WAGGA WAGGA CITY COUNCIL





MANGOPLAH AND HUMULA FLOOD STUDY

MILESTONE 1 REPORT





OCTOBER 2024



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MILESTONE 1 REPORT

OCTOBER 2024

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LIST OF ACRONYMS

AEP	Annual Exceedance Probability			
ARI	Average Recurrence Interval			
ALS	Airborne Laser Scanning			
ARR	Australian Rainfall and Runoff			
BOM	Bureau of Meteorology			
DCCEEW	Department of Climate Change, Energy, the Environment and Water			
DPE	Department of Planning and Environment (now DCCEEW)			
DRM	Direct Rainfall Method			
DTM	Digital Terrain Model			
GIS	Geographic Information System			
GPS	Global Positioning System			
IFD	Intensity, Frequency and Duration (Rainfall)			
Lidar	Light Detection and Ranging			
LFC	Layered Flow Constriction			
mAHD	meters above Australian Height Datum			
OEH	Office of Environment and Heritage (now DCCEEW)			
PMF	Probable Maximum Flood			
SCIMS	Survey Control Information Management System			
SRMT	Shuttle Radar Mission Topography			
TUFLOW	one-dimensional (1D) and two-dimensional (2D) flood and tide simulation software (hydraulic model)			
WBNM	Watershed Bounded Network Model (hydrologic model)			



FOREWORD

The NSW State Government's Flood Prone Land Policy, contained in the Flood Risk Management Manual (NSW Department of Planning and Environment 2023), provides a framework to ensure the sustainable use of floodplain environments. The primary objective of the NSW Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods using ecologically sustainable methods, where possible. At the same time, the Policy recognises the benefits flowing from the use, occupation, and development of flood prone land. The Policy provides a means of ensuring that any new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

Under the Policy, the management of flood liable land remains the responsibility of local government. The State Government subsidises flood mitigation works to alleviate existing problems and provides specialist technical advice to assist Councils in the discharge of their floodplain management responsibilities.

The Policy provides for technical and financial support by the Government through five sequential stages:



This document constitutes the first of the management process for the study area. It presents a compilation of the data collected for the towns of Mangoplah and Humula.



ACKNOWLEDGEMENTS

This study was undertaken by WMAwater Pty Ltd, on behalf of Wagga Wagga City Council. Wagga Wagga City Council has prepared this document with financial assistance from the NSW Government through its Floodplain Management Program. This document does not necessarily represent the opinions of the NSW Government or the Department of Climate Change, Energy, the Environment and Water.

A number of organisations and individuals have contributed both time and valuable information to this study. The assistance of the following in providing data and/or guidance to the study is gratefully acknowledged:

- Wagga Wagga Flood Risk Management Advisory Committee
- Residents of the study area
- Wagga Wagga City Council
- Department of Climate Change, Energy, the Environment and Water
- NSW State Emergency Service



1. INTRODUCTION

The Mangoplah and Humala Flood Study aims to improve an understanding of flood behaviour and impacts in the townships of Mangoplah and Humula to better inform the management of the flood risk in the area. The Study Area lies within the Wagga Wagga City Council Local Government Area (LGA). Mangoplah is subject to mainstream flooding from Burkes Creek and Humula is impacted by Carabost Creek and Umbango Creek. In addition, both towns are also impacted by local overland flow affectation.

No previous formal flood studies have been undertaken for Mangoplah or Humula. As such, Council seeks to use the latest available tools and data to provide a definition of flood risk in Mangoplah and Humula under current catchment conditions.

Council is responsible for managing development of flood prone land under guidance provided in the NSW Flood Risk Management Manual (NSW Government, 2023) and previous Floodplain Development Manual (NSW Government, 2005). The flood modelling tools and outputs developed as part of this study can be used by Council to improve the understanding of flood behaviour and impacts, for informed decision-making about land-use planning, for emergency management, and in future studies to assess the effectiveness of potential measures to reduce flood risk. The models have been calibrated using observations from historical floods and subsequently used to estimate the impacts of flooding for a range of standardised "design" flood probabilities. This modelling has been completed in accordance with the guidelines in Australian Rainfall and Runoff (Reference 1).

This study will enable Council to:

- Understand the current flood risk across the catchment
- Provide up to date flood data for all end users
- Enable future development planning
- Assess cumulative impacts of future development
- Assess the effectiveness of potential flood mitigation measures
- Inform emergency management and planning (in collaboration with NSW State Emergency Service)

This Milestone 1 report discusses Data Collection activities undertaken to date and documents the available data that will be used in the Flood Study. Data Collection is the first stage in the NSW Floodplain Management Process, described in the Foreword.

2. BACKGROUND

2.1. Study Area

Mangoplah

Mangoplah is located 36 kilometres south of Wagga Wagga. Burkes Creek rises in Turkey Springs, below the Kyeamba Gap about 25km upstream of the township, at an elevation of 1,155 m AHD and travels east to west, north of the town. The study area, shown on Figure 1a, covers the town of Mangoplah and the hydraulic features that influence the flood behaviour within it, which include:

- Paper Forest Creek, which joins Burkes Creek just upstream of town;
- Holbrook Road Bridge on Burkes Creek.
- Road crossings.

Mangoplah has a population of approximately 291 (2021 Census) with land use in the township predominantly composed of Village (RU5) and some Public Recreation (RE1). In addition, there are large areas of open space (rural landscape) surrounding the town centre, characterised by hills sloping down towards Burkes Creek. The ground levels in the developed areas of Mangoplah vary between 260 - 280 mAHD. The local topography is presented on Figure 2a.

Humula

Humula is located at the confluence of Carabost Creek with Umbango Creek, between Tarcutta and Tumbarumba. Umbango Creek is a tributary of Tarcutta Creek within the Murrumbidgee River catchment and flows south to north through the town. The study area, shown on Figure 1b, covers the town of Humula and the hydraulic features that influence the flood behaviour within it, which include:

- Carabost Creek, which joins Umbango Creek just downstream of Humula Eight Mile Road;
- Deep Creek which joins Umbango Creek 200m downstream of its confluence with Carabost Creek;
- Eight Mile Road Bridges on Carabost Creek and Umbango Creek;
- Road crossings.

Humula has a population of approximately 129 (2021 Census) with land use in the township predominantly composed of Village (RU5) and Public Recreation (RE1) areas. In addition, there are large areas of open space (rural landscape) surrounding the town centre, which slopes down towards the creeks. Areas closer to the creeks are relatively flat with elevations varying between 276 – 280 mAHD, while the ground levels in the developed regions of Humula vary between 280 - 300 mAHD. The local topography is presented on Figure 2b.

2.2. Demographic Overview

Understanding the social characteristics of the study area can help in ensuring appropriate risk management practices are adopted, and shape the methods used for community engagement. Census data regarding house tenure and age distribution can also provide an indication of the community's lived experience with recent flood events, and hence an indication of their flood awareness.

The following information has been extracted from the 2021 Census for Mangoplah and Humula and is considered relevant, while



Statistics from: https://www.abs.gov.au/census/find-census-data/quickstats/2021/SAL11959

Table 1 below shows some of the characteristics of the two towns compared to the NSW average.





Single parent families can mean a low adult-to-child ratio within the household and therefore can make evacuation more difficult.

Statistics from: https://www.abs.gov.au/census/find-census-data/quickstats/2021/SAL11959

	Mangoplah	Humula	NSW
Population Age:			
0 – 14 years	13.5%	17.2%	18.2%
15 - 64 years	70.7%	55.7%	64.2%
> 65 years	15.8%	27.1%	17.7%
Average people per dwelling	2.8	2.4	2.6
Own/mortgage property	78.7%	86.2 %	64%
Rent property	17%	11.8%	32.6%
Other tenure type/not stated	8.5%	5.9%	3.4%
No cars at dwelling	5%	0%	9.0%
Speak only English at home	90.4%	90.7%	67.6%

Table 1: Characteristics of the (Australian Bureau of Statistics, 2021)

The characteristics noted above are considered in the community engagement strategy and when considering response modification options, such as flood education, warning or evacuation systems. Given the high proportion of English-only households, the delivery of community consultation material in English only is deemed appropriate. The proportion of residents over the age of 65 is lower than the NSW state average in Mangoplah but higher in Humula. This suggests that online engagement strategies may be as effective as face-to-face or postal communications.

In addition to communication strategies, census data can be used as an indicator of a community's vulnerability regarding flood risk management. Aged residents are more likely to be frail and physically unable to respond as quickly to flood emergencies. Provision of assistance to such residents should be a key consideration when developing flood evacuation systems and the lead time with which warnings are provided.

The family composition within a residence can also affect flood awareness and capacity to respond. There are 13 lone person households within Mangoplah and nine (9) within Humula who are at greater risk of being unaware of flood warnings or evacuation orders. There are also eight (8) single parent families in each of the towns, which can mean a low adult-child ratio and result in difficulties preparing for and safely undertaking evacuations. Conversely, the higher proportion of those who own or have a mortgage on their property could mean greater awareness of the flood risk exposure to their property.



2.3. Nature of Flooding

Mangoplah

Mangoplah is impacted by local overland flow and mainstream flooding from Burkes Creek and Paper Forest Creek. Some parts of the study area, lying diagonally through the town are elevated above the rest of the town which results in these regions being at a lower risk of mainstream flooding. Flooding to the north of the elevated areas is impacted by Burkes Creek while the areas to the south are impacted by Paper Forest Creek. The Holbrook Road bridge is one of the worst impacted locations within the study area. In the October 2010 event, the bridge was flooded above the concrete rails.

Humula

Flooding in Humula occurs due to local overland flow and mainstream flooding from Umbango Creek and its tributaries. Within the town centre, the immediate floodplain closer to the creeks is relatively flat and at a lower elevation compared to the developed region of the town. This reduces the mainstream impacted area. Carabost Creek Bridge and Umbango Creek Bridge at Eight Mile Road in Humula, are of the worst impacted locations within the study area, with significant damage occurring to the Carabost Creek bridge in the October 2010 event.

2.4. Historic Flood Events

Limited information on the flood history of Mangoplah and Humula is available except for the October 2010 and the March 2012 events. Flood events within the Burkes Creek catchment have occurred in 1891, 1912, 1927, 1928, 1931, 1934, 1939, 1955, 1974, 1988, 1989, 1992, 2010, 2012 and 2022 which may have most likely occurred within Mangoplah as well.

Humula falls within the Tarcutta Creek Catchment which had floods in 1870, 1891,1916, 1923, 1931, 1932, 1935, 1936, 1939, 1948, 1950, 1955, 1970, 1974, 1983, 1986, 1991, 1992, 2000, 2005, 2010, 2011, 2012, 2020, 2021 and 2022 which may have impacted Humula as well.

It is noted that this is not an exhaustive list of flood events, as details were not available for all recorded floods.

2.4.1. October 2010

The event occurred on the 15th of October 2010. 134mm of rainfall was recorded at the Mangoplah Forest Vale Gauge (#74264) and 112mm at the Humula Rylands Gauge (#72024) between 9 AM 13th October 2010 and 9 AM 16th October 2010.

Mangoplah

During the event, Holbrook Road Bridge on Burkes Creek in Mangoplah was closed at 5pm on the 15th October 2010 and remained closed for a week. By 8:30pm on the same day, the creek rose above the concrete guard rails of the bridge. This was the highest flood level observed at the bridge in recent history. No other information about the interaction of the event with the community is available.

It is to be noted that some monitoring of the levels at the Holbrook Road Bridge was conducted



and based on this an informal warning for the downstream town of The Rock was issued.



Photo 2: Holbrook Road Bridge (15th Oct, 5:30pm)



Photo 1: Esitmated Peak Flood Height

Humula

Based on the feedback received from the community, the October 2010 flood was the biggest one that they had ever experienced in Humula. Although Umbango Creek is ungauged but anecdotal evidence suggests that it was the main contributor to the flood at the downstream town of Tarcutta.

Umbango Creek Bridge and Carabost Creek Bridge at Eight Mile Road were damaged during the event. Debris were deposited at the Humula Eight Mile Road. Humula Citizens Sports Club was also flooded. Information on the observed flood levels and the properties flooded is not available. Some photos from the event are provided below.



Photo 3: Carabost Creek Bridge



Photo 4: Umbango Creek Bridge



Photo 5: Humula Citizens Club

2.4.2. March 2012

The March 2012 flood event occurred between the 28th of February and 4th of March. A total of 230mm of rainfall was recorded at the Mangoplah Forest Vale Gauge (#74264) and 229mm Humula Rylands Gauge (#72024) between 9 AM 29th February and 9 AM 4th March.

Holbrook Road Bridge in Mangoplah was flooded during this event however the flood level was estimated to be 0.4m below the October 2010 event. Substantially higher flow from Paper Forest Creek was observed during the March 2012 event. No other information describing the impact of the event within Humula and Mangoplah could be located.



Photo 6: Holbrook Road Bridge (4th Mar, 9am)



3. PREVIOUS STUDIES

3.1. Flood Intelligence Collection and Review for towns and Villages in the Murray and Murrumbidgee Regions following the October 2010 Flood (Reference 3)

The flood intelligence was compiled in February 2012 following the floods of October 2010. The investigation involved 14 towns and villages across 5 local government areas (LGA). Although Mangoplah and Humula were not analysed separately, some information was provided for Burkes Creek (for the downstream area of The Rock) and Tarcutta Creek catchments. Various information sources were used including rainfall data, stream water level data, flood photos, community questionnaires etc. The report was commissioned and funded by NSW SES.

The document provides photos and information on the flood levels at the Holbrook Road Bridge within Mangoplah. Some information on the damages that occurred at Carabost Bridge and Umbango Creek Bridge within Humula have also been provided. Rainfall gauges at both the towns were analysed.

Additionally, the flood intelligence report made the following recommendations pertaining to the study areas:

- Clearing the debris at Humula;
- Installation of flood warning gauge along Umbango Creek;
- Installation of new stream gauge on Burkes Creek at Mangoplah Bridge.

In accordance with the above recommendation, a gauge was installed on Burkes Creek at Mangoplah nearly 800m downstream of the Holbrook Road Bridge in May 2016.

3.2. Flood Intelligence Collection and Review for 24 towns in the Murray and Murrumbidgee Regions following the March 2012 Flood (Reference 4)

Another flood intelligence collection was conducted in June 2013 for the floods of March 2012. This investigation was conducted for 24 towns and villages across four Local Government Areas. Similar to Reference 3, this study did not include an individual analysis of Mangoplah and Humula but had some information for the two catchment areas. The report was commissioned and funded by NSW SES.

The methodology used for the analysis of the event, information used, and the structure of the report is similar to Reference 3. As a part of the document, the observed levels at Mangoplah Bridge were analysed with the simultaneous impact at the downstream town of The Rock. At The Rock, a comparison of the surveyed flood levels from the October 2010 event and the March 2012 event was included in the document which showed that generally the flood levels through most of the town were higher in the 2012 event.

The recommendations provided within this report were same as those provided in Reference 3.

4. AVAILABLE DATA

4.1. Aerial Imagery

For the purposes of mapping and spatial data and modelling results interpretation, aerial imagery from Six maps will be utilised. Nearmap does not cover either town.

4.2. Topographic Data

Light Detection and Ranging (LiDAR) topographic survey of the study area and its immediate surroundings was captured by the NSW Government Spatial Services. This dataset is freely available from Geosciences Australia (ELVIS). The LiDAR creates a high-resolution topographic model of the ground elevation using laser scanners and GPS devices mounted on a small aircraft. The DEM (Digital elevation model) is then derived from a series of points with a typical density of 4 points per square metre.

The LiDAR datasets available for the study areas are as follows:

- LiDAR with 5m resolution covering the entire Burkes Creek Catchment up to The Rock, collected in 2014.
- LiDAR with 2m resolution covering the Umbango and Carabost Creek Catchments up to 650m upstream of the confluence of both the creeks, collected in 2017.
- LiDAR with 5m resolution covering the remainder of the catchment area and study area for the town of Humula.

Additionally, Photomapping Services PTY LTD were engaged by Wagga Wagga City Council to procure 1m LiDAR data for the study area of Humula and Mangoplah. This data was provided to WMAwater as point cloud files which was filtered and converted into a gridded DEM using inhouse tools.

For this study, this data will be utilised to:

- Define the sub-catchment and catchment boundaries for the study area which forms the basis for the hydrological model.
- Define the terrain for the 2D Hydraulic model.

The accuracy of the ground information obtained from LiDAR survey can be adversely affected by the nature and density of vegetation, the presence of steeply varying terrain, the vicinity of buildings and/or the presence of water. The accuracy is typically \pm 0.15 m for clear terrain.

Surveyed ground level data will be sought from Council to validate the accuracy of the LiDAR.

4.3. Hydraulic Structures

Hydraulic structures influence the flood behaviour and therefore form an essential input in the 2D hydraulic model. These include bridges and stormwater infrastructure such as culverts and pipes. Limited information about the stormwater network within Humula and Mangoplah is available. Plans for the three (3) bridges within Humula and one (1) Bridge in Mangoplah has been requested from Council as a part of the data request sent on the 24th November 2023.

4.4. Gauge Data

4.4.1. Stream Gauges

There are no current stream gauges within the Umbango Creek catchment and one stream gauge is located within the Burkes Creek catchment within the Mangoplah study area downstream of the Holbrook Road Bridge. Details of the gauge are provided on Table 2.

Table 2: Stream Gauges

Station	Name	Operating Authority	Opened	Closed
41000280	Burkes Creek at Mangoplah	WaterNSW	2016	-

4.4.2. Rainfall Gauges

Mangoplah

There are two current rainfall gauges located within the study area catchment and only one operating as a pluviometer gauge. These records are used to create rainfall hyetographs (a temporal representation of rainfall), which forms the model input for historical events against which the model is calibrated. The details of these gauges are provided in Table 3 and the location theses are shown on Figure 3a.

Table 3: Mangoplah Rainfall Stations

Station	Name	Operating Authority	Observation Interval	Opened	Closed
74264	Mangoplah (Forest Vale))	BOM	Daily	2002	-
41000280	Burkes Creek at Mangoplah	WaterNSW	Pluviometer	2016	-
74200	Westby (Waverley)	BOM	Daily	1966	1968
74195	Pulletop (Wolonga)	BOM	Daily	1966	2009
72166	Mangoplah (Glengarry)	BOM	Daily	1983	2004
74203	Mangoplah (Ardlui)	BOM	Daily	1968	1989

Humula

There is one current rainfall gauge located within the study area catchment with none operating as pluviometer gauges. However, a pluviometer gauge exists on Tarcutta Creek outside the study area catchment which will be used create rainfall hyetographs (a temporal representation of rainfall), which forms the model input for historical events against which the model is calibrated. The details of these gauges are provided in Table 4 and the location theses are shown on Figure 3b.

Table 4: Rainfall Stations

Station	Name	Operating	Observation	Opened	Closed
		Authority	Interval		
72012	Carabost	BOM	Daily	1886	-
72017	Carabost (Yallowin)	BOM	Daily	1999	2021
72067	Kyamba	BOM	Daily	1879	2021



*Gauge outside the study area catchment, will be used to derive the rainfall temporal pattern for the calibration events.

4.5. Site Visit

A site visit was conducted on 8th November 2023 as part of the data collection process for this project. The aim of this site visit was to become more familiar with the area in general and gain an understanding of the creeks in the study area and their interactions. During this site visit, WMAwater staff undertook a tour around the study area, accompanied by a Council officer.

5. STAKEHOLDER ENGAGEMENT

The Flood Risk Management Manual (Reference 2) provides 10 principles for the Flood Risk Management (FRM) process and one of these principles is to be consultative. Active engagement with government agencies, stakeholder groups and community are crucial to achieve the following key outcomes:

- Inform the community about the current study;
- Identify community concerns and knowledge in regard to flooding;
- Gather ideas and information on practical and realistic management options for the floodplain; and
- Develop decisions and outcomes in an inclusive way.

"Community" refers to government (both state and local), business, industry and the general public. Consultation with the community is an important element of the Flood Risk Management process facilitating community engagement, building confidence in flood modelling tools, and leading to acceptance and ownership of the overall project.

5.1. Flood Risk Management Committee

The process of managing flood risk within Humula and Mangoplah will be assisted by the Flood Risk Management Advisory Committee (FRMAC). The committee is generally made up of Councillors, Council staff from a variety of areas across Council, NSW Government Agencies including DCCEEW and the NSW SES, and community representatives. The Flood Risk Management Advisory 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, providing information of historical flooding and areas of concern to the community. The committee is the driving force behind the study.

5.1.1. Meetings

Meetings will be held with the FRMC throughout the study to inform the FRMAC about the present the key objectives and various stages of the study and update them on the progress. To date an initial presentation has been delivered in addition to minor updates.

5.2. Community Consultation

As part of the Data Collection stage, a range of community consultation activities were undertaken in Mangoplah and Humula with the following aims:

- Inform the community and promote awareness of the study and its objectives and outcomes;
- Gather information on past floods (flood marks, observed flood behaviour, photographs) for use in the calibration of flood models;

The consultation period ran during September 2024, and comprised the following engagement methods:

- Flyers with the information about the consultation were delivered to resident's mail boxes in Mangoplah;
- Newsletter and questionnaire, made available as hardcopies at the Mangoplah Hotel and Humula Citizens Sports Club;
- Drop-in Sessions were conducted at the Humula Citizens Club on the 4th September 2024, 6pm– 8pm and at Mangoplah Public Hall on the 5th September 2024, 6pm– 8pm; and
- Option for residents to provide flood photos via email and a USB flash drive was available at the Humula Citizens Club for the residents to provide any flood photos.

A copy of the newsletter and questionnaire is provided in Appendix A.

5.2.1. Drop-in Session

Drop-in sessions were held with WMAwater staff and a Council officer at each of the towns. The first session was conducted for Humula at Humula Citizens Sports Club from 6pm to 8pm on Wednesday, 4th September 2024 and the second at Mangoplah at Mangoplah Public Hall from 6pm to 8pm on Thursday, 5th September 2024.

The session in Humula was well attended, with 8 attendees. The residents provided information about their experiences in the past flood events, specifically the October 2010 event. Issues such as debris in the creeks, emergency management, road access during floods, structural integrity of bridges, drainage maintenance and flooding due to Carabost Creek were raised by the residents. Attendees mentioned that the October 2010 flood was the biggest one they had observed with other events in 2012, 2021 and 2022. It is to be noted that only a few of the attendees had experienced the 2010 flood as others were relatively new in the area.

The session in Mangoplah had low attendance and unfortunately no information on flooding beyond the impacts at Holbrook Road bridge.

5.2.2. Questionnaire Results

Questionnaires were created for both the towns with the aim of gathering information about specific experiences and observations of flooding in the community. Hard copies of the questionnaire were left at the Mangoplah Hotel and Humula Citizens Club. Unfortunately, no written responses were received from either towns. This could be attributed to the low population in both the towns, in addition to the relatively limited direct property impacts during past flood events.



6. REFERENCES

- Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors)
- 1. **Australian Rainfall and Runoff A Guide to Flood Estimation** Commonwealth of Australia, Australia. 2019
- 2. Flood Risk Management Manual NSW Government, June 2023

Bewsher Consulting

3. Flood Intelligence Collection and Review for Towns and Villages in the Murray and Murrumbidgee Regions following the October 2010 Flood NSW State Emergency Services, February 2012

Bewsher Consulting

4. Flood Intelligence Collection and Review for 24 Towns and Villages in the Murray and Murrumbidgee Regions following the March 2012 Flood. NSW State Emergency Services, June 2013

















72012 : Carabost

Source: Esrl, Maxar, Earthstar Geographics, and the GIS User Com

72102-HUMULA STATION

72036 - MURRAGULDRIE STATE FOREST 2 72035-MURRAGULDRIE STATE FOREST1

72024-HUMULA (RYLANDS)

72017-CARABOST (YALLOWIN)

72067-KYAMBA 72012-CARABOST

72014-CARABOST STATE FOREST 2 72013-CARABOST FOREST HEADQUARTERS

30

72019-HOLBROOK (GLENFALLOCH)

10

72058 - NOONBAH (YAMMACOONA)

72078 - GARRYOWEN (YALLOCK)

- Pluviometre and Stream Gauge \circ
- Daily Rainfall Gauge \circ
- Pluviometer
- Umbango Creek Catchment

72015-COPABELLA

20

N

FIGURE 3 RAINFALL AND STREAM GAUGES

410155 - TARCUTTA CREEK AT BELMORE BRIDGE

72082-BATLOW (HALLOWEEN)

72064-HILLSIDE (ADELONG)

40 km









HUMULA FLOOD STUDY

We invite you to share your past flooding experiences and local knowledge with us to help us better understand localised flood behaviour in Humula in more detail.

We are specifically interested in collecting records of flooding such as photographs of flood marks or observations of flood behaviour you may have witnessed. We're interested in recent floods like 2010, 2012, and 2014, as well as earlier floods.

Wagga Wagga City Council has engaged WMAwater to undertake a detailed Flood Study for the town of Humula. The Flood Study will give Council a better understanding of the current flood risk to the community and support a range of Council functions including development, planning, community education and mitigation works.

How can you contribute? Attend the Community Pop-up

Date Wednesday, 4th September 2024 Time: 6:00pm – 8:00pm

Location Humula Citizen Sports Club, Mate St, Humula NSW 2652

Share your Property Flood Mark photos floodfutures@wagga.nsw.gov.au

Please provide details for each photo including the time, date and location at which they were taken.

Aims of the Flood Study



Flooding in Humula, October 2010

The Flood Study aims to provide an understanding of the nature and extent of potential flooding from Carabost Creek and Umbango Creek (mainstream flooding), and local stormwater runoff that drains to these waterways (overland flow). The first stage of the Flood Study will collect, compile and review all available information, including valuable community knowledge and experiences of past floods.

As part of the study, computer models will be established to determine flood behaviour in Humula. To ensure the flood models are as accurate as possible, historical data such as observations and photos of flooding behaviour from the community are required.

Humula's Flood History

Major floods occurred within Humula in 2010, 2012 and 2014.

The October 2010 flood resulted in the closures of several bridges in Humula including Carabost Bridge, and Umbango Bridge.

The Floodplain Management Process

This project is supported by the NSW Government's Floodplain Management Program which aims to reduce the impacts of flooding and flood liability on individual owners and occupiers, and to minimise private and public losses resulting from flooding. Under the Program, local government is responsible for managing flood liable land.

The Floodplain Management Process, undertaken in accordance with the NSW Government Flood Prone Land Policy as outlined in the NSW Flood Risk Management Manual. The process ultimately encourages the development of solutions to existing flood problems in developed areas, and strategies for ensuring that new development:

- is compatible with the flood hazard, and
- does not create additional flooding problems in existing developed areas.

In this first stage, the Flood Study, an understanding of the flood behaviour and its impacts will be developed. Future stages will identify and assess strategies for the long term management of flood risk.



What are Flood Marks?

Flood marks physically show the height a flood rose to, or how far the floodwaters extended. Flood marks can include mud or debris lines on buildings or fences, or depth markers or signposts on inundated roads, for example.

Flood marks are essential to flood engineers! Flood marks are used to make sure flood models are able to reproduce real flood behaviour as accurately as possible. This is called 'model calibration'.

Do you have any photos of flood marks on your property? Show us!



The Floodplain Management Committee

The Humula Flood Study, and subsequent studies under the NSW Floodplain Management Process, are driven by the Floodplain Risk Management Advisory Committee (FRMAC). The FRMAC includes Council staff, Councillors, community representatives and NSW government agencies, including the SES and Department of Planning and Environment, and provides a forum for discussion of the range of viewpoints within the study area.







MANGOPLAH FLOOD STUDY

We invite you to share your past flooding experiences and local knowledge with us to help us better understand localised flood behaviour in Mangoplah in more detail.

We are specifically interested in collecting records of flooding such as photographs of flood marks or observations of flood behaviour you may have witnessed. We're interested in recent floods like 2010, 2012, and 2014, as well as earlier floods.

Wagga Wagga City Council has engaged WMAwater to undertake a detailed Flood Study for the town of Mangoplah. The Flood Study will give Council a better understanding of the current flood risk to the community and support a range of Council functions including development, planning, community education and mitigation works. How can you contribute? Attend the Community Pop-up

Date Thursday, 5th September 2024 Time: 6:00pm – 8:00pm

Location Mangoplah Public Hall, 14 Cox Street, Mangoplah,NSW,2652

Share your Property Flood Mark photos floodfutures@wagga.nsw.gov.au

Please provide details for each photo including the time, date and location at which they were taken.

Aims of the Flood Study



The Flood Study aims to provide an understanding of the nature and extent of potential flooding from Burkes Creek (mainstream flooding), and local stormwater runoff that drains to these waterways (overland flow). The first stage of the Flood Study will collect, compile and review all available information, including valuable community knowledge and experiences of past floods.

As part of the study, computer models will be established to determine flood behaviour in Mangoplah. To ensure the flood models are as accurate as possible, historical data such as observations and photos of flooding behaviour from the community are required.

Mangoplah Bridge, October 2010

Mangoplah's Flood History

Major floods occurred in Mangoplah in 2010, 2012 and 2014.

The October 2010 flood resulted in the closures of several bridges in Mangoplah including Holbrook Road Bridge. The flood level at the Holbrook Road Bridge in Mangoplah rose above the concrete guard rails resulting into its closure for 1 week.

The Floodplain Management Process

This project is supported by the NSW Government's Floodplain Management Program which aims to reduce the impacts of flooding and flood liability on individual owners and occupiers, and to minimise private and public losses resulting from flooding. Under the Program, local government is responsible for managing flood liable land.

The Floodplain Management Process, undertaken in accordance with the NSW Government Flood Prone Land Policy as outlined in the NSW Flood Risk Management Manual. The process ultimately encourages the development of solutions to existing flood problems in developed areas, and strategies for ensuring that new development:

- is compatible with the flood hazard, and
- does not create additional flooding problems in existing developed areas.

In this first stage, the Flood Study, an understanding of the flood behaviour and its impacts will be developed. Future stages will identify and assess strategies for the long term management of flood risk.



What are Flood Marks?

Flood marks physically show the height a flood rose to, or how far the floodwaters extended. Flood marks can include mud or debris lines on buildings or fences, or depth markers or signposts on inundated roads, for example.

Flood marks are essential to flood engineers! Flood marks are used to make sure flood models are able to reproduce real flood behaviour as accurately as possible. This is called 'model calibration'.

Do you have any photos of flood marks on your property? Show us!



The Floodplain Management Committee

The Mangoplah Flood Study, and subsequent studies under the NSW Floodplain Management Process, are driven by the Floodplain Risk Management Advisory Committee (FRMAC). The FRMAC includes Council staff, Councillors, community representatives and NSW government agencies, including the SES and Department of Planning and Environment, and provides a forum for discussion of the range of viewpoints within the study area.







HUMULA FLOOD STUDY

Please complete this questionnaire and return to council by Monday 30th September 2024 Responses can also be scanned and emailed to floodfutures@wagga.nsw.gov.au

1. Your Details

Your contact details are optional and will only be used to contact you for more information for this study with your consent.

Name	
Address	
Telephone	
Email	

2. Can we contact you directly for more information?	
Yes, via telephone Yes, via email No	
3. How long have you lived/worked in this area?	
Years Months	
4. Is this property a residence, business or other?	
Residence Business Please provid - e.g. Farm, V	e details 'ineyard
5. Are you aware that parts of Humula are prone to flooding?	
Yes No	
6. Approximately how close is your property to the nearest river, creek or drainage char	nnel?
7. Have you been affected by flooding from Carabost, Umbango or other creeks?	
Yes No	Other

8. If you were affected by flooding, please indicate if the prope	rty was:		
Flooded over floor Flooded in the front or backyard Flooded in the garage Flooded on the road outside my property	Other (please specify)		
9. Do you know where the water that entered your property ca	me from?		
Carabost / Umbango/ other Creek: Neighbours' property	Other (please specify)		
Road Playing Field / grass area Manholes			
10. If you were affected by flooding, how did it affect your day	-to-day activity?		
Other (please source of the second se	specify)		
11. If you were affected by flooding, how long did the water ta	ke to drain away?		
Hours Water had to be pumped out Days Unsure	Please provide further details		
12. If you were affected by flooding, what action did you take to protect yourself, your property, or your business? For example: evacuated, sandbagged door, plastic sheeting, elevated stock/items etc			

13. Please describe the flood behaviour you have observed (e.g. height the flood reached on your house, fence or shed, damaged caused by the flood, dates and times, rainfall around the time of the flood)

I have never observed any flooding in the region	I observed flooding in parks
Neighbours / local areas	I observed flooding on roads
Details	

14. Do you have any information we could use such as photographs of flooding or recorded observations of flood depths?

Yes

To help ensure the flood models reproduce locally observed flood behaviour as closely as possible, we value your descriptive details on how flood(s) behaved or records of flooding levels such as photographs or flood marks (e.g. mud or debris lines).



15. Please use this section to provide any addition information or comments if you have any.





MANGOPLAH FLOOD STUDY

Please complete this questionnaire and return to council by Monday 30th September 2024 Responses can also be scanned and emailed to floodfutures@wagga.nsw.gov.au

1. Your Details

Your contact details are optional and will only be used to contact you for more information for this study with your consent.

Name	
Address	
Telephone	
Email	

2. Can we contact you directly for more information?		
Yes, via telephone Yes, via email No		
3. How long have you lived/worked in this area?		
Years Months		
4. Is this property a residence, business or other?		
Residence Business Please provid - e.g. Farm, V	e details 'ineyard	
5. Are you aware that parts of Mangoplah are prone to flooding?		
Yes No		
6. Approximately how close is your property to the nearest river, creek or drainage char	nnel?	
7. Have you been affected by flooding from Burkes Creek or other creeks?		
Yes No	Other	

8. If you were affected by flooding, please indicate if the prope	rty was:		
Flooded over floor Flooded in the front or backyard Flooded in the garage Flooded on the road outside my property	Other (please specify)		
9. Do you know where the water that entered your property ca	me from?		
Burkes Creek/ other Creek: Neighbours' property Road Playing Field / grass area Manholes	Other (please specify)		
10. If you were affected by flooding, how did it affect your day	-to-day activity?		
Business closed No access to your property Other (please stopping) Isolated in your property Isolated in your property	specify)		
11. If you were affected by flooding, how long did the water ta	ke to drain away?		
Hours Water had to be pumped out Days Unsure	Please provide further details		
12. If you were affected by flooding, what action did you take to protect yourself, your property, or your business? For example: evacuated, sandbagged door, plastic sheeting, elevated stock/items etc			

13. Please describe the flood behaviour you have observed (e.g. height the flood reached on your house, fence or shed, damaged caused by the flood, dates and times, rainfall around the time of the flood)

I have never observed any flooding in the region	I observed flooding in parks
Neighbours / local areas	I observed flooding on roads
Details	

14. Do you have any information we could use such as photographs of flooding or recorded observations of flood depths?

Yes No To help ensure the flood models reproduce locally observed flood behaviour as closely as possible, we value your descriptive details on how flood(s) behaved or records of flooding levels such as photographs or flood marks (e.g. mud or debris lines).



15. Please use this section to provide any addition information or comments if you have any.