



Job Number: 230021
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GRC Hydro
Level 20, 66 Goulburn Street
Sydney NSW 2000

Elena Slogeris
NSW Department of Planning and Environment
4 Parramatta Square, 12 Darcy Street,
PARRAMATTA NSW 2150



Dear Elena,

Re: Flood Advice for a State Significant Development Proposal BaptistCare Carlingford- Seniors Housing – Stage 2 Review

Executive Summary

A State Significant Development (SSD) in the form of an aged care facility is proposed for 1 Martins Lane and 3A Homelands Avenue, Carlingford at Carlingford (the site).

A flood impact assessment (FIA) has been undertaken for the proposed development and this assessment documents that the design responds well to the local flooding regime in that it offers an adequate level of safety for its residents and staff in the event of flooding at the site. This is confirmed by the proposed design's compliance with the flood-related planning instruments relevant to the site.

GRC is of the view that the proposed development is fit for this location and its flood exposure and is satisfied with how the Applicant, via WMS, has responded to, and resolved, the queries and concerns put to them by a number of government agencies.

Introduction

A State Significant Development (SSD) in the form of an aged care facility is proposed for 1 Martins Lane and 3A Homelands Avenue, Carlingford at Carlingford (the site). The site, which has previously functioned as an aged care facility, is situated within the Parramatta LGA. Flood liable properties within this LGA are ordinarily subject to the flood-related controls outlined in the following planning instruments:

- The Parramatta Local Environmental Plan (2023) (PLEP); and
- The Parramatta Development Control Plan (2023) (PDCP).

A Flood Impact Assessment (FIA) and Flood Emergency Response Plan (FERP) has been submitted for this proposed development. The most recent versions of these reports are as follows:

- Baptist Care, Carlingford – Flood Impact Assessment, WMS Engineering, March 2024
- Baptist Care, Carlingford – Flood Emergency Response Plan, WMS Engineering, March 2024.

These reports refer to architectural and civil drawings for the proposed development, the most recent of these being:

- Lot B, 1 Martins Lane, Carlingford – SSD RFI Submission, DKO Architects, September 2023.
- 1 Martins Lane & 3A Homelands Avenue Carlingford NSW 2118, Stantec, 1 December 2023.

Background

GRC Hydro (GRC) has been engaged by the NSW Department of Planning, Housing and Infrastructure to review the flood-related components of the development submission.

This review has followed an iterative process in which GRC has previously requested information and clarity on previous reports submitted by WMS, the Applicant's flood consultant.

WMS has provided this requested information in the latest FIA and FERP and GRC's Stage 2 Review (this report) will refer primarily to these latest reports.

This review consists of verifying the following components of the provided reporting:

- The modelling basis and results;
- The modelled impact of the proposed development on flood affectation surrounding the site;
- How the proposed development complies with local planning controls; and
- How the safety of residents and occupants is secured and managed in the event of a flood emergency.

Review

Modelling

Hydrology

WMS's modelling parameters with regard to hydrology are outlined in Section 2 of their FIA.

A direct rainfall approach has been adopted and the design rainfall, losses, temporal patterns and Climate Change parameters have been sourced from the ARR Datahub for the site's location and this approach is consistent with those recommended in ARR 2019.

Hydraulics

The components which emulate the site's physical composition for hydraulic modelling appears sensible and consistent with best practice.

The existing topography used in the model is 1m LiDAR, the topography in the proposed case is supplemented with a surface provided by Lendlease, and the proposed on-site drainage infrastructure has also been provided by Lendlease. Drainage infrastructure surrounding the site has been provided by Hydrospatial. This infrastructure has been modelled under both a 50% blockage and a 100% blockage scenario.

Flood Affection

The flood behaviour at the site can be primarily characterised as sheet flow that flows across the site from north to south. The proposed development incorporates a number of drainage features that collect and convey flow away from entrances, towards two onsite detention basins, a small depression towards the south of the site and then off site to the south.

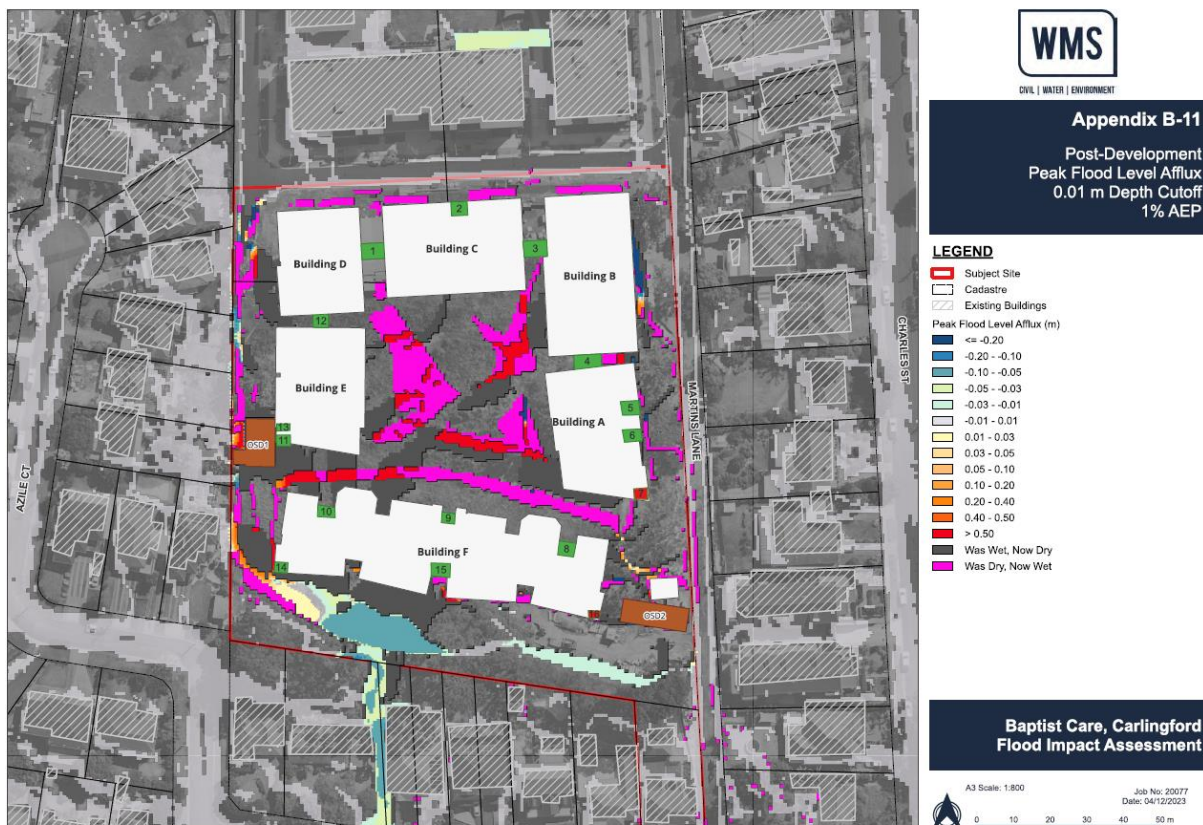
Appendix C of the FIA documents the site's flood affection in the post-development case under a 1% AEP scenario with a full 100% stormwater network blockage. This conservative sensitivity scenario was run at GRC's request and the peak flood hazard in this scenario was predominantly H1 and H2 (low hazard) with some small pockets of H3 (low-medium hazard).

The flood levels and depths largely don't differ between the 50% blockage and 100% blockage aside from some small pockets in the south of the site.

Flood Impact

The proposed development's impact on local flood affection in the 1% AEP event is documented in Appendix B-11 of the FIA. Flood levels under the existing case experience some small increases in the middle of the site and inside its western boundary, however in the south of the site, and in the adjacent properties south of the site, the flood level decreases relative to the existing case. There are a small number of random cells south-east of the site that show as "Was Dry, Now Wet" but these appear to be characteristic of some minor model instability so in reality, this area is unlikely to be affected by the proposed development.

Figure 1: Post-Development Peak Flood Level Afflux



Planning Compliance

The proposed building's compliance with local planning instruments is documented in Section 10 of the FIA.

GRC is satisfied that the proposed development meets the flood-related requirements outlined in the Parramatta LEP and DCP. GRC understands that the structural soundness of the proposed development will be confirmed by a structural engineer in the detailed design phase.

The proposed development is compliant with regard to flood planning levels. Adequate flood protection for building and enclosed car park entrances has been documented in Table 9-1 and Figure 9-1 of the FIA along with references to the architectural and civil drawings which document the finished floor levels and/or berms referenced in Table 9-1.

Flood Emergency Response

The flood emergency response plan outlines a shelter-in-place strategy. This is not uncommon for developments proposed in the City of Parramatta LGA. This strategy avoids the need for vulnerable residents to expose themselves to floodwaters in the process of evacuating. The proposed development has ample refuge space above the PMF level. All of the building entrances are above, or are flood protected to a level above the PMF level.

The modelled flood affectation to be experienced at the site is largely indicative of sheet flow even in the PMF event. Electricity supply is unlikely to be affected specifically by flooding of this nature at the site.

A primary, everyday function of the site is the provision of services (including food) to aged residents. In this sense, the proposed development is well suited to support residents and occupants in the event of an emergency as the provision of food, water and emergency support (first aid) is the status quo. In the event of an emergency these function can continue uninterrupted.

Summary of Applicant's Responses to Agency Queries

Throughout the course of this review process, the Applicant, via WMS, has adequately addressed the queries raised by the following agencies:

- NSW Environment and Heritage (EHG)
- NSW Department of Planning and Environment (DPE) / Department of Planning, Housing and Infrastructure (DPHI); and
- The NSW State Emergency Services (SES)

The queries and responses that accumulated throughout this process are documented in Table 1 along with GRC's comment where appropriate.

Table 2: Collated Flood-Related Queries and Responses Regarding the Proposed Development

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
Table 1-1 Request for Information from 14th of April 2023					
EHG	EHG-1.1	The Flood Impact Assessment Report is lacking modelling and mapping of the 1% AEP flood event including climate change and the Probable Maximum Flood (PMF). It is suggested that for the purposes of clarity, depths below a threshold of 0.1m may be removed from the mapping. However, the impact assessment should be undertaken with these low depths included.	Cutoff depth of 0.01 m for the modelling due to utilisation of rain-on-grid.	Section 6	This is a regular practice for direct rainfall modelling conducted for developments in this LGA.
EHG	EHG-1.2	A flood impact assessment has been undertaken for the 1% AEP event, which demonstrates there is no significant impact to external properties in that event. The assessment is also required for the PMF.	Modelling updated to include PMF results.	Section 6	PMF modelling now included with no adverse impact to external properties.
EHG	EHG-1.3	The Flood Impact Assessment Report appears to suggest the development would be considered residential under the Land Use Category Definitions for flooding listed in Table 2.4.2.1.1 of the development control plan (DCP). This is incorrect. This development includes seniors housing and a residential care facility and is, therefore, a sensitive development. According to the DCP, sensitive development is not considered appropriate on the floodplain, meaning any land below the level of reporting to demonstrate that the proposed development is compatible with the flood risk. Otherwise, the proposal should be reconsidered.	The site is largely classified as 'Not Expected to Flood', as the buildings are outside the 1% AEP, however the western portion of the site is classified as 'Medium Risk' and may be subject to flooding in a moderate flood. The building Finished Floor Levels are raised to provide appropriate freeboard.	Section 9	
EHG	EHG-1.4	Regarding flood planning levels, the minimum of the PMF level or the 1% AEP flood level plus 500 mm freeboard would apply to all floor levels. While it is reasonable to consider flood depths of less than 0.1 m as stormwater runoff and not as flooding, this approach should not be adopted where there is a defined overland path. The available mapping indicates that there is a defined overland flow path on the site under existing conditions. Under proposed conditions, this flow path has been routed to the west of the proposed buildings. Consideration should be presented in the report as to the extent of this flow path and whether the extension along the northern boundary should also be included. Where there is a defined overland flow path, flood planning levels should be provided for each of the building entries. Entries would include any points where floodwater could enter the building including balcony doors, windows, and vents, not only pedestrian or vehicular entries.	Flood levels (greater than 0.10 m) adjacent to at all entries provided in Section 9, with corresponding FFL.	Section 9	Flood levels relative to entrances and levels now well documented in Section 9.
EHG	EHG-1.7	The use of retaining walls described in the report has not been adequately explained or detailed and a "retaining wall" is shown across a roadway and another across a driveway. Clarity is needed on where actual retaining walls vs. flood walls / berms are proposed.	Retaining walls no longer utilised or required as part of proposed development.	Section 5	
EHG	EHG-1.8	The proposed use of three parallel 300 mm diameter stormwater pipes below the swale on the northern boundary is questionable. Given the relief across the site, a larger pipe less prone to blockage would be preferable. Adopted blockage fosters for all pits and pipes should be provided. Assuming zero blockage would show an unrealistically low volume of water as overland flow.	Swales and three parallel 300 mm diameter stormwater pipes no longer utilised or required as part of proposed development.	Section 5	
EHG	EHG-1.9	The location of impermeable fences appears to funnel water onto the pedestrian entryways. Then, pits are proposed in swales downstream. It would be preferable to locate pits in road uphill to prevent water flowing onto footpaths. There appear to be pits in East-West Road and these should be included in the flood model.	Existing pit and pipe network within East West Road and Martins Lane included in model for pre-developed and post-developed scenario.	Section 5	
EHG	EHG-1.11	Regarding emergency management, it is strongly recommended that the State Emergency Service (SES) is consulted to provide advice on the proposal. EHG considers that it may be possible to provide an appropriate design, however, this may require substantial revisions, which could only be considered with suitable PMF mapping. Flood free access and egress must be provided in all events up to and including the PMF. A shelter in place strategy is not considered a suitable alternative and a private emergency management plan is unlikely to be supported.	A draft Flood Emergency Response Plan (FERP) has been provided to SES for consultation. Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.	Refer to report: 20131-R01-FERP-0	
SES	SES-1	The consent authority will need to ensure that the assessment is considered against the relevant Ministerial Section 9.1 Directions, including 4.1 – Flooding and is consistent with the NSW Flood Prone Land Policy as set out in the NSW Floodplain Development Manual, 2005 (the Manual). Attention is drawn to the principles outlined in the Manual which are of importance to the NSW SES role as described above.	Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event. However, shelter in place is the preferred option, as there will likely be insufficient warning time prior to a flood. However, in the event of an emergency, the site	Refer to report: 20131-R01-FERP-0	Shelter in place is a common flood emergency response strategy in the City of Parramatta. It avoids the chances of evacuating residents being caught in floodwaters mid-evacuation. In a 1% AEP event, the site may be safely accessed by emergency services should a personal medical emergency occur during a flood event.

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
			can be safely evacuated both on foot and in a vehicle.		
SES	SES-2	Zoning should not enable development that will result in an increase in risk to life, health, or property of people living on the floodplain. "The Assessment confirms the site subject to the 1% AEP peak flood level and largely shallow flood waters with depths equal to or less than 0.15 m. However, certain low-lying areas of the site experience ponding with depths up to 0.3 to 0.5 m under the predevelopment conditions. Under post-development conditions, the localised ponding areas were mostly limited to the above ground detention basin within the southern portion of the site and the kerb and gutter along East West Road which separates Site and Site B." Under the post-developed scenario, the proposed southern buildings are surrounded by shallow floodwater. Although this risk does not sound significant, the risk assessment should consider the full range of flooding and the velocities associated with the flooding. Even if the floodwater is shallow, if it has a high velocity the hazard (and the risk the potential occupants are exposed to) can be dangerous.	Modelling updated to include PMF results.	Section 6	This development is proposed for an existing aged care site. The modelled flood affectation at the site is predominantly low hazard in the 1% AEP and PMF. The proposed development is in keeping with the LEP and DCP requirements for a development of this type on a site with this level of flood risk.
SES	SES-3	The EIS should be revised to understand the risk up to the PMF.	Modelling updated to include PMF results.	Section 6	PMF modelling now included with no adverse impact to external properties.
SES	SES-4	Further understanding of the flood risk up to the PMF is required to adequately assess the risks associated with the development, including access and egress during flooding. Ideally, rising road access / egress should be maintained throughout the flood to reduce the risks associated with entering floodwater, particularly for the proposed age demographic.	Modelling updated to include PMF results. Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.	Section 6	PMF modelling now included with low hazard flooding near all entrances except one - entrance 14. Can be managed as there are alternative, safe entrances to this building.
SES	SES-5	Development strategies relying on deliberate isolation or shelter in buildings surrounded by floodwater are not equivalent, in risk management terms, to evacuation. 'Shelter in place' strategy is not an endorsed flood management strategy for the NSW SES for future development. Such an approach is only considered suitable to allow existing dwellings that are currently at risk, without increasing the number of people subject to such risk. The flood evacuation constraints in an area should not be used as a reason to justify new development by requiring the new development to have a suitable refuge above the PMF. Allowing such development will increase the number of people exposed to the effects of flooding. Other secondary emergencies such as fire and medical emergencies may occur in buildings isolated by floodwater. During flooding it is likely that there will be a reduced capacity for the relevant emergency service agency to respond in these times. Even relatively brief period of isolation, in the order of a few hours, can lead to personal medical emergencies that have to be responded to. However, further understanding of the risks associated with the PMF, as well as the maximum duration of potential inundation and / or isolation is required to further assess the risks associated with either option.	Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event. However, shelter in place is the preferred option, as there will likely be insufficient warning time prior to a flood. However, in the event of an emergency, the site can be safely evacuated both on foot and in a vehicle.	Section 6 and report 20131-R01-FERP-0	Shelter in place is a common flood emergency response strategy in the City of Parramatta. It avoids the chances of evacuating residents being caught in floodwaters mid-evacuation. In a 1% AEP event, the site may be safely accessed by emergency services should a personal medical emergency occur during a flood event.
SES	SES-6	Development strategies relying on an assumption that mass rescue may be possible where evacuation either fails or is not implemented are not acceptable to the NSW SES.	Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.	Section 6 and report 20131-R01-FERP-0	
SES	SES-9	The NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management.	Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.	Section 6 and report 20131-R01-FERP-0	
SES	SES-10	NEW SES is opposed to development strategies that transfer residual risk, in terms of emergency response activities, to NSW SES and / or increase capability requirements of the NSW SES.	Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.	Section 6 and report 20131-R01-FERP-0	
SES	SES-11	Consent authorities should consider the cumulative impacts any development will have on risk to life and the existing and future community and emergency service resources in the future.	Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.	Section 6 and report 20131-R01-FERP-0	

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
DPE	DPE-3a	Provide the results data for the scenarios documented in the Flood Impact Risk Assessment reports to enable assessment of the modelling methods and assumptions used.	Provided as part of report submission.		
DPE	DPE-3b	Provide flood level raster grids for the 1% AEP event for both the existing and post-development scenarios (whole extent and not trimmed).	Provided as part of report submission.		
DPE	DPE-3c	Provide modelling and mapping for the 1% AEP event inclusive of the potential influence of future climate change for floor depths, hazard categorisation and flood level differences for the post-development versus existing scenarios.	Modelling updated to include 1% AEP with climate change, RCP 8.5 for year 2090.	Section 6	
DPE	DPE-3d	Provide a map and / or table highlighting flood planning levels for each entrance location and how they compared with the proposed entrance floor levels.	Provided.	Section 9	
DPE	DPE-3e	Include a digital elevation model of the post-development ground levels for the site.	Provided as part of report submission.		
Request for Information from 20th of October 2023					
EHG	EHG-1.1	The response in the Flood Impact Assessment reads “Cutoff depth of 0.01m for the modelling due to utilisation of rain-on-grid.” EHG’s original suggestion relates solely to the mapping outputs and not to modelling parameters. Flood depths below a threshold of 0.1m may be removed from the mapping.	Noted and updated. Modelling and flood impact assessment have been undertaken without a cutoff depth, but mapping has been updated with a cutoff depth of both 0.01 m and 0.1 m. It was decided to keep both cutoffs in the mapping to allow for a better distinction between shallow sheet flow and overland flow paths.	Appendix A Appendix B	This is a common practice as waters of this low depth (0.1 m) do not constitute flooding per se.
EHG	EHG-1.2	The Probable Maximum Flood (PMF) modelling has demonstrated that the development causes significant increases in flood hazard in Martins Lane. Under existing conditions there are areas of hazard category H1 to H5 on the road, but some areas of hazard category H5 increase to cross the whole width of the road. Further, the new category of H5 then also precludes access to parts of the development via Martins Lane. This is discussed further under the last item.	There is indeed an increase in the PMF hazard classification along Martins Lane in the post-developed scenario. This high hazard classification is a result of high velocities due to the steepness of the road rather than increased flood depths, which are very low along Martins Lane. This high hazard has been considered acceptable and is not expected to hinder access via Martins Lane for the following reasons: <ul style="list-style-type: none"> Flood depths along Martins Lane are generally below 0.1 m, except at localised areas within the gutters. Flood velocities along Martins Lane are generally below 3.0 m/s, except at localised areas within the gutters. The depth-velocity product along Martins Lane does not exceed 0.3 m²/s. According to Table 6.7.2 of the ARR 2019 (Book 6, Chapter 7), small passenger vehicles can safely traverse floodwaters where depths are below 0.1 m if velocities are lower than 3.0 m/s and the depth-velocity product is lower than 0.3 m²/s. Therefore, vehicles would still be able to access Martins Lane during a PMF event. Emergency vehicles such as ambulances would likely be considered large passenger vehicles, for which the aforementioned safety criteria are even higher (0.15 m, 3.0 m/s and 0.45 m²/s, respectively). As such, emergency vehicles would be able to 	Section 6	GRC accepts that the flood hazards in a PMF event are not greatly exacerbated by the proposed development and the flood depths remain below 0.1 m and the high hazard duration of ~30 minutes or less doesn’t greatly inhibit the ability for emergency services to perform their duties during an event of this extremely rare magnitude.

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
			<p>comfortably drive through Martins Lane and enter the site via the two driveways on Martins Lane if required.</p> <ul style="list-style-type: none"> In addition, an analysis of the duration of flooding along Martins Lane indicates the road would only be subject to hazard classifications H3 or greater for 30 minutes or less for the critical storm durations at the road. Therefore, if access via Martins Lane is still considered unsafe, this is still considered acceptable given the short period during which access would be hindered. The hazard along Martins Lane was discussed with the SES on a meeting on the 24th of May 2023, where it was agreed that the high hazard along the road is acceptable given the short duration it is expected to last. The meeting minutes were later sent to the SES, who provided no comment. 		
EHG	EHG-1.4	Regarding flood planning levels, the following comments are provided to Table 8-1 and Figure 8-1 of the Flood Impact Assessment. The Flood Emergency Response Plan may also need updating.	Noted and updated as per below.	N/A	
	EHG-1.4	The PMF levels for Locations 1, 2, and 3 may also need to be checked against local ponding adjacent to the building.	The flood levels at Locations 1, 2 and 3 have been checked against the local ponding along the northern boundary, which are lower than the levels along the road which have been reported in Table 8-1. Other locations of local ponding in the vicinity of these entrances are less than 0.1 m in depth and therefore have been disregarded, as depths of this magnitude are generally a result of local stormwater runoff rather than overland flow flooding. It is expected that all runoff generated within the site will be captured and conveyed via the development's internal drainage system, which has not yet been designed at this stage and therefore has not been included in the model.	Section 9	Accepted as normal practice.
	EHG-1.4	For Location 7, the basement car park driveway crest (or berm arrangement) should have freeboard to the 1% AEP flood. This has been provided and should be maintained. The driveway crest level shown on the civil drawings does not appear to align with the level in Table 8-1, nor the architectural drawing. These levels should be checked.	The driveway crest level in Table 8-1 has been updated to align with the level of 84.47 mAHD shown on the civil drawings.	Section 9	
	EHG-1.4	Similarly, the entry to the basement car park driveway crest (or berm arrangement) at Location 16 needs a minimum of 300mm freeboard to the 1% AEP flood level, which appears not to have been provided. At location 16, the flood level in Martins Lane may be relevant as well. The driveway crest level shown on the civil drawings (79.93) does not appear to align with the level in Table 8-1 (79.88), nor the architectural drawing (~79.78). These levels should be checked.	The driveway crest level in Table 8-1 has been updated to align with the level of 79.95 mAHD shown on the civil drawings. This level exceeds the PMF level of 79.77 mAHD which had been adopted as the flood planning level.	Section 9	

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
	EHG-1.4	Location 14 is apparently protected using a berm. However, the flood mapping shows PMF extents directly adjacent to the building. The protection of this entry should be clarified and detailed.	The access at Location 14 is towards the south of the building which is free from flooding, rather than the western side where water is shown adjacent to the building – refer architectural drawing DA200. The ground level at this location, in front of the entrance, is 79.94 mAHD, which is the level reported as the ‘berm level’.	Section 9	Landscaping along the western side of this entrance directs flow further downstream (south), past the entrance.
	EHG-1.4	Per previous advice, relevant entry points include any points where floodwater could enter the building including balcony doors, windows, and vents, not only pedestrian or vehicular entries.	The pedestrian and vehicular entrances are considered the most at risk, as these are typically located flush with the adjacent ground level. Given the low water depths experienced across the site, it is unlikely that floodwater would rise enough to enter the buildings through windows or balcony doors. In addition, as shown in the mapping with cutoff depths of 0.1 m, there are limited locations where water ponds to a depth greater than 0.1 m adjacent to a building. This local ponding is expected to be captured and conveyed via the development’s internal drainage system, which has not yet been designed at this stage and therefore has not been included in the model. A note has been added to the current report recommending that, during the detailed design stage, all vents be located above the PMF levels.	Section 9	Accept this statement that there are no windows or other fenestrations that may offer water ingress aside from the entrances mentioned in Section 9.
EHG	EHG-1.10	The Stantec letter states “Swale along northern boundary has been removed.” However, the flood mapping clearly shows ponding adjacent to the northern side of the buildings and a series of pipes connecting these ponding areas. The swale remains and has been shown on the civil drawings with drainage pit numbers E1 to E6 along its length. Therefore, this appears to have been co-ordinated and be resolved.	The courtyard areas along the northern boundary are a trapped low point, with East West Road being located higher than the courtyard and building FFLs. As such, an emergency overland flow path must be maintained which directs water away from the building in case of flooding. A pit and pipe system has been proposed (pits E1 to E6) to capture any surface flows within the courtyards and 2 x DN300 pipes are proposed under the raised main entrances into the buildings (at Locations 1, 2 and 3) to ensure flows can be directed to the west, away from the buildings, in case of pit and pipe network blockage.	N/A	
	EHG-1.11	The response states that “Safe access and egress with a flood hazard classification of H1 has been provided up to the PMF event.” However, category H5 flooding is present in the PMF across the entire roadway in parts and may prevent access to the driveways and car parks. Based on the mapping provided, EHG does not agree with the assertion in the Flood Emergency Response Plan that the category H5 flooding is only in the kerb and gutter.	As discussed in the response to EHG-1.2 above, vehicle access via Martins Lane would still be possible in the PMF as the flood depths, velocities and depth-velocity product along the road meet the safety criteria for small passenger vehicles and larger. In addition, the duration of flooding with hazard H3 or greater along this road is not expected to last longer than 30 minutes for the critical storm durations at the road. Therefore, in the unlikely event that access is deemed unsafe, the temporary loss of access via Martins Lane would be limited to a very short period. Should	Section 6	

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
			horizontal evacuation be required during this period, it is still achievable at all times via the northern boundary of the site as outlined in Section 4.3 of the FERP. Internal evacuation can be achieved on foot towards East West Road, where it can continue north on foot or vehicle via Martins Lane or North South Road to Pennant Hills Road.		
	EHG-1.11	The Flood Emergency Response Plan presents conflicting information on flooding behaviour in Martins Lane, stating on page 14 that “The flood depth for the critical storm duration does not exceed 0.06m” (in the PMF), which conflicts with the statement on page 9 “In the 1% AEP event, flood levels in East West Road are expected to be about 70mm above gutter invert, while levels in Martins Lane are about 80mm above the gutter invert.” The Flood Impact Assessment refers to depths of up to 0.3m in the PMF.	Wording in both the FIA and FERP reports has been updated to ensure consistency.	FIA and FERP	
	EHG-1.11	Only the northern buildings B, C and D appear to have direct access, with Buildings A and E having access through the aforementioned. The two car parks, and particular Building F, would not appear to have access. Importantly, the ambulance drop off / pick up is via Martins Lane. Any staff with cars parked in the car park would be unable to leave or finish their shift and similarly new staff would be unable to relieve them. Any visitors to the site with cars parked in the car park would be unable to leave the site.	All buildings have direct pedestrian access to areas with no flooding or flood hazard H1 in the PMF. As such, should it be required, horizontal evacuation can be achieved on foot internally. Refer to responses to EHG-1.2 and EHG-1.11 above for discussion on access via Martins Lane.	Section 6	
		It is recommended that the mapping cut off depths be reviewed per the first item. Additionally, a technical solution may be possible to reduce the hazardous flooding on Martins Lane e.g., a flood mitigation measure.	Mapping cutoff depths have been revised. As discussed in the responses above, the high hazard in Martins Lane has been considered acceptable and therefore flood mitigation measures to reduce this hazard have not been investigated in detail.	N/A	
		All references to Flood Warnings issued by the Bureau of Meteorology should be deleted from the FERP. There is no available service from the Bureau of Meteorology that provides flood warnings for this location. The FERP should not include general information that is not relevant for the future users of the site. This sentence may create an expectation that a flood warning for the site would be available from BoM. Instead, it should be noted that the site is in a flash flood catchment, and it is possible that flooding occurs without any form of notification or warning.	FERP has been updated as requested.	FERP	
EHG	N/A – Email RFI	An assessment of the proposed development relative to the flood-related components of Parramatta’s LEP (5.21 and 7.11) and DCP – The entrances and floor levels have been compared with the flood levels as required by the DCP but compliance with the whole suite of flood-related controls should be demonstrated in order to fully assess the proposed development’s compliance.	Assessment against Parramatta’s LEP and DCP has been undertaken and included in the current report.	Section 10	The table documents the proposed development’s compliance with Council-endorsed planning instruments.
EHG	N/A – Email RFI	The proposed ground surface (in asc or tif format). We understand this was submitted by the Applicant but was not listed as a downloadable component on the project’s website. Please provide to enable a better assessment of how the entrances are protected.	Provided as part of report submission.	N/A	
EHG	N/A – Email RFI	More detail on how the swale/flowpath north of Building F will work or be maintained so that protection is ensured in the long term.	No formalized swale is proposed to the north of Building F. The flow path modelled in the flood model is essentially a depression in the surface to the north of Building F travelling west and represents an emergency overland flow path that will exist within the podium on top of an internal drainage system that shall be installed to capture 1 in 100 year flows. The details of the internal drainage system are not available at this stage as this is typically done as part of detailed design. As the internal drainage has not been included in the flood model (only external	N/A	The modelling of a full blockage scenario provides confidence that the proposed topographic (landscaping) changes to the site will allow for a drainage process that will result in low hazards surrounding entrances and throughout the highly trafficked areas of the site. The architectural and civil drawings confirm that no major swale is proposed.

Agency	Agency Reference	Comment from Agency	WMS Response	Section Reference	GRC Comment
			drainage has been included), the results presented in the current report are considered the worst-case scenario.		
SES	SES-1	Recommend that the Flood Emergency Response Plan (FERP) include more information regarding evacuation arrangements for higher risk areas on site, such as the Dementia Garden and drop off area which are located at lower RLs than most of the site, as well as the proposed route(s) for the evacuation of Building F as mentioned in the FERP.	These details are not yet available at this stage, and will be included in the FERP during detailed design once a site specific evacuation management plan has been developed.	N/A	Accept that this will be undertaken during the detailed design phase.
SES	SES-2	Note that building / basement entrances are proposed to be designed above the PMF storm event.	Noted.	N/A	Table 9-1 confirms that the entrances have been proposed above the PMF level.
SES	SES-3	Recommend ensuring that all openings to the carpark (vents, etc) are also located above the PMF level.	A note has been added to the current report recommending that, during the detailed design stage, all vents be located above the PMF levels.	Section 11	Accept that this will be undertaken during the detailed design phase.
SES	SES-4	Recommend investigating if alternate access points through the site to Building F for emergency services may be feasible, noting that the only current access road to Building F is Martins Lane which becomes impacted by H5 hazard flooding in a Probable Maximum Flood (PMF) event.	Refer to responses to EHG-1.2 and EHG-1.11 above.	N/A	Accept that the SES has since confirmed that the hazards on Martins Lane have been deemed as acceptable given the depth of flooding and the ~30 minute or less duration of hazard H3 or higher.
Request for Information from 8th March 2024 Agency					
DPHI	DPHI-8	Provide further information on the justification for the berm protection values in Table 8-1 of Attachment B – Revised Flood Impact Assessment.	Table 8-1 has been updated to include a column with Berm Level source.	Section 9	Now confirmed with updated civil and architectural drawings.
DPHI	DPHI-9	Update the modelling to clearly show how the site will perform in a full stormwater blockage scenario given the sensitive and vulnerable nature of the Residential Aged Care/Independent Living Unit users.	A full stormwater blockage sensitivity test has been performed and the results have been provided in this report.	Section 8 Appendix C	The full blockage scenario gives further confidence that the proposed design is compliant with the flood affectation of the site.
DPHI	DPHI-10	Update the Flood Emergency Response Plan (FERP) in line with the SES advice of 5 March 2024.	FERP has been updated as outlined below.	FERP	Accepted as updated.
SES	SES-1	Request removal of the any statements in the FEMP that “vehicles can safely traverse floodwaters” at lower flooding levels.	Both the FIA and FERP reports have been updated as requested.	FIA and FERP	
SES	SES-2	Request that references to ‘Evacuation Warnings’ and ‘Evacuation Orders’ are replaced. The Australian Warning System uses three categories of hazard warnings: Advice, Watch and Act, and Emergency Warning. These categories replace the previous terminology.	The FERP has been updated to include the three categories of hazard warning instead of ‘Evacuation Warnings’ and ‘Evacuation Orders’.	Section 3.3 of the FERP	
SES	SES-3	Recommend ensuring measures to prevent cars exiting basement parking into flood waters on Martins Lane are included in the FEMP.	The FERP has been updated to include a section on required signage for the basement parking to prevent cars from driving into Martins Lane when flooded.	Section 4.6 of the FERP	

Summary

GRC's review of the provided flood-related studies indicates that:

1. The modelling methodology is sound and the results appear reliable for the purposes of assessing the proposed development's flood affectation.
2. The site is primarily subject to shallow sheet flow and the proposed development has managed this flow via surface and stormwater drainage.
3. The Applicant, via WMS, has responded to the requests made to them from EHG, DPE/DPHI and the SES and has made changes where requested.
4. The proposed development is compliant with the relevant planning instruments for this LGA, this proposed land use and the flood risk at this location. The flood compatibility of the proposed development is the only outstanding item not confirmed in these reports and GRC understands this will be confirmed elsewhere by a structural engineer.
5. The site does not adversely impact properties surrounding the site.

GRC is of the view that the proposed development is compatible with the flood affectation at the site and the safety of residents, staff and occupants will be managed effectively both by design and through the flood emergency response measures outlined in the FERP.