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Your Reference
LAHC 2020/642
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Response to Submissions: Water Quality & Stormwater Addendum

26th September 2023

For the attention of: Susan Oktay

Dear Susan,

The Riverwood Estate Planning Proposal was placed on public exhibition between 12 August and 25 September 2022.

The project has been affected by recent market changes primarily because of significant increases in construction costs impacting on the overall viability of the project.

LAHC has implemented a revised strategy that will now focus on the delivery of an exemplar first stage of the project which will deliver approximately 420 new dwellings with less impact on existing local infrastructure. This will enable the wider masterplan to be considered in the future to ensure it meets the aspirations of the local community and allow identified local infrastructure to be delivered in tandem.

Rezoning of an exemplar first stage will build on the previous renewal work at Washington Park noting that the land and proposed redevelopment in this stage mirrors the 2022 exhibited planning proposal. As the proposed first stage sits within the exhibited proposal, this means the land needed for future infrastructure such as road widening will be unaffected. The subject site is shown below in **Error! Reference source not found.** below:

Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (OEH/EPA, 2017);

- Water quality and the extent to which the proposed development protects, maintains or restores water health and the community’s environmental values and use of waterways;
- Provide WSUD options for the proposal;
- Demonstrate that it has been undertaken in consultation with Canterbury Bankstown City Council and Georges River Council;
- Identify flooding behaviour for existing and developed scenarios in order to outline the suitability of the land for proposed uses;
- Identify flooding characteristics i.e. flow, levels, extent, velocity, rate of rise, hydraulic and hazard categories, and the flood constraints of the land for the full range of flooding up to the probable maximum flood (PMF), for both mainstream and overland flow path;
- Address the impact of flooding on future proposed development, including flood risk to people and properties for key flood events including the 1% AEP and the PMF. The assessment should address relevant provisions of the NSW Floodplain Development Manual (2005);
- Provide preliminary assessment on recommended flood management measures, including mitigation works and development controls;
- Undertake sensitivity analysis to address the impact of climate change due to increase of rainfall intensity;
- Ensure development in the floodplain is consistent with the NSW Flood Prone Land Policy and Principles of the NSW Floodplain Development Manual;
- Maintain the flood function of the floodplain to minimise impact of the development on flood behaviour and adverse impacts to existing communities;
- Ensure development is compatible with the flood constraints of the land; and
- Ensure safe evacuation from the land and no adverse impacts of development on the safety of existing communities in emergency response and existing evacuation requirements.

1. Overland Flooding

Several trapped low points were identified within the Study Area during the site visit. During large storm events, stormwater will pond at these low points and in some locations, this ponding results in flows “spilling” over these ponds and through properties. In these locations, future developers of the lots may wish to upgrade the proposed drainage network within the site to provide for overland flow. There are also opportunities to remove existing trapped low points through road grading. A map highlighting areas with trapped low points is shown in **Error! Reference source not found.** below.

This review of overland flow paths and trapped low points was consolidated with an overland flow study conducted by Council. The results of this study confirmed the observations made on site. The overland flooding for the 100-year and PMF storm events are shown in the figures below. It should be noted that overland flow is separate from mainstream flooding.

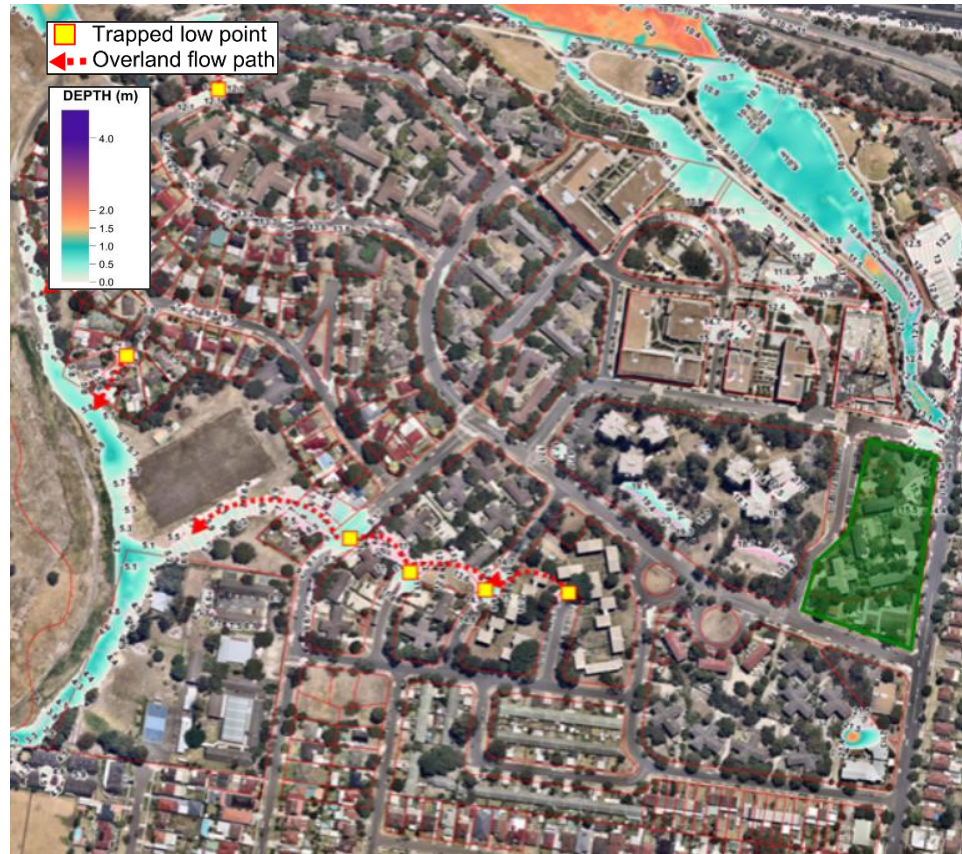


Figure 2 Overland Flow Depths - 100 -Year Event

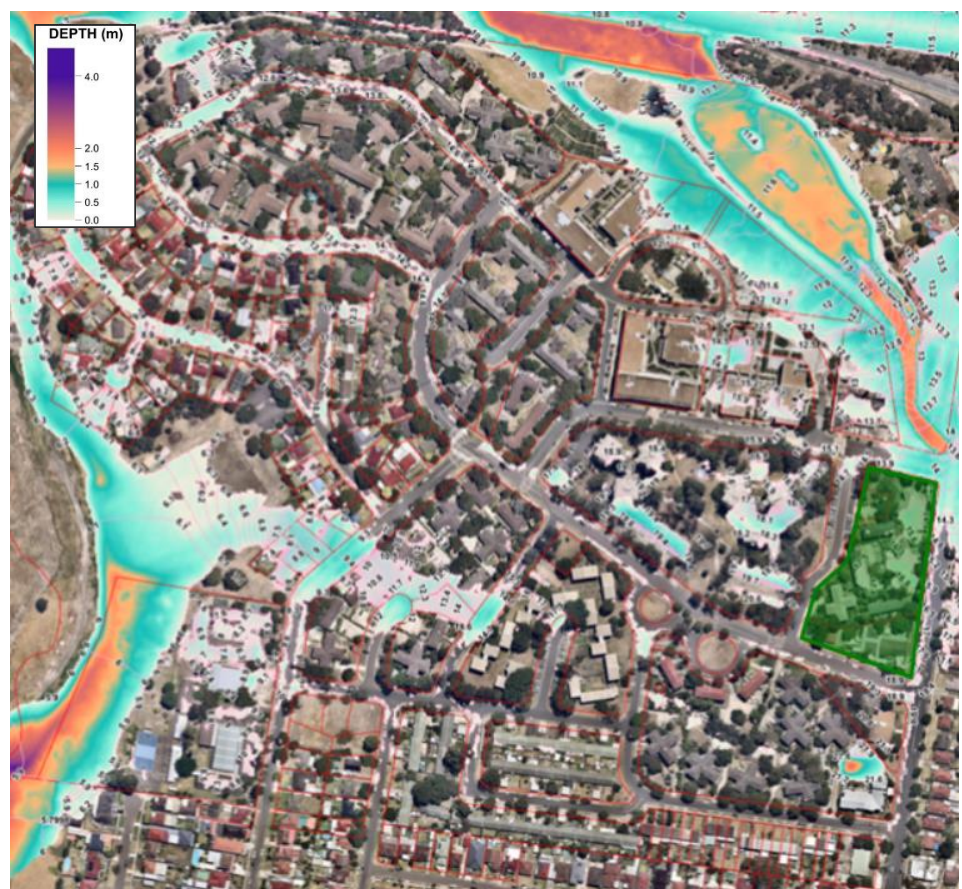


Figure 3 Overland Flow Depths - PMF Events

Planning Considerations

There are two options available with regard to management of trapped low points across the site:

- Option 1 - Preserve the trapped low points. A trunk drainage pipe and overland flow easement would be required in this case; or
- Option 2- Mitigate the trapped low points by constructing a road or green corridor in place and regrading the lots.

As the existing street network is largely being redesigned, there is an opportunity to correct the trapped low points and overland flow paths on the site. Grading works could be undertaken to ensure that new roads drain to the street network.

2. Stormwater Management

A large portion of Sydney's suburban areas are now undergoing redevelopment as a result of Sydney's growing population, particularly in areas around major centres and transport nodes. Within these areas considerable changes in development typology are being observed with low density housing being intensified to incorporate higher density land uses. These medium and high density developments can lead to more intensive site usage and less efficient stormwater drainage systems. Without compensatory measures, the cumulative impacts of the increased stormwater runoff and loss of flood storage across development sites would increase the flooding risk to downstream properties.

In order to manage the intensified land uses, On-Site Detention (OSD) must be provided for all new developments. OSD is the temporary storage of stormwater, traditionally within a development footprint, to ensure that peak runoff from a development site does not incur adverse impacts to downstream properties.

Canterbury Bankstown Council requires all multi dwelling housing and residential flat building developments to provide OSD regardless of the impervious area before and after the development, and regardless of whether the site falls toward or away from the street. A minimum of 75 percent of the site area must drain to the detention basin. The OSD must be designed to ensure stormwater flows do not exceed a permissible site discharge (PSD) of 150 L/s per hectare.

Mott MacDonald has undertaken a high-level assessment of the existing drainage network and flood affected areas in response to the Study Requirements issued by the Department of Planning, Industry and Environment in December 2020.

Stormwater Modelling

Refer to the Water Quality and Stormwater Report for the methodology of the DRAINS modelling parameters, assumptions and input data.

The piped flows modelled in DRAINS for the Riverwood Renewal project have been designed to convey the minor storm event with safe overland flows for the major storm event. If the major system cannot meet the safety and flooding criteria, then the capacity of the minor system has been increased. It should be noted that only trunk stormwater pipes (assumed 600mm diameter and greater) have been included in the model. The proposed model is shown in the Figure below.

As detailed within the Water Quality and Stormwater report iterations were performed in the DRAINS model to determine the size of the proposed piped network required to meet Council's requirements. The proposed drainage system has largely been designed to cater for the 1 in 10-year ARI event leading to the outlet to the downstream drainage network. A provision for overland flows for events greater than the 1 in 10-year ARI event has also been considered.

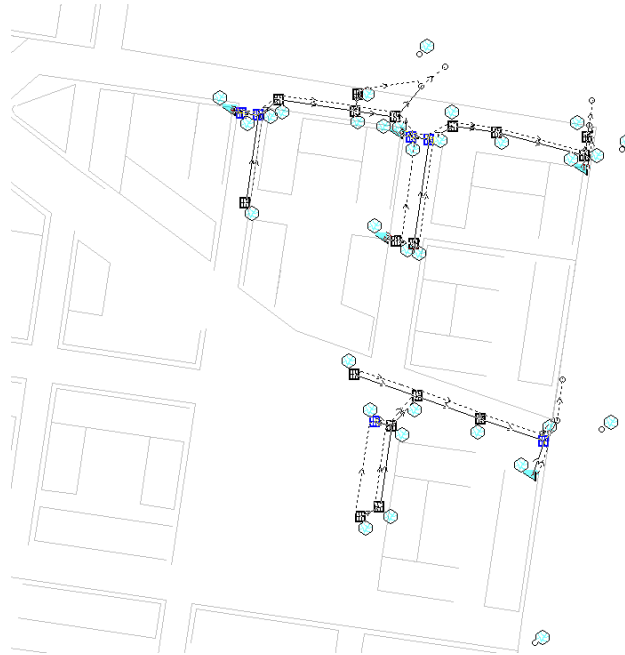


Figure 4 Proposed DRAINS Model - Eastern Catchment

The eastern catchment will be treated via lot based OSD, before discharging to the existing downstream pit and network in Belmore Road. Details of the required OSD for the eastern catchment are tabulated below.

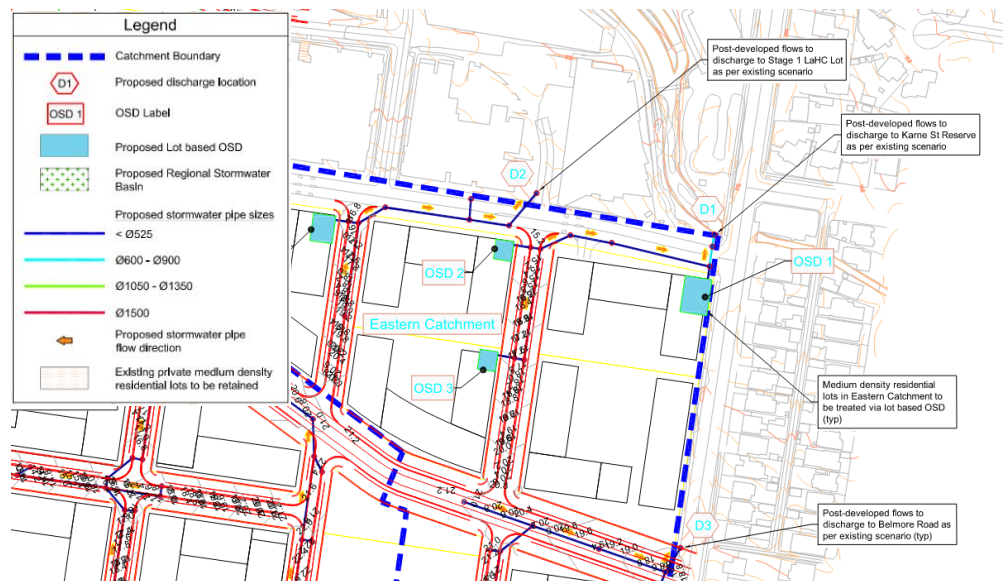


Figure 5 Proposed OSD Strategy

The eastern catchment will be treated via lot based OSD, before discharging to the existing downstream pit and network in Belmore Road. Details of the required OSD for the adjusted area are tabulated below.

Table 1: Lot Based OSD Summary

Basin	Contributing Catchment (Ha)	PSD (L/s)	Volume (m ³)	Invert Level (m)	10-year TWL (m)
1	1.3031	195	402	11.94	13.28

To further consolidate the above results, post-development peak discharges were compared to pre-development peak discharges for each catchment. As shown in the Table below, the proposed detention strategy ensures that there is no increase in the peak stormwater runoff as a result of the development in both the 10-year and 100-year ARI events.

Table 2: Pre-Post Discharge Comparison

Catchment	Discharge Location	10-year ARI		100-year ARI	
		Pre-Developed Peak Discharge (m ³ /s)	Post-Developed Peak Discharge (m ³ /s)	Pre-Developed Peak Discharge (m ³ /s)	Post-Developed Peak Discharge (m ³ /s)
Eastern	1	1.13	0.502	1.65	1.30
	2	0.585	0.207	0.842	0.225
	3	0.776	0.489	1.12	1.09

3. Water Quality Management

The Riverwood Renewal Project is situated within the Saltpan Creek Catchment and similarly with many other urbanised areas in Sydney, the Study Area at times can result in poor water quality from roads and open spaces, particularly after heavy rain. This untreated runoff in the localised catchment also contributes to the overall water quality in Saltpan Creek. As part of the master plan, Water Sensitive Urban Design (WSUD) procedures have been incorporated to improve water quality in local waterways.

There are two different considerations for the WSUD design:

1. Discharge from the future development lots to the proposed road (dedicated to council); and
2. Discharge from the public stormwater network towards Salt Pan Creek / the Riverwood Channel.

Item 1 requires compliance with council's DCP water quality targets and requirements as they will ultimately be the owners and operators of the public road network.

Item 2 requires adherence to the *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* which is a principles-based approach across the entire catchment.

Water Quality Modelling

Modelling of the master plan was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software. The software was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

To assess the proposed site, rainfall pluviograph data was taken from nearby Sydney Airport in accordance with general engineering practice. The water quantity catchments shown in Section **Error! Reference source not found.** were modified for the MUSIC model, as only the proposed development footprint is required for this analysis. The dwellings to the south of the Study Area boundary were therefore removed, reducing the total assessment area from 32.4 ha to 30.8 ha. Each catchment was split into the following land use types:

- Medium density residential;
- Medium and high density residential;

Table 3: MUSIC Catchment Breakdown

Catchment	Medium Density Residential (Ha)	Medium/High Density Residential (Ha)	Road Reserve (Ha)	Open Space (Ha)	Total (Ha)
M7	3.790	0.497	2.117	0.478	6.882
Total	14.296	3.474	8.354	4.724	30.849

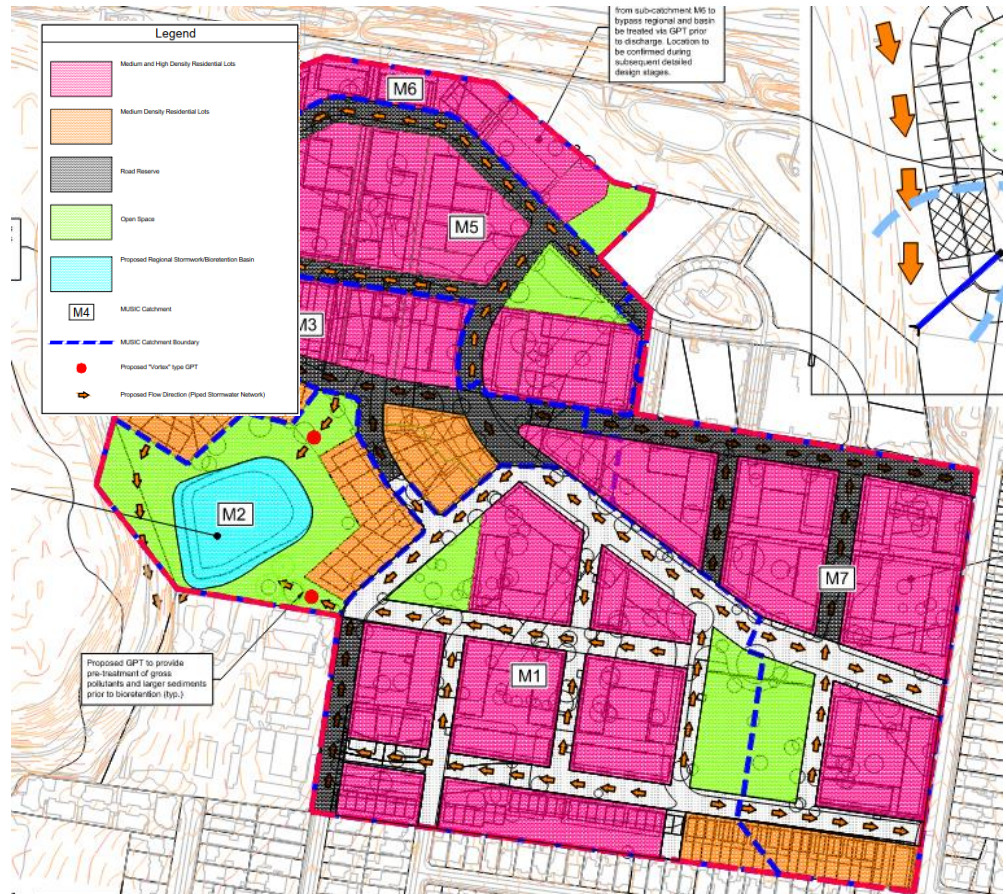


Figure 6 MUSIC Catchment Plan & Proposed Treatment Train

Water Quality Treatment Train

Post-developed flows from sub-catchment M7 are to be treated via lot based measures with the type, size and location of treatment devices to be confirmed during the subsequent detailed design stages.

The summary of infrastructure service items outlined in the main Riverwood Estate State Significant Precinct Water Quality and Stormwater Report and summarised for the revised project extent, are valid for the new extent and adequately address the SEARS requirements and respond appropriately to the relevant submissions.

4. Mainstream Flooding

As part of the investigation into the feasibility of development across the Study Area, an assessment of flood water impacting the site and potential impacts of development on flooding was undertaken.

The Study Area is located between Salt Pan Creek and the Bell Street Branch which both experience flooding during the 100-year and PMF flooding events. Flood models were obtained from Canterbury Bankstown Council, and the following commentary is provided on the impacts of flood waters on the Riverwood Renewal project.

In the 100-year ARI flood event, floodwaters extend towards the site between Salt Pan Creek Reserve and Riverwood Public School. The flood affected area is generally contained outside any developable area and does not pose any risk or impact to potential development. In the PMF event, the flood affected area extends around the eastern side of the old waste management facility site as shown in Figure 7 100-Year Flood Extents below.

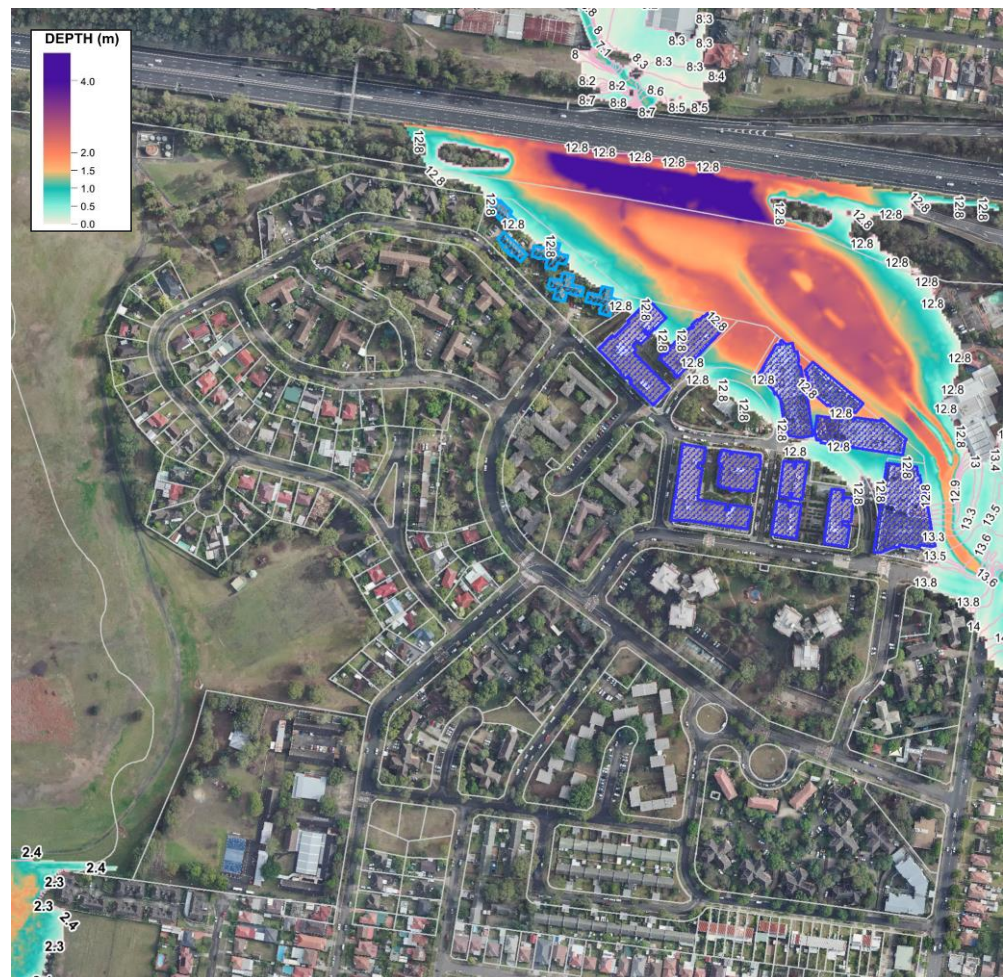


Figure 7 100-Year Flood Extents

The existing PMF flood extends further into the site adjacent to Kentucky Road, again this ponding is controlled by the M5 drainage. Safe refuge from flood waters will need to be provided in these areas. This would be achieved by either moving to a higher level within the building or evacuating further south into the site. The constraints of flood storage and flood worsening generally do not apply in this situation as it is a risk management exercise. The PMF flood level is approximately RL 14.1 m

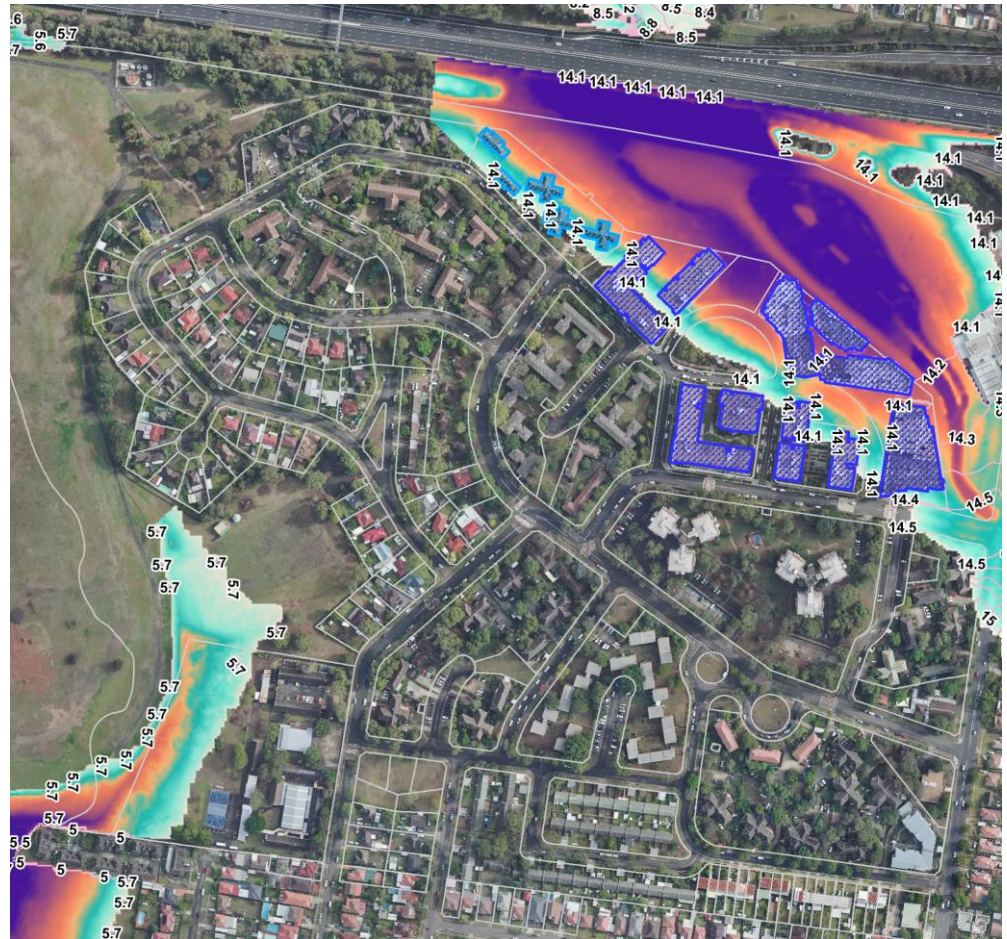


Figure 8 PMF Flood Extents

The results of the assessment identified within the Water Quality and Stormwater Report indicate that no flood worsening should be expected in the 100-year event as the proposed buildings are located outside the flooded area. As the building footprints in the existing scenario lie within the floodplain, there is an overall improvement to the mainstream flooding in this case.

Site specific flood evacuation management strategies will be provided for each building at the DA stage, however they will generally be in accordance with the broad strategy shown below. Emergency management plans should be referred to SES for comment and approval as part of any development application. Developments may be safe for “shelter-in-place” strategies subject to the scale, form and orientation of the buildings, hazard exposure and availability of logical clear escape routes. This would be determined on a case-by-case basis through the development approval framework.

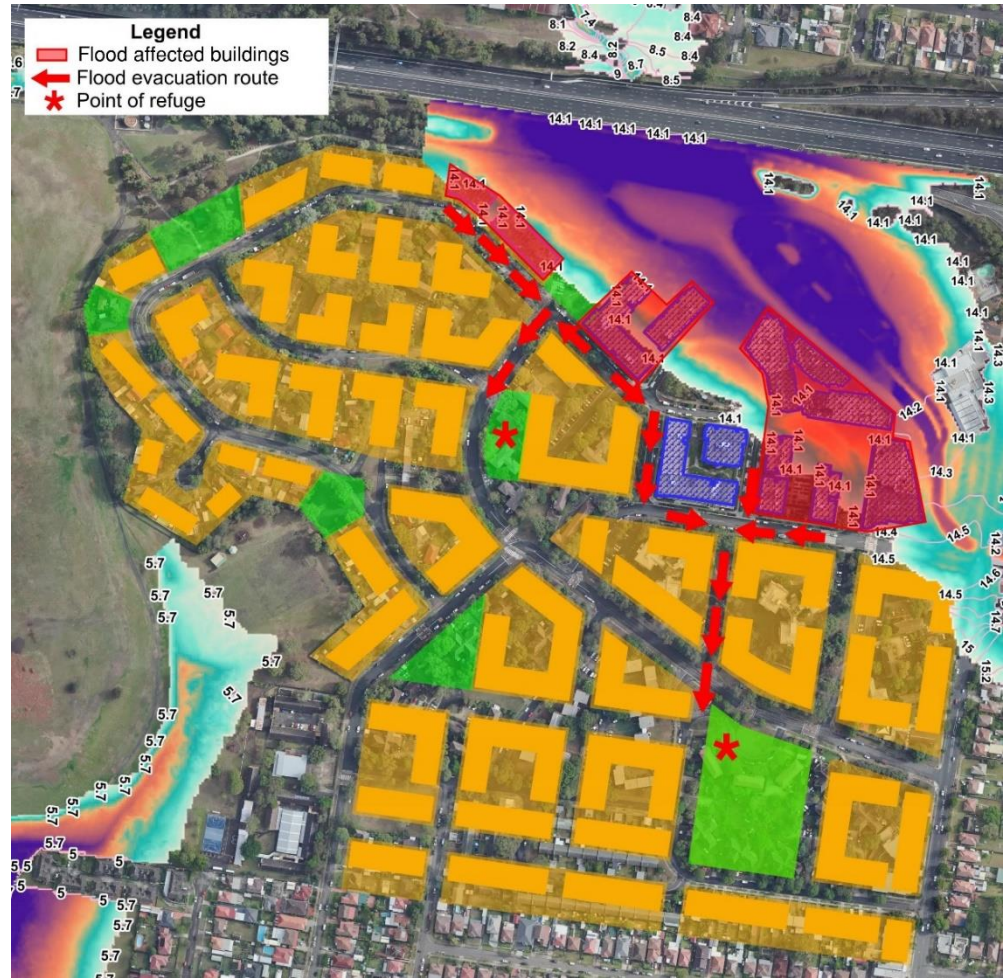


Figure 9 Flood Evacuation Map

The above analysis considers the proposed development with consideration to the master plan and the potential impacts on development opportunity and ensures that there is no increase in flood affectation on downstream dwellings or infrastructure.

5. Response to Submissions

As part of the Riverwood Estate State Significant Precinct (SSP), The Department of Planning and Environment (DPE) has received a number of Council comments regarding the long-term renewal and redevelopment of the Riverwood Housing Estate as proposed by Land and Housing Corporation (LAHC).

These have been responded to below with a specific focus on the revised rezoning extent:

LAHC provide indicative feasibility comparison for on-site versus regional detention systems, and indicative annual maintenance costs of the proposed wetland in Kentucky Road Reserve, and demonstrate how individual sites will be capable of meeting stormwater management requirements.

It is noted that the revised rezoning extent sits completely in an area planned to be serviced via on-lot OSD. It would not be viable to utilise the wetland for this portion of the catchment. As such the individual site is capable of meeting its stormwater management requirements without the use of the reserve.

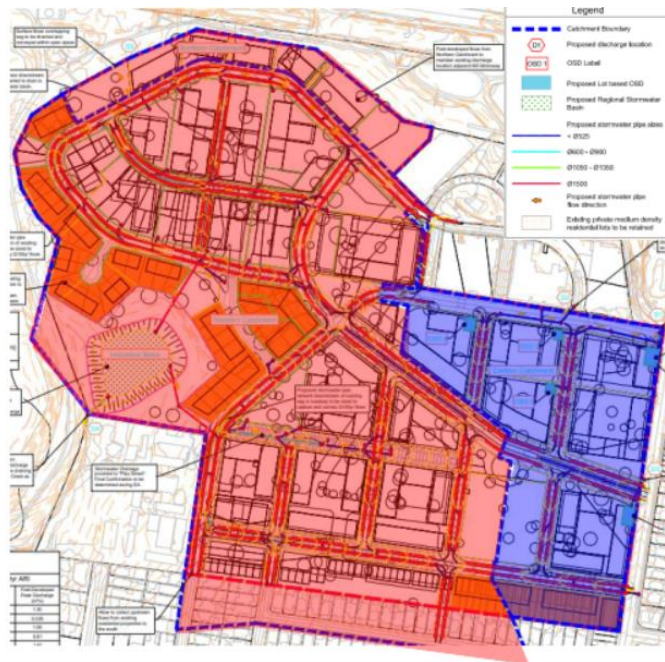


Figure 10 - OSD Only Catchment (Blue)

Detention basins are generally provided on the proponent’s land and dedicated to Council at the conclusion of the development. The realisation of the SPCM is a long term prospect that is likely to go beyond the timeframe of the Riverwood SSP redevelopment, as a result the provision of the wetland ahead of the playing fields identified in the SPCM will also result in a maintenance burden to Council without the benefit of using the wetland to assist in servicing the future playing fields.

Please see the response to item 1, no detention basins are proposed for the revised site area as it will require solely on on-lot onsite detention to meet its stormwater requirements.

A residential flat building in an infill scenario typically requires onsite detention system to manage stormwater run-off. LAHC should provide indicative figures of the cost of providing onsite stormwater management versus a regional detention basin for the purposes of determining any offsets. This is necessary for Council to determine whether monetary contributions or works in kind for this aspect of the project should be included in any planning agreement

Consider strengthening proposed DCP controls for smaller-scale water sensitive urban design measures in new development.

Please see the response to item 1, no detention basins are proposed for the revised site area as it will require solely on on-lot onsite detention to meet its stormwater requirements, a regional basin would not be suitable for the revised rezoning extent.

Controls for water quality to align with broader Council requirement for the area, have been included within the DCP requirements. The flexibility of lot-based controls is to be maintained so as to not preclude the use of proprietary/generic devices by individual developments, i.e.. the use of interventions such as porous paving, swales or raingardens should be encouraged but not mandatory.

As the Water Sensitive Urban Design (WSUD) measures for each lot would be highly dependent on the building form, basement design and landscaping, the

specific details of any on-lot treatment would form part of future building Development Application's for each building lot.

An accurate cost of on-lot treatment would only be able to be achieved as a part of the building design for each lot which would occur as part of Development Application. The developer of the lot would be responsible for the design and implementation of the stormwater and detention solution for that lot.

The proponent states that the "evacuation procedure will be managed through building management with appropriate warning systems". EHG recommends any evacuation, shelter-in-place, and site-specific emergency management plans to mitigate potential risks to residents, visitors, and workers of the proposed developments under major and extreme flooding events should be referred to the NSW State Emergency Service (SES) and Canterbury-Bankstown Council for comment prior to its adoption.

Development strategies relying on deliberate isolation or sheltering in buildings surrounded by flood water are not equivalent, in risk management terms, to evacuation. 'Shelter in place' strategy is not an endorsed flood management strategy by the NSW SES for future development.

We agree that emergency management plans should be referred to SES for comment and approval as part of any development application. Developments may be safe for "shelter-in-place" strategies subject to the scale, form and orientation of the buildings, hazard exposure and availability of logical clear escape routes. This would be determined on a case-by-case basis through the development approval framework.

LAHC to update the relevant reports noted above The NSW Floodplain Development Manual 2005 has been replaced by the NSW Flood Risk Management Manual 2022, and therefore the Water Quality and Storm Water Reports should be updated accordingly

The approach to flooding assessment completed to the NSW Floodplain Development Manual (2005) and associated Practical Consideration of Climate Change (2007) supplementary guidance documented in the existing reports remains valid.

The Flood Risk Management Manual Package (2022) provides additional and updated information that should be used in developing controls and potential development plans for the precinct. In particular, further guidance on climate change approaches and the derivation of flood planning levels should be incorporated into future assessments, however the updated guidance is not considered to significantly alter the fundamental approach to development documented in the existing reports.

Of note is the climate sensitivities in the original assessments which are equivalent to the updated uplift factors recommended in recent versions of ARR and data provided through the ARR datahub. As the original reports meet the requirements of the NSW Flood Risk Management Manual 2022 no update is proposed to the existing flood studies.



Yours sincerely,
For and on behalf of
Mott MacDonald Australia Pty Ltd

A handwritten signature in blue ink, appearing to read 'dfettell', written in a cursive style.

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Pronouns: he, him, his

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