Horsley Creek Floodplain Risk Management Study and Plan

Initial Assessment of Flood Management Options

Overall Floodplain Management Process

Floods are part of the Australian landscape. They occur in many parts of Australia, and their severity and causative mechanisms may vary widely between locations.

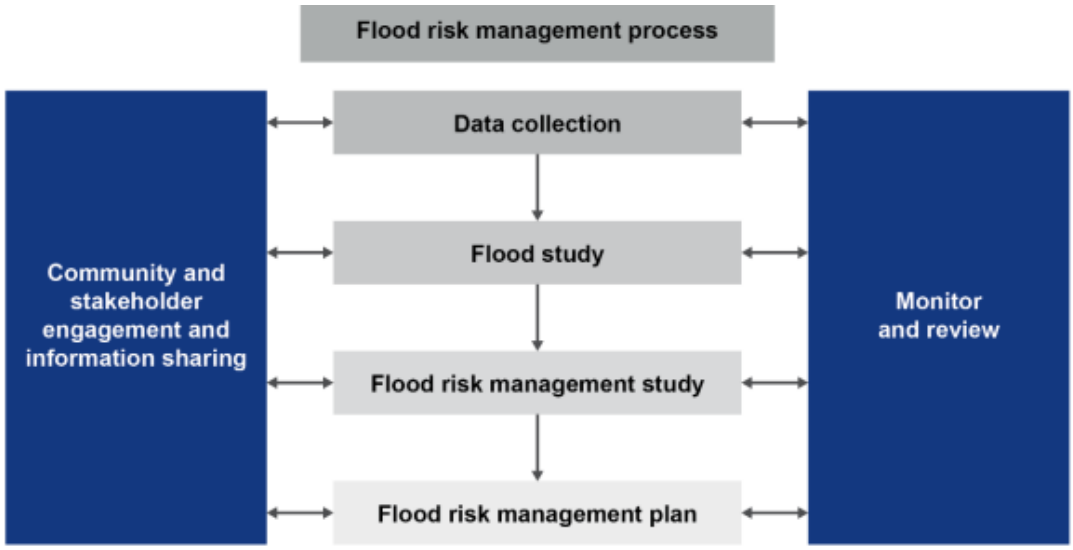
The impacts of flooding include human fatalities and injuries, economic damage, environmental damage, and disruption of individuals' lives and the function of communities.

Studies such as the *Horsley Creek Floodplain Risk Management Study and Plan* are undertaken to help local government make informed decisions about managing flood risk by using detailed flood models to quantify flood characteristics and investigating options to manage and alleviate flood risk including potential property, flood and response modification measures.

The NSW Government's Flood Prone Land Policy is directed towards providing solutions to existing flooding problems in developed areas and ensuring that new development is compatible with the existing flood hazard and does not create additional flooding problems in other areas.

Under the Policy, the management of flood liable land remains the responsibility of local government. The State Government provides financial and technical assistance to local government through its Floodplain Management Program which is administered by the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW).

The NSW Floodplain Risk Management Process consists of a number of stages as defined in the Flood Risk Management Manual and reproduced in the figure below. The process is cyclical, and reviews may be triggered by various instances; for example, the occurrence of significant flood events which provide additional data on flood behaviour, or the occurrence of significant changes to the catchment condition over time.



NSW Flood Risk Management Process (Figure 2, Manual)

Where are we up to?

As part of the Horsley Creek Floodplain Risk Management Study an existing flood model has been updated to reflect contemporary catchment conditions. Several changes in landform have occurred in the catchment since a flood model was last developed, including the construction of the Albion Park Rail Bypass and the associated flood detention basins on the south side of the freeway.

The updated flood model has been calibrated against the March 2011 flood event and validated against the March 2014 and April 2024 weather events.

The flood model has been used to simulate a range of design flood events, such as the 1 in 100 year flood, according to the guidance provided in *Australian Rainfall and Runoff: A Guide to Flood Estimation 2019 (ARR2019)*.

The 1 in 100 year flood is referred to as the 1% Annual Exceedance Probability (AEP) flood, which reflects the fact that there is a 1% chance that such a large flood could occur in any given year. Flood depth mapping for the 1% AEP flood is provided in **Figures 1 to 4**.

For each design event, the predicted flood levels are compared against property floor levels to determine the level of flood affectation at each property. The depth of flooding above property levels is subsequently used to estimate the overall flood damage cost for each design event, to quantify the impact of flooding in economic terms. It is estimated that a 1 in 100 year flood would cause approximately $8.7 million of damage, affecting 528 properties, with 64 of those experiencing above floor flooding.

Annual Average Damage (AAD) is a measure of the flood damages that could be expected to be borne by the community each year, on average. This is calculated from the estimated flood damages and the likelihood of each design event, ranging from the 20% AEP event (1 in 5 year) to the Probable Maximum Flood (1 in 100,000 year). For the Horsley Creek Catchment, the AAD is estimated to be about $800,000.

An initial Currently we are at the stage of investigating new flood mitigation measures to reduce the impact of flooding on the Horsley Creek community.

Assessment of Flood Mitigation Options

Several flood mitigation options were tested with the flood model to assess the potential to reduce flood levels across the floodplain. This included assessment of several variations of particular options, in order to optimise the benefit provided.

The options offering the greatest reduction in flood levels were selected for further assessment of the benefit versus the cost of works. The benefit was assessed according to the reduction in flood damages provided at downstream properties. This was compared to the cost of construction of each option to determine a Benefit-Cost Ratio for each option.

The location and layout of options are shown in attached **Figures M1 to M10**. Further information on each option is outlined in the following.

The impact of options on 1% AEP flood levels is shown in attached **Figures F1 to F6**. Not all options are shown given the impacts between some options are similar.

Tongarra Road Detention Basin (Options 1, 2A, 2B, 2C)

The intention is to reduce the rate of flow along the creek downstream of Tongarra Road and thereby reduce flood levels and flood damages.

The Option 1 detention basin would involve:

- Construction of a flood detention basin on the vacant land at the corner of Tongarra Road and Croome Road.
- Excavation to a depth of up to 3 metres over an area of 2.7 hectares.
- Installation of an outlet pipe flowing under Tongarra Road.

Initial flood modelling showed that additional works are required in combination with the proposed basin, to feed upstream runoff into the basin and reduce local street inundation.

- Option 2A – Open drainage channel along the western side of Croome Road
    - From Grevillea Street to the basin near Tongarra Road.
    - Channel base width of about 4 metres, about 1.5 metres deep.
- Option 2B – Large stormwater pipe beneath and along Croome Road:
    - 1800 mm diameter pipe to carry flows down Croome Road and into the proposed basin.
    - Several stormwater inlet pits along the kerb.
- Option 2C – Regrading of Croome Road near the intersection with Maple Street:
    - Road level to be lowered by up to 0.3 metres to direct runoff into the basin.
    - New 900mm diameter stormwater pipe to redirect Croome Road stormwater system into the proposed basin.
    - This option was also investigated for a smaller version of the Tongarra Road detention basin which has a depth of excavation of average of 1.2 metres and maximum of 2 metres (Option 2D).

Creek Vegetation Management (Option 3)

The intention is to increase flow conveyance along the creek by reducing the "roughness" of the creek, and thus reduce flood levels and flood damages at adjacent properties.

Vegetation management of the creek would involve the partial clearing of riparian areas to decrease the vegetation density and would include ongoing maintenance.

Flood Diversion Channel at Airport (Option 4)

The intention is to create a secondary channel to increase the flow capacity of the creek and divert flows away from residential properties, reducing flood levels and flood damages.

This option would involve excavation of a new channel with a base width of about 1.5 metres and depth of about 2 metres.

Voluntary House Purchase (VHP)(Option 5)

This option involves the voluntary purchase of residential properties located in high hazard areas. These are properties with a high likelihood of flooding above floor level and considered dangerous for occupants.

Two properties along Station Road have been identified for voluntary purchase.

Albion Oval Detention Basin (Options 6 & 7)

The intention is to reduce the rate of flow along the creek downstream of the Princes Highway and thereby reduce flood levels and flood damages of properties around Kaylaur Crescent/Reserve and beyond.

The Option 6 detention basin would involve:

- Construction of a smaller detention basin option at Albion Oval, including excavation to a depth of up to 2 metres over an area of 2.2 hectares.
- Installation of a basin outlet pipe discharging to the existing Princes Highway cross-drainage system.

Initial flood modelling indicated a larger basin could incorporate additional flow paths and provide additional basin volume to further reduce downstream flows and hence, flood levels.

The Option 7 detention basin would involve:

- Construction of a larger detention basin option at Albion Oval, extending further west, including excavation to a depth of up to 2 metres over an area of 2.8 hectares.
- Installation of two basin outlet pipes discharging to the existing Princes Highway cross-drainage system.

Underground Drainage Channels at Kaylaur Reserve (Option 8)

The aim is to extend the existing drainage culverts beneath the Princes Highway downstream along Kaylaur Reserve and thereby reduce overland flows through the reserve that might cause damage to properties in the area.

Option 8 would involve installation of underground box culverts along the alignment of the existing open channels to extend the Princes Highway culverts to the downstream end of the residential properties adjacent to Kaylaur Reserve. This would effectively remove the open channels.

Raising of Industrial Road at Casuarina Street (Option 9)

The objective is to create flood-free access in the 1% AEP event to the west for ambulances and other Industrial Road properties.

Option 9 would involve raising Industrial Road at the intersection with Casuarina Street by up to 1.0 metre over a distance of about 130 metres.

Pioneer Drive Basin (Option 10)

The intention is to reduce the rate of flow along the creek channel downstream of Pioneer Drive, reducing flood levels and flood damages.

The Option 10 detention basin would involve:

- Construction of a flood detention basin on Council land between Pioneer Drive and the Princess Highway
- Excavation to a depth of up to 3 metres over an area of 0.4 hectares.
- Upgrade the capacity of the existing Pioneer Drive stormwater drainage system and integrate with the basin outlet pipe.

Pioneer Drive Diversion Channel and Bunds (Option 11)

The aim is to divert floodwaters along a new channel beside the railway, reducing the impact of flooding at properties between the creek channel, Pioneer Drive and the railway.

The Option 11 diversion channel and bunds would involve:

- Construction of diversion channel along southern side of the railway between Pioneer Drive and Creek, with a channel base width of about 6 metres and a depth of about 1.5 metres. A small bridge would be required at the eastern end of the channel to maintain access to the railway.
- Construction of two bunds within the Pioneer Drive grassed road reserve to direct excess flow to the downstream creek and away from properties and the Princes Highway. The bunds would be constructed along south-eastern side of Pioneer Drive and northern side of Princes Highway to a height of about 1 metre.

Upgrade of Outlet for Existing DB4 Basin at the Albion Park Rail Bypass (Option 12)

This option will involve the construction of an outlet structure to optimise the slow release of floodwaters and thereby reduce the rate of flow to the creek downstream of the Princes Highway, thus reducing flood levels and flood damages. Council has funding to proceed with the works. Detailed design is currently underway.

Modification of Railway Culverts east of New Lake Entrance Road (Option 13)

This option would aim to remove/block the existing culverts beneath the railway to the east of New Lake Entrance Road, with the intention of reducing the rate of flows passing to the south beneath the railway and then west along the railway reserve into the downstream creek.

Summary of Flood Mitigation Options Assessment

The assessment of flood mitigation measures is summarised in the table below. The number of properties benefited by each option encompasses the properties where there is a reduction in 1% AEP flood levels, or elimination of flooding at the properties.

The indicative Benefit-Cost Ratio has been determined using an assessment of the Net Present Value (NPV) of flood damages reduction over 30 years against the NPV of the cost of the works. The BCR is indicative at this stage, given it has been calculated only considering the results of flood modelling for the 5% AEP and 1% AEP events and the Probable Maximum Flood.

The assessment has highlighted the following options that would be worthwhile for further assessment to confirm the benefit across the wider range of design floods, and subject to community feedback during this consultation:

- Option 2A/2C – Tongarra Road Detention Basin
    - Despite the relatively low BCR, these options are selected as they benefit a number of properties along Station Road, reducing 1% AEP flood levels by up to 0.21 metres.
- Option 9 – Raising of Industrial Road
    - This option provides a flood-free route in the 1% AEP flood from the Industrial Road area, including the ambulance station. The benefit cannot be assessed in terms of reduction in damages, but will reduce flood risk and allow ambulance access during a flood.
- Option 11 – Pioneer Drive Diversion Channel and Bunds.
    - This option offers the highest indicative BCR of 0.72, providing a benefit to Pioneer Drive properties, with several remaining flood-free in the 1% AEP event.

Table 1 Flood Mitigation Option Assessment Summary

Option ID	Option Description	Reduction in 1% AEP Flood Levels (m)	Number of Properties Benefited	Construction Cost	Reduction in Average Annual Damages	Indicative Benefit-Cost Ratio (based on NPV)
Western Arm of the Catchment						
1	Tongarra Rd Detention Basin	Only initial testing completed, requires additional works to feed flows into basin – refer Option 2A to 2D				
2A	Tongarra Rd Basin + Croome Rd channel	0.18	86	$10.2m	$118,000	0.13
2B	Tongarra Rd Basin + Croome Rd SW Upgrade	0.19	65	$13.6m	$157,000	0.13
2C	Tongarra Rd Basin + Croome Rd regrading	0.21	69	$9.92m	$124,000	0.15
2D	Smaller Tongarra Rd Basin + Croome Rd regrading	0.13	69	$7.82m	$84,000	0.12
3	Vegetation management along creek between Tongarra Rd and Station Rd	NA	27	Not costed, will require ongoing maintenance		
4	Diversion channel at airport	0.14	15	Very localised benefit, not costed, BCR not assessed		
5	Voluntary House Purchase (Station Road)	NA	2	$2.0m	$13,000	0.08
Central Arm of the Catchment						
6	Smaller Albion Park Oval Basin	0.22	37	$4.6m	$12,000	0.03
7	Larger Albion Park Oval Basin	0.51	40	$6.1m	$17,000	0.03
8	Large box culverts between Princes Hwy and Kaylaur Crescent (creek undergrounding)	NA	5	No benefit, not costed, BCR not assessed		

9	Road raising at Industrial Road to maintain access for ambulance station during a flood	NA	NA	$1.27m	NA	
South-Eastern Arm of the Catchment						
10	Pioneer Drive detention basin	NA	8	No significant benefit, not costed, BCR not assessed		
11	Pioneer Drive flood diversion channel and bunds	0.14	14	$1.33m	$82,000	0.72
12	Upgrade of outlet for DB4 basin	TBC	TBC	TBC	TBC	TBC
Eastern Arm of the Catchment						
13	Modification to culverts beneath the railway to the east of New Lake Entrance Road	Nil	Nil	No benefit, not costed, BCR not assessed		

Council is Seeking Community Feedback

Shellharbour City Council would like your feedback on the flood mitigation options outlined above.

Please complete the attached questionnaire.