ITEM 3 DRAFT TOWRADGI CREEK FLOOD STUDY, FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

The Wollongong Local Government Area is naturally prone to flooding, and due to our location between the mountains and the sea, flash flooding can occur as water travels down the escarpment toward the ocean.

The draft Towradgi Creek Floodplain Risk Management Study and Plan (FRMSP) follows on from the revised Flood Study (2019). These studies and plan were prepared in accordance with the New South Wales (NSW) Flood Prone Land Policy and the principles of the Floodplain Development Manual (NSW Government, 2005). The FRMSP reviewed options for managing the flood risk for the suburbs of Corrimal, East Corrimal, Towradgi and Tarrawanna.

The draft Towradgi Creek Floodplain Risk Management Study and Plan was publicly exhibited from 24 October to 21 November 2022. Council received 48 submissions which commented on various aspects of the draft Study and Plan. Most residents were supportive of the recommended options within the draft Study and Plan. It is recommended that the Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan be adopted.

RECOMMENDATION

The Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan be adopted.

REPORT AUTHORISATIONS

Report of: Jeremy Morgan, Manager Infrastructure, Strategy + Planning
Authorised by: Joanne Page, Director Infrastructure + Works

ATTACHMENTS

1 Location Plan -Towradgi Creek Catchment
2 Northern Area Floodplain Risk Management Committee Meeting Minutes 3 May 2023
3 Executive Summary - Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan Revised
4 Engagement Report - Managing Flood Risk in the Towradgi Creek Catchment

BACKGROUND

The Towradgi Creek Flood study (2015) was reviewed and updated in the revised Flood Study (2019), to account for changes associated with Council's Blockage Policy (2016). The Flood Study (2019) provides the most up-to-date information on flooding for the catchment and provided the basis for the draft Towradgi Creek Floodplain Risk Management Study and Plan.

The NSW Government's Floodplain Development Manual provides a framework to ensure the sustainable development and activation of floodplain environments and incorporates the NSW Flood Prone Policy. Under the Policy, planning for flood liable land is led by Local Government, with State Government subsidising flood mitigation works 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 sequential 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 – Development of a plan of management for the floodplain based on the evaluation work in the Floodplain Risk Management Study.

4 Implementation of the Plan – Taking action to implement the agreed flood modification measures, response modification measures, and property modification measures.

5 Review – Reviews are recommended on average every 5-10 years and in response to significant changes or events.

The draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan were prepared in accordance with the NSW Government's Floodplain Development Manual and the Australian Rainfall and Runoff 2019 guidelines and included a review of the 2003 Towradgi Creek Floodplain Risk Management Study and Plan.

The preparation of the Study and Plans has been overseen by the Northern Area Floodplain Risk Management Committee, comprising membership of Councillors, community representatives and State Government agencies.

Public exhibition of the draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan occurred between 24 October to 21 November 2022.

On 3 May 2023, an overview of the draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan was presented to the Northern Area Floodplain Risk Management Committee, and the Committee recommended the report be adopted by Wollongong City Council (refer Attachment 2).

PROPOSAL

It is proposed that Council adopt the draft Flood Study, Floodplain Risk Management Study and Plan for the Towradgi Creek catchment. This will enable Council to implement identified priority options and seek funding from the State Government. Implementation of identified options in the Plan is estimated to cost in the order of $5.6M, based on current cost estimates. Funding for specific options will be prioritised and considered in future budgeting cycles. Executive Summaries of the 'Draft Flood Study, Floodplain Risk Management Study and Plan' are included in Attachment 3.

After the adoption of the Floodplain Risk Management Study and Plan, the following actions will be undertaken:

- Incorporate the Flood Risk Precinct Mapping into Council's GIS system.
- Update the relevant Section 10.7 Planning Certificate codes relating to flooding.
- Update the Flood Planning Levels (FPL).
- Update the relevant sections within the Wollongong DCP 2009. Prepare grant submissions to State and Federal Government seeking assistance to implement options within the implementation plan; and
- Commence the implementation of the plan (subject to funding).

CONSULTATION AND COMMUNICATION

The draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan were developed through consultation with the local community, Technical Working Group and the Floodplain Risk Management Committee. The draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan was publicly exhibited from 24 October to 21 November 2022. Engagement with Aboriginal stakeholders occurred between 23 August to 21 November 2022. A drop-in community information session at the Towradgi Surf Club took place on 2 November 2022 from 3:30pm to 6:30pm and was attended by 48 community members.

Consultation occurred via:

- Distribution of over 2800 newsletters and questionnaires/feedback forms to all residents, businesses, and property owners within the floodplain area at the commencement of the public consultation phase to give the opportunity to provide feedback.
- Media release and notice in the Illawarra Mercury.
- Council's website.
- Public exhibition and community information session.
- Emails/letters to Neighbourhood Forum 4.
- Emails/letters to other stakeholders including State Government Agencies, schools, and business and industry bodies.

- Social media posts.
- Meetings of the Floodplain Risk Management Committee.
- Meetings of the Technical Working Group.

The exhibition project webpage was viewed 309 times and reports were downloaded 145 times.

Council received 48 submissions (7 letters/emails, 41 on-line/hardcopy surveys). The key themes from the submissions were stormwater infrastructure and maintenance; creek and vegetation maintenance; development and planning control.

The submissions are summarised in Council's Engagement Report (Attachment 4).

Most residents were supportive of the recommended options within the draft Flood Study, Floodplain Risk Management Study and Plan.

Drop-in Community Information Session

A drop-in community information session at the Towradgi Surf Club took place on 2 November 2022 from 3:30pm to 6:30pm and was attended by 48 community members. Attendees were given the opportunity to ask questions of the engineers working on this project and provide comments on the proposed options. People suggested additional or alternative measures to reduce flood impacts and they also noted their observations of flooding and flood impacts in these areas.

Aboriginal Stakeholder Meetings

Meetings with Aboriginal stakeholders were held between 23 August to 21 November 2022. The three Aboriginal Traditional Custodians and knowledge holders we spoke to, indicated there are sites and artefacts, or high potential for these, near the location of some of the recommended measures. They requested to have site officers survey areas of proposed works that are near the creek and to have them monitor sites during construction. Questions and concerns were raised about access, safety and site disturbance impacts of the measures.

Northern Floodplain Risk Management Committee

On 3 May 2023, an overview of the draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan was presented to the Northern Floodplain Management Committee. The Committee recommended the report be adopted by Wollongong City Council (refer Attachment 2).

Outcome of Community Consultation

Comments from the community and from State Government agencies have been reviewed and, where appropriate, incorporated into the final version of the Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan.

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Our Wollongong 2032 Goal 1 – We Value and Protect Our Environment. It specifically delivers on the following:

Community Strategic Plan 2032		Delivery Program 2022-2026
Strategy		Service
1.3	Increase our resilience to natural disasters and a changing climate to protect life, property and the environment.	Stormwater Services This service strategically plans for a coordinated approach to floodplain risk management and stormwater management including protection of waterways, beaches, lakes, lagoons and creeks.

SUSTAINABILITY IMPLICATIONS

The recommended options within the draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan have been assessed on the principles of sustainability in social, environmental, cultural and economic terms, using a multi-criteria assessment.

RISK MANAGEMENT

The draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan provides a better understanding of the flood behaviour and flood risk on the existing and future communities within the catchment and provides ways to manage flood risk efficiently and effectively into the future.

FINANCIAL IMPLICATIONS

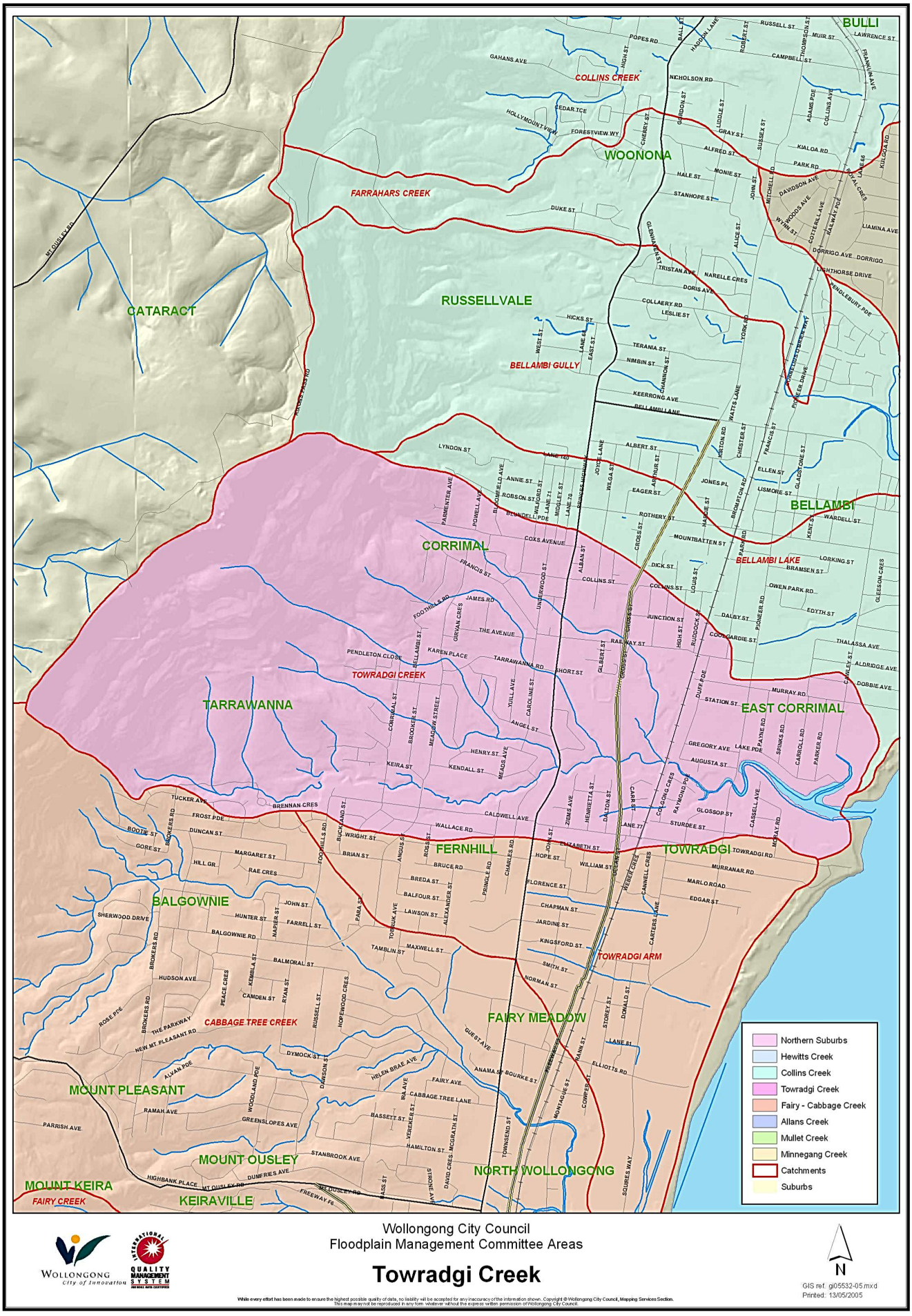
The preparation of this Flood Study, Floodplain Risk Management Study and Plan has cost $164,637 (GST inclusive); approximately two thirds of which has been funded by State Government. The State has contributed $92,370.66. Implementation of all options within the Floodplain Risk Management Plan is estimated to cost in the order of $5.6M. Allocation of funds to priority options will be considered in future budgeting cycles.

Pending adoption of the Flood Study, Floodplain Risk Management Study and Plan, applications to State and Federal Governments will be made for financial assistance to implement options within the Floodplain Risk Management Plan. Where successful, grants are usually provided in the ratio of 2:1 (two parts Government, one part Council).

CONCLUSION

The draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan has been prepared with the cooperation, assistance, and support of many stakeholders, including community members and State Government representatives.

The draft Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan is an important milestone in the floodplain risk management process that will allow the implementation of appropriate flood risk management strategies such as planning controls, emergency response measures, education, and infrastructure solutions to benefit the community and businesses within the catchment. The report and associated flood data will be put onto the NSW Flood Data Portal so it can be publicly accessed, with the aim to provide a better understanding of flood behaviour, flood risk and wiser decision making for the Towradgi Creek catchment.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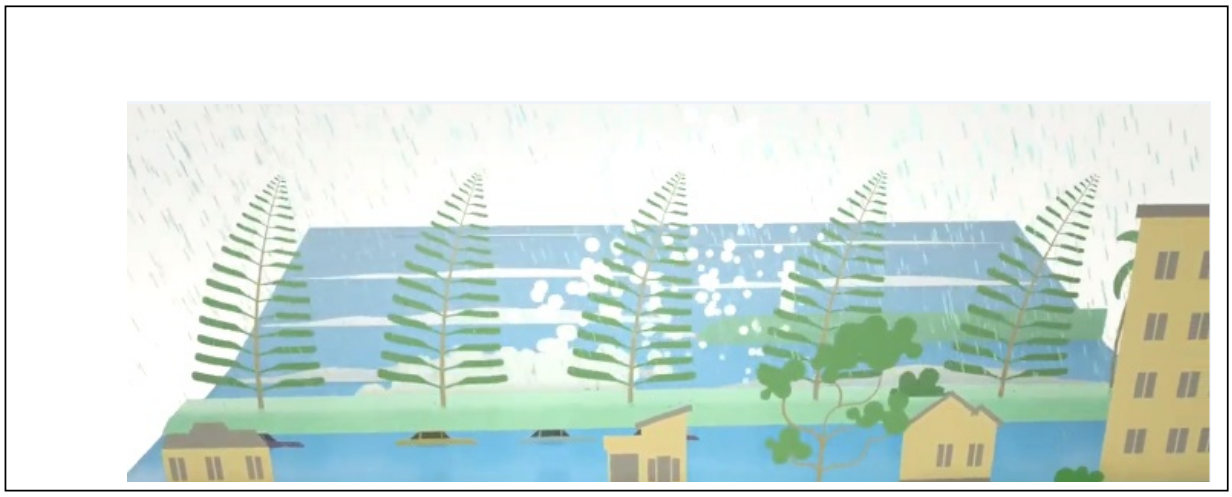
BALGOWNIE
TOWRADGI ARM
FAIRY MEADOW
CABBAGE TREE CREEK
MOUNT PLEASANT
MOUNT OUSLEY
NORTH WOLLONGONG
MOUNT KEIRA
KEIRAVILLE
COLLINS CREEK
FARRAHARS CREEK
BELLAMBI GULLY
TOWRADGI CREEK
FAIRY CREEK
Northern Suburbs
Hewitts Creek
Collins Creek
Towradgi Creek
Fairy - Cabbage Creek
Allans Creek
Mullet Creek
Minnegang Creek
Catchments
Suburbs
Wollongong City Council
Floodplain Management Committee Areas
Towradgi Creek
N
GIS ref: gl05532-05.mxd
Printed: 13/05/2005

FLOODPLAIN RISK MANAGEMENT COMMITTEE – NORTHERN AREA



3 May 2023

AGENDA

FLOODPLAIN RISK MANAGEMENT COMMITTEE MEMBERS – NORTHERN AREA

4PM

3 May 2023

PURPOSE OF MEETING

Under the NSW Government's Floodplain Development Manual (2005), a Floodplain Risk Management Committee is required to assist Councils in the development and implementation of Floodplain Risk Management Plans across their respective Local Government Areas. A Floodplain Risk Management Committee for the Central Area has been formed to oversee this process for the Hewitts Creek, Collins Creek and Towradgi Creek catchments.

MEMBERS	
Cr Mithra Cox	Councillor Delegate
Cr Richard Martin	Councillor Delegate
Cr Cameron Walters	Councillor Delegate
Andrew Monk	Transport NSW
Nathan Pomfret	Department of Planning, Industry and Environment
Stuart Milling	Transport NSW
Graham Towers	Planning NSW
Rodney Whalan	SES Illawarra/South Coast Region
Shaza Raini	Environment NSW
Jen Byrne	Community Representative
Robert Smith	Community Representative
Jeremy Morgan	Manager Infrastructure Strategy and Planning
Andrew Heaven	Development Engineering Manager
David Green	Land Use Planning Manager

INVITED	
Isabelle Ghetti	Transport and Stormwater Services Manager
Manel Mariner	Floodplain + Stormwater Unit Leader
Ray Piatek	Senior Stormwater and Floodplain Design Engineer
Yelia Pandika	Floodplain Management Engineer
Robert Dinaro	Floodplain Management Engineer
Ali Sevenler	Floodplain Management Engineer
Clare Robinson	Emergency Management Officer
Glenda Fewings	Administration Officer (Minutes)
Erin Askew	WMA Water (Consultant)
David Tetley	Catchment Management Solutions (Consultant)

AGENDA

FLOODPLAIN RISK MANAGEMENT COMMITTEE MEMBERS – NORTHERN AREA

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FLOODPLAIN RISK MANAGEMENT COMMITTEE MEMBERS – NORTHERN AREA

1 STANDING AGENDA ITEMS

1.1 Welcome and Introduction

In line with NSW Health guidelines about Novel Coronavirus, we have made some changes to the way we are engaging the community, to keep our staff and people in our safe. Instead of having face-to-face conversations with people, meetings are currently being conducted via Teams.

1.2 Acknowledgement of Country

The traditional owners of the land were acknowledged.

1.3 Nomination of Chair

Cr Mithra Cox sent an apology, Cr Cameron Walters stood in as Chair.

1.4 Apologies

Apologies were received and accepted on behalf of Cr Mithra Cox, Cr Richard Martin, Isabelle Ghetti (WCC Transport Asset and Stormwater Manager), Andrew Heaven (WCC Development Engineering Manager), Stuart Milling (Transport for NSW), Graham Towers (Planning NSW).

1.5 Disclosures of Interests

Nil

1.6 Confirmation of Minutes of Previous Meeting held on (3 November 2022)

The Minutes of the meeting held on 3 November 2022 were accepted. Moved Jen Byrne/Seconded Jeremy Morgan.

2 FLOOD MANAGEMENT UPDATE

2.1 Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan

The consultant (WMAwater) provided a summary of the study findings, including key outcomes of the public exhibition and how they have been considered in the final draft Plan.

The committee recommended that Council adopt the Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan (2023).

There were no questions posed following the presentation.

Action: Jeremy proposed the committee recommend that Council adopt the Towradgi Creek Flood Study, Floodplain Risk Management Study and Plan (2023).

Moved Stuart Milling/Seconded Robert Smith.

Nil objections.

2.2 Hewitt's Creek Flood Study, Floodplain Risk Management Study and Plan

The consultant (WMAwater) provided a summary of the study outcomes to date.

Following recent flooding in the catchment and consultation with local residents, additional potential options were identified for consideration. They are currently looking at a range of options, following community feedback re recent flooding and investigations particularly around Lachlan St where there has been a significant amount of feedback.

Jen raised the following:

1. What is the timing for assessment of the Lachlan Street options. Robert Dinaro advised Council estimates within the next 2-3 months assessment of the Lachlan Street options would be completed, following which consultation with the local residents (including Jen) would be undertaken.
2. In terms of new developments in a catchment area, i.e. resident doing modification extension, imagining there are certain planning provisions for stormwater to be maintained, is this part of the assessment/considerations? Erin advised the future development scenario would be looking at hard surfaces and structures within the catchment as used as guidance. Erin could not advise if retaining of stormwater was required, that would need to be answered by council. David Green advised as part of a Development Application (DA) there are requirements for onsite detention and this depends on where you are in the catchment as to what is required, it may be not required for a small addition however chapters E13 and E14 of the Development Control Plan (DCP) sets this out.
3. Are there ways we can modify our homes to be flood resilient? It is hard to get information from trusted sources, is there the ability to promote solutions to residents through these studies? Erin advised the intent of the recommendation will provide help and information to help residents. Jeremy advised the plan will be, suggest for council due to the ever-changing availability of materials that are flood compatible.

Once a draft report has been prepared, this will be presented back to the Committee.

Carried over from the meeting of 3 November 2022, when a draft is ready for exhibition, we will action the minutes of the previous meeting related to this matter, being:

- The reports are to be presented to committee prior to exhibition.
- Cr Martin requested advice be provided to Thirroul Village Committee and Northern Illawarra Residents Action Group as part of the exhibition.
- When an update is available, Lachlan Street residents to be provided with an update by Council officers, prior to the exhibition.

2.3 Collins Creek Flood Study, Floodplain Risk Management Study and Plan

An update on the progress of this project was presented at the meeting by David Tetley from Catchment Simulation Solutions with a focus on what has been completed. The study comprises two stages:

1. Stage 1 – Flood Study using ARR 2019
2. Stage 2 – Floodplain Risk Management Study and Plan.

Stage 1 has been completed with Stage 2 in progress.

Stage 1 identified flooding hot spots, and a flood damages assessment has been carried out as part of Stage 2 (average annual damage bill would be $6.6million). David advised the LEP and DCP had been reviewed with several recommendations made and the Local Flood Plan had several small updates suggested. In addition, the shelter-in-place/evacuation assessment was completed. David acknowledged flooding across this catchment is very flashy and there is a very high flood risk and potential for damage.

Mitigation options put forward have been grouped into 2 categories:

1. Catchment wide options
2. Location specific options

The initial list of options compiled:

1. Initial list of ~50 options qualitatively assessed.
2. Site visit completed.
3. Top 10 options being assessed in detail.

The next steps:

1. Detailed evaluation of individual options:
    - Hydraulics,
    - Economics,
    - Social and emergency response,
    - Environmental impacts.
2. Assessment of combinations of options.
3. Preparation of draft reports.

Following the presentation Andrew asked was the large list of options available.

Action: David Tetley will forward the options report to Council and Robert Dinaro will send to Andrew Monk.

Jen advised she is interested in shelter in place work and wondered if this is looked at beyond the Collins Creek catchment given the quickness of flooding – Jeremy advised in the previous 2 presentations there are 2 measures in place and response measures is one of these which is community and what they have in place in their personal preparations – this may be shelter in place, he advises, having worked at SES, having to get a large scale area evacuated in a flash flood event is challenging and appropriate responses are developed on individual matters.

2.4 Update on Implementation of Floodplain Risk Management Plans

Implementation of recommended engineered measures by the FRMSPs is undertaken under the Infrastructure Delivery Plan (IDP).

In the absence of the Senior Floodplain and Stormwater Engineer, Ali Sevenler (Floodplain Management Engineer) provided an update on the following projects being actively implemented by Council and that will provide flood mitigations benefits to our community:

- **Bellambi Gully Flood Mitigation Scheme** – Funding received through National Flood Mitigation Infrastructure Program for Stage 1 and 2. Further funding for stage 3 has been sought from NSW Flood Recovery Resilience Grant Program and awaiting an outcome. Tender process is in progress with works expected to start on stage 1 and 2 in the next months. Waiting for further funding with the expectation of stage 2 to progress in next few months – currently in the Tender process.
- **Gordon Hutton Park Debris Control Structure** – Design has been completed and tender awarded for construction.
- **Russell Vale Golf Course Debris Control Structure** – Design has been completed and tender awarded for construction.
- **Albert Street/Memorial Drive Debris Control Structure** – Design in progress and approvals are being sought to finalise. Following this it will go to Tender.
- **Brompton Road Debris Control Structure** – Design has been completed and tender awarded for construction.
- **Ursula Road Scheme** – Flood mitigation works in the vicinity of Ursula Road, Benelong Street and Trinity Row are proposed. The concept design has been completed and detailed design has been commenced in-house. In addition, Council has applied for funding under the Floodplain Management Program 2023 for implementation of the high priority option WC06 i.e., proposed levees at Franklin Avenue, Spinners Way, and Benelong Street.

As importantly, other recommended flood mitigation measures include:

- Raising flood awareness and providing flood information including videos for education which will be released shortly.
- Sharing flood intelligence and information with the SES is to be ongoing.
- Updating our Planning and Development controls related to flooding is ongoing.

AGENDA

FLOODPLAIN RISK MANAGEMENT COMMITTEE MEMBERS – NORTHERN AREA

3 GENERAL BUSINESS

3.1 Business Arising from Previous Minutes

Ali introduced Manel Mariner to the Committee. Manel commenced with Council on 17th April 2023 as Floodplain and Stormwater Unit Leader replacing Joel Harris. Ali also advised Isabelle Ghetti was moving to the Environment Planning Manager position and thanked her for her valuable contribution over the years.

Manel passed on thanks from Isabelle, she wanted the committee to know it was a pleasure working with them and thanked the members for their input.

Manel advised he was looking forward to working at Council and improving the LGA.

4 NEXT MEETING

To be advised – depends on when community engagement is to occur with exhibition.

5 CLOSE MEETING

5.07pm

EXECUTIVE SUMMARY

The Towradgi Creek Floodplain Risk Management Study and Plan (FRMS&P), which follows on from the previous Addendum to the Towradgi Creek Flood Study and Floodplain Risk Management Study and Plan completed in 2003 and builds on the updated flood modelling developed as part of the Review of Towradgi Creek Flood Study, completed in 2015 and the Flood Study, completed in December 2019. The study has been undertaken in accordance with the NSW Government's Flood Prone Land Policy. This study provides recommendations for reducing flood risk due to flooding in the Towradgi Creek catchment. The flood behaviour was defined in the Review of Towradgi Creek Flood Study (2015) and the Flood Study (2019) which developed a suite of models that have been thoroughly reviewed and revised in accordance with best practice.

In this study, a full assessment of the existing flood risk in the catchment has been carried out, including hydraulic hazard across the study area, over floor flooding of residential, commercial, and industrial properties, identification of known flooding issues and hotspots, and emergency response during a flood event. Various measures aimed at managing this flood risk were assessed for their efficacy across a range of criteria. The options were rated according to a detailed matrix of possible impacts. Those rated highest have been recommended in the Floodplain Risk Management Plan, and prioritised based upon how readily the management measures can be implemented, their capital cost, what constraints exist and how effective the measures are. Measures with little cost that can readily be implemented, and which are effective in reducing damage or personal danger would have high priority.

Flood Prone Land Policy Framework

The NSW Government Flood Prone Land Policy supported by the Floodplain Development Manual provides a framework for the assessment and management of flood risk across the state. Specifically, the Floodplain Development Manual guides Councils in the development and implementation of detailed local floodplain risk management plans in order to plan for and manage flood risk. The Floodplain Development Manual outlines the process and the roles and responsibilities of the various stakeholders involved in the process.

Council (both elected members and Council staff) are primarily responsible for managing flood prone land through the implementation of floodplain risk management strategies. The Floodplain Risk Management Committee assists Council in the development and implementation of these strategies by providing a forum for discussion of the differing viewpoints within the study area, identifying management options and considering and making recommendations to Council on appropriate measures and controls with the primary objective of achieving a beneficial but equitable result for the study area. The committee is the driving force behind the study and plan.

The committee includes elected local government officials, Council staff, emergency managers, state government representatives and members of the local community. In addition to the local community committee members, the broader local community, who live and work in the floodplain, have been given the opportunity to contribute to the plan development through community consultation periods at various stages of the study.

FINAL DRAFT

State Government agencies provide funding and technical support to assist Council and the committee in developing a robust Floodplain Risk Management Plan. In most cases a specialist consultant is engaged by Council to undertake the required technical investigations and assessment. The committee directs the consultant through this investigation and receives this information from the consultants to assist with their deliberations.

WMAwater has undertaken the investigation and assessment for this Towradgi Creek Floodplain Risk Management Study under the guidance and direction of the Floodplain Risk Management Committee and developed the Towradgi Creek Floodplain Risk Management Plan.

Background

Towradgi Creek is located within the Wollongong City Council Local Government Area (LGA). The 7.5km^2 catchment incorporates the northern Wollongong suburbs of Tarrawanna, Corrimal, East Corrimal and Towradgi (Figure 1), and extends from the Illawarra Escarpment in the west, discharging at Corrimal Beach in the east.

Towradgi Creek catchment includes several smaller tributaries:

- South Angels Creek;
- North Angels Creek;
- South Corrimal Creek;
- North Corrimal Creek;
- Carr Creek (sometimes locally known as Jones Creek); and,
- Parker Creek.

The upper half of the catchment is heavily vegetated and forms a section of the Illawarra Escarpment falling steeply from 430 m to 250 m AHD. The lower half of the catchment is generally flatter with a mixture of land uses including, residential, commercial and open space. The catchment land use is shown on Figure 2.

The entrance of Towradgi Creek to Towradgi Lagoon is defined as an Intermittently Closed or Open Lake or Lagoon (ICOLL). Council have adopted an Entrance Management Policy (2007), which provides operational details on when entrance should be opened if conditions and resources permit. The entrance has historically been opened naturally during flood events.

Existing Flood Behaviour

A number of historical flood events have occurred in the Towradgi floodplain, including flooding in April 1988, December 1989, and January 2013, with the largest and most significant flood event occurring in August 1998. This August 1998 event resulted in damage to private and public property.

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As part of the Flood Study Review (2015) areas known to be inundated frequently were identified; these locations have been confirmed with updated flood modelling as part of this study (including the Flood Study (2019)). The locations identified are described below:

- Channel capacity near Lemrac Avenue and Willow Grove. Flood walls, channel works and a debris structure have since been constructed as management measures;
- Overland flow from North Corrimal Creek at Underwood Street resulting in flooding to the shopping centre between Underwood Street and Princes Highway. Blockages to the entry of the twin culverts at 81 Collins Street is thought to be a contributor;
- Pipe capacity under Railway Street near Memorial Drive contribute to flooding due to the size and tendency to become blocked with debris;
- The channel capacity downstream of Railway Street has been reduced;
- Channel capacity near Colgong Crescent causes inundation to properties in this area. Flooding along Colgong Crescent is made worse from blockages that can occur to the culvert at the Illawarra Railway line;
- Overflow at Pioneer Road Bridge resulting in inundation to properties on both the upstream and downstream sides of the bridge.

Economic Impact of Flooding

A flood damages assessment was carried out for the inundation of residential and commercial properties in the study area. The internal damages assessment was based on estimated floor levels. The assessment identified 475 properties impacted by over floor flooding and 772 properties impacted externally across the Study Area up to the PMF. The annual average damages for residential and commercial/industrial properties was found to be $778,700. This represents the average cost of flooding each year.

Flood Risk Management Measures

This Floodplain Risk Management Study process under the direction of the Floodplain Risk Management Committee has identified and assessed a range of risk management measures that would help mitigate flooding to reduce existing and future flood damages. The options were assessed using a multicriteria analysis, which considered not only flood impacts, but also construction feasibility, economic merits and the alleviation or exacerbation of property damages, risk to life and pressure on the SES.

These measures have been grouped into the following general categories:

Flood modification measures modify the flood's physical behaviour (depth, velocity, etc) by undertaking structural works in particular areas of the floodplain. Among the flood modification options considered are upgrades to the stormwaters lines, and retarding or detention basins.

Property modification measures modify the existing land use or buildings as well as development controls for future development. These measures primarily involve updating policies and regulations which relate to development on the floodplain. Property modification measures including Voluntary Purchase and Voluntary House Raising were assessed, as well as a broad range of planning measures that aim to reduce flood risk to life, to proposed development and to the wider floodplain.

FINAL DRAFT

Response modification measures are aimed at changing and enhancing the community's response to the potential hazards of flooding. This is achieved by educating the property owners and the wider community about flooding, its behaviour and potential damages, so that they can make better informed decisions. The response modification measures considered in this FRMS are generally to 'continue and improve' on current flood emergency management systems and practices including improvements to driver safety.

Recommended Options

The outcomes of the analysis undertaken in this Floodplain Risk Management Study are presented in this report (Table i) and from that information, the Floodplain Risk Management Committee has made recommendations which include property modification (for example, planning controls), flood modification (for example, drainage improvements) and response modification (for example, community education, flood emergency management planning), and are detailed in Table i overleaf. The Final Draft Floodplain Risk Management Study and Plan was placed on public exhibition to allow the broader community and stakeholders to provide feedback on the recommendations. The Floodplain Risk Management Committee considered the submissions received in finalising the Floodplain Risk Management Plan before adoption by Council.

FINAL DRAFT

Table i Draft Floodplain Risk Management Plan

	Option ID (Ref)	Option	Description	Benefits	Concerns	Responsibility	Funding	Cost	B/C Ratio	Priority
Property Modification Options	**PM01 (8.3.1)**	Adoption of Flood Planning Levels (FPL)	Council to adopt the following Flood Planning Levels: • Defined Flood Event + freeboard where the Defined Flood Event has been determined to be the 1% AEP including 0.90 m SLR and 16.9% increase in rainfall. Freeboard is 0.5m Adopt the Flood Planning Level, for sensitive, vulnerable or critical uses: • Probable Maximum Flood Amend LEP Dictionary definition for FPL	FPLs are effective tools to limit property damage to new development and redevelopment.	Developer may consider a FPL onerous. Education can help to mitigate this.	Council	N/A	In house	~1	High
	PM02 (8.3.2)	Adoption of Flood Planning Area (FPA)	The FPL, and other flood related development controls, are applied to properties within the Flood Planning Area (FPA). Adopt associated Flood Planning Area map developed in this FRMS&P, which delineates the FPA. Adopt the Flood Planning Area for residential development as the area defined by the extent of: • Defined Flood Event + Freeboard where the Defined Flood Event has been determined to be the 1% AEP (including envelope of blocked and unblocked scenarios) including 0.9 m SLR (2090) and 16.9% increase in rainfall and Freeboard is 0.5 m Adopt the extent of the Probable Maximum Flood for planning purposes on land with a significant risk to life, sensitive, vulnerable or critical uses, or land with hazardous materials or industry.	The FPA will provide clear guidance on the properties subject to flood related development controls.	A planning proposal may be required to amend the LEP and implement the new FPA definition. Consultation would be required.	Council	N/A	In house	N/A	High
	PM03 (8.3.3)	Provision of Flood Information to Residents via Section 10.7 Planning Certificates.	Increase resolution of flood information to be provided on s10.7(2) and (5) certificates to identify the property's flood hazard, hydraulic category and whether or not flood related development controls apply using high resolution outputs from this study.	The more informed a home owner is, the greater the understanding of their flood risk. During a flood event this information can help prepare residents to evacuate and reduces the number of residents that elect to take shelter in high hazard areas.	Limited - s10.7(2) certificates already contain basic information, Council to provide further detail from current FRMS results. May increase demand on Council staff, however GIS systems can be established to provide this information efficiently.	Council	NA	In house	~1	High
	PM04 (8.3.4)	Managing Development in Flood Prone Areas	Adopt the DFE as the 1% AEP including 0.90 m SLR and 16.9% increase in rainfall for planning related matters. Adopt the Flood Risk Precinct Definition and Mapping as defined by Figure 13 from this study for the purposes of flood related planning controls. Adopt a consistent set of flood related planning controls across the LGA with guidance from the example matrix and controls from this study. Adopt Major/Minor Overland Flow definition and mapping as defined by Figure 5 from this study. Adopt a set of flood related planning controls for areas of Overland Flow as defined by this study and recommended as part of this study. Consider Flood Risk Precincts and Flood Emergency Response Classifications in land use planning decisions.	Ensure developments are designed, constructed and managed in such a way as to minimise flood risk to the structure and (if relevant) its occupants, in addition to minimising the impacts of flooding.	There may be resistance from developers who consider new controls to be onerous or likely to reduce the development yield.	Council	Council	In house	N/A	High

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	Option ID (Ref)	Option	Description	Benefits	Concerns	Responsibility	Funding	Cost	B/C Ratio	Priority
	PM05 (8.3.5)	Voluntary House Raising	Undertake a feasibility investigation for the 11 identified properties (including to confirm structural compatibility of the identified buildings, owner interest and a more accurate cost estimate of raising to at least the DFE + 0.5 m flood level), and if found viable, prepare the documentation for funding applications.	Seeks to reduce the frequency of exposure to flood damage of the house and its contents by raising the house above the Flood Planning Level (FPL), resulting in a reduction in the frequency of household disruption and associated trauma and anxiety.	External flood risk remains, and evacuation is required before inundation in cases where the property becomes isolated. Community appetite may be a challenge. VHR schemes are long term options and may take approximately a decade to implement.	Council/ Landholder	Landholder may be eligible for NSW Government funding assistance	Approximately $100,000 (Dependent on quotes) Feasibility investigation $50,000	1.15 – 2.63	High (Feasibility Study)
	PM06 (8.3.6)	Voluntary Purchase	Undertake further investigation to determine inclusion of the additional 11 properties in the ongoing VP scheme, including consultation with the identified properties, prioritisation and if appropriate, prepare the documentation for funding applications. Combine with CM01.	Voluntary Purchase (VP) schemes are a long-term option to remove residential properties from areas of high flood hazard.	Community appetite for or acceptance of VP may be a challenge. VP schemes are long term options and may take approximately a decade to implement.	Council	Council may be eligible for NSW Government funding assistance	Dependent on property purchase price Further Investigation $50,000	N/A	High (Further Investigation)
	PM07 (8.3.7)	Flood Proofing/Flood Resilient Buildings	Allow flood proofing within Council's DCP enabling new and existing buildings to be developed with due consideration given to their flood risk and minimisation of internal flood damages and recovery time.	Flood proofing reduces damage and recovery costs and time following flood events.	Retrofitting to existing buildings can have challenges.	Council/Landholder	Council/ Landholder	Varies	N/A	High
Response Modification Options	**RM01 (8.4.1)**	Amend Local Flood Plans with Flood Information Derived from this Study	Develop local flood plans and operational plans to include information on flood risk due to overland flow, drawing on modelling and information provided in this FRMS&P	Detailed information will allow for better management and recovery of overland flow flood risk and will increase understanding of the different levels and types of risk present in the study area.	Modelled results should be used as a guide only, as real flood behaviour may vary from modelled design results.	SES	SES	$15,000	N/A	High
Response Modification Options	**RM02 (8.4.2)**	Facilitation of Communication with Emergency Services and Response Agencies	Ongoing facilitation of communication between Council and emergency service agencies. Improvements to volunteer coordination. Identify vulnerable occupants.	Improved understanding of roles and responsibilities for more effective, efficient, and safe actions during and following flood events.	Challenges include change of personnel, difficulty in organising meetings and exercises between flood events.	All response agencies, including but not limited to the SES, Council, RFS, Fire and Rescue, and community organisations.	May be eligible for NSW Government funding assistance	Minimal - In house	N/A	High
Response Modification Options	**RM03 (8.4.3)**	Improve Community Flood Education and Awareness	Council to implement a flood education program to improve ongoing flood awareness in study area using a range of approaches and engagement strategies.	Flood awareness significantly improves preparedness for and recovery from flood events, building a more flood resilient community.	Ongoing efforts to ensure information is not forgotten. Potential for residents to become bored or complacent with messaging.	Council in collaboration with other response agencies and community organisations.	May be eligible for NSW Government funding assistance	Annual Budget to be determined and allocated.	~1	High
Response Modification Options	**RM04 (8.4.4)**	Flood Warning Improvements	Utilise Severe Weather Warnings from the BOM to prepare for potential flash flooding events, look at utilising innovative gauge technologies following review of the Fairy Creek pilot program, couple with community awareness campaigns and utilise information from the FRMS&P to understand the consequences of the warning (SES and Council).	Improve current system understanding by using outputs from the FRMS&P to inform interpretation. Potentially to increase warning time of possible event for the community.	May not be possible to significantly increase warning time in overland catchments due to short catchment response time. Communication needs to be at the correct level to avoid false alarms and complacency.	Council, SES	May be eligible for NSW Government funding assistance	$250,000 Upfront $40,000 ongoing	N/A	Medium
Flood Modification Options	**CM01 (8.5.4.1)**	Conversion of Existing Building into Overland Flow Path as part of voluntary purchase scheme	Purchase and removal of building on Princes Highway to create overland flow path between Bertram Lane and Princes Highway	Improved flood behaviour between Princes Highway and Bertram Laned including reduced flood levels and decreased time of inundation, improve property damages, reinstates an overland flow path from Collins Street to the Princess Highway, increases the pedestrian accessibility throughout the precinct	Option occurs partially on private properties, flood level would increase east of the property, minor flood level increases downstream, land acquisition, potentially complex design and construction process, potential public safety concern during events, private ownership of a portion of the proposed site, not economically viable from a flood risk management perspective.	Council	May be eligible for NSW Government funding assistance	$2,720,000	0.26 – 0.52	Additional
Flood Modification Options	**CM02 (8.5.4.2)**	Towradgi Creek Entrance	Review Entrance Management Policy to determine if trigger levels can be adjusted.	A potential change to trigger levels can improve effectiveness of entrance management.	Trigger level performance under future climate conditions needs to be considered. Community education around the changes and impacts will be required.	Council	May be eligible for NSW Government funding assistance	$70,000 (Review of Entrance Management Policy)	0.1	Medium

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	Option ID (Ref)	Option	Description	Benefits	Concerns	Responsibility	Funding	Cost	B/C Ratio	Priority
	CM03 (8.5.4.3)	Pioneer Road Regrading	Regrading a 200 m stretch of Pioneer Road to remove low spot. Includes excavation of 300m^3 – Undertake in conjunction with other road or drainage works in the area.	Improved flood behaviour on Pioneer Road and Lake Parade, improved property damages, opportunity for works to be incorporated into existing road maintenance	Existing services, design needs to tie into existing driveways, temporary road closure required during construction, not economically viable.	Council	May be eligible for NSW Government funding assistance	$530,000	0.56	Additional
	DM06 (8.5.5.6)	Upgrade Structure Under Lake Parade at Parker Creek	The current pipes are replaced with a single box culvert 6 m by 2 m, alternatively, the current pipes are replaced with a bridge and the road is raised. – Undertake in conjunction with other road or drainage works in the area.	Increases the conveyance under the road and reduces the backwatering along Parker Creek, flood levels lowered north of Lake Parade for frequent events, increase road safety during frequent storm events for an important access road (Corrimal Beach tourist park), water quality may be improved. Alternative evacuation access to Murray Road	Road access must be maintained during roadworks, significant structure cost, not economically viable.	Council	May be eligible for NSW Government funding assistance	$420,000 - $750,000	0.48 – 0.77	Additional
	VM (8.5.6.1)	Vegetation Management	Continuation of existing and extension of Council's vegetation management program to maintain native vegetation, bank stability and weed removal.	The current vegetation management practices have been shown to be reducing flood levels by between 0.1 – 0.3 m at various locations throughout the catchment.	Community may perceive that current works are insufficient. Education required to communicate the importance of vegetation to bank stability, and that further removal of riparian vegetation would not achieve significant reductions in flood levels, may cause erosion and sedimentation and require artificial bank stabilisation or reducing the bank slope.	Council	May be eligible for NSW Government funding assistance	$40,000 - $60,000	<<1.0	High
	DCM (8.5.6.2)	Debris Control Measures	Consider the installation of debris control measures at locations identified to be sensitive to blockage.	Flood levels at the identified locations can potentially increase by up to 2.5 m if blockage is not appropriately managed.	Management of blockage requires catchment wide approach to reduce potential debris load. Structures may still become blocked.	Council	May be eligible for NSW Government funding assistance	From $370,000	0.01 – 2.15	High

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OUR WOLLONGONG JOIN THE CONVERSATION

wollongong
city of innovation

Managing Flood Risk in the Towradgi Creek Catchment

Draft Floodplain Risk Management Study & Plan

Engagement Report

November 2022

Table of Contents

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

As part of our commitment to managing flood and stormwater risks in our region, we're working on a review of the Towradgi Creek Floodplain Risk Management Study and Plan (FRMSP). We shared the preliminary options recommended for flood mitigation and draft reports with the community and key stakeholders and sought their input.

Engagement details

Engagement with Aboriginal stakeholders ran from 23 August to 21 November 2022. Broader community engagement ran from 24 October to 21 November. We sent letters, Frequently Asked Questions (FAQ), a map and a survey to more than 2,800 residents and owners of properties identified as flood affected. They were invited to learn more and join the conversation. We sent the information to Neighbourhood Forum 4, participants in previous Towradgi Creek catchment flood engagements and other stakeholders including State Government agencies, schools and business and industry bodies. We published a project webpage on our.wollongong.nsw.gov.au, which included the draft FRMSP reports, a map showing the location of the preliminary options, FAQ, an online survey and Q&A forum. We issued a media release and published a notice in the Illawarra Mercury Community Update. We held meetings with Aboriginal stakeholders and a drop-in community information session at Towradgi Surf Club. People could also access the information from Council's Customer Service Centre, and Wollongong and Corrimal Libraries.

Engagement participation

We invited feedback on the draft FRMSP and received 48 submissions, including 12 via the online survey, five emails, one letter, 29 hardcopy surveys and one provided feedback on a map. Some provided photos with their submisisons. We had conversations with 48 attendees at the community information session and three Aboriginal Traditional Custodians and knowledge holders. One person submitted a question to the online Q&A and the project webpage had 309 unique views.

What we heard

Survey

Most feedback was provided via the survey (41 submissions). Most respondents have lived, worked or visited in the catchment for more than 21 years. The most common response people said they would have to a major flood in the area, is to remain at their house.

During a flood event, respondents they would most commonly seek information about predicted flood levels, followed by evacuation notices and road closures. The places they would seek this information from were mainly radio or TV, however Council's website, word of mouth and social media were also common responses.

Repondents were asked to indicate their level of support for the options for managing flood risk in the Towradgi Creek Catchment. Most were either strongly supportive or somewhat supportive of each option. Several object to widening the Towradgi Lagoon entrance, building an overland flow path in Corrimal town centre and voluntary purchase of the worst flood-affected residential properties at market value.

Respondents were also asked if they had other suggestions for managing flood risk in the catchment. Some requested creek, vegetation or infrastructure maintenance or made suggestions for works they believe will help, such as weed, silt and debris removal. There were requests to do more regular maintenance.

Some had concerns relating to over density and development near creeks. There were calls to have strict controls to ensure developments don't increase surface runoff or have negative impacts downstream. Several referenced the Corrimal Coke Works development, calling for it to be stopped, scaled down or have strict sediment controls to prevent run-off and sediment increasing flood risks.

Some respondents requested stormwater infrastructure or maintenance to help improve drainage on Pioneer Road on the south side of Blue Divers Bridge.

Several provided photos or video with their submissions, to share their observations and experiences of flooding. All originals have been provided to the project team for assessment.

Meetings with Aboriginal stakeholders
The three Aboriginal Traditional Custodians and knowledge holders we spoke to indicated there are sites and artefacts, or high potential for these, near the location of some of the recommended measures. They requested to have site officers survey areas of proposed works that are in close proximity to the creek and to have them monitor sites during construction. Questions and concerns were raised about access, safety and site disturbance impacts of the measures.

Open submissions
We received seven open, written submissions from local resident/s and property owners, an operator of an electrical distribution network and a government organisation that supplies water. Lengthy and/or technical submissions were provided in full to the team working on the FRMSP. The main points raised in these submissions included requests for:

- Installation of new stormwater structures or works to reduce flood impacts.
- Additional/alternative measures to those proposed.
- Creek maintenance or repairs to surrounding infrastructure.

The representative of the electrical distribution network operator provided advice regarding their flood response plan and impacts of floods on the network.

Information session
Forty-eight people attended the information session at Towradgi Surf Club. People suggested additional or alternative measures to reduce flood impacts. They also noted their observations of flooding and flood impacts in these areas.

Social media
The commentary was about creeks between Wollongong and Stanwell Park needing flood management and regular checking for blocked culverts and pipes to maintain maximum water flow during excessive rainfall.

Next steps

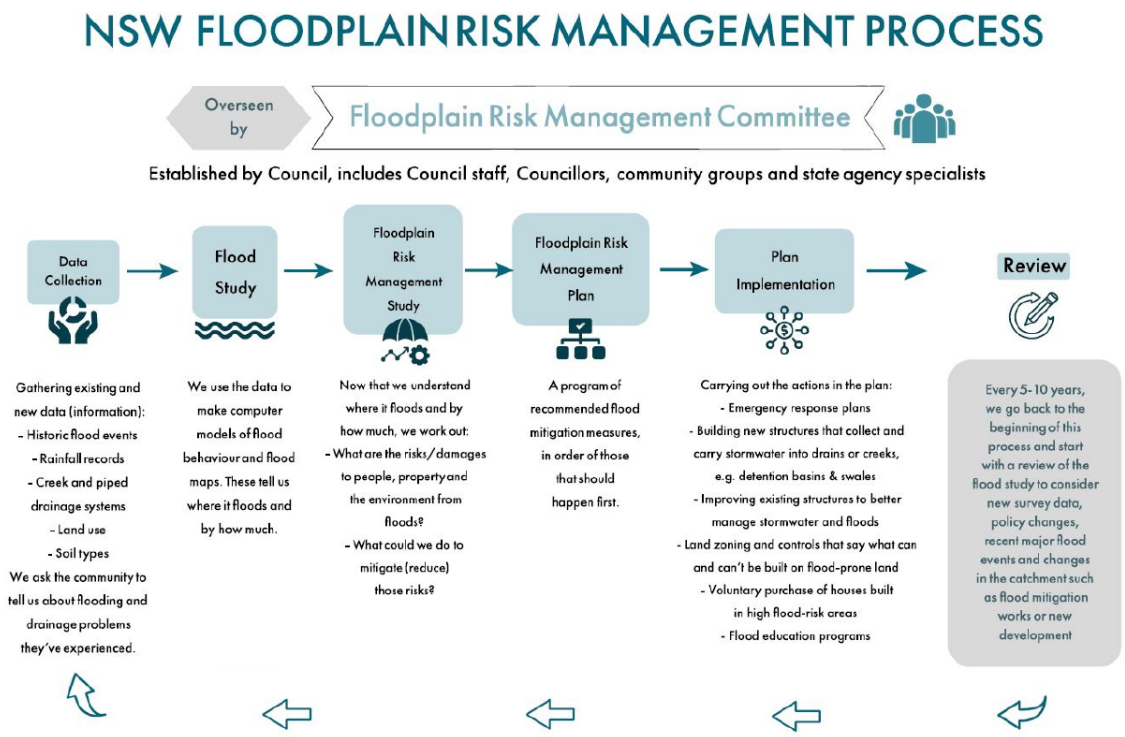
We will use this feedback to inform any required revisions to the draft Floodplain Risk Management Study and Plan. These are preliminary discussions about the recommended options. They will each require further investigation, consultation and approvals before going ahead. We will continue sharing information with the community and key stakeholders and seek input as we progress.

Background

As part of our commitment to managing flood and stormwater risks in our region, we're working on a review of the Towradgi Creek Floodplain Risk Management Study and Plan (FRMSP). These reports identify flooding "hotspots" and explain what the risks and damages from floods in these areas might be. The risks and damages can be to people, property and the environment. The reports present potential options for ways we could reduce those risks. Examples of these measures include:

- Emergency response plans.
- Building new or improving existing structures that collect and carry stormwater into drains or creeks, e.g. detention basins or culverts.
- Land zoning and development controls that guide what can and can't be built on flood-prone land.
- Voluntary purchase of houses built in areas of high flood-risk.
- Flood education programs.

We consider changes to flood risk as a result of these strategies and under future conditions, e.g. climate change and future development. The report includes recommendations for strategies to reduce flood risk.



Flood study reviews and previous engagement

Flood studies describe flood behaviour and identify areas that are flood prone. We use computer flood models to estimate where it might flood, and by how much. These studies are used to inform land use planning, planning certificates and for the development of the floodplain risk management studies. The community has provided valuable input to previous flood investigations within the Towradgi Creek catchment, with the most recent inputs provided in 2019 as part of the flood study review. The community provided accounts of their observations of flooding and feedback on the

flood mapping through online surveys and at community drop-in sessions. The flood models were updated as a result. The Towradgi Creek Flood Study (2019) was updated and finalised following the public exhibition. The reports was adopted by Council at its meeting on 9 December 2019. As part of our review of the 2003 FRMS&P for the Towradgi Creek catchment, we are building on the outcomes of the revised flood study (2019).

- 7.3km2 study area
- Includes North and South Angels Creeks, North and South Corrimal Creeks, Carr and Parker Creeks
- Suburbs of Corrimal, Towradgi, Tarrawanna
- Residential, commercial and open space land uses
- Towradgi discharges to Corrimal Beach

The Northern Area Combined Floodplain Risk Management Committee assists Council in developing and implementing FRMSP for northern-area catchments. Members of this advisory group include Councillors, specialist Council staff, various state agency representatives and members of the local community.

Stakeholders

Stakeholders identified prior to the start of the engagement period included:

- Participants in previous engagements
- Northern Floodplain Committee
- NSW Department of Planning and Environment
- Lord Mayor & Councillors
- NSW SES Southeastern Zone
- Transport for NSW
- Emergency Services
- Sydney Water
- Endeavour Energy
- Development industry
- Flood-affected residents, ratepayers and businesses
- Register of Interest - Flood
- Neighbourhood Forum 4
- Aboriginal stakeholders
- Schools
- General community

Methods

Methods	Details of Methods
Communication Methods	
Email to key stakeholders	An email with the map, FAQ and link to the project webpage was sent to key stakeholders identified through an analysis process. This included an email to 1,212 registered participants on Our Wollongong; the Register of Interest (Flood) and those in the catchment area.
Letter	A letter about the public exhibition and how to submit feedback (via phone, email, online or in person) was delivered to more than 2,800 residents, businesses and property owners identified as either living on, working on, or owning flood-affected land. It included a copy of the FAQ, map and survey.
Frequently Asked Questions (FAQ)	Responses to common questions about the draft FRMSP were distributed with the letter and emails, and published on the project webpage.
Draft FRMSP reports	The draft FRMSP reports, which included information about the recommended options, we published on the website and hardcopies were available to view at the information session.
Draft map	A map was produced showing the FRMSP study area and location of the recommended options for managing flood risk in the catchment.
Aboriginal stakeholder meetings	Aboriginal stakeholders were emailed the information. All were invited to attend a meeting with a flood engineer working on the project to learn more and have their questions answered.
Our Wollongong website	The project webpage hosted background information and supporting documents: • Frequently Asked Questions • Draft FRMSP reports • Map of the catchment study area and location of the recommended options • Q&A forum • Online survey
Wollongong City Council website	Event listings promoting the information session were published on Council's website and corporate calendar.
Information session	A drop-in information session was held at Towradgi Surf Club on Wednesday 2 November 3:30pm – 6:30pm, where we displayed: • Draft FRMSP reports • Comparison between ARR2019 and ARR1987 • Design flood extent map B1 - 1% and 5% Probable Maximum Flood • Flood risk precincts • First event flooded above floor • Map showing location of the recommended options • Impact mapping
Illawarra Mercury Community Update	A notice appeared on the Council page in the 2 November edition of The Illawarra Mercury to promote the engagement.

Engagement Methods	
Our Wollongong website	• An online survey was used to capture participants' comments • An online Q&A forum was provided for participants to ask questions about the draft FRMSP.
Aboriginal stakeholder meetings	Stakeholders shared feedback with Council staff at the meetings.
Information session	The flood engineers working on this project attended to answer people's questions. A summary of open feedback and actions was noted.
Email	People emailed in open written submissions and completed hardcopy surveys.
Post	People posted in open written submissions and completed hardcopy surveys.

Results

All stakeholders and the wider community were invited to provide feedback on the draft Towradgi Creek Floodplain Risk Management Study and Plan.

Two community members posted a link to the engagement webpage in a local Facebook group with 7.1K members, on 27 October and 2 November. They received 11 likes, one share and three comments.

Engagement Participation

This section provides details on the participation in engagement activities and feedback received during the exhibition period. Details of the number of participants for each engagement activity are presented in Table 2.

Table 2: Participation in Engagement

Engagement Activities	Participation
Emails (some respondents submitted both an email and hardcopy survey)	5
Letters	1
Feedback provided on a map	1
Aboriginal stakeholder meetings	3
Information session	48
Hardcopy surveys	29
Online Participation	
Aware – Total number of unique visitors who viewed the project webpage.	309
Informed – Total number of people who clicked a hyperlink, e.g., to download the maps or draft reports.	145
Engaged – Total number of people who actively contributed to the project, e.g., by submitting comments via the survey or asking a question in the Q&A	13

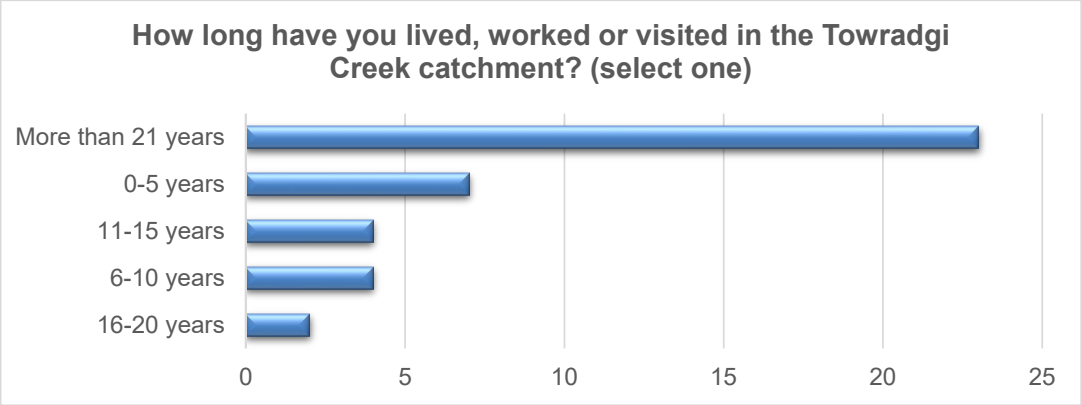
Submission results

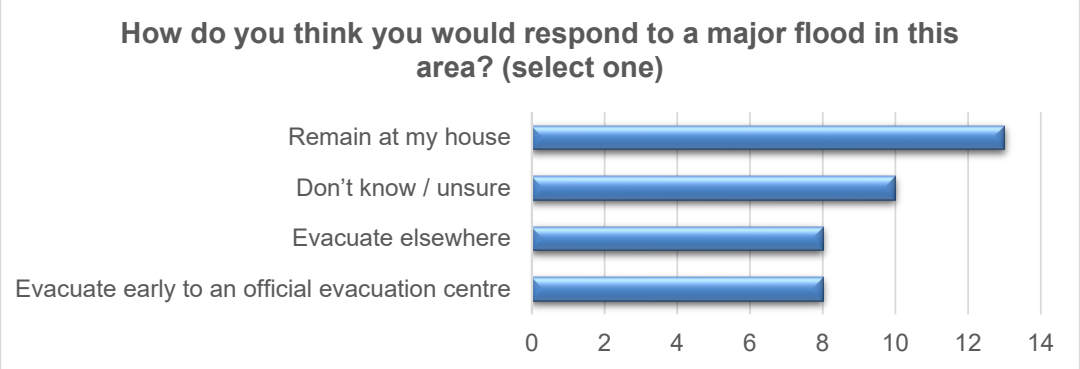
We received 48 submissions and had conversations with 51 people. Representatives from the following organisations made either an open submission or submitted responses via the survey:

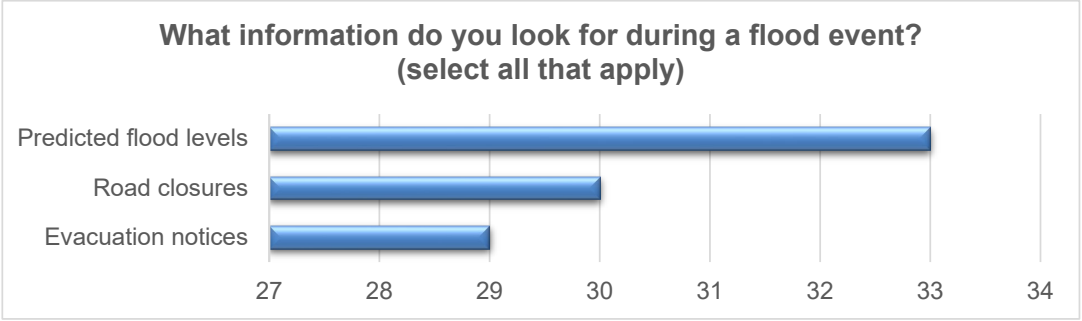
- Aboriginal Traditional Custodians and knowledge holders
- An operator of an electrical distribution network
- A government organisation that supplies water

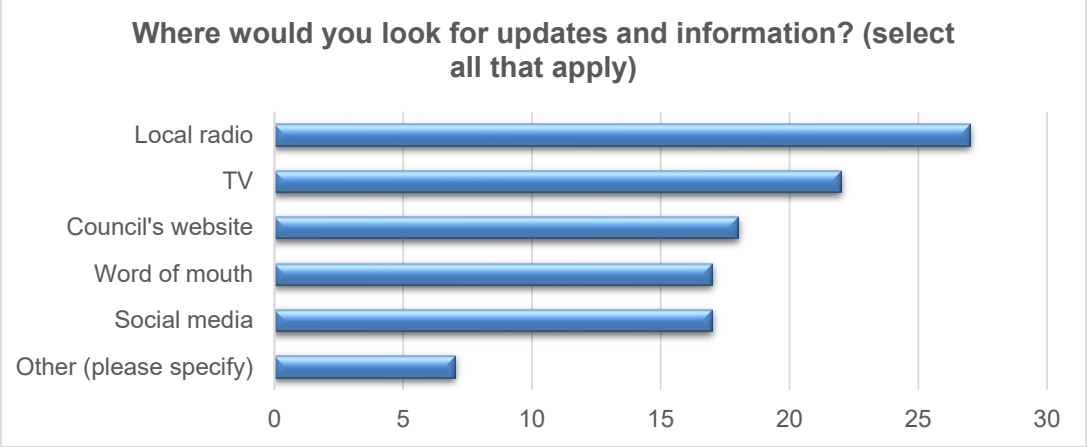
Online and Hardcopy Survey Feedback

We received online and hardcopy surveys. Some were only partially completed, with either some of the questions skipped or only partially completed. Following is a summary of the feedback we received via the survey.





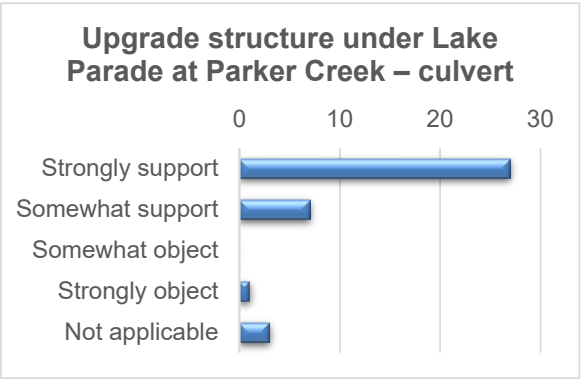


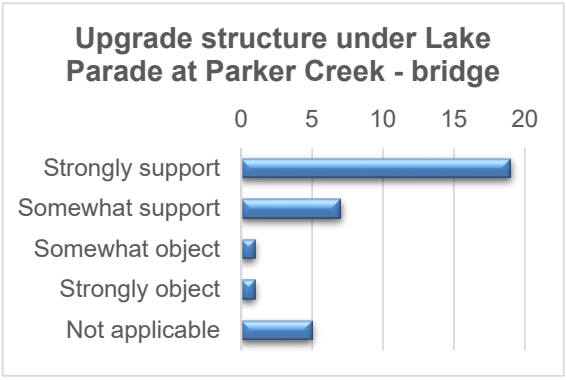


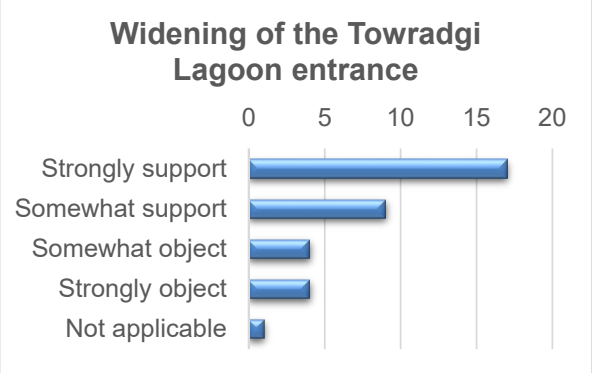
Other places respondents said they would look for updates and information included:

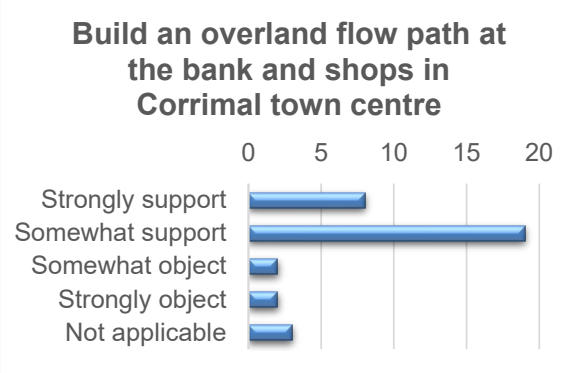
- Local knowledge
- Text message
- NSW SES
- Bureau of Meteorology / weather bureau
- Other related websites
- Media or newspaper in the lead up to the event
- Community centres

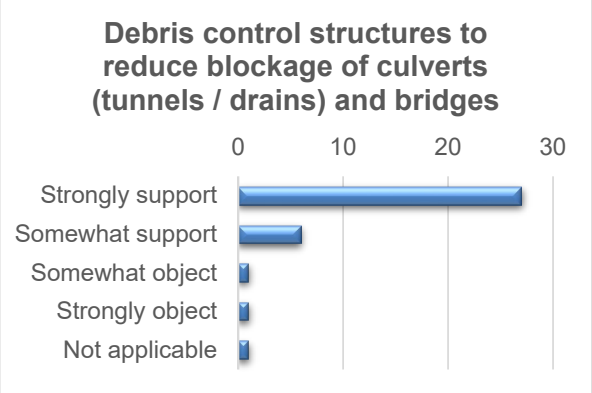
Respondents were asked to indicate their level of support for the following options for managing flood risk in the Towradgi Creek Catchment. Most were either strongly supportive or somewhat supportive of each option. Several object to widening the Towradgi Lagoon entrance, building an overland flow path in Corrimal town centre and voluntary purchase of the worst flood-affected residential properties at market value.

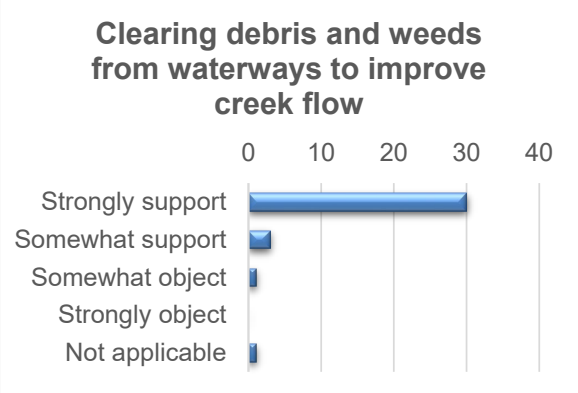


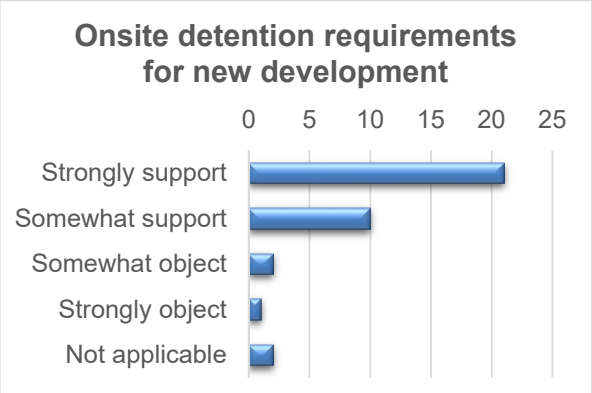


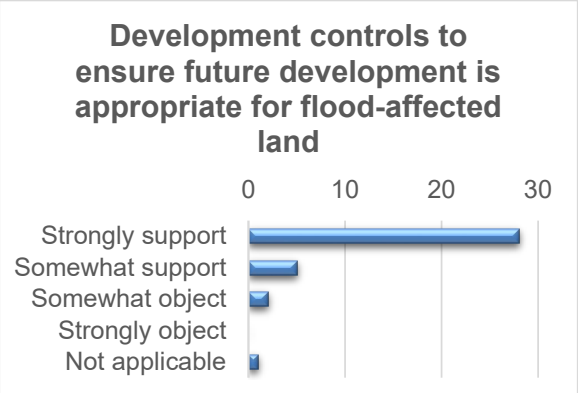

Widening of the Towradgi Lagoon entrance
0
5
10
15
20
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable

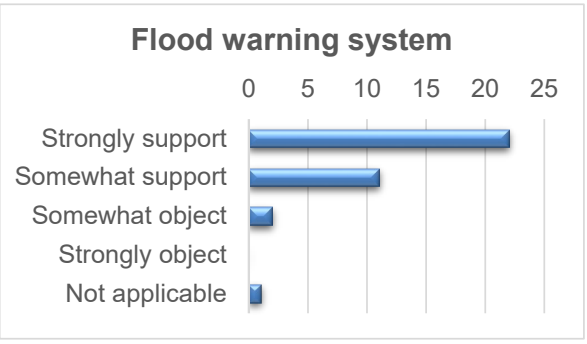

Build an overland flow path at the bank and shops in Corrimal town centre
0
5
10
15
20
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable

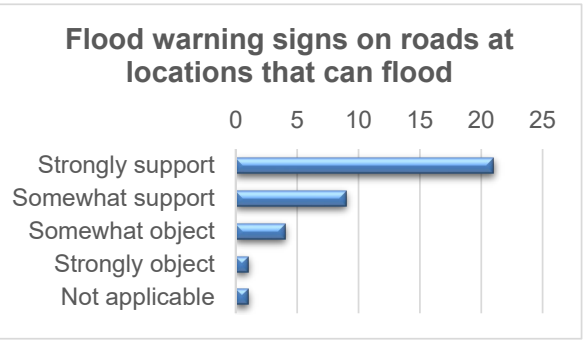

Debris control structures to reduce blockage of culverts (tunnels / drains) and bridges
0
10
20
30
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable

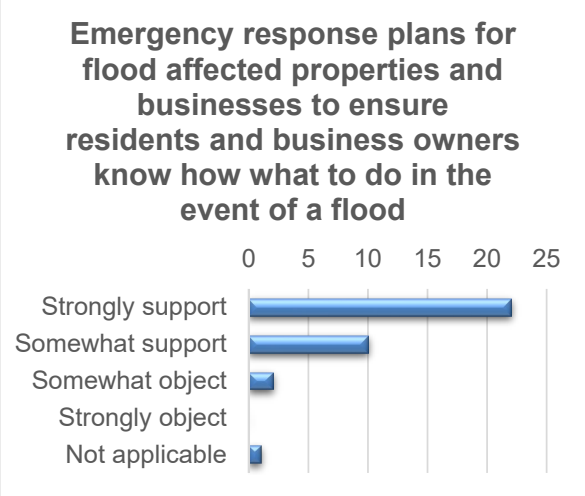

Clearing debris and weeds from waterways to improve creek flow
0
10
20
30
40
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable

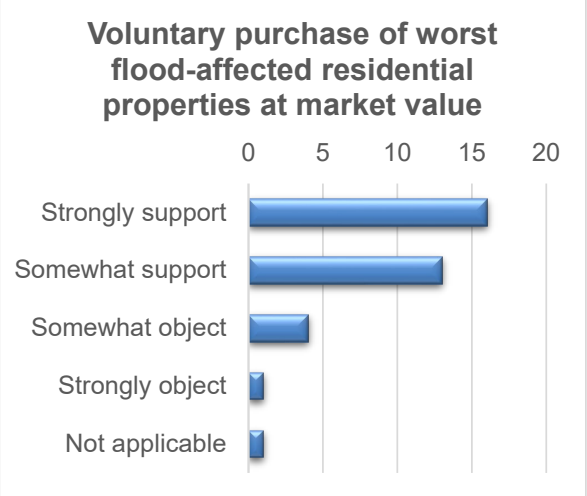

Onsite detention requirements for new development
0
5
10
15
20
25
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable


Development controls to ensure future development is appropriate for flood-affected land
0
10
20
30
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable


Flood warning system
0
5
10
15
20
25
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable


Flood warning signs on roads at locations that can flood
0
5
10
15
20
25
Strongly support
Somewhat support
Somewhat object
Strongly object
Not applicable





Respondents were asked if they had other suggestions for managing flood risk in the catchment. These are summarised as follows:

Creek and vegetation maintenance
Some respondents requested creek and vegetation maintenance or made suggestions for works they believe will help:

- Prevent silt and weed accumulation by removal on as-needs basis.
- Clean up the creek in Tarrawanna. There is a perception this is increasing flood impacts.
- Clear all weeds, trees and bushes at the rear properties on Lake Parade, near the Lagoon entrance. A resident has observed an increasing build-up of sand and weeds in the area over the last 5 years.
- Clear rubbish, fallen trees and overgrowth around Blue Divers Bridge and the small creeks entering the main creek.
- Clean out creeks and vegetate with appropriate local native plants.
- Reinforce creek banks that back onto houses to prevent erosion.

One respondent doesn't believe widening of the Towradgi Creek entrance will help, as "the entrance moves widely and characteristically when the tides change".

Development and planning controls
Some respondents had concerns relating to over density and development near creeks. There is a view these create vast hard surfaces that increase flood impacts. There were calls to have strict development controls to ensure no negative impacts downstream, especially in the tidal flow areas of the creek. It was suggested to increase the green areas in all developments and have more parks for natural water absorption rather than funnelling and flooding.

Construction of the Daintree Villa complex next to the creek in Tarrawanna was criticised, with a view this has negatively impacted elderly, vulnerable residents as it is expensive to fix the issues caused by flooding at this site.

Several referenced the Corrimal Coke Works development, calling for it to be stopped, scaled down or have strict sediment controls to prevent run-off and sediment increasing flood risks.

Suggestions were made to:

- Not allow sheet metal fences to back onto creeks, as the panels get dislodged in flood events and block pipes and culverts.
- Change the LEP so developments can't fully pave lots and increase surface runoff.

> OSDs help in the short term, but get full of sediment and become less effective after a while. Permeable pavements or larger landscape areas may be a solution. If densification of the city is the primary objective of Council's planning controls, then increase height limits to overcome the loss of developable space by increasing green space.

There is a view the mountain bike trails in the escarpment, land clearing, heavy machinery for constructing the trails and increased human activity is contributing to the acceleration of erosion and siltation, thereby reducing the flow capacity of waterways. It was requested that Council look into this. An offer was made to take engineers working on the FRMSP on a tour of the area to show where and what the perceived issues are.

> Water flows through the escarpment and connects to the flood zone via streams and creeks. The fragile and steep soils are protected from excessive erosion by leaf litter and plant life which mountain bike riders rake aside or remove. With nothing to slow heavy rain, the trails quickly become eroded. New parallel trails are then created, escalating the damage. Hundreds of tonnes of disturbed soils, rocks and mud are washed down, clogging up the streams and creeks. This in turn reduces the flow capacity, increasing flood levels and urban damage.

Stormwater infrastructure
Some respondents made suggestions for stormwater infrastructure or repairs/maintenance they believe would help reduce flood impacts:

- Prevent silt and weed accumulation by putting in concrete box drains for problematic areas.
- Improve drainage on Pioneer Road on the south side of Blue Divers Bridge.
- Install a lead out / vein / gutter / groove / ditch from the entranceway into the parkland on the south-eastern side of Blue Divers Creek. "It needs to run on an angle from the driveway point through the bush bank to the creek. This will alleviate water over the road and allow the natural water flow to be back to its historical flow and direction".

Flood modelling
One respondent queried whether their property was as flood-affected as modelling suggests, and requested a review to consider additional factors.

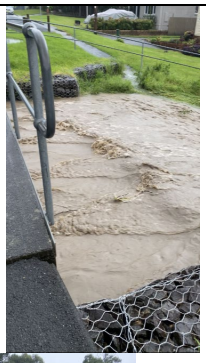
Another suggested making computer models of flood risks and supporting data available online (open source) so that "competent, interested people could possibly contribute to improving them". They noted this could be constrained by property insurance and liability considerations.

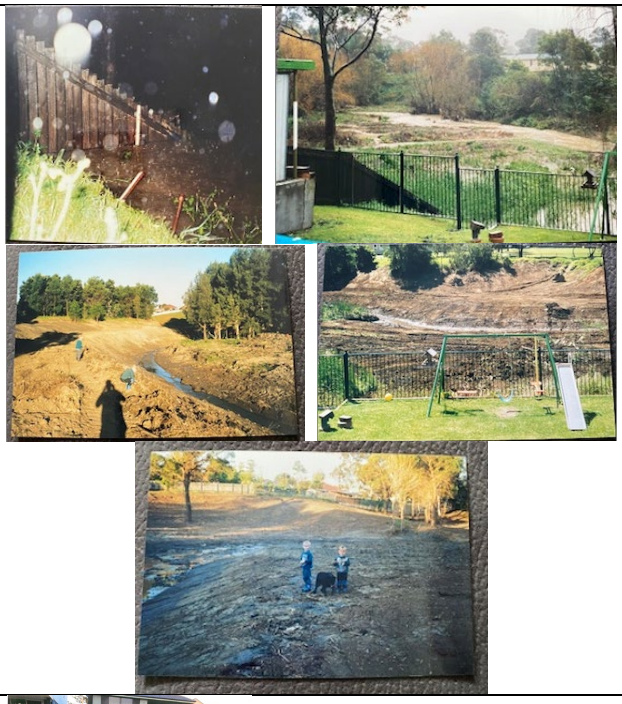
Other feedback
It was suggested that the relatively inexpensive flood warning measures in the Plan be implemented

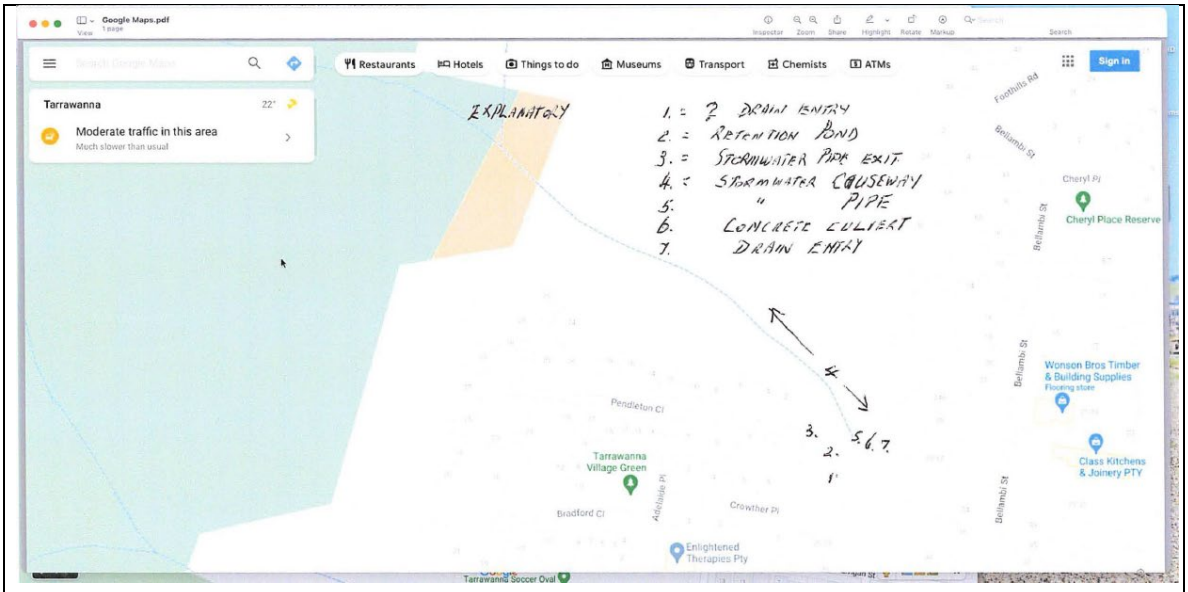
within the next six months and other measures be implemented within three years, with priorities based on benefit/cost ratios.

Another respondent didn't have any suggestions, but said they appreciate the review by Council of these issues.

Photos and video accompanying submissions
All originals have been provided to the project team for assessment.

Photo	Location and/or comment
	Flooding at Blue Divers Bridge Towradgi on 26 March 2022 "caused by having only one drain on the east side of the street not coping. The raising of the bank on the side of the creek creates a dam effect, forcing the water to flow in the opposite direction of the creek flooding my property and the road." This respondent also submitted a video which has been provided to the project team for consideration.
  	Please clean up the creek in Tarrawanna.

	In the late 1990s [I think] there was a flood. Someone decided on the works seen in the photos. 1998 flood and subsequent 'works' - view from 42 Caldwell Ave
	• Respondent is unsure who owns the land this easement with the stormwater outlet is located on – said they were unable to find out from Council or NSW Government when they enquired. • Respondent said they did works near the outlet to prevent people (children) falling into the ditch and getting injured. • Respondent took the drone shots of the lagoon near Lake Parade. • They requested that Council clear the vegetation and silt build up in this location. • Said Council used to maintain this area but stopped approximately two to three years ago. Respondent said they have been sharing the responsibility for mowing the grass with neighbouring residents. • Suggested putting in another channel through the vegetated area.



Location and/or comment:
Stormwater drains in the vacant land at the bottom of Crowther Place Tarrawanna. Request for Council to determine whether the drain entrances are fully functionable and without impediment, with surrounding areas cleared so the drain entries are easily visible.

Aboriginal stakeholder meetings

The three Aboriginal Traditional Custodians and knowledge holders we spoke to indicated there are sites and artefacts, or high potential for these, near the location of some of the recommended measures. They requested to have site officers survey areas of proposed works that are in close proximity to the creek and to have them monitor sites during construction.

A question was asked about what happens to the footpath/access if a bridge is built (DM06, upgrade stormwater pipes under Lake Parade at Parker Creek). Council staff confirmed access would remain. It was shared that the area near Parker Creek has a cultural food source. A concern was raised regarding child safety if children play near the proposed stormwater structure. It was suggested to have some sort of safety guard to prevent children getting pulled in if water is gushing under the bridge.

Concern was raised about how deep the debris control structures go into the ground. It was requested to look at installing structures that get screwed in so there is less site disturbance.

There may also be a possible cultural layer where the overland flow path is proposed to go, even though the site has already been disturbed.

Open submissions

We received seven open, written submissions from:

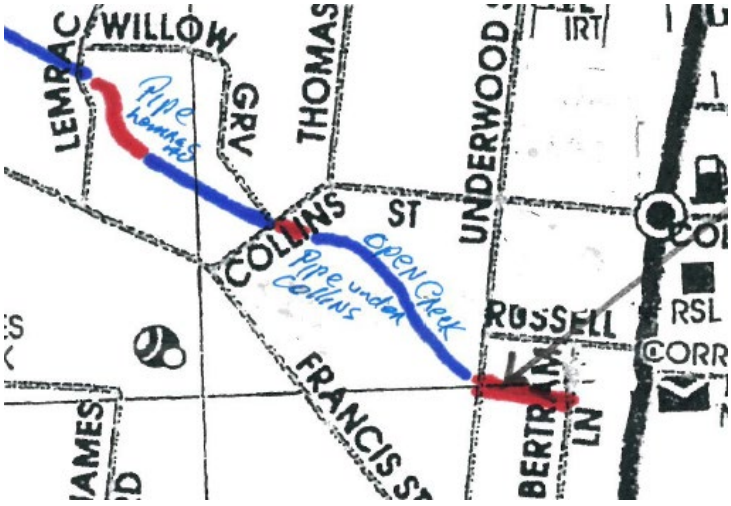
- Local resident/s and property owners
- An operator of an electrical distribution network
- A government organisation that supplies water

Lengthy and/or technical submissions were provided in full to the team working on the FRMSP. Following is a summary of the key points raised in these submissions.

There were requests for alternative measures to those proposed and new infrastructure or works to help reduce flood impacts:

- A debris control structure to be installed upstream of Blue Divers Bridge (Pioneer Rd) to stop the debris build up at the bridge that occurs at present.
- Assess the capacity of the drainage pipe system to determine if system is surcharging. If so, at what point and what intensity.
- Formalise pathway Ziems Ave to Ziems Park with a ducted causeway and shared pathway, designed as a major flood route.
- Put in a cycleway from the highway at Fernhill to the cycleway at Towradgi Park along the creek. It would run under the rail line and Memorial Drive, connect to the cycleway proposed in the Coke Works site and act as a major flood route.
- Increase the volume of stormwater into the South Corrimal Arm with one of these options:
    - Redirect stormwater from the Corrimal North Creek Arm into Corrimal South Creek Arm at Collins St to the open channel behind the Bowling Club.
    - Have a surge pit in Underwood Street to have floodwaters run down Underwood St to Tarrawanna Rd as a major flood route.
- DMO6 (proposed replacement of pipes at Lake Parade):
    - Provide an evacuation point through the northern end of the Corrimal camping area onto Murray Road to allow for exit from the area to the east under flood conditions.
    - Lower the road height to accommodate the causeway height and lengthen the dip level.
    - Provide flood height indicators.
- CM03 (Pioneer Rd regrading):
    - Instead of regrading, reinstate the dished gutter across the Lake Parade intersection.
    - Reset the traffic island further back into Lake Parade so the flow of water down Pioneer Rd is not hindered.
    - Install larger drainage inlets near August St to direct water to Towradgi Creek.
- CM01 (overland flow path at the bank and shops in Corrimal town centre):
    - Instead, install 2 additional pipes from Bertram Lane to the open drain in the park.
    - Lower the ground level of the playing field in the park to act as a floodplain.
    - Develop and implement a maintenance strategy to reduce build-up of silt in the ducts under Memorial Drive and debris caught in the debris trap.

In relation to measure CM01, one respondent said a 2m concrete stormwater pipe was installed under the new Aldi building (drawn in red on the following map) but is not connected to the creek or any further than Bertram Lane.



They said there are three concrete pipes under the new Aldi building to the original network which pick up the creek on the western side of Underwood Street between numbers. Their view is that for the water to flow from Bertram Lane, it would have to overflow the creek across Underwood Street then flow down Russell Street missing Bertram Lane because of levels and run down the highway to the park, or if there was enough water, it could flow between Aldi and the doctors' offices on Underwood, then Bertram, and then cross the highway at the park. This map accompanied their comments:

It was suggested to excavate two existing vacant blocks on Lemrac Avenue down to creek level, leaving the bank at a slope that the grass could be mowed. It was also suggested to buy additional properties in this location and on Willow Grove and do the same type of excavation. This is to create flood pathways and a temporary stormwater holding pond so the proposed overflow in Corrimal town centre would not be needed.

There were several requests for creek and infrastructure maintenance or repairs, including:

- Removal of silt, debris and grass build-up from Bellambi, Parker and Towradgi Creeks.
- Ongoing (yearly) maintenance to remove debris and trees from Towradgi and Parker Creeks.
- Removal of numerous fallen trees on either side of Blue Divers Bridge.
- Repair of existing gabion baskets downstream of bike track bridge (Corrimal Beach) to prevent children from cutting themselves on them.

- Repair/maintenance of concrete on the bike track bridge.
- Removal of mangroves in Bellambi Lagoon, to stop them spreading and increasing flood risk.

Waiting for the community to complain is not satisfactory management / maintenance of these structures.

There is a perception that there is no schedule for regular maintenance of drainage paths or standard within which acceptable conditions are managed. It was requested to include infrastructure maintenance in the “Structures” section of “Flood Risk Management Measures”.

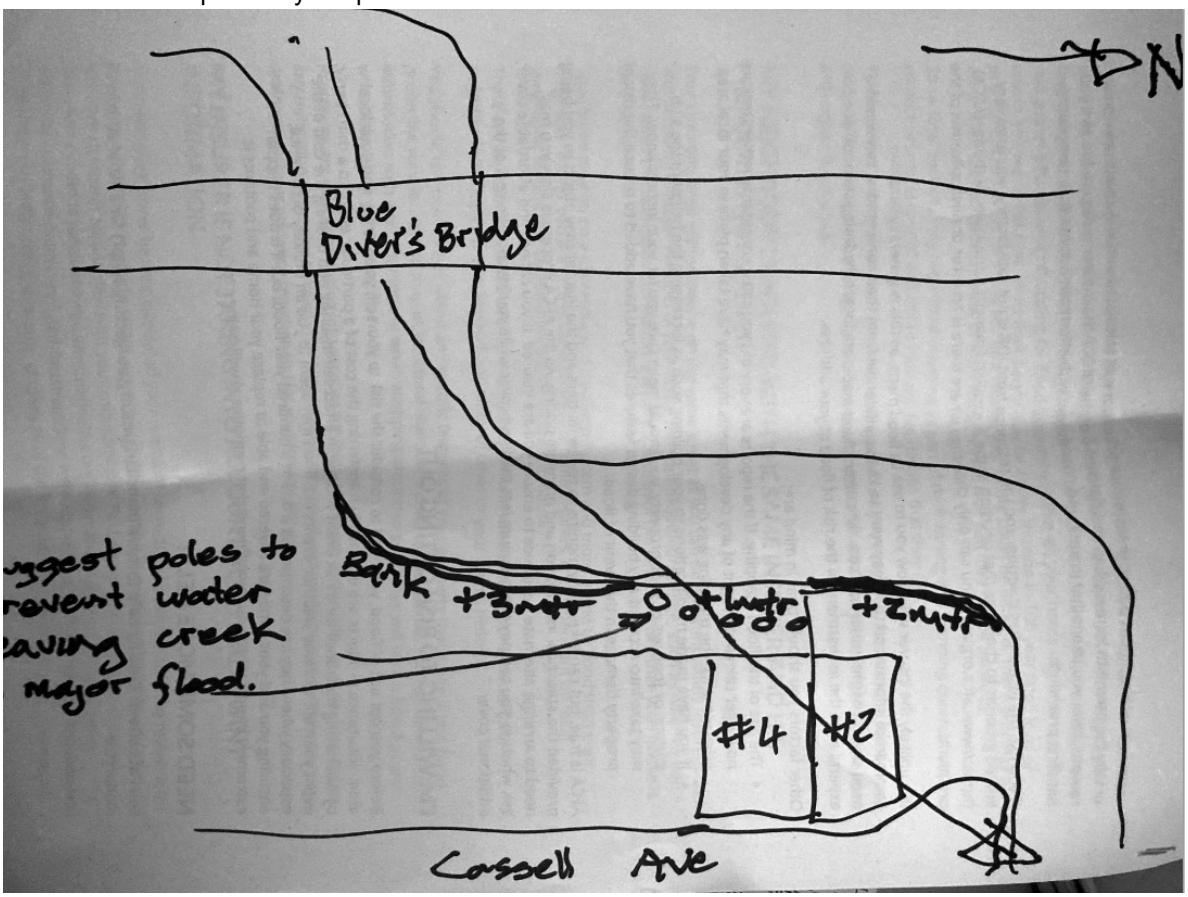
The submission from the operator of the electrical distribution network provided advice regarding their flood response plan and impacts of floods on the network.

A flood mitigation strategy that assists in maintaining road access to critical infrastructure allows for electricity supply to be maintained for a longer period and quicker restoration of supply.

Information session

Forty-eight people attended an information session at Towradgi Surf Club. The photos show some of the attendees, members of the project team and information displays at the event. Those pictured provided their consent to be included in these photos.

This option was suggested by a resident who understood the water would be diverted in the creek only when debris is captured by the poles.



Social media

The commentary was about creeks between Wollongong and Stanwell Park needing flood management and regular checking for blocked culverts and pipes to maintain maximum water flow during excessive rainfall.

Next steps

We will use this feedback to inform any required revisions to the draft Floodplain Risk Management Study and Plan. These are preliminary discussions about the recommended options. They will each require further investigation, consultation and approvals before going ahead. We will continue sharing information with the community and key stakeholders and seek input as we progress.