RYLSTONE

FLOOD STUDY

REPORT
DEPARTMENT OF WATER RESOURCES

RYLSTONE
FLOOD STUDY
REPORT

June 1987

Date Due

15/7/98

S & M SUPPLY Co 3005
The Government's Flood Policy is directed at providing solutions to existing flooding problems in developed areas and to ensuring that 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 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 a flood plain management system comprising the following four sequential stages:-

1. **Flood Study**
   - Determines the nature and extent of the flood problem.

2. **Floodplain Management Study**
   - Evaluates management options for the floodplain in respect of both existing and proposed development.

3. **Floodplain Management Plan**
   - Involves formal adoption by Council of a plan of management for the floodplain.

4. **Implementation of the Plan**
   - Construction of flood mitigation works to protect existing development.
   - Use of Local Environmental Plans to ensure new development is compatible with flood hazard.

The Rylstone Flood Study constitutes the first stage of the management process for the Rylstone flood plain and has been prepared for Rylstone Shire Council to define flood behaviour under current conditions. It was fully funded by the State Government.
Because Rylstone does not have a significant flooding problem, it is unnecessary to undertake a formal floodplain management study. However it would be prudent for Council to consider floodplain management options for the valley, taking into account both the problems of existing flood liable development and the impact of possible urban expansion. The initiative for this assessment rests with Council.

The results of the assessment, together with consideration of related social, ecological and economic issues, should enable Council to adopt a sound management plan for the floodplain.
9. FLOOD DAMAGE
   9.1 Purpose
   9.2 Flood Damage History

10. FLOOD MONITORING
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   10.2 Flood Data

11. FLOOD MITIGATION

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1. SUMMARY

This chapter contains all key information in the form of a checklist. It is intended for quick reference by persons unfamiliar with the town or flood study.

1.01 Title

TOWN: Rylstone
TYPE OF STUDY: Reconnaissance
DATE OF RELEASE: 1987

1.02 Catchment

VALLEY: Macquarie
MAIN STREAM: Cudgegong River
CONTRIBUTING AREA: 580 km²

1.03 Government

SHIRE: Rylstone
SEAT OF GOVERNMENT: Rylstone
STATE ELECTORATE: Bathurst
FEDERAL ELECTORATE: Calare

1.04 Local Council

POSTAL ADDRESS: Rylstone Shire Council
Louee Street
RYLSTONE, N.S.W. 2849
TELEPHONE NUMBER: (063) 791205
COUNCIL CLERK: Mr. D.H. Ramsland
COUNCIL ENGINEER: Miss E. Martins
COUNCIL PLANNER: Miss E. Martins

1.05 Department of Environment and Planning

RESPONSIBLE OFFICE: Dubbo
ADDRESS: Dept. of Environment & Planning
P.O. Box 69, DUBBO, N.S.W. 2375.

1.06 Department Records

FLOOD MAP FILE: 86/15033
CALCULATION FOLDER:

1.07 Base Map

TYPE: Air Photo: Gulgong N.S.W.
SOURCE: 2900 - Run 1
DATE: Department of Lands
20.11.1980
1.08 Hydraulics

Basis for determining flood profile: Historical flood levels:
February 1955

Source of flood levels: Department surveys

1.09 Surveys

Basis for delineating inundation limits: Field survey by Department
2. INTRODUCTION

2.1 Flood Policy

In order to contain the growing cost of flood damages, the New South Wales Government introduced a policy on the development of flood prone lands in 1977. In essence the policy was to discourage further urban development on flood prone land, to keep floodways clear of obstructions. Flood prone land was defined as that subject to inundation by the once in 100 years flood or lesser floods. Floodways were defined as those areas subject to inundation by the one in 20 years flood or lesser floods. Both definitions were deemed to apply, unless otherwise determined by the responsible Government instrumentality.

Although the 1977 policy was effective in reducing the potential increase in flood damage, there was concern that its rigid application was, at times, causing undue hardship to property owners. As a consequence, the Government reviewed the policy and, after public comment, issued a revised policy in December 1984.

The primary objective of the new flood policy is to reduce the impact of flooding and flood liability on individual owners and occupiers, and to reduce private and public losses resulting from flooding. The policy recognises the need to treat developed and undeveloped land differently and provides for all development and building proposals to be treated on their merits.

It reaffirms that the basic responsibility for management of flood liable land rests with local government. In order to discharge the responsibility, councils are encouraged to prepare and implement floodplain management plans and incorporate these into local environment plans. The role of the State Government is to provide financial, engineering and planning assistance. As with the previous policy, technical advice on flooding is provided by the Public Works Department along the tidal reaches of coastal streams, and by the Department of Water Resources elsewhere in the State.
2.2 **Flood Study Reports**

Under the revised policy, technical advice on flooding is to be provided in the form of flood study reports. These will serve as the hydraulic and hydrologic input to floodplain management plans formulated at the local level. As well as documenting the studies undertaken to assess the frequency and extent of inundation, the flood report also provides technical details on all other flooding aspects which must be considered when formulating a management plan.

It is intended that the flood report provide all the relevant details in a comprehensive but succinct format. The body of the report describes the physical setting, the nature of flooding, the available information and the procedures used to determine the inundation limits and floodway extent. It identifies floodway areas, provides the bases for locating areas of different flood hazard, summarizes potential flood damages, suggests priority areas for monitoring future floods and details the flood mitigation measures proposed for the town. At the rear of the report will be found a reference plan containing both flood levels and flood limits.

Two types of urban flood studies are undertaken by the Department of Water Resources – detailed studies and reconnaissance studies.

Detailed studies involve detailed hydrological and hydraulic investigations and extensive field surveys. Such studies are only undertaken for towns where the degree of flood affectation, its size and its rate of growth, warrant the considerable effort involved.

For smaller towns, or towns with less significant flood problems, a reconnaissance flood study may be undertaken. Such studies document the pattern of inundation for a large historical flood. It is considered that in towns with minor flooding problems, the reconnaissance flood studies will be adequate for the purpose of formulating a flood plain management plan. The present report is a reconnaissance flood study report for the town of Rylstone.
2.3 **Flood Standard**

An important change resulting from the 1984 policy is that the definition of flood liable land as being that covered by the once in 100 year flood, has been abandoned as a statewide standard. Instead the designated flood levels will be determined by individual councils having regard to technical factors and local circumstances.

The flood standard is the size of the flood adopted as the basis for planning and controlling development on flood liable land. In selecting the flood standard, councils should take into consideration social, economic and ecological issues, as well as flooding considerations.

It may be some time before all the information necessary to select the appropriate flood standard is available. In the meantime councils will be required to make planning decisions and determinations on particular proposals on the basis of some interim flood standard.

Under the 1977 flood policy, flood levels and inundation maps were determined for the statistical 100 year flood or the highest known flood. In the short-term at least, such data will remain the most widely available form of information. It is therefore likely that most councils will choose to adopt either the 100 year flood or highest known flood as the interim flood standard.

The present report details the results of flood investigations based on the historical flood of February 1955. It is provided as an interim data source to assist council in undertaking its floodplain management responsibilities. The use of the historical 1955 flood in this report is a matter of expediency, and is not intended to pre-empt councils determination of a final flood standard when all relevant information is available.
2.4 Flood Advice

The involvement of the Department in flooding problems at a particular town does not end with completion of the flood study. The Department is likely to be represented on the local flood plain management committee which prepares the floodplain management plan. In some cases the Department may be involved in the selection, design and construction of flood mitigation works. The Department may also be asked by the local council to advise and assist with the evaluation of significant development proposals.

2.5 Reasons for Study

Following investigations into flooding at Rylstone for the Macquarie Valley Flood Plain Management Study [Sinclair Knight and Partners (1984)], Rylstone Shire Council expressed interest in a flood report on Rylstone to delineate flood liable areas in and around the township.
3. NATURE OF FLOODING

3.1 Physical Setting

Rylstone is located on the left bank of the Cudgegong River which, at the town, has a catchment area of 580 square kilometres. A map of the catchment is presented in Figure 3.1. The Cudgegong River at Rylstone has a very narrow flood plain consisting of a series of river flats. A plan of the township showing the street layout, the river and the railway line is presented at Figure 3.2.

3.2 Flood Behaviour

Urban development in Rylstone extends to the edge of the narrow flood plain of the Cudgegong River, but the only development on the flood plain itself are playing fields and associated buildings. During major floods the Cudgegong River spreads out over the flood plain to the edge of town. The lower end of Louee Street has been raised to give flood free access to the houses located there.

Rylstone Water Supply Dam is located 1 kilometre upstream of the town and is operated to provide municipal water supply only. It is kept as full as possible at all times and has no significant effect on floods at Rylstone.
TOWN PLAN

OF

RYLSTONE
4. **DATA BASE**

4.1 **Flood Records**

Flood heights were not recorded on a regular basis at Rylstone until 1957 when the Department of Water Resources established a gauge on the town traffic bridge. However, local information and archival records show that the 1955 flood was the highest flood recorded this century. The elevation of the 1955 flood is equivalent to a gauge height of 4.0 m on the traffic bridge gauge.

4.2 **Flood Levels**

There are no residential or industrial dwellings affected by flooding in Rylstone. As a result virtually no floodmarks have been recorded on buildings or other structures. However the Department obtained three flood marks of the 1955 flood which allowed an estimate of the 1955 flood profile in the town to be made.

The flood marks were connected to Australian Height Datum (AHD) and their location and values are summarised in Table 4.1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Flood Level m AHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cudgegong River backwater at the Filtration Plant Road</td>
<td>Level with Concrete Causeway</td>
<td>570.4</td>
</tr>
<tr>
<td>Cudgegong River</td>
<td>Louee Street just upstream of Traffic Bridge</td>
<td>570.0</td>
</tr>
<tr>
<td>Cudgegong River at end of Cudgegong Street</td>
<td>Ground level at Pinetree</td>
<td>568.4</td>
</tr>
</tbody>
</table>
5. HYDRAULICS

5.1 Methodology

The hydraulic component of a flood study based on a large historical flood involves locating flood marks of that flood throughout the study area, and determining the profile of the flood using those surveyed flood marks.

Observed flood marks usually exhibit a scatter about the actual flood levels. This scatter can be caused by many factors such as:

- wave action
- back water
- obstructions immediately upstream of the flood mark
- flood levels created by local runoff entering the stream in the study area
- water marks on buildings being higher than actual flood levels because of moisture rising up the walls by capillary action
- debris being piled higher than actual flood levels by high velocities.

Where insufficient flood marks of the chosen historical flood are available it is often possible to use the characteristics of the channel such as a change in bed slope and obvious high flow controls (bridges, narrowing of channel, sharp bends) to locate the breaks in slope of the water surface and help to identify the profile.

5.2 Flood Profiles

The Cudgegong River flood profile for the 1955 flood was established by using the surveyed flood marks in conjunction with the characteristics of the river channel to identify the profile.

The adopted 1955 flood profile is set out in Table 5.1.
### TABLE 5.1

**1955 Flood Profile: Cudgegong River at Rylstone**

<table>
<thead>
<tr>
<th>Location</th>
<th>1955 Flood Level (m AHD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration Plant</td>
<td>570.5</td>
</tr>
<tr>
<td>Louee Street Bridge</td>
<td>570.0</td>
</tr>
<tr>
<td>Dabee Street</td>
<td>569.5</td>
</tr>
<tr>
<td>Upstream end of Showground</td>
<td>569.0</td>
</tr>
<tr>
<td>Cudgegong Street</td>
<td>568.5</td>
</tr>
<tr>
<td>100m upstream of Cox Street</td>
<td>568.0</td>
</tr>
<tr>
<td>200m downstream of Cox Street</td>
<td>567.5</td>
</tr>
</tbody>
</table>
6. FLOODWAY DELINEATION

6.1 Definition

The floodways are those areas of the floodplain which must be kept clear to permit the unimpeded flow of floodwaters. If the floodways are blocked or partially blocked, there will be a redistribution of flood flows, causing some areas to receive deeper and swifter floodwaters than previously.

The 1977 and 1978 policy circulars defined the floodway as the area inundated by the 1 in 20 year flood, unless otherwise determined by the Public Works Department in tidal reaches, or the Department of Water Resources elsewhere. It was intended that this simple frequency criterion (1 in 20 years) would be used as an interim basis for defining the floodway, but that subsequently the floodway would be more accurately defined by a hydraulic analysis using hydraulic criteria.

With adoption of the merit based flood policy, the delineation of floodways has become more important. This is because a clear distinction is drawn between floodway and flood fringe areas. Within flood fringe areas councils can approve any development consistent with the approved floodplain management plan. The only conditions attached relate to flood proofing, structural adequacy and access during flooding. However, within floodway areas, a development proposal will only be approved if it can be demonstrated that there will be no increase in flood levels, that fail-safe evacuation is possible, and the structure will be adequate.

It is therefore essential that the flood study report enable the council to determine whether a particular development proposal is to be sited within the floodway. Often this will be the major determinant in council's decision.
6.2 Criteria

If it is available, a hydraulic model of the floodplain can be employed to determine the floodway limits. The procedure is to progressively encroach across either floodplain towards the channel until the designated flood level has increased by a significant amount (usually 0.1m) above the existing (unencroached) flood levels. This indicates the limits of the hydraulic floodway since, any further encroachment will intrude into that part of the floodplain necessary for the free flow of floodwaters – that is, into the floodway.

In flood studies for which a hydraulic model is not available, the floodways may be defined using one or more of the following criteria:

(i) frequency of inundation (e.g. 1 in 20 year floods)

(ii) the product of velocity and depth (areas of deepest and swiftest flow)

(iii) simple hydraulics and existing development (maintaining flood paths).

These criteria have been previously used in determining floodways in several towns on the major western rivers. The flood maps for these towns were based on the flood profile of a recent major event approximating the 100 year flood and no hydraulic model was established.

6.3 Results

The flood liable areas in Rylstone are a clearly defined narrow strip consisting of the Cudgegong River flats. At present there is no development that is affected by floods of the magnitude of the 1955 flood. There is no pressure to develop the flood liable areas at this time as there is plenty of flood free land available.

It is therefore suggested that the 1955 flood inundation limits be generally adopted as the floodway limits.
7. **SURVEYS**

7.1 Permanent Survey Marks

Field surveys were required at two stages during the course of the flood study. In the first stage flood marks located in the town were connected to AHD. This information was used to establish the water surface profile. In the second stage surveys were carried out to locate on the ground the inundation limits of the 1955 flood. All levels are related to AHD.

The following permanent marks were used during surveys undertaken for the present study. Their details are summarised in Table 7.1. As the marks themselves can be moved or destroyed, it is recommended that the most current details pertaining to their location and elevation be obtained from the Lands Department before use. The Department of Water Resources and such of its officers, employees, agents, servants or other persons who have been involved in preparing the information do not accept responsibility for any inaccuracies which may be contained in that information.

**TABLE 7.1**

<table>
<thead>
<tr>
<th>Mark Numbers</th>
<th>Location</th>
<th>Reduced Level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSM 7756</td>
<td>SE corner Dabee and Louee Street</td>
<td>575.902</td>
</tr>
<tr>
<td>SSM 7757</td>
<td>SW corner Dabee and Hudgee Street</td>
<td>583.567</td>
</tr>
</tbody>
</table>
7.2 Delineation of Inundation Limits

After determination of the historical flood levels throughout the study area, the flood inundation limits in built-up areas were located on the ground by undertaking a flood fringe survey. Under the amended flood policy, flood inundation maps are no longer produced by the Public Works Department or the Department of Water Resources. However, the flood fringe survey for Rylstone was carried out before the change in Government policy in December 1984 and was therefore available.

The inundation limits located by the Department are shown on the reference plan at the rear of this report.

The flood fringe surveys originated from the permanent survey marks listed in Table 7.1.
8. FLOOD HAZARD

8.1 Methodology

The hazard to persons from flooding varies across the floodplain and with the individual capabilities of persons exposed to the hazard. For convenience the Flood Plain Development Manual (Department of Environment and Planning N.S.W. (1987)) divides flood-affected land into two hazard categories:

- High Hazard; and
- Low Hazard

Under Low Hazard conditions, should it be necessary, people and their possessions could be evacuated by trucks. Able-bodied adults would have little difficulty in wading. Damage potential and the risk to life and limb is low.

In High Hazard areas, floodwaters could cause structural damage to buildings and in extreme cases light framed houses could be washed away. Evacuation by heavy trucks would be impossible and other methods would be difficult and potentially dangerous. There may be danger to life and limb and social disruption and financial losses could be high.

From the above it can be seen that flood hazard depends upon three factors:

- the depth and speed of floodwaters,
- the available evacuation time, and
- any evacuation difficulties e.g. flood islands.

The provisional hazard at a particular site is determined solely on the basis of depth and speed of floodwaters using Figure 8.1.
The degree of hazard may be either -
- reduced by the establishment of an effective flood evacuation procedure,
- increased if evacuation difficulties exist.

Within area the degree of hazard is dependent on site conditions and the nature of the proposed development.

Example:
if the depth of floodwater is \(0.7\) m
and the velocity of floodwater is \(1.5\) m/sec
then the provisional flood hazard is high
The provisional hazard categories could subsequently be revised by a local Flood Plain Management Committee to account for any evacuation difficulties. The provisional hazard category may be reduced if an effective community evacuation plan is implemented. Alternatively, the provisional hazard category may be increased if there are substantial difficulties associated with the evacuation of people and possessions, or if the frequency of flooding is such that the community is not well adapted to flooding.

8.2 Application

Reconnaissance flood study reports such as this are based on recorded flood levels only and do not involve a hydraulic analysis. Therefore no calculations of velocity are made. However as a guide, velocities on the flood plain would be 1 m/sec or less, whilst velocities in the main channel of the Cudgegong River would be 3 m/sec or more.
9. **FLOOD DAMAGE**

9.1 **Purpose**

It is necessary to estimate flood damages as part of the flood study in order to assess the value of proposed flood mitigation measures. The flood damages avoided constitute the benefits which must be compared with the costs of constructing and maintaining the flood mitigation works.

9.2 **Flood Damage History**

The highest known flood to date has been the 1955 flood. During this flood no flood damage occurred to residential and business properties as no dwellings were flooded.

The 1955 flood came close to houses at the northern end of Louee Street and as floods greater than the 1955 flood can occur, it is possible that flood damage to dwellings could occur in the future.
10. FLOOD MONITORING

10.1 Purpose

Every flood investigation is handicapped to some degree by the lack of adequate hydrologic or hydraulic information. It is therefore imperative that every opportunity be taken to make measurements and observations of flood behaviour. This information can subsequently be used to improve the accuracy of predicted flood levels and velocities. The use of observed data engenders a greater confidence in the reliability of the results obtained, and enables the predicted flood behaviour to be related to an actual event.

Many useful observations can be made during a flood event without any special equipment or training. These can include estimates of flood surface velocities, flow directions, locations of still water or back eddies, areas of turbulent water, rate of rise and fall in water level and, of course, maximum flood levels. This chapter highlights the measurements and observations which can be made by Council staff or other interested persons during a flood.

10.2 Flood Data

This flood study is based on 1955 flood marks obtained from local residents. Available observed flood levels did not cover the whole study area and estimates had to be made where necessary.

It is important that flood levels of future major floods be monitored to help confirm the present adopted profile.

Flood levels should be pegged at the peak of the flood and surveyed after the flood event.

It would also be useful to estimate surface water velocities which can be estimated by timing the travel of surface debris along a measurable distance.

To aid in defining the floodway limits, areas of backwater should also be determined.
11. FLOOD MITIGATION

There is a range of flood mitigation options, both structural, and non-structural, which have application in individual circumstances.

At Rylstone all low lying areas adjacent to the Cudgegong River are inundated, but little actual development is affected. Accordingly structural mitigation options are not warranted.

The following non-structural flood mitigation measures for Rylstone are proposed:

- urban development on the flood liable river flats should be discouraged by maintaining appropriate zonings over the land;
- owners of existing flood liable land should be made aware that their properties are flood liable and that larger floods than the 1955 flood could occur;
- any new development in the flood-fringe should be subject to appropriate flood-proofing conditions.
12. CONCLUSIONS

A flood study for the town of Rylstone has been carried out.

As flood marks for the 1955 flood were not available throughout the study area, the flood profile was estimated where necessary using the river bed profile and channel characteristics as a guide.

The approximate inundation limits of the adopted profile were defined by field survey.

No detailed analysis of the degree of flood hazard was made but approximate velocities on the floodplain and main channel are given to allow the degree of flood hazard to be estimated.

During the 1955 flood no flood damage occurred to residential and business properties.

It is recommended that future major floods should be monitored so that the adopted flood profile can be confirmed.

Measurements and observations to be made are as follows:

- flood levels pegged and surveyed.
- estimation of surface water velocities.
- determination of backwater areas to aid in the definition of the floodway.

Structural flood mitigation works are not warranted. It is proposed that the flood plain should be managed by applying appropriate planning and development controls and promoting flood awareness.
13. REFERENCES

