Flooding and Stormwater SSDA Report

(LHAP-CI-TTW-RPT-CP-009009 B)

Liverpool Hospital Multi-Story Car Park

Prepared for Health Infrastructure / 3 March 2020

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Contents

1.0 Introduction

Liverpool Hospital is located within the Liverpool Central Business District (CBD), on the corner of Elizabeth Street and Goulburn Streets, Liverpool. The Hospital includes land east and west of the Main Southern Railway, which forms an eastern and western campus. The proposed works are located in the northern portion of the western campus which is currently occupied by an existing 4 storey car park and at-grade car parking. The site is legally described as Lot 501 in DP1165217.

The application seeks consent for the construction of a multi-storey car park, connections to the existing road work and associated landscaping. A detailed project description is provided by Ethos Urban within the EIS.

This report has been prepared by Taylor Thomson Whitting (TTW) to respond to the Secretary's Environmental Assessment Requirements (SEARs) outlined in *Table 1*.

SEARs reference and requirements:	Relevant report section
17. Flooding · The EIS must identify flood risk on-site (detailing the most recent flood studies for the project area) through the mapping of the following feature relevant to flooding, as described in the NSW Floodplain Development Manual (DIPNR, 2005), including: o Flood prone land. o Flood planning area, the area below the flood planning level. o Hydraulic categorisation (floodways and flood storage areas). o Flood Hazard. · The EIS must assess the impacts of the proposed development on flood behaviour, including: o Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure o Consistency with Council floodplain risk management plans o Consistency with any Rural Floodplain Management Plans o Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land	2.0 Flooding
16. Drainage · Detail measures to minimise operational water quality impacts on surface waters and groundwater. · Stormwater plans detailing the proposed methods of drainage without impacting on the downstream properties.	0 Stormwater Drainage
20. Sediment, Erosion and Dust Controls Detail measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles. ***Relevant Policies and Guidelines:*** · Managing Urban Stormwater - Soils & Construction Volume 1 2004 (Landcom) · Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA) · Guidelines for development adjoining land managed by the Office of Environment and Heritage (OEH, 2013)	4.0 Erosion and Sediment Control

Table 1 - SEAR's requirements

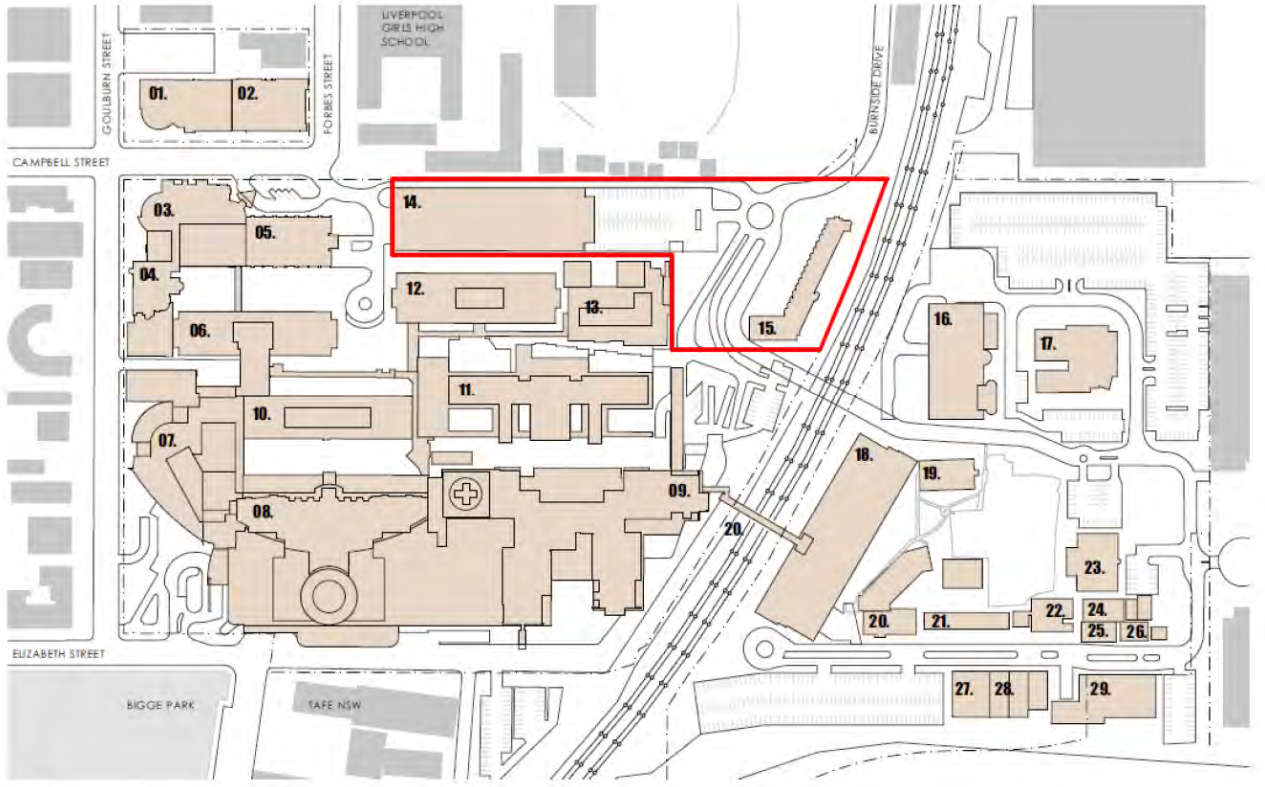


Figure 1 - Site location plan

Figure 2 - 3D aerial image

1.1 Guidance documents

The following documents have informed the Flood Assessment and Stormwater Drainage in this report:

- State Environment Planning Policy (Infrastructure 2007);
- Liverpool Local Environmental Plan (LEP) 2008;
- Liverpool Development Control Plan (DCP) 2008;
- Australian Rainfall and Runoff (2019);
- NSW Floodplain Development Manual (April 2005); and
- AS 3500.3:2018 Plumbing and drainage Part 3: Stormwater drainage.

2.0 Flooding

This section of the report addresses SEARs requirement '17. Flooding' as shown in Figure 3:

17. Flooding

- The EIS must identify flood risk on-site (detailing the most recent flood studies for the project area) through the mapping of the following feature relevant to flooding, as described in the NSW Floodplain Development Manual (DIPNR, 2005), including:
  - Flood prone land.
  - Flood planning area, the area below the flood planning level.
  - Hydraulic categorisation (floodways and flood storage areas).
  - Flood Hazard.
- The EIS must assess the impacts of the proposed development on flood behaviour, including:
  - Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure
  - Consistency with Council floodplain risk management plans
  - Consistency with any Rural Floodplain Management Plans
  - Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land

Figure 3 - SEARs requirement 16. Flooding (SSD-10389 - 27/11/19)

2.1 Approved flood mitigation works

It should be noted that proposed stormwater upgrade works in Goulburn and Campbell Street have already been approved under a separate application. These works will alleviate known flooding issues at the existing hospital and are due to start on site in early 2020. The assessment in this report takes these approved works into account when assessing flood risk.

2.2 Flooding Assessment

The DCP is an application of the State Policy contained in the Floodplain Development Manual (April 2005), reflecting local circumstances, as identified for some floodplains, through the preparation of Floodplain Risk Management Plans.

The key objectives applicable to the Liverpool Hospital Multi-Storey Car Park are outlined below:

- To ensure essential services and land uses are planning in recognition of all potential floods;
- To reduce the risk to human life and damage to property caused by flooding through controlling development on land affected by potential floods; and
- To ensure that development should not detrimentally increase the potential flood affection on other development or properties either individually or in combination with the cumulative impact of

development that is likely to occur in the same floodplain.

Figure 4 is a flow chart provided in the DCP for the determination of flood risk. The remainder of this section works through these steps to determine the flood risk, and applicable controls for future development.

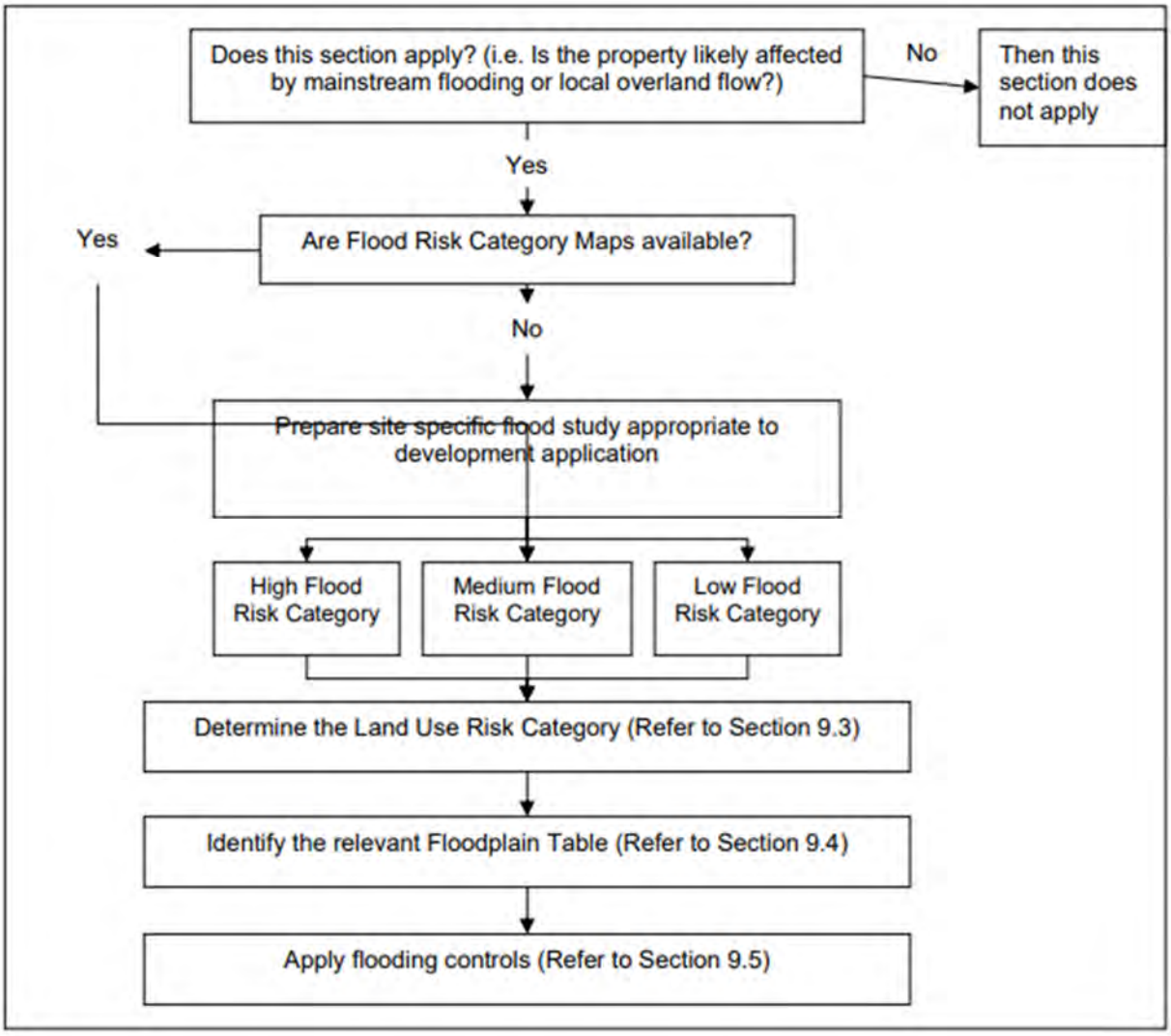


Figure 4 - Flow chart for the determination of flood risk

2.2.1 Flood Risk Category

Liverpool Hospital is affected by mainstream flooding and local overland flow. A site specific flood study is available which has been used to categorise the site as a 'Low Flood Risk Category'. This means land above the 1% AEP flood but within the floodplain (i.e. within the extent of the probable maximum flood) and not identified within either the High Flood Risk or Medium Flood Risk Category.

2.2.2 Land Use Risk Category

Liverpool Hospital falls under the 'Critical uses and Facilities' Land Use Risk Category. However, given that it is existing it can be evaluated as a 'Concessional Development' if it satisfies the following:

'Rebuilding of a development in a manner which substantially reduces the flood risk having regard to property damage and personal safety when compared to the existing development'.

The proposed flood protection up to the PMF will substantially reduce the flood risk as will the approved stormwater upgrade works in Goulburn and Campbell Street. As such the Liverpool Hospital Redevelopment has been assessed as a Concessional Development.

2.2.3 Floodplain Table

Liverpool Hospital is located within the Georges River floodplain as shown in Figure 5.

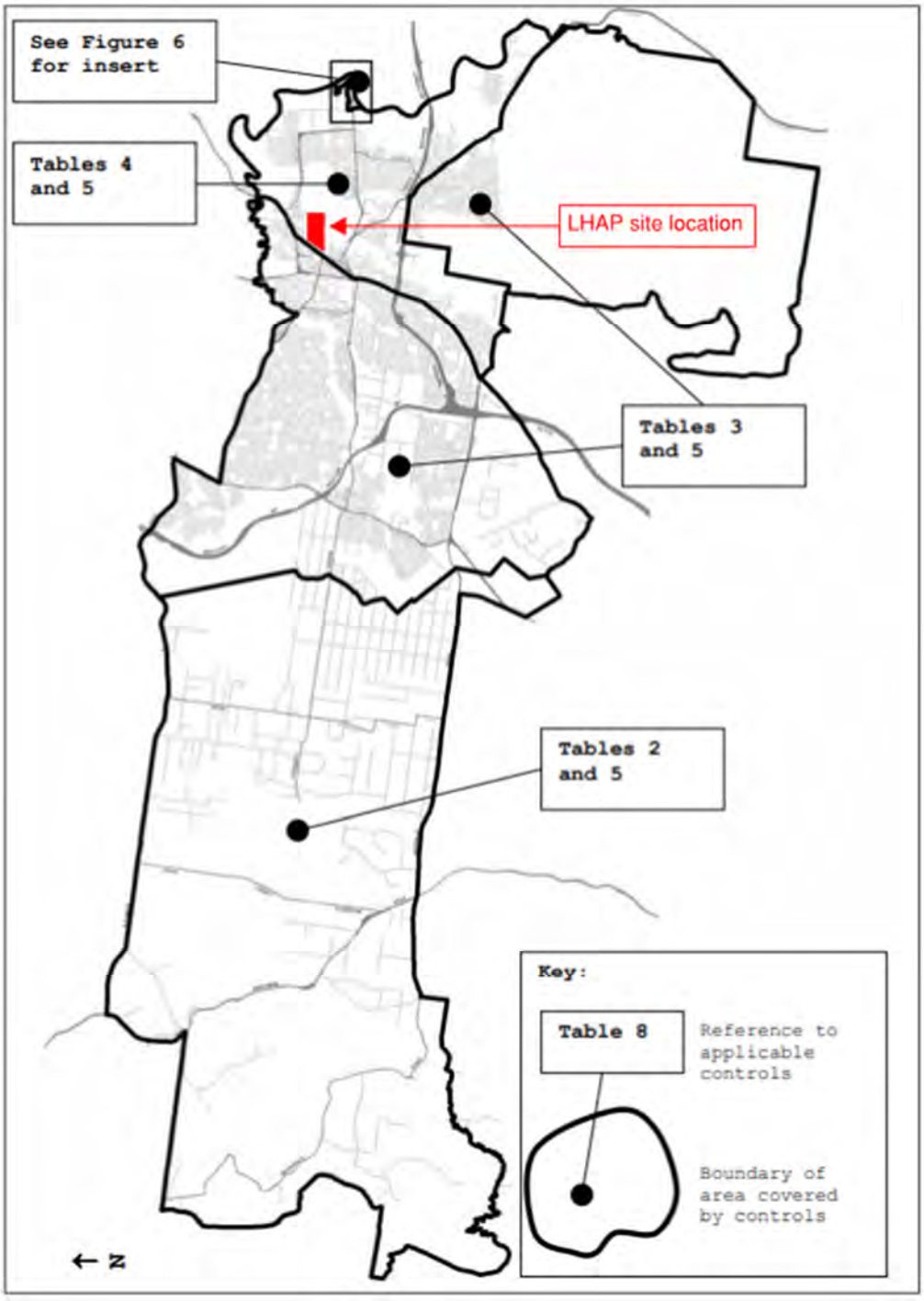


Figure 5 - Map for identification of relevant floodplains

2.2.4 Flooding Controls

The Georges River floodplain has two sets of controls; Mainstream Flooding Controls and Local Overland Flooding Controls. Figure 6 shows planning controls required for mainstream flooding and Figure 6 shows the planning controls required for local overland flooding. The specific controls applicable to the Liverpool Hospital Redevelopment are encircled red. The proposed development needs to satisfy these controls.

Flood Risk Category	Land Use Risk Category	Planning Controls							
		Floor Level	Building Components	Structural Soundness	Flood Effects	Car Parking & Driveway Access	Evacuation	Management & Design	Fencing
Low Flood Risk	Critical Uses & Facilities								
	Sensitive Uses & Facilities	13	4	4	2, 4, 5	2, 3, 6, 7, 8	6, 8, 9	2, 4	
	Subdivision				2, 4, 5			1	
	Residential (++)	2, 6	2	3	2, 4, 5	2, 3, 6, 7, 8	6, 9		
	Commercial & Industrial	4, 8, 15	2	3	2, 4, 5	2, 3, 6, 7, 8	(4 or 9), 6	2, 3, 5	
	Tourist Related Development	2, 6, 15	2	3	2, 4, 5	2, 3, 6, 7, 8	6, 9	2, 3, 5	
	Recreation & Non-Urban	2, 7	2	3	2, 4, 5	1, 5, 7, 8	6, 8	2, 3, 5	
	Concessional Development	14, 15	2	3	2, 4, 5	1, 7, 8, 9	6, 9	2, 3, 5	
Medium Flood Risk	Critical Uses & Facilities								
	Sensitive Uses & Facilities								
	Subdivision				1, 4, 5			1	1, 2, 3
	Residential	2, 6, 15	2	2	2, 4, 5	2, 3, 6, 7, 8	6, 9		1, 2, 3
	Commercial & Industrial	8, 4, 15	2	2	2, 4, 5	2, 3, 6, 7, 8	4, 6	2, 3, 5	1, 2, 3
	Tourist Related Development	2, 6, 15	2	2	2, 4, 5	2, 3, 6, 7, 8	6, 9	2, 3, 5	1, 2, 3
	Recreation & Non-Urban	2, 7	2	2	2, 4, 5	1, 5, 7, 8	6, 8	2, 3, 5	1, 2, 3
	Concessional Development	14, 15	2	2	2, 4, 5	1, 7, 8, 9	8, 9	2, 3, 5	1, 2, 3
High Flood Risk	Critical Uses & Facilities								
	Sensitive Uses & Facilities								
	Subdivision								
	Residential								
	Commercial & Industrial								
	Tourist Related Development								
	Recreation & Non-Urban	2, 7	2	2	1, 4, 5	1, 5, 7, 8	6, 8	2, 3, 5	1, 2, 3
	Concessional Development	14, 15	2	2	1, 4, 5	1, 7, 8, 9	6, 9	2, 3, 5	1, 2, 3

Key:

- Not Relevant
- Unsuitable Land Use
- 1, 2, 3 — Control reference number relevant to the particular planning consideration. (see Table 6)
- (++) Attached dwellings, Dwelling houses, dual occupancies, multi unit dwelling housing, residential flat buildings (not including development for the purpose of group homes or seniors housing). Secondary dwellings and Semi-detached dwellings are exempt from these controls.

Figure 6 - Mainstream flooding (Georges River Floodplain) – Planning Controls (those applicable to Liverpool Hospital Redevelopment encircled red)

Flood Risk Category	Land Use Risk Category	Planning Controls							
		Floor Level	Building Components	Structural Soundness	Flood Effects	Car Parking & Driveway Access	Evacuation	Management & Design	Fencing
Local Overland Flood Risk	Critical Uses & Facilities	13	4	5	3	4, 7, 8	7	3, 5	2, 4
	Sensitive Uses & Facilities	13	4	5	3	4, 7, 8	7	3, 5	2, 4
	Subdivision				3		5	1	2, 4
	Residential	3, 5	1	6	3	4, 7, 8	5		2, 4
	Commercial & Industrial	10	1	6	3	4, 7, 8	5	3, 5	2, 4
	Tourist Related Development	3, 5	1	6	3	4, 7, 8	5	3, 5	2, 4
	Recreation & Non-Urban	3, 5	1	6	3	4, 7, 8	5	3, 5	2, 4
	Concessional Development	14	1	6	3	4, 7, 8	5	3, 5	2, 4

Key:

	Not Relevant
1, 2, 3	Control reference number relevant to the particular planning consideration.

Figure 7 - Local overland flooding - Planning Controls (those applicable to Liverpool Hospital Redevelopment encircled red)

The following section provides clarification on the Planning Controls that have been adopted for the MSCP. Although assessed as a Concessional Development the Critical Uses & Facilities Controls have been adopted where these can be met. Where multiple planning controls are shown in Figure 6 and Figure 7 only the most onerous has been included:

Floor Level:

14	Floor levels to be equal to or greater than the minimum requirements normally applicable to this type of development. Where this is not practical due to compatibility with the height of adjacent buildings, or compatibility with the floor level of existing buildings, or the need for access for persons with disabilities, a lower floor level may be considered. In these circumstances, the floor level is to be as high as practical, and, when undertaking alterations or additions no lower than the existing floor level.

Floor levels are not strictly applicable to the MSCP as there are no internal areas however the lifts have been set as practical and are above the 1% AEP flood level plus 500mm freeboard.

Building Components:

4	All structures to have flood compatible building components below the PMF level.

The above will be provided with all electrical infrastructure either appropriately waterproofed or located above the PMF.

Structural Soundness:

5	Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF.

The structure and façade will be designed to withstand the PMF water level.

Flood Effects:

2	The flood impact of the development to be considered to ensure that the development will not increase flood effects elsewhere, having regard to: (i) loss of flood storage; (ii) changes in flood levels and velocities caused by alterations to the flood conveyance; and (iii) the cumulative impact of multiple potential developments in the floodplain. An engineer's report may be required.

Section 2.3 of this report documents the existing flood modelling that shows the MSCP will not increase flood effects elsewhere.

Car Parking & Driveway Access:

9	Driveway and car parking space levels shall be no lower than the minimum requirements normally applicable to this type of development. Where this is not practical, a lower level may be considered. In these circumstances, the level is to be as high as practical and, when undertaking alterations or additions no lower than the existing level.
3	Garages capable of accommodating more than 3 vehicles on land zoned for urban purposes, or basement car parking, must be protected from inundation by floods equal to or greater than the 1% AEP flood plus 0.1m freeboard.

Car parking & driveway access for Critical uses and Facilities would normally need to be protected from floods greater than the 1% AEP plus 0.1m freeboard. This requirement is exceeded.

Evacuation:

8	The evacuation requirements of the development are to be considered. An engineer's report will be required if circumstances are possible where the evacuation of persons might not be achieved within the effective warning time.

The critical duration of the mainstream flooding is 48 hours which gives adequate time for safe evacuation during a PMF event. There is also an opportunity to shelter in place on the upper levels of the MSCP. Flood depths on the ground floor of the car park are <300mm.

Management and Design:

3	Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 500mmfreeboard.
5	No storage of materials below the design floor level which may cause pollution or be potentially hazardous during any flood.

The MSCP is located above the 1% AEP plus 500mm freeboard.

Fencing:

2	Fencing is to be constructed in a manner that does not obstruct the flow of floodwaters so as to have an adverse impact on flooding.
4	Fencing shall be constructed to withstand the forces of floodwaters.

There is no proposed fencing below the 1 % AEP plus 0.5m freeboard or located within the PMF floodway.

2.3 Existing flooding

There are two identified flood risks to the site:

- Mainstream flooding from Georges River; and
- Localised overland flow from Liverpool CBD.

Mainstream flooding is from Georges River to the south east of the site (Reference: Georges River Floodplain Risk Management Study & Plan, May 2004). Overland flooding is from the CBD catchment to the south and west of the site (Reference: Liverpool City Centre Overland Flow Path Mapping, December 2016). Each flood has different characteristics and affects different areas of the site. The peak mainstream flood level occurs during the 48-hour storm, whilst the peak overland flood level occurs during the 1.5 hour storm. The natural topography of the local catchment falls directly toward the low point in Goulburn Street, to the west of the

hospital site as shown in Figure 8. The combined extent of Council's mainstream and overland flood modelling is shown in Figure 9.

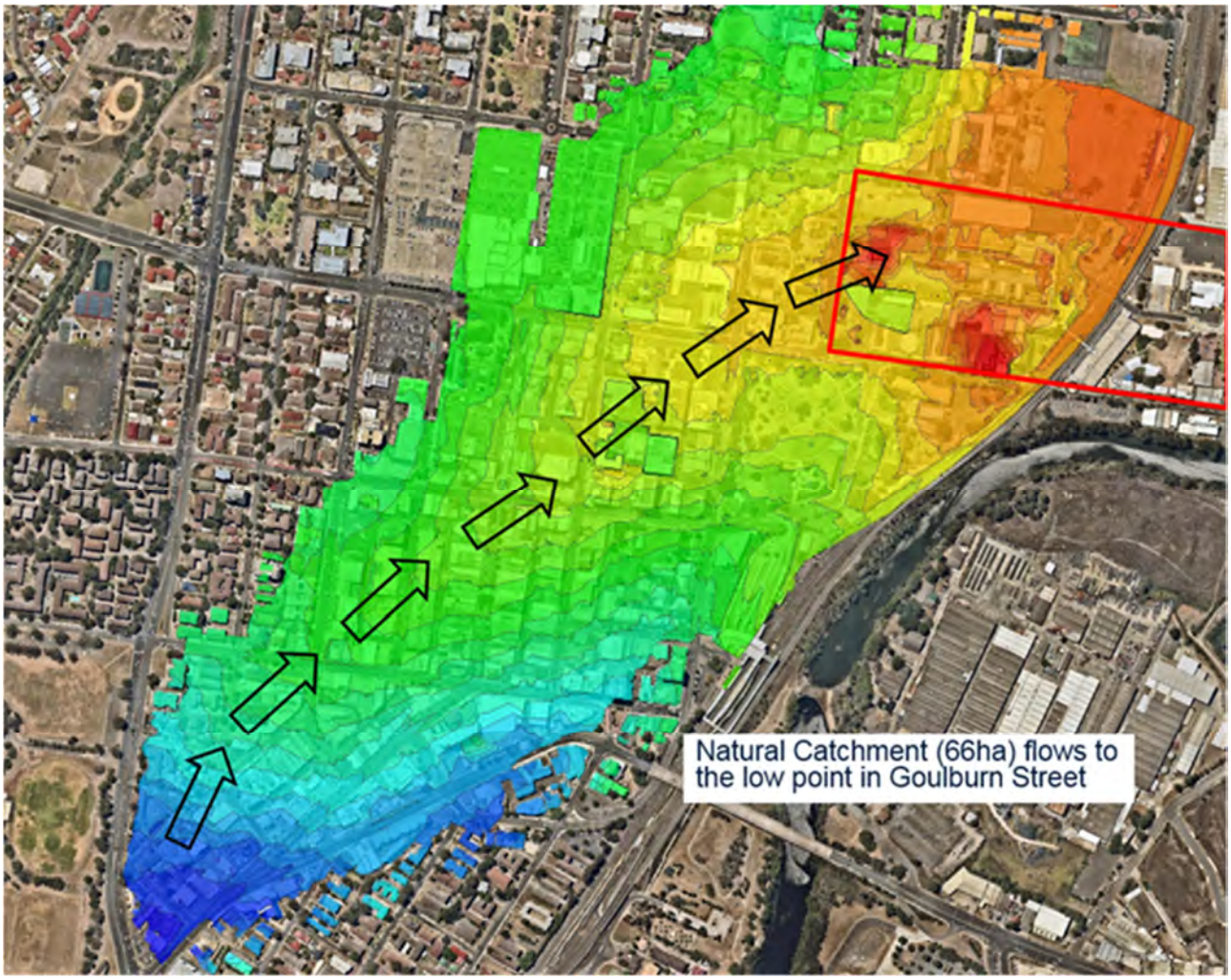


Figure 8 - Natural catchment topography and overland flow route through Liverpool CBD

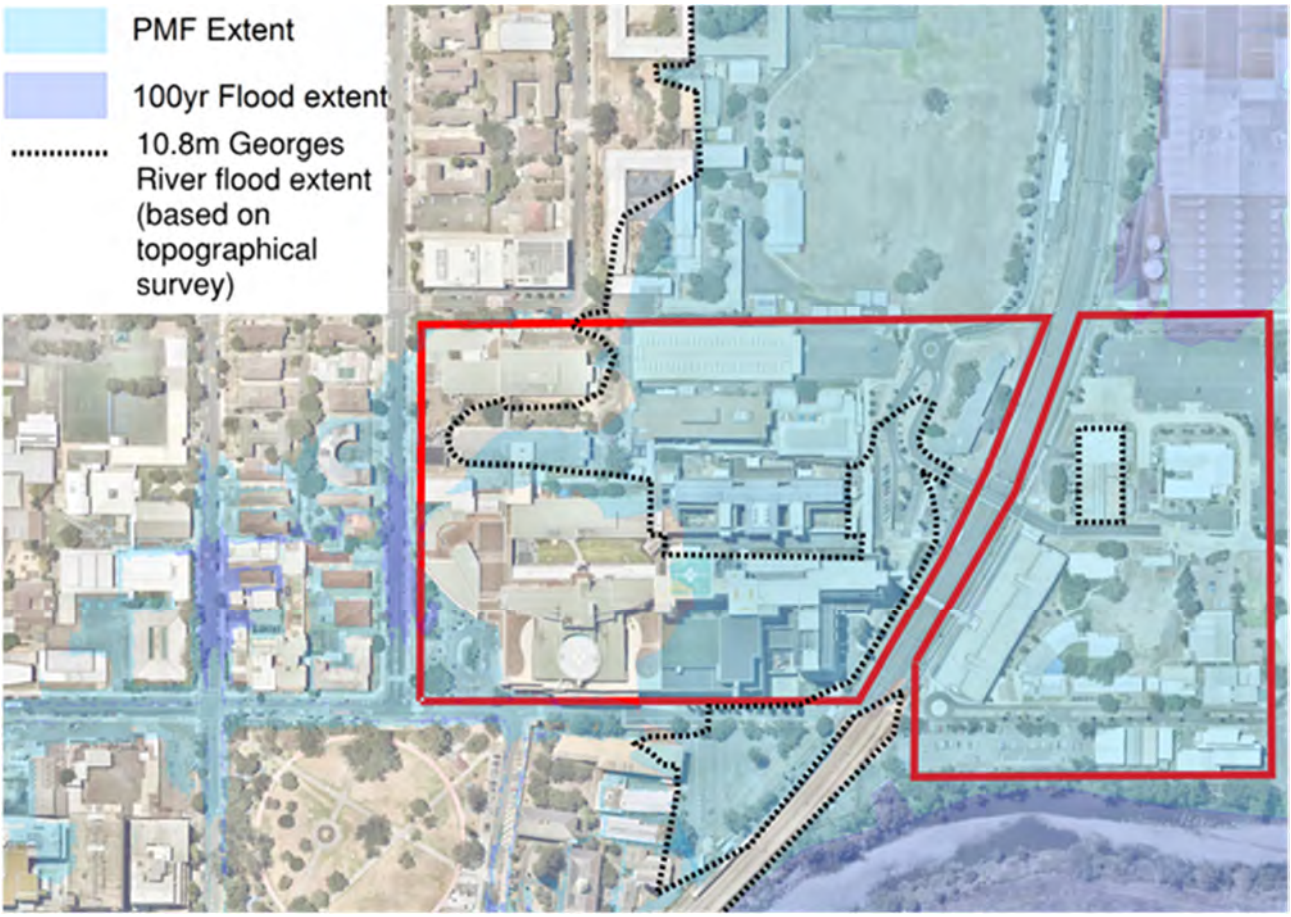


Figure 9 - Flood extent for mainstream and overland flooding (Georges River Floodplain Risk Management Study & Plan, May 2004 and Liverpool City Centre Overland Flow Path Mapping, December 2016)

2.3.1 Georges River Mainstream Flooding

Liverpool City Council's ePlanning Tool identifies mainstream flooding from Georges River affects most of the campus during the Probable Maximum Flood (PMF), although only a small area of the redevelopment site. The peak PMF level associated with mainstream flooding is 10.80m AHD. The western campus is not at risk from a 1 in 100 year (1% Annual Exceedance Probability - AEP) mainstream flood event. The peak 1% AEP flood level is 8.80m AHD.

2.3.2 Local Overland Flooding

In 2016 BMT WBM completed flood modelling of the CBD, for Liverpool City Council, following stormwater trunk line upgrades recommended in a previous flood study by GHD. The updated report identified significant localised overland flooding risk to Campbell, Goulburn, and Elizabeth Streets. Flooding to these streets is due to trapped low points within the overland flow path across the CBD catchment. Overland flow fills the trapped low point in Goulburn Street and overflows through the hospital site south along Elizabeth Street. The 1% AEP and PMF extents from the BMT WBM model are shown in Figure 10 and Figure 11 respectively.

Figure 10 - Overland 1% AEP flood extent (Liverpool City Centre Overland Flow Path Mapping, December 2016)

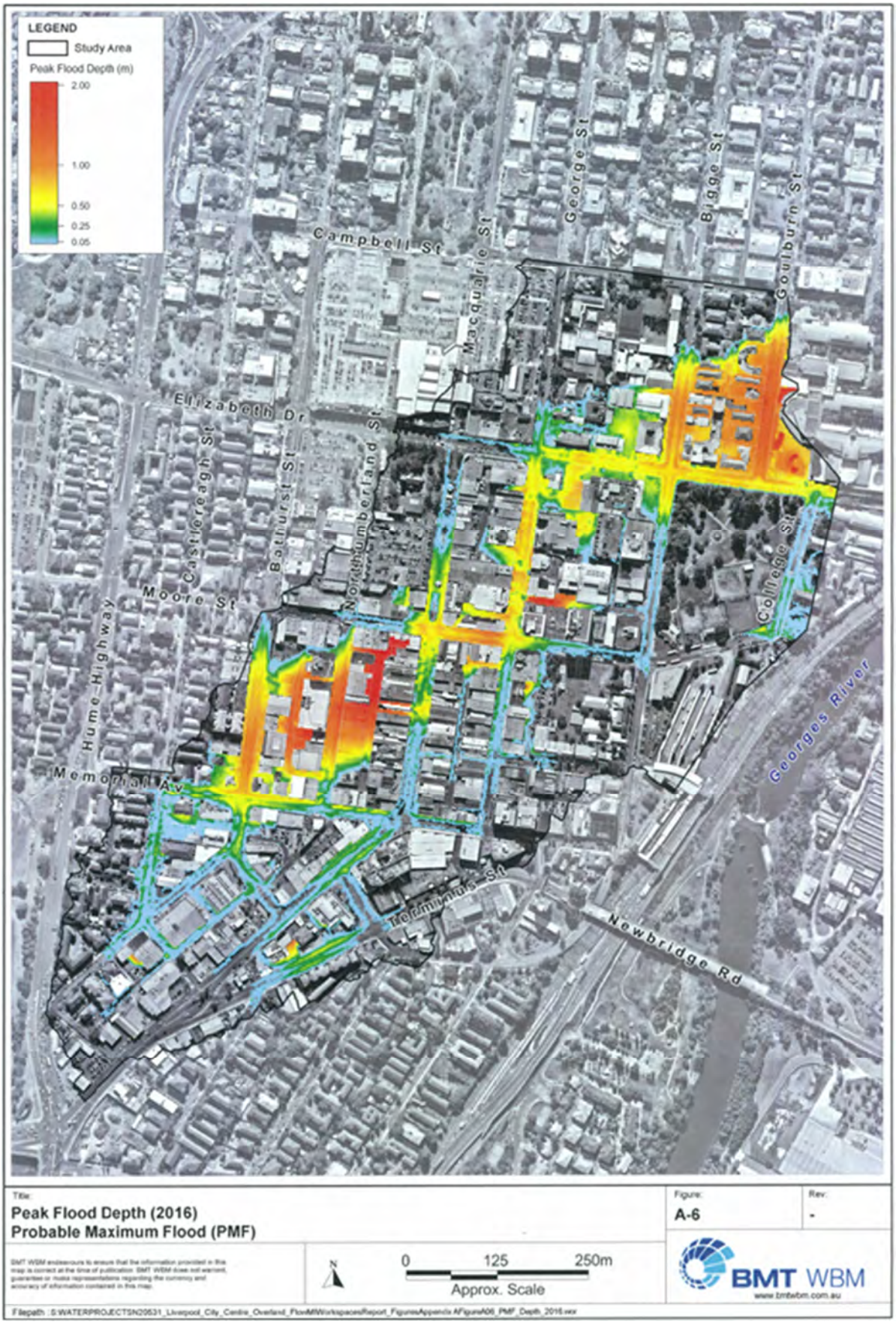


Figure 11 - Overland PMF extent (Liverpool City Centre Overland Flow Path Mapping, December 2016)

As per section 2.1 flood mitigation works in Goulburn and Campbell Street have already been approved under a separate application. The proposed stormwater upgrades include additional inlet pits and a new 900mm pipe collecting flows from the low point on Goulburn Street. This runs north then east along Campbell Street and connects to an existing 1200mm diameter pipe located adjacent to the north east corner of the existing MSCP. About 130m of existing pipe from this connection point back to the low point on Forbes & Campbell Street is to be re-laid at a flatter grade to ensure adequate cover in Goulburn Street. These works are being undertaken to alleviate known flooding issues at the existing hospital including inundation of the basement car park (CP1) exit.

The BMT WBM overland flood model was provided by Liverpool City Council and updated by TTW as part of the planning submission for the approved upgrade works. The BMT WBM flood model was extended east to the rail tracks to include the hospitals western campus, and north to Lachlan Street to include the school. The extension to Lachlan Street included the upstream catchment for an existing pipe that runs east along the connection between Forbes Street and Burnside Drive, adjacent to the northern site boundary. This information was taken from Liverpool City Council record drawings. The model was also updated to reflect the latest available information at the time including topographical and drainage surveys. All other parameters of the Council flood model remained unchanged. This updated flood model including the approved upgrade works provides the baseline 1% AEP and PMF flood depths shown in Figure 12 and Figure 13 respectively.

Figure 12 – Baseline 1% AEP flood depth with approved stormwater upgrades

Figure 13 - Baseline PMF flood depth with approved stormwater upgrades

2.4 Proposed flooding

The MSCP is outside the 1% AEP flood extents. Therefore, the proposed flooding focuses on the PMF and ensuring an overland flow route is maintained along Hospital Road from the low point on the corner of Campbell and Forbes Street, east through to the railway tracks. This would be effective in extreme rainfall events that exceed the capacity of the below ground pipework and in case of blockages.

2.4.1 Climate change

Assessment of the potential effects of climate change, sea level rise and an increase in rainfall intensity has been considered.

Sea level rises will have a negligible effect on flood levels as the mainstream flooding from the Georges River has minimal impact on the MSCP development. It would also not impact the free discharge tail water condition adopted as the critical durations of the mainstream and overland flooding do not coincide. This is supported by the downstream boundary condition sensitivity analysis documented in BMT WBM Liverpool City Centre Overland Flow Path Mapping (December 2016).

Australian Rainfall and Runoff (ARR) 'recommends that if the design probability for a structure is 1% AEP then the possible impacts of climate change should be assessed using 0.5% and 0.2% AEP (Bates et al. 2015, ARR Book 2 Rainfall Estimation p.42). ARR does not recommend any additional analysis with respect to climate change impacts on the PMF. The Liverpool City Centre Overland Flow Path Mapping included a sensitivity analysis of rainfall intensity increases of 10%, 20% and 30% based on the NSW Government guideline (DECC, 2007) for Practical Consideration of Climate Change. The 0.5% and 0.2% AEP events represent increase in intensities of about 9% and 23% respectively. As a result, a sensitivity analysis has been conducted adopting a worst case 30% increase in rainfall intensity. The results are included Figure 16 flooding increases it is still contained within the kerb. Therefore, the MSCP remains outside the 1% AEP flood extents. The Georges River 1% AEP flood level of 8.8m would not increase sufficiently as a result of climate change to impact the site given it is more than a metre above this level.

2.4.2 Proposed flood depth

The proposed flood depths are shown in Figure 14 and

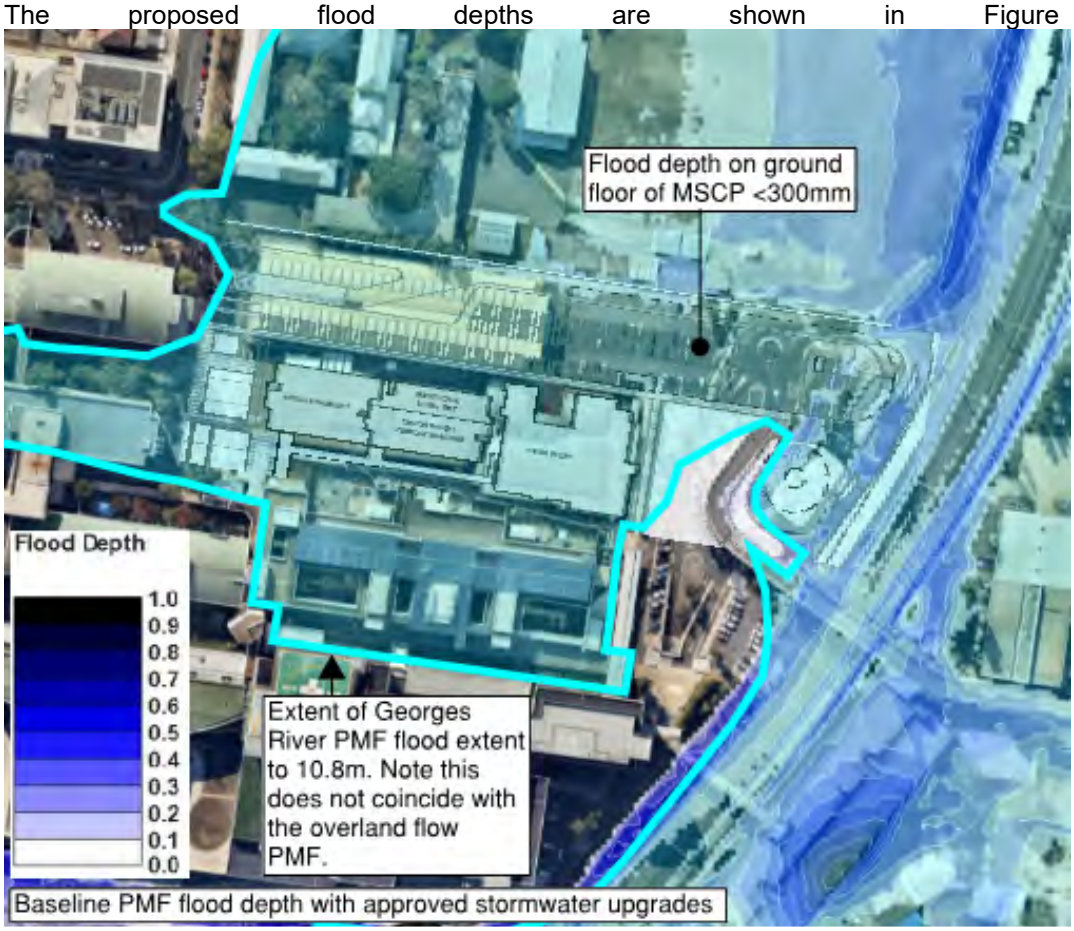


Figure 15. The sensitivity analysis for climate change including a 30% increase in rainfall intensities is in shown in Figure 15.

The ground floor level of the MSCP is generally at 10.5m, so flood depths in the PMF would reach 300mm. Flood waters would rise up gradually from the Georges River providing adeqaute time for safe evacuation. All critical infrastructure such as substations will be protected upto the PMF level.

Figure 14 - Proposed 1% AEP flood depth with approved stormwater upgrades

Figure 15 - Proposed PMF flood depth with approved stormwater upgrades

Figure 16 - Proposed 1% AEP with 30% increase to rainfall intensities

3.0 Stormwater Drainage

This section of the report addresses SEARs requirement '16. Flooding' as shown in Figure 17:

16. Drainage

- Detail measures to minimise operational water quality impacts on surface waters and groundwater.
- Stormwater plans detailing the proposed methods of drainage without impacting on the downstream properties.

Figure 17 - SEARs requirement 15. Drainage (SSD-10389 - 27/11/19)

3.1 Stormwater Quantity

Section '6.1 Gravity Drainage to Council's drainage system' of the 'Liverpool Development Control Plan (DCP) 2008: Part 1 General Controls for all development' provides guidance on the requirement for On-Site Detention (OSD). This is shown in Figure 18.

On-Site Stormwater Detention

1. On-Site Detention (OSD) systems provide temporary storage of stormwater runoff from developments and restrict discharge from the site at a rate which council's existing drainage system is capable of accommodating.
2. OSD may only be used where:
   - The existing or proposed stormwater pipe system that is unable to cater for the increase in discharge due to development.
   - The development will involve an increase in impervious area on the site.
   - It is intended to connect stormwater directly to the street kerb and gutter only and the discharge exceeds 20 litres per second for the 10-year ARI.
3. OSD will not be required where:
   - The increased discharge for all storms up to and including a 100-year ARI can be accommodated by the existing stormwater pipe system.
   - A building addition or internal alteration is within the footprint (plan area) of the existing building.
   - The additional impervious surfaces (e.g. roof, driveway, paving) total is less than 30sqm in plan area. (NOTE: the designer is advised to confirm with council engineer first to ensure the cumulative total of previous and future additions still remain less than 30sqm, otherwise OSD will apply).
   - The sub-division of an existing development does not change the buildings or the impervious areas of the site.
   - Sites substantially inundated by flooding.
   - The development contributes funds to a major basin strategy that mitigates the impact of the increased impervious area and there are no other local drainage issues requiring OSD.
4. Calculations shall account for the total development site area.

Refer to Council's *On Site Stormwater Detention Policy and Design Specification.*

Figure 18 - OSD requirement from Liverpool DCP

Whilst the MSCP will increase the impervious area, the existing stormwater pipe system is able to cater for the increase in discharge due to the development. The position of the site in close proximity to the Georges River, where it outfalls, means that the inclusion of OSD could lead to a worsening of upstream flooding. Additionally, Liverpool City Council has not required previous redevelopments to include OSD when the site is within the floodplain and near the Georges River. As a result OSD is not proposed for the MSCP site.

3.2 Stormwater Quality

The drainage SEARS requirement states 'detail measures to minimise operational water quality impacts on surface waters and groundwater. This has been satisfied by meeting the water quality targets contained in Section '6.4 Stormwater Runoff Quality' of the Liverpool DCP. These are shown in Figure 19. The following water quality treatment devices are proposed to meet the water quality targets:

- Ocean Protect VortSentry HS (GPT) or equivalent;
- Ocean Protect Jellyfish filter or equivalent; and
- Ocean Protect OceanGuard basket or equivalent (in pits that bypass the GPT).

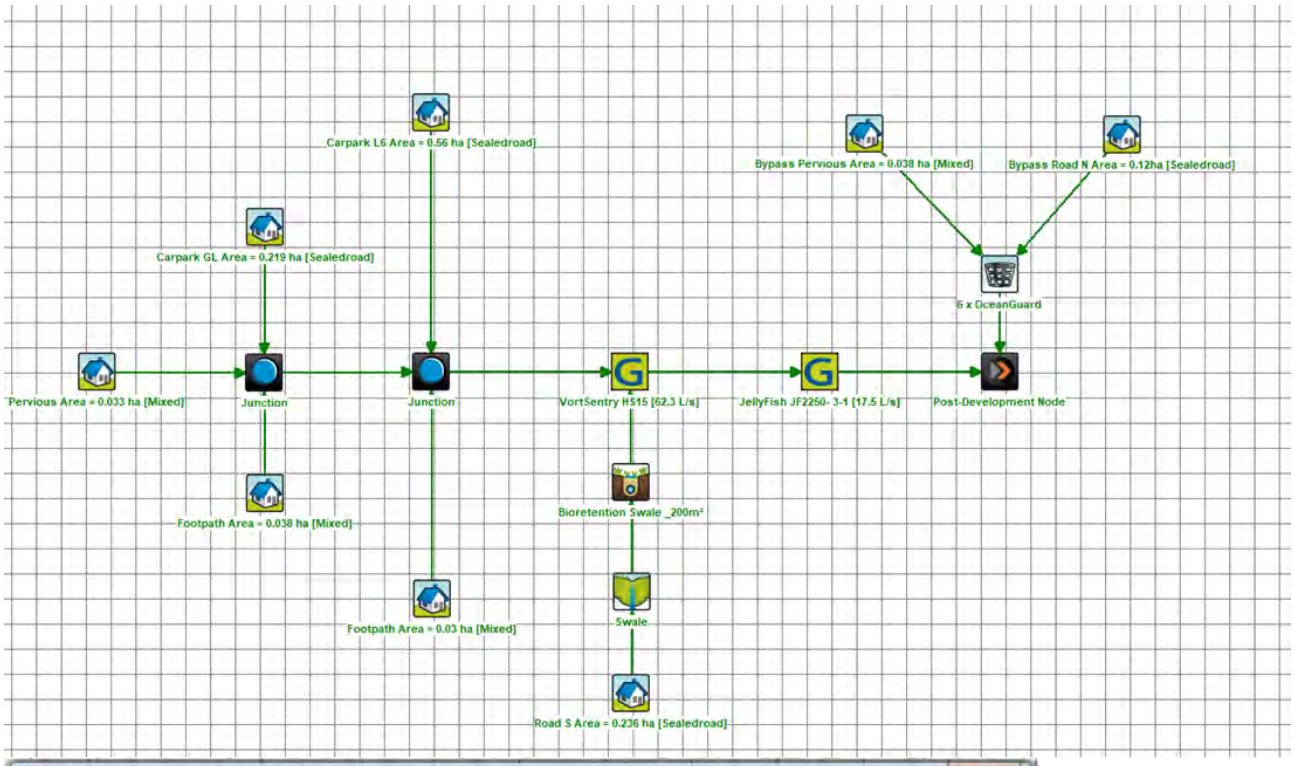
Water Sustainable Urban Design (WSUD) principles will be applied where possible across the site through the use of passive irrigation and water quality treatment. Passive irrigation will direct runoff from the MSCP roof to soft landscaping areas. This will both reduce the potable water demand for irrigation and reduce the volume of water leaving the site. These are likely to take the form of a wicking bed with an overflow back to the main system and proprietary treatment. All WSUD proposals are subject to detailed design and coordination.

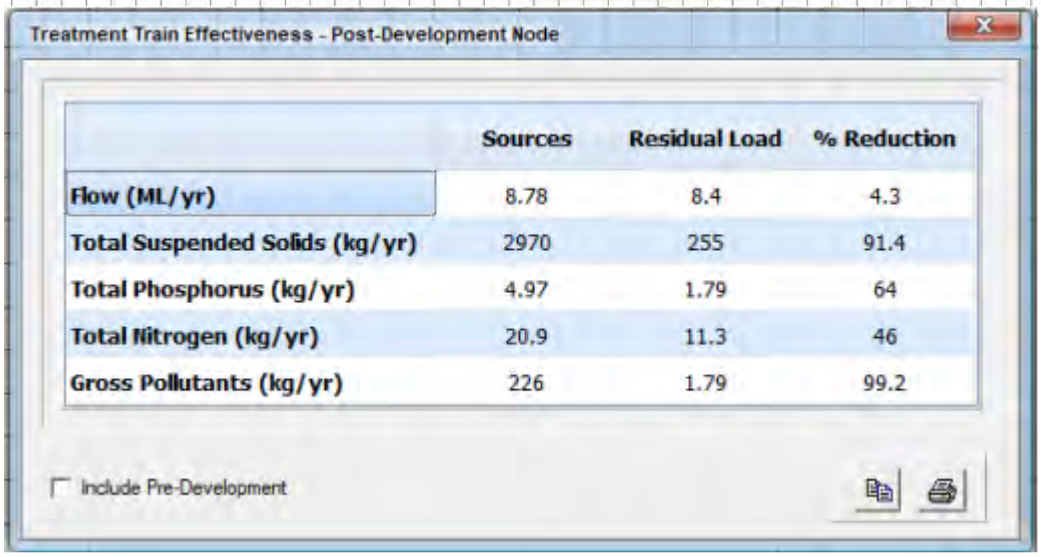
The MUSIC network and results are shown in Figure 20.Figure 20 - MUSIC network and results

The post development water quality shall be reduced to the following targets when compared to pre development water quality:

- 45% reduction in the mean annual load of total nitrogen.
- 45% reduction in the mean annual load of total phosphorus.
- 80% reduction in the mean annual load of total suspended solids.

Figure 19 - Water Quality targets (Liverpool DCP)





	Sources	Residual Load	% Reduction
Flow (ML/yr)	8.78	8.4	4.3
Total Suspended Solids (kg/yr)	2970	255	91.4
Total Phosphorus (kg/yr)	4.97	1.79	64
Total Nitrogen (kg/yr)	20.9	11.3	46
Gross Pollutants (kg/yr)	226	1.79	99.2

Figure 20 - MUSIC network and results

4.0 Erosion and Sediment Control

This section of the report addresses the SEARs requirement '19. Water and Soils' as shown in Figure 21:

20. Sediment, Erosion and Dust Controls
Detail measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles.

Relevant Policies and Guidelines:
- Managing Urban Stormwater - Soils & Construction Volume 1 2004 (Landcom)
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)
- Guidelines for development adjoining land managed by the Office of Environment and Heritage (OEH, 2013)

Figure 21 - SEARs requirement 19. Soils and Water (SSD-10389 - 27/11/19)

Erosion and sediment control devices and procedures will be put in place during construction to ensure that stormwater runoff will be collected and diverted around the disturbed site with sediments removed prior to discharge to the existing stormwater system.

The proposed controls are shown in Appendix B and will include:

- Silt fences at the downstream boundary of the construction zone;
- Wash down and diversions at temporary vehicle entrances/exists to the construction zone;
- Sedimentation trap/basin with outlet control and overflow;
- Diversions to prevent upstream runoff entering the construction zone; and
- Sandbag sediment traps and geotextile filters to protect existing stormwater pits and inlets.

The erosion controls and sediment collection devices will need to be modified and adjusted by the contractor to suit building work stages and programme as it progresses.

All erosion and sediment control measures are to be constructed in accordance with "Managing Urban Stormwater – Soils & Construction Volume 1 2004 (Landcom)" and "Approved Methods for the Modelling and Assessment of air pollutants in NSW (EPA).

Prepared by
TAYLOR THOMSON WHITTING (NSW) PTY LTD
in its capacity as trustee for the
TAYLOR THOMSON WHITTING NSW TRUST

TIM MOORE
Associate

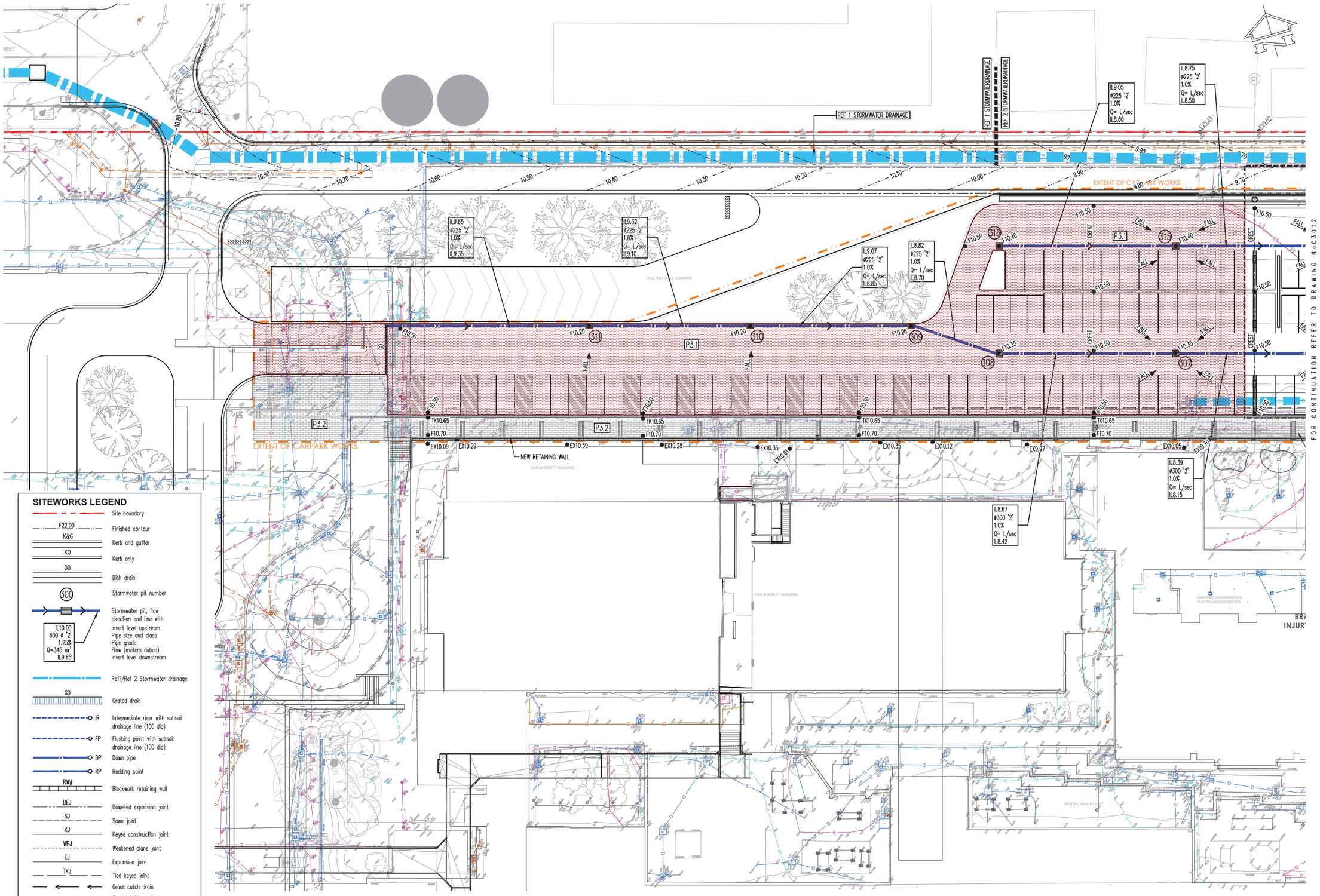
Authorised By
TAYLOR THOMSON WHITTING (NSW) PTY LTD
in its capacity as trustee for the
TAYLOR THOMSON WHITTING NSW TRUST

STEPHEN BRAIN
Technical Director

P:\2018\1810\181052\Reports\TTW\Civil\200221 MSCP - SSDA Stormwater and Flood Report (LHAP-CI-TTW-RPT-CP-009009 A) - Copy\200311 MSCP - SSDA report.docx

Appendix A

Stormwater Management Plan



SITEWORKS LEGEND

- Site boundary
- F22.00 — Finished contour
- K&G — Kerb and gutter
- KO — Kerb only
- DD — Dish drain
- 300 — Stormwater pit number
- IL10.00 / 600 ø 'Z' / 1.25% / Q=345 l/s / IL9.65 — Stormwater pit, flow direction and line with Invert level upstream, Pipe size and class, Pipe grade, Flow (meters cubed), Invert level downstream
- Ref1/Ref 2 Stormwater drainage
- GD — Grated drain
- IR — Intermediate riser with subsoil drainage line (100 dia)
- FP — Flushing point with subsoil drainage line (100 dia)
- DP — Down pipe
- RP — Rodding point
- RW — Blockwork retaining wall
- DEJ — Dowelled expansion joint
- SJ — Sawn joint
- KJ — Keyed construction joint
- WPJ — Weakened plane joint
- EJ — Expansion joint
- TKJ — Tied keyed joint
- Grass catch drain
- Overland flow path
- Guard Rail

EXISTING SERVICES LEGEND

- S — Existing sewer
- W — Existing water
- E — Existing underground electrical
- Existing aerial electrical
- Existing communications
- G — Existing gas
- D — Existing stormwater
- Existing stormwater to be removed

PAVEMENT LEGEND

P3.1 — 40mm Thickness asphaltic concrete (AC14) on 150mm Compacted thickness fine crushed rock (DGB20) on 280mm Compacted thickness fine crushed rock (DGS40) on 2% CBR

P3.2 — Pavers where noted by Landscape Architect on mortar on 100mm Thickness concrete (f'c=32MPa) with SL82 fabric (40 top cover) on 25mm Sand bedding on compacted subgrade

SCALE 1:250 AT ORIGINAL SIZE 0 2.5 5 7.5 10 12.5 m

TTW Taylor Thomson Whitting
LEVEL 3/48 CHANDOS ST, ST LEONARDS NSW 2065

AMENDMENTS

REV	DATE	DESCRIPTION	CHK
P1	20.09.19	SCHEMATIC DESIGN	TW

PROJECT
LIVERPOOL HEALTH & ACADEMIC PRECINCT
Health South Western Sydney Local Health District
ELIZABETH STREET LIVERPOOL NSW

CLIENT
NSW Health Infrastructure
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QUANTITY SURVEYOR
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LANDSCAPE ARCHITECT
CLOUSTON associates
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SCHEMATIC DESIGN

DRAWING
MSCP - SITEWORKS PLAN - WEST

DRAWN	APPROVED	PRINT DATE
WW		20/09/2019
SCALE		PROJECT STAGE
1:250@A1		SCHEMATIC DESIGN
PROJECT NO.	DRAWING NO.	ISSUE
181052	C3011	P1

FOR CONTINUATION REFER TO DRAWING No C3011

IL8.75
ø225 'Z'
1.0%
Q= L/sec
IL8.50

IL8.45
ø225 'Z'
1.0%
Q= L/sec
IL8.20

IL8.15
ø300 'Z'
1.0%
Q= L/sec
IL7.90

REF 2 STORMWATER DRAINAGE

IL6.40
ø900 'Z'
1.0%
Q= L/sec
IL610

EXISTING STORMWATER
TO BE REMOVED

IL7.85
ø300 'Z'
1.0%
Q= L/sec
IL7.70

EXISTING 1050ø IL6.72

EXISTING 1050ø IL6.43

JELLYFISH JF2250-3-1
BY OCEAN PROTECT.

VORTSENTRY MODEL HS15
BY OCEAN PROTECT.

IL7.05
ø450 'Z'
1.0%
Q= L/sec
IL6.75

IL6.70
ø450 'Z'
1.0%
Q= L/sec
IL6.65

20m

REF 2 STORMWATER DRAINAGE

IL8.39
ø300 'Z'
1.0%
Q= L/sec
IL8.15

EXISTING RETAINING WALL
TO BE REMOVED

IL8.12
ø300 'Z'
1.0%
Q= L/sec
IL7.91

EXISTING 1050ø STORMWATER TO BE CONCRETE ENCASED AND RETAINED BENEATH PROPOSED LIFT PIT, REFER TO STRUCTURAL DRAWINGS FOR PILE LAYOUT AND PILE CAP.

IL7.88
ø300 'Z'
1.0%
Q= L/sec
IL7.60

IL7.55
ø300 'Z'
1.0%
Q= L/sec
IL7.35

IL7.32
ø450 'Z'
1.0%
Q= L/sec
IL7.10

BRAIN
INJURY UNIT

SITEWORKS LEGEND

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SCALE 1:250 AT ORIGINAL SIZE 0 2.5 5 7.5 10 12.5 m

TTW Taylor Thomson Whitting
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AMENDMENTS

REV	DATE	DESCRIPTION	CHK
P1	20.09.19	SCHEMATIC DESIGN	TM

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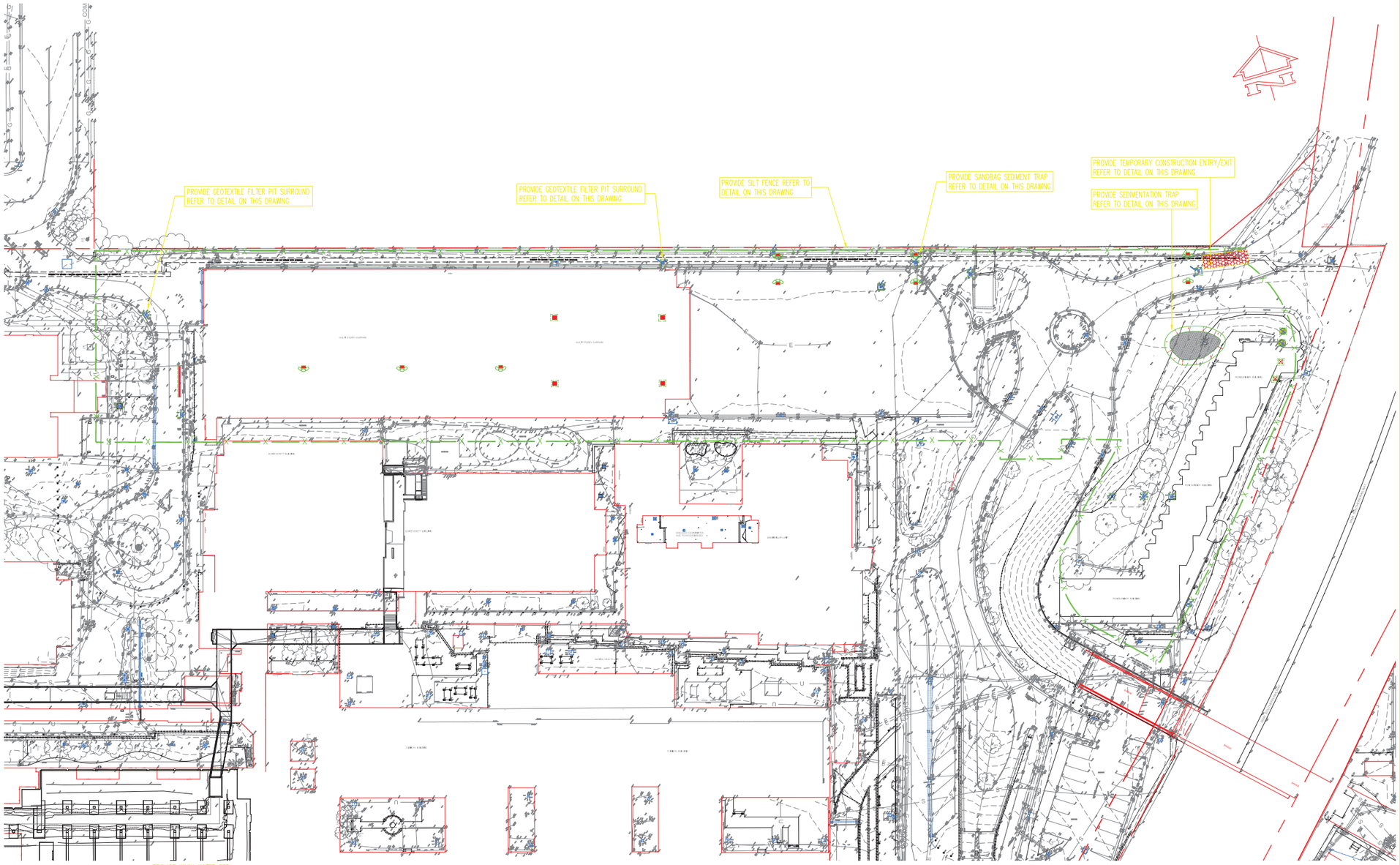
SCHEMATIC DESIGN

DRAWING
MSCP - SITEWORKS PLAN - EAST

DRAWN	APPROVED	PRINT DATE
WW		20/09/2019
SCALE		PROJECT STAGE
1:250@A1		SCHEMATIC DESIGN
PROJECT NO.	DRAWING NO.	ISSUE
181052	C3012	P1

Appendix B

Erosion and Sediment Control Plan



EROSION AND SEDIMENT CONTROL NOTES

1. All work shall be generally carried out in accordance with
   (A) Local authority requirements,
   (B) EPA – Pollution control manual for urban stormwater,
   (C) LANDCOM NSW – Managing Urban Stormwater: Soils and Construction ("Blue Book").
2. Erosion and sediment control drawings and notes are provided for the whole of the works. Should the Contractor stage these works then the design may be required to be modified. Variation to these details may require approval by the relevant authorities.
   The erosion and sediment control plan shall be implemented and adapted to meet the varying situations as work on site progresses.
3. Maintain all erosion and sediment control devices to the satisfaction of the superintendent and the local authority.
4. When stormwater pits are constructed prevent site runoff entering the pits unless silt fences are erected around pits.
5. Minimise the area of site being disturbed at any one time.
6. Protect all stockpiles of materials from scour and erosion. Do not stockpile loose material in roadways, near drainage pits or in watercourses.
7. All soil and water control measures are to be put back in place at the end of each working day, and modified to best suit site conditions.
8. Control water from upstream of the site such that it does not enter the disturbed site.
9. All construction vehicles shall enter and exit the site via the temporary construction entry/exit.
10. All vehicles leaving the site shall be cleaned and inspected before leaving.
11. Maintain all stormwater pipes and pits clear of debris and sediment. Inspect stormwater system and clean out after each storm event.
12. Clean out all erosion and sediment control devices after each storm event.

Sequence Of Works

1. Prior to commencement of excavation the following soil management devices must be installed.
1.1. Construct silt fences below the site and across all potential runoff sites.
1.2. Construct temporary construction entry/exit and divert runoff to suitable control systems.
1.3. Construct measures to divert upstream flows into existing stormwater system.
1.4. Construct sedimentation traps/basin including outlet control and overflow.
1.5. Construct turf lined swales.
1.6. Provide sandbag sediment traps upstream of existing pits.
2. Construct geotextile filter pit surround around all proposed pits as they are constructed.
3. On completion of pavement provide sand bag kerb inlet sediment traps around pits.
4. Provide and maintain a strip of turf on both sides of all roads after the construction of kerbs.

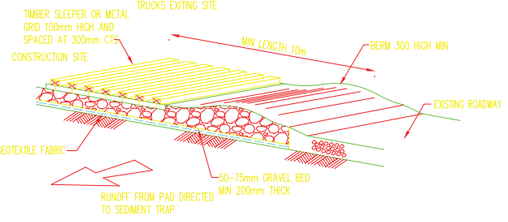
WATER QUALITY TESTING REQUIREMENTS

Prior to discharge of site stormwater, groundwater and seepage water into council's stormwater system, contractors must undertake water quality tests in conjunction with a suitably qualified environment consultant outlining the following:

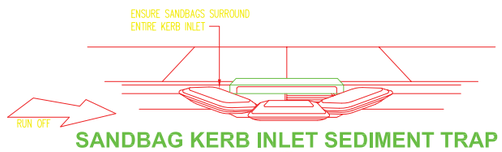
- Compliance with the criteria of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)
- If required subject to the environmental consultants advice, provide remedial measures to improve the quality of water that is to be discharged into Councils storm water drainage system.This should include comments from a suitably qualified environmental consultant confirming the suitability of these remedial measures to manage the water discharged from the site into Councils storm water drainage system. Outlining the proposed, ongoing monitoring, contingency plans and validation program that will be in place to continually monitor the quality of water discharged from this site. This should outline the frequency of water quality testing that will be undertaken by a suitably qualified environmental consultant.

EROSION AND SEDIMENT CONTROL LEGEND

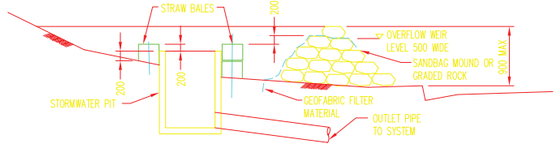
- Siltation fence
- Stormwater pit with Geotextile filter surround
- Hay bale barriers
- Sandbag sediment trap
- Catch drain



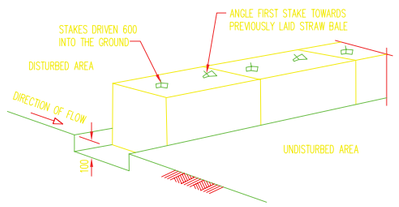
TEMPORARY CONSTRUCTION VEHICLE EXIT
NTS



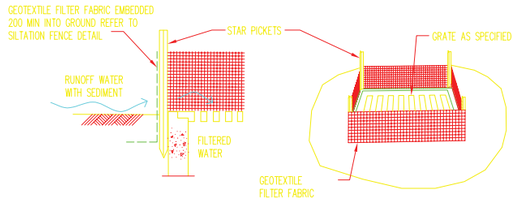
SANDBAG KERB INLET SEDIMENT TRAP
NTS



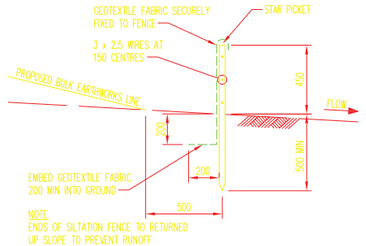
SEDIMENTATION TRAP
NTS



HAY BALE SEDIMENT FILTER
NTS
NOTE: STAKE TO BE EITHER TAR COATED STAR OR 50 x 50 HARDWOOD



GEOTEXTILE FILTER PIT SURROUND
NTS



SILTATION FENCE DETAIL
SCALE 1: 20

SCALE 1:500 0 5 10 15 20 25 m
AT ORIGINAL SIZE

TTW Taylor Thomson Whitting
LEVEL 3/48 CHANDOS ST, ST LEONARDS NSW 2065

AMENDMENTS

REV	DATE	DESCRIPTION	CHK
P1	???	SCHEMATIC DESIGN	TM

PROJECT
LIVERPOOL HEALTH & ACADEMIC PRECINCT
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PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DRAWING
MSCP - OVERALL PLAN

DRAWN	APPROVED	PRINT DATE
WW	TM	
SCALE @A1		PROJECT STAGE
1:500@A1		PRELIMINARY
PROJECT NO.	DRAWING NO.	ISSUE
181052	C3001	P1