Macquarie Health Corporation C/- John Simpson

Preliminary Flood Assessment: President Private Hospital, Kirrawee, NSW

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P1907286JR01V01
September 2020

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

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Document and Distribution Status

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Revision No.	Description	Status	Release Date	Document Location			
				File Copy	Macquarie Health Corporation C/- John Simpson		
1	State Significant Development Application	Draft	25.09.2020	1P, 1E	1P		

Distribution Types: F = Fax, H = hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

All enquiries regarding this project are to be directed to the Project Manager.

Executive Summary

Martens & Associates Pty Ltd (MA) have prepared this preliminary flood assessment to support a State Significant Development Application (SSDA) for a proposed alteration and addition to an existing hospital at 369 – 381 President Avenue, Kirrawee, NSW (the site). This report documents the procedures and findings of hydrologic and hydraulic modelling of the site in existing and proposed conditions.

Assessment concluded that:

1. Proposed flood characteristics are largely consistent with existing conditions, and differences due to the proposed development are negligible.
2. The proposed design effectively renders the site development area flood free in the 1% AEP flood.
3. The proposed development would have no material offsite flood impacts.
4. Compliance with Council flood planning level requirements for building and car park levels are achieved.
5. The proposed development is compatible with the existing floodplain environment.
6. The compliance assessment demonstrates the site can be developed in accordance with Council flood planning requirements.

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1 Introduction

1.1 Overview

Martens & Associates Pty Ltd (MA) have prepared this preliminary flood assessment to support a State Significant Development Application (SSDA) for proposed alterations and additions to an existing hospital at 369 – 381 President Avenue, Kirrawee, NSW (the site).

1.2 Project Scope and Objectives

Project scope and objectives are:

1. Prepare a hydrologic model (RAFTS) for the site to determine the peak flow of the 1% annual exceedance probability (AEP) flood and probable maximum flood (PMF) events.
2. Prepare a hydraulic model (TUFLOW) for the site under existing and proposed conditions.
3. Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards and impacts.
4. Comment on flood characteristics and model outcomes in existing and proposed conditions.
5. Prepare a preliminary flood emergency response plan (FERP) for the developed site.
6. Address Council's flood related comments in letter dated 27/05/19.

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1.3 Summary of Agency Comments

The Council raised a list of pertinent flood related matters in their letter Review of SEARS for alterations and additions to President Private Hospital dated 27 May, 2019 (refer to Attachment A). These comments are addressed in Table 7 in Section 6 of this report.

1.4 Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

1. Commonwealth of Australia (Geoscience Australia) (2016), *Australian Rainfall and Runoff – A Guide to Flood Estimation.*

2. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

3. Sutherland Shire Council (2015), *Sutherland Shire Local Environmental Plan (LEP)*.

4. Sutherland Shire Council (2015), *Sutherland Shire Development Control Plan (DCP)*.

1.5 Definitions

AEP	Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
ARI	Average recurrence interval: the average time between flood events occurring. A 100 year ARI flood occurs on average once every 100 years.
ARR	Australian Rainfall & Runoff
BOM	Bureau of Meteorology
Council	Sutherland Shire Council (SSC)
DA	Development application
FERP	Flood emergency response plan
FFL	Finished floor level
FPL	Flood planning level
IFD	Intensity frequency duration – design rainfall data for frequent and infrequent storm events.
MA	Martens & Associates Pty Ltd
PMF	Probable maximum flood – the most extreme flood event possible for a certain location, with an approximate ARI of 100,000 to 10,000,000 years.
PMP	Probable maximum precipitation – design rainfall data for extreme storm events.
SSDA	State significant development application

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2 Site Description and Background Data

2.1 Location and Site Description

Existing site description summary is provided in Table 1.

Table 1: Existing site description summary.

Address	369 – 381 President Avenue, 61-65 Hotham Road, 2-4 Bidurgal Avenue, Kirrawee, NSW
Lot / DP	Lot 1 DP 841502, Lots 22-24A DP 26995, Lots 54-55 DP 29493
Site Area	9,519.86 m^2
Local Government Area (LGA)	Sutherland Shire Council (SSC)
Current Land Use	Hospital facility and urban residential
Current Zoning	SP1 – special activities & R2 – low density residential
Site Description	The site is primarily paved, with some grassed areas. There are several structures on the site including the existing President Private Hospital buildings and dwellings on 61-65 Hotham Road and 2-4 Bidurgal Avenue.
Surrounding Land Uses	Low density residential to the north, west and south, and medium density residential to the east.
Site Elevation	Approximately 66 mAHD at south-eastern site boundary rising to 72mAHD at the western site boundary and 76 mAHD at the northern site boundary.
Site Grading & Aspect	Approximately 5%, SE aspect.
Site Drainage	A 1050 mm diameter Council drainage easement pipe runs underneath the site from north-west to south-east and connects to the pit and pipe network on President Avenue.

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2.2 Site Inspection

Site inspection was conducted on 10 March, 2020 and included:

- General walkover to identify local land forms and site characteristics to understand local drainage behaviour.
- Identification and observation of existing site stormwater infrastructure and natural drainage lines.

2.3 Catchment Description

We note the following regarding the catchment upstream of the site:

- The site is located within the Dents Creek catchment.
- Upstream catchment is primarily urban residential areas, and includes the suburb of Kirrawee.

- The total catchment area is 12.4 ha and is shown in MA planset P1907286PS02-R01 plan K000.

2.4 Site Flood and Overland Flow Mechanisms

The site is likely affected by overland flows from the site itself and the local upstream catchment (refer Section 2.3).

2.5 Previous Flood Studies

A review of previous flood investigations was undertaken to assess likely local flood behaviour and characteristics for the site and the Dents Creek catchment. This review did not identify any flood studies adopted by SSC which would be relevant to this assessment, and this was confirmed by the phone discussion on 31/3/2020 between MA and SSC drainage and stormwater engineer, Jack Slater, who confirmed that no formal study had been undertaken for the site to inform us of flood levels or flow rates.

2.6 Proposed Development

2.6.1 Overview

Architectural drawings prepared by Imagescape Design Studios indicate that the proposed development will include:

- Demolition of existing residential dwellings on site, as well as the timber and rendered buildings in the south-west corner of the site.
- Construction and upgrade of the existing hospital, including a multi-storey west, east and north wing, a western and northern car park, and two driveway accesses.
- Construction of a four-level basement carpark beneath the buildings.
- Development of a landscape area in the south-western corner of the site.

MA also iteratively and holistically designed a 2 m wide swale in the landscape area at the south-western corner of the site to capture the upstream overland flows and redivert it away from the carpark and hospital buildings and discharges it to President Avenue to ensure project objectives are met.

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3 Hydrology Modelling

3.1 Overview

The DRAINS software package (version 2019.091 – 5 December, 2019) was used with the RAFTS hydrological engine to assess the 1% AEP flood and PMF peak flow rates for a range of storm durations between 5 minutes and 6 hours.

3.2 Model Setup

Parameters used in the model are provided in Table 2. Model inputs are as follows:

1. Sub-catchment delineation, flow paths and slopes were developed using LIDAR data provided by Land and Property Information NSW (LPI 2013). Refer to MA planset P1907286PS02-R01 plan K000 for site catchment plan.

2. Sub-catchment impervious areas were adopted based on recent catchment aerials obtained from Nearmaps (2020).

3. Roughness coefficients were determined using a weighted average based on the XP-RAFTS (1996) *User's Manual* and the sub-catchment's land use as per recent site aerials obtained from Nearmaps (2020).

4. Intensity Frequency Duration (IFD) data and rainfall temporal patterns were based on the Bureau of Meteorology (BOM 2020) *Rainfall IFD Data System* and the Australian Rainfall & Runoff (ARR 2020) *Data Hub*.

5. Probable Maximum Precipitation (PMP) intensities and temporal distributions were determined using the BOM (2003) *Generalised Short-Duration Method*.

6. RAFTS parameters have been derived from the suggested values in the XP-RAFTS (1996) *User Manual*. Sub-catchment surface soils are assumed to be loamy sand, based on the NSW Department of Planning, Industry and Environment (2020) *eSPADE – NSW Soil and Land Information* website.

Table 2: Details of sub-catchments used in RAFTS modelling.

Area (ha) [1]	Catchment Slope (%) [1]	Impervious (%) [2]	PERN Roughness Coefficient [3]
12.4	4.2	70.0	0.018

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Notes

1. Obtained based on LIDAR data provided by LPI (2013). Refer to MA planset P1907286PS02-R01 plan K000 for site catchment plan.
2. Adopted based on recent catchment aerials obtained from Nearmaps (2020).
3. Obtained from the weighted average land use based on recent catchment aerial photographs obtained from Nearmaps (2020) and the XP-RAFTS User Manual (1996).

3.3 Results

3.3.1 Hydrology Results

Results of peak flow rates for catchments arriving at the site for the critical duration 1% AEP flood event and PMF events are summarised in Table 3. The critical storm duration was determined to be 5 minutes for the 5% and 1% AEP flood event, and 15 minutes for the PMF event.

Table 3: Peak 5% AEP, 1% AEP and PMF flow rates for critical duration storms estimated by DRAINS modelling for sub-catchments arriving at the site.

Flood Event	Critical Storm Duration (mins)	Peak Catchment Flow Rates (m^3/s)
5% AEP	5	6.11
1% AEP	5	7.78
PMF	15	29.4

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4 Hydraulic Modelling

4.1 Overview

The TUFLOW hydraulic model was used to determine flood characteristics including flood extents, levels, depths, velocities and hydraulic hazard for the critical 1% AEP flood and probable maximum flood (PMF) events for existing and proposed conditions. Based on a preliminary calculation of the flow capacity of the 1050 mm Council drainage easement pipe running through the site, it was deemed that the pipe had enough capacity to contain the critical 5% AEP flood and thus hydraulic modelling was not used for the critical 5% AEP flood.

4.2 Scenarios

The hydraulic model was setup to represent the following flood condition scenarios:

1. Existing condition: the catchment and site in their current state as described in Sections 2.1, 2.3 and 2.4.
2. Proposed condition: the catchment in its current state and the site in its proposed state as described in Section 2.6.

The hydraulic model was used to assess flooding for the following events:

1. 1% AEP 5 minute (critical duration) event.
2. PMF 15 minute (critical duration) event.

In summary, a total of 4 scenarios were modelled as part of this assessment (2 flood condition scenarios and 2 flood events each).

4.3 Terrain Data

Site LIDAR data provided by LPI (2013) was used to create a 3D surface for the existing conditions site and the local floodplain environment used in the TUFLOW model.

The proposed conditions surface also included site design grading as shown in MA planset P1907286PS02-R01 plan C100 for proposed conditions grading details.

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4.4 Model Setup

4.4.1 Existing Conditions

TUFLOW model construction for existing conditions consisted of:

1. A 1.0 m topographic grid based on the available LIDAR data.

2. The model domain was defined from Balgang Avenue 130 m upstream of the site to President Avenue 180 m downstream of the site. Model boundary extents were generally placed along catchment ridgelines and / or connecting catchment high points surrounding the study area, and are shown in MA planset P1907286PS02-R01 plan K030.

3. Inflow boundary conditions based on the critical duration 1% AEP and PMF hydrographs from DRAINS for the catchment discharging to the study area, with inflow location shown in MA planset P1907286PS02-R01 plan K030.

4. Computed water slopes for downstream model extent boundary conditions based on the slopes from available LIDAR data, with locations shown in MA planset P1907286PS02-R01 plan K030.

5. Manning's zones based on Nearmaps (2020) aerial photography of the study area, with roughness coefficients adopted as per Table 4.

6. Existing buildings were assigned elevations above the floodplain to model as flow obstructions.

7. A 1D network to model the relevant pit and pipe network:

    a. The trunk drainage easement pipe underneath the site and the downstream connection have been modelled as a 1D network. All other pits and pipes in the study area have conservatively been assumed to be 100% blocked.

    b. 1D network pipe sizes, invert levels and locations are based on Australian Locating Services (2020) CCTV survey data and LIDAR data.

    c. Pipe roughness coefficient of 0.013 (concrete) was adopted.

    d. Pipe blockages of 25% have been adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016).

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Table 4: Manning's roughness values for TUFLOW modelling.

Catchment Material Type	Manning's Roughness Coefficient [1]
Buildings	2.000
Grass	0.035
Residential / Urban Areas [2]	0.150
Roads / Concrete	0.020
Swale	0.040

Notes
1. Based on typical values from similar catchments.
2. Based on the weighted average land use of a representative urban lot area and the adopted roughness coefficients for pervious / impervious areas.

4.4.2 Proposed Conditions

The existing conditions model was modified as follows to simulate proposed conditions:

1. The 1.0 m topographic grid was updated to include the proposed site grading, as shown in MA planset P1907286PS02-R01 plan C100.
2. Site manning's zones were updated to represent design surfaces.
3. Site buildings were removed and replaced with proposed buildings to model as flow obstructions.
4. The proposed pedestrian footbridge and the southern edge of the carpark near over the swale near President Avenue were modelled as layered flow constrictions. Levels were adopted based on Imagescape Design Studios architectural plans and LIDAR data, and structure blockage of 25% was adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016).
5. The 1D network was updated to include the proposed 1D elements, and detailed design is provided in MA planset P1907286PS01-R01 plan E100. All other pit and pipe parameters are consistent with the existing conditions model.

All other model construction elements remained consistent with the existing conditions model.

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4.5 Results

4.5.1 Flood Results

Flood mapping results (flood levels, depths, velocities and provisional hazard categories) for the critical duration 1% AEP flood event and PMF events in existing and proposed conditions are provided in MA planset P1907286PS02-R01, with drawing references summarised in Table 5.

Table 5: Flood map drawing references in MA planset P1907286PS02-R01.

Flood Condition Scenario	Critical Duration Flood Event	Water Level & Depth	Water Velocity	Provisional Hydraulic Hazard Categories [1]	ARR Flood Hazard Categories [2]	Water Level Impact
Existing Conditions	1% AEP	K160	K162	K164	K165	–
	PMF	K180	K182	K184	K185	–
Proposed Conditions	1% AEP	K260	K262	K264	K265	K360
	PMF	K280	K282	K284	K285	–

Notes

1. Provisional hydraulic hazard categories are based on NSW Floodplain Development Manual (2005) definitions and are shown in Figure 1.
2. ARR flood hazard categories are based on ARR 2019 combined flood hazard category definitions and are shown in Figure 2.

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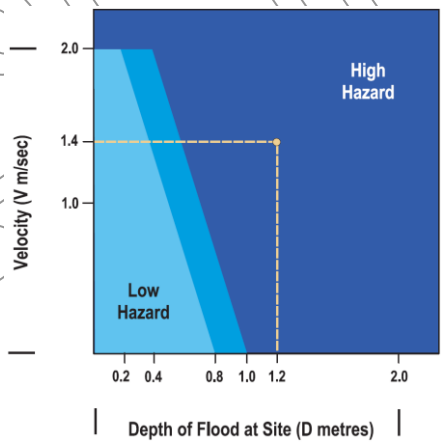

Figure 1: Provisional hydraulic hazard categories (*NSW Floodplain Development Manual*, 2005).

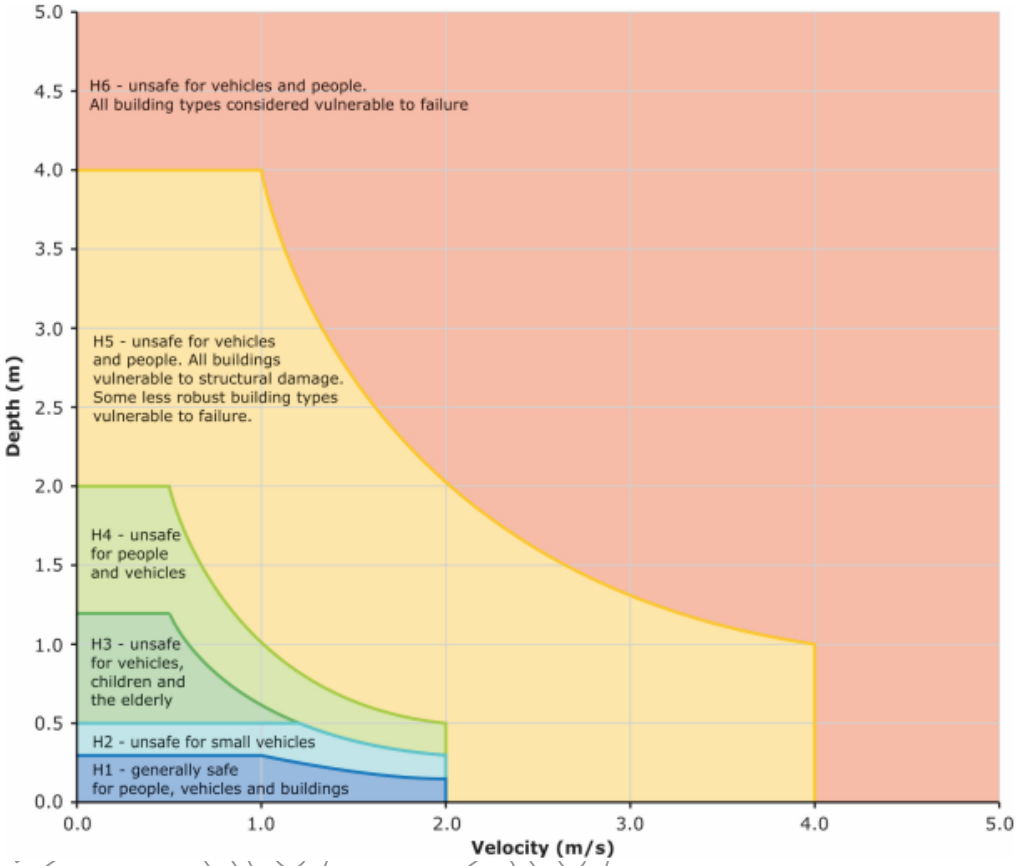

Figure 2: Combined flood hazard curves (*ARR, 2019*).

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4.6 Discussion

We note the following regarding modelled flood behaviour:

4.6.1 Existing Conditions

1. Flood waters flow into the site from the west and is funnelled into the narrow flow paths between the timber and rendered buildings, through the south-western carpark, and onto President Avenue. Due to the constriction of the floodplain, water is temporarily backed up behind the timber buildings.

2. 1% AEP flood depths reach up to approximately 0.8 m between the buildings in the north-western corner of the site, and up to 0.3 m at the discharge location onto President Avenue at the southern boundary.

3. In the 1% AEP event, flood velocities on-site are relatively high, generally reaching up to 2.5 m/s in the main overland flow path, and up to 5.0 m/s in the narrow constriction between the buildings.

4. Hydraulic hazards on-site in the 1% AEP event are generally quite high in the primary flow path and in the constriction between the buildings. Elsewhere on the site hydraulic hazards are generally low.

5. PMF flood depths reach up to approximately 1.75 m between the buildings in the north-western corner of the site, and up to 0.55 m at the southern boundary.

6. PMF flood velocities on-site are very high, reaching up to and over 4 m/s across the entire flood affected portion of the site. Consequently, flood hazards are also high in the majority of the affected area.

4.6.2 Proposed Conditions

1. The proposed swale redirects the upstream overland flow and prevents inundation of the proposed south-western carpark, however the discharge location onto President Avenue remains approximately the same as in existing conditions, hence the swale does not materially affect local flood characteristics and the overall range of flood depths, velocities and hazards remain the same as in existing conditions.

2. All flood events up to and including the 1% AEP event are fully contained within the proposed swale.

3. Apart from shallow flood depths in the south-western carpark and landscape area, the proposed development is completely flood free in the PMF event.

4. The peak 1% AEP flood level affecting the Hospital West Wing building is 69.7 mAHD, and the peak PMF level affecting the west wing is 70.3 mAHD.

5. The peak 1% AEP flood level at the upper end of the swale are approximately 71.0 mAHD, and the peak PMF level is approximately 71.5 mAHD.

6. Floor level compliance:

    a. SSC classifies the site as an Initial Assessment Potential Flood Risk, which means there is no quantified flood risk for the site as of yet. However, as an "Essential Community Facility", the proposed development is required to be flood free in events up to and including the PMF. Therefore, the strictest flood level planning control requires floor levels to be set at a minimum of the PMF level or 1%

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AEP + 0.5 m freeboard, whichever is greater (Sutherland Shire DCP 2015).

b. Table 6 summarises proposed site building and flood planning levels, and demonstrates that the site achieves compliance with SSC floor level requirements.

Table 6: Comparison of flood planning levels within proposed swale and building ground floor levels.

	Flood Level (mAHD)				
Building [1]	**1% AEP [2]**	**PMF [3]**	**Flood Planning Level (mAHD) [4]**	**Ground Floor Level (mAHD) [1]**	**Complies?**
West Wing	69.7	70.3	70.3	70.3	Yes
Foyer	71.0	71.5	71.5	71.9	Yes
Existing Hydrotherapy Pool	71.0	71.5	71.5	71.9	Yes
East Wing	NA [5]	NA [5]	NA [5]	70.09	Yes

Notes

1. Refer to Imagescape Design Studios architectural plans for proposed site layout and ground floor levels.
2. Refer MA planset P1907286PS02-R01 plan K260 for modelled proposed 1% AEP flood levels.
3. Refer MA planset P1907286PS02-R01 plan K280 for modelled proposed PMF flood levels.
4. SSC requires the flood planning level to be the greater of the 1% AEP flood level + 0.5 m and the PMF level.
5. These buildings do not have nearby flood water in the proposed conditions 1% AEP flood event.

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4.6.3 Offsite Flood Impacts

1. The proposed development has negligible offsite impacts on the floodplain environment in the 1% AEP event.

2. There is a small area of offsite flood level increase of up to 200 mm in the 1% AEP flood on the footpath of President Avenue. This impact extends slightly onto the carriageway and increases flood levels by up to 30 mm.

3. These impacts do not affect any lots or existing buildings, and only occur locally as a result of the concentration of the upstream overland flows due to the proposed swale. However, the flood hazard of President Avenue in the vicinity remains largely unchanged, and hence the impact is unlikely to cause an increase risk to people or property.

4. Thus, the proposed development is considered to have no material off-site impacts.

5 Preliminary Flood Emergency Response Plan

5.1 Overview

The site is affected by short duration overland flooding and in the PMF event, President Avenue to the south of the site is a flow path that is inundated by high hazard flood waters in the PMF event concurrently with the site. The northern carpark and main entrance which connects to Hotham Road are all unaffected by flood waters, which would allow for possible evacuation from the site to the north, across the railway and up to the commercial sector near Kirrawee Station if necessary. As the ground floor of each building in the proposed conditions is above the PMF level, safe shelter in place is available to all site occupants.

We note the following with respect to the preliminary flood emergency response plan (FERP):

1. The site is managed, hence a responsible flood officer shall be appointed to manage flood education and instructions for the management and all occupants.

2. No evacuation to President Avenue is allowed during flood events. Evacuation is to be undertaken via the northern carpark and the main entrance which connects to Hotham Road.

3. The responsible flood office shall be subscribed to flood warning systems including the SES emergency alert telephone warning system, BOM alerts and press releases, weather apps and media warnings.

4. The proposed development finished floor levels (FFLs) are above the peak PMF levels, hence it is not affected by flood events up to and including the PMF. Thus, PMF refuge is available on the ground floor of each building.

5. Proposed buildings will be designed to resist flood forces (water and debris) and any buoyancy forces.

6. Buildings should contain emergency kits including torch and spare batteries, portable radio with spare batteries, first aid kit, high visibility vest, non-slip footwear, and megaphone.

7. Modelling indicates the shelter-in-place duration in the critical duration PMF event is in the order of 20 minutes. We consider that longer duration PMF events may require a longer shelter-in-place duration, however this is likely to be less than 3 hours.

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6 Compliance Assessment

We note the following based on Sutherland Shire Council flood planning policies provided in Sutherland Shire LEP and DCP (2015):

1. A High Flood Risk Precinct is defined as the area below the 1% AEP flood level that is either subject to high hydraulic hazard or where there are significant evacuation difficulties.

2. A Medium Flood Risk Precinct is defined as the area below the 1% AEP flood level that is not subject to high hydraulic hazard or where there may be some evacuation difficulties.

3. A Low Flood Risk Precinct is defined as the area between the 1% AEP flood level and the PMF level.

4. Where existing knowledge is incomplete, areas are classified as "Initial Assessment Potential Flood Risk".

5. The site is classified as an "Initial Assessment Potential Flood Risk", which by SSC which indicates that SCC believes there is a high risk of flooding occurring on the site, however no formal studies have been undertaken to quantify and assess the risk.

6. The proposed development is an alteration and expansion of the existing private hospital which is categorised as an "Essential Community Facility" land use, and thus it is not permitted on any land classified as low, medium, or high flood risk.

7. In existing conditions the site and the main hospital building is below the 1% AEP flood level. The hospital main building generally experiences low hydraulic hazard, however the south-western carpark and timber buildings experience high hazard, thus the site would fall under the category of "high flood risk".

8. The proposed design renders the development area flood free for events up to and including the PMF.

Flood specific controls are provided in the DCP at Chapter 40 Part C 'Flood Risk Management'. A compliance assessment for the proposed development based on Table 5.5 and the planning considerations in Section 5.6 of the DCP for an essential community facility land use is summarised in Table 7, which demonstrates that all the applicable flood planning requirements for the proposed development site are

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effectively addressed, and compliance with the Sutherland Shire Council DCP is achieved.

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Table 7: Compliance with Sutherland Shire DCP (2015) development matrix prescriptive controls.

Sutherland Shire DCP Requirement	Compliance Assessment
FLOOR LEVEL	
1. Habitable floor levels shall be no lower than the PMF level or the 1% AEP flood levels plus 500mm freeboard, whichever is higher.	(1) The proposed floor levels complies with the DCP requirements. Refer to Table 6 in Section 4.6.2 for more details.
BUILDING COMPONENTS & METHOD	
1. All structures to have flood compatible building components below the PMF.	(2) All structures up to 71.5 mAHD, the peak site PMF level, are to be constructed from flood compatible building components. Details will be provided at detailed design stage.
STRUCTURAL SOUNDNESS	
1. An engineer's report is required to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF level.	(3) All structures are to be constructed from flood compatible building components and buildings shall be designed considering the forces of the floodwater, debris, buoyancy and inundation up to the site PMF level of 71.5 mAHD. Details will be provided at detailed design stage.
FLOOD EFFECTS	
1. An engineer's report is required to certify that the development will not increase flood effects elsewhere, having regard to: i. Loss of flood storage; ii. Changes in flood levels, flows and velocities caused by alterations to flood flows;	(4) The proposed swale offsets the loss in flood storage of the proposed southern carpark. (5) The proposed development is not likely to materially affect flood levels, velocities or hazards as the swale does not increase the flows on site, it only redirects the flow. Therefore, we also do not expect there will be adverse environmental impacts such as erosion or siltation.
CAR PARKING AND DRIVEWAY ACCESS	
1. The minimum surface level of open car parking spaces shall be no lower than the 1% AEP flood level or the level of the crest of the road at the location where the site has access to the road.	(6) The proposed carpark is at 70 mAHD which is above the 1% AEP peak level at the carpark of 60.9 mAHD and therefore complies with Council carpark surface level requirements.

Sutherland Shire DCP Requirement	Compliance Assessment
2. Restraints or vehicle barriers shall be provided to prevent floating vehicles leaving a site during a 1% AEP flood. A flood depth of more than 200 mm will cause serious water damage to a typical vehicle and a depth of 300 mm is sufficient to cause a typical vehicle to float.	(7) The carpark is not affected by the 1% AEP flood.
EVACUATION	
1. Reliable access for pedestrians or vehicles shall be provided during a 1% AEP flood.	(8) The southern carpark vehicle access is unavailable during a 1% AEP flood, however the pedestrian bridge is not inundated by high hazard flows. (9) The eastern site access is available during events up to and including the PMF event.
2. Reliable access for pedestrians or vehicles shall be provided from the building commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level.	(10) The ground floor level of the proposed buildings is above the PMF level. (11) Evacuation from the site to an area of refuge above the PMF level is available through the eastern site access.
3. Adequate flood warning systems, signage and exits shall be available to allow safe and orderly evacuation without increased reliance upon the SES or other authorised emergency services personnel.	(12) To be provided.
4. The development shall be consistent with any relevant flood strategy, Floodplain Risk Management Plan adopted by Council or similar plan.	(13) To be provided.
5. An engineer's report shall be provided to certify that an area of refuge is available if circumstances are possible where the evacuation of persons might not be achieved within an effective warning time.	(14) A flood emergency evacuation plan will be provided at detailed design stage outlining the evacuation and shelter-in-place procedures.
MANAGEMENT AND DESIGN	
1. Applicant shall demonstrate that area is available to store goods above the PMF level.	(15) To be provided.
2. No storage of materials which may cause pollution or be potentially hazardous during any flood is permitted below the 1% AEP plus 500 mm.	(16) To be provided.

7 Response to Agency Comments

Council has reviewed the Secretary's Environmental Assessment Requirements (SEARs) for the proposal of the alterations and additions to President Private Hospital and has provided several flooding related comments and recommendations which MA have responded to in Table 8 below.

DRAFT

Table 8: MA response to SCC's comments (27/05/2019) regarding site flooding.

SCC Comments	MA Response
1. Assess the impacts of the proposed development, the flood risk, emergency response and evacuation procedures, and address all relevant flood related development controls.	The flood impacts and risk of the proposed development are discussed in Section 4.5 and 4.6. Preliminary emergency response procedures are discussed in Section 5, and relevant flood related development controls are addressed in Section 6, Table 7.
2. Model existing flood behaviour using 2-dimensional modelling software, preferably TUFLOW. The model extents must include the subject site, and extend well upstream and downstream of the site. The hydrologic model developed for the assessment must be built based on the guidance in Australian Rainfall and Runoff 2019 (ARR19).	TUFLOW has been used to model the existing and proposed flood behaviour. The RAFTS hydrologic model developed for the assessment has been built based on the ARR 2019 data and guidelines.
3. Include all results of the flood modelling including flood behaviour in frequent, infrequent, and rare storm events, up to the PMF, including flood heights, depths, and velocities in and around the site. The report must also assess flood hazard and hydraulic categories in accordance with NSW Government's Floodplain Development Manual (figure L2) and ARR19 Guidelines (figure 6.7.9). The report must include mapping of all results.	Flood modelling result maps for the 1% AEP and PMF events, including flood heights, depths, velocities, and hazards are provided in MA planset P1907286PS02-R01.
4. Assess flood impacts as a result of the proposed development, including modelling of proposed building footprints. Mapping of post development results including difference mapping must be included in the report. Where appropriate the report must recommend and model flood mitigation measures.	Flood impacts as a result of the proposed development, including proposed building footprints, for the 1% AEP flood event have been assessed in Section 4.6.3, and the results are mapped in MA planset P1907286PS02-R01 plan K360.
5. Assess and map flood risk. Hospitals are defined as essential community facilities under Chapter 40 of the DCP. According to the risk matrices in the DCP, essential community facilities are not suitable on any land identified as flood affected. The assessment must recognise this and justify how the development addresses flood risk. Reference to the objectives of Chapter 40 of the DCP should be made.	The proposed earthworks grading of the flood affected areas of the site are sufficient enough to contain the critical duration 1% AEP flood and the critical duration PMF event and thus prevent flood affectation of the proposed development.

PRELIMINARY

SCC Comments	MA Response
6. Include a table that highlights compliance with all relevant flood related development controls. The report must include all assumptions, results, discussion, and recommendations in detail.	A DCP flooding compliance assessment is provided in Section 6, Table 7.

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8 Summary and Recommendations

A detailed hydrologic and hydraulic model has been developed for the site using proposed design elements to assess local flood characteristics.

The models were used to determine the existing and proposed flood conditions in the 1% AEP flood and PMF events. Modelling concluded that:

1. Proposed flood characteristics are largely consistent with existing conditions, and differences due to the proposed development are negligible.

2. The proposed swale effectively render the site development area flood free in the 1% AEP flood.

3. The proposed development would have no material offsite flood impacts.

4. Compliance with Council flood planning level requirements for building and car park levels are achieved.

The following recommendations are made:

1. Piers are to be designed by a suitably qualified engineer to withstand the forces of floodwater, debris and buoyancy.

2. Structures below the site PMF flood level of 71.5 mAHD are to be constructed using flood compatible materials in accordance with Council requirements.

3. A flood risk management plan should be prepared at detailed design stage to outline shelter-in-place and evacuation requirements to minimise flood risk to life and property associated with the use of land.

The proposed development has been designed to ensure compatibility with the existing floodplain environment. As the proposed development has been designed to achieve Council requirements, no further recommendations are considered necessary.

PRELIMINARY DRAFT
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9 References

Bureau of Meteorology (2003), *The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method*.

Bureau of Meteorology (2020), *Rainfall IFD Data System*, www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016.

Commonwealth of Australia (Geoscience Australia) (2016), *Australian Rainfall and Runoff – A Guide to Flood Estimation*.

DRAINS (2019), *DRAINS Content Menu*.

NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

NSW Department of Planning, Industry & Environment (2020) *eSPADE – NSW Soil and Land Information*, www.environment.nsw.gov.au/eSpade2WebApp.

Sutherland Shire Council (2015), *Sutherland Shire Local Environmental Plan (LEP)*.

Sutherland Shire Council (2015), *Sutherland Shire Development Control Plan (DCP)*.

Weeks, W and Rigby, T (2016), *Blockage of Hydraulic Structures*, Chapter 6 of Book 6 in *Australian Rainfall and Runoff – A Guide to Flood Estimation*.

XP-RAFTS (1996), User's Manual.

PRELIMINARY DRAFT NOT FOR DISTRIBUTION

10 Attachment A: Sutherland Shire Council Comments

PRELIMINARY DRAFT
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David Sheehan - 9710 0965
File Ref: DN19/0015

27 May 2019

Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Via email to Megan.fu@planning.nsw.gov.au

Dear Sir/Madam

Development Referral No. DN19/0015
Proposal: Review of SEARS for alterations and additions to President Private Hospital
Property: 369-381 President Avenue, Kirrawee

I refer to the above request for input into Secretary's Environmental Assessment Requirements (SEARs) for the above proposal under clause 3 of Schedule 2 of the Environmental Planning and Assessment Act 1979.

Council understands that the Department of Planning & Environment are satisfied the application is State Significant Development pursuant to the provisions of both Clause 8(1)(a) and (b) of State Environmental Planning Policy (State and Regional Development) 2011.

Council has reviewed the supplied scoping report and provides the following comments and recommendations:

The Site and Heritage: The site contains a dwelling known as Hotham House (65 Hotham Road) that is the subject of an Interim Heritage Order. Council recently resolved to forward for gateway consideration a planning proposal to add the property to the Sutherland Shire Local Environment Plan 2015 heritage schedule.

The dwelling is proposed to be demolished as part of the new development. Given the heritage value of this dwelling to the local community, opportunities to integrate the dwelling within the overall proposal should be explored.

Council recommends that Point 7 of the SEARs should be adjusted as follows:

"7. Heritage

- Provide a statement of significance and an assessment of the impact on the heritage significance of any heritage items on the site, ***and an assessment of the impact on the heritage significance of the house and garden at 65 Hotham Road (an Interim Heritage Order was applied over this***

property on the 23 November 2018) in accordance with the guidelines in the NSW Heritage Manual.

- Address any archaeological potential and significance on the site and the impacts the development may have on this significance".

Flooding: President Private Hospital is situated on land identified as flood affected under the Sutherland Shire Council 2004 Initial Subjective Assessment of Major Flooding. While the site is considered flood affected, the Initial Assessment provides limited information about site specific flood behaviour and flood heights, velocities, and risk is not known.

It is therefore requested that the SEARs include a requirement that applicant engage a suitably qualified engineer with significant experience in flood risk management and flood modelling to prepare a flood assessment report for the proposed development. The report must:

- assess the impacts of the proposed development, the flood risk, emergency response and evacuation procedures, and address all relevant flood related development controls.

- model existing flood behaviour using 2 dimensional modelling software, preferably TUFLOW. The model extents must include the subject site, and extend well upstream and downstream of the site. The hydrologic model developed for the assessment must be built based on the guidance in Australian Rainfall and Runoff 2019 (ARR19).

- include all results of the flood modelling including flood behaviour in frequent, infrequent, and rare storm events, up to the PMF, including flood heights, depths, and velocities in and around the site. The report must also assess flood hazard and hydraulic categories in accordance with NSW Government's Floodplain Development Manual (figure L2) and ARR19 Guidelines (figure 6.7.9). The report must include mapping of all results.

- assess flood impacts as a result of the proposed development, including modelling of proposed building footprints. Mapping of post development results including difference mapping must be included in the report. Where appropriate the report must recommend and model flood mitigation measures.

- assess and map flood risk. Hospitals are defined as essential community facilities under Chapter 40 of the DCP. According to the risk matrices in the DCP, essential community facilities are not suitable on any land identified as flood affected. The assessment must recognise this and justify how the development addresses flood risk. Reference to the objectives of Chapter 40 of the DCP should be made.

- include a table that highlights compliance with all relevant flood related development controls. The report must include all assumptions, results, discussion, and recommendations in detail.

Council has used the following consultants for flood studies in the past and they have a degree of familiarity with this type of work that might be of assistance:

- BMT
- WMA Water
- Advisian
- Floodmit

Drainage: The site is burdened by a major Council trunk drainage stormwater easement with an assumed 1200mm diameter pipe and pits. The proposed development is subject to flood and stormwater related development controls as outlined under Chapters 38 and 40 of Sutherland Shire development Control Plan 2015 (SSDCP 2015).

The submitted drawings show at least part of the proposed development over the existing easement. No structures are permitted on, or cantilevered over drainage easements as this may impact on Council's ability to maintain the infrastructure.

There is reason to believe that the stormwater pipeline may have been moved at some stage to the south of shown location, however, there is limited information available to confirm if this occurred. It is requested that the SEARs include requirement for detailed survey of the underground pipeline. If necessary, the easement should be amended and registered so that it falls over the location of the pipeline. Any proposed structures over the current location of the pipe should be deleted.

The applicant may wish to consider relocating the pipeline altogether to facilitate the development. Council may consider relocation of its asset, however, the applicant must demonstrate through modelling using DRAINS software that the relocation does not impact on the capacity of the pipeline. The applicant must submit the DRAINS model and an accompanying design, and a design report for review. The applicant must also follow the access and realignment application process through Council's Property Services.

Additional impervious area will place a significant burden on existing drainage infrastructure. It is requested that Point 14 of the SEARs reference the Sutherland Shire DCP2015 Chapter 38 and Sutherland Shire Council's Specifications for Stormwater Works, and/ or the relevant underpinning Australian Standards and documents that informed the chapter.

Landscaping: Council policy seeks to ensure that significant existing trees are retained, that landscaping is provided commensurate with the scale of development, and that development is set within a native, well-landscaped context.

A detailed survey showing all existing trees, including along the boundaries of/with adjoining properties, and an arborist report is required. It is recommended that landscape strategy identified within Point 3 of the SEARs be expanded upon to achieve the above outcome.

It is requested that within the Plans and Documents section of SEARs:

A. the site survey plan also make reference to existing trees, including along the boundaries of/with adjoining properties, and
B. the landscape architectural drawings also include the following information:

- *Be prepared by a qualified Landscape Architect or Designer (eligible for membership with AILA or AILDM)*
- *Detail specific species selection, location and quantities*
- *Detail existing trees to be retained/removed*
- *Detail proposed design and existing context, including hard and soft landscaped areas, contours, spot heights, finished levels and areas of cut and fill.*
- *Detail proposed fences and retaining walls (indicate height and material) basic drainage details, i.e. location of all pits, lines and irrigation; and*
- *Ensure supporting documentation is coordinated*

Transport and Accessibility: Council is broadly supportive of the requirements specified at Point 5 of the SEARs, however, requests that Point 5 also state the following:

> *"Analysis of all vehicle ingress, egress and circulation arrangements to, from and within the site including identification of measures to mitigate any adverse road safety impacts."*

A Traffic and Parking Impact Assessment Report should form part of the documents and plans to address the matters specified within Point 5 and also detail compliance against the requirements AS2890.1 and 2890.6. In particular that:

- parking spaces and aisle widths comply with user Class 3
- disabled and shared spaces are provided in accordance with AS2890.6; and
- levels and grades of driveways comply.

It is usual Council practice to request the proponent to formally and separately apply to Sutherland Shire Council to determine and obtain property alignment levels to allow the internal driveway and pedestrian access-way to correspond with the Council issued levels within the public domain and Road Reserve. This may assist in avoiding a future modification applications to rectify mismatched levels.

Utilities and Infrastructure: It is noted that Point 12 of the SEARs requires preparation of an Infrastructure Management Plan. Council's policy discourages the placement of utility structures in the front boundary setback at the expense of landscaping or parking requirements. It is requested that an additional dot point be provided requiring any such services to be facilitated and designed within the fabric of the main building(s).

Council is broadly supportive of the SEARs as proposed. In facilitating new development, a balance needs to be achieved between facilitating expansion of an essential community facility, whilst respecting Sutherland Shire's heritage and providing a suitable relationship with the surrounding low-density environment and road network. I welcome the opportunity to work with the Department and the proponent going forward to achieve this outcome.

If you need any clarification of the above comments, please contact Council's Development Assessment Officer David Sheehan on 9710 0965 or email dsheehan@ssc.nsw.gov.au and quote the application number in the subject.

Yours faithfully

Peter Barber
Director, Shire Planning