas

	Workroom	1	18	18	Hot desk & Safe Withdrawal zone for staff
	Staff WC	1	4	4	Unisex for staff
	Clean Utility & Medication	1	12	12	Adjacent Staff Base
	Dirty Utility / Waste	1	12	12	Soiled Linen Hold, Bedpan Sterilizer & 3 Waste Bins
	Cleaners Room	1	9	9	
	Equipment Store / Patient Belongings	1	10	10	
	Staircase Access to roof	1	5	5	
	Sub-Total			284	
	Circulation Allowance @ 40%			114	
	TOTAL Nursing Unit			**398**	
	TOTAL Entry + Nursing Unit			**550**	
	Plant @ 10%			55	
	TOTAL FECA			**605**	
	External Facilities				
	24/7 Courtyard - All weather	1	100	100	Fully enclosed with veranda for sun shading
	Building Outlook and Privacy screening	1	100	100	External, soft landscaping
Design Criteria	As per Australian Health Facility Guidelines (AHFG's).				
End User Groups	LMH Mental Health stakeholders and Emergency Department Clinicians.				
Engineering Requirements	Full range of engineering services required.				
Internal or Fitout Requirements	To be determined.				
Other Specialist Requirements	To be determined.				
Future Requirements	To be determined.				
Other Considerations	To be determined.				

Project Team – Professional Services Contractors

Lead Professional Service Contractor shall be	☒ Architect ☐ Engineer ☐ Project Manager ☐ Other, describe:

Professional Service Contractors required	☐ Architect ☐ Planner ☐ Surveyor ☒ Geotechnical ☒ Access ☒ BCA/ Certifier ☐ Landscape ☒ Interior ☐ Traffic/ Transport ☐ Heritage ☐ Irrigation	☒ Engineers ☒ Civil/ Structural ☒ Hydraulics ☒ Mechanical ☒ Electrical ☒ Lighting ☒ Vertical Transportation ☐ Cost Manager ☐ Other, describe:

Specialised Services Required

SERVICE	Information Available	Service Required	Comments
SITE DEFINITION			
Contamination testing	☐	☒	
Car parking onsite/off site	☐	☒	
ENGINEERING SERVICES			
Electrical capacity investigation	☐	☒	
Electrical distribution condition	☐	☒	
Underground services survey	☐	☒	
Fire services investigation	☐	☒	
Gas and Medical provision	☐	☒	
IT Data /Telephone distribution	☐	☒	
Water supply/rain water/RO Plant	☐	☒	
Stormwater disposal	☐	☒	
Other waste disposal issues	☐	☐	
BUILDING			
Building Condition Assessment	☐	☒	
Seismic Assessment	☐	☒	
WHS Issues Safety in Design - SID	☐	☒	
Acoustic issues	☐	☒	
Disability Access	☐	☒	

	Any known joint use agreements	☐	☐	
Engagement PSCs	The engagement of a Design Team to further develop and test the brief assumptions is required. It is anticipated that the Design Team will continue throughout all phases from Concept Phase to Construction/ Completion Phase. A select tender call for Lead PSC's and PSC's is proposed.			
Preferred procurement method	Construction procurement process is to be determined.			

Communications, Quality and Risk Assessment

Communication and Protocol	What is the preferred consultative model for end users and other stakeholders? ☐ **Directive** (Direction Given) ☐ **Informative** (Stakeholder comments considered) ☐ **Iterative** (Input Sought) ☒ **Collaborative** (Work together to agree the preferred method)
Client Contacts	In the absence of the lead agency representatives, who do we contact for: **Day to Day Issues:** Mario Viskic, Redevelopment manager, NALHN **Management Issues:** Mandy Ross, Commissioning Coordinator, NALHN
Quality Management Plan Required?	Require formal risk assessment and Quality Management Plan.
Identified Risks	Risk Assessment required.
Management	If you had to trade off amongst the following four management areas, list the priority order from 1 to 4.

Area	Priority
Scope Management	2
Time Management	3
Cost Management	4
Quality Management	1

Post Construction Review	Indicate the requirements for Review Post-Construction and Review Post-Occupancy Evaluation : ☒ **Combined Review** Post-Construction and Post-Occupancy Evaluation at 3 months ☐ **Separate Reviews** A review for Post-Construction at 3 months, A review for Post-Occupancy Evaluation at 12 months

Other

BIM	What level of Building Information Modelling is required? ☒ Project Specific (BIM Required) ☐ Core BIM (Minimum Level Required) ☐ N/A, Not Suited to BIM
WHS	Has a risk assessment report been undertaken? ☐ Yes (attach) ☒ No (refer to guide note for details on how to prepare register)

Attachments

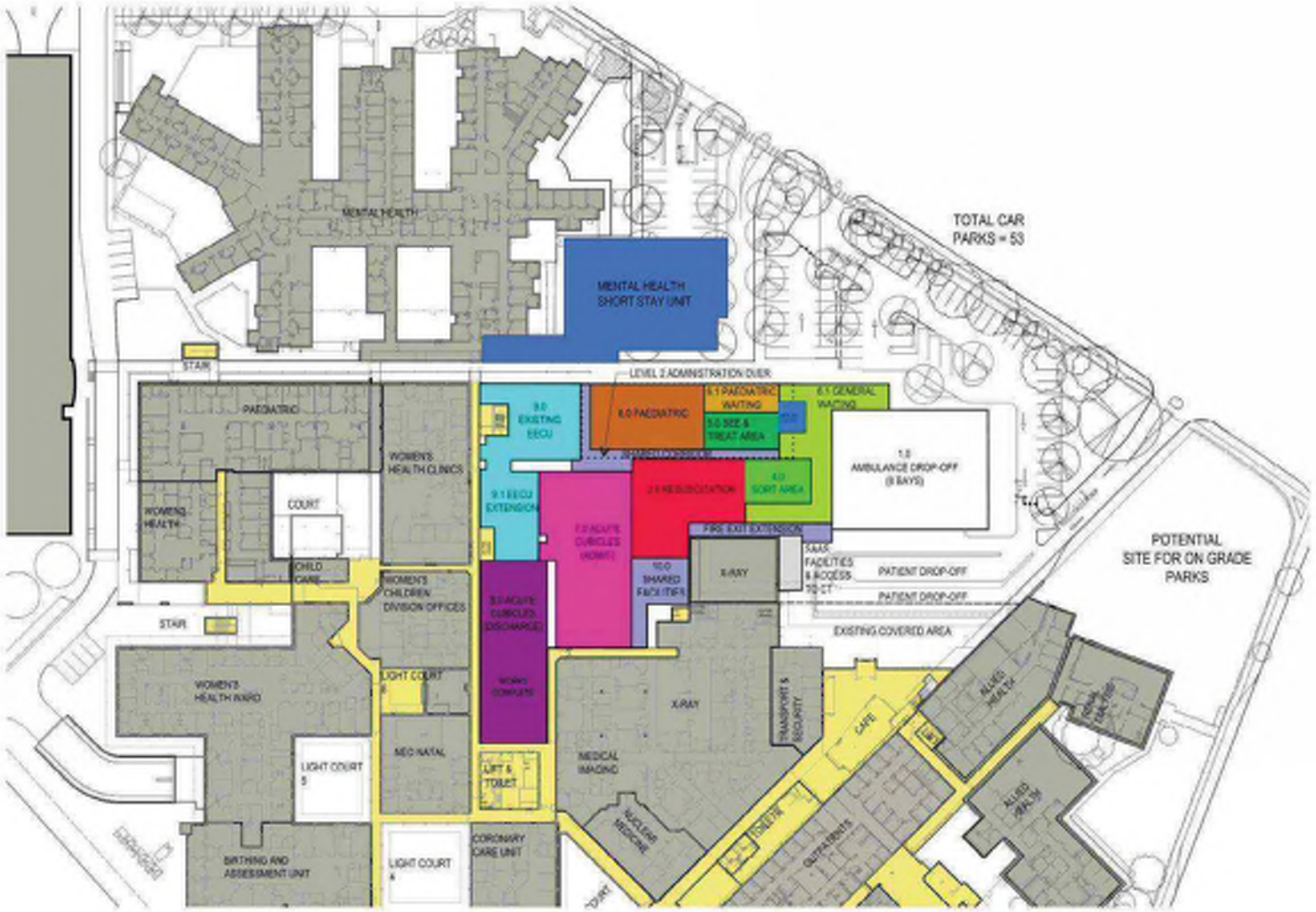
- ☐ **Certificate of Title**
- ☐ **SAMIS Site Plan/ Building Plans**
- ☐ **SAMIS Room Reports**
- ☐ **Hazardous Materials Reports**
- ☐ **Work Health Safety Risk Register**
- ☐ **Accommodation- Schedule of Areas**
- ☐ **Other; Specify:**

Wilshire + Swain documentation noted below:

LMH MHSSU Design Development Floor Plan 20170531 - signed off

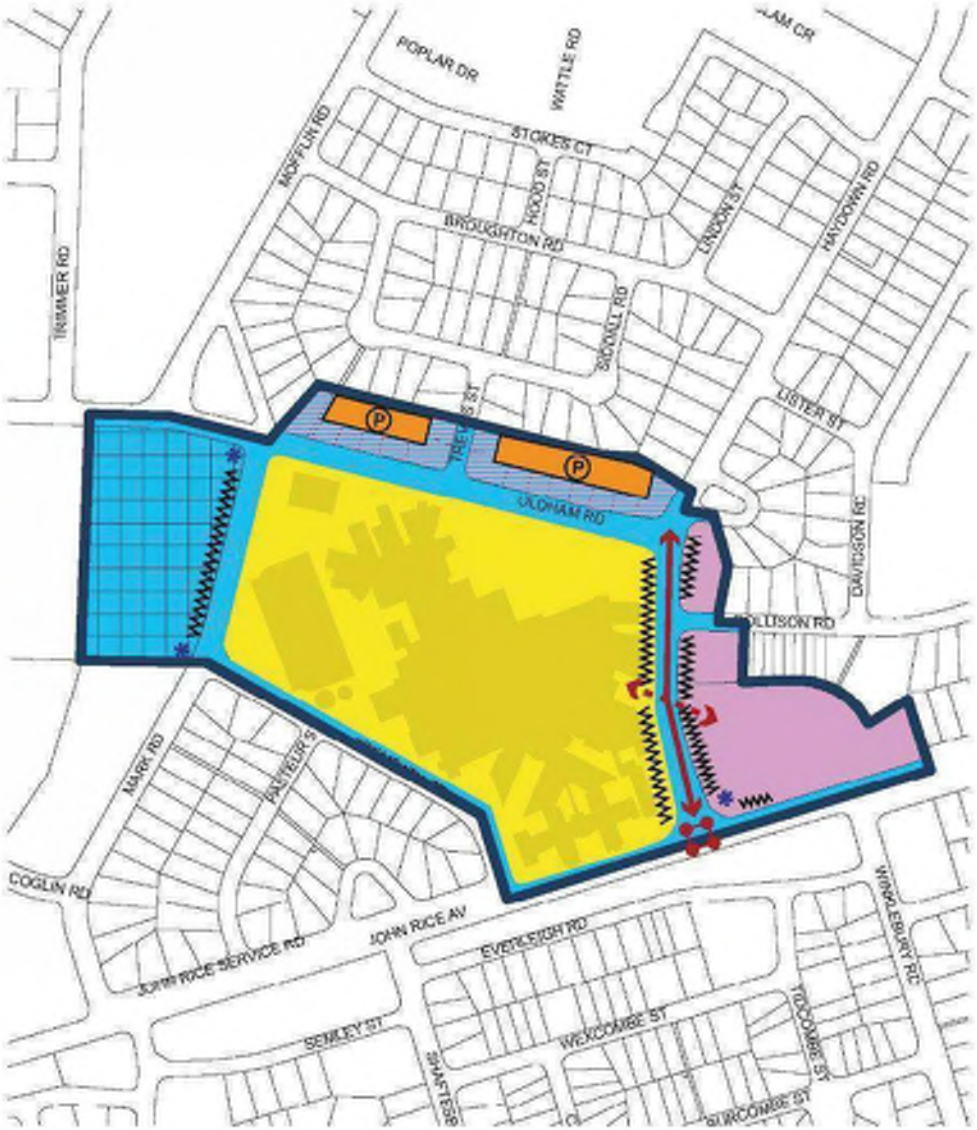
16037 Fitments schedule v.01.pdf
55502 SP-01(01).pdf
160590 C01.pdf
160590-preliminary desig_20170711151642.pdf
A01_16037-A1 LAYOUT DPTI.pdf
A02_16037-A1 LAYOUT DPTI.pdf
A03_16037-A1 LAYOUT DPTI.pdf
A04_16037-A1 LAYOUT DPTI.pdf
A05_16037-A1 LAYOUT DPTI.pdf
A06_16037-A1 LAYOUT DPTI.pdf
A07_16037-A1 LAYOUT DPTI.pdf
A08_16037-A1 LAYOUT DPTI.pdf
A09_16037-A1 LAYOUT DPTI.pdf
A10_16037-A1 LAYOUT DPTI.pdf
A11_16037-A1 LAYOUT DPTI.pdf
LHM MHSSU Safe Design Report.pdf
LMH MHSSU RDS : RLS v.02.pdf

LMH ED Brief (SA Health 15-09-17)



APPENDIX B

CITY OF PLAYFORD CONCEPT PLAN MAP



Concept Plan Boundary
Suburban Activity Node Zone
H Hospital
Carparking
Icon Building
Main Street Mixed Use/Allied Health
Secondary Mixed Use/Allied Health
Tertiary Education and Commercial
Key Active Frontage
Signalised Intersection
Main Street
Pedestrian Link

N

0 50 100 150 200 250 m

ELIZABETH VALE

Concept Plan Map Play/33

LYELL MCEWIN HEALTH SUBURBAN ACTIVITY NODE

PLAYFORD (COUNCIL)

Consolidated - 27 June 2017

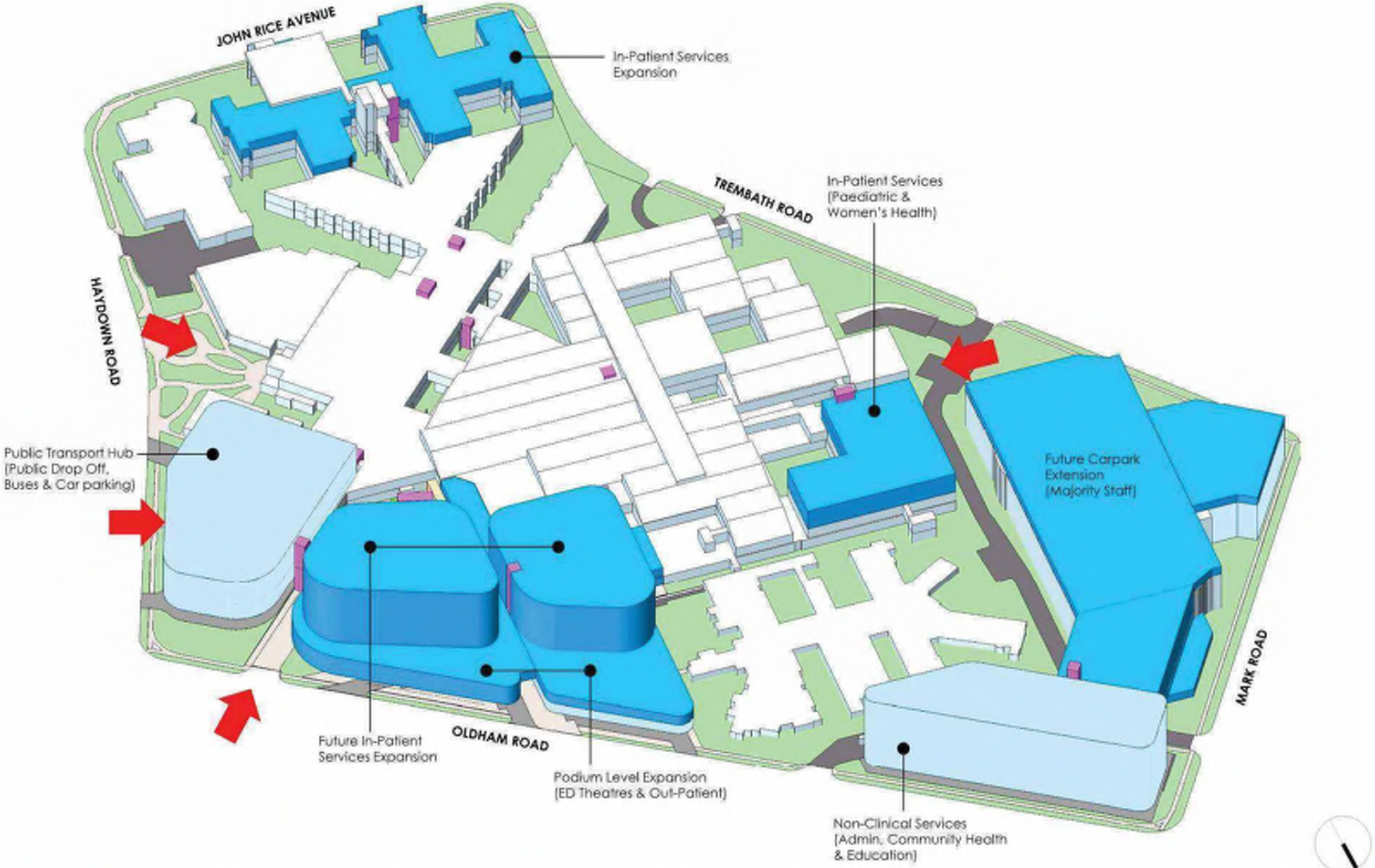
APPENDIX C

AERIAL VIEW


OLDHAM ROAD
MOFFLIN ROAD
MOFFLIN ROAD
TREVES STREET
HAYDOWN ROAD
OLDHAM ROAD
MARK ROAD
HAYDOWN ROAD
ROLLISON ROAD
ELIZABETH VALE
SHOPPING CENTRE
TREMBATH ROAD
MARK ROAD
PASTEUR STREET
JOHN RICE AVENUE
MARK RO

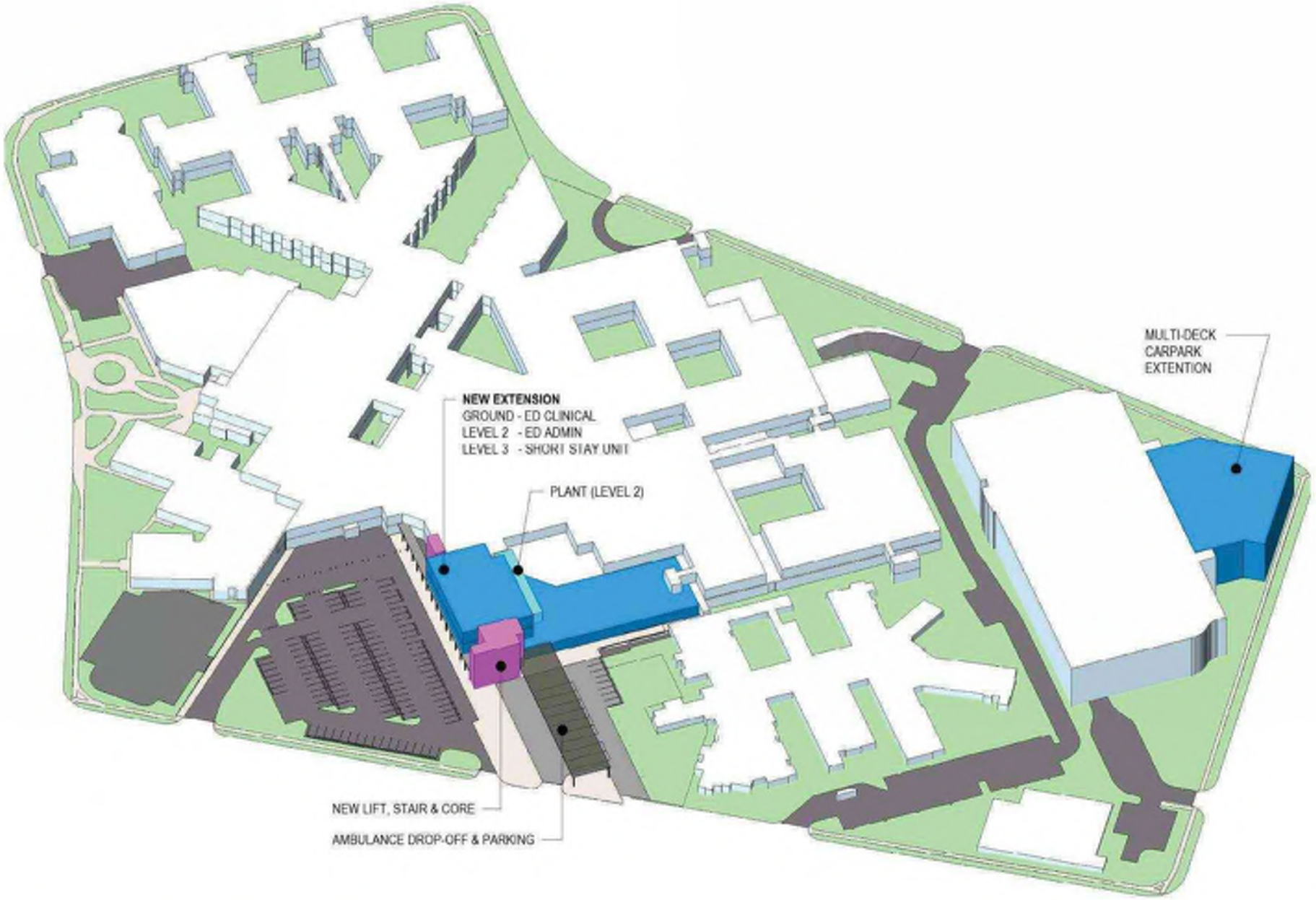
APPENDIX D

MASTERPLAN SITE PLAN


JOHN RICE AVENUE
In-Patient Services Expansion
TREMBATH ROAD
In-Patient Services (Paediatric & Women's Health)
HAYDOWN ROAD
Public Transport Hub (Public Drop Off, Buses & Car parking)
Future Carpark Extension (Majority Staff)
MARK ROAD
Future In-Patient Services Expansion
OLDHAM ROAD
Podium Level Expansion (ED Theatres & Out-Patient)
Non-Clinical Services (Admin, Community Health & Education)
N

APPENDIX E

DEVELOPMENT SITE PLAN


MULTI-DECK
CARPARK
EXTENTION
NEW EXTENSION
GROUND - ED CLINICAL
LEVEL 2 - ED ADMIN
LEVEL 3 - SHORT STAY UNIT
PLANT (LEVEL 2)
NEW LIFT, STAIR & CORE
AMBULANCE DROP-OFF & PARKING
N

APPENDIX F

DEVLOPMENT PERSPECTIVE VIEW

1. HOT DIPPED GALVANISED STEEL COLUMNS

2. ALUMINIUM SUN SHADE LOUVRES

3. BRIGHTON LITE CONCRETE
3a. GRC CLADDING

4. ALUMINIUM FRAMED WINDOW WITH VISION GLASS & SPANDRAL GLASS

5. RED BRICKS

APPENDIX G

IGRAT ESD PLAN

Think beyond the square

ESD and Sustainability Consultants
Master Planning
Resource Management
Strategic Advice
Governance
Advocacy

Lyell McEwin
New Build and Refurbishment

IGRAT Green Plan

D Squared Consulting Pty Ltd
Trading as dsquared
ACN 159 612 067
ABN 38 159 612 067

Suite 5, 241 Pirie Street
Adelaide SA 5000

Contact Deborah Davidson
T: 0425 870 289
E: deborah@dsquaredconsulting.com.au

Issue	Date	Change	Checked	Approved
-	7/5/19	First Issue	DD	PD

Think beyond the square

Contents

1 Introduction

SA Health have developed the In-house Green RAting Tool (IGRAT), a third party assessment process for use on SA Health projects in lieu of a conventional Green Star assessment process.

The IGRAT is comprised of individual credits either taken directly from the Green Star suite of tools or developed by SA Health independently. The IGRAT establishes sustainability and environmental goals for the project.

Third party assessment of the IGRAT is undertaken by the Independent Environmental Advocate (IEA) employed directly by SA Health as a specialist consultant.

The purpose of this document is to summarise the content of the IGRAT for the Lyell MEwin Hospital Upgrade project, considering both the new building areas and major refurbishment areas.

An IGRAT Evidence Required Matrix (IGERM) which provides the design team with guidance on the evidence that the IEA will need to see in order to verify that the IGRAT Green Plan has been complied with is provided separately.

This IGRAT Green Plan has been prepared for Design Review submission, and will be updated at completion of design development. A further review and assessment will be required at the end of Construction Stage to verify that the design intent has been met. An As-Built IGRAT and IGERM will be published at the end of the Design Stage to confirm to the team the As-Built requirements.

This document has been prepared by Deborah Davidson, a Green Star Accredited Professional (Design & As-Built, Communities) a Green Star Certified Assessor, Green Star Faculty Member, and the appointed IEA for this project. This report does not constitute an assessment by the Green Building Council of Australia and is to be used for the purposes of project in-house review only.

2 Applicable Occupied Functional Area

2.1 New Building Area

This IGRAT Tool is applicable in full to all new build areas of the Lyell McEwin project unless otherwise identified in the schedule below:

Room Ref	Room Name	Credit 15 Lighting Comfort	Credit 16 Visual Comfort
TBA	Ward	YES	YES
TBA	Patient Room	YES	YES
TBA	Operating/Treatment Room	YES	NO
TBA	Emergency Room	YES	NO
TBA	ITU/ICCU	YES	NO
TBA	Store	NO	NO
TBA	Utility	NO	NO
TBA	Lounge	YES	YES
TBA	Therapy	YES	YES
TBA	Cleaners Room	NO	NO
TBA	Corridor, Lobby, Circulation	YES	YES
TBA	Interview, Large Interview	YES	YES
TBA	WC	NO	NO
TBA	Staff work room	YES	YES
TBA	Ward Office	YES	YES
TBA	Dining	YES	YES
TBA	Meeting Room	YES	YES

The room references and names used for this initial IGRAT are generic only. They will be updated as the design proceeds. The application of room applicability to the credits listed will also be updated in conjunction with the design team.

2.2 Existing Building Area

For the areas with minor refurbishment works, no IGRAT rating or assessment will be formally assessed, however all areas of refurbishment subject to the same ESD specification as IGRAT requirements where appropriate, i.e. newly painted areas subject to VOC requirements, new lighting subject to same lighting specification as major refurbishment, etc.

3 IGRAT Green Plan

The following confirms the IGRAT Green Plan for the Lyell McEwin project:

No.	Credit	Building Area	Points Available	Points Targeted in IGRAT
1	Compliance with Government ESD Policies	All	1	1
2	Adaptability and Future Proofing	New only	1	1
3	Services and Maintainability Review	Refurb only	1	1
4	Commissioning and Tuning	All	4	4
5	Infection Control	All	2	2
6	Metering and Monitoring	New	1	1
7	Building Management System (BMS)	New	2	2
8	BMS - Design, Training, Handover	New	1	1
9	As-built project documentation	All	3	3
10	ICT - Environmental Impacts	New	2	1
11	Construction Environmental Management	All	1	1
12	Operational Waste	All	1	1
13	Indoor Air Quality	All	4	3
14	Outdoor Pollutant Control	New	1	1
15	Lighting Comfort	All	3	1
16	Visual Comfort	All	3	1
17	Indoor Pollutants	All	3	3
18	Greenhouse Gas Emissions	All	20	8
19	HVAC Life Cycle Analysis	New	3	3
20	Solar PV - Future enablement	All	2	2
21	Peak Electricity Demand Reduction	New	2	1
22	Max Demand - Sizing and Augmentation	All	1	1
23	Max Demand - Construction Spikes	All	1	1
24	Operational Transport Planning	All	3	1
25	Potable Water	New	12	6
26	Life Cycle Impacts - Concrete	New	3	0
27	Life Cycle Impacts - Steel	New	1	0
28	Responsible Building Materials	All	3	2
29	Flooring	All	3	2
30	Construction and Demolition Waste	All	1	1
31	Stormwater	New	2	2
32	Microbial Control	New	1	1
33	Refrigerant Impacts	New	1	1
34	Innovation	All	10	5
Totals			**103**	**65**

The points requirement to achieve the Star Rating levels is:

Rating	Minimum Points Required
4 Stars	41
5 Stars	52
6 Stars	72

The minimum requirement is for the project to achieve a 5 Star rating. At the time or preparing this IGRAT Green Plan the project is targeting 60 points plus 5 Innovation points for a 5 Star IGRAT rating.

Targeted innovation points include (assumed for now maximum 5 achieved):

1. Building air tightness test.
2. Incorporation of nature/biophilia.
3. Openable windows to mental health areas.
4. Material reuse from existing (credit from refurb tool).
5. Daylight to mental health spaces in excess of tool requirements.
6. Influence energy in other areas of hospital, i.e. lighting upgrade to additional areas beyond scope.

4 IGRAT Credits

The following describes the criteria for achieving the IGRAT credit points, and how the project intends to target the credit points:

1 - Compliance with Government ESD Policies

Criteria

One point is awarded if the Design Team demonstrates to the satisfaction of the IEA that the following polices and principles have been delivered on the project to an appropriate extent:

i. That the principles contained in the relevant DPTI ESD Guidance notes ('Planning, Design & Delivery' and 'Environmentally Sustainable Building Materials - Selection') have been delivered to the extent relevant and practical.

ii. Solar PV: a minimum 5 kWh Solar Photovoltaic system has been provided as per the Solar Panel for Government Funded Building Projects policy.

iii. Plumbing Fixtures: that the tapware and showerheads selected are in compliance with the Water Efficient Outlets in Government Buildings Policy effective from July 1 2011, with allowable alternatives as described in the Technical Note.

iv. Solar Hot Water: a minimum 50% of the total annual hot water consumption demand is to be delivered by solar hot water, with the balance delivered by gas fired hot water. *See Technical Note.*

v. Rainwater Reuse: that to the extent practicable rainwater has been captured off all new-build roof space, and that the associated tanks are sized to enable maximum sensible reuse providing that a suitable end use such as toilet flushing and landscape irrigation can be identified.

vi. Process Water Reuse: that active consideration has been given to collecting and reusing any waste water from major water consuming equipment/processes such as reverse osmosis, equipment cooling waste water, sterilisation, HVAC waste water and fire services test water.

vii. All lighting used in the project is LED.

viii. All early concept stage reports required by IGRAT credits, where these credits are targeted in the IGRAT Green Plan, have been satisfactorily completed and issued prior to the completion of PIP Stage 1 (Concept).

Project Response

The project is intending to comply fully and appropriately with all of the conditional requirements in the new build and major refurbishment areas.

Points Targeted

1 out of 1

2 - Adaptability and Future Proofing (New building only)

Criteria

One point is awarded for the Design Team providing a report during Concept Development showing how future adaptability has been considered within the design development process and how each of the client nominated issues has been addressed. The client nominated issues are:

(i) The ability for the facility to adapt to impacts associated with climate change such as increased storm events and higher summer temperatures

(ii) The adaptability of the building for future expansion/change of use/changed model of care

(iii) HVAC, Electrical, gas and hydraulic Infrastructure redundancy capacity

(iv) ICT infrastructure redundancy capacity.

One additional point is available if in the opinion of the IEA the as-built form adequately addresses these issues.

Project Response

The project is intending to provide a compliant report which addresses appropriately all of the client nominated issues.

Points Targeted

1 out of 1

3 - Service & Maintainability Review (Refurbishment only)

Criteria

The aim of the credit is to ensure that a formalised review of the serviceability and maintainability of the existing engineering services systems has been undertaken at design stage.

One point is awarded if a comprehensive review has been undertaken, the recommendations made have been adopted in the design, and the process is summarised in a "Service and Maintainability Report".

Project Response

The project is intending to undertake a review and provide a compliant report.

Points Targeted

1 out of 1

4 - Commissioning & Tuning

Criteria

The aim of the credit is to ensure that a formalised commissioning process is followed and that the engineering services systems are fully commissioned and appropriately monitored and adjusted during the initial stages of operation. This applies to new building areas and new systems in the refurbished areas.

As a mandatory minimum standard, documented targets for the environmental performance of the project must be set, which as a minimum shall include energy, greenhouse gas emissions, water, and waste.

1 point is available where a comprehensive maintainability review of the design is performed by the FM team and the review comments are incorporated in the design.

1 point is available where comprehensive system commissioning is undertaken in accordance with the CIBSE Commissioning Codes.

1 point is available where the systems are monitored and tuned during the first 12 months of operation.

1 point is available where an Independent Commissioning Agent (ICA) is engaged to oversee the commissioning and tuning processes.

Potential Innovation point: A potential innovation point will be awarded of the project adopts the BSRIA Soft Landings approach to commissioning and handover.

Project Response

The project is intending for a maintainability review to be undertaken, for all systems to be commissioned in accordance with the CIBSE Codes, and for 12 months tuning to take place. The project intends to claim the innovation point for BSRIA soft landings.

Points Targeted

4 out of 4

5 - Infection Control

Criteria

One point is awarded for providing evidence demonstrating that the nominated SA Health employee from 'Infection Control' was adequately consulted during Concept Development and that they approved in principle what was proposed from an Infection control point of view.

One additional point is awarded when this consultation and review continues into the construction stage, and adequate infection control measures are maintained throughout construction.

Project Response

The project is intending to obtain 'Infection Control' approval at design and construction stages.

Points Targeted

2 out of 2

6 - Metering & Monitoring (New building only)

Criteria

The aim of the credit is to ensure that comprehensive energy and water metering is installed, the metering data being recorded and readily available for use.

In summary an effective metering strategy must be developed to ensure that all electricity, gas, and water consumption is effectively metered and monitored. In addition, all meters provided shall be automatically monitored such that the metering data can be stored, accessed and used to manage the ongoing efficiency of the facility.

Project Response

The project is intending to implement a comprehensive metering strategy, and provide a compliant metering and monitoring system.

Points Targeted

1 out of 1

7 - Building Management System (BMS) (New building only)

Criteria

One point for is awarded for the delivery of a BMS System. The BMS system shall be capable of monitoring all metering installed, and providing automatic control and regulation of the building engineering services systems.

One additional point is awarded if the BMS can be remotely accessed.

Project Response

The project is intending to provide a fully compliant BMS system as an extension from the existing system, which can be remotely accessed.

Points Targeted

2 out of 2

8 - BMS - Design, Training, and Handover (New building only)

Criteria

To achieve this point the Design Team and the Strategic Asset Manager must be provided with a Report (anticipated to be during Detailed Design phase) describing the functionality of the BMS.

At the end of defects liability the Strategic Asset Manager (or their delegate) must provide written confirmation that all aspects of the BMS has been provided as proposed in the BMS Report.

Project Response

The project is intending to provide a fully compliant BMS report and for the installed system to be fully compliant.

Points Targeted

1 out of 1

9 - As-Built Project Documentation

Criteria

Three points will be awarded if a full suite of post construction documents is be provided in an appropriate format to the IEA, the site Redevelopment Officer, the SA Health Infrastructure Projects Team Leader and the DPTI Risk Manager.

As a minimum this is to include:

i. All as-built drawings (architectural and services).

ii. The Operations & Maintenance Manuals for all relevant mechanical, hydraulic and electrical equipment.

iii. The Operations and Maintenance Manuals (or similar) for maintaining landscaped area, stormwater infrastructure and relevant building surfaces& materials.

Project Response

The project is intending for the full suite of as-built documentation to be provided.

Points Targeted

3 out of 3

10 - ICT Environmental Impacts (New building only)

Criteria

1 point is awarded for the provision of a report summarising how the key environmental issues relating to ICT are to be managed. As a minimum this shall include:

(i) Use of environmental life cycle to analysis and ESD evaluation criteria as part of the selection process for all major ICT equipment purchased from the Project budget.

(ii) That the ways in which comms room are air-conditioned is energy efficient, including room layout, set point regime and efficiency of any supplementary HVAC system or zoning arrangement

(iii) Action taken to minimize resources use including cabling etc.

(iv) Provision of remote access to the BMS.

An additional point is awarded if in the opinion of the IEA the environmental impacts of ICT equipment/process was completed to a world's best practice standard.

Project Response

The project is intending to provide a compliant ICT report, with a standard SA Health ICT system.

Points Targeted

1 out of 2

11 - Construction Environmental Management

Criteria

The aim of the credit is to ensure that a formalised Environmental Management System is used by the head contractor and all sub-contractors so that site works have a reduced impact.

A formalised Environmental Management System (EMS) provides a framework to identify, manage, audit and reduce environmental impacts on the site.

The EMS shall be either:

i. certified to ISO 14001, or

ii. proven to comply with the NSW Environmental Management Systems Guidelines. A free copy of the guidelines can be downloaded here: https://www.procurepoint.nsw.gov.au/before-you-supply/environmental-management-system-accreditation.

The EMS shall apply to all aspects of the project site works from demolition throughout construction to practical completion.

It is expected that all Level 1 and Level 2 DPTI pre-qualified Head Contractors will be capable of readily complying with this credit.

Project Response

The intention is for the head contractor either to have an ISO 14001 certified EMS, or otherwise to implement a fully compliant EMS.

Points Targeted

1 out of 1

12 - Operational Waste

Criteria

The aim of the credit is to ensure that adequate space and facilities are provided for the separation, recycling and safe disposal of all operational waste streams.

In summary, a comprehensive waste management plan shall be prepared and adequate space and facilities provided for the effective separation and collection of the following waste streams as a minimum:

- General waste
- Paper and cardboard
- glass
- plastics
- medical waste
- green waste

The plan should also set targets for diverting materials from landfill and/or reducing the total volume of waste generation.

The waste management plan should be developed in accordance with third party best practice guidelines, such as City of Sydney's Policy for Waste Minimisation in New Developments, or other local equivalent if approved by the IEA.

Project Response

The project is intending to prepare a comprehensive waste management plan and provided adequate space and facilities for all waste streams.

Points Targeted

1 out of 1

13 - Indoor Air Quality

Criteria

The aim of the credit is to ensure a high quality indoor air environment is provided.

1 point is awarded where the entry of outdoor pollutants is mitigated, the ventilation systems are designed for ease of maintenance and cleaning, and the system has been cleaned prior to occupation and use.

2 points are available where outdoor air supply rates are higher than AS 1668:2:2012 (1 point for 50% higher, 2 points for 100% higher) or where automatic CO_2 control is provided (1 point for a maximum CO2 level of 800ppm, 2 points for 700ppm).

1 point is available where separate exhaust systems are provided for pollutants such as printing equipment, cooking processes, and vehicle exhausts.

All new and existing ductwork that serves the building must have been cleaned in accordance with one of the following standards:

i. AIRAH HVACE 2010 Hygiene Best Practice Guideline
ii. ASHRAE Standard 62.1-2013
iii. ACR 2006 Assessment, Cleaning and Restoration of HVAC Systems
iv. SMACNA IAQ Guidelines for Occupied Buildings under Construction.

All print and photocopy equipment must be located in an enclosed print/photocopy area that is exhausted directly to the outside, or to a dedicated exhaust riser. The exhaust system must not recycle air to other building enclosures, or to the return air duct of the ventilation system. Each print/photocopy room must achieve a minimum exhaust ventilation flow rate in accordance with AS 1668.2-2012.

All kitchens must be ventilated in accordance with AS 1668.2-2012. A separate exhaust system must be provided for the kitchen exhaust. A 'kitchen' is defined as a space that includes cooking equipment such as stove tops or ovens. Kitchenettes or tea points with basic tea/coffee making or simple reheat equipment is not included.

Project Response

The project is intending for the ventilation systems to be fully compliant for outdoor pollutant mitigation, ease of maintenance and system cleaning. In addition, the design is expected to provide outside air at a rate on average a minimum 50% higher than AS levels, and separate compliant pollutant exhaust systems will be provided.

Points Targeted

3 out of 4

14 - Outdoor Pollutant Control

Criteria

The aim of the credit is to control and mitigate external pollutant sources.

1 point is awarded where the location of outdoor intake points, including doors and windows if these are used for ventilation purposes, are in accordance with ASHRAE Standard 62.1-2013 Section 5, Table 5.1, and are fully compliant with ASHRAE Standard 62.1-2013 Section 5.6 including all sub-clauses.

The building services should be designed to comply with ASHRAE Standard 62.1:2013 in regards to minimum separation distances between pollution sources and outdoor air intakes.

The pollutants prevention components or designs in a ventilation system can include:

- the locations of the ventilation system's intakes away from car parking areas, cooling towers, helipads, kitchen and toilet exhaust systems, and outdoor smoking areas;
- filters; and
- pollution detection systems.

Project Response

The project is intending for the ventilation systems to be fully compliant with the required standards.

Points Targeted

1 out of 1

15 - Lighting Comfort

Criteria

The aim of the credit is to ensure that high quality artificial lighting is provided.

As a conditional requirement, all light fittings specified shall be flicker free.

1 point is awarded where lighting levels and quality comply with best practice guidelines and glare is eliminated.

1 point is awarded where a combination of lighting and surfaces improve uniformity of lighting to provide visual interest.

1 point is awarded where:

i. All individually enclosed spaces have dedicated light switching, that light switch zones do not exceed 100sqm in area for 95% of the occupied space, and that all light switching is clearly labelled and is easy to use, and

ii. All tertiary spaces (e.g. storerooms, plant rooms, switch rooms etc) are provided with automatic lighting controls that turn the light fittings off when the space is not in use.

Flicker-free lighting refers to luminaries that have either:

- A minimum Class A1 & A2 ballast.
- High frequency ballasts for all fluorescent lamps
- Electronic ballasts in High Intensity Discharge (HID) lighting
- LED.

The best practice guidelines for general illuminance and uniformity of lighting are considered to be AS 1680.1:2006 Appendix B.

Occupants will be deemed to have the ability to control lighting in their immediate environment if the following provisions are made:

- Bedded areas - locally switched task lighting is provided per bed, and the ceiling mounted light fitting provided for background lighting can be individually switched from the bed location.
- Administration spaces - locally switched task lighting is provided to desks and workstations.
- All other spaces - locally switched dedicated lighting zones with separate zone switching for all spaces greater than 100sqm in floor area.

A partial point will be awarded for control of lighting where only part of the occupied floor area is provided with compliant lighting control on a pro-rata basis.

'Occupied Spaces' applicable to this credit shall be defined on a project by project basis by the IEA in the IGRAT Green Plan (the 'Applicable Occupied Functional Area' table).

Project Response

The project is intending all light fittings to be flicker free, and for lighting levels and quality to comply with best practice guidelines and be glare free. Subject to completion of the final design reviews the project may target additional points for the lighting comfort credit.

Points Targeted

1 out of 3

16 - Visual Comfort

Criteria

The aim of the credit is to ensure that access to high quality daylight is provided, and that daylight glare is adequately controlled to all areas.

Glare

As a conditional requirement, glare from daylight is controlled to all areas. This can be achieved through any combination of external shading, screens, internal blinds or other means.

Glare will be deemed to have been adequately controlled if it is proven that there is no direct sunlight on a plane 700mm above finished floor level for 80% or more of daytime hours.

Where internal or external blinds are provided which have a maximum VLT of 10% and can be locally operated by either manual or motorised controls, the project will be deemed to be compliant without the need for sun path analysis modelling.

Where internal or external blinds are not provided, compliance can be demonstrated by the modelling of the sun path and a glare incidence model and report completed confirming that the criteria has been achieved throughout a full calendar year.

Glare control can be achieved by the combination of internal or external operable blinds, external building features and shading, and shading provided by existing external buildings.

Daylight

It is a conditional requirement that the project scope of works does not result in a reduction in daylight levels or adequate daylight access to any existing occupied space.

For new build areas, up to 2 points are awarded where a percentage of the nominated occupied floor area is adequately daylit (40% of nominated area for 1 point, 60% for 2 points).

1 point is awarded where 60% or more of the nominated area has a clear line of sight (a view) to a high quality internal or external daylit area.

'Occupied Spaces' applicable to this credit shall be defined on a project by project basis by the IEA in the IGRAT Green Plan (the "Applicable Occupied Functional Area" table).

Project Response

The project is intending to provide internally operable blinds to all facades to comply with the conditional requirement. In addition, the design will not seek to reduce daylight to occupied areas and improve where possible. A daylight assessment is still to be carried out to determine if further points are available.

Points Targeted

1 out of 3

17 - Indoor Pollutants

Criteria

The aim of the credit is to ensure that the indoor air quality is safeguarded through the reduction in the use of materials that off-gas VOC's and formaldehyde.

1 point is awarded where at least 95% of all internally applied paints, adhesives, sealants and carpets meet the stipulated Total VOC (TVOC) limits.

1 point is awarded where at least 95% of all engineered wood products meet the stipulated formaldehyde limits.

1 point is awarded where all mattresses supplied meet the stipulated GreenGuard emissions criteria for TVOC and formaldehyde.

This credit applies to all new products used in the refurbishment. Where no new products are proposed and the existing applied products are proven to be more than 3 years old the associated points will be automatically awarded.

<u>Paints, Adhesives, and Sealants</u>

The stipulated VOC (TVOC) limits are as follows:

Product Type	**Maximum VOC Content (g/litre)**
General Purpose adhesives*	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140

Product Type	Maximum VOC Content (g/litre)
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

**Most adhesives and sealants are addressed in the 'General purpose adhesives and sealants' category of the table below, unless they clearly belong in the other specialised product categories.*

This credit addresses internal applications for paints applied on-site only, including both exposed and concealed applications. Exterior-grade and solvent-based paints used on an internal surface must meet the credit criteria. Internal car parks are excluded from this requirement.

TVOC limits are based on the final paint product as mixed and ready to use, inclusive of tints.

The following test methods are to be used in determining VOC content in Paints and coatings:

- ISO Method 17895 (2005), for a material with a presumed VOC content <1%,
- ISO Method 11890.2 (2006), for a material with a presumed VOC content <15%,
- ISO Method 11890.1 (2007), for a material with a presumed VOC content >15%; OR
- ASTM D3960, which is comprised of four individual testing procedures that measure TVOC (D2369) as well as density (D1475), water content (D4017), but not excluding exempt compounds (D4457).

The testing method for adhesive and sealants is the ASTM D3960 as detailed for paints. For more information on ASTM De960 refer to South Coast Air Quality Management District Rule 1168.

Where the VOC content of individual components is not known, a theoretical calculation based on the subtotal of the known VOC values of the product's raw material components is acceptable. The calculation must including the following:

- Numerical TVOC results expressed in g/litre of product and
- Statement that the results have been obtained based on the subtotal of the known TVOC values of the product's raw ingredients.

<u>Carpets</u>

This credit applies to all new products used in the project.

Unfinished surfaces and reused materials are excluded from this credit.

The stipulated VOC (TVOC) limits are as follows:

Test Protocol	Maximum VOC Content
ASTM D5116 – Total VOC limit	0.5 mg/m² per hour
ASTM D5116 – 4 – PC (4-Phenylcyclohexene)	0.05 mg/m² per hour
ISO 16000 / EN 13419 – TVOC at three days	0.5 mg/m² per hour
ISO 10580 / ISO / TC 219 (Document N238) – TVOC at 24 hours	0.5 mg/m² per hour

Engineered Wood Products

The stipulated formaldehyde limits are as follows:

Test Protocol	Emission limit/ Unit of measurements
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	< 1.0 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.0 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber	< 1.0 mg/L

Mattresses

SA Health have previously tested two mattresses to determine compliance with the Green Star criteria for formaldehyde and VOC emissions. Both mattresses, standard Pentaflex and Bariatric, were deemed compliant, coming in much lower than the emissions limits specified. Either of these can be specified to achieve compliance with the IGRAT Indoor Pollutants - Mattress credit.

If a different mattress is preferred, testing must be carried out by an approved laboratory to ensure that the mattresses meet the following emissions criteria:

Formaldehyde: 0.0135ppm (0.0165mg/m^3).

Total VOC: 0.22mg/m.

Project Response

The project is intending to comply with the standards required for all products including mattresses.

Points Targeted

3 out of 3

18 - Greenhouse Gas Emissions

Criteria

The aim of the credit is to ensure that greenhouse gas emissions associated with building energy consumption is reduced, and an energy efficient building facade is utilised.

The predicted building GHG emissions and energy consumption shall be compared against two alternative reference cases:

Case 1: Reference Building. The Reference Building shall be as per the actual design but with minimum BCA compliant building fabric, using the same systems. A minimum 3 points shall be achieved for a minimum 15% improvement over the reference case.

Case 2: Benchmark Building. The Benchmark Building shall be as per the actual design but with minimum BCA compliant building fabric, and minimum BCA compliant systems. A minimum 5 points shall be achieved for a minimum 40% improvement over the benchmark case.

Important note on NCC 2019

It is intended that the energy model encompass both new building and refurbished areas. The final approach and scoring is to be determined in consultation with the building services engineers carrying out the energy modelling.

It is noted that the NCC 2019 may affect this project. It is a requirement that the building services engineers carry out an assessment of the proposed design energy efficiency against the new NCC requirements (even if the current version of the code applies to the approval of this project) to assist SA Health with planning for the implications of this change and to ensure that this project meets minimum practice in energy efficient design when built

It appears that the greatest potential to achieve points under the 2019 NCC will be to reduce the HVAC energy consumption. The greatest source of HVAC load is expected to be the glazing, and therefore it is recommended that the project team prioritise design of an energy efficient glazing and shading arrangement.

Use of high-efficiency HVAC plant will have a greater impact on the building's overall energy consumption under the 2019 NCC, and hence energy efficiency should be prioritised when comparing various options within the HVAC life cycle assessment report.

It is also recommended that an increased emphasis be placed on reducing the GHG emissions intensity of the building's energy source. A solar PV feasibility assessment is recommended to be completed early in the project's design process, and other opportunities for renewable energy systems should be explored.

Refer to the 'Impact Assessment of Changes to Section J in NCC 2019' in Appendix A for further information.

Project Response

The project is intending to meet the minimum standards required. Energy calculations are yet to be undertaken to confirm the full number of points available, but 8 points are targeted.

Points Targeted

8 out of 20

19 - HVAC Life Cycle Analysis

Criteria

The aim of the credit is to ensure that an energy efficient solution has been established for the Heating, Ventilation and Air Conditioning Systems (HVAC).

The project team are required to establish a minimum of four alternative HVAC options and complete a Life Cycle Analysis (LCA) template following SA Health's prescriptive format.

3 points are awarded where in the opinion of the IEA the LCA template has been satisfactorily completed, and an appropriately energy efficient system choice has been recommended.

Project Response

The project is intending complete a compliant LCA assessment and adopt an energy efficient HVAC solution.

Points Targeted

3 out of 3

20 - Solar PV - Future Enablement

Criteria

1 point is awarded for provision of a report (during Concept Development) with the following content:

(i) provide a list and order of cost information for works that might most cost effectively be undertaken during construction to facilitate the easy retrofit of solar PV at a later date (e.g. additional capacity of distribution boards, additional riser capacity for wiring)

(ii) describe the suitability of the proposed roof design in terms of structural integrity, pitch & orientation, fixing panels, providing access for maintenance etc.

(iii) basic schematics of what might be feasible in terms of panel layout, access, wiring and fixing panels to the structure.

An additional 1 point will be awarded if the required infrastructure is installed to facilitate future Solar PV installation.

This system shall be in addition to the 5kWe system required in *Credit 2 - Compliance with Government ESD Policies.*

Project Response

The project is intending to provide a compliant report with a designated roof area and electrical infrastructure capable of supporting an additional PV installation in the future. Note that a large solar array is proposed for this building (separate project, but integrated into this building design).

Points Targeted

2 out of 2

21 - Peak Electricity Demand Reduction

Criteria

The aim of the credit is to reduce the maximum demand imposed on the electricity network by the building.

The project team are required to fully model the building peak electricity.

1 point is awarded where a peak demand reduction of 20% or more is provided compared to the reference case.

2 points are awarded where a peak demand reduction of 30% or more is provided compared to the reference case.

Project Response

The project is intending to provide a peak electricity demand reduction of 20% or more (given the large PV system to be installed, 2 points are possible).

Points Targeted

1 out of 2

22 - Max Demand - Sizing and Augmentation

Criteria

1 point is awarded for the provision of a report to the Design WorkGroup and the Senior Environmental Officer Infrastructure detailing any proposed changes to the sites electrical or gas infrastructure that would impact either:

(i) The maximum demand levels established for any NMI or MIRN

(ii) Result in any augmentation works being required by SAPN/Envestra

(iii) Impact security of supply including reserve feeder arrangements.

It is a conditional requirement that any SAPN/Envestra connection or augmentation agreements that may be required must be submitted for the review and comment by the Senior Environmental Officer Infrastructure prior to any connection agreement being signed off on.

Project Response

The project is intending to provide a compliant report and comply with all conditional requirements.

Points Targeted

1 out of 1

23 - Max Demand - Construction Spikes

Criteria

Criteria

1 point is awarded where the design of the works including infrastructure and services results in there being no increase in the site electricity maximum demand, such that there are no SAPN costs incurred.

1 point is awarded where there are no maximum demand spikes caused during construction which lead to SA Health incurring a maximum demand penalty charge.

Maximum demand increases can be avoided through a combination of:

- Energy efficient services design
- The installation of demand management control systems

- The installation of solar PV or other embedded generation systems
- Using appropriate energy modelling/data to inform the maximum demand prediction, and not using an overly conservative approach to demand calculation

Artificial demand spikes have occurred on SA Health project spikes in the past, creating high cost penalties. These can easily be managed with coordination and advanced planning of construction energy use. Construction spikes can be caused by:

- The connection of electrically operated construction equipment
- The connection of electrically operated construction tools
- The temporary loading up of electrical circuits for testing
- The commissioning and testing of HVAC systems, in particular chillers

Project Response

The project aims to comply with both credits and have commenced discussions with SAPN.

Points Targeted

1 out of 1

24 – Operational Transport Planning

Criteria

1 point is awarded where a survey is undertaken to determine the existing transport provisions, and a needs analysis undertaken to determine practical options for the introduction of new facilities, such as bicycle storage, electric vehicle charge points, or other ways to lower the carbon impact of transport.

1 additional point is awarded where a need for new bicycle storage facilities is identified and quantified, and the bicycle storage facilities are installed.

1 additional point is awarded where a need for electric vehicle charge station (or charge stations) is identified, and at least one electric vehicle charge station is installed.

Project Response

The associated car park project contains a high number of bike spaces which are currently underutilised. The project team has liaised with SA Health over usage patterns, therefore 1 point is awarded for further encouraging use of these existing facilities.

Points Targeted

1 out of 3

25 - Potable Water

Criteria

The aim of the credit is to reduce potable water consumption through a combination of water efficient design and the use of alternative water sources where practicable.

The project team are required to model the predicted building potable water use and consider the use of rainwater wherever possible to reduce potable water use.

This credit only applies to areas where new hydraulic fixtures are included in the design.

Project Response

By complying with the *Credit 1 – Conditional Requirements*, the project team are expecting to comply with the minimum credit criteria. All rainwater will be collected and utilised through the site water collection system.

Points Targeted

6 out of 12

26 - Life Cycle Impacts - Concrete

Criteria

The aim of the credit is to ensure that the environmental impact of concrete use is reduced by reducing its cement content, virgin aggregates and other content.

In summary, 1 point is available where Portland cement content is reduced by 30%, and 2 points for 40%; 0.5 point is available where the mix water is at least 50% recycled or reclaimed; and 0.5 point is available where either 40% of the coarse aggregate used is an alternative material, and/or at least 25% of the fine aggregate used is an alternative material.

Project Response

The project is not intending to pursue these points at this stage as the project team have determined that sourcing the alternative products is not commercially viable in this instance.

Points Targeted

0 out of 3

27 - Life Cycle Impacts - Steel

Criteria

The aim of the credit is to ensure that the environmental impact of steel use is reduced by reducing its content, mass, and improving manufacturing efficiencies.

1 point is available where it can be demonstrated that the structure as designed uses 5% less steel than a conventional reference structure.

Project Response

The project is not pursuing this point at this stage as the project team have determined that taking this approach is not commercially viable in this instance.

Points Targeted

0 out of 1

28 - Responsible Building Materials

Criteria

The aim of the credit is to ensure that the environmental impact of typically high impact materials is reduced by selecting supply sources which are environmentally recognised.

1 point is awarded where at least 95% of all timber is FSC certified or from a reused source. It is a mandatory requirement that this point is achieved.

1 point is awarded where at least 95% of all steel is sourced from a Responsible Steel Maker.

1 point is awarded where at least 90% of all cables, pipes, flooring and blinds is either PVC free or meets the Best Practice guidelines for PVC.

Project teams can claim innovation points for reuse and recycling of building materials in the refurbished areas.

Project Response

The project is expecting all materials to be compliant with the steel and PVC criteria.

Points Targeted

2 out of 3

29 - Flooring

Criteria

The aim of the credit is to ensure that the environmental impact of flooring materials is reduced by selecting supply sources which are environmentally recognised.

Points will be awarded where the flooring used has an approved third party environmental certification or is reused, based on the flooring area:

1 point = 30%

2 points = 60%

3 points = 90% or more.

Flooring products which have GreenGuard or GECA environmental certification will be deemed to be compliant.

All reused flooring will be deemed to be compliant.

Compliance can be demonstrated by a combination of new and reused flooring.

Project Response

The project is expecting that the specified flooring will be compliant with the credit criteria.

Points Targeted

2 out of 3

30 - Construction & Demolition Waste

Criteria

The aim of the credit is to ensure that construction and demolition waste is appropriately managed and diverted from landfill.

1 point is awarded where at least 90% of all demolition and construction waste (by mass) is diverted from landfill.

Project Response

The project is expecting to employ head contractors who will comply with the credit criteria.

Points Targeted

1 out of 1

31 - Stormwater

Criteria

The aim of the credit is to ensure that no additional stormwater peak loads or pollution are imposed on the sewer network.

Up to 2 points are available. In Summary, the project will need to prove that post-development peak discharge to sewer is no higher than pre-development for 1 point, and that any water discharged to sewer meets the required water quality and filtration standards for a second point.

Project Response

The project is expecting to comply with the credit criteria.

Points Targeted

2 out of 2

32 - Microbial Control

Criteria

The aim of the credit is to ensure that impacts associated with harmful microbes in building cooling systems are either eliminated or well managed.

1 point is available where the building is naturally ventilated, has water-less heat rejection systems, or has water based heat rejection systems that include measures for Legionella control and Risk Management.

Project Response

The project is expecting to comply with the credit criteria by utilising air cooled air conditioning systems only.

Points Targeted

1 out of 1

33 - Refrigerant Impacts

Criteria

The aim of the credit is to ensure that impacts associated with the use of refrigerants in building systems are either eliminated or well managed.

1 point is available where the Total System Direct Environmental Impact of the refrigerant systems is within acceptable limits, and/or a leak detection system in place, and/or alternative low impact refrigerants have been selected.

Project Response

The project is expecting to comply with the credit criteria by utilising low environmental impact refrigerants.

Points Targeted

1 out of 1

34 - Innovation

Criteria

Up to 3 additional Innovation Points maybe awarded at the discretion of the IEA for initiatives not covered by the IGRAT Credits, or where the IGRAT Credit criteria has been significantly exceeded.

Project Response

Targeted innovation points include (assumed for now maximum 5 achieved):

1. Building air tightness test.

2. Incorporation of nature/biophilia.

3. Openable windows to mental health areas.

4. Material reuse from existing (credit from refurb tool).

5. Daylight to mental health spaces in excess of tool requirements.

6. Influence energy in other areas of hospital, i.e. lighting upgrade to additional areas beyond scope.

Points Targeted

5 out of 10

Think beyond the square

ESD and Sustainability Consultants
Master Planning
Resource Management
Strategic Advice
Governance
Advocacy

Lyell McEwin Hospital

Emergency Department Redevelopment

Impact Assessment of Changes to Section J in NCC 2019

D Squared Consulting Pty Ltd
Trading as dsquared
ACN 159 612 067
ABN 38 159 612 067

Suite 5, 241 Pirie Street
Adelaide SA 5000

Contact Paul Davy
T: 0405 106 268
E: paul@dsquaredconsulting.com.au
W: www.dsquaredconsulting.com.au

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MEMBER 2018-2019

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Document Control

Issue	Date	Change	Checked	Approved
01	01/11/18	Draft - First Issue	JB	PD
02	08/11/18	Second Issue – Incorporating SA Health input	JB	PD

Changes incorporated in Issue 02:

- Table 1 expanded (summary of changes to 2019 NCC)
- Section 3.2 expanded (renewable energy)
- Section 4.5 expanded (DHW)
- Section 4.8 added (air tightness)
- Section 4.9 added (thermal bridging)
- Section 5.2 expanded (overview of implications for Green Star/IGRAT)
- Section 5.3.6 added (recommended option for amending IGRAT scoring)

Disclaimer:

The energy and greenhouse gas emissions modelling and calculations undertaken, and all predictions made in this report, are illustrative only and have been prepared solely for the purpose of informing decisions relating to project and IGRAT planning. The data included in this report are not sufficiently accurate to form the sole basis of determining future infrastructure demands or project costs for the site.

The impact of the increased stringency of the Deemed-to-Satisfy (DtS) provisions in Section J of the 2019 NCC have been assessed to determine the potential implications for the proposed Emergency Department Redevelopment at the Lyell McEwin Hospital, Elizabeth Vale, South Australia.

The impact assessment consisted of two simplified annual energy calculations based on the concept design of the proposed Emergency Department Redevelopment: one for a Reference Building based on the DtS Provisions of the 2016 NCC, and another for a Reference Building based on the increased stringency DtS Provisions of the 2019 NCC. Comparison of these figures provides an indication of the increased difficulty of improving upon the DtS provisions under the 2019 NCC.

The calculated energy consumption of each Reference Building is presented in the following table.

End Use	Reference Building Annual Energy Consumption (kWh p.a.)			Comment
	NCC 2016	NCC 2019	Difference	
HVAC	212,323	112,037	-47%	Reduction primarily due to increased glazing performance and reduced lighting load in 2019.
Lighting	218,124	65,437	-70%	Large reduction in energy usage due to increased stringency in lighting efficiency requirements in 2019. Minimal potential to improve proposed lighting designs relative to 2019 DtS benchmarks.
Domestic Hot Water	9,057	9,057	0%	No change to DtS Provisions in 2019 NCC.
Lifts	9,512	9,512	0%	DtS Provisions for lift energy efficiency are not referenced by IGRAT, hence new provisions in 2019 have nil impact.
Total	**449,016**	**196,042**	**-56%**	

It appears that the greatest potential to achieve points under the 2019 NCC will be to reduce the HVAC energy consumption. The greatest source of HVAC load is expected to be the glazing, and therefore it is recommended that the project team prioritise design of an energy efficient glazing and shading arrangement.

Use of high-efficiency HVAC plant will have a greater impact on the building's overall energy consumption under the 2019 NCC, and hence energy efficiency should be prioritised when comparing various options within the HVAC life cycle assessment report.

It is also recommended that an increased emphasis be placed on reducing the GHG emissions intensity of the building's energy source. A solar PV feasibility assessment is recommended to be completed early in the project's design process, and other opportunities for renewable energy systems should be explored.

Beyond the scope of the ED Redevelopment project, it is recommended that SA Health consider the options proposed for amending the scoring scheme used in the IGRAT Greenhouse Gas Emissions credit, to better reflect the increased stringency of the 2019 NCC.

On balance, we consider that a recalibrated scheme with additional innovation points available for achieving emissions reductions beyond 50% would provide an appropriate methodology for recognising simple energy efficiency improvements resulting from effective design principles, while also offering incentive for innovative project teams to strive for low-carbon or zero-carbon outcomes.

Think beyond the square

Contents

1 Introduction

1.1 Background

The impact of the increased stringency of the Deemed-to-Satisfy (DtS) provisions in Section J of the 2019 NCC have been assessed to determine the potential implications for the proposed Emergency Department Redevelopment at the Lyell McEwin Hospital, Elizabeth Vale, South Australia.

The impact assessment consisted of two simplified annual energy calculations based on the concept design of the proposed Emergency Department Redevelopment: one for a Reference Building based on the DtS Provisions of the 2016 NCC, and another for a Reference Building based on the increased stringency DtS Provisions of the 2019 NCC. The energy consumption figures for each building represent the benchmarks for the IGRAT GHG Emissions modelling credit, and therefore comparison of these figures provides an indication of the increase in difficulty of achieving points under this credit that will result from the implementation of the 2019 NCC.

1.2 Summary of key changes in NCC 2019 Section J

The key changes to the DtS Provisions proposed for Section J of the 2019 NCC are listed in Table 1. Note that it is not an exhaustive list, but rather a summary of the key changes that are anticipated to most heavily impact the new Lyell McEwin ED development and other typical SA Health buildings.

NCC Clause	Item	Proposed Change
J1.3	Roof total R-value	Increase in minimum total R-value from R3.2 to R3.7 for climate zone 5 (metropolitan Adelaide).
J1.5	Wall-glazing construction	Increased stringency in glazing thermal performance requirements - maximum glazing U-value decreased by up to 50% and SHGC decreased by up to 40%, depending on window-wall ratio, façade orientation, extent of shading etc.
J5.2	Air-conditioning system control	Threshold for economy cycle changed from 35 kWr capacity to 3500 L/s supply air quantity (for climate zone 5), i.e. fewer systems will require economy cycle functionality.
J5.3	Carpark exhaust systems	Carbon monoxide sensors required for all carpark exhaust systems.
J5.9	Space heating	Minimum system efficiency increased from 80% to 86% for systems with rated consumption up to 500 MJ/hr, and 90% for systems exceeding 500 MJ/hr.
J5.10	Chillers	Increase in minimum system efficiency: approx. 20% increase for air-cooled chillers, and approx. 15% increase for water-cooled chillers, depending on capacity.
J5.11	Packaged air-conditioning units	Increase in minimum system efficiency: approx. 10% increase, depending on system type and capacity.
J6	Artificial lighting	Significant decrease in allowable lighting power densities: between 10% and 80% decrease, depending on building type.
J6.7	Lifts	Introduction of minimum requirements for lift energy efficiency (no such requirements existed in NCC 2016).
J7.3	Swimming pool heaters	Introduction of minimum requirement for gas water heater system efficiency (in line with revised space heater system efficiency requirements in J5.9), and introduction of minimum R-value for pool covers.

NCC Clause	Item	Proposed Change
JV4	Air leakage rate	Introduction of performance verification method whereby compliance with building sealing provisions (JP1) may be verified via air leakage testing. However, for Climate Zone 5 (i.e. metropolitan Adelaide), this method is only applicable to Class 2 or Class 4 buildings.
Spec J1.2b and J1.2c	Impact of thermal bridging	Methodology for calculating total system R-value of metal-framed walls and roofs/ceilings has been expanded to account for effects of thermal bridging. Total system R-values are generally reduced due to thermal bridging and hence additional insulation may be required to compensate.

Table 1: Summary of key changes to NCC 2019 Section J

For a full list of changes and further details refer to:

- NCC 2019 Public Comment Draft Version 1.2:

  https://www.abcb.gov.au/Resources/Publications/NCC-2019-Public-Comment-Draft/NCC-2019-Volume-One

- Centre for International Economics, "Commercial building energy efficiency RIS", prepared for the ABCB, September 2017:

  http://abcb.gov.au/Resources/Publications/NCC-2019-Public-Comment-Draft/Energy-efficiency-of-commercial-buildings

2 Methodology

2.1 Methodology

A simplified annual energy calculation has been performed, based on concept drawings for the proposed Emergency Department Redevelopment, using (a) a Reference building based on the DtS Provisions in the 2016 NCC, and (b) a Reference building based on the DtS Provisions in the 2019 NCC.

Results from both the 2016 and 2019 Reference Buildings were then compared and broken down into the various energy end uses (HVAC, lighting, etc.) to identify which aspects are most heavily impacted by the changes, and which will have the greatest remaining opportunity to improve (relative to the DtS benchmark) following the release of the 2019 NCC.

2.2 Basis of assessment

The assessment is based on the following documentation:

- Architectural drawings provided by Cheesman Architects, dated 10th October 2018 (as per Figure 1 and Figure 2).

Figure 1: Concept Floor Plan – Ground Floor. NB – assessment based on new additions only (in red).

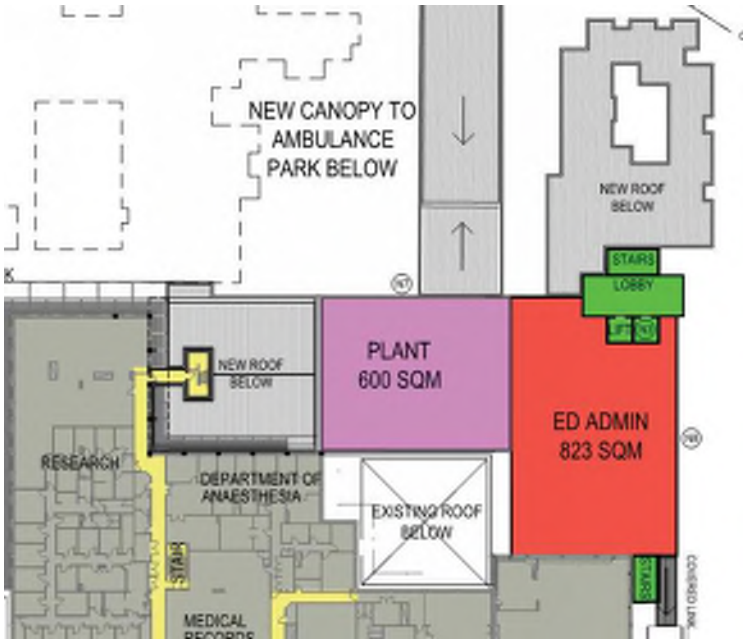

Figure 2: Concept Floor Plan – Level 1. NB – assessment based on new addition only (in red).

Building characteristics are as per Table 2.

Characteristic	Value	Comment
Total floor area	2,490 m2	"New Emergency Refurb" area excluded
NCC classification	Class 9a	
Climate zone	5	Applicable to metropolitan Adelaide
Façade height	3.5 m	Assumed value
Window-wall ratio	43% (all façades)	Assumed value
Shading provisions	1.5 m overhang above all glazing	Assumed value
Occupant density	30 m^2/person (time averaged)	As per IGRAT modelling requirements
Lighting, equipment, and occupancy profiles	As per IGRAT GHG Emissions modelling requirements, Table 29	
A/C operating schedule	24/7 operation	As per IGRAT modelling requirements
Heat recovery ventilation	Not utilised	As per IGRAT modelling requirements
Economy cycle mode	Not utilised	As per IGRAT modelling requirements

Table 2: Building characteristics and assumed values used for each Reference Building

3 Results

Calculated annual energy consumption figures of the 2016 and 2019 Reference Buildings are presented in Table 3. A breakdown of factors that contribute to the reduction in HVAC load in the 2019 Reference Building is presented in Figure 3.

End Use	Reference Building Annual Energy Consumption (kWh p.a.)			Comment
	NCC 2016	NCC 2019	Difference	
HVAC	212,323	112,037	-47%	Reduction primarily due to increased glazing performance and reduced lighting load in 2019. Refer to Figure 3.
Lighting	218,124	65,437	-70%	Large reduction in energy usage due to increased stringency in lighting efficiency requirements in 2019. Minimal potential to improve proposed lighting designs relative to 2019 DtS benchmarks.
Domestic Hot Water	9,057	9,057	0%	No change to DtS Provisions in 2019 NCC.
Lifts	9,512	9,512	0%	DtS Provisions for lift energy efficiency are not referenced by IGRAT, hence new provisions in 2019 have nil impact.
Total	**449,016**	**196,042**	**-56%**	

Table 3: Calculated annual energy consumption of the 2016 and 2019 Reference Buildings

The reduction in HVAC energy of the 2019 Reference Building is due to an increase in thermal performance of the roof and glazing, reduced lighting power density, increased air tightness, and increased HVAC system efficiency. The relative contributions of each of these sources is presented in Figure 3.

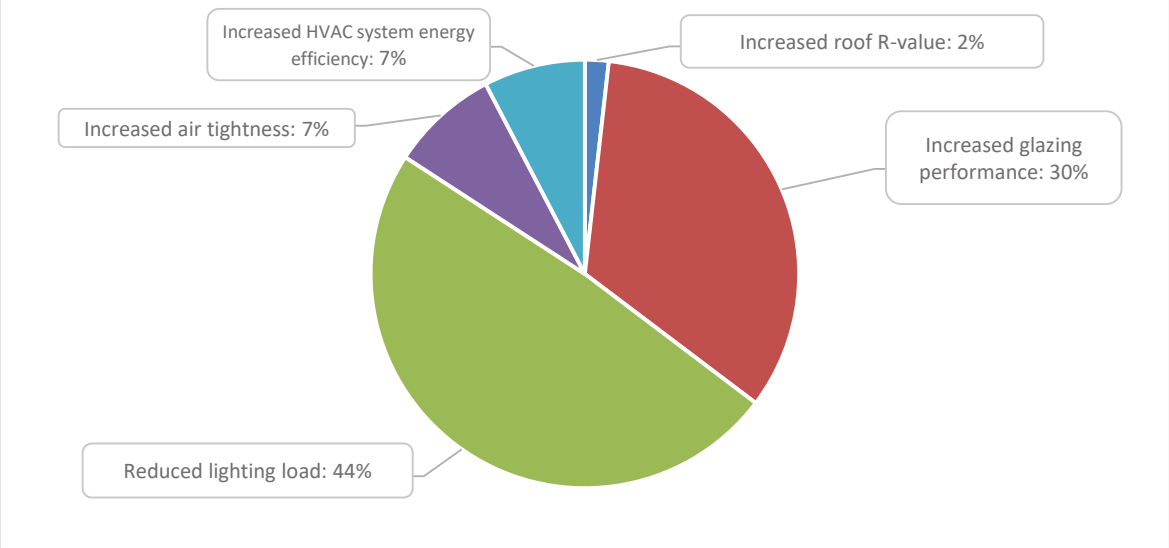

Figure 3: Sources of reduced HVAC energy consumption in 2019 Reference Building relative to 2016 Reference Building

3.1 Analysis

The 2019 Reference Building achieved a 56% reduction in energy consumption relative to that of the 2016 Reference Building (as shown in Table 3), due to the increased stringency of the DtS provisions in Section J of the 2019 NCC.

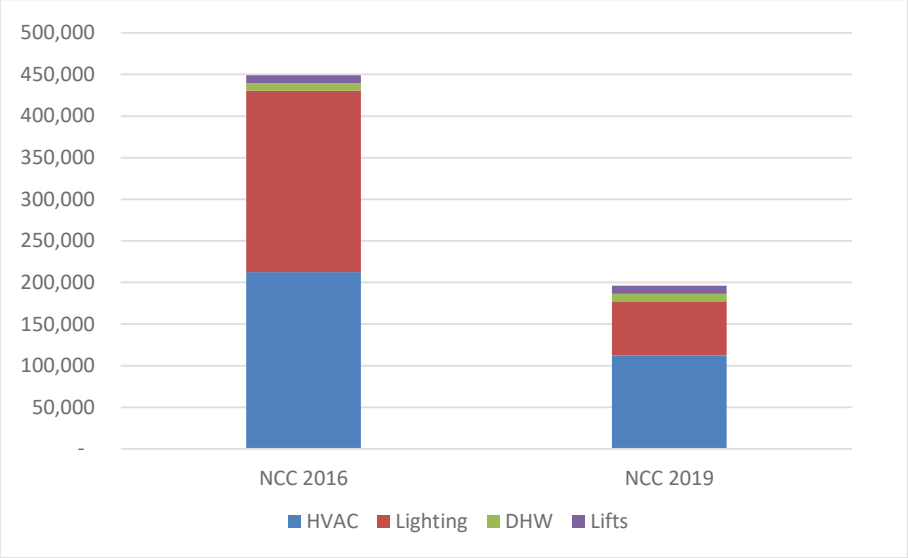

Figure 4: Energy consumption by end use for each Reference Building

The primary impact is the substantial reduction in maximum allowable DtS lighting energy intensity in the 2019 NCC. SA Health's current best practice lighting systems generally consist of LED lighting throughout and hence will likely already comply with the 2019 allowances. However, given that the DtS benchmarks will be greatly reduced, the improvement relative to the new benchmarks will be much less substantial than it typically would have been under the 2016 NCC, and hence in 2019 fewer IGRAT points will be achieved due to implementation of SA Health's current best practice lighting systems.

Given the reduction in lighting energy component of the 2019 Reference Building, the HVAC energy is the greatest contributor to the overall energy consumption, as shown in Figure 4. HVAC energy consumption can be attributed to:

(a) the building air conditioning load (heat gains/losses via the roof/walls, glazing, ventilation, and air leakage, and heat gains from the internal lighting, equipment, and occupants); and

(b) the energy efficiency performance of the HVAC system (i.e. its Energy Efficiency Ratio).

The relative contributions from each source of air conditioning load in the 2019 Reference Building are shown in Figure 5.

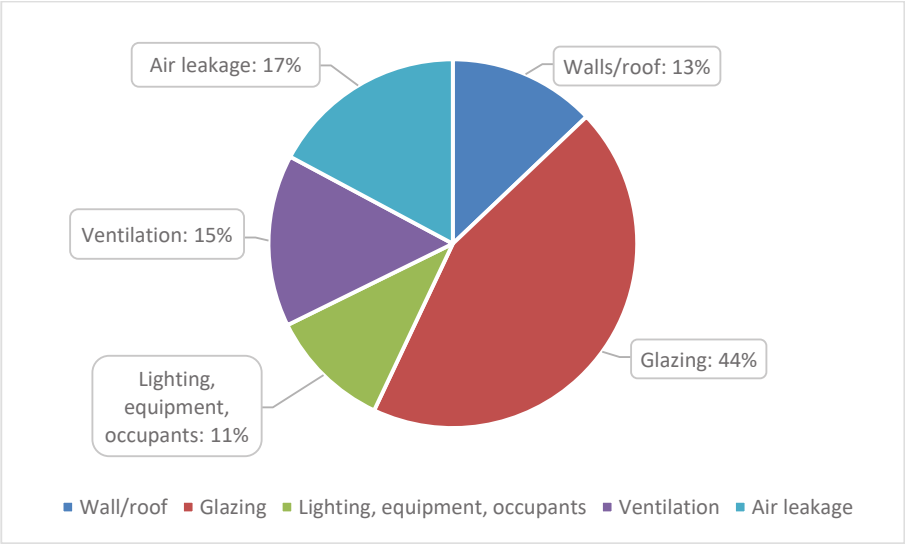

Figure 5: Sources of overall air conditioning load in 2019 Reference Building

As the glazing is the primary contributor to the air conditioning load, improving the energy efficiency of the proposed building's glazing will have the greatest impact on reducing the overall energy consumption relative to the 2019 Reference Building, and hence maximising the project's IGRAT score.

Improving the energy efficiency of the glazing can be achieved via:

- Increasing the glazing performance, i.e. selecting glazing systems with low U-values and optimising solar heat gain coefficients;
- Designing optimised shading provisions that block out solar radiation in summer but not during winter; and
- Rationalising glazing areas, particularly on east and west façades.

As the HVAC system is the largest contributor to the 2019 Reference Building's overall energy consumption, the benefit of selecting HVAC plant with high energy efficiency ratios (EER) will also be magnified.

3.2 Renewable energy

Under the IGRAT GHG Emissions credit, points can be achieved via a combination of (a) improving the energy efficiency of the proposed building and (b) reducing the carbon intensity of the proposed building's energy source.

As a building becomes more energy efficient, each subsequent dollar spent on energy efficiency initiatives generally produces diminishing energy savings. Given the significant increase in energy efficiency of the 2019 Reference Building, it will likely be increasingly difficult and costly to improve the energy efficiency of the proposed building relative to the new benchmarks. Consequently, to maximise the number of IGRAT GHG Emissions points achieved under the 2019 NCC, there will be an increased value in reducing the carbon intensity of the building's energy source.

Options for reducing the carbon intensity of the building's energy source include but are not limited to:

- Installing on-site renewable energy systems e.g. a solar PV array
- Use of renewable energy purchasing schemes and/or GreenPower
- Avoiding use of gas/diesel-fuelled equipment and appliances where possible, to avoid the imposition of permanent sources of greenhouse gas emissions that can only be mitigated via purchase of certified carbon offsets.

It should be noted that, under the Green Star Greenhouse Gas Emissions credit, the number of points available to be claimed for any given project due to the benefits of power purchasing schemes is limited to the number of points being claimed as a result of improving the energy efficiency of the proposed building; e.g. if 3 points are being claimed for reduction in annual greenhouse gas emissions due to energy efficiency improvements, then the number of points available to be claimed due to a power purchasing scheme is also limited to 3, regardless of the quantity of renewable energy being purchased.

It is understood that the SA Government will commence an ongoing supply contract in 2020 to source electricity from renewable energy systems. For GBCA-certified Green Star projects, additional points can be claimed based on this agreement, however the number of points that are available to be claimed depends on the GHG emissions intensity of the proposed building. The greater the reduction in GHG emissions relative to the Reference Building, the greater the number of points that are available to be claimed. Therefore, to maximise the number of points achieved, improving the energy efficiency of the proposed building's façade and services will still be necessary following the commencement of the supply contract.

4 Impact Assessment

4.1 Overview

Should the Lyell McEwin ED Redevelopment project's development application be assessed against the 2019 NCC, the implications on each aspect of the building design that the project team should consider are discussed below.

4.2 Lighting

Despite the large increase in stringency of the lighting efficiency DtS Provisions in the 2019 NCC, it is anticipated that the current SA Health best practice lighting systems will be adequate to meet the new requirements. Indeed, depending on the types of spaces present within the ED, the current best practice approach may exceed the 2019 requirements, although to a much lesser extent than the 2016 requirements.

As SA Health's current best practice lighting systems already consists of LED lighting with motion and daylight sensor controls, it is not anticipated that there will be a high potential for improvement relative to the DtS lighting system. However it is still recommended that options for higher efficiency LED luminaires and optimised lighting layouts be investigated during the design development phase.

4.3 HVAC

It is anticipated that the current SA Health approach to selecting HVAC equipment will also remain sufficient to achieve compliance with the 2019 DtS HVAC energy efficiency ratios. However, given that HVAC energy is the greatest contributor to the building's overall energy consumption, any further improvements that can be made will achieve significant energy savings and contribute towards the number of points claimed under the IGRAT GHG Emissions credit.

When assessing various HVAC systems during the Life Cycle Assessment Options Analysis, we recommend that an increased weighting be applied to the operational energy component. Reducing the operational energy will not only reduce the payback period but also achieve more IGRAT points, which will be at an increased premium under the 2019 NCC, and this should be factored into the LCA options analysis.

To further reduce HVAC operational energy, we recommend that feasibility analyses of the following system controls are also completed during the concept design phase:

- Economy cycle operation
- Heat recovery ventilation to pre-condition outside air
- Outside air modulation via use of CO_2 sensors

4.4 Glazing

Given the large increase in stringency of the 2019 DtS glazing performance requirements, it is particularly important to focus on achieving an energy-efficient glazing design. It is recommended that glazing compliance assessments are completed early in the design process, to allow the results to inform the design and ensure that the glazing exceeds the DtS compliance level. The glazing performance greatly influences the building's overall energy consumption (as discussed in Section 3.1), and hence is a key factor in determining the project's IGRAT score.

To increase the energy efficiency of the glazing systems, particular attention should be paid to the window-wall ratio, which should be rationalised were possible especially on east and west façades. Additionally, shading provisions such as overhangs, reveals, and external louvres or sunscreens should be considered as these can create cost-effective energy savings if designed correctly. The thermal performance of the glazing products should also be carefully considered. Double glazing will likely be required, thermally-broken frames will have a greater impact, and solar heat gain coefficients should be optimised to suit the façade orientation and shading provisions.

4.5 Domestic hot water

The DtS provisions for DHW systems are unchanged in the 2019 NCC. Nonetheless, given the greatly reduced potential to improve the lighting system relative to its DtS Provisions in 2019, a greater emphasis should be placed on increasing the efficiency of the DHW system. As such it is recommended that a life cycle assessment options report is completed, to ensure that all operational energy usage is considered when assessing various DHW system options.

As the DtS requirements for DHW systems in the 2019 NCC are unchanged, the IGRAT requirement for solar water heating to contribute 50% of the building's total DHW demand is equally applicable to projects assessed using the 2019 NCC as to those assessed using the 2016 NCC.

4.6 Lifts

The 2019 NCC introduces new minimum lift energy efficiency requirements, which should be considered by the project team for compliance purposes. However, these new requirements will not impact the IGRAT scoring, as the GHG Emissions credit uses a prescribed method for calculating the lift energy consumption of the Reference Building and hence the IGRAT does not refer to the NCC DtS Provisions. Consequently, the benchmarks for lift energy consumption will remain unchanged for the purposes of the IGRAT GHG Emissions credit.

4.7 Building fabric

The 2019 DtS roof total R-value has increased from R3.2 to R3.7, and a DtS maximum solar absorptance value of 40% has been introduced. These changes should be accounted for when designing the roof.

Exceeding the DtS R-values of the roof and external walls typically provides negligible operational energy savings.

4.8 Air tightness

Air leakage contributes significant load on the HVAC system, particularly for the Emergency Department which will have long air-conditioning operating hours. For example, the reduced air leakage rate in the 2019 Reference building (0.35 air changes per hour, compared to 0.50 air changes per hour in the 2016 Reference building) resulted in a 7% reduction in total HVAC energy usage (refer to Figure 3).

The Lyell McEwin Emergency Department redevelopment does not meet the eligibility criteria of the performance method for verifying air tightness that will be introduced in the 2019 NCC, due to the project's building classification (Class 9a) and Climate Zone (5). Thus air leakage testing cannot be used to demonstrate compliance with the building sealing DtS Provisions of Section J.

Nonetheless, air leakage testing can be used to quantify the air tightness performance of the façade such that any issues can be identified and rectified during construction. The test results can be used to demonstrate improved air tightness performance relative to the 2019 Reference Building when modelling the proposed building for the IGRAT GHG Emissions credit, potentially improving the score achieved.

4.9 Thermal bridging

For metal-framed external walls and roofs/ceilings, the reduction in total system R-value due to thermal bridging is quantified within Specifications J1.2b and J1.2c of the 2019 NCC. As a result, higher performance insulation may be required for metal-framed construction elements to compensate for the effects of thermal bridging.

Use of thermal breaks in glazed façade systems and windows will also reduce thermal loads and therefore help in reducing HVAC energy consumption.

4.10 Renewables

Due to the increased difficulty of reducing the energy consumption of the proposed building relative to the 2019 DtS Reference Building, it is likely that a greater reliance upon reducing the greenhouse gas intensity of the building's energy source will be necessary to achieve the targeted IGRAT score.

A solar PV feasibility assessment is recommended, to determine not only the potential financial benefit but also the number of IGRAT points that could be achieved via installation of an on-site solar PV system.

5 Implications for IGRAT

5.1 Introduction

Looking beyond the Lyell McEwin ED Redevelopment project, the 2019 NCC will have significant implications for all IGRAT and Green Star projects. Several IGRAT/Green Star credits will be directly impacted by the changes, although the GHG Emissions credit will be the most heavily impacted.

The GBCA are currently exploring methods of amending the scoring methodology for the Green Star GHG Emissions credit, to better reflect the 2019 Section J minimum requirements. SA Health may wish to consider amending the IGRAT scoring methodology in a similar manner. Potential amendment options are discussed below.

5.2 Overview

It is anticipated that the following IGRAT and Green Star credits will be impacted by the 2019 NCC:

IGRAT Credit (New Build)	Green Star Credit	Anticipated impact of 2019 NCC	Anticipated impact level
2 Adaptability and Future Proofing	03 Adaptation and Resilience	The increased difficulty of improving upon energy efficiency benchmarks may result in more project teams installing on-site renewable energy generation systems when seeking to reduce the building's GHG emissions. On-site generation systems provide resiliency against network power outages, which can constitute part of a climate adaptation plan, and therefore more project teams may target this credit.	Low
3 Commissioning and Tuning	02 Commissioning and Tuning: 2.2 Building Commissioning	The increased difficulty of improving upon energy efficiency benchmarks may result in more project teams seeking air permeability testing as a means of demonstrating improved energy efficiency, and therefore more teams may target the Building Commissioning credit.	Low
12 Indoor Air Quality	09 Indoor Air Quality: 9.2 Provision of Outdoor Air	Providing increased outdoor air quantities, as is required by credit 9.2, may cause excessive HVAC energy consumption unless ventilation demand controls are implemented (e.g. CO_2 controls). Therefore the benefit of using ventilation demand controls is anticipated to increase.	Low
15 Visual Comfort	12 Visual Comfort: 12.1 Daylight	Increased DtS glazing performance requirements may necessitate darker glazing products to reduce solar heat gains. This may compromise daylight levels and result in fewer project teams targeting the daylight credit.	Medium
16 HVAC Life Cycle Assessment	19 Life Cycle Impacts	Increased DtS energy efficiency benchmarks will result in increased difficulty of reducing operational energy usage relative to Reference Building.	Medium
17 Greenhouse Gas Emissions	15 Greenhouse Gas Emissions	Increased DtS energy efficiency benchmarks will result in greatly increased difficulty of reducing GHG emissions relative to a Reference Building. Eligibility requirements for project star-ratings (e.g. minimum 6 points required for projects to be eligible for a 6-star rating) will become more onerous and potentially prohibitive in some instances. Installation of large renewable energy generation systems may be required to meet eligibility criteria, in lieu of increasing building energy efficiency.	High

IGRAT Credit (New Build)	Green Star Credit	Anticipated impact of 2019 NCC	Anticipated impact level
19 Solar PV – Future Enablement 20 Peak Electricity Demand Reduction 21 Maximum Demand – Sizing and Augmentation	16 Peak Electricity Demand Reduction	Increased difficulty of reducing peak electricity demand relative to Reference Building due to increased DtS energy efficiency benchmarks. Installation of large renewable energy generation systems may be required to meet credit criteria, in lieu of increasing building energy efficiency.	High
31 Microbial Control	28 Microbial Control	High-efficiency water-based HVAC systems may become more prominent as project teams seek to increase scores for credits 15, 16, and 19. Credit 28 awards points for waterless heat-rejection systems, and therefore fewer project teams may target this credit.	Low
N/A	25 Heat Island Effect	More project teams may be inclined to target this credit, as the criteria are only marginally more stringent than the 2019 DtS requirement of a maximum solar absorptance of 0.40.	Low

Table 4: List of IGRAT and Green Star credits impacted by 2019 NCC

Given that the GHG Emissions credit represents such a major component of the overall project's scoring system and is associated with eligibility requirements for 5- and 6-star ratings, the impact upon this credit is the most consequential and is discussed in further detail below.

5.3 Greenhouse Gas Emissions credit

Currently the IGRAT Greenhouse Gas (GHG) Emissions credit awards points based on assessing (a) the operational energy consumption due to building fabric and (b) the GHG emissions of the whole building (including building services and accounting for any renewable energy generation etc.) relative to the NCC DtS Reference Building, as per Table 5.

Credit Element	Reduction achieved (proposed building relative to NCC DtS Reference Building)	Points Awarded
Building Fabric Assessment (Energy consumption of HVAC, lighting, etc. is excluded from this part of the assessment)	5%	1.0
	10%	2.0
	15%	3.0
	20%	4.0
Whole Building Assessment	10%	1.6
	20%	3.2
	30%	4.8
	40%	6.4
	50%	8.0
	60%	9.6
	70%	11.2
	80%	12.8
	90%	14.4
	100%	16.0

Table 5: Current IGRAT scoring methodology for the GHG Emissions credit

Note that all points are awarded based on improvements over the NCC DtS Reference Building. It is anticipated that the 2019 DtS provisions will achieve an average reduction in Reference Building GHG Emissions by approximately 50% for Class 9a projects in Adelaide (source: Energy Action Section J review, prepared for ABCB).

For example, a building that achieves a 50% reduction over its 2016 Reference Building, and hence would be awarded 8.0 points if assessed using the 2016 NCC, would achieve 0 points when compared to its 2019 Reference Building. Similarly, a proposed building that performs only 10% better than 2019 code requirements (which is the minimum requirement for Green Star projects) will not score any points if using the 2019 benchmarks, but would have scored 8.0 points under the 2016 NCC. Note that the thresholds for 4, 5 and 6-star ratings are 45, 60, and 75 points respectively, and hence a loss of 8.0 points could be highly consequential to a project's overall rating.

In response to the proposed changes to the NCC in 2019, the GBCA have established a technical working group to develop a revised scoring scheme for the Green Star GHG emissions credit. The intent is to prevent the increased stringency of the 2019 DtS Provisions from prohibiting project teams from meeting the credit's conditional requirement, and the associated 5- and 6-star eligibility requirements. The GBCA are intending to release a Position Paper and a minor Green Star tool update by March 2019, prior to the release of the 2019 NCC in April.

SA Health may wish to amend the IGRAT scoring methodology for the GHG Emissions credit to achieve a similar outcome and also ensure that projects which improve upon the 2019 DtS benchmarks are given a level of recognition that is equivalent to that of other projects that were previously assessed against the less-stringent 2016 benchmarks, to maintain consistency of results.

Options for amending the IGRAT GHG Emissions credit criteria are listed below.

5.3.1 Option 1 – Scoring recalibration – exponential scheme

Recalibrate the scoring criteria using an exponential relationship between emissions reductions achieved and the number of points awarded, such that a greater proportion of the total available points are awarded towards the lower end of the emissions reduction scale, given that these smaller improvements will become considerably more difficult to achieve under the 2019 NCC. An example recalibrated scoring scheme is outlined in Table 6 and presented graphically in Figure 6 and Figure 7.

Credit Element	Reduction achieved (proposed building relative to NCC DtS Reference Building)	Points Awarded	
		Current scheme	Proposed Option 1
Building Fabric Assessment (Energy consumption of HVAC, lighting, etc. is excluded from this part of the assessment)	5%	1.0	2.0
	10%	2.0	3.0
	15%	3.0	3.5
	20%	4.0	4.0
Whole Building Assessment	10%	1.6	5.5
	20%	3.2	8.5
	30%	4.8	10.5
	40%	6.4	12.1
	50%	8.0	13.3
	60%	9.6	14.3
	70%	11.2	15.0
	80%	12.8	15.5
	90%	14.4	15.8
	100%	16.0	16.0

Table 6: Proposed IGRAT scoring scheme for Option 1

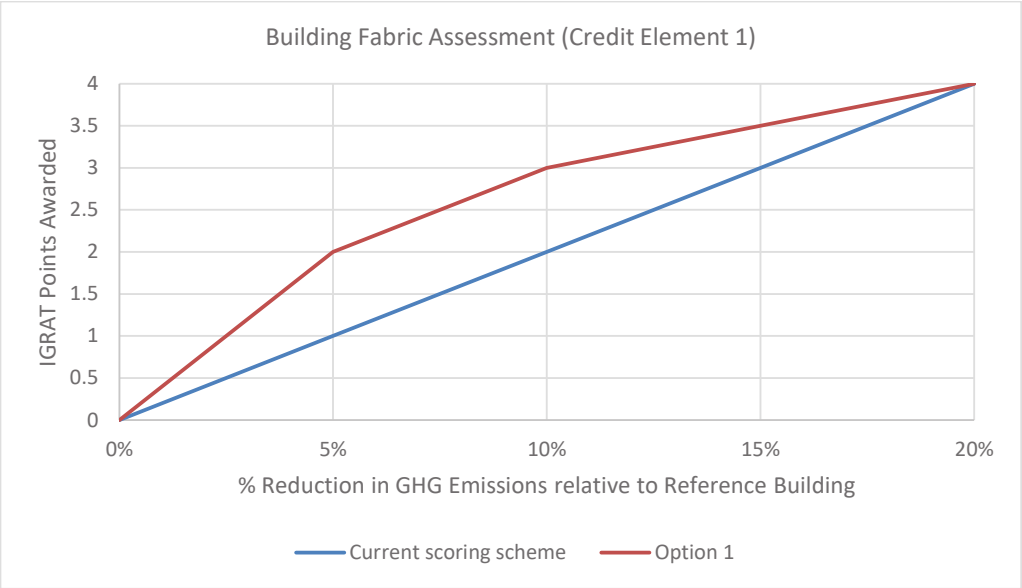

Figure 6: Comparison of proposed recalibrated IGRAT GHG Emissions credit scoring scheme (Option 1) with current scoring scheme, for the Building Fabric Assessment (i.e. the first credit element)

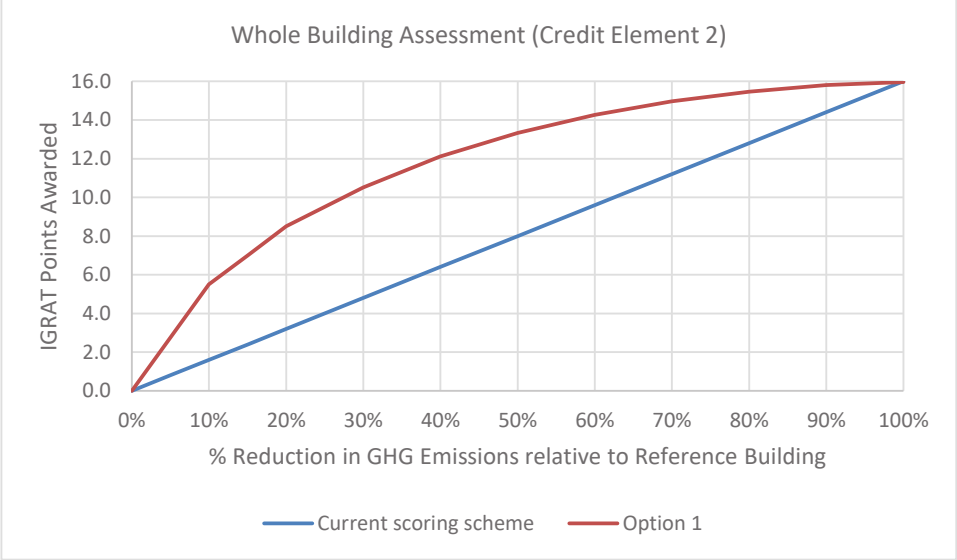

Figure 7: Comparison of proposed recalibrated IGRAT GHG Emissions credit scoring scheme (Option 1) with current scoring scheme, for the Whole Building Assessment (i.e. the second credit element)

This recalibrated scheme would provide a greater level of consistency amongst the scores achieved by projects assessed against this scheme, in comparison to projects previously assessed using the 2016 NCC.

For example, consider a building that achieves a 60% reduction in GHG emissions relative to a 2016 Reference Building. Using the current scoring system, 9.6 points would be awarded for the second credit element, as shown by the orange line in Figure 8.

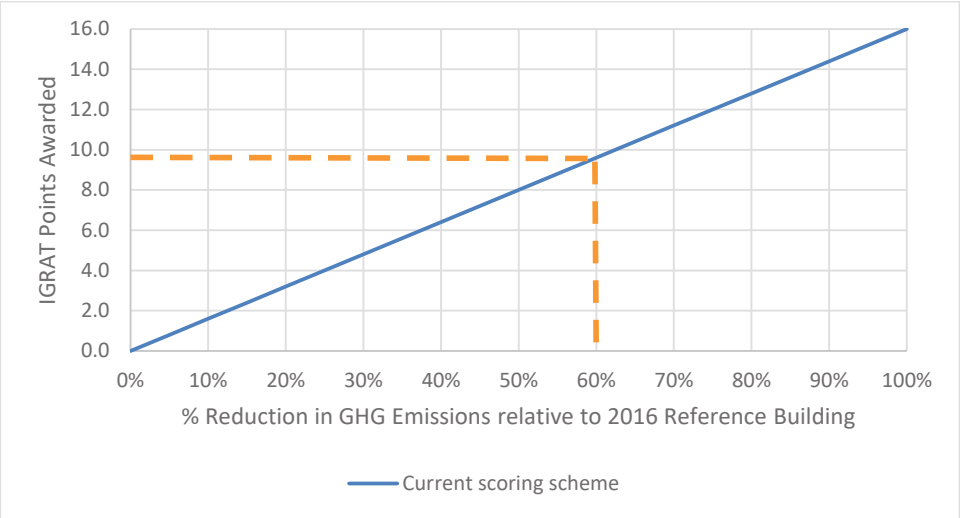

Figure 8: Assessment of an example building that achieves a 60% reduction over the 2016 Reference Building, using the current scoring scheme

The GHG emissions intensity of the 2019 Reference Building is anticipated to be approximately half that of the 2016 Reference Building. Therefore, if assessed using the 2019 NCC, the same building would achieve an improvement over the 2019 Reference Building of approximately 20%. Under the current scoring scheme, a 20% improvement would only achieve a score of 3.2 points (as per the orange line in Figure 9), whereas under the recalibrated scheme, 8.5 points would be awarded (green line in Figure 9), which is more consistent with the 9.6 points that would have been awarded using the 2016 NCC.

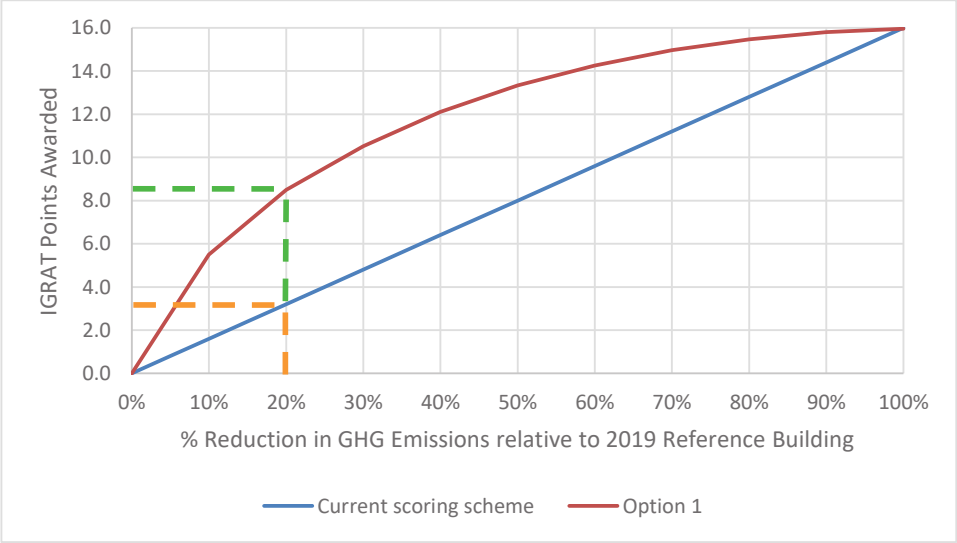

Figure 9: Comparison of assessing the same example building (as per Figure 8) against the 2019 Reference Building using (a) the current scoring scheme and (b) the scheme proposed in Option 1

The disadvantage of the recalibrated scheme in Option 1 is that it offers reduced incentive for projects to target high emissions reductions in the whole building assessment (e.g. in the 70-100% range), as it provides diminishing returns at the higher end of the spectrum. However, it is anticipated that the increased difficulty of achieving high reductions (e.g. beyond 50%) under the 2019 NCC will prohibit many project teams from targeting reductions in this range, regardless of the IGRAT scoring scheme.

5.3.2 Option 2 – Scoring recalibration – linear scheme with additional innovation points

An alternative method of recalibrating the scoring scheme is to retain the linear scoring relationship of the current scheme but to award the full 16 points in the Whole Building assessment for a 50% reduction in GHG Emissions, to account for the increased difficulty of achieving a 50% reduction over the 2019 Reference Building.

To incentivise project teams to target GHG emissions reductions beyond 50%, 5 additional Innovation Points are available for exceeding a 50% reduction, as per Table 7 and presented graphically in Figure 10.

The building fabric assessment (first credit element) in Option 2 is as per the current scoring scheme.

Credit Element	Reduction achieved (proposed building relative to NCC DtS Reference Building)	Points Awarded	
		Current scheme	Proposed Option 2
Building Fabric Assessment (Energy consumption of HVAC, lighting, etc. is excluded from this part of the assessment)	5%	1.0	1.0
	10%	2.0	2.0
	15%	3.0	3.0
	20%	4.0	4.0
Whole Building Assessment	10%	1.6	3.2
	20%	3.2	6.4
	30%	4.8	9.6
	40%	6.4	12.8
	50%	8.0	16.0
	60%	9.6	16 + 1 Innovation Point = 17.0
	70%	11.2	16 + 2 Innovation Points = 18.0
	80%	12.8	16 + 3 Innovation Points = 19.0
	90%	14.4	16 + 4 Innovation Points = 20.0
	100%	16.0	16 + 5 Innovation Points = 21.0

Table 7 Proposed IGRAT scoring scheme for Option 2

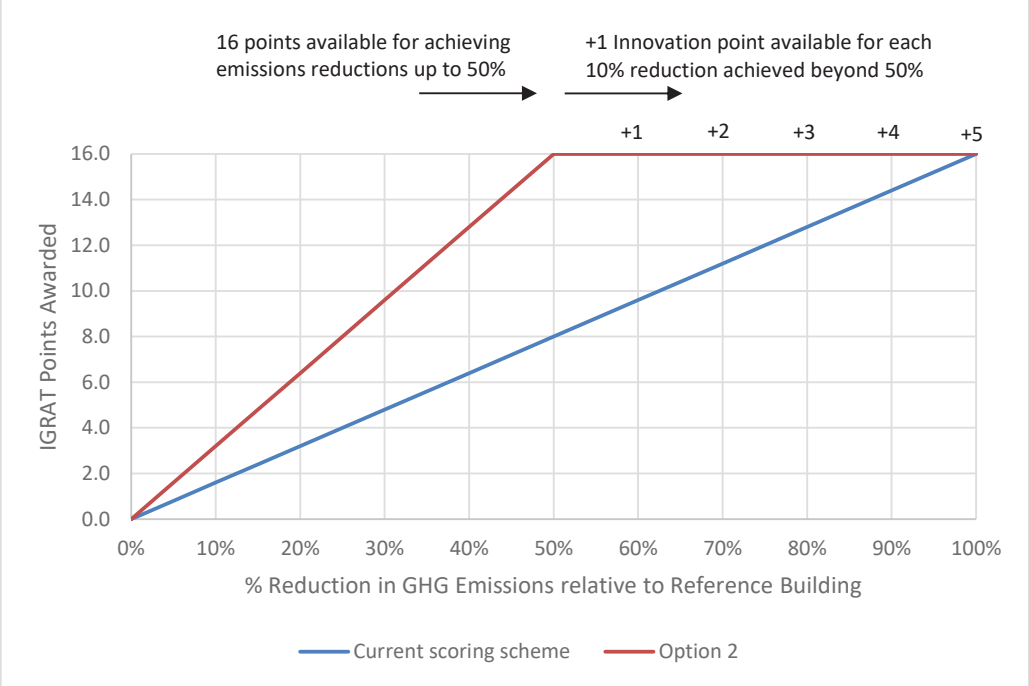

Figure 10: Comparison of proposed Option 2 scoring scheme with current scoring scheme, for the Whole Building Assessment (i.e. the second credit element)

Option 2 retains the linear relationship as per the current scoring scheme, and the first credit element remains unchanged. Due to this consistency, Option 2 may be more readily adopted by project teams and simpler to implement, relative to Option 1.

Given that a 2019 Reference Building generally has approximately half the GHG emissions of the 2016 Reference Building, it is anticipated that doubling the number of points awarded in the 0 to 50% range (as per Option 2) will result in projects achieving scores that are relatively consistent with those achieved previously under the 2016 NCC.

As is the case in Option 1, it is anticipated that the increased difficulty of achieving GHG emissions reductions under the 2019 NCC will prohibit many project teams from targeting reductions beyond 50%. Therefore awarding the full 16 points for a 50% reduction is considered more reasonable than it would be under the 2016 NCC. However for projects in which this extent of reduction may be feasible, the additional innovation points are available as incentive.

5.3.3 Option 3 – Increased emphasis on whole building assessment

The building services are the component that is most heavily impacted by the changes in the 2019 NCC. To recognise project teams that improve upon the more stringent building services benchmarks, Option 3 places an increased emphasis on the energy efficiency of the services, by replacing the building fabric assessment (i.e. the first credit element) with a whole-building energy efficiency assessment, i.e. an assessment that only considers the quantity of energy consumed by the building. The second credit element remains as a whole-building assessment of GHG emissions, as per the current scoring scheme.

The intent of the energy-efficiency assessment in Option 3 is to limit the number of points that can be achieved by installing renewable energy generation systems, such that project teams are incentivised to also improve the energy efficiency of the building itself. Without the energy-efficiency component of the credit, projects could claim the full 20 points simply by meeting the minimum energy efficiency requirements for the building fabric and building services and relying solely on renewable energy generation to reduce the building's GHG emissions, which is not the intent of the credit.

Credit Element	Reduction achieved (proposed building relative to NCC DtS Reference Building)	Points Awarded – Proposed Option 3
Whole Building Assessment – Energy Efficiency (kWh p.a.) (i.e. not accounting for GHG emissions intensity of energy source)	5%	1.0
	10%	2.0
	15%	3.0
	20%	4.0
Whole Building Assessment – Greenhouse Gas Emissions (kg CO_2-e p.a.)	10%	1.6
	20%	3.2
	30%	4.8
	40%	6.4
	50%	8.0
	60%	9.6
	70%	11.2
	80%	12.8
	90%	14.4
	100%	16.0

Table 8: Proposed IGRAT scoring scheme for Option 3

A potential consequence of increasing the emphasis on the building services' performance, as is proposed in Option 3, is that the whole-of-life operational energy efficiency of buildings may be compromised. Building services typically experience a greater decline in performance towards the end of their operational life, in comparison to energy-efficient façades and building envelopes which typically retain their thermal performance more effectively. By shifting the focus towards energy-efficient building services and away from the façade and building envelope, it may incentivise building designs that are more susceptible to declining performance towards the end of their operational life.

5.3.4 Option 4 – Benchmarking against existing SA Health buildings

Considering the anticipated magnitude of reduction in GHG emissions intensity of 2019 Reference Buildings relative to 2016 Reference Buildings, Option 4 is to award IGRAT points based on a comparison of the proposed building to other similar existing SA Health buildings, in lieu of using the NCC Reference Building as the basis.

This approach is similar to that used for NABERS assessments, in which an area-weighted and time-weighted metric (e.g. GHG emissions per square metre of NLA per hour of active building operation) is used as a benchmark to compare the performance of different buildings. Points would then be awarded depending on the percentile of all SA Health buildings that the proposed building falls within, for example via the scoring scheme in Table 9.

GHG Emissions intensity of proposed building - Percentile of all existing SA Health Buildings	Points Awarded – Option 3	Comment
50th percentile and below	0	The 50th percentile represents the average level of performance among existing SA Health buildings. If the proposed building is below average, no points are awarded.
50th to 60th percentile	3.5	
60th to 70th percentile	7.0	
70th to 80th percentile	10.5	
80th to 90th percentile	15.0	
90th to 100th percentile	18.5	
100th percentile and above	20	The 100th percentile represents the highest performing existing SA Health building. If the proposed building exceeds this level of performance, the full 20 points are awarded.

Table 9: Proposed IGRAT scoring scheme for Option 4

Each new building that is awarded points under this credit would cause the average performance to increase, thereby raising the benchmark for future projects. This shift would occur progressively, allowing project teams to adjust their strategies over time to keep up with the benchmark, in lieu of the abrupt shift that is anticipated to occur if the NCC Reference Building continues to be used as the benchmark in which case it will be much more difficult for project teams to adjust.

Additionally, comparing a proposed building against similar existing buildings is a more holistic approach to measuring its performance. Under the current methodology, the comparison of the proposed building is limited to a code-compliant version of itself, and as a result the impacts of some key building characteristics (e.g. orientation) are not considered.

Data collection and analysis of existing SA Health buildings would be required to establish the benchmarks, and regular updating of the database would be necessary as new projects are completed. While an area-weighted and time-weighted metric allows for a fair comparison between many buildings, this method of benchmarking may not be suitable in every instance given the unique nature of many SA Health projects.

5.3.5 Comparison of options

The benefits and disadvantages of each option are summarised in Table 10.

Option	Benefits	Disadvantages
Retain current scoring system	Maintain consistency with Green Star scoring scheme.	Inconsistency of scores relative to projects assessed using 2016 NCC, due to increased stringency of 2019 NCC. Greatly increased difficulty of achieving points.
Option 1: Scoring recalibration – exponential scheme	Greater consistency of scores relative to those achieved by projects assessed using 2016 NCC.	Reduced incentive for projects to target high-end emissions reductions (e.g. beyond 50%).
Option 2: Scoring recalibration – linear with additional Innovation Points	Greater consistency of scores relative to those achieved by projects assessed using 2016 NCC. Simpler scoring system may be easier to implement, relative to Option 1.	Reduced incentive for projects to target high-end emissions reductions (e.g. beyond 50%), although innovation points are available beyond 50%.
Option 3: Increased emphasis on whole building assessment	Greater recognition for projects that improve upon the more stringent performance requirements for building services in 2019 NCC.	Emphasising building services in lieu of façade and building fabric may lead to buildings that are more susceptible to declining performance during latter stages of operational life.
Option 4: Benchmarking against existing SA Health buildings	Provides more holistic approach to measuring performance. Incentivises project teams to continuously raise the benchmark for SA Health projects.	Inconsistency of scores relative to projects assessed using 2016 NCC, due to fundamental change in assessment method. Benchmarking against existing buildings may not be suitable for unique projects.

Table 10: Comparison of options for amending IGRAT GHG Emissions credit

5.3.6 Recommended option

On balance, we consider that option 2 (recalibrated scheme with innovation points available for achieving emissions reductions beyond 50%) provides an appropriate methodology for recognising simple energy efficiency improvements resulting from effective design principles, while also offering incentive for innovative project teams to strive for low-carbon or zero-carbon outcomes.

6 Conclusion

This assessment demonstrated an expected reduction in Greenhouse Gas emissions of 56% for a Reference Building based on the new Lyell McEwin Emergency Department relative when assessed under the 2019 NCC, relative to that of the 2016 NCC. The main causes of this reduction are increases in lighting energy efficiency and glazing performance requirements.

Should the Lyell McEwin ED Redevelopment be assessed using the 2019 NCC, achieving points under the IGRAT Greenhouse Gas Emissions credit will be significantly more difficult, as a result of the increased stringency of the NCC Section J DtS Provisions.

It appears that the greatest potential to improve upon the 2019 NCC will be to reduce the HVAC energy consumption. The greatest source of HVAC load is expected to be the glazing, and therefore it is recommended that the project team prioritise design of an energy efficient glazing and shading arrangement.

Use of high-efficiency HVAC plant will have a greater impact on the building's overall energy consumption under the 2019 NCC, and hence energy efficiency should be prioritised when comparing various options within the HVAC life cycle assessment report.

It is also recommended that an increased emphasis be placed on reducing the GHG emissions intensity of the building's energy source. A solar PV feasibility assessment is recommended to be completed early in the project's design process, and other opportunities for renewable energy systems should be explored.

Beyond the scope of the Lyell McEwin ED Redevelopment project, it is recommended that SA Health consider the options proposed for amending the scoring scheme used in the IGRAT Greenhouse Gas Emissions credit, to better reflect the increased stringency of the 2019 NCC.

On balance, we consider that a recalibrated scheme with additional innovation points available for achieving emissions reductions beyond 50% would provide an appropriate methodology for recognising simple energy efficiency improvements resulting from effective design principles, while also offering incentive for innovative project teams to strive for low-carbon or zero-carbon outcomes.

APPENDIX H

STRUCTURAL, CIVIL AND STORMWATER MANAGEMENT REPORT

WALLBRIDGE GILBERT AZTEC

Cheeseman Architects

Lyell McEwin ED Upgrade

CONCEPT DESIGN REPORT

Project No. 171581
Doc No. WGA171581-RP-ST-0001
Rev. A

09 May 2019

Revision History

Rev	Date	Issue	Originator	Checker	Approver
A	09/05/2019	Client Issue	ADW	ADW	ADW

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Appendices

1 INTRODUCTION

Wallbridge Gilbert Aztec (WGA) has been engaged by the South Australian Department of Planning Transport and Infrastructure (DPTI) to provide consulting Civil and Structural Engineering design services for the redevelopment of the emergency Department at the Lyell McEwin Hospital. Also incorporated into the project is a new Mental Health Short Stay Unit.

This report provides an outline of the civil and structural design parameters and the concept design response for the project which includes the following elements;

- Ambulance bay canopy
- New emergency department addition over 2 levels
- New mental health unit located on a third level above the emergency department addition
- Refurbishment of existing emergency department areas

The new works are to be located immediately adjacent the existing Emergency Department on the northern side of the site along the Oldham Road site frontage.

2 GEOTECHNICAL CONDITIONS

The Lyell McEwin site has been the subject of numerous site investigations conducted over the last 20 years as the facility has been continually upgraded and rebuilt. WGA has also been involved in all of the major developments over this period and has a thorough understanding of the expected geotechnical conditions for the site.

The most relevant of the investigations was conducted by Coffey Partners Geotechnical Consultants in October 2010, refer to the appended report reference 06487AA-AC and in particular the soil profiles from boreholes 17 & 18 which are closest in proximity to the new works.

The soil profile typically comprises of a layer of gravel fill material as pavement layers to approximately 300mm underlain by a thin layer of sandy topsoil and then highly reactive red brown clays to a depth of approximately 1.4m below the surface. Orange brown clayey alluvium occurs beneath the red brown clays and contains variable proportions of calcareous material. The limit of sampling in this area was 4m and the following geotechnical design parameters are recommended:

Free Swell Ys (no trees)	40mm
Site Classification to AS2870	M-D
Site sub-soil class	De
Maximum allowable bearing pressure	175kPa
Recommended CBR for pavement design	4%

It is intended that supplementary investigations be completed to confirm the above in targeted locations now that the design of the building footprint is relatively settled.

In addition, there is historical evidence that the termiticides (primarily organochlorines) were used extensively throughout the former facility prior to redevelopment works commencing circa 2000. The areas over which new buildings are to be constructed will be examined for the presence of contaminants to enable both construction to proceed with safety and permit the disposal of any excess spoil.

3 DESIGN BASIS AND INTENT SUMMARY

Civil

The relevant civil design parameters for the new facility include:

- Match existing Emergency Department floor level at RL 44.700AHD
- Maximum grade of ambulance bay pavements at 1 in 32
- Connection of stormwater drainage to the existing underground system. This is separated as roof stormwater which connects to the storage tank on the southern side of the site and allows for the harvesting of stormwater, and surface stormwater which connects to the adjacent council network.
- Underground pipe network to be designed for minimum 1 in 20 ARI storm event
- Overland flow around the building to be provided for major storm events and floor level to be above predicted 1 in 100 year floor level

Concept designs for the civil works are yet to be finalised but will incorporate the following features:

- Maintenance of floor level of 44.700 AHD which is approximately 1.5m above Oldham Road top of kerb levels and well above predicted flood levels in this part of the site.
- Achievement of maximum pavement grades and provision for overland floor around but away from the building.
- The site is already effectively sealed by pavements and roofs and as such the variance in stormwater run off volumes will be negligible. The alterations to existing stormwater pipe networks will also be negligible however the existing roof stormwater main continues under the building.
- Car park kerb layouts to be adjusted to suit new entry paths and ambulance entry.
- Imported fill will be required to raise external levels to make up the difference in level between Oldham Road and the emergency entry across the ambulance drop off area. The imported fill will be compacted as controlled engineered fill.
- Concrete pavements to be provided beneath ambulance drop off area, asphalt pavement to be used for general car park areas.

Structural

The new Emergency Department will be designed as a post disaster facility to satisfy Importance Level 4 requirements however the existing Emergency Department is housed within a part of the structure constructed as part of the Stage A development prior to the implementation of the current seismic design standard AS1170.4 - 2007. Whilst the original structure is expected to perform reasonably during a significant seismic event, it is not designed to be compliant with the current Importance Level 4 (IL4) requirements. Due to the inherent connectivity between the current ED with the remaining hospital it is not considered practical to undertake seismic upgrade works of the base structure only within the existing ED and upgrading of the base structure beyond the ED is also considered to be cost prohibitive. It is however practical to ensure that all non-structural components within a refurbished ED such as ceilings, partitions and building services are adequately restrained to prevent injury to building occupants for even minor seismic events. A pragmatic

approach to significant refurbishment works within the existing building is therefore recommended to be as follows:

- Remove and retrofit all internal ceilings and partitions together with above ground services incorporating appropriate seismic restraints to the existing structure. It is preferred that new plant room areas which are designed to current standards act as feeds to the newly refurbished areas fitted with flexible seismic movement joints at all appropriate junctions of structural discontinuity.

- Where services mains originate from existing plant areas within the complex then flexible seismic movement joints shall be incorporated at the perimeter of the ED.

Any areas which are receiving only a cosmetic refurbishment would not be subject to the above.

The new structure will be designed to satisfy current IL4 requirements however it will need to be seismically isolated from the existing building. This is will require a physical gap of approximately 100mm, independent columns, seismic joints at floor junctions and articulation of services.

The new structure will be designed for a 50 year design life to comply with the following:

- Dead loads
  - Concrete - 2500 kg/m^3
  - Roof sheeting / cladding - 0.15 kPa
  - Services - 0.25 kPa
  - Plasterboard ceiling/insulation 0.15 kPa
- Wind Loads

Wind loads applied to the building were determined in accordance with AS/NZS 1170.2: Wind actions. Are as follows:

- Building importance level 4
- Annual prob of exceedance
  Limit state 1/2500
  Serviceability 1/25
- Regional wind speed
  Limit state 48 m/s
  Serviceability 37 m/s

- Terrain category 3
- Mz,cat 0.89 for up to 15m height
- Md 1.0
- Ms 1.0
- Mt 1.0

- Earthquake loads

Earthquake actions will be determined in accordance with AS1170.4: Earthquake actions in Australia, based on the following design parameters:

- Annual prob of exceedance 1/2500
- Probability factor, Kp 1.8
- Hazard factor, Z 0.10
- Site subsoil class De
- Earthquake design category III

Deflection Limits

The following in service deflection limits are proposed for the building structure:

Element	Deflection limit under service loads
Beams	Span/400
Cantilevers	Span/250
Braced frame under wind	Height/250
Portal frame under wind	Height/150
Drift under earthquake	Height/150
Differential settlement	Span/400

Material Section

The structure is to be designed for durability and with the intent of minimal ongoing maintenance to current best practice.

Design working life	50 years
Location	Elizabeth, South Australia
Climatic Zone	Temperate (Near Coastal)

Concrete

Minimum concrete strength:

- Footings, Slab on ground - 32 MPa
- Post tensioned (PT) floor slabs - 40 MPa
- Precast concrete - 40 MPa

Structural Steelwork

Unless otherwise stated, all steel shall be in accordance with:

- AS 3679 Grade 300 Plus for rolled sections
- AS 1163 Grade 350 for SHS, RHS and CHS sections, UNO
- AS 1163 Grade 450 for SHS and RHS where noted
- AS 3678 Grade 250 for hot rolled plates.

Unless otherwise noted, protective surface treatment to all new steelwork shall be as follows:

- Steelwork exposed to weather or cast into concrete: hot dip galvanised in accordance with AS/NZS 4680 with minimum coating of 600g/m2.
- Internal steelwork within enclosed buildings: Blast clean to class 2.5 in accordance with AS 1627 Part 4. Apply class 4 inorganic zinc silicate primer 75 microns dry film thickness.
- Steelwork in contact with the ground: as for steelwork above ground, but with additional protection with Denso wrap or 3 coats of approved bituminous paint system, such as Interzone 954HS to 400 Micron dry film thickness.
- Site welds: Power wire brush and apply 2 coats of Dulux Zincanode 202 or similar approved compatible system.

The supply and fabrication of structural steelwork will be specified to comply with the National Structural Steelwork Compliance Scheme and the South Australian Government Industry Participation Policy.

Structural Concept Design

The new building comprises a 3 storey section with a single storey link to the existing building. The exterior is to be clad with a combination of brickwork and glazing with some expressed banding.

The footings are to be a combination of reinforced concrete strip and pad footings combined with a concrete floor slab. The single storey section is to be of steel framed construction with columns and beams supporting a metal deck roof. The ambulance canopy will be of similar construction.

Several options have been considered for the floor systems for the 3 storey section including reinforced and/or concrete band beams with varying column layouts. The preferred option however is a 2 way post tensioned concrete slab with edge beams. This solution provides the best outcome with regard to column positions and also allows for an uninterrupted ceiling space for the installation of services.

Lateral stability for the resistance of earthquake and wind loads is provided by reinforced concrete shear walls and lift/stair cores. The metal deck roof will be supported by steel framing.

No allowance is intended for any vertical expansion (additional floors) in the future.

APPENDIX A

GEOTECHNICAL INVESTIGATION REPORT

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

LYELL MCEWIN HOSPITAL
STAGE C REDEVELOPMENT
ELIZABETH VALE
GEOTECHNICAL INVESTIGATION

Wallbridge and Gilbert

06487AA-AC
15 October 2010

Coffey Geotechnics Pty Ltd ABN 93 056 929 483
14B Henley Beach Road Mile End SA 5031 Australia

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

15 October 2010

Wallbridge and Gilbert
60 Wyatt Street
ADELAIDE SA 5000

Attention: Mr Mark Winter

Dear Sir

RE: LYELL MCEWIN HOSPITAL
STAGE C REDEVELOPMENT
ELIZABETH VALE
GEOTECHNICAL INVESTIGATION

Please find enclosed our report on the geotechnical investigation undertaken for the above project.

Your attention is drawn to the enclosed sheet titled "*Important Information About Your Coffey Report*", which outlines the limitations of this report.

Should you require any further information or clarification regarding our report, please contact the undersigned.

For and on behalf of
Coffey Geotechnics Pty Ltd

Roger Grounds

Principal Geotechnical Engineer

Distribution: 2 copies Wallbridge and Gilbert (email & 1 bound)
1 copy Coffey Geotechnics Pty Ltd Library
Original Coffey Geotechnics Pty Ltd

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1 INTRODUCTION

A geotechnical investigation has been undertaken by Coffey Geotechnics Pty Ltd (Coffey) for the proposed Stage C redevelopment of Lyell McEwin Hospital at Elizabeth Vale.

The proposed redevelopment involves the construction of four new buildings designated Buildings A, B, C and D. The proposed buildings range from single storey to four storeys in height with a single basement level proposed for Building B. The locations of the proposed buildings are presented in Figure 1.

The purpose of the geotechnical investigation was to assess the geotechnical conditions at the site relevant to the design of footings, retaining walls and pavements for the proposed redevelopment.

The geotechnical investigation was commissioned by Mr Mark Winter of Wallbridge and Gilbert (W & G) in an email dated 26 August 2010. The scope and extent of the geotechnical investigation were broadly consistent with a proposal prepared by Coffey dated 20 August 2010 (reference facsimile 06487AAP).

This report describes the investigation undertaken and summarises the subsurface conditions encountered. Recommendations relating to the design of footings and pavements are presented in Section 4.

The results of previous geotechnical investigations conducted by Coffey at the Lyell McEwin Hospital have been referred to in the preparation of the report recommendations.

2 OUTLINE OF THE INVESTIGATION

2.1 Field Investigation

The field investigation was carried out on 13 and 14 September 2010 and comprised drilling 19 boreholes (denoted BH1 to BH19) to depths ranging from about 1.1 m (terminated due to underground services) to 8 m over the proposed building areas.

The majority boreholes were drilled with a 4WD mounted Ezi-Probe using geo-probe sampling techniques. BH19 was drilled using hand gear and continuous push tube sampling due to limited access. During the course of drilling, Standard Penetration Tests were conducted at selected depths in BH7, BH11 and BH13.

The borehole locations were positioned on site to provide a broad coverage of the proposed building area subject to restrictions imposed by underground services, parked cars and other surface features. The locations of the boreholes are shown approximately on Figure 2 (Building A), Figure 3 (Building B) and Figure 4 (Buildings C and D) and are also summarised in Table 1.

Due to the presence of numerous underground services in the vicinity of Building B a borehole could not be drilled in the southern portion of the proposed building footprint.

The field investigation was undertaken in the presence of a Geotechnical Engineer from Coffey who was responsible for locating the boreholes, logging the soil profile encountered and undertaking subgrade sampling for subsequent laboratory testing.

The soil profile encountered in the boreholes is described on the engineering logs contained in Appendix A. The logs are preceded by an explanation sheet that outlines the terms and symbols used in the preparation of the logs.

Table 1: Summary of Borehole Locations

Building	Boreholes
A	BH3 to BH5 & BH7 (4 m) BH1, BH2, BH6 (6 m)
B	BH12 (1.1m), BH14 (1.7 m), BH15 and BH16 (4 m) BH11 & BH13 (8 m)
C	BH9 (6 m), BH10 (4 m), BH19 (3 m)
D	BH17 & BH18 (4 m)

2.2 Laboratory Testing

Laboratory testing comprised Atterberg limits and particle size distribution on two selected subgrade samples and shrink-swell tests on three undisturbed tube samples collected from the site.

The estimated CBR of each subgrade sample was calculated based on the Atterberg limits and particle size distribution using a procedure adopted by the Department for Transport and Infrastructure (DTEI).

The laboratory testing was undertaken at Coffey's NATA registered Adelaide laboratory in accordance with the relevant sections of AS1289 "*Methods of Testing Soils for Engineering Purposes*" and DTEI Materials Testing Procedures.

The results of the laboratory testing are presented in Appendix B.

3 SITE CONDITIONS

3.1 General

The Lyell McEwin Hospital is located along John Rice Avenue at Elizabeth Vale.

At the time of the investigation most of the development area for Building A comprised a bituminous sealed car park. Numerous nature trees were present around the perimeter of the car park. The ground surface ranged from flat to slightly undulating with a general fall to the north and west.

Building B is located to the east of the recently constructed multi-level car park. The location of Building B was predominately occupied by an existing bituminous sealed car park, which was underlain by extensive underground services. A transportable building and landscaped garden area was located near the north-eastern corner of the site. A large tree had recently been removed from this area. The site had a fall to the north west.

The location of Building C is currently occupied by an existing single storey masonry building (Community Health Centre). The front of the building comprised a lawn area, whilst the rear comprised a garden area. The site was generally level.

The location of Building D was partly occupied by a lawn area and partly by a bituminous sealed parking area. The ground surface was relatively flat. A small tree was located in the lawn area.

3.2 Regional Geology

The natural soil profile at the site to a depth of a least 4 m is expected to comprise up to about 0.4 m of topsoil overlying red-brown and brown clays and sandy clays with interbeds of clayey sand. These soils are alluvial in origin and contain variable calcareous inclusions particularly between depths of about 0.5 m and 1.5 m.

The clays and clayey sands are typically of low and medium plasticity and of very stiff to hard consistency, although friable in places. The upper 0.5 m to 1.0 m of clay beneath the topsoil may be of medium and high plasticity.

The soils typically have a porous structure (high voids ratio) due to ancient worm holes which are up to about 6 mm in diameter in places. Plate bearing tests (conducted at a site approximately 1 km east of the Lyell McEwin Hospital) indicate that the behaviour of the soil under load and wetting is characteristic of a "collapse" mode of failure. On wetting, the structure of such soil can collapse allowing closure of the voids.

Groundwater is not expected to be encountered within the upper 6 m.

The Geological Survey of South Australia (1:50,000 Gawler sheet) indicates that the area is likely to be underlain by undifferentiated Quaternary deposits of soils and sediments of the Adelaide plains (Q) which typically comprise red brown clays of the Pooraka Formation overlying Hindmarsh Clay.

3.3 Subsurface Conditions

Descriptions of the materials encountered in the boreholes are presented on the engineering logs contained in Appendix A. The subsurface conditions are summarised for Building A, B, C and D in Tables 2, 3 and 4 respectively.

An explanation sheet which outlines the terms and symbols used in the preparation of the logs is also presented in Appendix A.

The subsurface conditions encountered at the site were in general agreement with those expected from the regional geology and previous data from the site. However, particularly sandy profiles with a greater proportion of coarse sandy paleochannels were encountered beneath the central portion of Building A.

3.4 Groundwater

Groundwater was not encountered during the investigation. Seasonal variations in groundwater level may occur.

In particular, it should be noted however that seepage could be encountered in the more permeable sandy and gravelly lenses of the Unit C2 alluvium beneath Building A.

Table 2: Summary of Subsurface Conditions for Building A

Unit	Depth Range (m)								Material Description
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8	
A	0 to 0.3	0 to 0.25	0 to 0.3	0 to 0.35	0 to 0.25	0 to 0.25	0 to 0.3	0 to 0.25	**FILL:** pavement comprising bituminous seal overlying quarry product. Quartzite 20 mm nominal particle size.
B	0.3 to 0.5	0.25 to 0.8	0.3 to 0.5	0.35 to 0.6	0 to 0.9	0.25 to 0.6	0.3 to 1.0	0.25 to 0.7	**CLAY:** medium to high plasticity, red-brown, stiff to hard consistency. Generally near plastic limit.
C1	0.5 to 2.0	0.8 to 2.4	0.5 to 4.0	0.6 to 4.0[1]	0.9 to 4.0	0.6 to 6.0	2.4 to 4.0	0.7 to 4.0	**CLAYEY ALLUVIUM:** clay and sandy clay, orange brown and brown, low to medium plasticity (mainly medium). Very stiff to hard consistency, although friable where dry. Generally calcareous to about 1.5 m. Contains sand interbeds and slightly porous structure in places. Generally less moist than the plastic limit.
C2	2 to 6.0	2.4 to 6.0	NE	NE	NE	NE	1 to 2.4	NE	**GRANULAR ALLUVIUM:** silty sand and clayey sand. Grading to gravelly sand or sandy gravel below a depth of about 5.0 m and 5.8 m in BH1 and BH2 respectively. Fine to coarse grained, orange brown. Some black organic matter. Dry. Medium dense or dense. SPT N-value of 45 recorded in BH7 at a depth of 1 m.
NOTES: [1] interbedded sand and clay below about 2.8 m. NE: Not encountered									

Table 3: Summary of Subsurface Conditions for Building B

Unit	Depth Range (m)						Material Description
	BH11	BH12	BH13	BH14	BH15	BH16	
A	0 to 0.5	0 to 0.35	0 to 0.4	0 to 0.25	0 to 0.4	NE	**FILL:** pavement comprising bituminous seal overlying quarry product. Quartzite 20 mm nominal particle size.
	0.5 to 0.6	0.35 to 0.95	0.4 to 1.0	0.25 to 0.85	NE	0 to 0.85	**FILL:** mainly sandy clay, medium plasticity, brown, fine to coarse grained. Some gravel. Locally clayey sand or gravelly sand. Mainly moist.
	NE	0.95 to 1.1[T]	NE	0.85 to 1.7[T]	NE	NE	**FILL:** trench backfill sand.
B	0.6 to 0.8	NE	1 to 1.3	NE	NE	0.85 to 1.8	**CLAY:** medium to high plasticity, red-brown, very stiff to hard consistency. Generally moister than plastic limit.
C1	0.8 to 5.5	NE	1.3 to 5.8	NE	0.4 to 4	1.8 to 4	**Upper Clayey ALLUVIUM:** clay and sandy clay, orange brown and brown, ranging from low to high plasticity although mainly medium plasticity. Stiff to hard consistency, although friable where dry. Generally calcareous to about 1.5 m. Slightly porous structure in places and contains local sandy lenses. Generally moister than than plastic limit. SPT n-values ranged from 6 to 23, with lower N-values in BH11. Clayey sand and gravelly sand paleochannel observed below 2 m in BH15.
C3	5.5 to 8	NE	5.8 to 7.85	NE	NE	NE	**Lower Clayey ALLUVIUM:** clay and sandy clay, orange brown, brown and red brown with trace black speckle. Fine grained sand. Hard consistency. SPT N-values of 26, 36, 40 and over 50 recorded.
NOTES: T = Borehole terminated. NE: Not encountered.							

The fill encountered in BH12 and BH14 was assessed comprise pavement materials and fill associated with trench backfill around underground services. In the absence of construction records the fill is judged to be non engineered.

The results of Standard Penetration Tests conducted during borehole drilling in the footprint of Building B are presented in Figure 5. The SPT N values typically ranged from about 6 to 7 in the upper 5 m in BH11, indicating that the clay is of stiff consistency. Higher N-values were recorded in BH13. Below about 4.5 m to 6 m SPT N values ranged from about 23 to refusal indicating the clays were of hard consistency.

Table 4: Summary of Subsurface Conditions for Buildings C & D

Unit	Depth Range (m)					Material Description
	BH9	BH10	BH19	BH17	BH18	
A	NE	NE	0 to 0.7*	NE	0 to 0.35	FILL: pavement comprising bituminous seal overlying quarry product. Quartzite 20 mm nominal particle size. *Wood chips (0.1 m thick) overlying possible fill of sandy clay
	0 to 0.1	0 to 0.25	NE	0 to 0.6	0.35 to 0.4	**SURFICIAL SOILS/ TOPSOIL:** sandy clay and clay, brown, low to medium plasticity, fine to medium grained sand
B	0.3 to 1.6	0.25 to 0.8	0.7 to 1.5	0.6 to 1.4	0.4 to 0.9	**CLAY:** medium to high plasticity, red-brown, mainly very stiff or hard consistency, locally reducing to stiff. Generally moister than plastic limit. Locally gravelly in BH19
C1	1.6 to 6	0.8 to 4	1.5 to 3	1.4 to 4	0.9 to 4	**Clayey ALLUVIUM:** clay and sandy clay, orange brown and brown, ranging from low to high plasticity although mainly medium plasticity. Stiff to hard consistency, although friable where dry. Generally calcareous to about 1.5 m. Slightly to highly porous structure in places and contains local sandy lenses. Generally moister than plastic limit.
NOTES: NE: Not encountered.						

It was noted that the soil samples from BH19 (garden bed area) were in a relatively moist to wet condition in upper portion probably due to the presence of nearby irrigation.

4 GEOTECHNICAL ASSESSMENT

4.1 General

It is understood that the proposed redevelopment will comprise four new buildings as summarised in Table 5.

Table 5: Proposed Buildings

Building	Size
A	2 or 3 storeys
B	2 or 4 storeys, single basement (4.7 m deep)
C	1 or 3 storeys
D	Single storey

It is envisaged that buildings A, C and D will be supported on a stiffened raft footing system with enlarged integral pads where higher loads occur. Building B will be supported by isolated spread footings.

4.2 Site Characteristics

4.2.1 Site Classification

Based on the varying subsurface conditions encountered across the different building areas the soil profiles are expected to range from slightly reactive (predominately granular alluvium) to moderately and highly reactive (predominantly cohesive alluvium).

The results of shrink-swell tests on three samples recovered from the boreholes are summarised in Table 6.

Table 6: Summary of Shrink-swell results

Location	Building	Material Description	Shrink-Swell Index (I_{ss}, %)
BH9 (0.6 to 0.75 m)	Building C	CLAY, high plasticity (CH)	2.5
BH11 (1.5 to 1.8 m)	Building B	CLAY, low plasticity (CL)	0.7
BH13 (1.5 to 1.8 m)	Building B	CLAY / SANDY CLAY, medium plasticity (CL)	0.7

Based on the laboratory test results, a visual-tactile assessment and previous investigations by Coffey nearby, the red brown clays (Unit B) of medium to high plasticity are assessed to have a shrink-swell index of up to about 3%. Shrink-swell indices ranging between about 1% and 1.5% are considered appropriate for the clay and sandy clay alluvium (Unit C1), whilst the clayey sand with low to medium plasticity fines (Unit C2) is assessed to have a shrink-swell index of about 0.5%. The gravelly sand and sand lenses are considered to be essentially non reactive.

The estimated y_s values (rounded to the nearest 5 mm) for each borehole and building are presented in Tables 7. The range in y_s values typically reflects the variation in thickness and occurrence of less reactive granular alluvium and the range in plasticity of the alluvial clays.

Table 7: Summary of estimated y_s values in Buildings A, B, C and D

Building A		Building B		Building C	
Borehole	**Estimated y_s value (mm)**	**Borehole**	**Estimated y_s value (mm)**	**Borehole**	**Estimated y_s value (mm)**
BH1	30	**BH11**	30	**BH9**	50
BH2	30	**BH12**	P*	**BH10**	40
BH3	30	**BH13**	35	**BH19**	45
BH4	25	**BH14**	P*	**Building D**	
BH5	30	**BH15**	25	**BH17**	35
BH6	40	**BH16**	45	**BH18**	40
BH7	25	Note:* = Class P (Problem site) due to presence of fill*			
BH8	40				

Based on the design soil suction change profile for Adelaide presented in AS 2870-1996 *"Residential slabs and footings - Construction"*, a characteristic surface movement (y_s) ranging from about 25 mm up to about 55 mm is expected over the proposed building areas assuming that the site remains at the current ground surface level.

Accordingly the following site classifications for each building are generally considered appropriate based on reactive soil movements:

- Building A: CLASS M-D (Moderately reactive with deep moisture changes).
- Building B and C: CLASS H-D (Highly reactive with deep moisture changes).*
- Building D: CLASS M-D (Moderately reactive with deep moisture changes).

*NOTE: * Due to the presence of sandy clay fill to depths greater than 0.4 m in BH12 and BH14 a classification of Class P would apply. However, it is expected that this material will be removed as part of the basement excavation works.*

Where final site levels vary by more than about 0.3 m from the current ground level (either cut or fill) a further assessment of the potential shrink-swell movements is required.

Should future moisture content changes in the soil exceed the design moisture change reported in AS2870, a larger y_s value may occur. Such changes could occur adjacent to leaking water services or where the soils are desiccated by tree roots. The above y_s value does not include any allowance for the effects of desiccation by any trees.

Where a single tree is located a distance of three quarters of its mature height from the proposed building, the predicted characteristic surface movement (y_{st}) may increase to about 70 mm, based on a locally adopted method of analysis. Different ground surface movements would be predicted for other tree positions and further advice must be sought as appropriate.

Shrink-swell movements beneath the basement floor in Building B would be expected to be less than 15 mm provided that:

- the soils below the basement slab are protected from future moisture changes, including moisture infiltration (e.g. from around retaining walls), or desiccation by tree roots;
- the soils in the basement excavation are exposed for only a short period during construction and moisture changes in the exposed soils are minimised. This would require the application of a blinding layer of lean mix or quarry rubble (regularly wetted during warm weather) and good drainage control measures to prevent ponding during periods of wet weather

4.2.2 Site Factor

Bedrock is not expected to occur within the upper 30 m of the soil profile.

Using a Classification System presented in AS1170.4-2007 *"Structural design actions Part 4: Earthquake actions in Australia"*, it is assessed that the site sub-soil class would be Class De (Deep soil).

4.3 Footing Design

4.3.1 Footing Systems

At the time of reporting footing loads were not known for Buildings A, C and D, although it is understood that a stiffened raft footing system with integral pads has been adopted by W & G in the preliminary design. Such footings systems are considered appropriate provided all the existing non-engineered fill and topsoil is removed and footings are founded in the natural soils.

The main geotechnical issues associated with the design of footings for the proposed buildings are the lower undrained shear strength encountered below a depth of about 2 m boreholes beneath Building B and the weaker near surface soils beneath Building C.

Bored piles are generally not expected to be required and are unlikely to be suitable where sandy and gravelly lenses are present such as in Building A. Such granular layers would cause instability in any pile shafts. Isolated bored piers could be adopted where a greater thickness of fill is present or footings need to be taken deeper in areas where a basement is being adopted, such as Building B.

Continuous flight auger piles or possibly driven piles (subject to consideration of vibrations during pile driving) could be considered as suitable pile types. Further advice on piles should be sought if this footing system is considered necessary from a structural viewpoint.

4.3.2 Buildings A, C and D

For buildings A, C and D it is recommended that a stiffened raft footing system be designed using the engineering principles outlined in AS2870 based on the site classifications, y_s values and maximum allowable bearing pressures presented in Table 8.

Table 8: Summary of estimated y_s values and bearing pressures for Buildings A, C and D

Building	y_s value (mm)	Site Classification (AS2870)	Maximum allowable bearing pressure* (kPa)
A (BH1 to BH8)	40	Class M-D	175
C (BH9, BH10, BH19)	50	Class H-D	125
D (BH17 and BH18)	40	Class M-D	175
Note: * Maximum allowable bearing pressure apply to perimeter and internal footing beams be founded on undisturbed, natural clays of at least very stiff consistency at a minimum founding depth of about 0.6 m below the design ground level.			

A soil swell stiffness of 1000 kPa/m is recommended for the design of the raft.

Footings must not be founded on non-engineered fill, organic topsoil or disturbed or softened natural soils. Where such materials are encountered at the design founding level footing excavations must be deepened.

4.3.3 Building B - Basement

Building B would be supported by isolated spread footings founded below the 4.5 m deep basement as well as higher level spread footings located outside the basement.

The spread footings in the basement are up to about 4 m square with working loads of up to about 4700 kN. It has been assumed that the footings would be founded at a depth of approximately 1.0 m below the basement level (approximately 5.5 m below the existing ground surface level). At this depth spread footings are likely to be generally founded in sandy clay and clay (Unit C3) of very stiff or hard consistency.

Pad or strip footings founded in very stiff to hard clay at a depth of about 5.5 m may be proportioned on the basis of a maximum allowable bearing pressure of 250 kPa. It is noted that the undrained shear strength of the clay is markedly lower above a depth of about 5.5 m in BH11 and therefore a lower allowable bearing pressure may need to be adopted if footings are founded shallower than about 5.5 m.

The elastic (immediate) settlements presented in Table 9 have been estimated for selected footings in the basement of Building B uniformly loaded to the maximum allowable bearing pressure of 250 kPa.

Table 9: Estimated Elastic Settlement for Spread Footings - Building B Basement

Footing Size (m)	Estimated Elastic Settlement (mm)
3 by 3	10
4 by 4	10 to 15
1.2 by 10	10
5 by 5	15 to 20

Differential settlement resulting from soil variability beneath footings of similar size and bearing pressure is likely to be of the order of one half of the predicted settlements in Table 9.

The long-term total settlement of the footings is not expected to exceed the elastic settlements reported in Table 9 by more than about 30%. It would be expected that the majority of the settlement would occur during the construction period with only relatively small total and differential settlement expected after construction.

Where settlements of the above magnitude are not acceptable lower bearing pressures would need to be used or a piled foundation system adopted. For design purposes, it may be assumed that for a given footing size the elastic settlements will be directly proportional to the bearing pressure for bearing pressures up to 250 kPa. The option of reducing the bearing pressure and increasing the footing size may not necessarily reduce total settlement.

Footings must not be founded on non-engineered fill, organic topsoil or disturbed or softened natural soils. Where such materials are encountered at the design founding level footing excavations must be deepened.

4.3.4 Building B – high level

The design of spread footings founded above the basement excavation would need to consider a number of geotechnical factors. These include:

- the presence of non-engineered fill associated with existing underground services;
- the variations in undrained shear strength of the clays both laterally and vertically;
- the presence of backfill adjacent to the retaining wall. It is recommended that footings be founded entirely in natural soil outside the zone of backfill around the retaining wall and preferably at least 0.6 m below the temporary cut batter. A reduction in strength of the natural soils may occur near the temporary cut batter due to such factors as stress relief, disturbance during excavation and moisture content changes during construction;
- the lateral loading applied to the retaining wall by footings in close proximity. It is preferable that all footings are located below an imaginary line inclined upwards at 40 degrees to the horizontal from the rear base of the retaining wall. This may require some footings to be founded deeper.

In view of the above considerations it is recommended that pad or strip footings founded above the basement excavation be proportioned on the basis of a maximum allowable bearing pressure of 150 kPa. This assumes that the footings are founded at least 0.6 m below the temporary cut batter (or pre-existing ground surface) in clay of at least very stiff consistency and that all backfill placed behind the retaining wall is engineered and compacted to a dry density ratio of at least 98% based on Standard compaction (AS1289 5.1.1).

For spread footings up to 3 m wide the elastic settlement is unlikely to exceed 25 mm, with a differential settlement of around 15 mm. Further settlement analyses are recommended as part of the final design for specific footings.

Footings must not be founded in softened or disturbed natural soils or non-engineered fill. Where such materials are encountered at the design founding level, footings would need to be founded deeper.

4.3.5 Footing Construction Issues

Care should be taken during construction to prevent water from ponding in the base of any footing excavation. The ponding of water could result in softening of the foundation soils and additional post construction settlement. It is recommended that a blinding layer of lean mix concrete be placed in the base of all footing excavations to reduce moisture content variations in the foundation soils during construction.

It is recommended that the base of all footing excavations be observed by a suitably experienced Engineer to check that the conditions exposed are consistent with the design assumptions. Footings must not be founded in non-engineered fill, organic topsoil or softened natural soil.

4.4 Floor Slabs – Building B

In basement excavations it is recommended that the concrete floor slab be cast directly in contact with the natural soils or temporary working surface, with the provision of a moisture vapour barrier where required. Underfloor drains or granular drainage layers are not recommended, as they increase the potential for migration and retention of water beneath the building, which may result in softening or heaving of the subgrade and a loss of serviceability to the floor slab.

The detailing of the floor slab must cater for shrink-swell movements in the foundation soils as discussed in Section 4.2.1.

Floor slabs may be designed based on an average Young's Modulus value of 15 MPa for the medium to high plasticity clay.

Structurally independent floor slabs must be detailed to permit relative movement between spread footings due to shrink-swell effects of load induced settlement of spread footings. The potential for lipping at perimeter doorways must be considered and partitions or other components supported on the floor slab are expected to move differentially relative to the main structural elements, and connections should be detailed to permit such movements.

4.5 Retaining Wall Design – Building B

Retaining walls in areas with a basement are anticipated to be up to about 4.5 m in height. Over this depth range, the walls would mainly retain fill, clay and sandy clay. Groundwater is not expected to be encountered above a depth of about 8 m, however seepage may be encountered from the gravel and sand layers during periods of rainfall which may adversely affect the construction of footings in the basement.

It is understood that the permanent retaining wall will be constructed in front of a battered excavation rather than temporary support (such as a near contiguous wall) provided prior to excavation.

Careful consideration will need to be taken of allowable lateral movements where existing buildings are located near to the basement excavation. The existing buildings could be adversely affected should lateral movements become excessive.

Excavations are unlikely to stand vertically without adequate support and therefore temporary excavations will need to be battered. The following temporary batter slopes are recommended:

- Non-engineered granular fill and topsoil: 2H:1V (or flatter);
- Natural sandy clay or clay of at least very stiff consistency: 1H:1V;
- Natural sandy or gravelly lenses: 1.5H:1V (or flatter).

The fill and natural soils will be susceptible to scour and erosion by water and therefore adequate surface drainage must be provided to prevent water flowing down the cut batter face. In addition the batter must be protected against moisture changes by use of PVC sheeting or shotcrete.

Flatter temporary batter slopes would be required where groundwater seepage is encountered.

The conditions exposed in the cut batters must be checked by a Geotechnical Engineer during construction to confirm that the above batter slopes are appropriate.

For the design of permanent, flexible cantilevered retaining structures the active earth pressure coefficients presented in Table 10 may be adopted.

Table 10: Design Parameters for Flexible Retaining Walls

Layer	Typical Depth Range (m)	K_a	K_o	Bulk Density (kN/m^3)
Unit A - Fill	0 to 0.5 m to >1.7*	0.33	0.5	19
Unit B - Red-Brown Clay	0.5 to 1.5	0.45	1	19.5
Unit C - Alluvium	1.5 to 8	0.4	0.8	20

Notes:

* depth of fill not proven in vicinity of underground services

1) K_a = active earth pressure coefficient, K_o = at rest earth pressure coefficient.

2) The retaining wall must also consider surcharge loadings applied on the ground surface behind the wall and horizontal loads from adjacent footings whereby they are founded above the base of the retaining wall.

For rigid or fully braced retaining walls or for a contiguous piled wall installed prior to excavation of the basement further advice must be sought.

Where retaining walls have significant backfill placed after construction, it is expected that the compaction induced pressures will be much greater than the above active earth pressures.

The compaction equipment used to compact backfill behind the wall must be carefully selected and preferably light-weight compaction equipment should be used. The load on the retaining wall due to compaction equipment may be estimated from Figure J5 in AS4678-2002 "Earth Retaining Structures". For select compacted granular backfill, a typical active coefficient, K_a of 0.3 and an at rest coefficient, K_o of 0.45 are suggested together with a bulk density of 20 kN/m^3.

In general, retaining walls should be designed in accordance with the recommendations of AS4678-2002 "*Earth Retaining Structures*".

The design of the retaining wall would also need to consider (as appropriate):

- any surcharge loadings (e.g. new or existing footings or traffic) behind the wall;
- the provision of surface and subsurface drainage to prevent the build-up of excess hydrostatic pressures behind the retaining wall.

The footings of adjacent buildings may require some form of temporary support (such as underpinning) depending upon their type, founding depth and geometry. Where existing footings are founded at a higher level than the base of any excavation and are located above an imaginary plane inclined upwards at 40° from the toe of the excavation, underpinning of such footings would need to be undertaken. Existing footings located beyond a distance equal to the depth of the excavation should not require underpinning provided the excavation is adequately battered during construction and a permanent retaining structure is provided to control lateral soil movement.

Retaining wall footings would be founded at a depth of approximately 1.0 m below the basement level (approximately 5.5 m below the existing ground surface level) in sandy clay and clay of very stiff or hard consistency. Such footings may be proportioned on the basis of a maximum allowable bearing pressure of 150 kPa, assuming that the applied loading is slightly eccentric.

4.6 Flexible Pavement Design

Following completion of the site preparation methods outlined in Section 4.3, it would be expected that pavement subgrade would generally consist of red-brown clay of medium to high plasticity. The results of the two laboratory estimated tests undertaken on samples of likely subgrade materials are presented in Table 11.

Table 11: Summary of Laboratory CBR Tests

Location	Depth (m)	Material	Estimated CBR (%)
BH3	0.3 to 0.55	CLAY, medium to high plasticity, red-brown	9
BH10	0.3 to 0.5	CLAY, high plasticity, red-brown	4

It is considered that flexible pavements founded on clay of high plasticity may be proportioned on the basis of a design CBR of 4%. The design CBR value assumes that:

- non-engineered fill materials are initially stripped and the upper 200 mm of the underlying subgrade is compacted to achieve a dry density ratio of at least 98% based on Standard compaction (AS1289 5.1.1);
- the pavement is adequately drained to prevent saturation of the pavement materials and underlying subgrade.
- field testing is undertaken on subgrade and pavement materials during construction to ensure compliance with the above recommendations.

Pavements should be placed as soon as practicable after preparation of the subgrade to avoid wetting and resultant softening of the subgrade materials, or allowed to dry out if they do become saturated.

Further advice regarding pavement design can be provided once the design traffic loadings are known.

4.7 Construction Issues

4.7.1 Site Preparation

Fill (pavement materials) was encountered in the majority of boreholes (Building, A, C and D) to depths ranging between about 0.25 m and 0.35 m. In the absence of construction records, the fill is assumed to be non-engineered.

Deeper fill, encountered to depths ranging to between about 0.6 m and 1.7 m (base not proven), was also encountered in the proposed area for Building B. The fill was either associated with pavement subgrade materials or with service trenches. The majority of this fill is expected to be removed as part of the excavation for the basement.

It is recommended that any non-engineered fill, including the pavement material, be stripped from the proposed building and pavement areas. Stripping to depths ranging from about 0.15 m to 0.35 m (Buildings A, C and D) or about 0.6 m to greater than 1.7 m (Building B) is likely to be required based on the borehole drilling but the required depth of stripping must be confirmed during construction.

Following stripping the exposed natural surface should be proof-rolled with a vibrating pad foot roller of at least 10 tonnes static weight to identify any soft, wet or weak areas. Any soft, wet, weak or organic materials encountered during proof rolling must be removed and replaced with compacted select fill. The proof rolling should be observed by a suitably experienced Engineer.

Site won pavement materials from excavations could be used as engineered fill. In this regard, engineered fill must be conditioned to within about 2% of the optimum moisture content and compacted in layers not exceeding 200 mm in loose thickness to achieve a dry density ratio of at least 95% based on Standard compaction (AS1289 5.1.1) beneath building areas and 98% Standard beneath pavement areas. Pockets of oversized materials, organic material (if present) and potentially deleterious materials must be removed from the fill prior to re-use.

Select fill required to achieve design levels should comprise quarry sand, quarry waste or quarry rubble material with soaked CBR of at least 15%. The fill should be compacted in layers not exceeding 250 mm in loose thickness to achieve a dry density ratio of at least 95% based on Modified compaction (AS1289 5.2.1).

During compaction, care should be taken to avoid damage to the adjacent buildings as a result of vibrations from compaction equipment.

4.7.2 Excavatability

The natural soils encountered in the boreholes to a depth of at least 8 m are expected to be generally excavatable using conventional earthmoving equipment such as backhoes and excavators.

Dewatering of excavations is generally not expected to be required. Local dewatering will be required where a perched groundwater table is encountered in gravelly or sandy layers.

Based on the borehole drilling, groundwater is not expected to be encountered with the proposed basement excavation, although localised perched groundwater may be encountered during extended wet periods.

4.7.3 Trafficability

Trafficability of the medium to high plasticity clay is expected to be poor when wetted.

4.7.4 Footing Observations

It is recommended that the base of all spread footing excavations be observed by a suitably experienced Engineer to check that the conditions exposed are consistent with the design assumptions. Footings must not be founded in non-engineered fill, organic topsoil or softened natural soil.

It is recommended that the base of all bored piles be carefully observed by a suitably experienced Engineer to confirm that the foundation materials have geotechnical properties consistent with the design assumptions and to check base and shaft cleanliness.

4.7.5 Moisture Control

Care must be undertaken during construction to prevent desiccation or moisture ingress to the clay soils exposed in the basement or footing excavations. The ponding of water could result in softening and increased settlement of the footing, whilst desiccation could result in post-construction swelling movements.

It is considered essential that the soils exposed in the base of footing excavations be covered with a blinding layer of lean mix concrete to assist in reducing moisture content variations during construction.

The basement excavation should be promptly covered with lean mix or granular sub-base (at least 250 mm thick) to reduce desiccation effects. The sub-base layer should be kept moist during construction.

Any batter slopes should be promptly sprayed with bituminous emulsion or covered in plastic sheeting to assist in moisture retention.

4.7.6 Other Issues

The effects on adjacent properties of construction activities such as, vibrations during compaction, excavation works and changes in the soil moisture regime near the site boundary must be considered. Dilapidation surveys and regular monitoring during construction of any adjacent settlement sensitive structures are strongly recommended.

Further advice on mitigating potentially damaging construction activities on adjacent structures can be provided if required.

4.8 Landscaping, Drainage and Site Maintenance

It is recommended that the landscaping, drainage and future maintenance of the site be in accordance with the recommendations of AS2870 and the CSIRO Information Sheet BTF-18. In particular, the following should be noted:

- appropriate perimeter paving must be provided around the structures;
- stormwater and surface run-off must not be allowed to pond adjacent to footings. Roof stormwater should be piped to the street or an approved disposal area;
- trees and shrubs should be carefully selected and located to minimise desiccation effects.
- all underground service connections to the structures should be designed to accommodate the expected shrink-swell movements in the soils.

5 ADDITIONAL SERVICES

It is recommended that an experienced Geotechnical Engineer review plans and specifications that affect or are affected by geotechnical issues to help assure proper interpretation of the geotechnical findings and recommendations.

We are pleased to offer our services for additional investigations, review of plans and specifications, as well as inspections of footing excavations and earthworks quality control testing during construction.

6 LIMITATIONS

The findings contained within this report are the result of limited investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

For and on behalf of
Coffey Geotechnics Pty Ltd

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

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Important information about your **Coffey** Report

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.
Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

*. For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters, Canberra, 1987.

Figures

N

Scale (metres)

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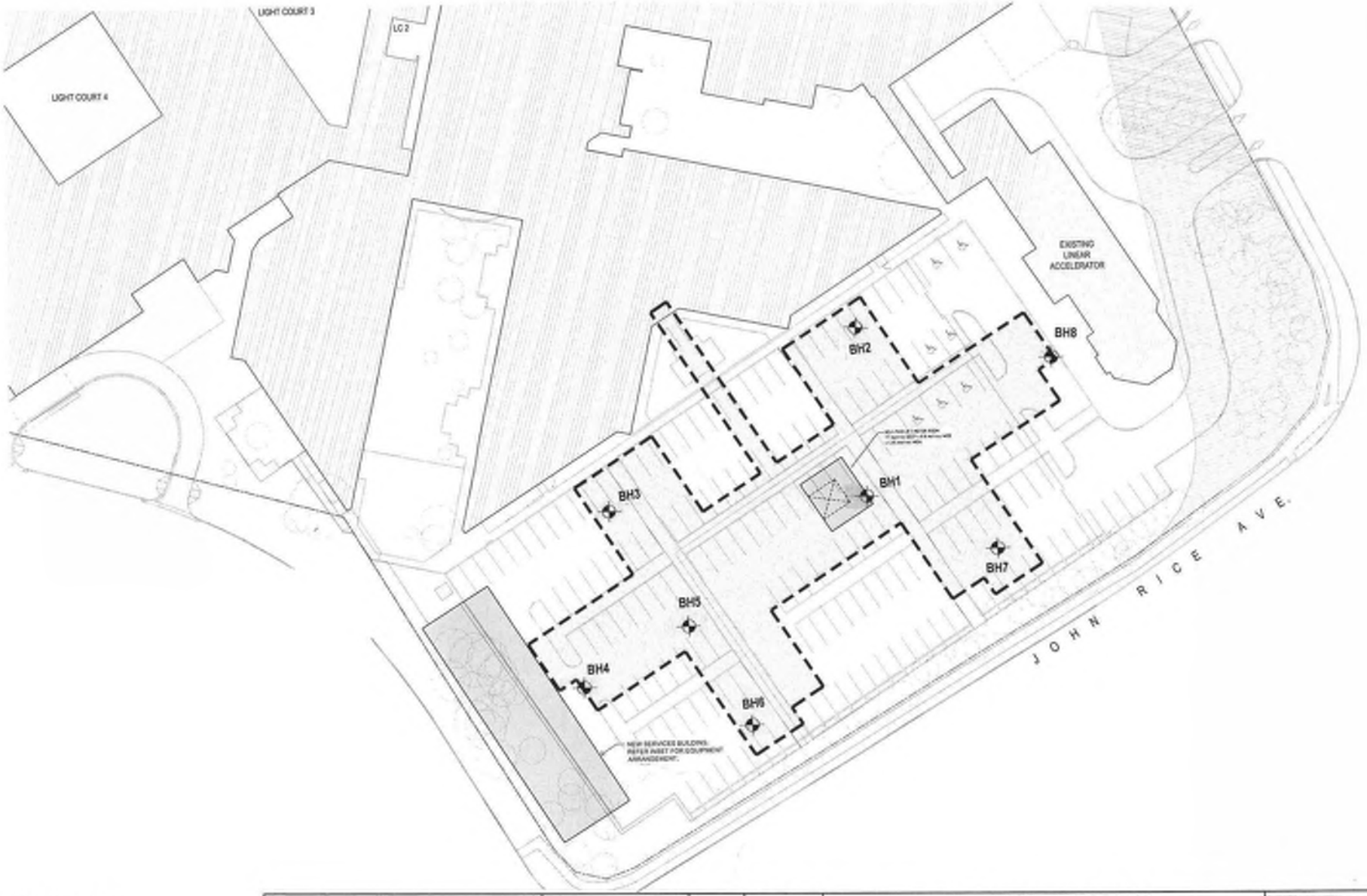
Drawn	LDR
Approved	
Date	15-Sep-10
Size	A3

WALLBRIDGE AND GILBERT
LYELL McEWIN HOSPITAL - STAGE C
ELIZABETH VALE
SITE PLAN

Drawing Number:
FIGURE 1

Job Number:
06487AA

F:\GEOTECHNICS\06400-06499\06487AA\[06487AA Figure 1.xlsx]A3 Landscape



Borehole locations are approximate only

Scale (metres)

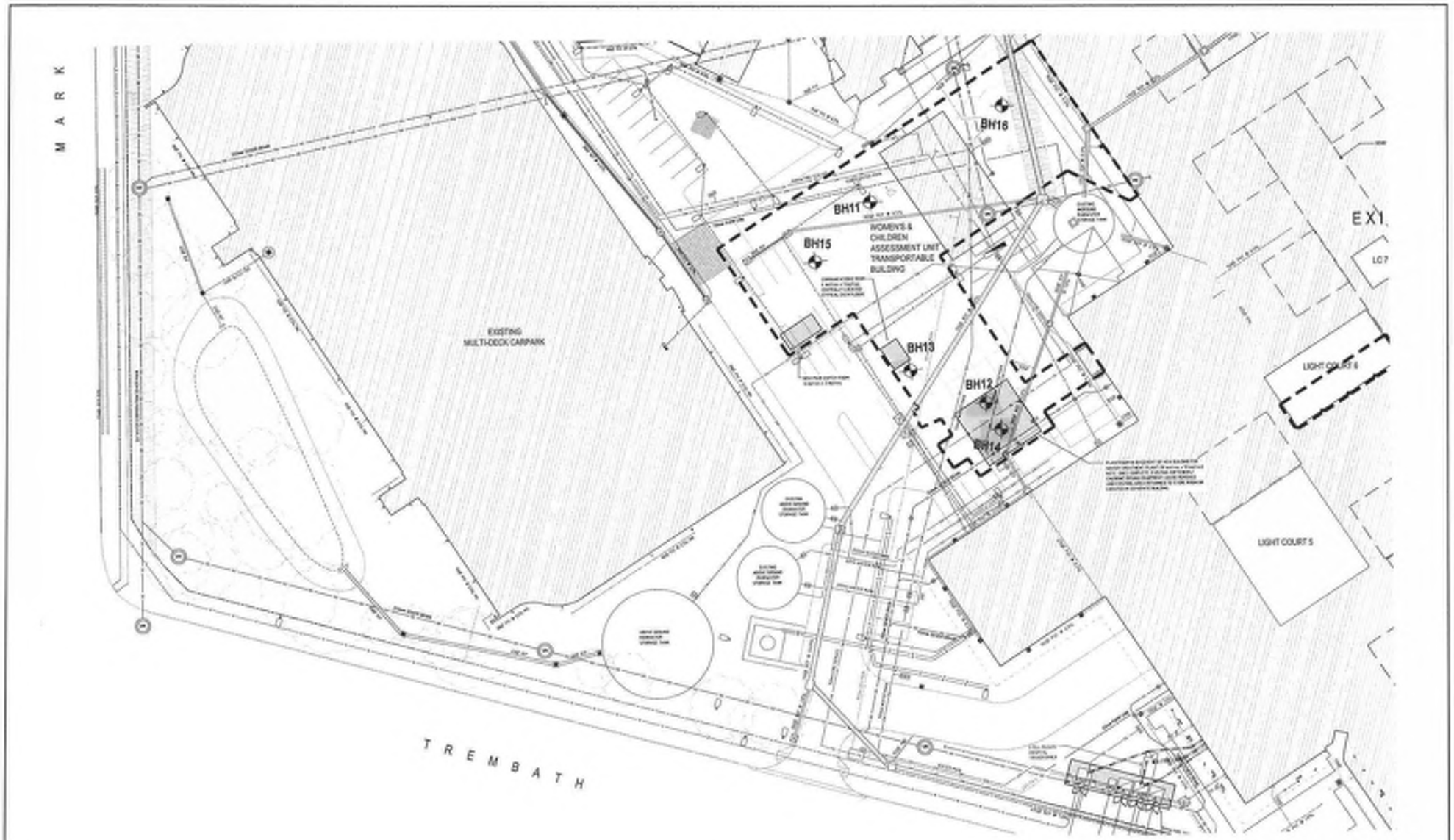
coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Drawn	LDR
Approved	
Date	15-Sep-10
Size	A3

WALLBRIDGE AND GILBERT
LYELL McEWIN HOSPITAL - STAGE C
PROPOSED BUILDING A - ELIZABETH VALE
BOREHOLE LOCATION PLAN

Drawing Number: FIGURE 2
Job Number: 06487AA

F:\GEOTECH\NC\609400-064999\06487AA\[06487AA Figure 2.xlsx]A3 Landscape



Borehole locations are approximate only

Scale (metres)

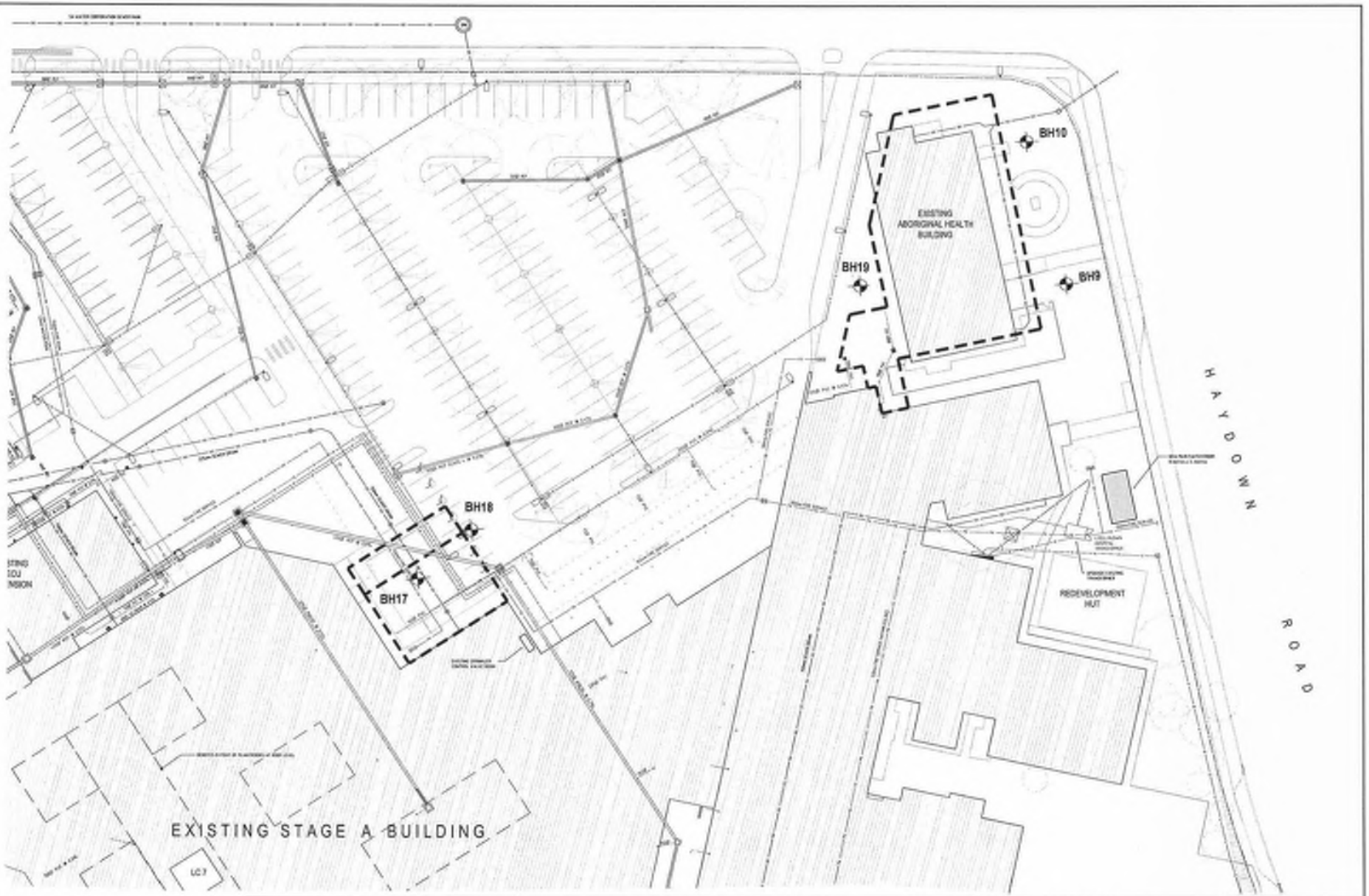
coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Drawn	LDR
Approved	
Date	15-Sep-10
Size	A3

WALLBRIDGE AND GILBERT
LYELL McEWIN HOSPITAL - STAGE C
PROPOSED BUILDING B - ELIZABETH VALE
BOREHOLE LOCATION PLAN

Drawing Number: FIGURE 3
Job Number: 06487AA

F:\GEOTECHNICS\06400-06499\06487AA\[06487AA Figure 3.xlsx]A3 Landscape



Borehole locations are approximate only

Scale (metres)

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

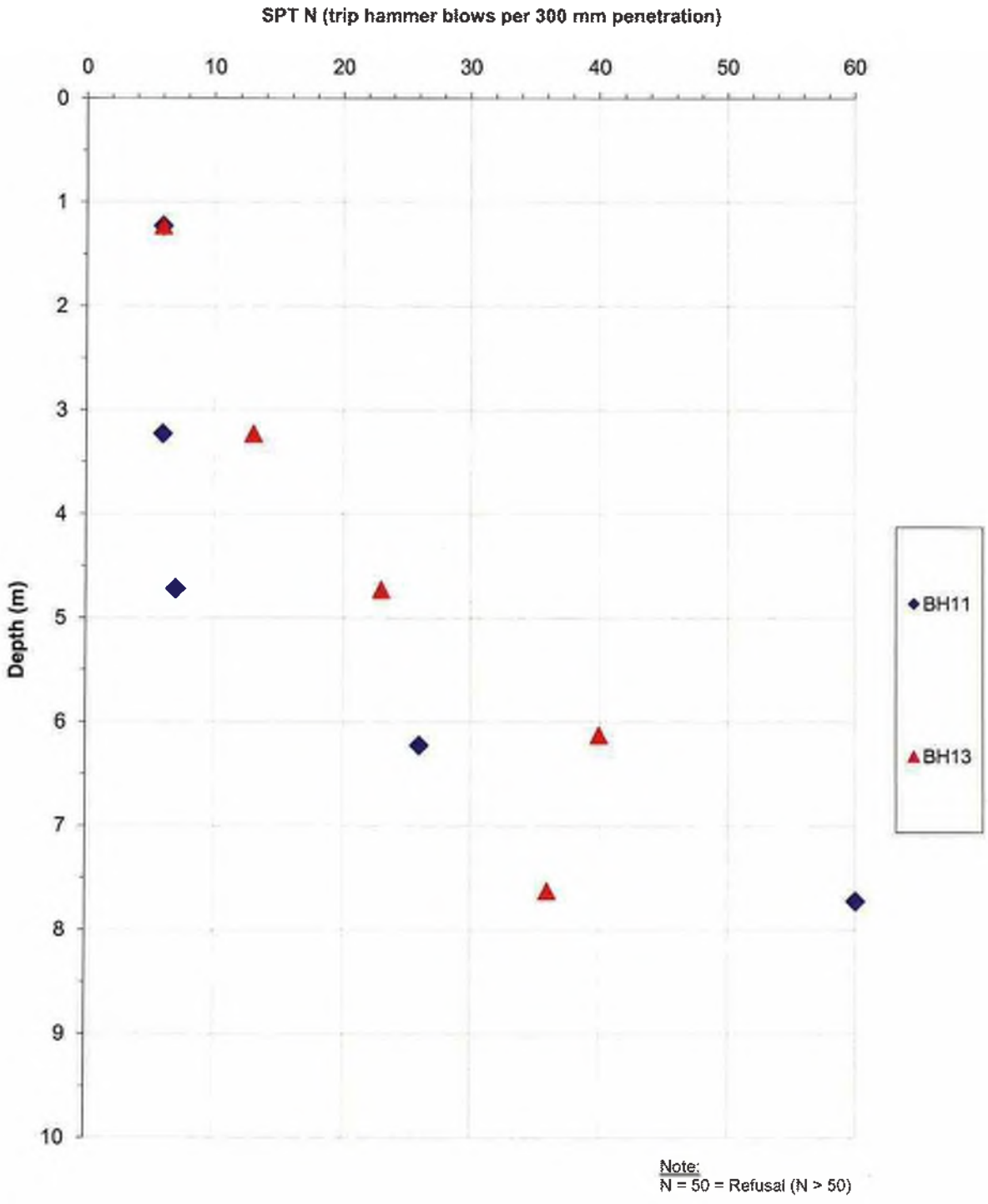
Drawn	LDR
Approved	
Date	15-Sep-10
Size	A3

WALLBRIDGE AND GILBERT
LYELL McEWIN HOSPITAL - STAGE C
PROPOSED BUILDING D & C - ELIZABETH VALE
BOREHOLE LOCATION PLAN

Drawing Number: FIGURE 4
Job Number: 06487AA

F:\GEOTECHNICS\06400-06499\06487AA\[06487AA Figure 4.xlsx]A3 Landscape

SPT N with Depth



Note:
N = 50 = Refusal (N > 50)

Drawn	MT
Approved	
Date	17-Sep-10
Scale	AS SHOWN
Size	A4

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WALLBRIDGE AND GILBERT
LYELL MCEWIN HOSPITAL, STAGE C
ELIZABETH VALE
SUMMARY OF STANDARD PENETRATION DATA

Job no: 06487/AA | Drawing Number: FIGURE 5

F:\GEOTECHNICS\PROJECTS\06400-06499\06487AA\[Figure 5 SPT plot v depth.xls]A4 Portrait SPT Depth Plot

Appendix A

Results of the Field Investigation

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Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 μm to 2.36 mm
	medium	200 μm to 600 μm
	fine	75 μm to 200 μm

MOISTURE CONDITION

Dry Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	-	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil	Deposited by wind.
Alluvial soil	Deposited by streams and rivers.
Colluvial soil	Deposited on slopes (transported downslope by gravity).
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes.
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.

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Soil Description Explanation Sheet (2 of 2)

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)								USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(About the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.				GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.				GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)				GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)				GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes				SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.				SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).				SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).				SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)		IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.						
				DRY STRENGTH	DILATANCY	TOUGHNESS			
		SILTS & CLAYS Liquid limit less than 50		None to Low	Quick to slow	None		ML	SILT
				Medium to High	None	Medium		CL	CLAY
				Low to medium	Slow to very slow	Low		OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50		Low to medium	Slow to very slow	Low to medium		MH	SILT
				High	None	High		CH	CLAY
				Medium to High	None	Low to medium		OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS		Readily identified by colour, odour, spongy feel and frequently by fibrous texture.						Pt	PEAT

• Low plasticity – Liquid Limit w_L less than 35%. • Medium plasticity – w_L between 35% and 50%. • High plasticity – w_L greater than 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

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Engineering Log - Borehole

Borehole No.	**BH1**
Sheet	1 of 1
Project No:	**06487AA**
Client:	**WALLBRIDGE AND GILBERT**
Date started:	**13.9.2010**
Principal:	
Date completed:	**13.9.2010**
Project:	**LYELL McEWIN HOSPITAL, STAGE C**
Logged by:	**MT:rn**
Borehole Location:	**REFER TO FIGURE 2**
Checked by:	

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed						**FILL: ASPHALTIC CONCRETE:** (15 mm thick) overlying **QUARRY PRODUCT:** quartzite (20 mm nominal size).	D			FILL, bituminous seal
									FILL: CLAY / SANDY CLAY: medium to high plasticity, red brown, fine to coarse grained sand, trace calcrete.	>Wp			Probable FILL
								CL	**SILTY CLAY:** low to medium plasticity, red brown, some fine to medium grained sand.	<Wp	Fb / VSt		NATURAL
						1		CL / CH	**CLAY / SANDY CLAY:** medium to high plasticity, red brown and orange brown, fine to coarse grained sand.	<Wp	H		
									trace calcareous mottle.				
									trace brown mottle.				
						2		CL	grading medium plasticity and siltier.				
								SC	**CLAYEY SAND:** fine to coarse grained, orange brown, medium plasticity fines, locally grading to sandy clay, trace fine to medium grained sub-rounded to sub-angular quartz gravel.	D	MD		paleochannel
						3							some sandy clay interbeds
						4			grading coarser.				
									trace dark brown organic mottle, sandy clay layer (150 mm thick).				
						5		GP / SP	**GRAVELLY SAND / SANDY GRAVEL:** fine to coarse grained sand, fine to medium grained sub-angular gravel, orange brown, some silty clay interbeds (typically <200 mm thick) with black organic mottle.				some sandy clay interbeds
													>500 kPa, moist, silty clay interbed
						6			increasing coarse grained gravel.				
									Borehole BH1 terminated at 6m				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

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Engineering Log - Borehole

Borehole No.	**BH2**
Sheet	1 of 1
Project No:	**06487AA**
Client:	**WALLBRIDGE AND GILBERT**
Date started:	**13.9.2010**
Principal:	
Date completed:	**13.9.2010**
Project:	**LYELL McEWIN HOSPITAL, STAGE C**
Logged by:	**MT:rm**
Borehole Location:	**REFER TO FIGURE 2**
Checked by:	

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None observed						**FILL: ASPHALTIC CONCRETE:** (40 mm thick) overlying **QUARRY PRODUCT:** quartzite (20 mm nominal size), some fine grained sand.	M			FILL, bituminous seal
								CL / CH	**CLAY:** medium to high plasticity, orange brown, some fine to medium grained sand, trace calcareous mottle.	<Wp	H		NATURAL
						1		CL	**SANDY CLAY / CLAY:** medium plasticity, brwon, fine to medium grained sand.	<Wp			>600 kPa porous structure
						2		SC / CL	**SANDY CLAY / CLAYEY SAND:** fine to medium grained, orange brown and brown, low to medium plasticity clay fines.	<Wp			locally interbedded alluvial sequence
								SM / SC	grading mainly **SILTY SAND / CLAYEY SAND:** low to medium plasticity fines.				
						3							too sandy for pocket penetrometer
						4							poor recovery
						5			locally grading to **SANDY CLAY** interbeds.				
									some coarse grained sandstone gravel.				
						6		GP	**SANDY GRAVEL:** fine to coarse grained, sub-rounded to sub-angular sandstone and siltstone, red brown and orange brown mottled white.	D	D		
									Borehole BH2 terminated at 6m				

method
AS auger screwing*
AD auger drilling*
RR rollertricone
W washbore
CT cable tool
HA hand auger
DT dialube
B blank bit
V V bit
T TC bit
*bit shown by suffix e.g. ADT

support
M mud N nil
C casing

penetration
1 2 3 4
no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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Engineering Log - Borehole

Borehole No.	**BH3**
Sheet	1 of 1
Project No:	**06487AA**
Client:	**WALLBRIDGE AND GILBERT**
Date started:	**13.9.2010**
Principal:	
Date completed:	**13.9.2010**
Project:	**LYELL McEWIN HOSPITAL, STAGE C**
Logged by:	**MT:rm**
Borehole Location:	**REFER TO FIGURE 2**
Checked by:	

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed						**FILL: ASPHALTIC CONCRETE:** (40 mm thick) overlying **QUARRY PRODUCT:** quartzite (20 mm nominal size), some fine to medium grained sand.	M			FILL, bituminous seal
				D				CL / CH	**CLAY / SANDY CLAY:** medium to high plasticity, brown to red brown, fine to coarse grained sand.	>Wp	H		NATURAL
								CL	**CLAY:** medium plasticity, brown, some fine to medium grained sand, trace calcareous mottle and calcrete nodules.	<Wp			
						1			possibly grading to **SANDY CLAY.**				
						2							
								CL	**SILTY CLAY / SANDY CLAY:** low to medium plasticity, brown, fine to medium grained sand.				
						3			trace black decayed nodules, locally silty sand pockets.				
									increasingly silty, mainly low plasticity.				
						4			Borehole BH3 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	rollertricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, N nil, C casing

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE: 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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Engineering Log - Borehole

Borehole No.	BH4
Sheet	1 of 1
Project No:	06487AA
Date started:	13.9.2010
Date completed:	13.9.2010
Logged by:	MT:rn
Checked by:	

Client: WALLBRIDGE AND GILBERT

Principal:

Project: LYELL McEWIN HOSPITAL, STAGE C

Borehole Location: REFER TO FIGURE 2

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0			**FILL: ASPHALTIC CONCRETE:** (40 mm thick) overlying **QUARRY PRODUCT:** quartzite (15 mm nominal size), some fine grained sand.	M			FILL, bituminous seal
								CL / CH	**CLAY:** medium to high plasticity, red brown, trace fine to medium grained sand.	<Wp	H	×	NATURAL >500 kPa
								CL	**SILTY CLAY:** medium plasticity, pale orange brown to orange brown, trace fine to medium grained sand, trace calcrete nodules.	<Wp	Fb		calcareous too friable for pocket penetrometer
						1							less calcareous
								CL	**SILTY CLAY / SANDY CLAY:** low plasticity, orange brown, fine grained sand.				non calcareous
						2			grading sandier.				
								SM	**SILTY SAND:** fine to medium grained, orange brown, low liquid limit fines.	D	MD		
						3		CL	**SILTY CLAY:** low plasticity, orange brown, some fine grained sand.	<Wp	Fb		
								SM	**SILTY SAND:** fine to medium grained, orange brown.	D			
								CL	**SILTY CLAY:** low plasticity, orange brown, some fine grained sand.	<Wp	Fb		
						4		CL / SC	**SILTY CLAY / CLAYEY SAND:** low plasticity, fine grained sand.				
									Borehole BH4 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	rollertricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH5**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rn**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 2***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed						**FILL: ASPHALTIC CONCRETE** overlying **QUARRY PRODUCT:** quartzite (25 mm nominal size).	D			FILL, bituminous seal
								CL / CH	**CLAY:** medium to high plasticity, red brown, some fine to coarse grained sand.	<Wp	H		
								CL	**SILTY CLAY:** medium plasticity, orange brown, some fine to medium grained sand.		Fb		
								CL / CH	**CLAY:** medium to high plasticity, red brown mottled orange brown, trace fine to coarse grained sand.		H		
						1		CL	**SILTY CLAY:** low to medium plasticity, orange brown mottled pale orange brown and cream, trace calcrete nodules, some fine grained sand.		Fb		calcareous
													slightly porous in places
													non calcareous
						2			grading mainly medium plasticity.		Fb / H		
						3			trace black speckle.				
								CL	**CLAY:** medium plasticity, orange brown and orange brown mottled, trace black speckle, locally grades high plasticity, trace fine grained sand.	<Wp	H		
						4			Borehole BH5 terminated at 4m				
						5							
						6							

method
AS auger screwing*
AD auger drilling*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
*bit shown by suffix e.g. ADT

support
M mud N nil
C casing

penetration
1 2 3 4
no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH6**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 2***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed						**FILL: ASPHALTIC CONCRETE:** (40 mm thick) overlying **QUARRY PRODUCT:** quartzite (20 mm nominal size), some sand.	D			FILL, bituminous seal
								CH	**CLAY:** high plasticity, red brown.	<Wp	H		NATURAL
								CL	**SILTY CLAY:** medium plasticity, orange brown, some fine to medium grained sand, trace calcrete nodules.		Fb		
						1					Fb / H		calcareous
								CL	**SILTY CLAY:** medium plasticity, orange brown and brown, some fine grained sand.		H		
						2							slightly porous structure
													friable in places
						3			mottled yellow brown in places, trace micaceous sand.				
						4			grading orange brown.				
						5		CL	**SILTY CLAY / SANDY CLAY:** medium plasticity, orange brown and brown, with trace yellow brown and black speckle, fine grained sand.				slightly porous in places
						6			grading sandier (possible sandy clay).				
									Borehole BH6 terminated at 6m				

method

AS	auger screwing*
AD	auger drilling*
RR	rollerfricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, N nil, C casing

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH7**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: **WALLBRIDGE AND GILBERT**

Principal:

Project: **LYELL McEWIN HOSPITAL, STAGE C**

Borehole Location: **REFER TO FIGURE 2**

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0			**FILL: ASPHALTIC CONCRETE** overlying **SANDY GRAVEL:** fine to coarse grained sub-angular quartzite (20 mm nominal size).	D			FILL: bituminous seal
								CH	**CLAY:** high plasticity, red brown, some fine to coarse grained sand.	≈Wp	H		NATURAL
									grading medium to high plasticity, mottled orange brown.	<Wp	H / Fb		slightly porous in places
						1		CL	**SANDY CLAY:** medium plasticity, orange brown, fine to medium grained sand.	D			
				SPT 23,20,25 N*=45				SM	**SILTY SAND:** fine to coarse grained, orange brown, low liquid limit to low plasticity fines, trace fine grained gravel.	D	MD / D		paleochannel
						2			grading to **GRAVELLY SAND:** with fine to medium grained sub-rounded to sub-angular quartz gravel. grading to **SILTY SAND.**				
								CL	**SANDY CLAY:** low plasticity, orange brown, fine grained sand, locally grades to **CLAYEY SAND.**	<Wp	Fb		
						3					VSt / Fb		
									local **CLAYEY SAND** layer.				
									grades to **SILTY SAND:** fine to medium grained, orange brown, brown.				
						4			Borehole BH7 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH8**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 2***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0			**FILL: ASPHALTIC CONCRETE:** (30 mm thick) overlying **SANDY GRAVEL:** fine to coarse grained sub-angular quartzite.	D			FILL, bituminous seal
								CH	**CLAY:** high plasticity, red brown, some fine to medium grained sand.	>Wp	H		NATURAL
											VSt	x	pp 250 - 300 kPa
								CL / CH	grading medium to high plasticity, trace calcareous mottle and calcrete nodules.		H		
						1							
								CL	**SANDY CLAY / CLAY:** medium plasticity, orange brown to brown, fine grained sand, some silty fines.	<Wp	VSt / H		
						2							
						3							
						4			Borehole BH8 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH9**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 4***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		NIL	None Observed					CL	**SANDY CLAY:** low plasticity, brown, roots, fine grained (topsoil).	M			NATURAL, grass surface
								CL	**SANDY CLAY:** medium plasticity, red brown, fine to medium grained.				
								CH	**CLAY:** high plasticity, red brown, some fine grained sand.	>Wp	H		
				D							VSt / sT		non-calcareous
						1			grading to Sandy Clay.	>>Wp			
								CH	**SANDY CLAY / SILTY CLAY:** low to medium plasticity, orange brown & brown, fine grained sand, some silt fines.	<Wp	H/Fb		friable in places
						2			trace black speckle.				highly porous structure
						3					H		less porous
						4			grading mainly medium plasticity.				
						5		CL/ CH	**CLAY:** medium to high plasticity, orange brown mottled red brown, with some trace black speckle, trace fine to medium grained sand.	<Wp	H		fissured in places
						6			Borehole BH9 terminated at 6m				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH10**
Sheet	1 of 1
Project No:	**06487AA**
Client:	**WALLBRIDGE AND GILBERT**
Date started:	**13.9.2010**
Principal:	
Date completed:	**13.9.2010**
Project:	**LYELL McEWIN HOSPITAL, STAGE C**
Logged by:	**MT:rm**
Borehole Location:	**REFER TO FIGURE 4**
Checked by:	

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed					SC	**CLAYEY SAND:** fine to medium grained, brown, low plasticity, roots (topsoil).	M			NATURAL, grass surface
				U_{50}				CL CH	**SANDY CLAY:** medium plasticity, red brown, fine to medium grained. **CLAY:** high plasticity, red brown, some fine grained sand. trace calcrete nodules. grading medium plasticity.	>Wp	VSt/H VSt / St		
						1		CL	**CLAY / SANDY CLAY:** medium plasticity, brown, fine to medium grained sand.				
						2		CL	**SILTY CLAY:** medium plasticity, brown, some fine grained sand.	<Wp	H		
								SC	**CLAYEY SAND:** fine to coarse grained, sub-angular, brown, medium plasticity fines.	D			
						3		CL	**SILTY CLAY:** low to medium plasticity, brown, some fine to medium grained sand, trace black, decayed organic matter	<Wp	H/Fb		slightly porous
									grading mainly medium plasticity	≈Wp			
						4			Borehole BH10 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH11**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:ldr**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 3***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: -90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed	SPT 3,2,4 N*=6		1		CL / CH	**FILL : ASPHALTIC CONCRETE:** (30 mm thick) over **SANDY GRAVEL:** fine to coarse grained subangular sandstone, quartzite, fine to medium grained sand, brown.	D			FILL
									FILL : GRAVELLY CLAY: medium plasticity, yellow brown, fine to coarse grained gravel.	M			
								CL	**CLAY:** medium to high plasticity, red brown, some fine to medium grained sand.	>Wp	H		NATURAL
				U_{50}					**CLAY:** medium plasticity, orange brown, mottled pale orange brown, some calcareous mottle and a trace of calcrete nodules, trace sand.				
						2		CL	**CLAY:** medium plasticity, brown, trace black, organic mottle, some fine grained sand.		VSt		
				SPT 3,3,3 N*=6		3					St		local porous structure
						4		CH	**CLAY:** high plasticity, red brown, some fine to medium grained sand. trace black organic speckle.		VSt / H		
				SPT 2,3,4 N*=7		5		CL / CH	**SANDY CLAY:** medium to high plasticity, orange brown, mottled brown, fine to coarse grained, some fine grained quartz gravel.				
								CL / CH	**CLAY:** medium to high plasticity, orange brown, trace black speckle, some fine grained sand.				
								CH	**CLAY:** high plasticity, orange brown mottled, brown, trace fine to coarse grained sand, trace black speckle, trace ironstone nodules.		H		
				SPT 6,12,14 N*=26		6							> 500
						7		CH	**CLAY / SANDY CLAY:** high plasticity, red brown. grading less sandy.	=Wp			
				SPT 14,25,25 N*=R		8							SPT Refusal, 50 blow for 250 mm
									Borehole BH11 terminated at 8m				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix e.g.	ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA BH11 & BH13.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH12**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:ldr**
Checked by:	

Client: **WALLBRIDGE AND GILBERT**

Principal:

Project: **LYELL McEWIN HOSPITAL, STAGE C**

Borehole Location: **REFER TO FIGURE 3**

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: -90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
Push Tube / HA		N	None Observed			0.5			**FILL : ASPHALTIC CONCRETE** (30 mm thick) over **GRAVELLY SAND:** fine to coarse grained, brown, fine to coarse grained, (20 mm maximum size) sandstone and quartzite gravel.	D			FILL - bituminous seal
						1.0			**FILL : SANDY CLAY:** medium plasticity, brown, fine to coarse grained sand, some fine to coarse grained subangular gravel.	M			
						1.5			**FILL : TRENCH BACKFILL SAND.**				
						2.0			Refusal with Hand Auger on Possible Service Borehole BH12 terminated at 1.1m				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	dietube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA BH12 & BH14.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH13**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:ldr**
Checked by:	

Client: **WALLBRIDGE AND GILBERT**

Principal:

Project: **LYELL McEWIN HOSPITAL, STAGE C**

Borehole Location: **REFER TO FIGURE 3**

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: -90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0			**FILL : ASPHALTIC CONCRETE:** (30 mm thick) over **GRAVELLY SAND:** fine to coarse grained, brown, fine to coarse grained subangular sandstone and quartzite gravel, trace brick gravel.	D			FILL
									FILL : SANDY CLAY: medium plasticity, brown, fine to coarse grained, some fine to coarse grained sub rounded and subangular sandstone gravel.	M			
				SPT 3,3,3 N*=6		1		CH	**FILL : GRAVELLY SAND:** fine to medium grained sandstone, yellow brown.	>Wp	VSt / H		NATURAL
								CL	**CLAY:** high plasticity, red brown.				
				U_{50}				CL	**CLAY:** medium plasticity, brown, mottled, pale orange brown, calcareous mottle, some fine to medium grained sand, some silt fines.	<Wp			
						2			**CLAY / SANDY CLAY:** medium plasticity, orange brown mottled brown, trace calcrete nodules, some silty fines, fine to medium grained sand, mostly fine grained sand.				porous structure
				SPT 4,6,7 N*=13		3			trace black organic mottle, locally sandy lenses.	>Wp			
						4		CL	**SILTY CLAY:** medium plasticity, orange brown mottled brow, some fine to medium grained sand, trace black speckle.				
				SPT 7,11,12 N*=23		5		CL	**SANDY CLAY:** medium plasticity, brown, fine to coarse grained sand, trace fine grained gravel.				
									trace medium to coarse grained sub rounded quartz gravel.				
								CL / CH	trace black organic speckle, grading orange brown and higher plasticity.				
				SPT 10,17,23 N*=40		6		CH	**CLAY:** high plasticity, orange brown, trace black mottle, some fine grained sand.		H		> 500
						7							> 500
													> 500
				SPT 9,17,19 N*=36									> 500
						8			Borehole BH13 terminated at 7.85m				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA BH11 & BH13.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH14**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:ldr**
Checked by:	

Client: **WALLBRIDGE AND GILBERT**

Principal:

Project: **LYELL McEWIN HOSPITAL, STAGE C**

Borehole Location: **REFER TO FIGURE 3**

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: -90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0.0			**FILL : ASPHALTIC CONCRETE:** (30 mm thick) over **GRAVELLY SAND:** fine to medium grained, brown, fine to coarse grained sandstone.	D			FILL
						0.5			**FILL : SANDY CLAY:** medium plasticity, brown, fine to coarse grained sand, some fine to coarse grained subangular slate and rubble gravel.	M			
						1.0			**FILL : SAND:** fine to medium grained, yellow brown.	M			service trench sand
						1.5							
						2.0			Abrupt Refusal at 1.7 m Borehole BH14 termineted at 1.7m				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	dietube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA BH12 & BH14.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH15**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 3***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
Push Tube		NIL	None Observed			0			**FILL: ASPHALTIC CONCRETE:** (30 mm think) overlying **GRAVELLY SAND:** fine to coarse grained sand, brown, fine to medium grained, sub-angular, sandstone, brick & quartzite	D			FILL, bituminous seal
								CL	**SANDY CLAY:** medium plasticity, brown, fine to coarse grained sand, trace sub-rounded to sub-angular calcrete, quartz gravel.	>Wp		x	NATURAL, possible fill
								CL	**SILTY CLAY / SANDY CLAY:** medium plasticity, brown to orange, trace calcareous mottle, fine to medium grained sand.	<Wp	VSt/ H	x	NATURAL
						1						x	pp 320-450 kPa
									increasingly sandy.			x	core loss
						2		SC	**CLAYEY SAND:** fine to coarse grained, orange brown, medium plasticity clay fines, some fine to coarse grained sub-rounded, sandstone, quartz gravel.	M	L / MD	x	paleochannel
						3		GP / SP	**GRAVELLY SAND / SANDY GRAVEL:** fine to coarse grained, orange, fine to coarse grained sub-angular to angular, quartz gravel				coarse paleochannel
						4			Borehole BH15 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4

no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH16**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: **WALLBRIDGE AND GILBERT**

Principal:

Project: **LYELL McEWIN HOSPITAL, STAGE C**

Borehole Location: **REFER TO FIGURE 3**

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0			**FILL: SANDY CLAY:** medium plasticity, brown, fine to coarse grained sand, some organic matter, trace fine to coarse grained sub-rounded to sub-angular sandstone gravel.	M			FILL, wood chippings
									FILL: SANDY CLAY: medium plasticity, orange brown, fine to coarse grained sand, some fine to coarse grained gravel.	M			Topsoil
									FILL: GRAVELLY SAND: fine to medium grained, red brown, fine to coarse grained sandstone gravel, some medium plasticity clay fines.	>Wp	H		NATURAL
						1		CH	**FILL: SANDY CLAY / CLAYEY SAND** **CLAY:** high plasticity, red brown, trace fine to medium grained sand. grading orange brown, trace calcareous nodules.				pp 300 - 500 kPa
						2		CL / CH	**CLAY / SILTY CLAY:** medium to high plasticity, orange brown mottled brown, fine to coarse grained sand, locally silty sand zones.	>Wp	VSt		pp 250 - 320 kPa
						3		CL	**SANDY CLAY / SILTY CLAY:** low to medium plasticity, brown, trace black speckle, high silt content.	<Wp	Fb / H		pp 250 - 350 kPa porous structure
						4			Borehole BH16 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH17**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rn**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 4***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0		CL	**SILTY SAND:** (50 mm thick) overlying **SANDY CLAY:** medium plasticity, brown, fine to medium grained, some roots (topsoil).	M		x	NATURAL, grass surface
								CL	**SANDY CLAY:** medium plasticity, red brown, fine to medium grained sand.	>Wp	VSt	x	
								CH	**CLAY:** high plasticity, red brown.		VSt / H	x	
						1			grading medium to high plasticity.			x	
									grading brown, trace calcrete nodules.			x	
								CL	**SILTY CLAY:** low to medium plasticity, orange brown, some fine grained sand, trace calcrete nodules.	<Wp	Fb / H	x	
						2						x	
									trace black speckle, grading medium plasticity.			x	
						3		CL	**CLAY:** medium plasticity, brown mottled pale orange brown, trace black speckle, some fine to medium grained sand, trace black decayed organic matter.	<Wp	H	x	friable in places
									grading increasingly silty.				some organic matter
						4		SM	**SILTY SAND:** fine to medium grained, brown.	D	MD		
									Borehole BH17 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, N nil, C casing

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

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coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH18**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: ***WALLBRIDGE AND GILBERT***

Principal:

Project: ***LYELL McEWIN HOSPITAL, STAGE C***

Borehole Location: ***REFER TO FIGURE 4***

drill model and mounting: EZI-PROBE, TOYOTA | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed			0			**FILL: ASPHALTIC CONCRETE:** (30 mm thick) overlying **SANDY GRAVEL:** fine to coarse grained sub-angular sandstone, quartzite, brown, fine to medium grained sand.	D			FILL, bituminous seal
								CH	**SANDY CLAY / CLAY:** medium plasticity, brown, fine to medium grained sand.	>Wp	H		reworked NATURAL / NATURAL
									CLAY: high plasticity, red brown, trace fine to medium grained, roots.				
						1			grading orange brown and medium to high plasticity.		VSt / H		
								CL	**SILTY CLAY:** medium plasticity, orange brown, with pale brown mottle, some silt, fine to medium grained sand.				
						2					VSt		
						3					St / VSt		moister
											VSt		
											St / VSt		
									some fine to medium grained sandy seams.				pp 160 - 250 kPa
						4			Borehole BH18 terminated at 4m				
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**BH19**
Sheet	1 of 1
Project No:	**06487AA**
Date started:	**13.9.2010**
Date completed:	**13.9.2010**
Logged by:	**MT:rm**
Checked by:	

Client: **WALLBRIDGE AND GILBERT**

Principal:

Project: **LYELL McEWIN HOSPITAL, STAGE C**

Borehole Location: **REFER TO FIGURE 4**

drill model and mounting: HAND GEAR | Easting: | slope: 90° | R.L. Surface:

hole diameter: 50 mm | Northing | bearing: | datum: NOT MEASURED

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
Push Tube		Nil	None Observed						**FILL: SAND:** fine to medium grained.	W			FILL, wood chippings
								CL / CH	**SANDY CLAY:** medium to high plasticity, brown mottled red brown, fine to coarse grained sand.	>Wp	St	×	FILL ? wet from irrigation pipe
									trace sub-angular quartzite gravel.			×	
								CH	**GRAVELLY CLAY:** high plasticity, red brown, fine to medium grained sub-angular to sub-rounded quartz gravel.	>Wp	H		NATURAL
						1		CH	**CLAY:** high plasticity, red brown, mottled orange brown, with some calcareous mottle.		VSt	×	
								CL / CH	sub-rounded quartz gravel, grading to medium to high plasticity.				
								CL	**SILTY CLAY:** medium plasticity, brown, some fine to medium grained sand, trace calcrete nodules and quartz gravel.	<Wp		×	locally friable
						2			grading to **SANDY CLAY** in places.	<Wp			
									trace black decayed organic mottle.			×	
												×	
						3						×	slightly porous structure
									Borehole BH19 terminated at 3m				
						4							
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE 06487AA - BH1 TO BH10, BH15 TO BH19.GPJ COFFEY.GDT 1.10.10

Form GEO 5.3 Issue 3 Rev 2

Appendix B

Results of Laboratory Testing

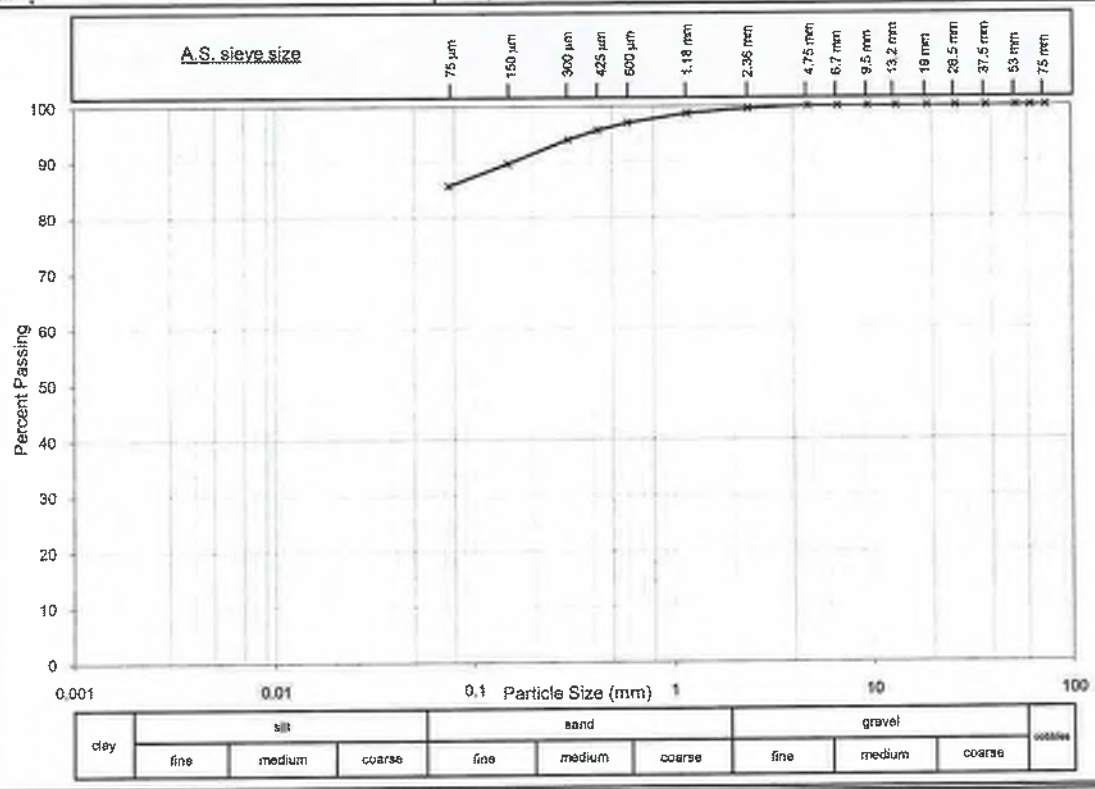
coffey information
SPECIALISTS IN SCIENTIFIC TESTING SOLUTIONS

A.C.N. 056 929 483

14B Henley Beach Road, Mile End, SA, 5031
Ph: (08) 8352 1744 Fax: (08) 8234 0932

Particle Size Distribution & Atterberg Limits

Client:	WALLBRIDGE AND GILBERT	**Job No.**	06487AA
Address:	60 WYATT STREET, ADELAIDE SA 5000	**Date:**	30-Sep-10
Principal:		**Report No.**	06487AA-R1
Project:	LYELL MCEWIN HOSPITAL STAGE C		
Location:	ELIZABETH VALE		
Sample No.:	9035	**Sample Identification:**	BH10, 0.3-0.5m



Particle Size Distribution AS1289 3.6.1

Sieve Size	% Passing	Specification
150 mm	100	
75 mm	100	
53mm	100	
37.5 mm	100	
26.5 mm	100	
19.0 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
600 um	97	
425 um	96	
300 um	94	
150 um	90	
75 um	86	

Atterberg Limits and Moisture Content

Test		Method	Result	Spec.
Liquid Limit	%	AS1289 3.1.2	55	
Plastic Limit	%	AS1289 3.2.1	19	
Plasticity Index	%	AS1289 3.3.1	36	
Linear Shrinkage	%	AS1289 3.4.1	15.0	
Moisture Content	%	AS1289 2.1.1	ND	

Sample History: ☐ Natural State ☐ Air Dried ☑ Oven Dried
Preparation Method: ☑ Dry Sieved ☐ Wet Sieved
Linear shrinkage: ☐ Crumbling ☑ Curling
Mould Length: 254 mm

ND = not determined NO = not obtainable NP = non plastic

Classification:
CLAY, HIGH PLASTICITY, DARK RED/ BROWN, TRACE FINE TO COARSE GRAINED SAND

Estimated CBR TSA-MAT-TP133

Method A - First Estimate of CBR	4.0	%
Method B - Second Estimate of CBR	4.6	%
Estimate of CBR	**4.0**	%

NATA Accredited Laboratory No. 431
Approved Signatures:

ROSS DINGLE

Date: 1/10/10

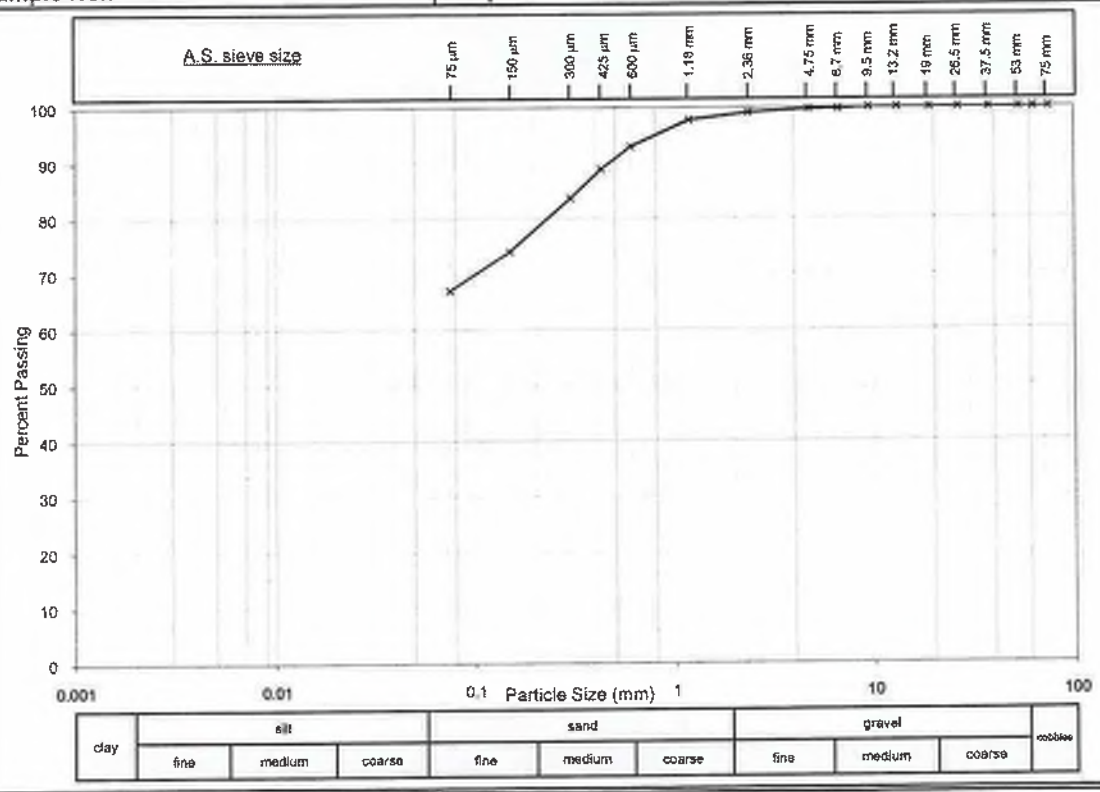
coffey information
SPECIALISTS IN SCIENTIFIC TESTING SOLUTIONS

A.C.N. 056 929 483

14B Henley Beach Road, Mile End, SA, 5031
Ph: (08) 8352 1744 Fax: (08) 8234 0932

Particle Size Distribution & Atterberg Limits

Client:	WALLBRIDGE AND GILBERT	**Job No.**	06487AA
Address:	60 WYATT STREET, ADELAIDE SA 5000	**Date:**	30-Sep-10
Principal:		**Report No.**	06487AA-R2
Project:	LYELL MCEWIN HOSPITAL STAGE C		
Location:	ELIZABETH VALE		
Sample No.:	9036	**Sample Identification:**	BH3, 0.3-0.55m



Particle Size Distribution AS1289 3.6.1

Sieve Size	% Passing	Specification
150 mm	100	
75 mm	100	
53mm	100	
37.5 mm	100	
26.5 mm	100	
19.0 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	99	
1.18 mm	98	
600 um	93	
425 um	89	
300 um	84	
150 um	74	
75 um	67	

Atterberg Limits and Moisture Content

Test		Method	Result	Spec.
Liquid Limit	%	AS1289 3.1.2	31	
Plastic Limit	%	AS1289 3.2.1	12	
Plasticity Index	%	AS1289 3.3.1	19	
Linear Shrinkage	%	AS1289 3.4.1	9.0	
Moisture Content	%	AS1289 2.1.1	ND	

Sample History: ☐ Natural State ☐ Air Dried ☑ Oven Dried
Preparation Method: ☑ Dry Sieved ☐ Wet Sieved
Linear shrinkage: ☑ Crumbling ☐ Curling
Mould Length: 250 mm

ND = not determined NO = not obtainable NP = non plastic

Classification:
SANDY CLAY, LOW PLASTICITY, DARK BROWN, FINE TO COARSE GRAINED SAND

Estimated CBR TSA-MAT-TP133

Method A - First Estimate of CBR	9.1	%
Method B - Second Estimate of CBR	9.4	%
Estimate of CBR	**9.0**	%

NATA Accredited Laboratory No. 431
Approved Signature:

ROSS DINGLE

Date: 4/10/10

coffey information
SPECIALISTS IN SCIENTIFIC TESTING SOLUTIONS

14B Henley Beach Road, Mile End, SA, 5031
Ph: (08) 8352 1744 Fax: (08) 8234 0932

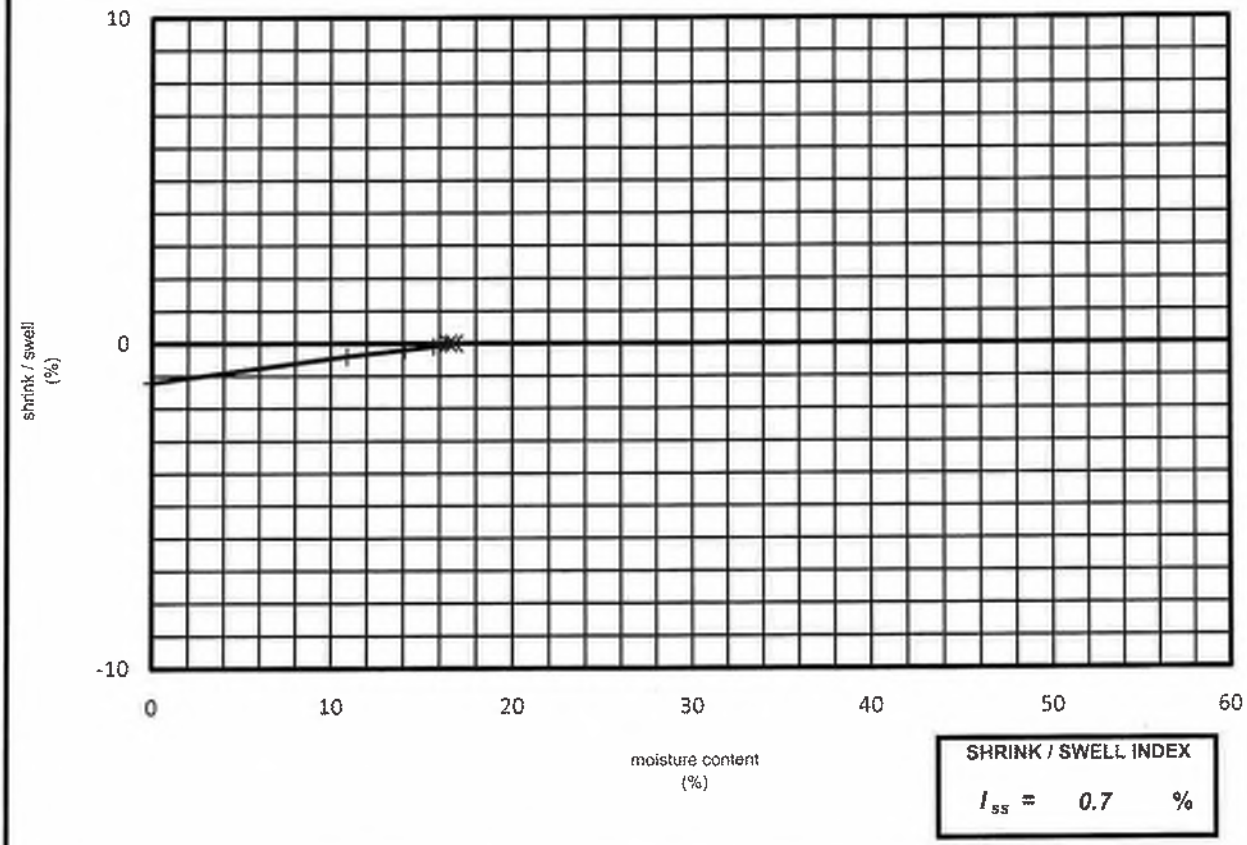
Shrink Swell Index

client:	WALLBRIDGE & GILBERT 60 WYATT STREET, ADELAIDE SA 5000	job no.:	06487AA
principal:		laboratory:	ADELAIDE
project:	LYELL MCEWIN HOSPITAL STAGE C	report date:	30 September 2010
location:	ELIZABETH VALE	test report number:	06487AA-R3

test procedure: AS 1289.7.1.1

sample number:	9032	date tested:	20/09/2010
sample location:	BH11, 1.5-1.8m		
material classification:			

SWELL TEST					SHRINK TEST			
swell on saturation (%)	moisture content (%)		estimated unconfined compressive strength (kPa)		shrink on drying (%)	estimated inert material present (%)	extent of crumbling during shrinkage	extent of cracking during shrinkage
	before test	after test	before test	after test				
0	16.5	16.8	-	-	1.2	1.9	NIL	MINOR



SHRINK / SWELL INDEX

I_{ss} = 0.7 %

remarks:

NATA Accredited Laboratory
No. 431
Approved Signatory:
ROSS DINGLE

Date: 1/10/10

coffey information
SPECIALISTS IN SCIENTIFIC TESTING SOLUTIONS

14B Henley Beach Road, Mile End, SA, 5031
Ph: (08) 8352 1744 Fax: (08) 8234 0932

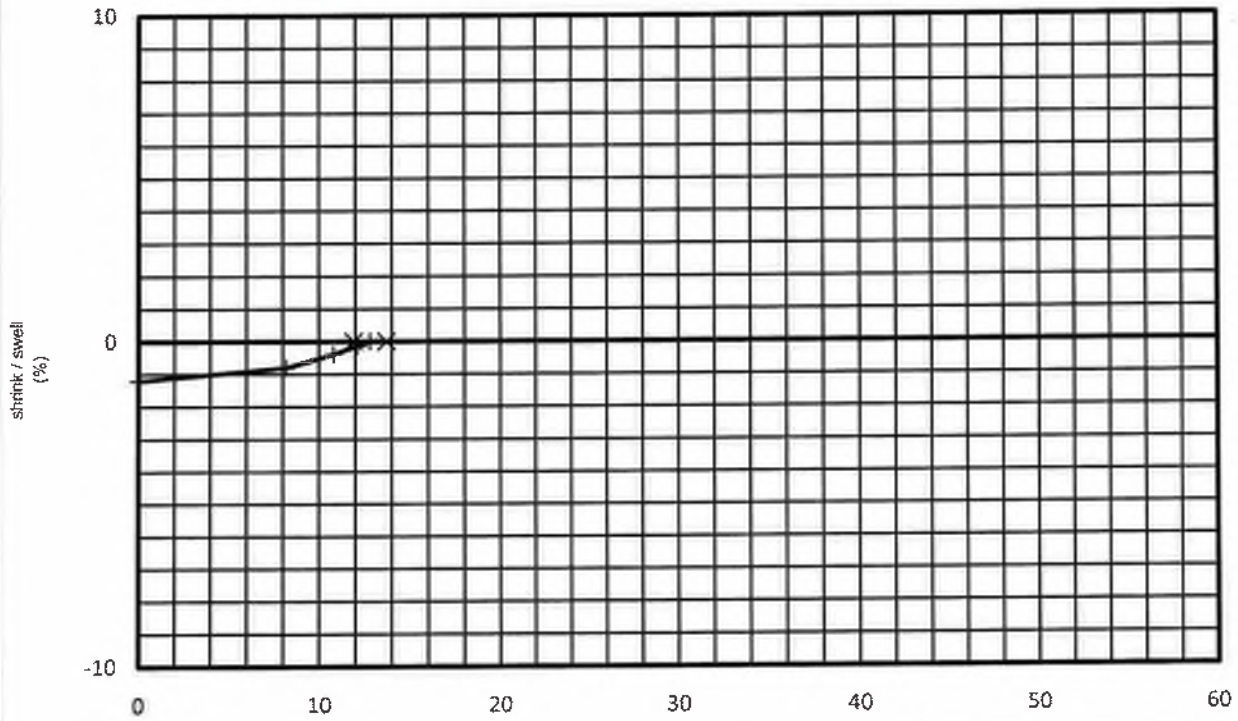
Shrink Swell Index

client:	WALLBRIDGE & GILBERT 60 WYATT STREET, ADELAIDE SA 5000	job no.:	06487AA
principal:		laboratory:	ADELAIDE
project:	LYELL MCEWIN HOSPITAL STAGE C	report date:	30 September 2010
location:	ELIZABETH VALE	test report number:	06487AA-R4

test procedure: AS 1289.7.1.1

sample number:	9033	date tested:	20/09/2010
sample location:	BH13, 1.5-1.8m		
material classification:			

SWELL TEST					SHRINK TEST			
swell on saturation (%)	moisture content (%)		estimated unconfined compressive strength (kPa)		shrink on drying (%)	estimated inert material present (%)	extent of crumbling during shrinkage	extent of cracking during shrinkage
	before test	after test	before test	after test				
0	11.9	13.7	-	-	1.2	7.8	SLIGHT	MINOR



SHRINK / SWELL INDEX
I_{ss} = 0.7 %

remarks:

NATA Accredited Laboratory
No. 431
Approved Signatory:
ROSS DINGLE

Date: 1/10/10

coffey information
SPECIALISTS IN SCIENTIFIC TESTING SOLUTIONS

14B Henley Beach Road, Mile End, SA, 5031
Ph: (08) 8352 1744 Fax: (08) 8234 0932

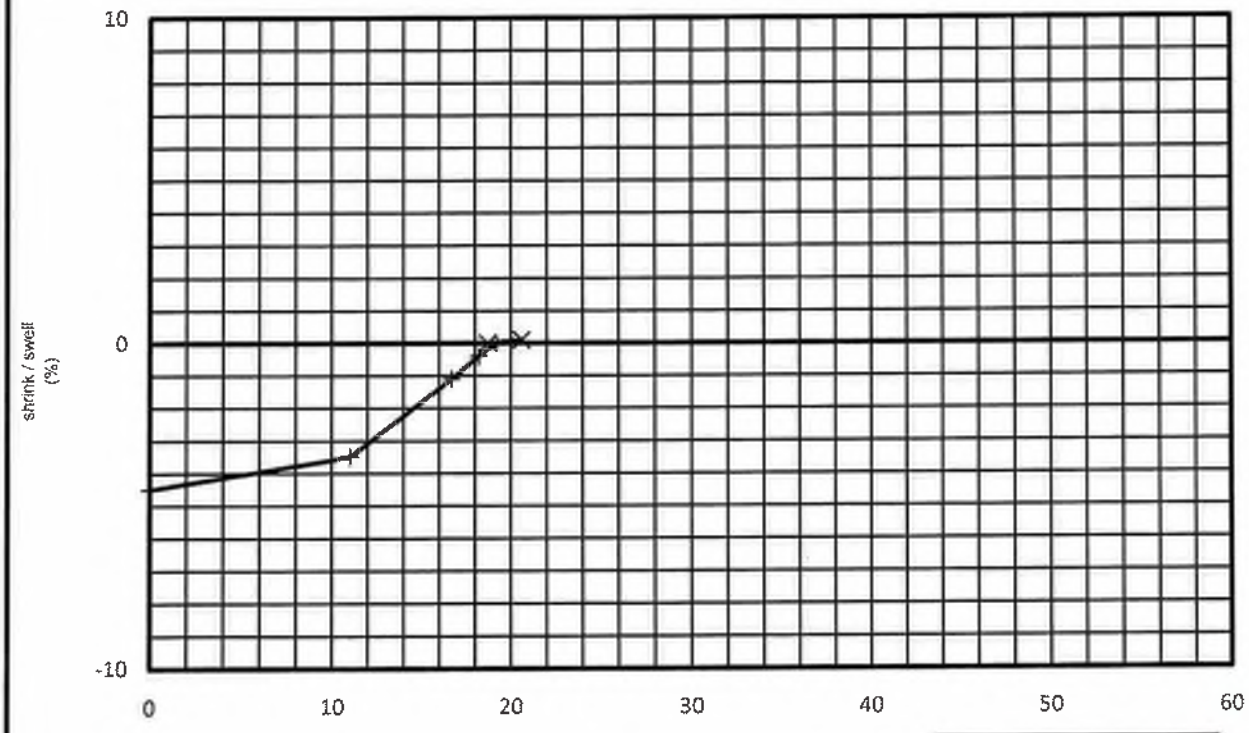
Shrink Swell Index

client:	WALLBRIDGE & GILBERT 60 WYATT STREET, ADELAIDE SA 5000	job no.:	06487AA
principal:		laboratory:	ADELAIDE
project:	LYELL MCEWIN HOSPITAL STAGE C	report date:	30 September 2010
location:	ELIZABETH VALE	test report number:	06487AA-R5

test procedure: AS 1289.7.1.1

sample number:	9034	date tested:	20/09/2010
sample location:	BH9, 0.6-0.75m		
material classification:			

SWELL TEST					SHRINK TEST			
swell on saturation (%)	moisture content (%)		estimated unconfined compressive strength (kPa)		shrink on drying (%)	estimated inert material present (%)	extent of crumbling during shrinkage	extent of cracking during shrinkage
	before test	after test	before test	after test				
0.1	18.7	20.6	-	-	4.5	0.2	NIL	SLIGHT



SHRINK / SWELL INDEX
I_{ss} = 2.5 %

remarks:

NATA Accredited Laboratory
No. 431
Approved Signatory:
ROSS DINGLE

Date: 1/10/10

Andrew Woods
DIRECTOR

Telephone: 08 8223 7433

Email: awoods@wga.com.au

ADELAIDE
60 Wyatt St
Adelaide SA 5000
Telephone: 08 8223 7433
Facsimile: 08 8232 0967

MELBOURNE
Level 2, 31 Market St
South Melbourne VIC 3205
Telephone: 03 9696 9522

PERTH
Level 1, 66 Kings Park Road
West Perth WA 6005
Telephone: 08 9336 6528

DARWIN
Suite 7/9 Keith Ln
Fannie Bay NT 0820
Telephone: 08 8941 1678
Facsimile: 08 8941 5060

WHYALLA
1/15 Darling Tce
Whyalla SA 5600
Phone: 08 8644 0432

WALLBRIDGE GILBERT AZTEC
www.wga.com.au
adelaide@wga.com.au

APPENDIX J

TRAFFIC ENGINEERING AND TRANSPORT REPORT

FRANK SIOW & ASSOCIATES

Traffic and Parking Consultants

P.O. Box 253
Kensington Park SA 5068
Tel: (08) 8364 1351
Email: frank@franksiow.com.au

9 April 2019

Mr Scott Suter
Cheesman Architects
304 The Parade
KENSINGTON SA 5048

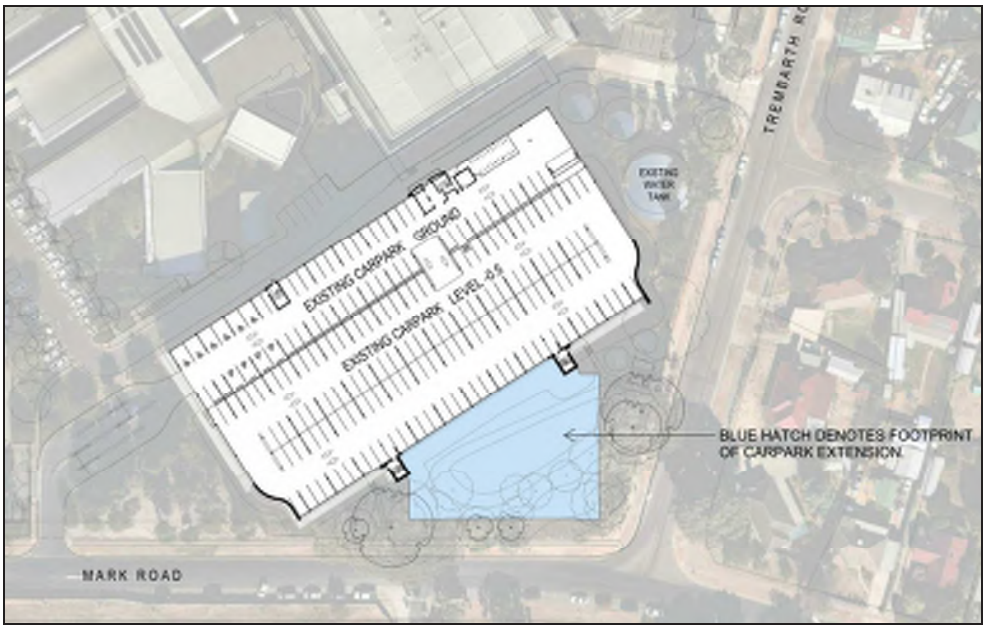
Dear Mr Sage,

LYELL McEWIN HOSPITAL (LMH) CAR PARK EXTENSION TRAFFIC AND PARKING ASSESSMENT

As requested, we have undertaken a traffic and parking assessment of the proposed Lyell McEwin Hospital (LMH) car park extension.

1.0 BACKGROUND

The current LMH multi-storey car park has 1,249 parking spaces, spread over the ground level and 5 levels above. It is a car park that is used by staff and visitors to the hospital. The multi-storey car park has been operating for a number of years. The proposed car park extension is identified in the Site Plan below.



Site Plan

The car park extension is proposed as part of the staging plan to increase parking at the site, which would then allow new facilities and buildings to be constructed at the main hospital site, in accordance with the Master Plan developed for the hospital site.

More particularly, it is envisaged that the next stages of the LMH Master Plan would involve additions to the Emergency Department (ED), the Mental Health Short Stay Unit (MHSSU) and redevelopment of the Ambulance facilities. These new buildings and facilities would encroach into the at-grade car park of the main hospital site and would result in the loss of car parking.

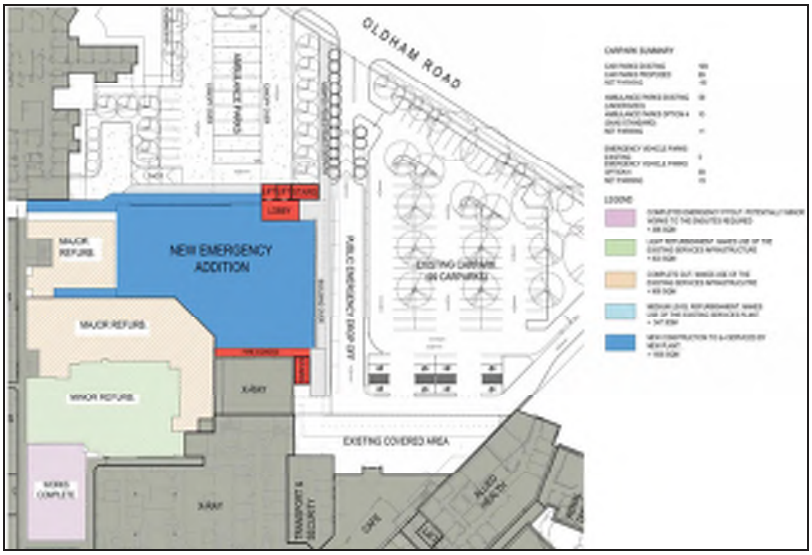
The proposed extension to the multi-storey car park would therefore replace the parking spaces affected by the new developments and would also provide additional new parking that would support the additional developments on the hospital site.

The next stages of the development, ie the Emergency Department/ Mental Health Short Stay Unit and redevelopment of the Ambulance facilities, would be the subject of future separate development applications to the relevant planning authority.

The proposed car park extension comprises of 45 new spaces added per level to the existing car park from Level 1 to Level 5. To accommodate the aisleways for the extended parking areas, 4 spaces of the existing car park would be removed for each level. The extension would add 205 new parking spaces overall to the hospital site.

2.0 PRELIMINARY PARKING ASSESSMENT OF FUTURE DEVELOPMENTS

While the new buildings for the hospital site would be the subject of separate future development applications to the relevant planning authority, we provide a brief overview of the future proposals below to assist in describing the planning and parking context associated with the car park extension.



Indicative concept only

We are advised that the above developments associated with the ED, MHSSU and Ambulance facilities would potentially add approximately 2,880m2 to the floor area of the hospital site. The indicative concept also shows that the new developments would potentially result in a net loss of 81 parking spaces to the existing at-grade car park in Oldham Road.

The hospital site is located in the *Suburban Activity Node* (SAN) zone of the Playford Council. The applicable parking rates for medical type land uses listed in Table Play/3 are:

- Consulting room in SAN zone - 5 spaces per 100m2 floor area
- Hospital in SAN zone - 4 spaces per 100m2

As the future proposals involve an expansion to the existing hospital, we are of the opinion that the hospital parking rate of 4 spaces per 100m2 would be appropriate for assessing the parking requirement.

The LMH enjoys long-standing use as a hospital land use on the subject site. The proposed development represents only a minor increase in floor area, compared to the overall floor area of the existing hospital.

In our experience, we believe that existing use rights would be applicable for the existing hospital. In this regard, we are of the opinion that the parking assessment should have regard only to the net increase in floor areas.

The parking implications would be as follows:

- Net increase in floor area – 2,880m2 (estimate only)
- Net loss of parking spaces – 81 spaces to be replaced elsewhere (estimate only)
- Parking required for new floor area – 2,880m2 @ 4 spaces per 100m2 = 115 spaces
- **TOTAL PARKING REQUIRED 81+115 = 196 spaces**

The proposed extension to the LMH multi-storey car park would result in approximately 205 new parking spaces provided on the hospital site, which would exceed the requirement (preliminary estimate) to support the new developments and to replace the loss of car parking from the at-grade car park.

3.0 CAR PARK LAYOUT

Four (4) existing parking spaces per level would be removed to allow a new aisleway to be provided to service the extended car park.

Table 1.1 of *AS/NZS 2890.1-2004* refers to hospital parking as being of User Class 3. FIGURE 2.2 of *AS/NZS 2890.1-2004* identifies User Class 3 as requiring 2.6m wide spaces and serviced by a minimum aisleway width of 5.8m.

We understand that there are significant complexities and constraints to be considered when undertaking extension work to an existing multi-storey car park and, during the design process, the following issues were considered:

- The constraints of the site, the limited space available for extension and the need to meet clearance requirements with existing floor to floor heights are best dealt with by repeating the existing grid spacing and parking widths.
- The re-use of elements of the existing carpark is possible if the grid spacing is repeated.
- The aisle widths provided of 6.1m are greater than the minimum set out in the standard and allow for enhanced manoeuvrability, notwithstanding the reduced space width.
- The majority of parking in the existing carpark is undertaken by staff and would be considered long-term, which would only require a 2.4m space width.

- Parking spaces in the extension are best suited for staff given the distance of the extension from the main entrance and there is potential for the hospital to manage the use of these spaces, therefore the 2.5m space width would comply with the parking standard for this category of users.

As a consequence of these factors, we understand that the parking space width for the extended car park would be kept at 2.5m, notwithstanding that the parking standard (*AS/NZS 2890.1-2004*) identifies the User Category as requiring 2.6m wide spaces.

In response, we make the following comments:

- If the parking spaces for the proposed extension were to be for 'staff' parking only, the proposed 2.5m space width and 6.1m aisleways would exceed the requirements of *AS/NZS 2890.1-2004*.

- If the parking spaces for the proposed extension were to be for hospital 'visitor' parking, the proposed 2.5m space width would not comply with the requirement of *AS/NZS 2890.1-2004*, however, the 6.1m aisleway width would exceed the requirement.

Accepting that the proposed design dimensions are to be remain for the design reasons stated previously, there would appear to be two potential options to enable the proposed parking layout to comply with *AS/NZS 2890.1-2004*:

1. Allocate the new parking spaces for 'staff' parking. We note that the proposed layout has only one 'entrance' to the new parking spaces for each level. It would then be relatively easy to install signage at the 'entrance' to advise that this part of the car park is for 'staff' parking only. It is not unreasonable or uncommon to allocate parking spaces that are furthest away from the building for use as staff parking.

2. Adjust the line marking to provide a mix of SMALL CAR space (2.3m width) and two standard 'visitor' spaces (2.6m width). This would fit within the proposed column to column grid spacing of 7.5m. That is, without altering the grid spacing, it would be possible to make the parking spaces comply with *AS/NZS 2890.1-2004*. We would estimate that for each level, there would be 10 SMALL CAR spaces resulting, which would total approximately 50 spaces overall. Over the entire LMH car park of approximately 1,454 spaces, the SMALL CAR provision would represent less than 4% of the overall car park. In our experience, it is not unreasonable or uncommon to allocate up to 10% of parking spaces in a car park as SMALL CAR spaces.

Based on the above assessment, we are of the opinion that the parking space layout within the car park extension area would be capable of satisfying the requirements of the parking standard (*AS/NZS 2890.1-2004*) by setting aside these spaces as STAFF SPACES, or adjusting the spaces (combination of Small Car/Standard Car spaces), which would allow the proposed column grid to remain.

There would be no changes to the proposed entrance to the car park from Mark Road. Access to the car park extension would be via the existing aisleways of the current car park.

4.0 CONCLUSIONS

The proposed development comprises of an extension to the existing LMH multi-storey car park. The proposed extension would result in an increase of 205 parking spaces to the hospital site.

The increase in parking spaces is intended to facilitate the next stages of the LMH development, which would include additions to the Emergency Department, the Mental Health Short Stay Unit and redevelopment of the Ambulance facilities.

Our preliminary parking assessment of the future developments indicate that the number of new parking spaces provided (205 spaces) would be able to: (1) replace the loss of parking spaces at the at-grade car park in Oldham Road and (2) to meet the additional parking requirements of the proposed new floor areas at the hospital site.

The new car park extension would have proposed space widths of 2.5m. The proposed parking layout for the new car park extension would be capable of meeting the requirements of the parking standard, by either designating the extended car parks for each level for STAFF PARKING, or by adjusting the line marking to include a combination of Small Car/Standard Car spaces, whilst still retaining the proposed column grids.

On the basis of the above assessment, we are of the opinion that the proposed car park extension would be supportable from a traffic and parking perspective.

Yours sincerely,

Frank Siow

FRANK SIOW
Principal Consultant

APPENDIX K

EXAMPLE WHS SAFETY REPORT
(JNH REDEVELOPMENT)

Project	James Nash House Redevelopment
Stakeholders	Facility (DPTI, SA Health, James Nash House Forensic Facility), Construction Contractor (BADGE), Design Team (Aurecon, SKM, Cheesman Architects)

Document Revision History

Rev	Date	Comments/Revisions
-	16/07/2013	Safety Design Review draft issued for comment
A	22/08/2013	Revised incorporating feedback + outcomes of recent like-project safety reviews
B	23/04/14	Updated Schedule incorporating feedback and outcomes from Safety Review of 23/08/2013 Risk control measures delineated into design/construction & commissioning and Operation activities with post-construction residual measures highlighted Removal of non-design related construction risks (managed through normal construction site management practices)
C	29/05/14	Final Safety Report Issue incorporating final feedback and comments.

Notes

+ This Risk Assessment forms part of a safety Report intended to satisfy the following safety objectives relevant to the design phase of the project in accordance with Section 295 of the WHS Regulation 2011:
  - Identify safety hazards associated with the design that may occur during the construction, operation, maintenance and/or demolition phases of the structure.
  - Document how the designers have attempted to eliminate or reduce (as far as is reasonably practical) the risk level associated with each identified safety hazard, such that those who properly construct, commission, maintain, repair, operate or use the facilities associated with our design services are not unduly exposed to the identified hazards
  - Provide a basis for transferring information about identified hazards and action taken or required to control risks to other designers involved in the project who may have capacity to further influence or control the matter
  - Provide a basis for transferring information about identified hazards and action taken or required to control risks to other duty holders involved in later stages of the project lifecycle (including the Proprietor and the Construction Contractor). The intent is to make other duty holders aware of any residual risks and minimise the likelihood of safety features incorporated into the design being altered or removed by those engaged in subsequent work on or around the building or structure

Assumptions

The following assumptions have been made in the Risk Assessment process

+ The scope of assessment is limited to hazards that are reasonably foreseeable at the time of the design and to hazards that could result from design aspects of the facility for which the designers are responsible.
+ The scope of assessment is limited to atypical design safety issues associated only with this particular design and not with other designs of the same type
+ Hazards arising due to normal site construction, installation, maintenance or operation as covered by Safework SA safe installation methods, Australian codes & standards, local codes and guidelines, practices and procedures etc. are not within the scope of this review
+ Any construction, operation, maintenance and demolition of the structure and its associated services will be carried out by organisations and/or personnel with appropriate experience, competence and qualifications to undertake such tasks
+ The completed facility will be operated, managed and maintained by organisations and/or personnel with appropriate experience, competence and qualifications to undertake such tasks
+ Any organisation or person responsible for any of construction, operation, maintenance or demolition of the structure and its associated services will review and update/incorporate any new hazards into the Risk Register as and when required
+ **Initial Risk Assessment includes allowance for application of existing James Nash House site operational risk control measures and practices (ie the risk is not assessed at untreated level in this instance)**

Risk Rating Matrix

Most Likely Consequence		Likelihood				
		Very likely will occur	Good chance to occur	Likely to occur	Unlikely to occur	Very unlikely to occur
		5	4	3	2	1
Disastrous	A	Extreme	Extreme	Extreme	Extreme	High
Critical	B	Extreme	Extreme	Extreme	High	High
Serious	C	Extreme	High	High	Moderate	Moderate
Significant	D	High	High	Moderate	Low	Low
Minor	E	Moderate	Moderate	Low	Low	Low

Severity

Disastrous	Single or multiple fatality
Critical	Disabling injury or illness - i.e. amputation and/or permanent loss of bodily function or any kind of permanent health impact
Serious	Any lost time injury resulting in one or more days off work or resulting in more than 1 week off normal duties
Significant	A medical treatment injury or restricted work injury resulting in less than 1 week on alternate duties
Minor	Minor first aid injury or injury not requiring treatment

Likelihood

Very likely to occur	Expected to occur in most circumstances – i.e. could occur once a week
Good chance to occur	Will probably occur in most circumstances – i.e. could occur once per month
Likely to occur	Might occur at some time – i.e. could occur once per year
Unlikely to occur	Could occur at some time – i.e. could occur once in 10 years
Very unlikely to occur	May occur only in exceptional circumstances – i.e. could occur once in 50 years

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
1	Design Phase																
2	Construction Phase																
2.01	Construction	Construction creates Dust and Dirt	Exposure of operational facility areas to dirt and dust Health and infection issues for patients and staff.	Inadequate barriers and construction management processes allowing ingress of dust and dirt	Contractor	**Initial risk reduced by existing site controls -** Pre-construction Infection Control procedures and monitoring Facility-grade cleaning processes	Facility	2	C	Moderate	Construction environmental management practices to be implemented during construction phase Identification of required barrier locations	Design Team	2	C	Moderate	**Construction & Commissioning** Implementation of construction quality management and validation processes to ensure compliance Construction environmental plan to be developed and implemented Specific monitoring to be conducted during and at completion of works	Contractor
2.02	Item removed																
2.03	Item removed																
2.04	Construction	Design potentially requires working at height during Construction	Falls causing critical injury or fatality	Inadequate safety management equipment and procedures	Contractor	Nil existing controls – Risk arising from new construction activities	-	4	A	Extreme	Facility design to consider required construction approach to minimize requirement for non-conventional /high risk construction practices with respect to working at heights	Design Team -	1	A	High	**Construction & Commissioning** Implementation of construction safety planning and management processes and safe construction methodology	Contractor
2.05	Construction	Design potentially requires movement of Heavy Objects during construction	Manual lifting leading to serious injury	Inadequate safety management equipment and procedures	Contractor	Nil existing controls – Risk arising from new construction activities	-	3	B	Extreme	Facility design to consider required construction approach to minimize requirement for non-conventional /high risk construction practices with respect to movement of heavy objects	Design Team -	2	C	Moderate	**Construction & Commissioning** Implementation of construction safety planning and management processes and safe construction methodology	Contractor
2.06	Construction	Existing hazardous materials – Asbestos etc encountered during construction	Exposure to hazardous materials leading to critical injury or fatality	Inadequate identification of potential material Inadequate safety procedures and equipment	Contractor	**Initial risk reduced by existing site controls -** Asbestos and Hazardous Material Register maintained to inform location of asberstos OHWS procedures controlling use of hazardous substances	Facility	1	A	High	Design documentation to encompass current site asbestos and hazardous material register for information Undertake testing if site for evidence of potential latent conditions Specification of hazardous material management requirements and processes if encountered Controlled hazardous chemicals to be removed by Facility prior to site handover where applicable.	Design Team	1	A	High	**Construction & Commissioning** Implementation of construction quality management and validation processes to ensure compliance Implementation of construction safety planning and management processes for hazardous materials	Contractor
2.07	Item removed																
2.08	Construction	Electrical Power Supply interrupted to Principal occupied areas	Unplanned disruption to power supply to patient treatment areas (accidental cable cutting/terminations etc) resulting in critical injury or fatality	Inadequate investigation and identification of existing electrical services prior to commencing work Inadequate notification/coordination of services shutdowns with Facility	Contractor	Nil existing controls – Risk arising from new construction activities	-	4	A	Extreme	Existing power supply systems to be surveyed and information incorporated within design documentation where applicable to new works	Design Team	1	A	High	**Construction & Commissioning** Implementation of construction safety planning and management processes (dial before you dig, site inspection etc) Implementation of Critical Activity Planning prior to commencement of works encompassing existing system investigation and consultation with Facility Emergency response and communication plan to be implemented	Contractor
2.09	Item removed																
2.10	Construction	Fire Safety to Principal occupied areas compromised during construction	Critical injury or fatality from exposure to fire or smoke in and adjacent construction zones	Inadequate temporary fire safety equipment and/or safety training Emergency egress routes from occupied facility areas blocked by construction	Contractor	**Initial risk reduced by existing site controls -** Existing building fire safety equipment, facilities and procedures maintained to Building Code compliance	Facility	3	A	Extreme	Construction zones to consider maintenance of fire safety equipment and egress requirements of occupied areas	Design Team	1	A	High	**Construction & Commissioning** Contractor to familiarize itself with existing fire safety provisions and coordinate temporary changes with Facility Temporary facilities, barriers, adjustments to be undertaken to maintain fire safety compliance through each stage of work. Implementation of construction safety management procedures and process and provision of suitable fire safety equipment. **Construction & Commissioning** Contractor inducted in Facility Emergency Security Management Plan	Contractor Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
2.11	Construction	Internal access restrictions to Principal occupied areas during construction	Facility security response teams are delayed in occupied facility areas by temporary construction barriers and/or temporary alternative access routes, In particular duress response to code black Resulting in critical injury or death	Construction hoardings and barriers blocking key paths of access Security Response team unfamiliar with temporary changes to access routes	Contractor	Nil existing controls – Risk arising from new construction activities	-	4	A	Extreme	Construction zones and access routes to be planned during design process	Design Team	1	A	High	**Construction & Commissioning** Contractor to familiarize itself with existing key paths of access adjacent construction zones and coordinate temporary changes with Facility Construction zones to consider maintenance of key access requirements of occupied areas Temporary facilities, barriers, adjustments to maintain key access paths.	Contractor
																Construction & Commissioning Facility to communicate temporary access restrictions to relevant facility stakeholders Facility to induct Contractor in Facility Emergency Security Management Plan	Facility
2.12	Construction	Noise & Vibration affecting Principal occupied areas during construction	Patient behavior and operations occupied facility areas disrupted by construction noise and vibration – particularly sensitive patient group resulting in serious injury	Inadequate implementation of environmental controls during construction Use of disruptive construction techniques and/or equipment Inadequate consideration of constructability requirements in design	Contractor Designers	Nil existing controls – Risk arising from new construction activities	-	4	C	High	Facility design to consider required construction approach to minimize disruption	Design Team	2	E	Low	**Construction & Commissioning** Contractor to consult with Facility and pre-plan disruptive works to occur at times of minimum impact Emergency stop-work procedure to be implemented	Contractor
																Construction & Commissioning Facility to consult and communicate with relevant facility stakeholders and pre-plan sensitive activities in consideration of construction activities	Facility
2.13	Construction	Electrical Power Supply – disruption to Principal occupied areas	Internal or external disruption to power supply during shutdown/cut-in/changeover activities (reduced back-up supply availability) Resulting in critical injury or death	Inadequate investigation and identification of existing electrical services prior to commencing work Inadequate notification/coordination of services shutdowns with Facility to reduce exposure of patients to risk Inadequate planning of shutdown activity including consideration of temporary emergency back-up generators Inadequate consideration of implementation requirements in the design process	Contractor Designers	**Initial risk reduced by existing site controls -** Back-up power supply – essential power on generator supply . 2 hour UPS system	Facility	2	A	Extreme	Facility design to consider required construction approach to minimize disruption Existing systems to be surveyed and shown on documentation where possible	Design Team	1	A	High	**Construction & Commissioning** Implementation of construction safety planning and management processes (dial before you dig, site inspection etc) Implementation of Critical Activity Planning prior to commencement of works encompassing existing system investigation, contingency planning in consultation with Facility Emergency response and communication plan to be implemented	Contractor
																Construction & Commissioning Implementation of Critical Activity Planning prior to commencement of works encompassing existing system investigation, contingency planning	Facility
2.14	Construction	Construction Site – public, patient & facility staff	Critical injury to public patients or facility staff arising from accessing operational construction area	Inadequate separation of construction activities from occupied facility areas Inadequate communication of construction activities/location to facility stakeholders	Contractor	Nil existing controls – Risk arising from new construction activities	-	4	B	Extreme	Planning to enable main construction activities to be undertaken in clearly delineated dedicated contractor areas with secure hoarding/barrier to perimeter.	Design Team	2	B	High	**Construction & Commissioning** Implementation of construction safety planning and management processes to prevent unauthorized access to construction areas Implementation of pre-planned temporary safety provisions and processes for minor works undertaken in areas remaining occupied by facility in consultation with facility	Contractor
																Construction & Commissioning Implementation of communication plan to inform public and facility stakeholders of construction activities	Facility
2.15	Construction	Construction noxious Chemicals affecting Principal occupied areas	Exposure of construction staff and facility stakeholders to short-term noxious chemical off-gassing/smells causing serious injury (headaches, nausea etc) (adhesives, paints etc)	Inadequate consideration of buildability considerations in selection of materials Inadequate provision of temporary protective plant and equipment to minimize exposure Inadequate planning of construction activities in occupied areas	Contractor	Nil existing controls – Risk arising from new construction activities	-	2	C	High	Consideration of material selections by designers to minimize VOC type chemical useage for in-situ use	Design Team	1	C	Moderate	**Construction & Commissioning** Implementation of construction safety planning and management processes to provide temporary protective equipment and barriers (PPE, temporary ventilation plant etc) for works requiring noxious chemicals Implementation of pre-planned temporary safety provisions and processes for minor works undertaken in areas remaining occupied by facility in consultation with facility	Contractor
																Construction & Commissioning Facility to consult and communicate with relevant facility stakeholders and pre-plan work in sensitive areas	Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
2.16	Construction	Security systems and equipment compromised to Principal occupied areas	Facility emergency response and security provisions compromised by construction activities resulting in increased risk of access to secure areas, delayed response to duress events or compromised security systems (duress, CCTV etc) resulting in critical injury or fatality	Construction hoardings and barriers blocking key paths of access Emergency Response team unfamiliar with temporary changes to access routes Construction site inadequately secured allowing access into facility buildings or exit by patients Accidental cutting /disruption/removal of security system equipment	Contractor	Nil existing controls – Risk arising from new construction activities		3	A	Extreme	Construction zones and access routes to be planned during design process with facility security stakeholder input Construction zones to be physically secured and managed to minimize risk of unauthorized access Contractor and facility to coordinate and familiarize with respective security provisions Contractor to familiarize itself with existing security provisions and coordinate temporary changes with Facility	Design Team	1	A	High	**Construction & Commissioning** Implementation of construction safety planning and management processes to provide temporary protective equipment and barriers (PPE, temporary ventilation plant etc) for works requiring noxious chemicals Implementation of pre-planned temporary safety provisions and processes for minor works undertaken in areas remaining occupied by facility in consultation with facility	Contractor
																Construction & Commissioning Facility to induct Contractor in Facility Emergency Management Plan Facility to consult and communicate with relevant facility stakeholders and pre-plan work in sensitive areas	Facility
2.17	Construction	Security risks elevated by construction adjacent Principal occupied areas - tools and equipment	Patients accessing unauthorized equipment such as contactor tools and materials resulting in critical injury or fatality (self harm or injury to staff/contractor members)	Contractor employees leaving tools and materials in existing public, staff or areas adjacent to patient wards	Contractor	Nil existing controls – Risk arising from new construction activities		3	A	Extreme	Design of works to consider main construction activities to be undertaken in clearly delineated dedicated contractor areas with secure hoarding/barrier to perimeter.	Design Team	1	C	High	**Construction & Commissioning** Implementation of construction safety planning and management processes to prevent unauthorized access to construction areas Contactor to ensure all tools to be locked away when not in use Implementation of pre-planned temporary security provisions and processes for minor works undertaken in areas remaining occupied by facility in consultation with facility	Contractor
																Construction & Commissioning Facility to induct Contractor in Facility Emergency Management Plan Facility to consult and communicate with relevant facility stakeholders and pre-plan work in sensitive areas	Facility
2.18	Item removed																
2.19	Construction	Security risks elevated by construction adjacent Principal occupied areas - escape assisted by construction areas	Temporary construction plant and equipment near occupied areas assists patient escape resulting in risk to patients, staff and the public leading to critical injury or fatality	Patient escaping from facility and accessing contractors site	Contractor	Nil existing controls – Risk arising from new construction activities	-	3	A	Extreme	Design of works to consider main construction activities to be undertaken in clearly delineated dedicated contractor areas with secure hoarding/barrier to perimeter.	Design Team	1	C	Moderate	**Construction & Commissioning** Implementation of construction safety planning and management processes to prevent unauthorized access to construction areas Contractor to ensure that the perimeter is secure primarily from theft or injury Contactor to ensure all tools to be locked away when not in use Implementation of pre-planned temporary security provisions and processes for minor works undertaken in areas remaining occupied by facility in consultation with facility Contractor to coordinate security plan with the existing facility security procedures	Contractor
																Construction & Commissioning Facility to induct Contractor in Facility Emergency Management Plan Facility to consult and communicate with relevant facility stakeholders and pre-plan work in sensitive areas	Facility
2.20	Construction	Security risks elevated by construction adjacent Principal occupied areas – interaction with construction staff	Patients provided with illegal material from contract workers resulting in critical injury	Contactors accessing plant above existing patient wards via existing security doors in roof space not locked	Contractor	Nil existing controls – Risk arising from new construction activities	-	3	B	Extreme	Design documentation to encompass requirement for police check screening documentation for contractors accessing sensitive areas of existing facility.	Design Team	3	C	High	**Construction & Commissioning** Implementation of construction safety planning and management processes to prevent unauthorized access to construction areas Contractor to ensure all police checks are current for contractors accessing existing facility. Contractor to coordinate works within roof space with facility management team to ensure all security measures are in place and access is restricted and clearly monitored Contractor to coordinate security plan with the existing facility security procedures	Contractor
																Construction & Commissioning Facility to review police check documentation for contractors for acceptance/conformance with site security requirements	Facility
2.21	Construction	Security	Patients viewing contractor vehicles and movement resulting in critical injury through sourcing of personal details and remotely arranged attack	Contractor parking vehicles in view of existing Claire Ward	Contractor	Nil existing controls – Risk arising from new construction activities	-	3	B	Extreme	Construction zones and access routes to be planned during design process	Contractor Facility	2	C	High	**Construction & Commissioning** Contractor to locate site entrance and site huts away from view of Claire Ward and if necessary provide solid hoardings to obscure view or treatments to windows	Contractor
2.22	Item removed																

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
2.23	Construction	Water Supply – disruption/contamination of supply to Principal occupied areas	Contamination of water supply to patient areas arising from construction activities causing infection Leading to critical illness	Inadequate investigation and understanding of existing systems Inadequate work quality and commissioning management Inadequate completion validation processes	Contractor	Nil existing controls – Risk arising from new construction activities	-	2	B	High	Facility design to consider required construction approach to minimize disruption Existing systems to be surveyed and shown on documentation where possible	Design Team	2	C	Moderate	**Construction & Commissioning** Implementation of construction safety planning and management processes (dial before you dig, site inspection etc) Contractor to familiarize itself with existing hydraulics systems prior to undertaking works Implementation of Critical Activity Planning prior to commencement of works encompassing existing system investigation, contingency planning in consultation with Facility Emergency response and communication plan to be implemented	Contractor
																Construction & Commissioning Implementation of Critical Activity Planning prior to commencement of works encompassing existing system investigation, contingency planning	Facility
2.24	Construction	Design potentially requires construction activities within confined Spaces during construction	Risk to personal safety arising from increased access by construction contractors to existing building confined spaces leading to critical injury or fatality	Inadequate pre-planning of construction activities within recognized confined spaces including safety measures and access provisions Inadequate consideration of constructability requirements during design of facilities Inadequate assessment of site to identify potential confined spaces	Contractor	**Initial risk reduced by existing site controls -** Existing facility underfloor area – confined space Procedures in place already at facility	Facility	2	A	Extreme	Facility design to facilitate implementation of existing controls Facility design to avoid requirement for working in existing spaces with restricted access where possible. New facility design to avoid having confined spaces. Items requiring access for maintenance to be located in accessible locations.	Design Team	1	A	High	**Construction & Commissioning** Implementation of construction safety planning and management processes to consider and minimize work in confined spaces (staging, temporary access, order of work etc)	Contractor
																Construction & Commissioning Facility to induct Contractor in Facility procedures for accessing existing confined spaces	Facility
3	**Operation & Maintenance**																
3.01	Operations & Maintenance	Heights – Access to Equipment for Maintenance	Risk of falling when accessing and working at heights undertaking regular maintenance activities (roof mounted equipment, high ceilings etc) Leading to critical injury or fatality	Inadequate provision of access and safety equipment, guards, barriers, fall arrest systems etc Poor placement of elevated equipment and plant Inadequate training of maintenance staff	Facility	**Initial risk reduced by existing site controls -** Provision of stair access to roof to existing facility. Secured access to roof with authorized access only Safety training of authorized persons	Facility	3	A	Extreme	Facility design to facilitate implementation of existing controls Placement of new equipment requiring maintenance within roof space in accessible locations via stair and walkways Secured stair access to roof with authorized access only Monitoring detail development during construction and review of shop drawings Incorporation of Safety Equipment where applicable (fall arrest harnesses etc Heavy plant equipment replacement considered and planned Access for scaffolding and platform ladders provided to locations where maintenance access is required (ceiling mounted services etc) Post-design Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes	Design Team & Facility	1	A	High	**Construction & Commissioning** Implementation of construction quality management and validation processes to ensure compliance with design documentation Items requiring access for scheduled maintenance to be located in accessible locations. Safety training of authorized persons nominated by Facility for new areas during handover	Contractor
																Operation Development, training, implementation and review of safe work policies and procedures for staff working practices including training of Facility staff in working at heights Implementation of scheduled testing and maintenance of safety systems and equipment to ensure reliability and continual coverage	Facility
																Construction & Commissioning Monitoring detail development during construction and review of shop drawings to ensure items are placed to reduce working at heights	Design Team
3.02	Operations & Maintenance	Heights – Access for Cleaning	Risk of falling when accessing and working at heights undertaking cleaning of building exterior Leading to critical injury or fatality	Inadequate provision of access and safety equipment, guards, barriers, fall arrest systems etc where regular access is likely Inadequate training of maintenance staff	Facility	**Initial risk reduced by existing site controls -** Provision of stair access to roof Secured access to roof with authorized access only Safety training of authorized persons	Facility	3	A	Extreme	Facility design to facilitate implementation of existing controls Design of building form and selection of materials to maximize opportunity for ground-based cleaning (i.e. extension window cleaning etc) Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes Provision of stair access to roof to eliminate need for ladders Secured access to roof with authorized access only Provision of Safety Equipment where applicable (fall arrest harnesses etc Use of pre-finished materials to reduce maintenance requirements at high levels	Design Team & Facility	1	A	High	**Construction & Commissioning** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed safety equipment during commissioning Safety training of authorized persons nominated by Facility for new areas during handover Training of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation Development, training, implementation and review of safe work policies and procedures for staff working practices Implementation of scheduled testing and maintenance of safety systems and equipment to ensure reliability and continual coverage	Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
3.03	Operations & Maintenance	Confined Spaces - Access for operations and maintenance	Risk to personal safety arising from restricted access to persons working in nominated confined spaces in the advent of a safety event Leading to critical injury or fatality	Inadequate pre-planning of access to designated confined spaces including safety measures and access provisions Location of items requiring maintenance access within confined spaces Provision of access to confined spaces leading to unauthorized access Inadequate training of maintenance staff in the identification of confined spaces and required procedures	Facility	**Initial risk reduced by existing site controls -** Training of maintenance staff in identification of confined spaces and procedures for working within them. Processes already in place within existing facility.	Facility	2	A	Extreme	Facility design to facilitate implementation of existing controls New Facility design to minimize requirement for working in existing spaces with restricted access New facilities to be designed without accessible confined spaces No access to be provided to concealed confined spaces which would be designated as confined spaces Items requiring access for scheduled maintenance to be located in accessible locations. Post-design Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes before construction	Design Team & Facility	1	A	High	**Construction & Commissioning** Implementation of construction quality management and validation processes to ensure compliance with design documentation Items requiring access for scheduled maintenance to be located in accessible locations. Monitoring detail development during construction and review of shop drawings to ensure items are not placed in confined areas	Contractor
																Operation Development, training, implementation and review of safe work policies and procedures for staff working practices including training of Facility of maintenance staff in identification of confined spaces and procedures for working within them	Facility
3.04	Operations & Maintenance	Chemicals – maintenance & Cleaning	Risks arising from exposure to noxious or aggressive materials during cleaning or maintenance of facilities leading to Significant Injury	Inadequate safety procedures for handling and storage of chemicals Inadequate training or compliance of staff in chemical safety procedures Inadequate provision of safety equipment / facilities for working with chemicals Use of materials / items requiring insitu use of aggressive agents for cleaning and/or noxious chemicals for repair	Facility	**Initial risk reduced by existing site controls -** Training of facility staff in maintenance and use of any specialized equipment Ongoing maintenance of safety equipment Ongoing training of staff in safety procedures for handling chemicals	Facility	3	D	Moderate	Facility design to facilitate implementation of existing controls New materials and items to be selected with consideration of cleaning and maintenance regimes and required cleaning agents etc to minimize/eliminate requirement for aggressive cleaning agents Post-design review of facility design by Facility cleaning, maintenance and infection control stakeholders for conformance with facility requirements and avoidance of undesirable cleaning agents	Design Team & Facility	2	D	Low	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Training of authorized facility persons nominated for new areas during handover including installed materials and required cleaning regimes etc Provision of detailed operations and maintenance manuals for maintenance and cleaning to reduce risk of accidental use of incorrect agents	Contractor Design Team Facility
																Operation - Development, training, implementation and review of safe work policies and procedures for staff working practices Obtain and maintain cleaning agent product safety information Implementation of scheduled testing and maintenance of equipment to ensure reliability and safe working operation	Facility
3.05	Operations & Maintenance	Lifting& Stretching – General operational Activities	Injury to staff arising from manual handling, lifting, bending etc to move/access items leading to serious injury	Absence of developed procedures for higher risk manual handling tasks Inadequate training or compliance of staff with manual handling and lifting equipment safety procedures Design of storage racks, shelves etc results in excessively high or low storage of items Inadequate provision of lifting equipment Inadequate access for use of lifting equipment in new facilities	Facility	**Initial risk reduced by existing site controls -** policies for storage of items (i.e. height limitations etc) Training of facility staff in maintenance and use of any specialized equipment Ongoing maintenance of safety equipment Training of staff in safety procedures for manual handling and compliance monitoring of same	Facility	3	C	High	Facility design to facilitate implementation of existing controls Facility design to facilitate use of lifting equipment and implementation of facility manual handling procedures Facility design to support policies and procedures – i.e. minimisation of high storage opportunities requiring stretching etc Post-design review of facility design by Facility safety representatives for conformance with facility operational safety policies and procedures	Design Team	2	C	Moderate	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Training of facility staff in maintenance and use of any specialized equipment before operational use	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff working practices Training of staff in safety procedures for manual handling and compliance monitoring of same Selection, maintenance and training in use of specialized equipment to support safe working practices	Facility
3.05A	Operations & maintenance	Pushing- General activities	Injury to staff arising from pushing trolleys to move/access items leading to serious injury	Absence of developed procedures for higher risk manual handling tasks Inadequate training or compliance of staff with manual handling and lifting equipment safety procedures Incorrect trolley/equipment selection Facility requires movement of trolleys etc up steep gradients	Facility	**Initial risk reduced by existing site controls -** Development of manual handling procedures for each task Training of facility staff in maintenance and use of any specialized equipment Ongoing maintenance of safety equipment Training of staff in safety procedures for manual handling and compliance monitoring of same	Facility	3	C	High	Facility design to facilitate implementation of existing controls Facility design to facilitate use of equipment and implementation of facility manual handling procedures Facility designed with low-gradient /low resistance movement paths for trolleys Post-design Review of facility design by Facility safety representatives for conformance with facility operational safety policies and procedures Supply and installation of fixed and loose equipment required to enact and support manual handling procedures	Design Team & Facility	2	C	Moderate	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Training of facility staff in maintenance and use of any specialized equipment before operational use	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff working practices Training of staff in safety procedures for manual handling and compliance monitoring of same Selection, maintenance and training in use of specialized equipment to support safe working practices	Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
3.06	Operations & Maintenance	Lifting – Maintenance of equipment etc	Injury to staff arising from manual lifting associated with maintenance activities leading to serious injury	Inadequate training of staff or compliance by staff with manual handling and lifting equipment safety procedures Inadequate provision of lifting equipment Equipment size and/or location which limits use of lifting aids and/or increases risk of staff lifting heavy loads	Facility	**Initial risk reduced by existing site controls -** Development of manual handling procedures for each lifting task Training of facility staff in maintenance and use of any specialized equipment Ongoing maintenance of safety equipment Training of staff in safety procedures for manual handling Provision of access to lifting aids and equipment	Facility	2	C	Moderate	Facility design to facilitate implementation of existing controls use of lifting equipment and implementation of facility manual handling procedures Facility design and plant equipment selection and positioning to consider method of movement associated with maintenance or replacement Post-design review of facility design by Facility safety representatives for conformance with facility operational safety policies and procedures	Design Team Facility	2	C	Moderate	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Training of facility staff in maintenance and use of any special features to assist access and movement of heavy items	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff working practices Training of staff in safety procedures for manual handling and compliance monitoring of same Selection, maintenance and training in use of specialized equipment to support safe working practices	Facility
																Construction & Commissioning Monitoring detail development during construction and review of shop drawings to ensure items are placed to reduce working at heights	Design Team
3.07	Operations & Maintenance	Security – Internal Areas	Staff injury from personal attack from /unknown persons at first points of contact (reception, etc) Resulting in critical injury or fatality	Inadequate security provisions for level of risk Facility layout / equipment / operational procedures do not provide sufficient safety against attack/duress (i.e. monitored duress notification, staff support availability, emergency egress routes in high risk areas) Aggravation of consumers/patients by poor staff service delivery and/or behavior Poor response to incidents of aggression	Facility	**Initial risk reduced by existing site controls -** Periodical security and risk review to confirm security and safety provisions Provision of physical protection to staff at first point of contact – counter screens etc On-site security monitoring and response staff Ongoing staff training in service delivery and passive management of aggressive patients and consumers Ongoing maintenance of security equipment	Facility	2	A	Extreme	Facility design in accordance with design for safety principles and to conform to on-site security systems and procedures Design of counters to provide passive protection / movement delay without overt barriers (which stimulate aggression) Design for provision of staff with duress alarm providing notification of a duress incident to full-time monitored central security control room to enable Code Black response Provision of egress (withdrawal) paths to safe zones from reception points where no physical barrier present Physical delineation of public front of house zones from secure zones(controlled access zones) Post-design Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes before construction	Design Team	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff Ongoing staff training in service delivery and passive management of aggressive patients and consumers On-site security monitoring and response staff Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility
3.08	Operations & Maintenance	Security – Internal Areas	Occupant injury from personal attack from patients/consumers in patient accessible areas Resulting in critical injury or fatality	Inadequate security provisions for level of risk Facility layout / equipment/operational procedures do not provide adequate security safety – i.e. no screening/access control, duress detection, egress paths etc Aggravation of consumers/patients by poor staff service delivery and/or behavior Poor response to incidents of aggression	Facility	**Initial risk reduced by existing site controls -** Periodical security and risk review to confirm security and safety provisions Development of security policies and procedures to respond to anticipated security incidents Provision of security monitoring and duress protection equipment Access control to high-risk areas On-site security monitoring and response staff Ongoing staff training in service delivery and passive management of aggressive patients and consumers Ongoing maintenance of security equipment	Facility	3	A	Extreme	Facility design in accordance with design for safety principles and to conform to on-site security systems and procedures Design of facilities and fixtures and fittings in patient areas to reduce opportunities for harm including: ▪ High levels of passive observation ▪ Physical delineation between patient and non-patient areas with secure perimeter and access ▪ Provision of safe withdrawal routes and safe secure area for staff in instances of high aggression ▪ Minimisation of spaces without dual egress ▪ Minimisation of spaces which can be barricaded against entry ▪ Use of robust fixtures and fittings secured with tamper resistant methods to reduce opportunity for use as weapons ▪ Ability to physically sub-divide patient areas to manage different patient groups/cohorts to reduce aggression and create temporary patient-free areas for cleaning/maintenance activities ▪ Acitivity spaces containing equipment /items requiring specific staff management to be physically secured against general access ▪ Location of plant, equipment and other items to minimise required access into patient areas by non-clinical staff to reduce unnecessary disturbances and reduce risk to staff (for maintenance purposes etc)	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Review of samples of higher risk fixtures and fittings by design team and facilities representatives prior to final ordering and installation Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation - Development, training, implementation and review of safe work policies and procedures for staff including ongoing staff training in risk assessment and service delivery and passive management of aggressive patients and consumers On-site security monitoring and response staff Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility

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	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
											▪ Design of facilities to reduce stimulation and anxiety through provision of personal space for patients including individual bedrooms/ensuites and multiple living and activity spaces to provide personal choice. Use of natural light and calming design approach including reducing institutional materials and elements to reduce anxiety. Provision of active safety and security systems and equipment and on-site security monitoring to enable staff to notify of duress events and response and support teams to be quickly directed to required location including personal duress alarm pendants for all staff in patient areas Post-design Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes before construction						
3.09	Operations & Maintenance	Security – External outside secure zones (ie staff carpark etc)	Risk to staff arising from personal attack in external areas resulting in critical injury or fatality	Inadequate security provisions for level of risk Low lighting to external areas Opportunities for concealment / dead-end spaces Low security presence – patrols, monitoring, CCTV etc Poor awareness of potential risks by staff	Facility	**Initial risk reduced by existing site controls -** Periodical security and risk review to confirm security and safety provisions Security monitoring and presence of risk areas including CCTV, patrols and passive observation Ongoing maintenance of security equipment Ongoing training of staff in security procedures Ongoing staff training in management of aggressive patients and consumers	Facility	3	A	Extreme	Facility design in accordance with design for safety principles and to support on-site security systems and procedures – external illumination of risk areas, minimisation of concealment opportunities, extension of existing security monitoring systems Passive observation of movement zones limiting opportunities for surprise attacks Review of facility design by Facility security representatives for suitability for conformance with site security requirements	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Review of samples of higher risk fixtures and fittings by design team and facilities representatives prior to final ordering and installation Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff including ongoing staff training insecurity and personal safety procedures, risk assessment and service delivery and passive management of aggressive patients and consumers On-site security monitoring and response staff Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility
3.10	Operations & Maintenance	Electrical - Medication	Critical injury or fatality arising from spoiled refrigerated medication due to undetected power failure	Failure of power supply to medication refrigerator No awareness of power supply failure	Facility	**Initial risk reduced by existing site controls -** Maintenance of storage equipment	Facility	2	A	Extreme	New facilities to incorporate essential power supply to essential equipment and services New Medication storage equipment provided with externally monitored alarm in advent of failure – Facility maintenance Review of facility design by Facility stakeholders for conformance with facility requirements and intended operation	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility equipment and systems including medication alarm notification Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training, implementation and review of policies and procedures for staff Maintenance and testing of medication storage equipment and alarm back-up system	Facility
3.11	Operations & Maintenance	Electrical – Critical Activities	Critical injury or fatality arising from unplanned failure of mains electrical power supply to critical patient activities	Failure of power supply without back-up supply Vulnerable offsite mains reticulation at new Utility Building	Facility	**Initial risk reduced by existing site controls -** Multiple power supply sources for critical activities Automatic Generator supplied essential power supply for critical equipment and activities Maintenance and testing of essential power supply	Facility	2	A	Extreme	Determination of critical activities by design team and facility Provision of essential power to identified critical equipment and activities in new areas Provision of alarm system in advent of failure to nominated facility staff (operational and maintenance) Review of facility design by Facility stakeholders for conformance with facility requirements	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility equipment and systems Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
																Operation – Development, training, implementation and review of policies and procedures for maintenance and testing of equipment and alarm back-up system Maintenance and testing of essential power supply generator and fuel supply	Facility
3.12	Operations & Maintenance	Incorrect Installation	Risk to staff and patients from incorrect / faulty installation equipment and services (nurse call, essential power etc) resulting in critical injury or death	Inadequate work quality and commissioning management Inadequate completion validation processes Inadequate investigation/understanding of existing infrastructure/systems leading to incorrect connection or overextension of existing capacity	Contractor	Nil – Risk arising from construction activities	-	2	A	Extreme	Configuration and capacity of existing infrastructure and systems to be confirmed prior to modifying	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Contractor to familiarize itself with existing systems prior to undertaking works Implementation of construction quality management processes and completion validation procedures Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability	Contractor
3.13	Operations & Maintenance	Security	Critical injury or fatality arising from unauthorized access by staff or patients to controlled medications and substances	Inadequate access controls and procedures enable access to controlled medications and substances	Facility	**Initial risk reduced by existing site controls -** Storage of medications in accordance with regulatory requirements Multiple-level access controls to controlled substances – self-closing doors with electronic swipe card/medication safe Monitored access to controlled medications Maintenance and checking of safety systems	Facility	2	A	High	Design of new facilities in conformance with regulatory and existing facility policies and procedures Multiple-level access controls to controlled substances – self-closing doors with electronic swipe card/medication safe Monitored access to controlled medications Placement of medication storage facilities to allow passive observation Review of facility design by Facility stakeholders for conformance with facility requirements Audited testing of installed equipment and systems during commissioning Maintenance and checking of safety systems	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility equipment and systems Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff and handling, storage and management of medications Maintenance and testing of equipment and alarm back-up system	Facility
3.14	Operations & Maintenance	Security	Critical injury or fatality arising from maintenance staff being attacked by patients when working in patient areas – particularly in patient personal spaces (bedrooms etc)	Facility layout / equipment / operational procedures do not support safe maintenance activities by staff	Facility	**Initial risk reduced by existing site controls** Patients restricted by staff from accessing areas whilst maintenance in progress	Facility	2	A	Extreme	Design of new facilities to support operational practices and policies Design for provision of staff with personal mobile duress pendant providing notification of a duress incident to full-time monitored central security control room to enable Code Black response Common use spaces within patient areas to be provided with dual egress where practical to maintain free path of egress in larger areas and reduce risk of barricading Single-access spaces to be provided with emergency access doors (or outward swinging doors) to reduce risk of barricading High-levels of passive observation designed into facility circulation and common-use internal and external spaces to increase cross-observation by ward staff of maintenance staff Access to engineering systems to be located outside of patients areas far as practicable to minimize need for maintenance staff to enter patient spaces (ie roofspace access) Facility layout to enable bedroom areas to be physically secured and exclude patient access for maintenance activities Review and endorsement of final facility design by Facility stakeholders for conformance with facility operational policies and procedures	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff working in patient areas FM team to develop a restricted operational plan for managing maintenance of patient areas Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
3.15	Operations & Maintenance	Security	Critical injury or fatality arising from cleaning staff being attacked by patients when working in patient areas – particularly in patient personal spaces (bedrooms etc)	Facility layout / equipment / operational procedures do not support safe cleaning activities by staff	Facility	**Initial risk reduced by existing site controls** Patients restricted by staff from accessing areas whilst cleaning in progress	Facility	2	A	Extreme	Design of new facilities to support operational practices and policies All cleaning staff provided with personal mobile duress pendant providing notification of a duress incident to full-time monitored central security control room to initiate Code Black response Common use spaces within patient areas to be provided with dual egress where practical to maintain free path of egress in larger areas and reduce risk of entrapment Single-access spaces to be provided with emergency access doors (or outward swinging doors) to reduce risk of barricading High-levels of passive observation designed into facility circulation and common-use internal and external spaces to increase cross-observation by staff of each other Facility layout to enable bedroom areas to be physically secured and exclude patient access for cleaning activities Review and endorsement of final facility design by Facility stakeholders for conformance with facility operational policies and procedures	Design Team & Facility	1	A	High	**Construction & Commissioning** – Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation - Development, training, implementation and review of safe work policies and procedures for staff working in patient areas i FM team to develop a restricted operational plan for managing cleaning of patient areas Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility
3.16	Operations & Maintenance	Security	Critical injury or fatality arising from staff being overwhelmed in patient areas in instances of quickly escalating patient aggression	Facility layout / equipment / operational procedures do not support safe withdrawal or separation of staff and patients in instances of aggressive behaviour	Facility	**Initial risk reduced by existing site controls** staff are accompanied at all times – not working alone relevant staff are aware of patient Individual Management Plans to support safe interaction and risk management. All staff provided with personal mobile duress pendant providing notification of a duress incident to full-time monitored central security control room to initiate Code Black response Continuous monitoring of patient behaviour by ward and clinical staff and implementation of patient management processes as part of overall risk management approach.	Facility	2	A	Extreme	Design of new facilities in conformance with regulatory and existing facility policies and procedures ensuring zones of wards can be locked/isolated from patients Patient area staff to have access to a secure safe area as 'safe'haven' in advent of escalating aggression in patient areas Secure safe area to be designed and constructed to higher strength to resist attack and access by patients using available items (loose furniture etc) Access to secure safe area to be controlled with higher level dual authentication system to doors to minimize risk of access by patients in advent of staff cards being obtained Secure safe area to be provided with dual paths of egress and safe path of withdrawal Facility layout to enable safe withdrawal by staff from ward areas via controlled exit doors without compromising overall facility security (ie discharge into secure areas) Review and endorsement of final facility design by Facility stakeholders for conformance with facility operational policies and procedures	Design Team & Facility	1	A	High	**Construction & Commissioning** – Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training, implementation and review of safe work policies and procedures for staff working in patient areas Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility
3.17	Operations & Maintenance	Security	Critical injury or fatality arising from individual staff being cornered and attacked by patient(s) in patient areas	Facility layout / equipment / operational procedures do not provide safe environment for staff working individually	Facility	**Initial risk reduced by existing site controls** Existing site operational policy that staff are accompanied at all times – not working alone Existing site policy that relevant staff are aware of patient Individual Management Plans to support safe interaction and risk management. All staff provided with personal mobile duress pendant providing notification of a duress incident to full-time monitored central security control room to initiate Code Black response	Facility	1	A	High	Design of new facilities to support operational practices and policies All staff provided with personal mobile duress pendant providing notification of a duress incident to full-time monitored central security control room to initiate Code Black response Common use spaces within patient areas to be provided with dual egress where practical to maintain free path of egress in larger areas and reduce risk of barricading Single-access spaces to be provided with emergency access doors (or outward swinging doors) to reduce risk of barricading High-levels of passive observation designed into facility circulation and common-use internal and external spaces to increase cross-observation by staff of each other Review and endorsement of final facility design by Facility stakeholders for conformance with facility operational policies and procedures	Design Team & Facility	1	A	High	**Construction & Commissioning** – Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
																Operation – Development, training, implementation and review of safe work policies and procedures for staff working in patient areas i Establishment of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage	Facility
3.18	Operations & Maintenance	Security	Critical injury or fatality arising from patient barricading in room - either self harm or to imprisoning another person in room	Patient restricting access by staff to bedroom resulting in delayed intervention by staff	Facility	**Initial risk reduced by existing site controls** Existing site operational policy that staff are accompanied at all times – not working alone Existing site policy that relevant staff are aware of patient Individual Management Plans to support safe interaction and risk management.	Facility	2	A	Extreme	Design of new facilities to support operational practices and policies All staff provided with personal mobile duress pendant providing notification of a duress incident to full-time monitored central security control room to initiate Code Black response Common use spaces within patient areas to be provided with dual egress where practical to maintain free path of egress in larger areas and reduce risk of barricading Single-access spaces to be provided with emergency access doors (or outward swinging doors) to reduce risk of barricading Review and endorsement of final facility design by Facility stakeholders for conformance with facility operational policies and procedures	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation – Development, training and monitoring of safe work policies and procedures for staff working in patient areas including use of personal safety equipment, protocols for entering restricted access spaces and code black event response. Existing site operational policy that staff are accompanied at all times – not working alone Existing site policy that relevant staff are aware of patient Individual Management Plans to support safe interaction and risk management. Ongoing scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage coverage	Facility
3.19	Operations & Maintenance	General safety - Sharp corners, edges etc causing scrape and grazes	Significant injury arising from sharp edges, corners etc of building, fitments and FFE items etc – i.e. corners to bench top external corners.	Building elements, fitments and loose FFE have projecting elements which may cause injury to unwary persons or provide a ligature opportunity	Facility	**Initial risk reduced by existing site controls** Assessment of new FFE for general safety and suitability Hazard highlighting of items posing injury risk Modification/removal of identified risk items	Facility	3	D	Moderate	Detailing of built-in elements, components and elements in accordance with established safe-design principles. Projecting corners (benches etc) treated, sharp elements (edges, projecting corners etc) avoided, low-hanging elements avoided or treated to minimise injury Review of facility design and FFE selections by Facility stakeholders for conformance with facility requirements	Design Team & Facility	2	D	Low	**Operation -** Ongoing maintenance of fixtures, fittings and fitments	Facility
3.20	Operations & Maintenance	Trips/Slips	Serious Injury arising from trips on uneven surfaces, slippery floor surfaces etc	Uneven surfaces Difference in levels of abutting materials (lips etc) Low visibility steps/changes in levels Slippery floor finishes Inadequate demarcation/warning of wet surfaces (cleaning activities etc) Tripping external areas due to reactive soil	Facility	**Initial risk reduced by existing site controls** Ongoing monitoring and reporting of potential risks Elimination of uneven surfaces, differences in levels etc Highlighting of low visibility steps/changes in levels Selection of floor finishes to provide slip resistance suitable to use and potential risk Training of staff in cleaning and clean-up activities and hazard warning procedures and monitoring of conformance of same Provision of safety equipment for temporary hazard highlighting Maintenance of surfaces to minimise hazards from wear and tear	Facility	4	C	High	Design of new facilities in conformance with regulatory and existing facility policies and procedures Review of facility design by Facility stakeholders for conformance with facility requirements Selection of flooring materials to provide slip resistance according to risk/likelihood in addition to clinical and cleaning requirements Use of flooring materials with reduced risk of trip hazards (low profile lips, edges etc) Avoidance of low visibility changes in level/steps etc Review and endorsement of final facility design by Facility stakeholders for conformance with facility operational policies and procedures	Design Team & Facility	3	C	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Implementation of construction quality management procedures to manage risk of uneven surfaces/hazards arising from poor workmanship Training of staff in cleaning and clean-up activities and hazard warning procedures and monitoring of conformance of same	Contractor
																Operation – Training of staff in cleaning and clean-up activities and hazard warning procedures and monitoring of conformance of same Provision of safety equipment for temporary hazard highlighting Maintenance of surfaces to minimise hazards from wear and tear	

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
3.21	Operations & Maintenance	Infection Control – transfer of infection	Risk of contracting or spreading infection between patients and/or staff leading to critical illness	Poor Infection control policies and procedures and/or compliance with same Inadequate PPE and infection control equipment/consumables Facilities/equipment do not support infection control practices (handbasins, separation of patients etc)	Facility	**Initial risk reduced by existing site controls** Ongoing development of infection control policies and procedures Ongoing testing and review of infection control management effectiveness Conformance with recognised infection control best-practice requirements Training of staff in infection control practices and monitoring of compliance with same Provision of facilities and equipment to minimise risk of transfer of infection (handbasins, waste management , PPE, separation etc)	Facility	2	B	High	Design of new facilities in conformance with regulatory and facility policies and procedures Provision of facilities, equipment and systems to support infection control practices – handbasins, PPE, physical separation of patients, waste management facilities and equipment Review of facility design by Facility stakeholders for conformance with facility requirements	Design Team & Facility	2	B	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems Implementation of construction quality management procedures to achieve required standards of finish. Facility-standard clean of completed works before handover. Provision of maintenance information to facility for cleaning and maintenance of finishes and fixtures	Contractor
																Operation – Ongoing development of infection control policies and procedures Ongoing testing and review of infection control management effectiveness Conformance with recognised infection control best-practice requirements Training of staff in infection control practices and monitoring of compliance with same Provision of equipment to minimise risk of transfer of infection (management , PPE, separation etc)	Facility
3.22	Operations & Maintenance	Infection Control – general cleanliness	Infection risks arising from unclean environments leading to critical illness	Inadequate cleaning procedures and/or compliance with same Facility finishes, fixtures and fitments cannot be cleaned to required standards (poor material selection. inaccessible crevices, dust ledges etc)	Facility	**Initial risk reduced by existing site controls** Ongoing monitoring and testing of critical facilities for infection control cleanliness compliance Training of staff in infection control cleaning practices and monitoring of compliance with same Development of infection control standards for new capital works projects Design of facilities and selection of fixtures and fitments to minimiise cleaning issues	Facility	2	B	High	Design of new facilities in conformance with regulatory and facility policies and procedures Selection of materials and detailing of fixtures and fittings to support best-practice clinical cleaning regimes Review of facility design details by Facility cleaning and infection control stakeholders for conformance with facility requirements	Design Team & Facility	2	B	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems Implementation of construction quality management procedures to achieve required standards of finish. Facility-standard clean of completed works before handover. Provision of maintenance information to facility for cleaning and maintenance of finishes and fixtures	Contractor
																Operation – Training of staff in infection control practices and monitoring of compliance with same Training of staff in infection control cleaning practices and monitoring of compliance with same	Facility
3.23	Operations & Maintenance	Infection Control - Legionella	Risks to personal safety arising from legionella in water supply leading to serious illness	Inadequate cleaning and maintenance regimes for hydraulic services Hot water supply type and configuration provides opportunities for legionella growth	Facility	**Initial risk reduced by existing site controls** Ongoing testing and cleaning of water supply system Hot water supply system (not warm water) Best-practice design and installation practices – minimisation of pipework deadlegs, no overflows to basins, provision of readily accessible maintenance points (Thermostatic mixing valve assemblies etc) to support regular effective maintenance	Facility	2	C	Moderate	Design of new facilities in conformance with regulatory and facility policies and procedures Ongoing testing and cleaning of water supply system Use of Hot water supply system (not warm water) in accordance with SA Health policies Best-practice design and installation practices – minimisation of pipework deadlegs, no overflows to basins, provision of readily accessible maintenance points (Thermostatic mixing valve assemblies etc) to support regular effective maintenance	Design Team & Facility	2	C	Moderate	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Best-practice design and installation practices – minimisation of pipework deadlegs, no overflows to basins, provision of readily accessible maintenance points (Thermostatic mixing valve assemblies etc) to support regular effective maintenance Effective familiarity training and handover of system to facility	Contractor
																Operation – Ongoing testing and cleaning regime	Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
3.24	Operations & Maintenance	Fire Safety	Risks to personal safety in advent of fire leading to fatality	Non-complying facility and/or fire safety systems Inadequate emergency procedures or compliance with same Inadequate familiarity of responsible safety officers with safety provisions and requirements Inadequate maintenance of fire safety equipment	Facility	**Initial risk reduced by existing site controls** Ongoing facility compliance upgrades and procedures development Ongoing training of staff and safety officers in fire safety procedures Ongoing maintenance of fire safety equipment and systems	Facility	2	A	Extreme	Design of new facilities in conformance with regulatory and facility policies and procedures Provision of higher-than-required standard fire safety equipment (automatic sprinkler system etc) Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes Fire safety design principles and installed fire safety equipment suitable for secure patient facility to maintain effective operation in advent of fire (ie tamper resistant fittings, minimization of fittings within patient areas etc) Review of facility design by fire-fighting authority (SAMFS) as part of pre-construction building regulatory approval process	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability External inspection and audit by fire safety authorities (SAMFS) Training of facility staff by contractor of specialized equipment and features Provision of detailed operations and maintenance manuals for use and maintenance of fire safety equipment and systems	Contractor
																Operation – Development, training and monitoring of fire safety policies and procedures for staff Ongoing scheduled testing and maintenance of fire safety systems and equipment to ensure reliability and continual coverage	Facility
3.25	Operations & Maintenance	Emergency Response	Critical injury or fatality arising from delays and/or incorrect response to detected Code Emergencies within facilities	Inadequate safety procedures and/or compliance with same Staff unfamiliarity with new facility configuration Facility does not support safety procedures (ie lock-downs etc)	Facility	**Initial risk reduced by existing site controls** Ongoing development of emergency response plan procedure in relation to Code Emergency events Training of staff in emergency event procedures and monitoring and testing of compliance of same Establishment and maintenance of equipment, systems and support for response procedures (detection, communication and response)	Facility	1	A	High	Design of new facilities in conformance with existing facility procedures and extending existing and enhancing existing systems and support facilities Provision of new full-time-monitored security control room to improve integration of existing facilities with new facilities and provide dedicated emergency response management centre Review of facility design by Facility stakeholders for suitability for operation and maintenance purposes	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability Training of staff in emergency event procedures and monitoring and testing of compliance of same	Contractor
																Operation – Development, training and monitoring of safety policies and procedures for staff for new facility Ongoing scheduled testing and maintenance of fire safety systems and equipment to ensure reliability and continual coverage	Facility
3.26	Operations & Maintenance	Communication systems	Critical injury or fatality arising from delays and/or incorrect communication of detected Code Emergencies within facilities	Inadequate safety procedures and/or compliance with same Incorrect operation of warning system in emergencies.	facility	**Initial risk reduced by existing site controls** Provide detailed discussions with operator to emergency management and training of the emergency management equipment	Facility	2	A	Extreme	Design of new facilities in conformance with existing facility procedures and extending existing and enhancing existing systems and support facilities Provision of new full-time-monitored security control room to improve integration of existing facilities with new facilities and provide dedicated communication management centre Review of facility design by Facility stakeholders for suitability for operation and maintenance purposes	Design Team & Facility	1	A	High	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation Audited testing of installed equipment and systems during commissioning and handover to ensure system reliability. Training of staff in emergency event procedures and monitoring and testing of compliance of same	Contractor
																Operation – Development, training and monitoring of safety policies and procedures for staff for new facility Ongoing scheduled testing and maintenance of fire safety systems and equipment to ensure reliability and continual coverage	Facility
3.27	Operations & Maintenance	Infection Control - Vermin infestation	Risks to personal hygiene and destruction of service runs leading to serious illness	Inadequate vermin protection to services entering the building Inadequate vermin management and eradication procedures Inadequate cleaning and waste management procedures attracting vermin	Facility	**Initial risk reduced by existing site controls** Ongoing vermin monitoring and eradication regimes waste management procedures to minimize risk of attracting vermin Implementation of required cleaning regimes	Facility	2	C	Moderate	Design of new facilities to minimize intrusion of vermin and support cleaning and maintenance regimes Design of new facilities to support required cleaning regimes to minimize risk of attracting vermin Design of facility to support waste management practices to minimize risk of attracting vermin Review of facility design by Facility stakeholders for suitability for operation and maintenance purposes	Design Team & Facility	2	C	Moderate	**Construction & Commissioning –** Implementation of construction quality management and validation processes to ensure compliance with design documentation maintenance of clean, vermin-free construction site and works to minimize risk of vermin establishment during construction Implementation of construction quality management procedures to achieve required standards of finish. Facility-standard clean of completed works before handover.	Contractor
																Operation – Ongoing vermin monitoring and eradication regimes Implementation of suitable waste management procedures to minimize risk of attracting vermin Implementation of required cleaning regimes	Facility

ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
3.28	Operations & Maintenance	Security	Critical injury or fatality arising failure to detect security incident	Inadequate security provisions for level of risk Facility layout / equipment/operational procedures do not provide adequate security safety – i.e. inadequate operational procedures for areas with low passive surveillance(patient bedrooms etc) Undetected blind spots (obstructed line of sight/low illumination etc) in areas where passive observation is assumed Duress incident detection/notification equipment malfunction	Facility	**Initial risk reduced by existing site controls -** Periodical security and risk review to confirm security and safety provisions Development of security policies and procedures to respond to anticipated security incidents and level of risk Provision of security monitoring and duress protection equipment Training of staff in operational procedures for working in low observation spaces Ongoing checking and maintenance of security equipment	Facility	3	A	Extreme	Facility design in accordance with design for safety principles and to conform to on-site security systems and procedures Incorporation of high-levels of passive observation opportunities into patient communal area facilities to minimize low-visibility spaces Minimisation of low visibility areas and coordinating lighting levels for the purpose of the area and detection technologies in use (CCTV) Post-design Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes before construction	Design Team & Facility	3	C	High	**Construction & Commissioning** – Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation - Development, training, implementation and review of safe work policies and procedures for staff including ongoing staff training in risk assessment and approach to working in low observation spaces – ie entering spaces after consumer, maintaining clear line of egress, maintaining audible communication opportunities to supplement duress alert pendants (doors open), maintaining awareness of individual patient management requirements and associated risk management approach. Pre-occupation review of facilities to confirm potential low-observation spaces where specific procedures will be applicable Provision of on-site security monitoring Implementation of scheduled testing and maintenance of security and safety systems and equipment to ensure reliability and continual coverage Implementation of system improvement processes including ongoing review of incidents to identify causation and implementation of suitable control measures where required.	Facility
3.29	Operations & Maintenance	Security	Damage to electrical supply or security equipment mounted externally at high level from lightning strikes resulting in security system disruption/failure leading to critical injury or fatality	Extreme weather conditions – lightning strikes Inadequate earthing protection to equipment No back-up power supply Inadequate operational contingency procedures in advent of failure	Facility	**Initial risk reduced by existing site controls -** Multiple power supply sources for critical activities and equipment Automatic Generator supplied essential power supply for critical equipment and activities (limited capacity) Maintenance and testing of essential power supply generator and fuel supply		2	A	Extreme	Determination of critical activities by design team and facility Provision of earthing to electrical equipment Provision of essential power to identified critical equipment and activities in new areas Provision of alarm system in advent of failure to nominated facility staff (operational and maintenance) Provision of new emergency power generation capacity to cover new equipment and improve reliability Review of facility design by Facility stakeholders for conformance with facility requirements	Design Team & Facility	1	A	High	**Construction & Commissioning** – Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation - Development, training, implementation and review of safe work policies and procedures for staff for system failure incidents Provision of on-site security monitoring Implementation of scheduled testing and maintenance of security and electrical systems and equipment to ensure reliability	Facility
3.30	Operations & Maintenance	Self-Harm	Building occupants (patients) self-harming as result of mental illness. Resulting in critical injury or fatality	Patient environment provides opportunity for self harm actions (ligature opportunity, access to potential self-harm implements) Inaccurate assessment of individual patient risk or implementation of individual patient management plans to manage risk of self harm Poor quality of patient environment exacerbates patient mental illness	Facility	**Initial risk reduced by existing site controls -** Assessment of individual patients and development and implementation of individual patient management plans Formal patient information exchange between staff to maintain knowledge of current risks Management of patient access to higher-risk areas/equipment and direct staff monitoring of patients when in higher risk areas Minimisation of self-harm opportunity-items in patient environment through installation of appropriate fixtures and fittings and isolating higher-risk items when not required for patient use.	Facility	3	A	Extreme	Facility design in accordance with design for safety principles and to conform to on-site security systems and procedures Design of facilities and fixtures and fittings in patient areas to reduce opportunities for harm including: ▪ High levels of passive observation to increase staff monitoring capability ▪ Physical delineation between patient and non-patient areas with secure perimeter and access ▪ Selection and design of fixtures and fittings with specific regard to minimising opportunities for self-harm with particular emphasis on ligature point and sharp objects ▪ Minimisation of engineering services items within the patient environment to reduce opportunity. Use of alternative solutions to BCA requirements where practical to reduce items ▪ Provide ability to manage access to each room and storage cupboards to reduce risk/improve direct observation as required ▪ Positioning of required building services items out of readily accessible locations reach of patients (ie on 2700mm min height ceilings or in concealed locations)	Design Team & Facility	1	A	High	**Construction & Commissioning** – Implementation of construction quality management and validation processes to ensure compliance with design documentation Verified testing of installed equipment and systems during commissioning and handover to ensure system reliability Review of samples of higher risk fixtures and fittings by design team and facilities representatives prior to final ordering and installation Training by construction team of designated 'train-the-trainer staff in the use of facility security equipment and systems. Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation - Development, training, implementation and review of safe work policies and procedures for staff including ongoing staff training in risk assessment and service delivery On-site security monitoring and response staff Implementation of scheduled testing and maintenance of security and safety systems and general facility to ensure reliability and continual coverage	Facility

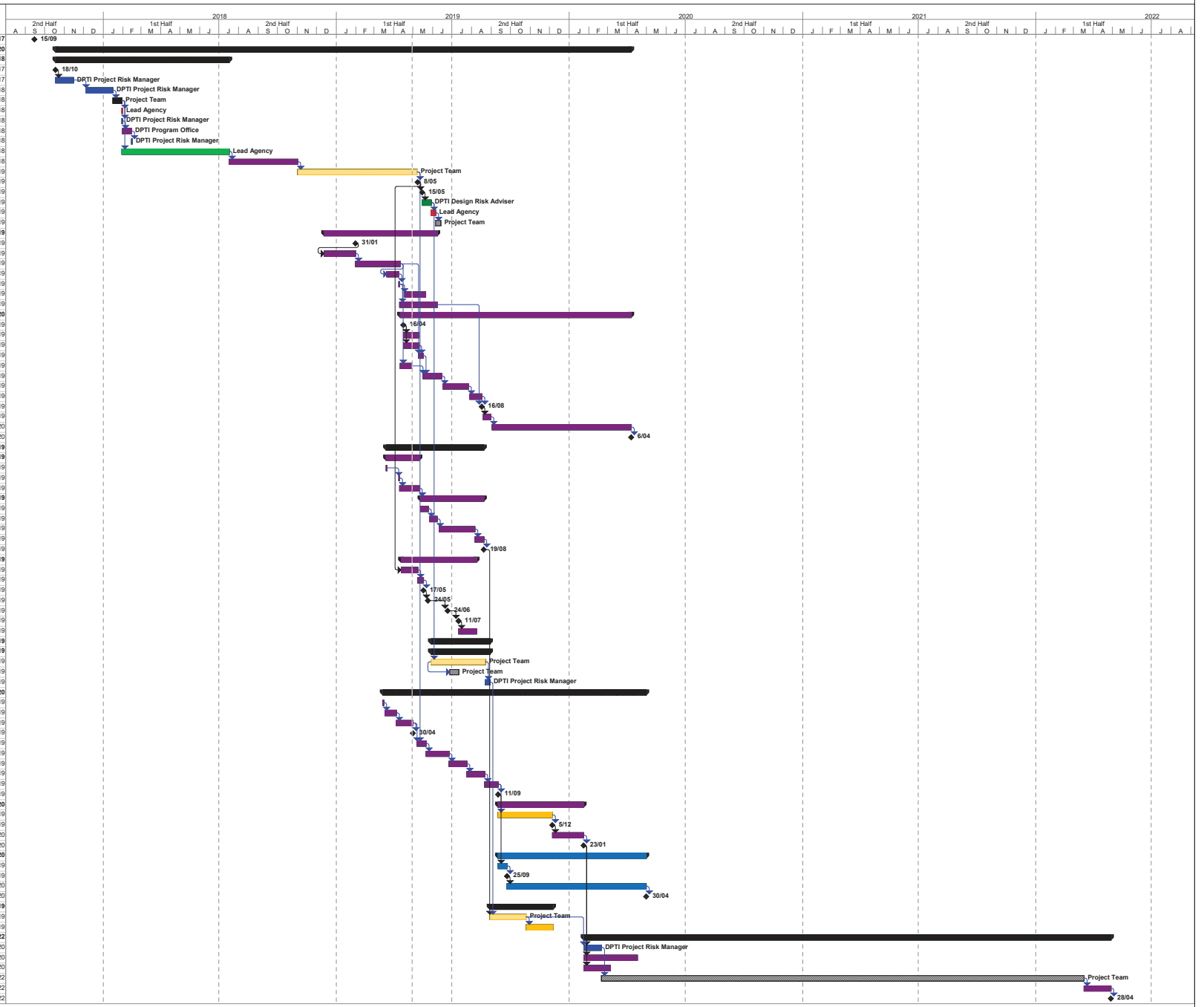
ID	Hazard Identification					Initial Risk Assessment					Risk Control – Design					Further Action	
	Phase (for Impact)	Source (i.e. Hazard)	Event/Risk – Including Consequence(s)	Possible Cause(s)	Risk Owner	Control Measures (Incl Exist Site Controls)	Action Owner	Current Risk L	C	R	Control Measures (Improvements)	Action	Residual Risk L	C	R	Further Action	Action
											▪ Provision of doors and locking systems to cupboards etc to enable access to higher-risk items to be controlled and managed ▪ Use of robust fixtures and fittings secured with tamper resistant methods to reduce opportunity for removal / use for self-harm ▪ Activity spaces containing equipment /items requiring specific staff management to be physically secured against general access ▪ Location of plant, equipment and other items outside patient areas where possible to reduce opportunity ▪ Design of facilities to reduce stimulation and anxiety through provision of personal space for patients including individual bedrooms/ensuites and multiple living and activity spaces to provide personal choice. Use of natural light and calming design approach including reducing institutional materials and elements to reduce anxiety. Provision of active safety and security systems and equipment and on-site security monitoring to enable staff to notify of self-harm events and response and support teams to be quickly directed to required location to provide assistance. Post-design Review of facility design by Facility safety representatives for suitability for operation and maintenance purposes before construction						
3.31	Operations and maintenance	Existing hazardous materials – Asbestos etc	Exposure to hazardous materials leading to critical injury or fatality	Inadequate identification of potential material Inadequate safety procedures Inadequate implementation of asbestos management plans	Facility	**Initial risk reduced by existing site controls -** Asbestos and Hazardous Material Register maintained to inform location of asbestos	Facility	1	A	High	Design documentation to encompass current site asbestos and hazardous material register for information Undertake testing if site for evidence of potential latent conditions Specification of hazardous material management requirements and processes if encountered Controlled hazardous chemicals to be removed by Facility prior to site handover where applicable.	Design Team	1	A	High	**Construction & Commissioning** Implementation of construction quality management and validation processes to ensure compliance Implementation of construction safety planning and management processes for hazardous materials Unregistered asbestos encountered during construction to be included in site Asbestos Register. Environmental engineering input to determine appropriate management action. Environmental management information to be included where latent condition requires ongoing maintenance/monitoring construction team to advise facility management staff of any amendments to site asbestos management requirements Provision of detailed operations and maintenance manuals for use and maintenance of security and safety equipment and systems	Contractor
																Operation Maintenance of existing site asbestos register Maintenance and implementation of asbestos management plans and associated staff training and procedures to maintain currency with site conditions and legislation.	Facility

APPENDIX L

PRELIMINARY PROGRAMME

LYELL MCEWIN HOSPITAL - EMERGENCY DEPARTMENT EXPANSION
MASTER PROGRAM

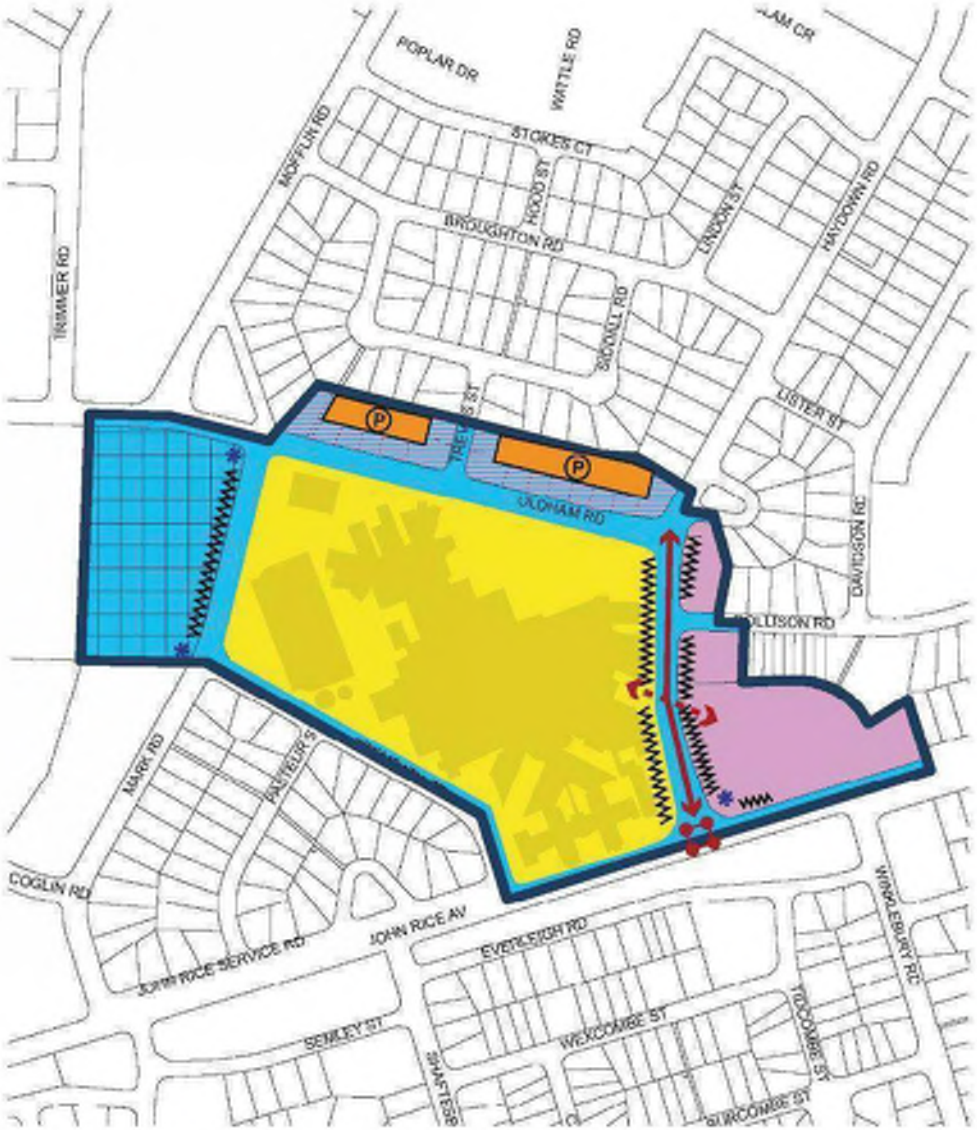
ID	Task Name	Duration	Start	Finish
1	**BRIEF DEVELOPMENT**	**0 days**	**Fri 15/09/17**	**Fri 15/09/17**
6	**STEP 5.1 - CONCEPT**	**599 days**	**Wed 18/10/17**	**Mon 6/04/20**
7	Appoint Project Design Team	**184 days**	**Wed 18/10/17**	**Mon 16/07/18**
8	*Acquisition Plan Approval*	0 wks	Wed 18/10/17	Wed 18/10/17
9	*PSC Tender Document Preparation*	4 wks	Wed 18/10/17	Tue 14/11/17
10	*PSC Tender Call*	4 wks	Tue 5/12/17	Mon 15/01/18
11	*PSC Tender Appraisal/ Evaluation*	2 wks	Tue 16/01/18	Mon 29/01/18
12	*PSC Lead Agency Recommendation Approval*	1 day	Tue 30/01/18	Tue 30/01/18
13	*PSC DPTI Engagement Delegate Approval*	1 day	Tue 30/01/18	Tue 30/01/18
14	*Award PSC Contract*	2 wks	Wed 31/01/18	Tue 13/02/18
15	*Design Start-Up*	1 day	Wed 14/02/18	Wed 14/02/18
16	Trice/PSA Deliverable (SAH)	24 wks	Tue 30/01/18	Mon 16/07/18
17	Consider various options and obtain decision from ELT	15.5 wks	Tue 17/07/18	Thu 1/11/18
18	Develop Concept Design	**23 wks**	Thu 1/11/18	Tue 7/05/19
19	Submit Concept Design Report	0 days	Wed 8/05/19	Wed 8/05/19
20	Present Concept Design to Stakeholders	0 days	Wed 15/05/19	Wed 15/05/19
21	DPTI/SAH Concept Review (design and cost)	2 wks	Wed 15/05/19	Wed 29/05/19
22	Secure Stakeholder Sign-off	1 wk	Wed 29/05/19	Wed 5/06/19
23	Finalise Concept Report	1 wk	Wed 5/06/19	Thu 13/06/19
24	**EARLY WORKS CARPARK SCOPE**	**109 days**	**Thu 13/12/18**	**Fri 7/06/19**
25	Direction to proceed with Carpark Scope	0 days	Thu 31/01/19	Thu 31/01/19
26	Prepare Concept	20 days	Thu 13/12/18	Wed 30/01/19
27	Prepare 100% docs	10 wks	Thu 31/01/19	Wed 10/04/19
28	SCAP Preparation for Carpark	13 days	Thu 21/03/19	Mon 8/04/19
29	SCAP Lodgement for Carpark	1 day	Tue 9/04/19	Tue 9/04/19
30	Building Rules Consent Granted	4 wks	Thu 18/04/19	Mon 20/05/19
31	SCAP Approval Carpark	8 wks	Wed 10/04/19	Fri 7/06/19
32	**PROCUREMENT FOR CARPARK**	**238 days**	**Thu 11/04/19**	**Mon 6/04/20**
33	Direction provided by SAH to proceed	0 days	Tue 16/04/19	Tue 16/04/19
34	Acquisition Plan Preparation and Approval	3 wks	Tue 16/04/19	Thu 9/05/19
35	Gateway 6 - Pre Tender Estimate / SAH Approval	3 wks	Tue 16/04/19	Thu 9/05/19
36	Prepare RFT docs	1 wk	Fri 10/05/19	Thu 16/05/19
37	DPTI/SAH Doc Review	2 wks	Thu 11/04/19	Mon 29/04/19
38	Call RFT	4 wks	Fri 17/05/19	Fri 14/06/19
39	RFT Assessment and Recommendation	6 wks	Mon 17/06/19	Fri 26/07/19
40	GBC Contract Formation	3 wks	Mon 29/07/19	Fri 16/08/19
41	GBC Contract Award	0 wks	Fri 16/08/19	Fri 16/08/19
42	Possession of Site	2 wks	Mon 19/08/19	Fri 30/08/19
43	Construction (incl mobilisation)	7 mons	Mon 2/09/19	Mon 6/04/20
44	Practical Completion	0 days	Mon 6/04/20	Mon 6/04/20
45	**MAIN WORKS PACKAGE (ED & MHSSU)**	**105 days**	**Wed 20/03/19**	**Mon 19/08/19**
46	**ODASA Pre-Lodgement Process**	**35 days**	**Wed 20/03/19**	**Fri 10/05/19**
47	Initial Meeting with ODASA/Planning	1 day	Wed 20/03/19	Wed 20/03/19
48	Briefing with Council	1 day	Tue 9/04/19	Tue 9/04/19
49	ODASA Design Review (7/05)	4 wks	Wed 10/04/19	Fri 10/05/19
50	**SCAP APPROVAL - MAIN WORKS**	**70 days**	**Mon 13/05/19**	**Mon 19/08/19**
51	SCAP Lodgement	2 wks	Mon 13/05/19	Fri 24/05/19
52	SCAP Fee Advice	2 wks	Mon 27/05/19	Fri 7/06/19
53	Council Referral	8 wks	Tue 11/06/19	Mon 5/08/19
54	Delegate Approval	2 wks	Tue 6/08/19	Mon 19/08/19
55	SCAP Approval	0 wks	Mon 19/08/19	Mon 19/08/19
56	**PWC (MAIN WORKS AND CARPARK)**	**80 days**	**Fri 12/04/19**	**Thu 8/08/19**
57	Draft PWC completed including acquittals	3 wks	Fri 12/04/19	Wed 8/05/19
58	Approve PWC Report by SAH	7 days	Wed 8/05/19	Fri 17/05/19
59	Submission to CE	0 days	Fri 17/05/19	Fri 17/05/19
60	Submission to Minister	0 days	Fri 24/05/19	Fri 24/05/19
61	Cabinet Meeting	0 days	Mon 24/06/19	Mon 24/06/19
62	Public Works Hearing	0 days	Thu 11/07/19	Thu 11/07/19
63	Public Works Report	4 wks	Thu 11/07/19	Thu 8/08/19
64	**STEP 5.2 - DESIGN**	**65 days**	**Wed 29/05/19**	**Thu 29/08/19**
65	Review Concept and Develop Design	**65 days**	**Wed 29/05/19**	**Thu 29/08/19**
66	*Design Development*	12 wks	Wed 29/05/19	Thu 22/08/19
67	*Risk Management Plan*	2 wks	Thu 27/06/19	Thu 11/07/19
68	Confirm Cost Plan	1 wk	Thu 22/08/19	Thu 29/08/19
69	**STEP 5.3 - TENDER MC PROCUREMENT**	**274.5 days**	**Fri 15/03/19**	**Thu 30/04/20**
70	Prepare EOI Documents	1 day	Fri 15/03/19	Fri 15/03/19
71	EOI Period	14 days	Mon 18/03/19	Thu 4/04/19
72	EOI Assessment and Recommendation to Shortlist	3 wks	Fri 5/04/19	Tue 30/04/19
73	Tender Field Selected	0 days	Tue 30/04/19	Tue 30/04/19
74	Prepare RFT Documents	2 wks	Tue 7/05/19	Tue 21/05/19
75	MC RFT Period	5 wks	Tue 21/05/19	Wed 26/06/19
76	RFT Assessment and Recommendation	4 wks	Wed 26/06/19	Wed 24/07/19
77	Gateway 7 Approval	4 wks	Wed 24/07/19	Wed 21/08/19
78	MC Contract Formation	3 wks	Wed 21/08/19	Wed 11/09/19
79	MC Award	0 days	Wed 11/09/19	Wed 11/09/19
80	**PART A - PRE-CONSTRUCTION SERVICES (ECI PHASE)**	**80 days**	**Wed 11/09/19**	**Thu 23/01/20**
81	ECI input to Documentation to GCS	60 days	Wed 11/09/19	Thu 5/12/19
82	Guaranteed Construction Sum submitted	0 days	Thu 5/12/19	Thu 5/12/19
83	Guaranteed Construction Sum reviewed for approval	20 days	Thu 5/12/19	Thu 23/01/20
84	Guaranteed Construction Sum approved	0 wks	Thu 23/01/20	Thu 23/01/20
85	**PART A - EARLY WORKS CONSTRUCTION (IF REQUIRED)**	**150 days**	**Wed 11/09/19**	**Thu 30/04/20**
86	Possession of Site	2 wks	Wed 11/09/19	Wed 25/09/19
87	Mobilisation	0 wks	Wed 25/09/19	Wed 25/09/19
88	Construction	7 mons	Wed 25/09/19	Thu 30/04/20
89	Practical Completion	0 days	Thu 30/04/20	Thu 30/04/20
90	**STEP 5.4 - DOCUMENTATION**	**70 days**	**Thu 29/08/19**	**Fri 6/12/19**
91	Prepare Construction Contract Documents to 90%	8 wks	Thu 29/08/19	Fri 25/10/19
92	Prepare Construction Contract Documents to 100%	6 wks	Fri 25/10/19	Fri 6/12/19
93	**PART B - CONSTRUCTION SERVICES**	**565 days**	**Thu 23/01/20**	**Thu 28/04/22**
94	Construction Mobilisation	4 wks	Thu 23/01/20	Thu 20/02/20
95	Tender Trade Packages	12 wks	Thu 23/01/20	Thu 16/04/20
96	Building Certification	6 wks	Thu 23/01/20	Thu 5/03/20
97	Construction	515 days	Thu 20/02/20	Thu 17/03/22
98	Contingency	6 wks	Thu 17/03/22	Thu 28/04/22
99	Practical Completion	0 days	Thu 28/04/22	Thu 28/04/22



APPENDIX M

SUPPLEMENTARY DRAWINGS


OLDHAM ROAD
MOFFLIN ROAD
MOFFLIN ROAD
TREVES STREET
HAYDOWN ROAD
OLDHAM ROAD
MARK ROAD
HAYDOWN ROAD
ROLLISON ROAD
ELIZABETH VALE
SHOPPING CENTRE
TREMBATH ROAD
MARK ROAD
PASTEUR STREET
JOHN RICE AVENUE
MARK RO



Concept Plan Boundary
Suburban Activity Node Zone
H Hospital
Carparking
Icon Building
Main Street Mixed Use/Allied Health
Secondary Mixed Use/Allied Health
Tertiary Education and Commercial
Key Active Frontage
Signalised Intersection
Main Street
Pedestrian Link

N

0 50 100 150 200 250 m

ELIZABETH VALE

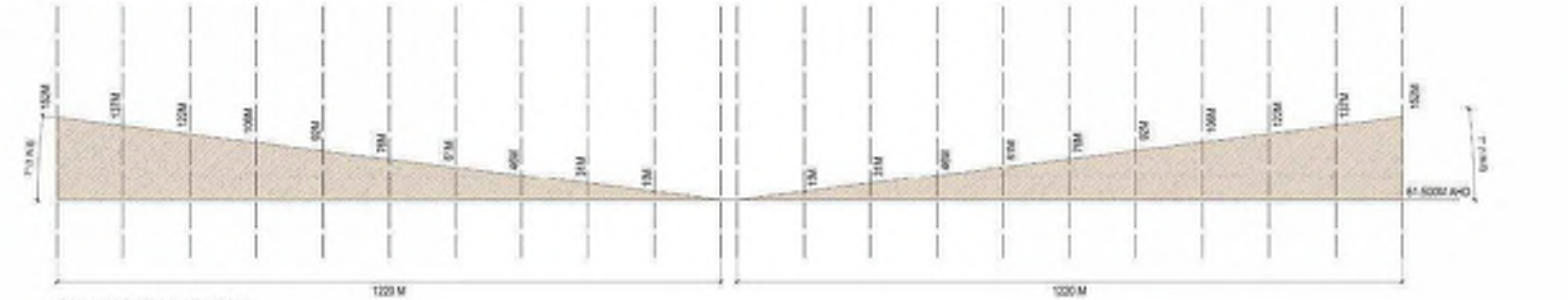
Concept Plan Map Play/33

LYELL MCEWIN HEALTH SUBURBAN ACTIVITY NODE

PLAYFORD (COUNCIL)

Consolidated - 27 June 2017

PLAN

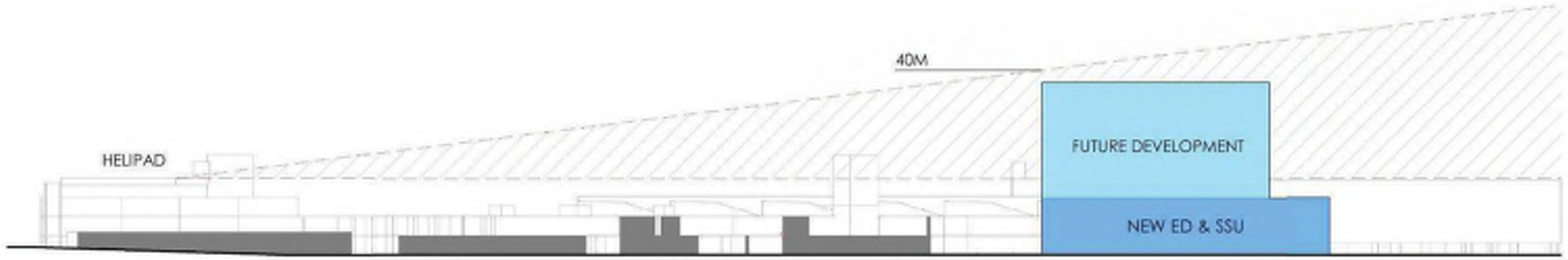


HEIGHTS ARE ABOVE THE AUSTRALIAN HEIGHT DATUM OF 61.500

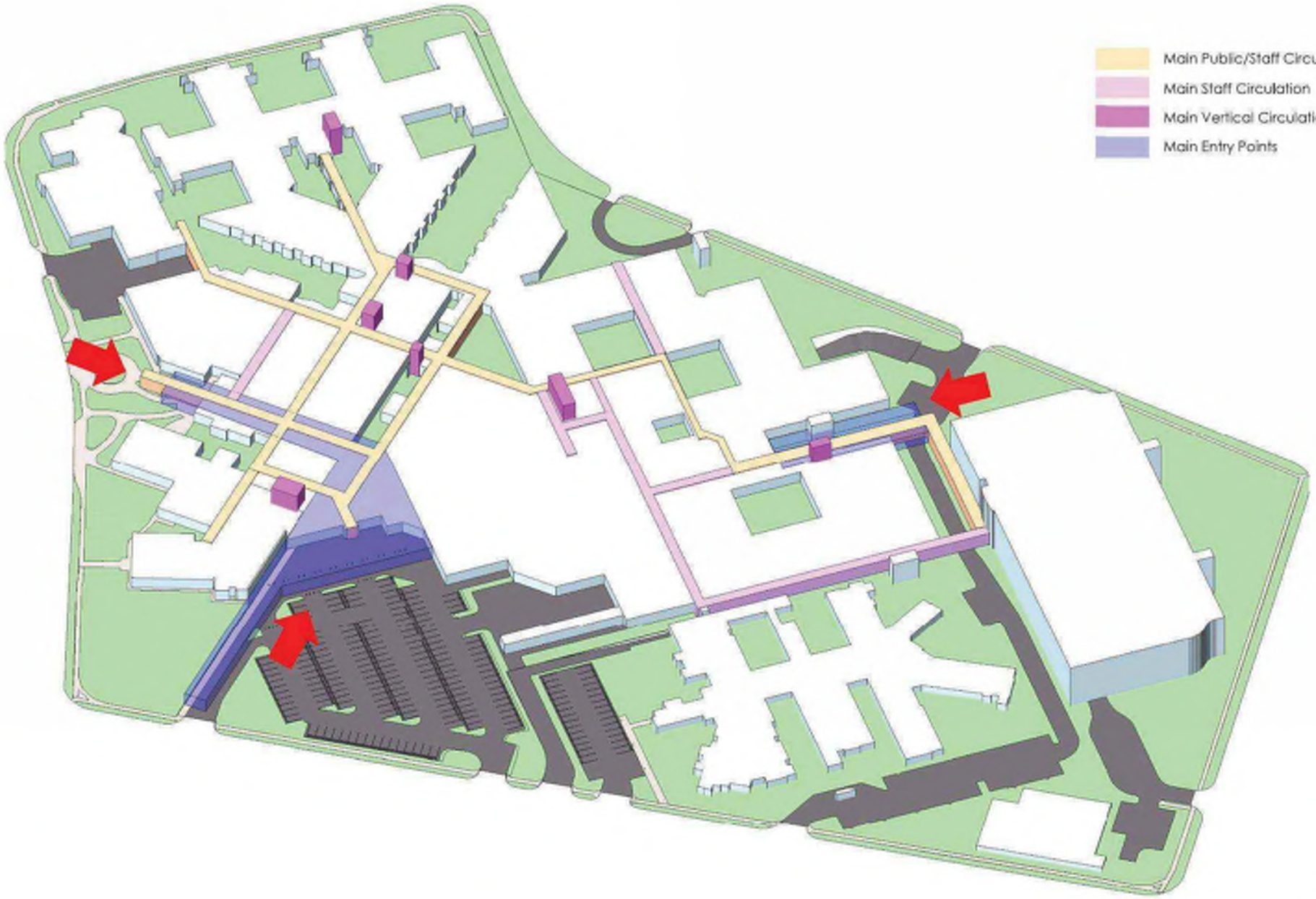
SECTION

THE HATCHED ZONE REPRESENTS THE MAXIMUM BUILDING HEIGHTS ABOVE THE AUSTRLIAN HEIGHT DATUM OF 61.500M (HEIGHT OF THE HELIPAD)

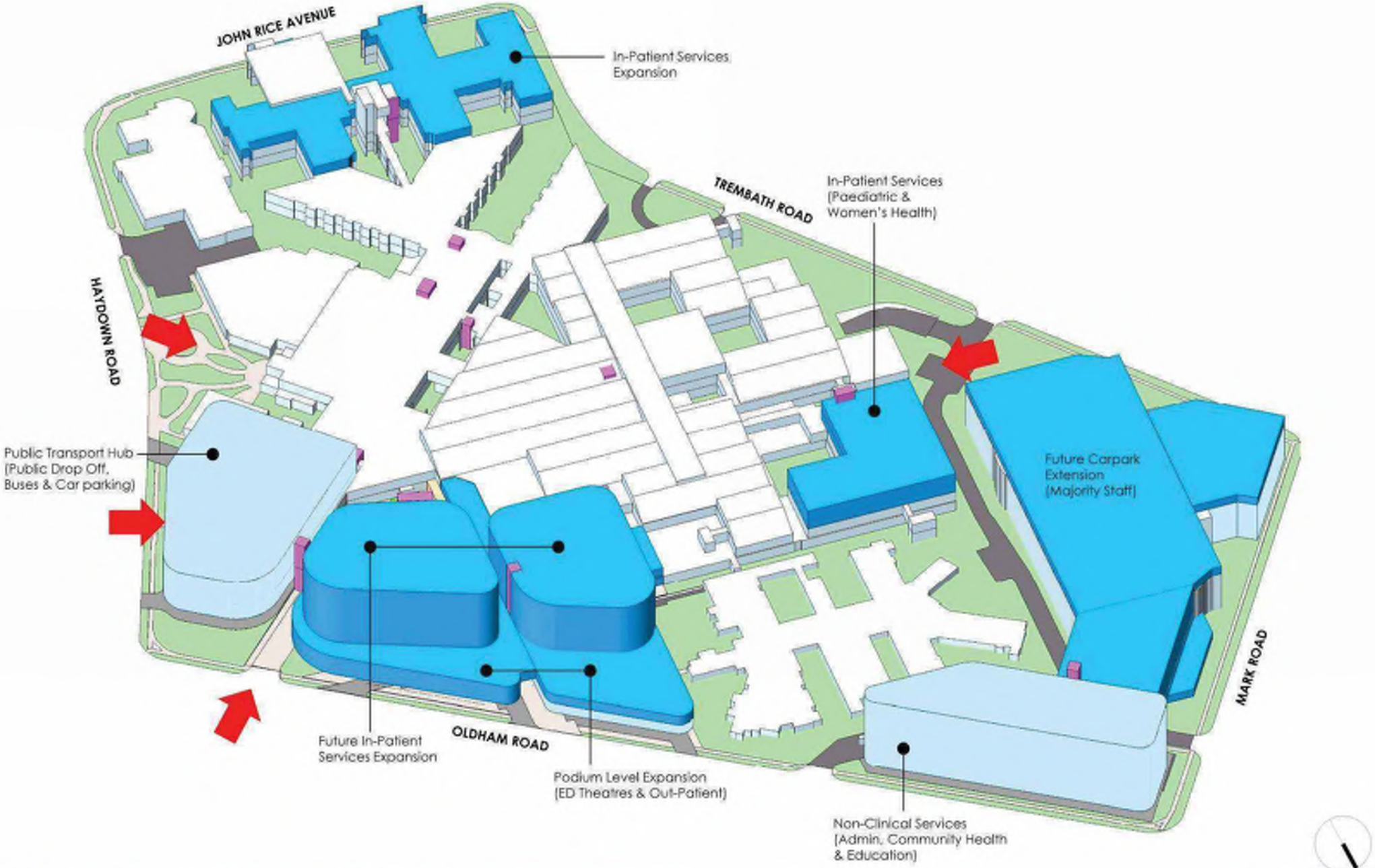
THE EXTENTS OF THE FLIGHT ZONE



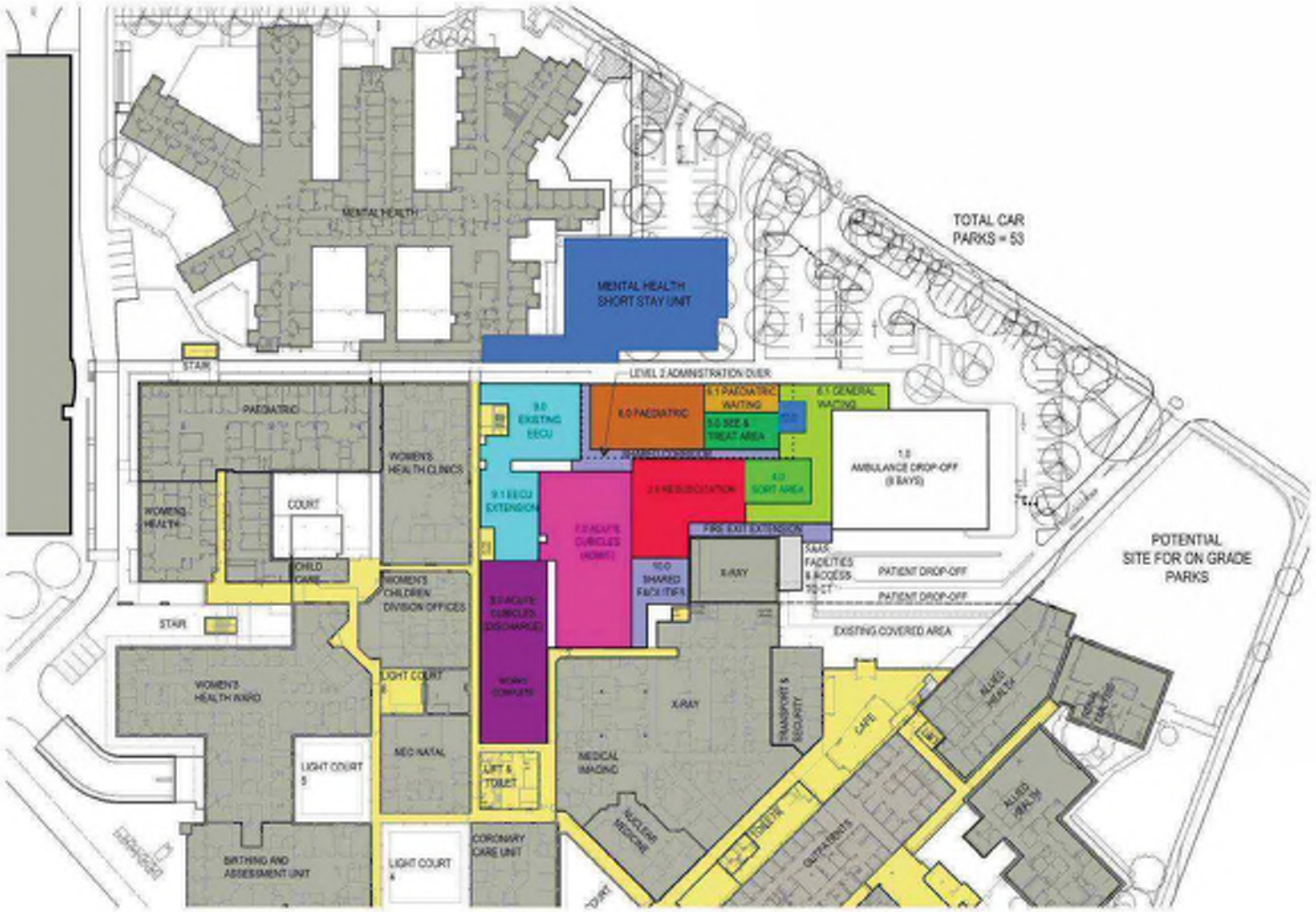
SECTION A



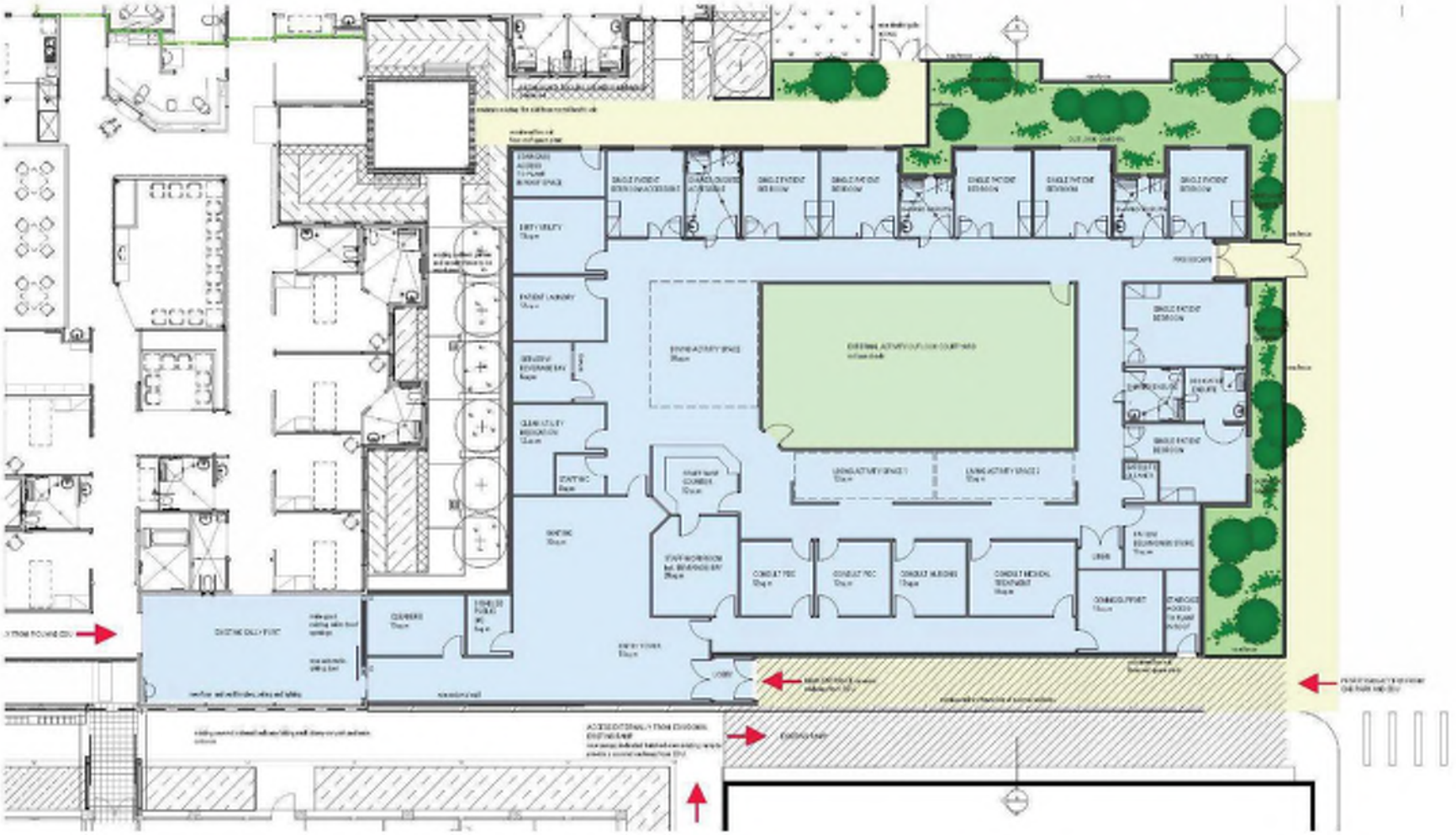
Existing Level 1

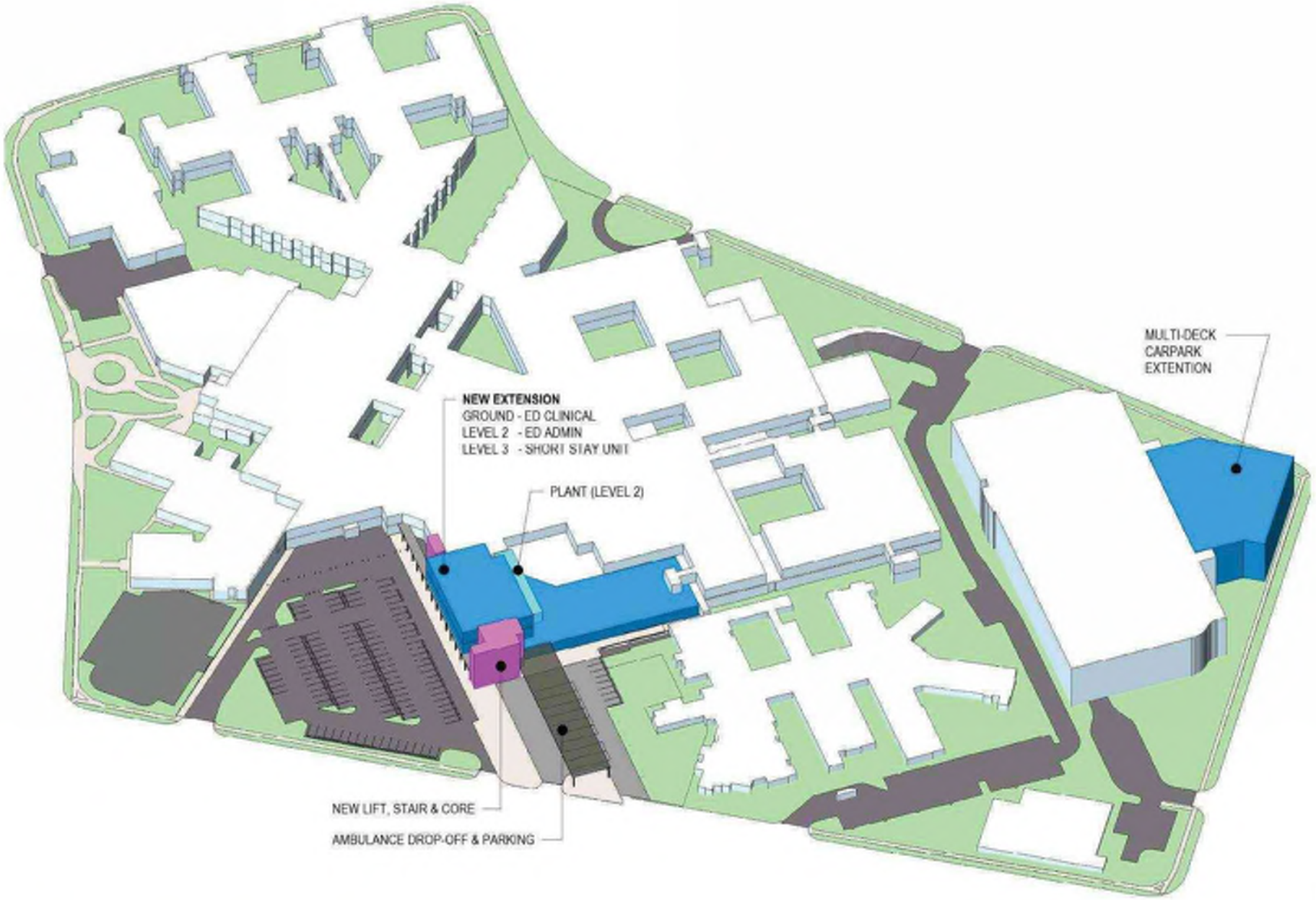

JOHN RICE AVENUE
In-Patient Services Expansion
TREMBATH ROAD
In-Patient Services (Paediatric & Women's Health)
HAYDOWN ROAD
Public Transport Hub (Public Drop Off, Buses & Car parking)
Future Carpark Extension (Majority Staff)
MARK ROAD
Future In-Patient Services Expansion
OLDHAM ROAD
Podium Level Expansion (ED Theatres & Out-Patient)
Non-Clinical Services (Admin, Community Health & Education)
N

LMH ED Brief (SA Health 15-09-17)



LMH MHSSU Brief (SA Health Original 2016)




MULTI-DECK
CARPARK
EXTENTION
NEW EXTENSION
GROUND - ED CLINICAL
LEVEL 2 - ED ADMIN
LEVEL 3 - SHORT STAY UNIT
PLANT (LEVEL 2)
NEW LIFT, STAIR & CORE
AMBULANCE DROP-OFF & PARKING
N

Cheesman Architects

Lyell McEwin Hospital - Emergency Department Redevelopment

Perspective 1

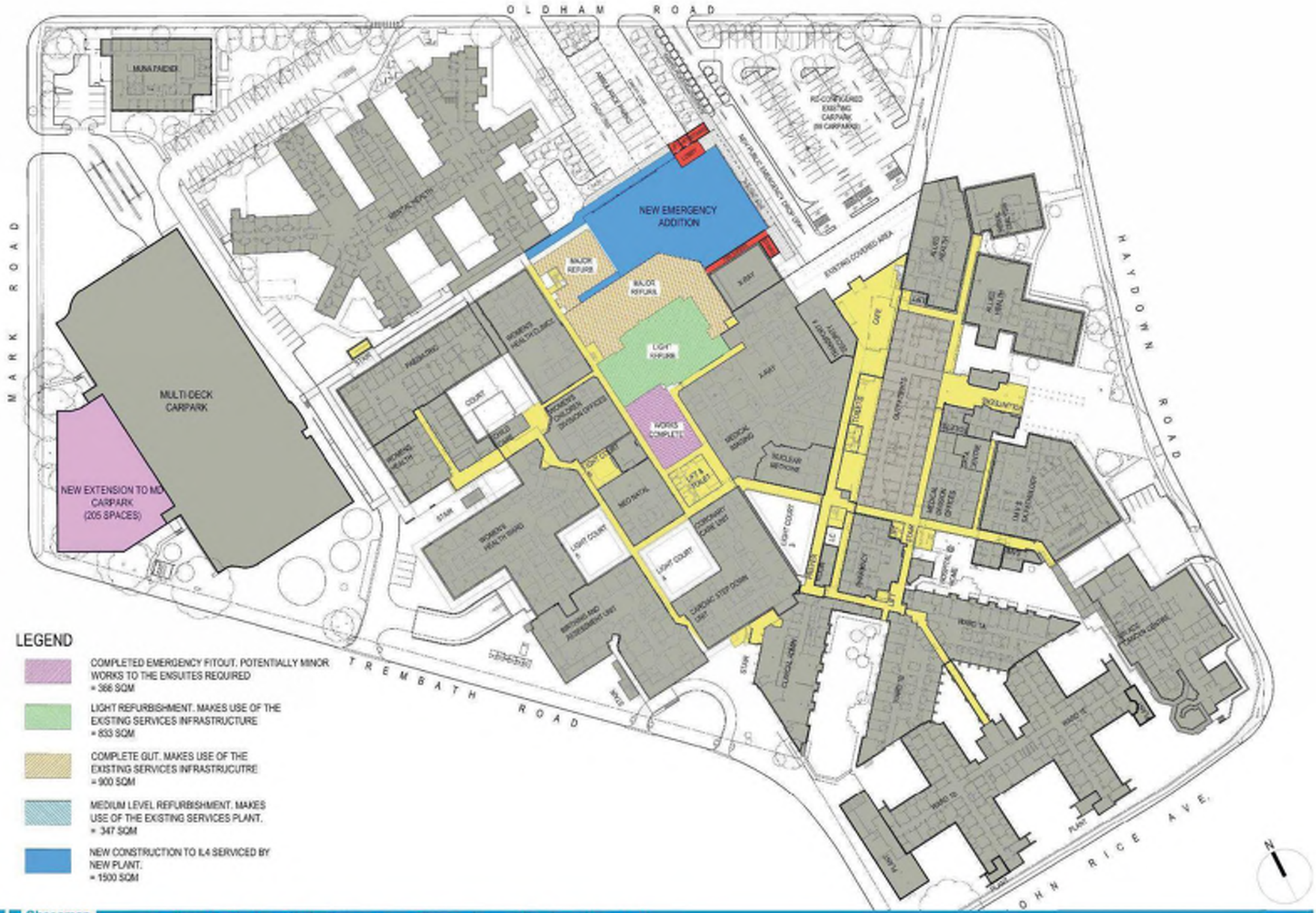
1. HOT DIPPED GALVANISED STEEL COLUMNS

2. ALUMINIUM SUN SHADE LOUVRES

3. BRIGHTON LITE CONCRETE
3a. GRC CLADDING

4. ALUMINIUM FRAMED WINDOW WITH VISION GLASS & SPANDRAL GLASS

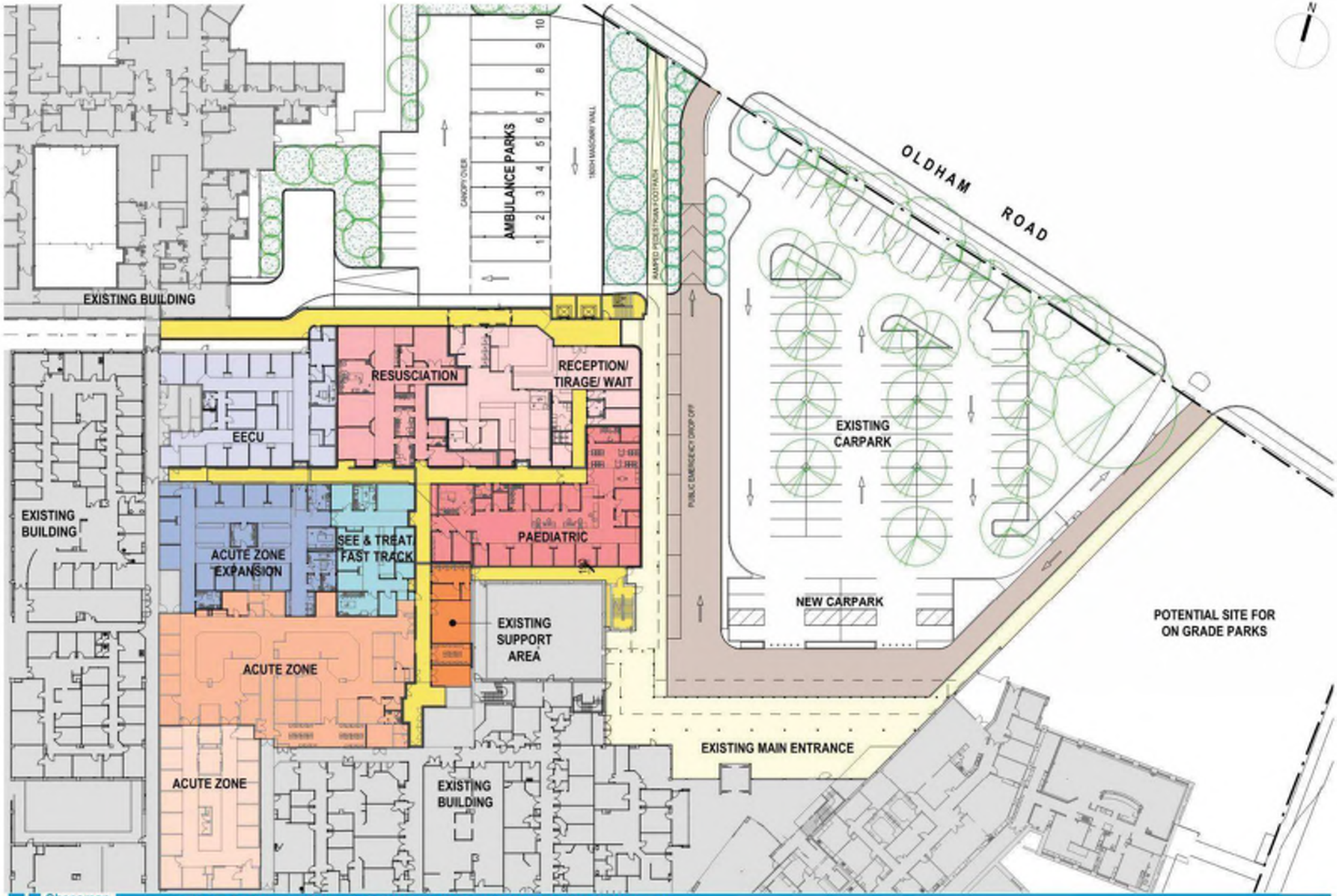
5. RED BRICKS

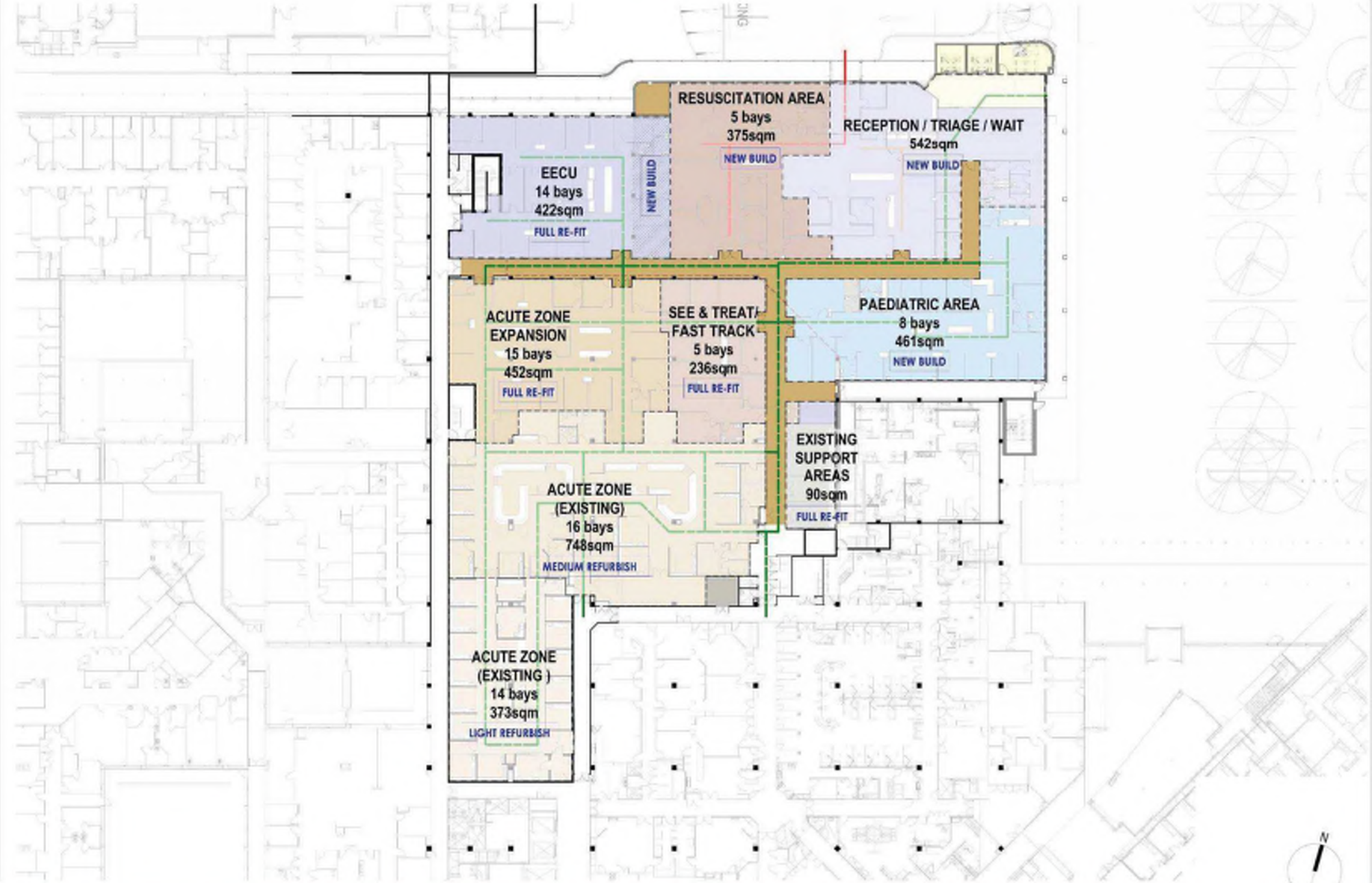


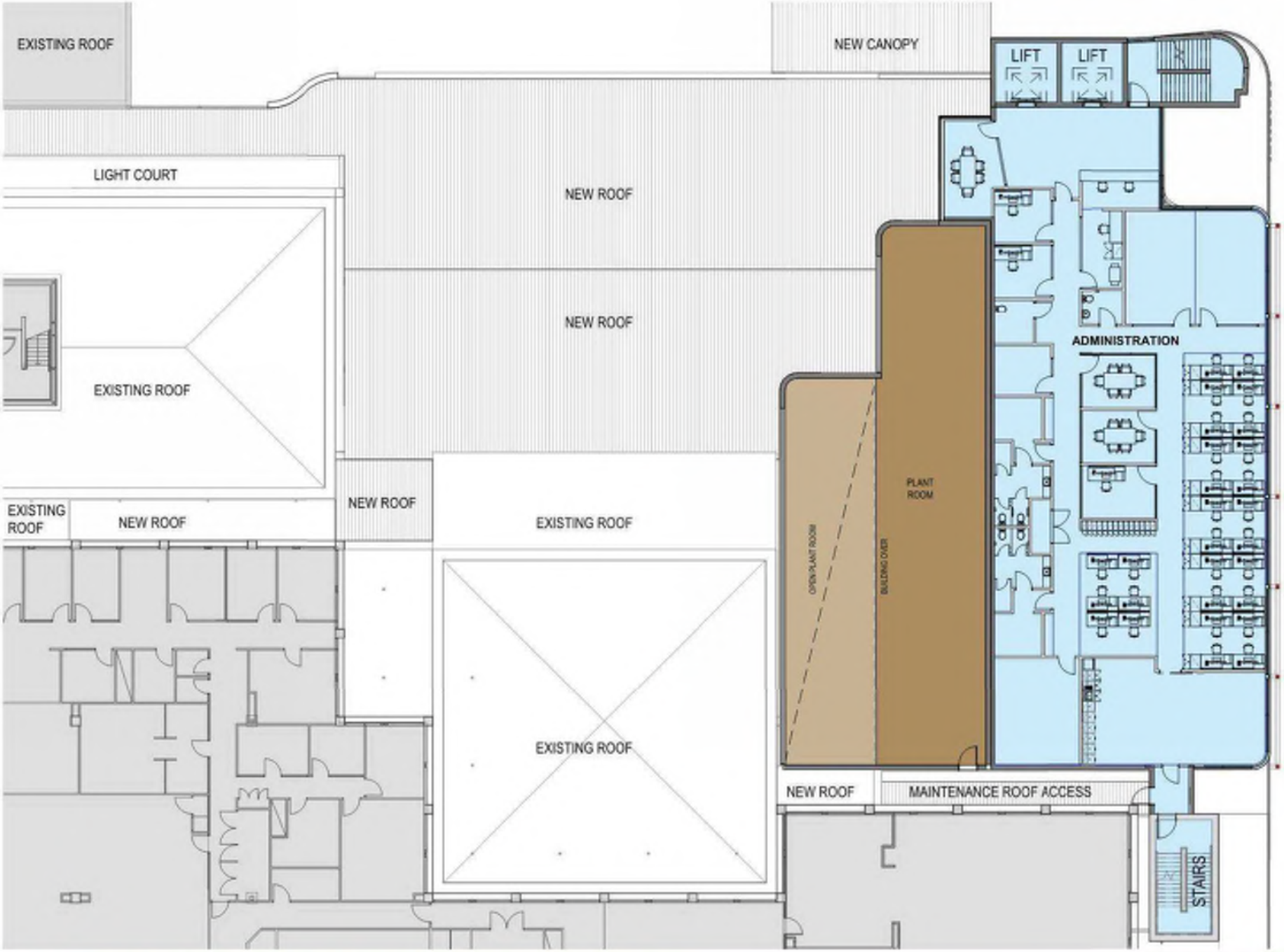
Cheesman Architects

Lyell McEwin Hospital - Emergency Department Redevelopment

Indicative Blocking Plan Level 1 (Ground)


N
OLDHAM ROAD
AMBULANCE PARKS
CANOPY OVER
1800H MASONRY WALL
RAMPED PEDESTRIAN FOOTPATH
EXISTING BUILDING
RESUSCIATION
RECEPTION/ TIRAGE/ WAIT
EECU
EXISTING CARPARK
PUBLIC EMERGENCY DROP OFF
EXISTING BUILDING
ACUTE ZONE EXPANSION
SEE & TREAT FAST TRACK
PAEDIATRIC
NEW CARPARK
POTENTIAL SITE FOR ON GRADE PARKS
EXISTING SUPPORT AREA
ACUTE ZONE
EXISTING MAIN ENTRANCE
ACUTE ZONE
EXISTING BUILDING


RESUSCITATION AREA
5 bays
375sqm
NEW BUILD
RECEPTION / TRIAGE / WAIT
542sqm
NEW BUILD
EECU
14 bays
422sqm
FULL RE-FIT
NEW BUILD
ACUTE ZONE
EXPANSION
15 bays
452sqm
FULL RE-FIT
SEE & TREAT
FAST TRACK
5 bays
236sqm
FULL RE-FIT
PAEDIATRIC AREA
8 bays
461sqm
NEW BUILD
EXISTING
SUPPORT
AREAS
90sqm
FULL RE-FIT
ACUTE ZONE
(EXISTING)
16 bays
748sqm
MEDIUM REFURBISH
ACUTE ZONE
(EXISTING)
14 bays
373sqm
LIGHT REFURBISH
N


EXISTING ROOF
NEW CANOPY
LIFT
LIFT
LIGHT COURT
NEW ROOF
NEW ROOF
EXISTING ROOF
ADMINISTRATION
PLANT ROOM
OPEN PLANT ROOM
BUILDING OVER
EXISTING ROOF
NEW ROOF
NEW ROOF
EXISTING ROOF
EXISTING ROOF
NEW ROOF
MAINTENANCE ROOF ACCESS
STAIRS
N


NEW ROOF BELOW
NEW ROOF BELOW
NEW ROOF BELOW
EXISTING ROOF BELOW
EXISTING ROOF BELOW
EXISTING ROOF
EXISTING ROOF
MENTAL HEALTH SHORT STAY UNIT
OPEN PLANT ROOM BELOW
NEW ROOF BELOW
EXISTING ROOF BELOW