

Coogee Bay Floodplain Risk
Management Study & Plan

APPENDIX

A

COMMUNITY NEWSLETTER

Floodplain Risk Management Options

The following list of potential floodplain risk management options presents some approaches that could be considered to minimise the risk of flooding in the Coogee Bay catchment. These options will be considered in further detail during the preparation of the Management Study and Plan.

Examples of Flood Management Options

Flood Modification Options

- upgrading of drainage systems (pits and pipes)
- improve overland flow paths
- construct detention basins
- culvert/pipe enlargement at trapped low points/ flood prone intersections
- improve drainage outlet at Coogee Bay

Property Modification and Planning Control Options

- building and development controls
- flood proofing with flood resistant building materials
- strategic land use planning

Emergency Response Modification Options

- updating the Local Disaster Plan (DISPLAN)
- public awareness and education—locality based flooding information for residents
- public awareness and education—flooding information for schools
- continuation of existing public awareness and education campaigns
- data collection strategies for future floods

Consultation

During the Floodplain Risk Management Study and Plan, community consultation will be undertaken in order to establish a list of flood risk management options.

Interested members of the community are invited to respond using the enclosed questionnaire. Additional comments can be submitted in writing with the attached questionnaire. Please return your completed questionnaire in the reply paid envelope. No postage stamp is required.

For further information regarding this project please contact Randwick City Council via the details below.

Information can also be found on Council's website www.randwick.nsw.gov.au.

Contact Us



Drainage Engineer
Randwick City Council
(02) 9399 0999



Newsletter

Randwick City Council has engaged Cardno to assist with the preparation of the Coogee Bay Floodplain Risk Management Study and Plan.

The Risk Management Study and Plan follows from the Flood Study, completed in 2013, which identified the existing flooding behaviour in the Coogee Bay catchment. The purpose of the Risk Management Study and Plan is to identify and recommend appropriate actions to manage flood risks in the Coogee Bay catchment.

This brochure provides an introduction to the Risk Management Study and Plan and its objectives.

Your feedback on the accompanying questionnaire will play an important role in the project.

prepared for



prepared by



Existing flooding issues

There is a long history of flooding in Coogee, due to the location of urban development along natural creek lines. Floods have occurred in 1959, 1999 and 2009.

The 29 October 1959 event was the largest historic flood within the catchment, with a daily total of 265mm of rainfall recorded at Randwick Bowling Club.

The most significant recent floods include the January 1999 and May 2009 events. A total of 74mm of rain was recorded on 24 January 1999 at Randwick Bowling Club, and 77mm was recorded at Randwick Bowling Club on 3rd May 2009. These more recent floods have a 10% chance of occurrence within any given year.

Study area

The catchment occupies a total area of 2.9km², (which is about 415 rugby union playing fields), and incorporates the majority of Coogee and parts of South Coogee and Randwick. The catchment drains to the east into Coogee Bay.

The natural creek systems have been modified and the study area is now drained entirely by a stormwater pipe network. When the capacity of this network is exceeded, overland flow will occur along the alignments of the original creeks. Many of the old creek alignments flow through developed properties, which presents a significant flood risk. The urban development within the study area includes low, medium and high density residential development and commercial uses, including the Coogee CBD along the beachfront.



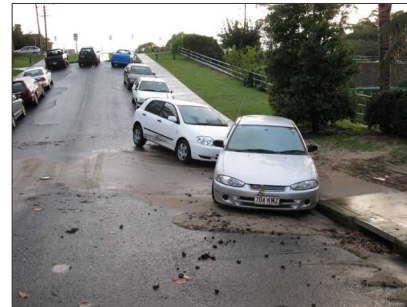
Flooding at Coogee Oval, 24 January 1999.

Flooding in Dolphin Street, 2 May 2009.



Flooding at Randwick Bowling Club, 3 May 2009

Flooding in Dolphin Street, 2 May 2009.



Floodplain management committee

Randwick City Council oversees the Floodplain Management process. The Committee meets regularly and includes representatives from Council, Office of Environment and Heritage (OEH), State Emergency Service (SES), NSW Department of Primary Industries (DPI), and representatives of the local community.

Floodplain risk management study and plan objectives

The objectives of the study and plan are:

Floodplain risk management study

Identify flood risk management measures and strategies to mitigate flood risk in accordance with the NSW Government Floodplain Development Manual (2005). The information from this study will enable Council to formulate a Floodplain Risk Management Plan for the study area.

Floodplain risk management plan:

Provide a priority program for implementation of the recommended works and mitigation measures. The plan will detail how the existing and future flood risk within the study area will be managed.

Floor level survey

Surveyors will be working in the area and may visit your property in the coming weeks to record floor levels. This is a standard task of the project and is required for the flood damages assessment. This involves estimation of the economic damages caused by flood for properties located in the floodplain.

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APPENDIX

B

SUMMARY OF PUBLIC EXHIBITION
SUBMISSIONS

Submission ID	Mode of submission	Summary of issue/question	Response	Modification to the FRMSP document
1	Website	In the floodplain study, I am surprised to see my building listed as flood affected. I have lived in 142 Beach St since 1982 and been on the strata committee for most of that time, and I have never known the building to be flood affected. The site is several metres above high water, so it should be safe from anthropogenic sea level rise until the next century (and large areas of Eastern Coogee not listed as flood affected will go under first).	The flooding on the subject property is as a result of overland flow from the catchment flowing through the property. Flooding is not from raised ocean levels during an ocean storm or sea level rise as a result of climate change. The flood modelling is for extreme rainfall events. A 100 Year ARI (1% AEP) event has not been recorded in or near to the catchment since 1986. Further detailed summary of overland flow behaviour at this location provided in response to submission 3 below.	Clarified in Section 4.0 that the flood process being documented is from rainfall on the catchment not ocean storms.
2	Website	Storm water from Alison Rd runs down St Marks Rd and finishes up in Oswald St near the corner of Clyde St. This is too much water for one outlet grate, and always overflows. This grate is always blocked with rubbish, I am unable to keep it clean and the street sweeper truck can't clean behind cars. Extra outlet is required at St Marks Rd.	The issue raised in this submissions was reviewed against the flood model data and was found to relate to ponding near Clyde Street (ponding location 1). Our report notes inlet capacity and flow obstruction from Coogee Road embankment are main causes. Pit option (Option 1) assessed at this location but found that to be truly effective interallotment drainage was needed. Increased maintenance of stormwater infrastructure is a high priority recommendation of the Floodplain Risk Management Study and Plan and may go some way towards addressing the issues raised. Pit will be added to Council's pits priority cleaning lists.	No change required.
3	Website	Our property is shown on the map as flood affected. We have owned our property since 1995. We know people who have grown up and lived in Kurrawa Ave and Beach St for 80 years and whose parents lived in the same property before them - so more than 100 years. No one can recall a flood event affecting our property or those south of us in their living memory or from stories from their parents. I have asked for the data and the assumptions behind our property and the 12 lots to our south also designated as flood affected, but with no success. Furthermore I have asked what remediation is being proposed by Council and the answer was that as there is no known or obvious possible cause there can be no remediation planned. The result is that our properties will stay with this designation whereas those also so designated but for which remediation is proposed, will come off the list of flood affected properties. For our properties with no known problems to be so disadvantaged is both unfair and unjust. As this designation will possibly affect our insurance and the value of our home, and there is no justification for the designation and no remedy for the supposed problem, our property and those to our immediate south should be removed from the list of flood affected properties.	This area was reviewed in detail following the committee meeting on 4 April 2016, including a site visit by Council staff on 6 April 2016. Detailed review of the model results showed that within 142, 144, and 146-152 Beach Street there are two sections of disconnected ponding sourced from the local catchment around Kurrawa Avenue and elevated properties further to the south. Within the model the flows enter the lowpoint on the sites from the Kurrawa Avenue driveway / walkways of the properties and cannot discharge from the low lying areas leading to ponding. The overland flow behaviour was reviewed through the site visit and it was confirmed that the driveway / walkways to these properties does grade away from the road to low lying sections in the middle of the property, which has no possible outlet for overland flows, therefore the modelled results have been verified by on site observations. Floodplain management options were assessed at this location in the early stages of this project, however the only suitable solution to address this overland flow is on-site or interallotment drainage. However such options were deemed to not be feasible for this study as interallotment drainage and acquisition of easements by Council was not seen as possible. This conclusion of new interallotment drainage not being feasible was adopted for the entire catchment, other options that were excluded as a result of this included Brook Street (FM15) and Carrington Road (FM5) among others. Residents could discuss with Council options to develop on-site drains to remove the flooding.	No change required.
4	Website Drop-in session	I have on occasions submitted & completed Floodplain Risk to you in the past. I have had inspectors come to my home & have explained the flooding that has occurred over many years. As I live in a plateau area the excess water originates from Arcadia St, Smithfield Av & Brook Sts. I have suggested to Council that extra drainage is required on the opposite side to no. 84 near the corner of Arcadia St & Brook St. It also affects nos. 82 & 80 Brook St & 8 Smithfield Av. The Council is well aware of the problem & we would appreciate if something can be done.	The issue raised in this submission was reviewed with regards to the flood model data and was identified as relating to ponding location (number 11). Options were initially considered for this site as part of this study but would require 200 metres of pipe upgrades along Brook Street and therefore were not considered feasible. In response to comments from a number of residents on Brook Street and Smithfield Ave, an option has been added to prepare a detailed investigation of this location (Option FM10) to assess other possible solutions.	Additional FM option has been added relating to a detailed investigation at this location (Option FM10a)
5	Website	There appears to be no quality assurance in place for contractors who complete works involving new road gutters, kerbs and driveways. I know of several places where new work has been done and the slope or gradient of the new driveway allows stormwater to leave the gutters and flow over onto paths and into properties. When obviously the design should contain waters and have them enter stormwater drains. An example of this is at 64 Howard St Randwick. I have raised this issue several times but nothing has been done to correct it. Please help.	This location lies outside of the Coogee Bay catchment and therefore is not relevant to this FRMS&P. Nonetheless Council have reviewed this comment and have responded and addressed outside of the context of this Study.	No change required.
6	Website	I received a letter in the mail on 18th July 2016 showing that the Street where I live had been identified as a flood zone. It also stated that in 2013 Randwick Council wrote to all property Owners. I have never received anything regarding this. I would like a copy of this letter if possible. I believe that this intended re-zoning to a flood area will devalue my property and also the properties in the street where I live. Where is the evidence and reports and who did them? I have taken photos of my street during the recent storms that destroyed alot of Coogee Beach and there is certainly no flooding even though there was torrential rain. I am happy to provide them as evidence.	The flood study for this catchment was completed in 2013. The flood study modelled the topography, drainage network and built form to see how water moves through the catchment in various rainfall events. To check that the model is producing reliable results, the process included for the model to be calibrated against historical events. The Flood Study was developed by a specialist consultant in accordance with the NSW Government guidelines. The development of the Flood Study was overseen by the Coogee Bay Floodplain Management Committee which included representation from the State Government, local SES, the community, Councillors and Council staff. Following a period of community consultation, the Coogee Bay Flood Study was adopted by Council in June 2013. The responsibility for identification of flood zones is taken very seriously. The model is carefully checked and each area is then inspected to confirm that the outputs of the model are reliable. The 1%AEP storm event (1 in a 100 year) is used to determine which areas are identified as flood prone. Interestingly, the recent storms in Coogee were not significant in terms of rainfall and flooding, with the significance of the event being a result of the combination of huge sea swell and king tides. You can request a copy of the previous letter by sending an email to Council@randwick.nsw.gov.au.	No change required.

7	Website	Please advise what impact this study will have on properties identified as flood risk. In particular 158 Clovelly Road, Randwick. This is a block of 8 units and in the last two years Council requested that our stormwater detention pit be upgraded which we complied with at cost of around \$10k. However, the neighbour at 156 continues to discharge water across our property and Council officers advised Council could not take action. Now our property has been identified as a flood zone which may have a detrimental impact on values if it is shown on the 149 Certificate. Our property is the only one with a detention pit, will this need to be upgraded further and if so at who's expense? Please advise whether 149's will show this rating and why our property and the one next door are identified and yet the properties behind are not. Thank you.	Detailed review of this location has shown that flood affectation of this site is marginal and caused by flooding of the basement of the adjacent property. As a result of the minor affectation the property has been removed from property tagging.	Property removed from flood affected property database.
8	Website	I live in Rainbow St in one of the flood prone areas. My question is: how can I respond at this stage? It seems as a resident I can do very little if we have the 100 year flood and/or the main drainage tank blocks. My property is currently well drained, but that won't be of any use if these events described in the Flood Study occur. So again, is there anything I can do to protect my property?	The flood issue on Rainbow St is very particular. The best way to respond to the flood is to be aware that your property can be flood affected and know how to act in case of an emergency. For example, check the SES floodsafe website (www.floodsafe.com.au) which gives useful information on how to act before, during and after a flood or how to prepare an emergency kit. In particular during expected heavy rainfall be prepared for immediate evacuation if flooding is observed in the area.	No change required.
		Your answer to my question [above] was not satisfactory. Preparing myself for a flood with an emergency kit? What about some reassurances from Council that the drainage issues in Rainbow St are to be addressed as a matter of priority? That the risk is to be minimised as Council enacts appropriate mitigation strategies? I would appreciate what plans the Council has in place beyond 'assessment of the problem'. Thankyou.	Council plan to consider Rainbow Street in finer detail. Further understanding of the nature of flooding in this area is required before options can be considered. However, potential management and mitigation options will be assessed as part of the process for developing the Draft Floodplain Risk Management Study and Plan.	No change required.
9	Website	When will more detailed investigation of flooding in the area [Rainbow Street Area] occur?	This is a high priority activity as explained in the implementation program on page 102 of the Draft Floodplain Risk Management Study and Plan (FRMSP); see "Rainbow Street Detailed Investigation" (option FM16). Following adoption of the FRMSP by Council, we intend to apply for funding from the State Government to allow this to commence as soon as possible.	No change required.
10	Website	Why were residents of Leeton Avenue not advised of flood risk by Council if flood risk was known for decades.	The flood study for this catchment was completed in 2013. Prior to this date Council did not have reliable information about flooded properties, water depth, velocity or hazard within the Coogee Bay Catchment. The flood study modelled the topography, drainage network and built form to see how water moves through the catchment in various rainfall events. The Flood Study was developed by a specialist consultant in accordance with the NSW Government guidelines. The development of the Flood Study was overseen by the Coogee Bay Floodplain Management Committee which included representation from the State Government, local SES, the community, Councillors and Council staff. Following a period of community consultation, the Coogee Bay Flood Study was adopted by Council in June 2013. At the time all residents within the flood planning area were contacted, including the residents at Leeton Avenue. It is necessary to complete a flood study to properly understand flooding in a given location. Accordingly, Council's Flooding Advice and Flood Related Development Control Policy nominates the point in time when Council will notate flood affected properties on S149 certificate. The policy states that S149 notations will be made "Where the Council has commissioned a flood study and Council has resolved that the study is appropriate for public exhibition....".	No change required.
		Draft report says that Bardon Park is Council-owned, but it is actually Crown Land. Have Crown Lands been consulted with or received a copy of the draft report?	Report has been update accordingly as Bardon Park is indeed Crown Land. Crown Land has not been contacted as Bardon Park option has not been deemed feasible.	Report updated throughout to identify Crown Lands as the owner of Bardon Park.
		I would like to see Council make use of large catchment tank lying beneath Bardon Park.	Water from the Coogee Oval Carpark is collected and then pumped to the Bardon Park tank for irrigation. The tank, whilst sufficient for harvesting and irrigation purposes, is insufficiently sized for managing flood waters. A far greater volume of storage is required to provide a benefit during a flood. For this reason, we did investigate a storage basin in Bardon Park, however this option was not deemed feasible.	No change required.
		Would like Council to enhance current stormwater pipes system both 'qualitatively and quantitatively'	The focus of the Flood Study was on large flood generating flows. Stormwater quality (i.e. water quality is generally managed for smaller flow events). The study has found a number of locations where pit and pipe upgrades can significantly reduce flooding. Water quality treatment was not assessed in detail as part of this study. With regards to qualitative stormwater measures, Council operates a network of Gross Pollutant Traps at all major beach stormwater outlets. We also harvest water from the stormwater system for irrigation at both Bardon Park and Dunningham Reserve. Council has also worked closely with Sydney Water to undertake dry weather stormwater testing to ensure that there are no illegal sewerage connections impacting on stormwater flows that enter Coogee Bay.	No change required.

11	Phone	Doesn't believe his property is flood affected as he is in the upper part of the catchment (upstream of Fred Hollows) and lives on the 6th floor	The flooding described in the Flood Study and Floodplain Risk Management Study is as a result of fast flowing runoff from the catchment. Due to the majority of the catchment being developed with hard surfaces (e.g. roads, houses and pavement), when rain falls very little of it infiltrates into the ground and it runs off very quickly. This creates fast flowing water that can be dangerous and can build up very quickly if obstructed by buildings or other structures. These flowpaths are mapped in the Flood Study as flooded areas. Where a property is identified as flood affected this is due to a flow path on the property, not necessarily flood waters entering a building, particularly not elevated floors such as in this case.	No change required.
12	Phone	Submission requested further information about the study and the implications of the results.	The subject property is affected by the 1% AEP storm and in the flow path. Drainage upgrades are unlikely to provide any flood benefits during large events. The property is noted as a flood control lot which means that flood related development controls may apply if a development application is submitted.	No change required.
13	Email Drop-in session	Flooding depths at Coogee Tennis Club were actualy 100-120mm, rather than 1m as given in the flood study.	The Flood Study model contained information that the basement level was lower than the level of the tennis courts, however upon inspection it was found that the basement level of the tennis club is in fact higher than the adjacent tennis court. This would explain why there is a difference in observed flood depths inside the tennis club to that shown in the Coogee Bay Flood Study Report. It should be noted that flood depths rather than flood levels have been incorrectly represented here. The flood levels across this area remain valid. Accordingly, the comment on page 34 of the Flood Study that the basement of tennis club is below ground level is therefore in error. This statement is however correct for the basement of the bowling club. The notation that there is "1m (of water) above ground level" at the location of the tennis club as shown on Figures C5 and C6 of Appendix C are also incorrect for this same reason. There is however high levels of correlation between the flood model and nearby observations at the Bowling Club for the May 2009 flood model calibration event. The levels were also well represented at many other locations in the catchment where flood marks were collected (Oswald Street, Bowling greens, Coogee oval, Senior Citizens Centre). Furthermore, the model was also calibrated for the January 1999 event and validated for the October 1959 event. In both cases the model represented flow behaviour accurately. In summary, these notations in regards to historical depths experienced within the basement of the tennis club building appear to be incorrect due to error in the assumed floor level, however there is a high degree of correlation between the observed flood levels and the flood levels produced by the model in numerous nearby locations. On this basis, the errors do not highlight any concerns with the modelling of flood behaviour in the Coogee Bay catchment.	Text has been included in the review of flood study section of the report to clarify the issue.
		How reliable is the example of the Coogee Tennis Club for Voluntary Purchase PM2?	Voluntary purchase is in reference to the Tennis Club building to the south of the courts where there is 5cm of overfloor flooding in the 5yr event. A detailed review of other tennis club buildings was done as a result of questions raised previously at the Committee Meeting.	No change required.
		Queries whether the PMF is beyond realms of credibility due to its rarity, and whether it merits consideration. Wonders why it is given so much attention in Flood Study and FRMSP. Why not 1 in 1000 year flood as a more practical upper limit?	Flood risk management requires consideration of both probability and consequence given that risk is defined as the product of probability and consequence under AS/NZS 4360: 1999 Risk Management. Whilst the probability of these events may be rare, the consequences in some cases may be so significant that the flood risk cannot be ignored. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study. Whilst planning decisions around building conditions such as floor heights and structural stability generally focus on the 100 Year ARI, events up to the PMF are of more importance when looking at issues such as emergency response management. In most locations within the Coogee Bay Floodplain, the PMF is not significantly higher than the 1% AEP (unlike some large riverine catchment where it may be 5 or 10 metres higher). Therefore, the analysis of the PMF as the upper limit of flooding does not pose an unreasonable burden on the community. And in fact is not significantly dissimilar to evaluating the 1000 Year ARI event.	No change required.
		Flow rates can be increased by designing more efficient pit inlet geometry, where the number of inlet pits available is short of number required for pipe flow capacity. Potential problem of flooding when blockage of pit occurs.	The pipe capacity compared to the actual flow modelled in the pipes was used to identify where additional pits may be warranted. This formed the basis of the selection and testing of management options.	No change required.
		Area of Brook St between Arcadia St and Smithfield Ave floods with relatively little rainfall less than 20mm, over 10-15 mins. This occurs frequently - several times a year. Shorter critical duration events are of higher significance in smaller catchments. Flooding in this sub-catchment is primarily due to overland flow when drainage system capacity is exceeded, which may occur in as little as 10 mins.	The pipe at this location is flowing at full capacity in a 20% AEP event. The flood study identified that ponding occurred at this location at the 20% AEP event and greater. Therefore the ponding identified in the Flood Study was as a result of the pipe reaching capacity, and hence improving the inlet pits alone, would not improve the flooding behaviour. Pipe upgrades at this location were not deemed feasible due to the large cost and minor flooding of properties. The flooding described in the submission and photos, would suggest that the pit is not functioning properly. This is likely to be the outcome of a maintenance issue (such as blockage). The Floodplain Risk Management Study and Plan identifies increased maintenance of drainage and response to flooding complaints as a high priority action. In addition a floodplain modification option has been added providing a detailed investigation at this location (FM10a) to identify any other possible solutions.	Text in Section 4-3 has been updated to clarify the critical duration for all locations in the catchment.

		<p>Finds it difficult to accept the validity of the assumption that 2-hour storm is critical in catchment, thinks that higher rainfalls with shorter durations would be more significant. How long does it take stormwater in small catchments to leave those catchments? How long does it take stormwater from extremities of floodplain to reach discharge points?</p>	<p>A range of design event durations (0.25-hour, 0.5-hour, 0.75-hour, 1-hour, 1.5-hour, 2-hour, 3-hour, 4.5-hour, 6-hour and 9-hour) were simulated as part of the Flood Study to determine the critical duration for flooding throughout the study area. In general, the model simulations indicated the peak water levels in most areas corresponded to the 90-minute or two-hour durations. For local depression storage areas the critical conditions are flood volume driven for which a longer duration is required. In these areas the 9-hour duration (which was the longest duration considered) is the critical duration. The design flood results are the maximum condition from the combined 90-minute, 2-hour and 9-hour duration events, for which the distribution at the 1%AEP event is presented in Figure 6-1 (in the Flood Study). For the PMF event, the critical durations (and those from which the results have been derived) are the 15-minute, 30-minute, 45-minute and 4.5-hour durations. It is noted that the duration of rainfall does not relate to the time until flooding occurs, for example flooding of the properties during a 2 hour event may occur within 10 minutes as suggested. A 2 hour event is considered a short duration rainfall event with high intensity rainfall.</p>	<p>Text in Section 4-3 has been updated to clarify the critical duration for all locations in the catchment.</p>
		<p>How was the outline of the Flood Planning Area determined? Has any allowance been made for drainage line blockages? Has any allowance being made for existing construction?</p>	<p>The Flood Planning Area includes all land within the 1% AEP (100 Year ARI) flood extent plus a freeboard of 0.5m. No allowance has been made for blockage of drainage. The existing development in the catchment has been incorporated in the model using high "roughness" this in effect slows the flows down as through they would be when passing through areas of buildings, fences and other structures. However, this does not provide detailed representation of exact building footprints, blockages from retaining walls and fences and other localised obstructions to flow. This is beyond the scope fo a catchment wide flood study. The 0.5m freeboard is used to account for potential variations in the flow paths and depths as a result of these localised features and potential blockages.</p>	<p>No change required.</p>
		<p>I cannot see how any part of 95 Brook Street could be within the Flood Affected Area. Why has it been included?</p>	<p>Confirmation that 95 Brook Street is only marginally affected by the freeboard. To be removed from affectation</p>	<p>Property removed from flood affected property database.</p>
		<p>The Flood Planning Area is shown to include the highest part of 76 Brook Street Coogee. How was this determined?</p>	<p>The western portion of 76 Brook Street is included as a result of the freeboard applied to flooding on the road.</p>	<p>No change required.</p>
		<p>I have seen evidence of depths of water collecting at the eastern corner of the Hill Street and Arcadia Street intersection. Why has it not been included in the Flood Affected Area map?</p>	<p>Ponding of water was observed in the model results in this location. However, based on the depth of water and site inspections, it was not considered to be part of the "flow path" which commences to the west of the ponded water.</p>	<p>No change required.</p>
		<p>How much assumption/interpolation was necessary? Specifically for the flood study</p>	<p>As part of the FRMS&P all input data to the Flood Study and calibration runs undertaken as part of the Flood Study were reviewed. The aerial laser survey data was considered sufficiently accurate for a regional study of this kind and there was good correlation of the callibration events and the observed flood levels. Based on the outcomes of this review, it was concluded that no significant assumptions or interpolation was required in the preparation of the Flood Study.</p>	<p>No change required.</p>
		<p>Revisions to Appendix D of the Flood Study have been requested.</p>	<p>The Flood Study is not being updated as part of this public exhibition period. However, all comments and their relevance to the FRMS&P will be considered.</p>	<p>No change required.</p>
14	Email	<p>Flood Study Report and FRMSP Report do not evaluate in sufficient detail the causes of the flooding upstream, particularly with respect to FM1 solution. This submission provided significant details regarding the possible causes of flooding upstream and provides some potential solutions.</p>	<p>Flooding at this location has been reviewed in detail. Oswald Street lies within the Courland Street depression (Location 5 in the FRMS&P report). Models results suggest that flooding at this location is not a result of overland flow from St Marks Road or Fred Hollows Reserve but rather the local catchment. The reason that such a small catchment results in such extreme flooding is that there is a depression at the rear of the properties which offers no discharge point for overland flow resulting in significant ponding. Options were investigated at this location and one feaqisible option was identified (Option FM1). By adding an inlet pit at this location flooding may enter the underlying trunk drainage line and the site is drained effectively. Additional options such as increasing the storage within Fred Hollows Reserve will not alleviate flooding at this location. In relation to blockage, drain blockage resulting in flooding has been identified as an issue across many locations in the catchment. Increased maintenance and investigation by CCTV has been identified in the FRMS&P as a high priority action for Council, with Fred Hollows Reserve will be a key area of investigation. In addition, a drainage investigation upstream of Oswald St to improve pits inlet capacity will conducted as part of the Council Drainage Capital Works Program</p>	<p>No change required.</p>
	<p>Drop-in session</p> <p>Flow from St Marks Road doesn't get diverted into Fred Hollows Reserve. Reserve has capacity to accept more flow and this may alleviate issues of flooding downstream of Alison Road. Why was Fred Hollows Reserve not further updated as a detention basin, but rather only drainage improvements.</p>			
	<p>Drop-in session</p> <p>Tress and large debris flowing into Courland flowpath trunk pipe at beginning of pipe: Trees block the large drain, possibly could install blockage protections structures or CCTV for regular monitoring. Drain running past Oswald St has a right angle bend in it which the trees would not be able to get past. The model showed a bend in the path of the water which the resident referred to.</p>			
15	Drop-in session	<p>Resident wanted to know what the proposed drainage investigation option meant and how it could alleviate flooding on Mount Street.</p>	<p>There is a local depression at the rear of residential flat buildings. Initial modelling found this can easily be addressed with the addition of pits at the rear of the property, however Council's project scope did not include the analysis of interallotment drainage options. This option was therefore not included for further assessment within this study however the addition of an inlet pit at the rear of the property by the landowner could significantly reduce minor flooding that occurs at the rear of the property.</p>	<p>No change required.</p>
16	Drop-in session	<p>Interested in Option 1. 2 years ago a curb was added on Dolphin St, ending at 9 Dolphin St, 2 houses up from their property, which remained with the rotted treated pine curb. Water now rushes past the houses up the street along the curb and moves across the nature strip. There is only one grate, and a retaining wall now bulges</p>	<p>This issue relates more to local stormwater drainage and therefore is not relevant to this FRMS&P. Council will investigate this issue outside of the context of this Study.</p>	<p>No change required.</p>
17	Drop-in session	<p>A resident in Clyde Street was interested in how the proposed drainage works in her street would affect her with regards to construction works (e.g. will the street be closed, noise etc)</p>	<p>Council notify and discuss all residents affected by roadworks such as this prior to works commencing.</p>	<p>No change required.</p>

18	Drop-in session	Would Council revise the flood extents and tagged properties once drainage improvement were undertaken?	The Flood Study will be revised within a 5 to 10 year period. When this revision is undertaken all updated drainage details would be incorporated into the revised model to assess the changes to flood depths, velocities and extents as a result of works completed. If a property is no longer within the Flood Planning Area, it would no longer be tagged as flood affected.	Discussion on this process has been included in the document.
19	Drop-in session	Consider more options for properties at junction of Havelock Ave and Asher St. E.g. lowering level of Havelock St, Re-contouring Asher St to restrict water flow along Asher St towards Waltham St.	Review of flood model results at this location shows the property is marginally affected by the PMF event, therefore has been removed from property tagging.	No change required.
		Wanted to understand flooding risk better, as he is looking to extend his existing basement, on Cnr Asher and Havelock St. Requested information relating to the flood depths and extents on his property.	As part of this Study specific flood information for each property is not displayed. Residents may apply to Council for a flood report to get property specific information.	No change required.
20	Drop-in session	Adding a pipe on Brook St	This option will be assessed in further detail within Option FM10 to assess opportunities to reduce flooding of Brook Street near Smithfield Avenue.	Additional detailed investigation option added.
21	Drop-in session	Review of Table 9-2 Option FM3, seems to be a problem with the option description.	Table 9-2 has been reviewed and details of Option FM3 have been confirmed.	No change required.
22	Drop-in session	No comment supplied.	NA	No change required.
23	Drop-in session	Flooding occurs on Oberon and Rainbow Sts. Stormwater drain outside 171/173 Mount St is usually blocked, possibly add more drains on Oberon and Rainbow Streets to take runoff. Lack of drainage also on Mount St between Oberon St and Rainbow St.	Blockage of drains resulting in flooding has been identified as an issue across many locations in the catchment. Increased maintenance and investigation by CCTV has been identified in the FRMS&P as a high priority action for Council. Pit will be added to the pits priority cleaning lists.	No change required.
24	Drop-in session	Wanted to understand flooding in the area of his property	Issues discussed at drop in session	No change required.
25	Drop-in session	Discussed structural options with project team at drop in session. Also raised questions regarding potential blockages due to frequency of inundation.	Blockage of drains resulting in flooding has been identified as an issue across many locations in the catchment. Increased maintenance and investigation by CCTV has been identified in the FRMS&P as a high priority action for Council. Pit will be added to the pits priority cleaning lists.	No change required.
26	Drop-in session	Area only has one drain, leading to flooding.	Detailed investigation of flood modification options at Brook Street has been added as an outcome for this Study.	No change required.
27	Drop-in session	Wanted to understand flooding in the area of his property	Issues discussed at drop in session	No change required.
28	Drop-in session	Interested in flooding potential of residence off Alfreda Street	Issues discussed at drop in session	No change required.
29	Drop-in session	Wanted to understand flooding in the area of his property	Issues discussed at drop in session	No change required.
30	Drop-in session	Wanted to understand flooding in the area of his property	Issues discussed at drop in session	No change required.
31	Drop-in session	See submission 14	See response to submission 14	No change required.
32	Drop-in session	Complaint about tagging, asking to check tagging	See response to submission 7	No change required.
33	Drop-in session	Complaint about tagging, asking to check tagging	Review of flooding shows that a significant portion of the site is flood affected, property to remain tagged.	No change required.

Coogee Bay Floodplain Risk
Management Study & Plan

APPENDIX

C

SUMMARY OF BIONET RECORDS
FOR COOGEE BAY CATCHMENT

Scientific Name	Common Name	Status (NSW)	Status (C'wealth)
Plants			
<i>Allocasuarina portuensis</i>	Nielsen Park She-oak	E1,P,3	E
<i>Hibbertia puberula</i>		E1,P	
<i>Amperea xiphoclada var. pedicellata</i>		E4,P	X
<i>Acacia gordonii</i>		E1,P	E
<i>Acacia terminalis subsp. terminalis</i>	Sunshine Wattle	E1,P	E
<i>Prostanthera marifolia</i>	Seaforth Mintbush	E4A,P,3	CE
<i>Eucalyptus fracta</i>	Broken Back Ironbark	V,P	
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V,P	V
<i>Eucalyptus pulverulenta</i>	Silver-leafed Gum	V,P	V
<i>Eucalyptus scoparia</i>	Wallangarra White Gum	E1,P	V
<i>Melaleuca deanei</i>	Deane's Paperbark	V,P	V
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1,P	V
<i>Diuris arenaria</i>	Sand Doubletail	E1,P,2	
<i>Dichanthium setosum</i>	Bluegrass	V,P	V
<i>Persoonia hirsuta</i>	Hairy Geebung	E1,P,3	E
Birds			
<i>Anseranas semipalmata</i>	Magpie Goose	V,P	
<i>Stictonetta naevosa</i>	Freckled Duck	V,P	
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V,P	
<i>Hirundapus caudacutus</i>	White-throated Needletail	P	C,J,K
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	P	E
<i>Ardenna carneipes</i>	Flesh-footed Shearwater	V,P	J,K
<i>Ardenna pacificus</i>	Wedge-tailed Shearwater	P	J
<i>Ardea ibis</i>	Cattle Egret	P	C,J
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1,P	E
<i>Erythroriorchis radiatus</i>	Red Goshawk	E4A,P,2	V
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	P	C
<i>Hieraaetus morphnoides</i>	Little Eagle	V,P	
<i>Burhinus grallarius</i>	Bush Stone-curlew	E1,P	
<i>Charadrius leschenaultii</i>	Greater Sand-plover	V,P	C,J,K
<i>Charadrius veredus</i>	Oriental Plover	P	J,K
<i>Pluvialis fulva</i>	Pacific Golden Plover	P	C,J,K
<i>Pluvialis squatarola</i>	Grey Plover	P	C,J,K
<i>Arenaria interpres</i>	Ruddy Turnstone	P	C,J,K
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	P	C,J,K
<i>Calidris alba</i>	Sanderling	V,P	C,J,K
<i>Calidris bairdii</i>	Baird's Sandpiper	P	J,K
<i>Calidris canutus</i>	Red Knot	P	C,J,K
<i>Calidris ferruginea</i>	Curlew Sandpiper	E1,P	CE,C,J,K
<i>Calidris melanotos</i>	Pectoral Sandpiper	P	J,K
<i>Calidris tenuirostris</i>	Great Knot	V,P	C,J,K
<i>Gallinago hardwickii</i>	Latham's Snipe	P	C,J,K
<i>Limosa limosa</i>	Black-tailed Godwit	V,P	C,J,K

Scientific Name	Common Name	Status (NSW)	Status (C'wealth)
<i>Numenius minutus</i>	Little Curlew	P	C,J,K
<i>Tringa nebularia</i>	Common Greenshank	P	C,J,K
<i>Tringa stagnatilis</i>	Marsh Sandpiper	P	C,J,K
<i>Xenus cinereus</i>	Terek Sandpiper	V,P	C,J,K
<i>Stercorarius pomarinus</i>	Pomarine Jaeger	P	C,J
<i>Chlidonias leucopterus</i>	White-winged Black Tern	P	C,J,K
<i>Hydroprogne caspia</i>	Caspian Tern	P	C,J
<i>Sterna hirundo</i>	Common Tern	P	C,J,K
<i>Sternula albifrons</i>	Little Tern	E1,P	C,J,K
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V,P,2	
<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	E
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	E4A,P,3	CE
<i>Ninox strenua</i>	Powerful Owl	V,P,3	
<i>Epthianura albifrons</i>	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2,V,P	
<i>Epthianura albifrons</i>	White-fronted Chat	V,P	
<i>Petroica boodang</i>	Scarlet Robin	V,P	
<i>Stagonopleura guttata</i>	Diamond Firetail	V,P	
Mammals			
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E
<i>Dasyurus viverrinus</i>	Eastern Quoll	E1,P	
<i>Aepyprymnus rufescens</i>	Rufous Bettong	V,P	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V,P	
<i>Myotis macropus</i>	Southern Myotis	V,P	
<i>Dugong dugon</i>	Dugong	E1,P	
<i>Arctocephalus forsteri</i>	New Zealand Fur-seal	V,P	
<i>Arctocephalus pusillus doriferus</i>	Australian Fur-seal	V,P	
<i>Eubalaena australis</i>	Southern Right Whale	E1,P	E
<i>Megaptera novaeangliae</i>	Humpback Whale	V,P	V
Amphibians			
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1,P	V
Reptiles			
<i>Chelonia mydas</i>	Green Turtle	V,P	V

P = Protected, V = Vulnerable, E1, E2, E4A = Endangered under the TSC Act, E = Endangered under the EPBC Act, J = Japan-Australia Migratory Bird Agreement (JAMBA), C = China-Australia Migratory Bird Agreement (CAMBA), K = Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)