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ITEM 6 MINNEGANG CREEK FLOOD STUDY (2019) - LAKE HEIGHTS

The Minnegang Creek Flood Study (2019) went on public exhibition from 26 August 2019 through to 23 September 2019 and has now been finalised. It is recommended Council adopt the Minnegang Creek Flood Study (2019) which will inform land use planning and planning certificates.

This catchment is located in Lake Heights and drains to Lake Illawarra. The study improves the accuracy and reliability of flood levels and flood behaviour in the Minnegang Creek Catchment.

The reports and flood models for the Minnegang Creek Flood Study (2019) will be placed on the NSW Flood data portal so that they can be publicly accessed. This will lead to a greater understanding of flood behaviour and risk and wiser decision making.

RECOMMENDATION

- 1 That the Minnegang Creek Flood Study (2019) be adopted
- 2 Persons who made submissions be thanked and advised of Council's decision

REPORT AUTHORISATIONS

Report of: Mike Dowd, Manager Infrastructure Strategy + Planning

Authorised by: Andrew Carfield, Director Infrastructure + Works

ATTACHMENTS

- 1 Minnegang Creek Flood Study 2019 Executive Summary
- 2 Community engagement report Minnegang Creek Flood Study 2019

BACKGROUND

The NSW Government's Floodplain Development Manual provides a framework to ensure the sustainable use of floodplain environments and incorporates the NSW Flood Prone Policy. Under the Policy, the management of flood liable land remains the responsibility of Local Government with State Government subsidising flood mitigation works to alleviate existing problems and providing specialist technical advice to assist Councils in performing their floodplain management responsibilities.

The Policy provides for technical and financial support by the State Government through five stages -

- 1 Flood Study Determines the nature and extent of flooding.
- 2 Floodplain Risk Management Study Evaluates risks and management options for the floodplain in respect of both existing and proposed development.
- 3 Floodplain Risk Management Plan Involves formal adoption by Council of a plan of management for the floodplain.
- 4 Implementation of the Plan voluntary house purchase, flood readiness and response plans, construction of flood mitigation works to protect existing development and use of planning controls (LEP, DCP) to ensure new development is compatible with the flood hazard.
- 5 Review reviews are recommended on average every 5 years and are also generally recommended after significant flood events, policy changes, or land use changes and where impediments to floodplain management plan implementation exist that warrant a review.

Minnegang Creek Flood Study

In 2017, Rhelm Pty Ltd was commissioned by Wollongong City Council (WCC) to review the Minnegang Creek Flood Study (2002) to take into consideration Council's updated Conduit Blockage Policy (2016). The review incorporates new survey data, more detailed modelling techniques, the updated blockage factors, and additional development within the catchment located in Lake Heights.

Attachment 1 is an executive summary of the final report recommended for adoption by Council.



The results show that the revised 1% AEP flood levels are similar to the 2002 Flood Study levels across most of the floodplain. The flood levels are generally slightly lower (less than 0.1m) compared to the 2002 study, however flood levels have increased by up to 0.1m in isolated locations.

PROPOSAL

The Minnegang Creek Flood Study (2019) be adopted. After adoption, undertake the following actions:

- Update the flood planning levels Planning & Environment
- Update of the relevant Section 10.7 planning certificate Planning & Environment
- Provide flood level information advice in accordance with new study results Infrastructure & Works

CONSULTATION AND COMMUNICATION

On 1 August 2019, the draft flood study was presented to the Southern Floodplain Risk Management Committee who recommended public exhibition of the draft report.

The final draft Flood Study Report went on public exhibition from 26 August 2019 through to 23 September 2019. Also, 9 community members attended a community drop-in session from 9:30 am to 11:00 am on Saturday 7 September at the Warrawong Community Centre.

Mailed out a letter to 800 residents and property owners in flood affected areas (all properties within the extent of the probable maximum flood) to advise of the public exhibition process and seek feedback on the document.

Notices of the public exhibition published in the local newspaper on 28 August and 4 September 2019. Hard copies of the Flood Study were placed in the Warrawong Library and PDFs were available through Council's "Have Your Say" page. 28 people viewed the Website's project page. 12 people downloaded the documents from the Website. No submissions we received throughout the exhibition period.

A community engagement report is provided in attachment 2 and outlines in more detail the process and outcomes of the consultation.

The committee has been advised of the outcomes of the public exhibition and has not raised any objection to Council adopting the final report.

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Our Wollongong 2028 goal "We value and protect our environment". It specifically delivers on the following:

Community Strategic Plan	Delivery Program 2018-2021	Operational Plan 2019-20
Strategy	3 Year Action	Operational Plan Actions
1.1.3 The potential impacts of natural disasters, such as those related to flood and landslips are managed and risks are reduced to protect life, property and the environment	1.1.3.2 Establish effective urban stormwater and floodplain management programs	Develop and implement Floodplain Risk Management Plans

FINANCIAL IMPLICATIONS

The Minnegang Creek Flood Study (2019) cost \$84,383 excluding GST. The next stage in the flood planning process for this catchment, being the Floodplain Risk Management Study & Plan, will be funded from existing budget allocations with an application to be made for State Government grant funding.

CONCLUSION

The Minnegang Creek Flood Study (2019) was prepared with the cooperation, assistance and support of many stakeholders, including community members and State government representatives and the Northern Floodplain Risk Management Committee.



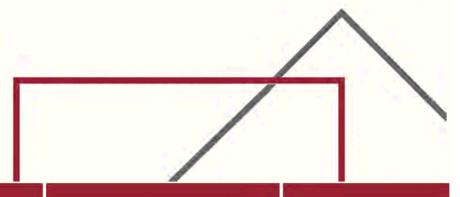
The study improves the accuracy and reliability of flood levels and flood behaviour in the Collins Creek Catchment. The reports and flood models for the Minnegang Creek Flood Study (2019) will be placed on the NSW Flood data portal so that they can be publicly accessed. This will lead to a greater understanding of flood behaviour and risk and wiser decision making.







Volume 1







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Document Control

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0	22 July 2019	Executive Summary issued to Council	LRE	RST
1	15 August 2019	Internal Review	LRE	RST/ERM
2	16 August 2019	Issue of Draft Flood Study to Council	LRE	RST
3	9 October 2019	Executive Summary issues to Council	RST	RST

Prepared For: Wollongong City Council

Project Name: Minnegang Creek Flood Study

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Client Reference: Stage 4 Report Draft Flood Study

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Foreword

The primary objective of the New South Wales (NSW) Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

Through the NSW Office of Environment and Heritage (OEH), NSW Department of Planning and Environment (DPE) and the NSW State Emergency Service (SES), the NSW Government provides specialist technical assistance to local government on all flooding, flood risk management, flood emergency management and land-use planning matters.

The Floodplain Development Manual (NSW Government 2005) is provided to assist councils to meet their obligations through the preparation and implementation of floodplain risk management plans, through a staged process. Figure F1, taken from this manual, documents the process for plan preparation, implementation and review.

The Floodplain Development Manual (NSW Government 2005) is consistent with Australian Emergency Management Handbook 7: Managing the floodplain: best practice in flood risk management in Australia (AEM Handbook 7) (AIDR 2017).

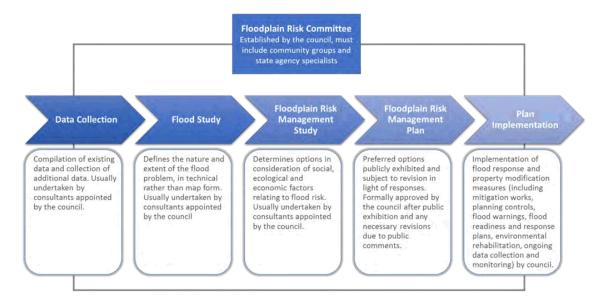


Figure F1 The Floodplain Risk Management Process (source: NSW Government, 2005)

Wollongong City Council is responsible for local land use planning in its service area, including in Minnegang Creek catchment and its floodplain. Through its Floodplain Risk Management Committee, Council has committed to prepare a comprehensive floodplain risk management plan for the study area in accordance with the NSW Government's *Floodplain Development Manual* (2005). This document relates to the flood study phase of the process.





Executive Summary

The Minnegang Creek Flood Study has been prepared for Wollongong City Council (Council) to define the existing flood behaviour in the Minnegang Creek catchment and to establish the basis for subsequent floodplain management activities.

The Minnegang Creek Catchment is located around 7km south of Wollongong. The Minnegang Creek Catchment is approximately 90 hectares in size and is largely developed and zoned as low density residential (roughly 80% of the catchment). The remaining part of the catchment comprises recreational and open-space areas, and some areas of bushland.

The catchment has a combination of natural open watercourses and piped drains. Minnegang Creek originates in the north west of the catchment. The creek is piped from Lake Heights Road through to the Barina Park Basin. Minnegang Creek continues to be piped to downstream of Barina Park Basin, discharging into a defined open channel downstream of Weringa Avenue. This remains as a defined open channel before passing through a culvert under Northcliffe Drive, before discharging into Lake Illawarra. A major tributary, originating from the north of Gilgandra Street, meets with Minnegang Creek at Barina Park

This project is a flood study, which is a comprehensive technical investigation of flood behaviour that provides the main technical foundation for the development of a robust floodplain risk management plan. It aims to provide a better understanding of the full range of flood behaviour and consequences. It involves consideration of the local flood history, available collected flood data, and the development of hydrologic and hydraulic models that are calibrated and verified, where possible, against historic flood events and extended, where appropriate, to determine the full range of flood behaviour.

A comprehensive engagement strategy was undertaken throughout the development of the flood study. This involved:

- Engaging agency and industry stakeholder to obtain details of historical flooding, survey data and
 other relevant data sets. Stakeholders have also been invited to provide feedback on the draft flood
 study during public exhibition.
- Community engagement has been undertaken through the mail out of an information brochure and brief survey. The purpose of the engagement was to raise awareness of the study and flood risk in the catchment, as well and obtain observations of historical flooding to assist in model calibration. Respondents were contacted for further information by phone and email, as required.
- Door knocking was also undertaken for selected properties identified based on preliminary review of the flood behaviour.
- The Flood Study has been overseen by the Southern Floodplain Risk Management Committee which includes representatives from community and state agencies.
- The Flood Study was placed on public exhibition from 26 August 2019 to 23 September 2019. During
 the exhibition period, letters were sent to residents and owners to inform them of the study. An
 information session was also provided on 7 September 2019.

Flood behaviour has been assessed using a TUFLOW hydraulic model incorporating the Direct Rainfall methodology.

A calibration and validation of the hydraulic model has been undertaken utilising historical rainfall intensities, community observations and comparisons to surveyed flood marks from events occurring in





1985, 1987, 1990 and 1998. The outcome of the calibration found that the model was able to represent the historical events to a reasonable level, providing confidence in the model to produce design flood event results.

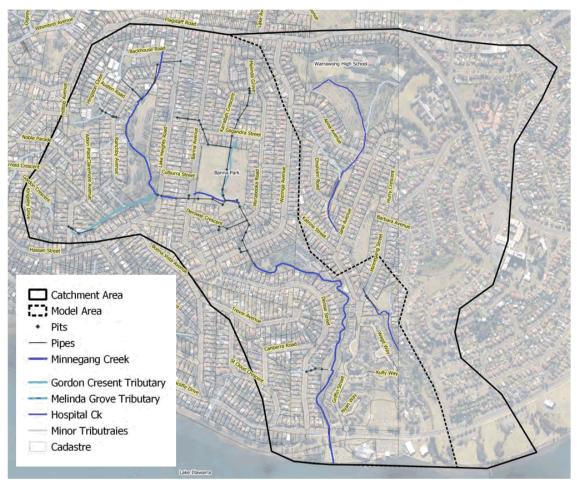


Figure i. Minnegang Creek Catchment

The hydrological and hydraulic models were analysed for the Probable Maximum Flood (PMF), 1% Annual Exceedance Probability (AEP), 2% AEP, 10% AEP and 20% AEP events. The models were analysed for 90 and 120 minute duration storms.

The models represent the catchment conditions at the time of survey, being 2017. This study represents the flood behaviour driven by catchment flooding. In the downstream areas of the study area, this flood study should be read in conjunction with the Lake Illawarra Flood Study (Lawson & Treloar, 2001) and the Lake Illawarra Floodplain Risk Management Study and Plan (Cardno Lawson Treloar, 2012).

An overview of the flood behaviour is provided for the PMF, 1% AEP and 20% AEP events in Figures ii to ix.

Minnegang Creek has two major tributaries. The Gordon Crescent Tributary commences in the far west of the catchment. Overland flows pass down Gordon Crescent, before flowing overland through residential properties to Ranchby Avenue. From Ranchby Avenue, flow again passes overland through residential lots,





joining with Minnegang Creek immediately upstream of Lake Heights Road. A smaller unnamed overland flowpath commences in Claremont Avenue, flows overland across Ranchby Avenue, and joins the Gordon Creek Tributary 100m upstream of the Minnegang Creek tributary.

The Melina Grove Tributary commences in Melinda Grove, in the north eastern region of the study area. It flows directly south, crosses Karrabah Crescent, and flows overland through residential lots until it crosses Gilgandra Street and discharges into Barina Park Basin.

Minnegang Creek begins in the north west of the catchment area. Minnegang Creek, and two unnamed tributaries, convey water from this region, through the public recreation zone between Ranchby Avenue and Lake Heights Road, before crossing Lake Heights Road and Barina Avenue, discharging into Barina Park Basin. In the PMF event, an additional overland flowpath is activated when flow breaks out of Lake Heights Road, and flows south-east across residential lots into Barina Avenue.

The flow along much of the upstream reaches are generally well contained with little change in extent between 20% AEP and 1% AEP and a minor increase in width in the PMF.

The Barina Park Basin lies in the centre of the catchment area, and intercepts flow from Minnegang Creek and Melinda Grove Tributary. It also indirectly intercepts flow from Gordon Crescent Tributary as this flowpath merges with Minnegang Creek upstream of Barina Park Basin.

The Barina Park Basin first overtops in the 10% AEP, though only engages a portion of the embankment. The embankment is fully engaged for events from the 5% AEP to the 1% AEP. The PMF results in additional overtopping of the embankment to both the east and the west of the designated spillway.

Downstream of Weringa Avenue, Minnegang Creek becomes a defined open channel. Flows are generally well contained within the channel for events up to the 1% AEP, although the rear of some properties are inundated. In the PMF, some overbank flows begin to occur, inundating the rear of adjacent properties. A number of overland flowpaths convey runoff from the developed areas to the west of the creek. These overland flows result in ponding along Denise Street, which loses access in the 20% AEP, though the duration is short, with flooding clearing in under an hour.

Immediately to the east Minnegang Creek is Hospital Creek, which drains the adjacent catchment area. While Hospital Creek does not form a part of this study, it was included in the modelling in order to assess whether any breakout flows occur from Hospital Creek to Minnegang Creek in larger events. At Jane Avenue, where the creeks are approximately 100m apart, some break out flow was observed in the PMF event. It was driven by the constriction of Hospital Creek flows when it passes through the culvert under Minnegang Street. At this location, flow backs up upstream of the culvert, and breaks out over the western bank, crosses Jane Avenue and flows into Minnegang Creek. The breakout occurred in both the design blockage and risk blockage scenarios. Along and downstream of Northcliffe Drive, the flooding is largely driven by backwater from Lake Illawarra.

Similar to other areas of the catchment, there was little change in extent between the 20% AEP and the 1% AEP, while the PMF extent was substantially larger, inundating much of the area. These changes are commensurate with the change in downstream boundary, which sees lake levels rise from 1.81m for the 1% AEP design runs to 2.24m for the PMF.

Sensitivity testing was undertaken on model roughness, inflows and blockage. It was found that overall, the model is relatively insensitive to model roughness assumptions, with potential variation in water levels in the order of +/- 0.05 metres arising from +/- 20% changes in roughness values. The model was more sensitive to



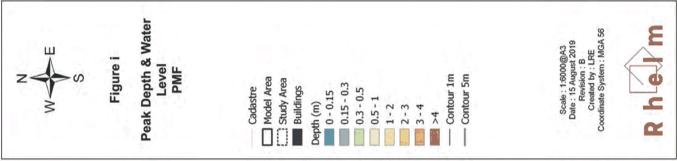


hydrological assumptions on flows, with levels changing by up to 0.3 metres in the downstream reaches of Minnegang Creek as a result of a 20% increase in flows in the 1% AEP event.

With respect to blockage, the sensitivity testing showed that the impact of blockage in the catchment is generally limited, with the majority for water level changes within +/- 0.05m between blocked (risk scenario) and unblocked cases, and only for very limited areas of the catchment. The most significant change is immediately upstream of Barina Avenue, where risk scenario blockages resulted in increases of up to 0.2 metres in the 1% AEP and 0.1 metres in the 20% AEP occurring between Barina Avenue and Lake Heights Road.

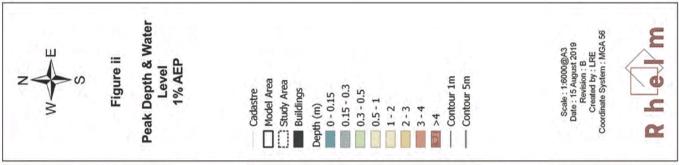
This report provides an understanding of the flood risk within the Minnegang Creek catchment and may be used to inform planning. This study provides a baseline against which a Floodplain Risk Management Study and Plan can be prepared.





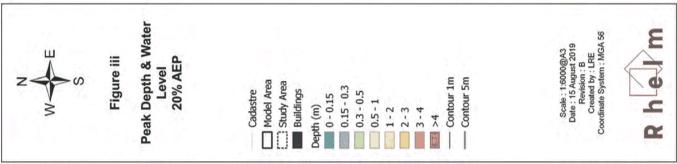






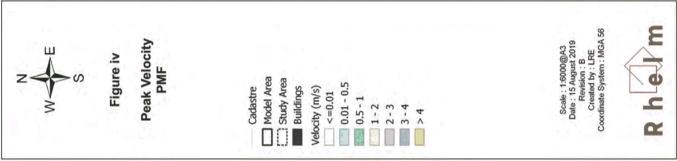






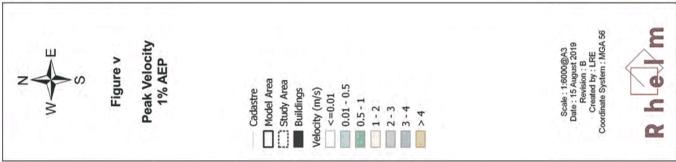






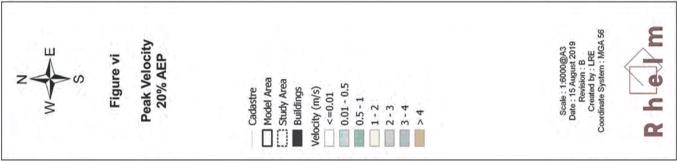






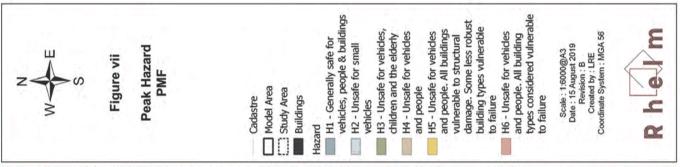






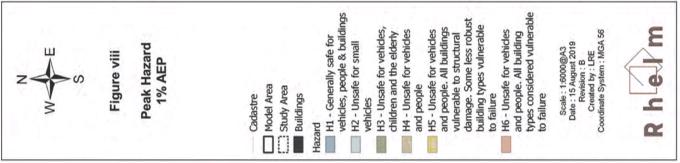


















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MINNEGANG CREEK FLOOD STUDY

ENGAGEMENT REPORT

OCTOBER 2019 Z19/228346





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The information in this report is based on data collected from community members who chose to be involved in engagement activities and therefore should not be considered representative.

This report is intended to provide a high-level analysis of the most prominent themes and issues. While it's not possible to include all the details of feedback we received, feedback that was relevant to the project has been provided to technical experts for review and consideration.



Executive Summary

Council is responsible for planning and managing flood prone lands in our area and has updated the Minnegang Creek Flood Study as part of this commitment. A report on the draft Flood Study was prepared with information on how it was updated and what the results are. The updated Study explains the way flooding happens in the Minnegang Creek catchment. The study will form a basis for the ongoing management of flood risk in the catchment.

Council's engagement team worked collaboratively with a technical consultant to share the draft Study with the community and key stakeholders. During the public exhibition period, 26 August to 23 September 2019, Council sent letters to more than 800 residents and property owners in the catchment area inviting them to learn more about the Study. Customer service information was included in the three most commonly-spoken languages in this area other than English; Macedonian, Italian and Arabic. The additional information let the community know that Council and the National Relay Service could provide language assistance if needed. Emails with this information were sent to community, education, Register of Interest (flood), business, government and emergency services' stakeholders. The information was also available at Council's Customer Service Centre. Copies of the draft report, a Frequently Asked Questions sheet and Feedback Form were made available at Warrawong Library, and at the information session at Warrawong Community Centre on 7 September 2019. They were also included on the project webpage, which also included a Google Translate feature to assist with online translation. Notices of the exhibition were published in the Advertiser on 28 August and 4 September 2019. The community were invited to provide feedback via Council's website, Customer Service Centre and at the community information session.

There were no submissions, however some comments were provided at the drop-in information session which was attended by a total of 9 community members, including SES volunteers and a floodplain committee member.

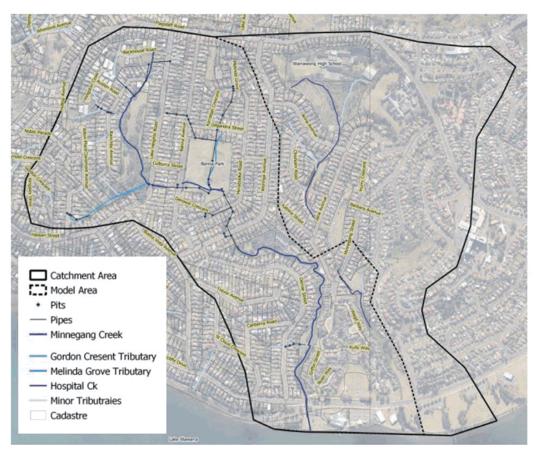
Feedback themes related to general interest about flood risk in the catchment. There was interest in the flood gates at the entrance of Warrawong Mall and in Council's proposal to manage erosion of the creek at Denise St, Lake Heights. Photos were provided of this creek area. There was some understanding of the risk of flooding to people's properties, with an interest in finding out further details specific to individual properties and what Council might do to reduce the risk. There was discussion on the next steps of the floodplain management process, which was to look at possible options to alleviate flooding e.g. creek modification and Voluntary House Raising or Voluntary Purchase in some cases where properties were quite severely flood-affected and where nominated criteria were met. Experiences of historical flooding were shared.



Background

Wollongong City Council is committed to finding solutions to reduce the social and economic damages of flooding. In 2016, Council updated its Blockage Policy and resolved to review and update its flood studies. The Minnegang Creek Flood Study is one of 10 studies to undergo review. This catchment is located in the Lake Heights area.

Figure 1 Minnegang Creek catchment map



A Flood Study for this catchment was completed in 2002. This was followed by a Floodplain Risk Management Study and Plan in 2004. These studies were jointly funded by Council and the NSW Government. These studies identified the risk within the Minnegang Creek catchment and the steps that can be taken to manage this risk now and into the future.

As part of updating the Study, Council's revised Blockage Policy was considered, which helps us work out how blocked stormwater structures might affect flooding. We have improved information, such as recent data from land and waterway surveying. We've included an extended network of drainage pits and pipes and used more improved and detailed modelling techniques. We've also extended the mapping to capture additional flood-prone areas and waterways that were not previously mapped. Data was collected and used to update the



computer models used to simulate the flooding in the catchment, and to update flood maps which provide a visual illustration of the flood risk in the catchment.

At the Southern Floodplain Risk Management Committee meeting on 1 August 2019, the public exhibition of the draft Minnegang Creek Flood Study was unanimously supported. The outcomes of the exhibition and resulting amendments to the Study will be reported to the Southern Floodplain Risk Management Committee and Council in view of adopting it in 2019.

The study provides an improved understanding of the potential impacts of floods on the local community and will form a basis for the ongoing management of flood risk in the Minnegang Creek catchment.



Methods

Our Stakeholders



Our Methods

Table 1: Details of Communication and Engagement Methods

Table 1: Details of Communication and Engagement Methods				
Methods	Details of Methods			
Communication Methods				
Presentation	Information about the proposal was presented at the Floodplain Risk Management Committee (Southern) meeting on 1 August 2019			
The Advertiser	Details of the public exhibition, information sessions and Engagement HQ webpage were included in Council's Community Update pages on 28 August and 4 September 2019			
Email to key stakeholders	An email and FAQ were sent to key stakeholders identified through an analysis process			
Register of Interest	An email was sent to all participants with registered interest in 'Flood'			
Info packs	Frequently asked question sheets and hardcopy feedback forms were made available at Warrawong Library and Customer Service. A hardcopy of the draft report was also made available at Warrawong Library.			
Letter	A letter about the public exhibition, information session and how to submit feedback (via phone, email, in person or post) was mailed to local residents and property owners			
Frequently Asked Questions	Responses to questions about updates to the Study and floodplain risk management were distributed with the letter and emails, published on the project webpage and distributed at the information session			
Posters	Posters were produced to help explain the floodplain risk management			



	process and what overland flow is	
Engagement HQ Website	 The project webpage hosted background info and supporting documents: Frequently Asked Questions with information on the Study and flood risk management News Feed for updates on project progress Document Library with the Report Floodplain risk management process and overland flow graphics Flood modelling video Flooding in Wollongong video Online survey tool to capture participant's feedback 	
Video	The Flooding in Wollongong video was used on the Engagement HQ webpage and a flood modelling video was screened at information sessions and on the Engagement HQ webpage	
Engagement Methods		
Engagement HQ Website	An online survey tool was used to capture participant's feedback. The page also hosted background info and supporting documents.	
Feedback Form	A hardcopy feedback form was made available at Warrawong Library and at the information session	
Community Information Session	A drop-in session was held to provide the community with information on the work undertaken to date and findings of the Report. The Report, flood modelling maps and flood modelling video were displayed along with the FAQ and feedback forms. Floodplain management engineers working on the Study were on hand to answer questions.	

Flood Study 2019



8

Results

All stakeholders and the wider community were invited to provide feedback on the draft Study. This section provides details on the participation at engagement activities (Table 2), and the feedback received during the exhibition period.

Item 6 - Attachment 2 - Community engagement report - Minnegang Creek

Engagement Participation

Details of the number of participants for each engagement activity are presented in Table 2.

Table 2: Engagement participation results

Engagement Activities	Participation
Southern Floodplain Risk Management Committee Meeting	8
Drop-in Community Information Session at Warrawong Community Centre	9
 Online Participation Aware – Total number of users who viewed the project page Informed – Total number of users who clicked a hyperlink, e.g. to download 	23
a document	12
• Engaged – Total number of users who actively contributed to the project, e.g. submitted feedback via the online form	0

Figure 2 Community Information Session at Warrawong Community Centre



Flood Study 2019



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Submission Results

There were no submissions. Feedback themes from discussions at the drop-in session related to general interest about flood risk in the catchment.

Flood mitigation

There was interest in the flood gates at the entrance of Warrawong Mall.

Creek at Denise St, Lake Heights

There was interest in Council's proposal to manage erosion of the creek at Denise St, Lake Heights. Photos provided of the creek area didn't have dates specified, but the older photographs were thought to have been from the 1970s and the newer ones are thought to have been from the 1980s.

Figures 3, 4 & 5 Photos provided of the creek at Denise St, Lake Heights







Impact of flooding on own property

There was some understanding of the risk of flooding to people's properties, with an interest



in finding out further details specific to individual properties and what Council might do to reduce the risk.

I bought the property about 12 years ago and knew that creek line was there. What can Council do to reduce the flood risk?

I haven't experienced any flooding but am aware that the garden is most likely to flood. I'll consider having the floor level surveyed to determine the potential for and depth of over-floor flooding.

Floodplain risk management process

There was discussion on the next steps of the floodplain management process, which was to look at possible options to alleviate flooding e.g. creek modification and Voluntary House Raising or Voluntary Purchase in some cases where properties were quite severely flood affected and where nominated criteria were met.

Historical floods

Flood Study 2019

Experiences of historical flooding were shared.

Floods used to get up the windows of the property before Barina Park was built