## APPENDIX A

## FREQUENTLY ASKED QUESTIONS

# FLOODPLAIN MANAGEMENT STUDIES 

## FREQUENTLY ASKED QUESTIONS

## Why do flood levels change over time?

There is a chance that floods of various magnitudes will occur in the future. As the size of a flood increases, the chance that it will occur becomes rarer. Because some of these rare floods have never been experienced since European settlement, the height of future floodwaters is normally predicted using computer models. These computer models simulate flood levels and velocities for a range of flood sizes and flood probabilities. Given the importance of estimating flood levels accurately, councils and the Department of Infrastructure Planning and Natural Resources (formerly DLWC) engage experts to establish and operate the computer models.

From time to time the computer models are revised and predicted flood levels can change. The resultant change in flood levels however is normally very small. The reasons why the computer models are revised can include:

- new rainfall or ground topography information becomes available;
- new floods occur which provide additional data from which to fine-tune the models;
- better computer models become available as the science of flood modelling improves and computer capabilities increase; or
- flood mitigation works may have been carried out, or development within the catchment may have occurred, that was not previously simulated in the models.


## How are these studies funded?

These types of studies are normally carried out under State Government guidelines and are funded on a $2: 1$ basis between the State Government and councils. This funding arrangement is also available for the construction of flood mitigation works.

## My property is in a Low Flood Risk Precinct. What does this mean?

The classification of a 'Low Flood Risk Precinct’ can differ slightly between councils. Generally it means that your property would not be inundated in a 100 year flood but still has a very slight risk of inundation from larger (i.e. rarer) floods.

If you are a residential property owner, there will be virtually no change to how you may develop your property. However, there may be controls on the location of essential services such as hospitals, evacuation centres, nursing homes and emergency services.

## My property is in a Medium Flood Risk Precinct. What does this mean?

The classification of a 'Medium Flood Risk Precinct' can differ slightly between councils. Generally it means that your property is inundated in a 100 year flood, however conditions are not likely to be hazardous. If you are a residential property owner development controls will probably be similar to those that currently exist.

## My property is in a High Flood Risk Precinct. What does this mean?

The classification of a 'High Flood Risk Precinct' can differ slightly between councils. Generally it means that your property will be inundated in a 100 year flood and that hazardous conditions may occur. This could mean that there would be a possible danger to personal safety, able bodied adults may have difficulty wading to safety, evacuation by trucks may be difficult, or there may be a potential for significant structural damage to buildings. This is an area of higher hazard where stricter controls may be applied.

## Will my property value be altered if I am in a Flood Risk Precinct?

Any change in a council's classification of properties can have some impact on property values. Nevertheless, councils normally give due consideration to such impacts before introducing a system of flood risk classifications or any other classification system (e.g. bushfire risks, acid sulphate soil risk, etc). If your property is now classified as being in a Flood Risk Precinct, the real flood risks on your property have not changed, only its classification has altered. A prospective purchaser of your property could have previously discovered this risk if they had made enquiries themselves.

If you are in a Low Flood Risk Precinct, generally there will be no controls on normal residential type development. Previous valuation studies have shown that under these circumstances, your property values will not alter significantly over the long term. Certainly, when a new system of classifying flood risks is introduced, there may be some short-term effect, particularly if the development implications of the precinct classification are not understood properly. This should only be a short-term effect however until the property market understands that over the long-term, the Low Flood Risk Precinct classification will not change the way you use or develop your property.

Ultimately, however, the market determines the value of any residential property. Individual owners should seek their own valuation advice if they are concerned that the flood risk precinct categorisation may influence their property value.

## My property was never classified as 'flood prone' or 'flood liable' before. Now it is in a Low Flood Risk Precinct. Why?

The State Government changed the meaning of the terms 'flood prone', 'flood liable' and 'floodplain' in 2001. Prior to this time, these terms generally related to land below the 100 year flood level. Now it is different. These terms now relate to all land that could possibly be inundated, up to an extreme flood known as the probable maximum flood (PMF). This is a very rare flood.

The reason the Government changed the definition of these terms was because there was always some land above the 100 year flood level that was at risk of being inundated in rarer and more extreme flood events. History has shown that these rarer flood events can and do happen (e.g. the 1990 flood in Nyngan, the November 1996 flood in Coffs Harbour, the August 1998 flood in Wollongong, the 1998 flood in Katherine, the 2002 floods in Europe, etc).

## Will I be able to get house and contents insurance if my house is in a Flood Risk Precinct?

In contrast to the USA and many European countries, flood insurance is generally not available for residential property in Australia. Following the disastrous floods in Coffs Harbour in November 1996 and in Wollongong in August 1998, some insurance companies are now offering very limited flood cover. The most likely situation is that your insurer does not offer you flood cover. If limited flood cover is offered, the classification of your property within a Flood Risk Precinct is unlikely to alter the availability of cover. Obviously insurance policies and conditions may change over time or between insurance companies, and you should confirm the specific details of your situation with your insurer.

## Will I be able to get a home loan if my land is in a Flood Risk Precinct?

Most banks and lending institutions do not account for flood risks when assessing home loan applications unless there is a very significant risk of flooding at your property. The system of Flood Risk Precinct classification will make it clear to all concerned, the nature of the flood risks. Under the previous system, if a prospective lending authority made appropriate enquiries, they would have identified the nature of the flood risk and considered it during assessment of home loan applications. As a result, it is not likely that the classification of your property within a Flood Risk Precinct will alter your ability to obtain a home loan. Nevertheless, property owners who are concerned about their ability to obtain a loan should clarify the situation with their own lending authority.

## How have the flood risk maps been prepared?

Because some large and rare floods have often not been experienced since European settlement commenced, computer models are used to simulate the depths and velocities of major floods. These computer models are normally established and operated by flooding experts employed by local and state government authorities. Because of the critical importance of the flood level estimates produced by the models, such modelling is subjected to very close scrutiny before flood information is formally adopted by a council. Maps of flood risks (e.g. 'low', 'medium' and 'high') are prepared after consideration of such issues as:

- flood levels and velocities for a range of possible floods;
- ground levels;
- flood warning time and duration of flooding;
- suitability of evacuation and access routes; and
- emergency management during major floods.


## What is the probable maximum flood (PMF)?

The PMF is the largest flood that could possibly occur. It is a very rare and improbable flood. Despite this, a number of historical floods in Australia have approached the magnitude of a PMF. Every property potentially inundated by a PMF will have some flood risk, even if it is very small. Under the State Government changes implemented during 2001, councils must now consider all flood risks, even these potentially small ones, when managing floodplains. As part of the State Government changes, the definitions of the terms 'flood liable', flood prone' and 'floodplain' have been changed to refer to land inundated by the PMF.

## What is the 100 year flood?

A 100 year flood is the flood that will occur or be exceeded on average once every 100 years. It has a probability of $1 \%$ of occurring in any given year. If your area has had a 100 year flood, it is a fallacy to think you will need to wait another 99 years before the next flood arrives. Floods do not happen like that. Some parts of Australia have received a couple of 100 year floods in one decade. On average, if you live to be 70 years old, you have a better than even chance of experiencing a 100 year flood.

## Why do councils prepare floodplain management studies and plans?

Under NSW legislation, councils have the primary responsibility for management of development within floodplains. To appropriately manage development, councils need a strategic plan which considers the potential flood risks and balances these against the beneficial use of the floodplain by development. To do this, councils have to consider a range of environmental, social, economic, financial and engineering issues. This is what happens in a floodplain management study. The outcome of the study is the floodplain management plan, which details how best to manage flood risks in the floodplain for the foreseeable future.

Floodplain management plans normally comprise a range of works and measures such as:

- improvements to flood warning and emergency management;
- works (e.g. levees or detention basins) to protect existing development;
- voluntary purchase or house raising of severely flood-affected houses;
- planning and building controls to ensure future development is compatible with the flood risks; and
- measures to raise the community's awareness of flooding so that they are better able to deal with the flood risks they face.


## Will the Flood Risk Precinct maps be changed?

Yes. All mapping undertaken by council is subjected to ongoing review. As these reviews take place, it is conceivable that changes to the mapping will occur, particularly if new flood level information or ground topography information becomes available. However, this is not expected to occur very often and the intervals between revisions to the maps would normally be many years. Many councils have a policy of reviewing and updating floodplain management studies and plans about every five years. This is the likely frequency at which the maps may be amended.

## Appendix B

## Updated RAFTS Flow Estimates <br> for 2001 Catchment Conditions

[Bewsher Consulting and WBM Oceanics, 2001]

Table B. $1 \quad$ Updated 2001 Peak Flow Estimates
Cabramatta Creek - Down to Hinchinbrook Creek

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \\ & \hline \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) |
| 1.00A | Denham Court | 3 | 120 | 2 | 120 | 13 | 60 |
| 1.00B | Denham Court | 8 | 120 | 6 | 120 | 36 | 60 |
| 1.00 C | Denham Court | 12 | 120 | 8 | 120 | 51 | 60 |
| 1.00D | Denham Court | 15 | 120 | 10 | 120 | 65 | 60 |
| 1.00G | Denham Court | 5 | 120 | 3 | 120 | 20 | 60 |
| 1.00 E | Denham Court | 4 | 120 | 3 | 120 | 15 | 60 |
| 1.00F | Denham Court | 12 | 120 | 9 | 120 | 53 | 60 |
| 1.00 H | Denham Court | 29 | 120 | 21 | 120 | 129 | 60 |
| 1.001 | Denham Court | 35 | 120 | 25 | 120 | 154 | 60 |
| 1.00 J | Denham Court | 4 | 120 | 3 | 120 | 17 | 60 |
| 1.00 K | Denham Court | 8 | 120 | 6 | 120 | 31 | 60 |
| 1.00L | Denham Court | 47 | 120 | 34 | 120 | 201 | 60 |
| 1.00M | Denham Court | 50 | 120 | 36 | 120 | 216 | 60 |
| 1.01 | Cab Ck J'dine Dr | 59 | 120 | 42 | 120 | 257 | 60 |
| 1.02 | Cab Ck J'dine Dr | 65 | 120 | 46 | 120 | 286 | 60 |
| 1.03 | Cabramatta Creek | 72 | 120 | 51 | 120 | 312 | 60 |
| 2.00A | Lawn Cemetery | 3 | 120 | 2 | 120 | 13 | 60 |
| 2.00B | Lawn Cemetery | 6 | 120 | 4 | 120 | 33 | 60 |
| 2.00 C | Lawn Cemetery | 10 | 120 | 7 | 120 | 55 | 60 |
| 2.00D | Lawn Cemetery | 6 | 120 | 4 | 120 | 27 | 60 |
| 2.00E | Lawn Cemetery | 17 | 120 | 12 | 120 | 90 | 60 |
| 2.01 A |  | 3 | 120 | 2 | 120 | 15 | 60 |
| 2.01B |  | 6 | 120 | 4 | 120 | 31 | 60 |
| 2.01C |  | 24 | 120 | 17 | 120 | 123 | 60 |
| 2.02 |  | 26 | 120 | 19 | 120 | 133 | 60 |
| 1.04 | Cam. Valley Way | 94 | 120 | 67 | 120 | 403 | 60 |
| 1.05 | Cabramatta Creek | 95 | 120 | 68 | 120 | 404 | 60 |
| 25.00 |  | 13 | 90 | 11 | 90 | 42 | 15 |
| 1.06 | Cabramatta Creek | 96 | 120 | 69 | 120 | 403 | 120 |
| 26.00 |  | 11 | 90 | 8 | 90 | 33 | 15 |
| 1.07 | Cab Ck. Bazaar | 97 | 120 | 70 | 120 | 412 | 120 |
| 1.08A | Cabramatta Creek | 98 | 120 | 71 | 120 | 420 | 120 |
| 3.00A | Creek E | 5 | 120 | 4 | 120 | 24 | 60 |
| 3.00B | Ck E C'psture Rd | 8 | 120 | 6 | 120 | 37 | 60 |
| 3.01 | Creek E | 12 | 120 | 9 | 120 | 52 | 60 |
| 4.00A | Ck E C'psture Rd | 8 | 90 | 6 | 90 | 25 | 60 |
| 4.00B | Creek E | 10 | 120 | 8 | 120 | 36 | 60 |
| 3.02 | Creek E | 13 | 120 | 10 | 120 | 72 | 60 |
| 3.03A | Ck E C'psture Rd | 11 | 90 | 9 | 90 | 37 | 15 |
| 3.03B | Ck E C'psture Rd | 13 | 90 | 10 | 90 | 42 | 15 |
| 3.03C | Ck E Golf Course | 18 | 90 | 14 | 90 | 91 | 60 |
| 3.04 |  | 24 | 120 | 19 | 120 | 107 | 120 |
| 1.08B | Cabramatta Creek | 111 | 120 | 81 | 120 | 527 | 120 |
| 1.09A |  | 10 | 90 | 8 | 90 | 31 | 15 |
| 1.09B |  | 12 | 90 | 10 | 90 | 43 | 15 |
| 1.09C | Cab Ck K'jong Rd | 113 | 120 | 83 | 120 | 545 | 120 |
| 1.10A |  | 6 | 90 | 4 | 90 | 21 | 60 |
| 1.10B |  | 8 | 90 | 6 | 90 | 33 | 60 |
| 1.10C | Cab Ck Y'nga Rd | 117 | 120 | 85 | 120 | 581 | 120 |
| 1.10D |  | 118 | 120 | 87 | 120 | 598 | 120 |
| 5.00A | Creek A | 3 | 120 | 2 | 540 | 15 | 120 |
| 5.00B | Creek A | 9 | 120 | 6 | 120 | 47 | 60 |
| 5.01A | Creek A | 5 | 120 | 3 | 120 | 24 | 60 |
| 5.01B | Creek A | 5 | 120 | 4 | 120 | 25 | 60 |
| 5.01C | Creek A | 14 | 120 | 10 | 120 | 74 | 60 |
| 5.01D | Creek A | 16 | 120 | 12 | 120 | 81 | 60 |
| 5.02 | Creek A | 21 | 120 | 15 | 120 | 90 | 120 |
| 27.00 | Creek A | 4 | 120 | 3 | 120 | 27 | 60 |
| 5.03 | Creek A | 24 | 120 | 18 | 120 | 106 | 120 |
| 5.04 | Ck A C'psture Rd | 22 | 90 | 17 | 90 | 114 | 120 |
| 5.05 | Ck A 19th Ave | 20 | 720 | 16 | 90 | 118 | 240 |
| 5.06 | Ck A 1st Ave | 23 | 90 | 18 | 90 | 121 | 240 |
| 1.11 | Cabramatta Creek | 130 | 120 | 98 | 120 | 673 | 120 |

Note: For detention basins, critical duration is shown for inflow only

Table B. 2 Updated 2001 Peak Flow Estimates Hinchinbrook Creek

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit Dur. (min) |
| 11.00 | Creek J | 9 | 90 | 7 | 90 | 28 | 60 |
| 11.01 | Creek J | 13 | 90 | 10 | 90 | 45 | 60 |
| 12.00A | Creek J | 16 | 90 | 13 | 90 | 46 | 15 |
| 12.00B | Ck J C'psture Rd | 25 | 90 | 20 | 90 | 78 | 60 |
| 11.02 | Creek J | 26 | 90 | 21 | 90 | 119 | 60 |
| 11.03 | Creek J | 28 | 90 | 23 | 90 | 124 | 60 |
| 9.00A | Creek K | 6 | 120 | 4 | 120 | 27 | 60 |
| 9.00B | Creek K | 8 | 120 | 6 | 120 | 36 | 60 |
| 9.00C | Creek K | 6 | 120 | 4 | 120 | 26 | 60 |
| 9.00 D | Creek K | 16 | 120 | 12 | 120 | 72 | 60 |
| 9.00E | Creek K | 4 | 120 | 3 | 120 | 18 | 60 |
| 9.00F | Ck K Liv. R'voir | 12 | 120 | 9 | 120 | 48 | 60 |
| 9.00G | Creek K | 19 | 120 | 13 | 120 | 79 | 60 |
| 9.00 H | Creek K | 33 | 120 | 24 | 120 | 141 | 60 |
| 10.00A | Creek K | 6 | 120 | 4 | 120 | 22 | 30 |
| 10.00B | Creek K | 9 | 120 | 6 | 120 | 35 | 60 |
| 9.01 | Ck K Ex. Dam | 44 | 120 | 32 | 120 | 184 | 60 |
| 9.02 | Creek K | 49 | 120 | 35 | 120 | 194 | 60 |
| 6.00A | Elizabeth Dr. | 8 | 120 | 5 | 120 | 35 | 60 |
| 6.00B | Creek K | 15 | 120 | 11 | 120 | 61 | 60 |
| 7.00A | Elizabeth Dr. | 8 | 540 | 6 | 540 | 40 | 120 |
| 7.00B | Creek K | 24 | 90 | 19 | 90 | 65 | 15 |
| 6.01 | Creek K | 29 | 90 | 23 | 90 | 115 | 120 |
| 6.02 | Creek K | 35 | 90 | 28 | 90 | 128 | 120 |
| 8.00C | Creek K | 6 | 120 | 4 | 120 | 22 | 30 |
| 8.00A | Creek K | 7 | 120 | 5 | 120 | 22 | 30 |
| 8.00B | Creek K | 9 | 120 | 7 | 120 | 31 | 30 |
| 8.00D | Creek K | 17 | 120 | 12 | 120 | 59 | 30 |
| 8.00E | Creek K | 22 | 120 | 16 | 120 | 75 | 60 |
| 6.03 | Cecil HIs Wetland | 47 | 90 | 38 | 90 | 188 | 60 |
| 6.04 | Hinchinbrook Ck | 36 | 540 | 28 | 540 | 185 | 120 |
| 6.05 | Hinchinbrook Ck | 81 | 120 | 55 | 540 | 362 | 60 |
| 6.06A |  | 2 | 90 | 2 | 90 | 8 | 60 |
| 6.06B |  | 5 | 90 | 4 | 90 | 19 | 60 |
| 6.06C | Hinchinbrook Ck | 84 | 120 | 58 | 540 | 392 | 120 |
| 6.07 | Hinchinbrook Ck | 105 | 120 | 70 | 120 | 490 | 60 |
| 13.00 A | Creek M | 4 | 120 | 3 | 120 | 20 | 60 |
| 13.00B | Creek M | 9 | 120 | 7 | 120 | 45 | 60 |
| 13.01 | Creek M | 12 | 120 | 9 | 120 | 59 | 60 |
| 14.00 A | Creek M | 3 | 120 | 2 | 120 | 17 | 60 |
| 14.00B | Creek M | 6 | 120 | 4 | 120 | 30 | 60 |
| 13.02 | Creek M | 18 | 120 | 12 | 120 | 87 | 60 |
| 13.03 | Ck M H Pk A'drme | 21 | 120 | 15 | 120 | 99 | 60 |
| 6.08 | Hinchinbrook Ck | 126 | 120 | 84 | 120 | 589 | 60 |
| 6.09 | Hinchinbrook Ck | 129 | 120 | 86 | 120 | 596 | 60 |
| 28.00 | C'psture Rd | 33 | 90 | 27 | 90 | 94 | 15 |
| 6.10 | Hinchinbrook Ck | 139 | 120 | 94 | 120 | 619 | 120 |
| 6.11 | Hinchinbrook Ck | 140 | 120 | 94 | 120 | 631 | 120 |
| 6.12 | Hinchinbrook Ck | 141 | 120 | 95 | 120 | 638 | 120 |
| 15.00A | Creek N | 4 | 120 | 3 | 120 | 19 | 60 |
| 15.00B | Ck N Mciver | 7 | 120 | 5 | 120 | 35 | 60 |
| 15.01 | Creek N | 11 | 120 | 8 | 120 | 51 | 60 |
| 15.02 | Ck N C'psture Rd | 18 | 120 | 13 | 120 | 85 | 120 |
| 16.00A | Creek L | 7 | 120 | 5 | 120 | 36 | 60 |
| 16.00B | Ck L 2nd Ave | 10 | 120 | 7 | 120 | 48 | 60 |
| 16.01 | Ck L C'psture Rd | 18 | 120 | 13 | 120 | 86 | 60 |
| 15.03 |  | 36 | 120 | 25 | 120 | 164 | 60 |
| 6.13 | Hinchinbrook Ck | 167 | 120 | 112 | 120 | 781 | 120 |
| 6.14A |  | 8 | 90 | 7 | 90 | 27 | 15 |
| 6.14B | Hinchinbrook Ck | 168 | 120 | 113 | 120 | 792 | 120 |
| 6.14C |  | 18 | 90 | 15 | 90 | 58 | 15 |
| 6.14D | Hinchinbrook Ck | 172 | 120 | 116 | 120 | 826 | 120 |
| 17.00A | Creek C | 7 | 90 | 5 | 90 | 28 | 60 |
| 17.00B | Ck C 2nd Ave | 13 | 120 | 9 | 90 | 61 | 60 |
| 17.01 | Ck C C'psture Rd | 23 | 90 | 18 | 90 | 79 | 60 |
| 17.02B | Creek C | 3 | 90 | 3 | 90 | 18 | 60 |
| 17.02A | Creek C | 30 | 90 | 23 | 90 | 114 | 60 |
| 6.15 | Hinchinbrook Ck | 189 | 120 | 131 | 120 | 926 | 120 |
| 6.16 |  | 189 | 120 | 130 | 120 | 937 | 120 |

Note: $\quad$ For detention basins, critical duration is shown for inflow only

Table B. $3 \quad$ Updated 2001 Peak Flow Estimates
Cabramatta Creek - Hinchinbrook Creek to Maxwells Creek

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \\ & \hline \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit Dur. (min) |
| 1.12 | Cab Ck I'roo Rd | 301 | 120 | 218 | 120 | 1565 | 120 |
| 1.13 | Cab Ck H. Pk Rd | 304 | 120 | 219 | 120 | 1586 | 120 |
| 1.14C | Miller Creek | 13 | 90 | 10 | 90 | 44 | 30 |
| 1.14A | Miller Ck Banks Rd | 36 | 90 | 29 | 90 | 121 | 15 |
| 1.14B | Miller Creek | 21 | 90 | 17 | 90 | 95 | 60 |
| 1.14D | Miller Ck Cart. Ave | 30 | 90 | 24 | 90 | 139 | 60 |
| 1.14 E | Miller Ck Cart. Ave | 33 | 90 | 26 | 90 | 147 | 60 |
| 1.14F | Miller Ck Cart. Ave | 310 | 120 | 225 | 120 | 1653 | 120 |
| 1.14G | Miller Ck Cart. Ave | 311 | 120 | 225 | 120 | 1661 | 120 |
| 1.15 | Miller Ck Cart. Ave | 311 | 120 | 226 | 360 | 1666 | 120 |

Note: For detention basins, critical duration is shown for inflow only

## Table B. $4 \quad$ Updated 2001 Peak Flow Estimates <br> Maxwells Creek

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit Dur. (min) |
| 23.00A | Creek I | 10 | 90 | 8 | 90 | 32 | 60 |
| 23.00B | Creek I | 11 | 90 | 9 | 90 | 41 | 60 |
| 23.01A | Creek I | 17 | 90 | 13 | 90 | 78 | 60 |
| 23.01B | Creek I | 19 | 90 | 14 | 120 | 87 | 60 |
| 22.00 A | Creek B | 4 | 120 | 3 | 120 | 20 | 60 |
| 22.00B | Ck B Skipton Lane | 5 | 90 | 4 | 90 | 22 | 60 |
| 20.00A | Creek D | 4 | 120 | 3 | 120 | 20 | 60 |
| 20.00B | Ck D Croatia Ave | 7 | 120 | 5 | 120 | 37 | 60 |
| 20.01 | Ck D C V Way | 17 | 120 | 12 | 120 | 73 | 120 |
| 20.02 | Ck D Ash Rd | 19 | 120 | 13 | 120 | 83 | 120 |
| 21.00 | Ck D Bernera Rd | 20 | 90 | 16 | 90 | 55 | 15 |
| 21.01 | Ck D Ash Rd | 25 | 90 | 20 | 90 | 73 | 60 |
| 20.03 |  | 36 | 120 | 27 | 120 | 126 | 60 |
| 18.00A | I'burn Army Camp | 9 | 90 | 7 | 90 | 26 | 60 |
| 18.00B | I'burn Army Camp | 16 | 90 | 13 | 90 | 60 | 60 |
| 18.00C | I'burn Army Camp | 23 | 90 | 17 | 90 | 88 | 60 |
| 18.00D | C'town Road | 26 | 120 | 19 | 90 | 101 | 60 |
| 19.00A | I'burn Army Camp | 5 | 90 | 4 | 90 | 20 | 60 |
| 19.00B | I'burn Army Camp | 10 | 120 | 7 | 120 | 45 | 60 |
| 19.01A | I'burn Army Camp | 18 | 120 | 13 | 120 | 78 | 60 |
| 19.01B | C'town Road | 21 | 120 | 15 | 120 | 92 | 60 |
| 18.01 | Maxwells Creek | 47 | 120 | 33 | 120 | 191 | 60 |
| 18.02 | Max Ck SW F'way | 56 | 120 | 39 | 120 | 236 | 120 |
| 18.03A |  | 12 | 90 | 9 | 90 | 38 | 60 |
| 18.03B | Max Ck C V Way | 60 | 120 | 42 | 120 | 250 | 120 |
| 18.04 A | Max Ck M5 | 59 | 120 | 42 | 120 | 250 | 120 |
| 18.04B | Maxwells Creek | 61 | 120 | 43 | 120 | 256 | 120 |
| 18.05 | Maxwells Creek | 79 | 120 | 56 | 120 | 336 | 120 |
| 29.00A | Ck B M5 | 14 | 90 | 11 | 90 | 38 | 15 |
| 29.00B | Creek B | 15 | 90 | 12 | 90 | 41 | 15 |
| 18.06 | Maxwells Creek | 81 | 120 | 58 | 120 | 345 | 120 |
| 18.07 | Maxwells Creek | 80 | 120 | 59 | 360 | 346 | 120 |
| 18.08 | Maxwells Creek | 81 | 120 | 60 | 360 | 356 | 120 |
| 18.09A |  | 5 | 90 | 4 | 90 | 17 | 60 |
| 18.09B | Max Ck K'jong Rd | 84 | 360 | 65 | 540 | 377 | 240 |
| 18.10 | Max Ck Showgrnd | 92 | 90 | 71 | 540 | 406 | 240 |
| 18.11 | Max Ck Jedda Rd | 94 | 90 | 74 | 540 | 417 | 240 |
| 18.12 | Maxwells Creek | 94 | 90 | 75 | 540 | 419 | 240 |
| 18.13 | Max Ck Lyn Pde | 108 | 120 | 88 | 120 | 500 | 60 |
| 18.14A | Maxwells Creek | 112 | 120 | 94 | 120 | 512 | 120 |
| 18.14B | Max Ck Hox Pk Rd | 116 | 120 | 100 | 120 | 542 | 120 |
| 18.15 | Maxwells Creek | 116 | 120 | 100 | 120 | 547 | 120 |

Note: For detention basins, critical duration is shown for inflow only

## Table B. $5 \quad$ Updated 2001 Peak Flow Estimates

Cabramatta Creek - Maxwells Creek to Brickmakers Creek

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \hline \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit Dur (min) |
| 1.16 | Cabramatta Creek | 407 | 360 | 306 | 360 | 2133 | 120 |
| 1.17 | Cab Ck Eliz Dr | 416 | 360 | 312 | 360 | 2148 | 120 |
| 1.18A | Prout Ck | 22 | 90 | 17 | 90 | 61 | 30 |
| 1.18B | Prout Ck | 26 | 90 | 20 | 90 | 72 | 30 |
| 1.18C | Cabramatta Ck | 423 | 360 | 317 | 360 | 2159 | 120 |
| 1.18D | Cab Ck O Grve Rd | 428 | 360 | 320 | 360 | 2170 | 120 |
| 1.19 | Cabramatta Creek | 432 | 360 | 323 | 360 | 2175 | 120 |

Note: For detention basins, critical duration is shown for inflow only

Table B. $6 \quad \begin{aligned} & \text { Updated } 2001 \text { Peak Flow Estimates } \\ & \text { Brickmakers Creek }\end{aligned}$ Brickmakers Creek

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit Dur. (min) |
| 24.00C |  | 5 | 90 | 4 | 90 | 15 | 60 |
| 24.00 A |  | 15 | 90 | 12 | 90 | 40 | 15 |
| 24.00B | Casula Mall Basin | 23 | 90 | 18 | 90 | 82 | 60 |
| 24.00D | B'mkrs Ck K'jng Rd | 13 | 90 | 12 | 90 | 93 | 60 |
| 24.01A | B'makers M5 | 22 | 90 | 19 | 90 | 111 | 60 |
| 24.01B |  | 29 | 90 | 24 | 90 | 120 | 60 |
| 24.02D |  | 25 | 90 | 20 | 90 | 72 | 60 |
| 24.02 |  | 44 | 90 | 35 | 90 | 148 | 120 |
| 24.02F | B'm Ck Reilly Rd | 50 | 90 | 39 | 90 | 176 | 60 |
| 24.02A |  | 23 | 90 | 18 | 90 | 63 | 60 |
| 24.02B |  | 30 | 90 | 23 | 90 | 94 | 60 |
| 24.02C | Hoxton Pk Road | 35 | 90 | 27 | 90 | 111 | 60 |
| 24.02G | B'mkrs Ck H P Rd | 78 | 120 | 60 | 120 | 288 | 60 |
| 24.03A | B'm Ck Memorial | 84 | 120 | 64 | 120 | 301 | 60 |
| 24.03B | B'mkrs Ck Eliz Dr | 89 | 120 | 67 | 120 | 308 | 60 |
| 24.04A | B'm Ck H'pde Ave | 91 | 120 | 69 | 120 | 319 | 120 |
| 24.04B | Brickmakers Ck | 93 | 120 | 72 | 120 | 340 | 120 |

Note: For detention basins, critical duration is shown for inflow only

Table B. $7 \quad$ Updated 2001 Peak Flow Estimates
Cabramatta Creek - Brickmakers Creek to Georges River

| Link No. | Subcatchment Description | 100 YEAR |  | 20 YEAR |  | PMF |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) | $\begin{aligned} & \text { Flow } \\ & \left(\mathrm{m}^{3} / \mathrm{s}\right) \end{aligned}$ | Crit. Dur. (min) |
| 1.20 | Cabramatta Creek | 470 | 360 | 353 | 720 | 2403 | 120 |
| 1.21 | Cab Ck Railway | 473 | 360 | 355 | 720 | 2414 | 240 |
| 1.22 | Cabramatta Creek | 475 | 360 | 358 | 720 | 2424 | 240 |
| 1.23 | Cab Ck George R | 479 | 360 | 361 | 720 | 2440 | 240 |

## APPENDIX C

## BRICKMAKERS CREEK <br> (Homepride Ave to Memorial Ave)

Review of Flood Behaviour

# Liverpool City Council 

## Brickmakers Creek <br> (Homepride Ave to Memorial Ave) <br> Review of Flood Behaviour

## December 2003

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## 1. INTRODUCTION

Brickmakers Creek is a tributary of Cabramatta Creek in Sydney's south-west. It has a catchment area of approximately 790ha, and drains a largely developed area of Liverpool. The creek commences near Casula to the south; flows adjacent to the Liverpool CBD area; and joins Cabramatta Creek near Warwick Farm.

Flood behaviour in Brickmakers Creek was investigated as part of the original Cabramatta Creek Floodplain Management Study [Bewsher Consulting, 1999] and is reported in more detail in the flood study report prepared as part of that study [Water Research Laboratory, 1998].

Since this time, Liverpool Council has been faced with increasing re-development pressures in the area immediately north of the Liverpool CBD area. Significant flooding was also experienced near the intersection of the Hume Highway and Orange Grove Road in January 2001 and again in February 2002. Council subsequently sought more detailed information on flooding in this area.

The objectives of the current investigation were to:
(i) provide more detailed modelling of the reach of Brickmakers Creek, between Memorial Avenue and Homepride Avenue;
(ii) provide revised flood extents and flood contours for the 20 year, 100 year and PMF floods, if these need to be revised;
(iii) investigate flood mitigation works to reduce the impact of flooding on affected properties in this reach of Brickmakers Creek, particularly creek rehabilitation works previously proposed by other consultants.

## 2. PREVIOUS MODEL RESULTS

Flood behaviour for Brickmakers Creek was previously assessed using the RAFTS hydrologic model to determine catchment flows and the RMA-2 hydraulic model to determine flood levels and the extent of flood inundation. The model represented flood behaviour over the entire Cabramatta Creek catchment, and subsequently was unable to include all areas in fine detail. On inspection of model results in the vicinity of lower Brickmakers Creek, and recent observations of flooding in this area, it was thought that the RMA-2 model might not contain sufficient detail to accurately represent flood behaviour within this area.

More recently, Patterson Britton \& Partners developed a HEC-RAS hydraulic model of the lower reaches of Brickmakers Creek to assess potential creek rehabilitation works immediately downstream of Orange Grove Road. These rehabilitation works involved the removal of four 1.2 m diameter low-flow pipes located below a grassed trapezoidal channel between Orange Grove Road and Homepride Avenue. The objective of these works was to increase the capacity of this channel, by lowering its invert level, and to re-instate a more 'natural' creek system through this part of Brickmakers Creek.

The HEC-RAS model is a one-dimensional hydraulic model that is capable of simulating flow conditions in the main channel. However, it is less appropriate for
modelling the potential overflow of floodwater out of the creek and the flow paths which could potentially occur through the residential area to the north of the Liverpool CBD.

Detailed flood investigations were also undertaken within the Cabramatta Creek catchment for the Roads and Traffic Authority, in connection with the proposed Western Sydney Orbital (WSO) highway [Bewsher Consulting and WBM Oceanics Australia, 2002]. Whilst these investigations did not include hydraulic modelling on Brickmakers Creek, they did involve a review of the RAFTS hydrologic model. The RAFTS model was subsequently updated to account for the following issues:
(i) it was updated to represent catchment conditions in 2001;
(ii) a split sub-area method was adopted to model the effects of catchment development, in line with current practice;
(iii) adoption of revised Intensity-Frequency-Duration rainfall data, as provided by Liverpool Council;
(iv) the areal reduction factor that had been applied to rainfall was removed, as this was less appropriate in the smaller subcatchment areas;
(v) the RAFTS calibration parameter was reduced from $\mathrm{Bx}=2$ to $\mathrm{Bx}=1$, as it was found that the higher value tended to underestimate flows in the smaller subcatchment areas.

## 3. REFINED FLOOD MODELLING ON BRICKMAKERS CREEK

### 3.1 RAFTS Hydrologic Model

There were two choices for the hydrologic model to be used for the current Brickmakers Creek flood investigations:
(i) the RAFTS model adopted for the Cabramatta Creek Floodplain Management Study; or
(ii) the updated RAFTS model that was used in association with investigations for the proposed WSO highway.

A comparison of flow estimates from both models is provided in Table 1

TABLE 1
Comparison of Flow Estimates ( $\mathrm{m}^{3} / \mathrm{s}$ ) in Brickmakers Creek

| Link | Location | Floodplain Management Study |  |  | WSO Investigations |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | PMF | $\mathbf{Q}_{\mathbf{1 0 0}}$ | $\mathbf{Q}_{\mathbf{2 0}}$ | PMF | $\mathbf{Q}_{\mathbf{1 0 0}}$ | $\mathbf{Q}_{\mathbf{2 0}}$ |
| 24.02G | Hoxton Park Rd | 318 | 60 | 43 | 288 | 78 | 60 |
| 24.03A | Memorial Ave | 328 | 65 | 47 | 301 | 84 | 64 |
| 24.03B | Elizabeth Dr | 332 | 68 | 49 | 308 | 89 | 67 |
| 24.04A | Homepride Ave | 333 | 70 | 52 | 319 | 91 | 69 |

The choice of hydrologic models is important on Brickmakers Creek, as there is no historic data available to calibrate the flood models. If flow estimates increase, then computed flood levels can also be expected to increase. This is contrary to the behaviour elsewhere on Cabramatta Creek where substantial calibration data does exist. In these areas, the calibration process will 'mask' any small variations in flow estimates and design flood levels are unlikely to change significantly.

As Brickmakers Creek is a relatively small subcatchment of the Cabramatta Creek catchment (representing only 10\% of the total catchment area) it was regarded that the results from the WSO investigations are likely to be more applicable on Brickmakers Creek. This is due to the parameters in the floodplain management study tending to underestimate flows in the smaller subcatchment areas.

### 3.2 TUFLOW Hydraulic Model

A new, more detailed hydraulic model was selected for modelling flood behaviour in the lower reaches of Brickmakers Creek. The model chosen was a combined 2D/1D hydraulic model, known as TUFLOW. This type of model has the advantage that it is able to accurately define the main creek channel as a one-dimensional section, and includes the overland flow paths through a fine scale two-dimensional grid. This type of model was also chosen to model the flood impacts of the WSO highway, although its extent did not include Brickmakers Creek.

The one-dimensional portion of the model covers the main creek, from 200m upstream of Memorial Avenue to just upstream of the confluence with Cabramatta Creek. This portion of the model is controlled by a series of culvert structures at locations listed in Table 2. The definition of channel cross sections and other culvert details have been based on the HEC-RAS originally provided by Council for the Paterson Britton investigations. This information is consistent with the details used to define the original RMA-2 model for the Cabramatta Creek Floodplain Management Study.

TABLE 2
Details of Culverts included in the TUFLOW model

| Location | Structure Descriptions | Remarks |
| :--- | :--- | :--- |
| Memorial Avenue | $3 \times 3.3 \mathrm{~m} \times 1.8 \mathrm{~m}$ RCBC |  |
| Moore Street | $2 \times 2.7 \mathrm{~m} \times 1.8 \mathrm{~m}$ RCBC plus <br> $1 \times 3.7 \mathrm{~m} \times 1.8 \mathrm{~m}$ RCBC |  |
| Elizabeth Drive | $2 \times 3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ RCBC |  |
| Orange Grove Road | $3 \times 3.0 \mathrm{~m} \times 2.4 \mathrm{~m}$ RCBC |  |
| Homepride Avenue | $2 \times 3.0 \mathrm{~m} \times 2.7 \mathrm{~m}$ RCBC plus <br> $2 \times 3.3 \mathrm{~m} \times 2.4 \mathrm{~m}$ RCBC |  |
| Between Orange Grove Road <br> and Homepride Avenue | $4 \times 1.2 \mathrm{~m} \mathrm{RCP}$ | Anticipate seriously blocked <br> during major storms. |

A blockage factor of $75 \%$ has been assumed for the four 1.2 m diameter low flow pipes between Orange Grove Road and Homepride Avenue. This is based on observations of debris build-up at the trash rack covering the inlet to these pipes that was observed
during a site inspection in October 2003. This is also consistent with evidence from photographs taken at this location following recent floods.

The extent of two-dimensional portion of the model covers the area from north of Memorial Avenue to approximately 450 m downstream of Homepride Avenue. A grid size of $2 m$ was selected for simulating overland flow conditions. The fine grid size allows the assessment of the flood impact of any future development proposal within the modelled area.

A digital elevation model (DEM) has been developed using the data from the 1996 photogrammetry survey of the Cabramatta Creek catchment. It is assumed that no major earthworks have occurred within the study area since this date.

Buildings have been represented in the model by digitising the footprint of the structure and assigning a very high roughness coefficient to the building footprint. This has the effect of eliminating the flow of floodwater through the building, but preserves the flood storage within the building. Building footprints have been determined from aerial photos of the site taken in 2002.

Other barriers to overland flow paths were identified by inspection of the 2002 aerial photos and by field inspection. The following structures were included in the model:
(i) sound barrier along Copeland Street (Hume Highway) between Campbell Street and Lachlan Street;
(ii) continuous boundary wall along Sydney Road (Hume Highway) between Lachlan Street and Pioneer Memorial Park; and
(iii) landscape short wall structures at either sides of Orange Grove Road near the intersection of Hume Highway.

Boundary conditions for the TUFLOW model were based on the 'total' RAFTS hydrograph at Memorial Avenue, input at the upstream end of the TUFLOW model, and 'local' RAFTS hydrographs representing the remainder of the downstream catchment, evenly distributed over the 'wet' area of the model. A stage-discharge relationship was adopted at Lawrence Hargrave Road to represent tailwater conditions near the confluence with Cabramatta Creek.

### 3.3 Comparison with Previous Flood Level Estimates

Results for the 100 year flood were compared with results from the Cabramatta Creek Floodplain Management Study and the more recent HEC-RAS modelling of Brickmakers Creek. The results of this comparison are shown in Table 3.

Both the RMA-2 and HEC-RAS model results are based on flow estimates provided from the original RAFTS model developed for the floodplain management study. A valid comparison with results from the current investigation should also be on this basis. Results for the TUFLOW model, shown in Table 3, therefore include results for both the floodplain management study RAFTS flows and the updated RAFTS model adopted for the current investigations.

TABLE 3
Comparison of Flood Level Estimates in a 100 year Flood (m AHD)

| Location | Comparison of Flood Level Estimates |  | ADOPTED |  |
| :--- | :---: | :---: | :---: | :---: |
|  | RMA-2 | HEC-RAS |  | TUFOW ${ }^{\mathbf{2}}$ |
| Memorial Ave US | 15.4 | 15.9 | 15.9 | 16.0 |
| Memorial Ave DS | 15.1 | 15.8 | 15.3 | 15.5 |
| Moore St US | 14.7 | 13.9 | 14.6 | 14.7 |
| Moore St DS | 14.0 | 14.2 | 14.1 | 14.2 |
| Elizabeth Dr US | 13.2 | 12.8 | 13.2 | 13.3 |
| Elizabeth Dr DS | 12.9 | 12.1 | 12.9 | 13.0 |
| Park Rd | 12.0 | 11.6 | 11.6 | 11.7 |
| Orange Grove Rd US | 11.2 | 11.1 | 11.4 | 11.6 |
| Orange Grove Rd DS | 10.9 | 10.5 | 10.9 | 11.0 |
| Homepride Ave US | 9.1 | 9.6 | 9.7 | 10.0 |
| Homepride Ave DS | 9.0 | 9.3 | 9.7 | 9.9 |
| Lawrence Hargrave Rd US | 7.8 | 7.9 | 7.7 | 7.9 |

1. TUFLOW estimate based on RAFTS flows from the Cabramatta Creek Floodplain Management Study
2. TUFLOW estimate based on updated RAFTS model for the WSO highway investigations (adopted for these investigations)

The comparison of flood levels shown in Table 3 indicates some variability in results between all three models. However, as the TUFLOW model is the most detailed model developed for the study area, and is best suited for modelling the overland flow component of flooding in this vicinity, results from this model are anticipated to be the most reliable.

## 4. EXISTING FLOOD BEHAVIOUR

Flood behaviour throughout the study area, based on the updated RAFTS flow estimates, has been assessed for existing conditions. Figures 1 to 3 provide details of flood conditions for the 20 year, 100 year and PMF events. Information on the extent of flood inundation, flood contours, depth of flooding and flood velocities are included for each of the flood events.

The modelling results exhibit a fairly complex flow regime for the study area. The key points are noted as follows:
< Hillier Road becomes an established flow path in the 100 year flood, with floodwater flowing parallel to Brickmakers Creek. Several properties at the intersection of Anderson Avenue are likely to be inundated.
< The Moore Street culvert appears to be significantly under-sized. This restriction contributes to floodwater spilling out of the channel upstream of the culvert and being redirected down Park Road and Carboni Street. This occurs in both the 100 year and 20 year floods. More than 20 properties west of Park Road are likely to be affected in the 100 year event.
< Elizabeth Drive appears to be seriously deficient in both the 100 year and 20 year floods. The channel capacity upstream and downstream of Elizabeth Drive also has limited capacity. Elizabeth Drive is estimated to be inundated over a length of approximately 300 m in a 100 year flood. In some places, the depth over the road is estimated to be at least 0.6 m . Significant floodwater flows are diverted to the east along Elizabeth Drive towards the Hume Highway (Copeland Street) and into the residential area to the north of the Liverpool CBD.
< The channel between Orange Grove Road and Elizabeth Drive is severely limited. A recent inspection revealed that the creek is undersized and heavily overgrown. There is also a sharp bend in the creek at the eastern end of Park Road, which would contribute to the flood flows leaving the creek and flowing onto the highway and into the residential area to the east.
< The model results also show that floodwater at the Orange Grove Road and Hume Highway intersection return to the main creek on either side of the Orange Grove Road culvert. This is contrary to past opinion that flooding in this area was due to the limited capacity of the Orange Grove Road culvert and downstream channel. That is, the problems are caused from floodwater spilling out of the creek further upstream, principally at Elizabeth Drive.
< The Hume Highway is located in a natural depression on the eastern floodplain, particularly in the vicinity of the Orange Grove Road intersection. Flood inundation depths of at least 1.0 m are predicted in the 100 year flood along the road.
< Landscaping features near this intersection, presumably to restrict floodwater from overflowing from the creek onto the Hume Highway, could in fact be exacerbating flood conditions in this vicinity, as floodwater which has already left the creek system further upstream is restricted in getting back to the creek.
< The overland flow on the eastern floodway that does not return to Brickmakers Creek, travels in a north-easterly direction through the residential area north of the Liverpool CBD area. This floodwater is then trapped by the highway sound barriers and other brick fences from spilling over the highway to re-enter the creek downstream of Orange Grove Road. Much of the floodwater collects in Lachlan Street, where inundation depths of up to 1 m can be expected in the 100 year flood.

## 5. POTENTIAL FLOOD MITIGATION MEASURES

A number of flood mitigation options have been considered to alleviate flooding problems within the study area. These options are shown on Figure 4, and include:
(i) Option 1 - Upgrade the Orange Grove Road culvert. The existing three cell $3.0 \mathrm{~m} \times 2.4 \mathrm{~m}$ box culverts would be supplemented by an additional $3.0 \times 2.4 \mathrm{~m}$ box culvert.
(ii) Option 2 - Upgrade the Orange Grove Road culvert (as per Option 1) plus undertake channel rehabilitation works on the channel between Orange Grove Road and Homepride Avenue. The objective of the channel works would primarily be for environmental restoration of this reach of the creek, by removing the four 1.2 m diameter low flow pipes and restoring the creek to a more 'natural'
condition. These works would also provide some improvement in the capacity of the creek (although this is not a major concern for this reach of the creek).
(iii) Option 3 - In addition to those works identified in Option 2, channel improvement works would be carried out between Orange Grove Road and Elizabeth Drive, including the construction of a low flood wall, approximately 200 m long, on the west side of the highway. The culvert under Elizabeth Drive would also be amplified from a two cell $3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ box culvert to a four cell $3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ box culvert.

Results of model runs for each of the three options are shown on Figures 5 to 7. Flood level comparisons at key locations are summarised in Table 4.

TABLE 4
Flood Levels Comparison for Mitigation Options (100 year flood levels m AHD)

| Location | Existing | Option 1 | Option 2 | Option 3 |
| :--- | :---: | :---: | :---: | :---: |
| Memorial Ave US | 16.0 | 16.0 | 16.0 | 16.0 |
| Memorial Ave DS | 15.5 | 15.5 | 15.5 | 15.5 |
| Moore St US | 14.7 | 14.7 | 14.7 | 14.7 |
| Moore St DS | 14.2 | 14.2 | 14.2 | 14.2 |
| Elizabeth Dr US | 13.3 | 13.3 | 13.3 | 12.4 |
| Elizabeth Dr DS | 13.0 | 13.0 | 13.0 | 12.0 |
| Park Rd | 11.7 | 11.7 | 11.7 | 11.5 |
| Orange Grove Rd US | 11.6 | 11.5 | 11.0 | 11.2 |
| Orange Grove Rd DS | 11.0 | 11.1 | 10.5 | 10.5 |
| Homepride Ave US | 10.0 | 10.0 | 9.7 | 10.2 |
| Homepride Ave US | 9.9 | 9.9 | 9.8 | 9.8 |
| Lawrence Hargrave Rd US | 7.9 | 7.9 | 7.8 | 7.8 |

Option 1 results in a slight drop in flood level at the upstream side of Orange Grove Road as a result of the amplified culvert. Inundation at Crimson Crescent would be alleviated with this option. However there is little or no reduction in flood levels elsewhere. (Refer Figure 5)

The channel rehabilitation works downstream of Orange Grove Road (Option 2) Option 2 provides a more significant reduction in flood levels upstream of Orange Grove Road, as shown on Figure 6. However, the benefit rapidly diminishes further upstream, and by Park Road there is negligible change in flood conditions.

The main benefits are evident for Option 3, which are primarily due to the channel improvement works upstream of Orange Grove Road and the culvert amplification at Elizabeth Drive. Significant flood level reductions are evident from Elizabeth Drive to Orange Grove Road for the 100 year flood. All overland flow to the east of Brickmakers Creek has now been eliminated in the 100 year flood, as shown on Figure 7. The Hume Highway is no longer inundated and the Liverpool CBD and residential area to the
north is no longer affected by floodwater spilling out of Brickmakers Creek. It should be noted that this area might still be subject to stormwater flooding from its own local catchment area. Stormwater drainage investigations are recommended to see whether any stormwater augmentation measures are required, particularly for the low-lying area surrounding Lachlan Street.

## 6. RECOMMENDATION

It is recommended that further consideration be given to implementing the measures outlined in Option 3. These measures are summarised in Table 5. The total cost of the recommendations is estimated at $\$ 4,900,000$.

TABLE 5
Recommended Flood Mitigation Measures

| Measure | Description | Estimated <br> Cost | Priority |
| :--- | :--- | :---: | :---: |
| Orange Grove Road <br> Culvert amplification | Add $1 \times 3.0 \mathrm{~m} \times 2.4 \mathrm{~m}$ RCBC to <br> existing $3 \times 3.0 \mathrm{~m} \times 2.4 \mathrm{~m}$ RCBC | $\$ 350,000$ | High |
| Creek rehabilitation <br> downstream of Orange <br> Grove Road | Remove 4x1.2m diameter low flow pipes, <br> lower creek invert, and restore channel to <br> more 'natural' state | $\$ 1,900,000$ | Medium |
| Channel improvement <br> works from Orange Grove <br> Road to Elizabeth Drive | Amplify and realign Brickmakers Creek <br> between Orange Grove Road and Elizabeth <br> Drive | $\$ 2,000,000$ | High |
| Floodwall | Construct low level flood wall, approximately <br> 200 m long, between Brickmakers Creek and <br> the Hume Highway | $\$ 100,000$ | Medium |
| Elizabeth Drive <br> amplification | Culvert $2 \times 3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ RCBC to <br> existing $2 \times 3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ RCBC | $\$ 570,000$ | High |

## FIGURES









FIGURE 7: 100 YEAR ARI FLOOD CONDITIONS FOR WORK OPTION 3

## PRELIMINARY COST ESTIMATES

Orange Grove Road Culvert Amplification
Supply additional $1 \times 3.0 \mathrm{~m} \times 2.4 \mathrm{~m}$ RCBC to existing $3 \times 3.0 \mathrm{~m} \times 2.4 \mathrm{~m}$ RCBC

| Item | Description | Quantity | Rate | Amount |
| :--- | :--- | :---: | :---: | ---: |
|  | Investigation \& design |  |  | $\$ 30,000$ |
| 1a | Site Establishment/Removal |  |  | $\$ 5,000$ |
| 1b | Traffic management |  |  | $\$ 5,000$ |
| 1c | Liaison with Service Authorities <br> (assumes no relocation works required) |  |  | $\$ 2,000$ |
| 1d | Erosion control measures |  |  | $\$ 2,000$ |
| 1e | Provision for trench shoring system | $100 \mathrm{~m}^{2}$ | $\$ 25$ | $\$ 5,000$ |
| 1f | Demolition of existing roadworks | $350 \mathrm{~m}^{3}$ | $\$ 45$ | $\$ 15,500$ |
| 1g | Trench excavation | $20 \mathrm{~m}^{3}$ | $\$ 350$ | $\$ 7,000$ |
| 1h | Construct cast-in-situ culvert base slab | $10 \mathrm{units}^{3}$ | $\$ 6,000$ | $\$ 60,000$ |
| 1i | Supply and lay box culvert units (2.44m length) | $60 \mathrm{~m}^{3}$ | $\$ 35$ | $\$ 2,100$ |
| 1j | Trench backfill to road subgrade level | $100 \mathrm{~m}^{2}$ | $\$ 50$ | $\$ 5,000$ |
| 1k | Road restoration - base course | $100 \mathrm{~m}^{2}$ | $\$ 25$ | $\$ 2,500$ |
| 1I | Road restoration - surface course | $20 \mathrm{~m}^{2}$ | $\$ 75$ | $\$ 1,500$ |
| 1m | Road structures |  |  | $\$ 120,000$ |
| 1n | Allowance for nightwork |  |  | $\$ 265,350$ |
|  | Sub Total |  |  | $\$ 79,605$ |
|  | Contingency (30\%) |  |  | $\$ 350,000$ |

## Elizabeth Drive Culvert Upgrade

Supply additional $2 \times 3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ RCBC to existing $2 \times 3.3 \mathrm{~m} \times 2.7 \mathrm{~m}$ RCBC

| Item | Description | Quantity | Rate | Amount |
| :---: | :---: | :---: | :---: | :---: |
|  | Investigation \& design |  |  | \$30,000 |
| 2a | Site Establishment/Removal |  |  | \$5,000 |
| 2b | Traffic management |  |  | \$8,000 |
| 2c | Liaison with Service Authorities (assumes no relocation works required) |  |  | \$3,000 |
| 2d | Erosion control measures |  |  | \$2,000 |
| 2 e | Provision for trench shoring system |  |  | \$8,000 |
| 2f | Demolition of existing roadworks | $210 \mathrm{~m}^{2}$ | \$25 | \$5,250 |
| 2 g | Trench excavation | $840 \mathrm{~m}^{3}$ | \$45 | \$37,800 |
| 2h | Construct cast-in-situ culvert base slab | $45 \mathrm{~m}^{3}$ | \$350 | \$15,750 |
| 2i | Supply and lay box culvert units (2.44m length) | 25 units | \$7,200 | \$180,000 |
| 2j | Trench backfill to road subgrade level | $125 \mathrm{~m}^{3}$ | \$35 | \$4,375 |
| 2k | Road restoration - base course | $210 \mathrm{~m}^{2}$ | \$60 | \$12,600 |
| 21 | Road restoration - surface course | $210 \mathrm{~m}^{2}$ | \$25 | \$5,500 |
| 2 m | Road structures | 40 m | \$75 | \$3,000 |
| 2 n | Allowance for nightwork |  |  | \$120,000 |
|  | Sub Total |  |  | \$440,275 |
|  | Contingency (30\%) |  |  | \$132,082 |
|  | Total |  |  | \$570,000 |

Construct 200m long block floodwall approx 1.0 m high

| Item | Description | Quantity | Rate | Amount |
| :--- | :--- | :---: | ---: | ---: |
| 3a | Site Establishment/Removal |  |  | $\$ 2,500$ |
| 3b | Traffic management |  |  | $\$ 500$ |
| 3c | Liaison with Service Authorities <br> (assumes no relocation works required) |  |  | $\$ 500$ |
| 3d | Erosion control measures |  |  | $\$ 1,000$ |
| 3e | Excavation for retaining wall footings | $50 \mathrm{~m}^{3}$ | $\$ 45$ | $\$ 2,250$ |
| 3f | Concrete footings | $50 \mathrm{~m}^{3}$ | $\$ 250$ | $\$ 12,500$ |
| 3 g | Blockwork | $200 \mathrm{~m}^{2}$ | $\$ 300$ | $\$ 60,000$ |
|  | Sub Total |  |  | $\$ 79,250$ |
|  | Contingency $(30 \%)$ |  |  | $\$ 23,775$ |
|  | Total |  |  | $\$ 100,000$ |

Realignment and widening existing channel between Orange Grove Road and Elizabeth Drive (approx 530m length)

| Item | Description | Quantity | Rate | Amount |
| :---: | :---: | :---: | :---: | :---: |
|  | General |  |  |  |
|  | Investigation \& design |  |  | \$60,000 |
| 4a | Site establishment/removal |  |  | \$10,000 |
| 4b | Temporary construction fencing | 1200 m | \$10 | \$12,000 |
| 4c | Traffic management |  |  | \$5,000 |
| 4d | Liaison with Service Authorities (assume no conflicts) |  |  | \$1,000 |
| 4e | Erosion control measures |  |  | \$10,000 |
| 4f | Protect existing trees and vegetation |  |  | \$2,000 |
|  | SubTotal |  |  | \$100,000 |
|  | Earthworks |  |  |  |
| 4 g | Remove grass and vegetation from site | 26,500 m ${ }^{2}$ | \$0.60 | \$15,900 |
| 4h | Strip topsoil and stockpile for respreading | 2,650 m ${ }^{3}$ | \$4.50 | \$11,925 |
| 4 i | Remove large trees (provisional) | 10 | \$150 | \$1,500 |
| 4j | Excavate material from channel to disposal off site | 30,000 m ${ }^{3}$ | \$30 | \$900,000 |
| 4k | Respread topsoil, trim and compact | 26,500 m ${ }^{2}$ | \$1.00 | \$26,500 |
|  | SubTotal |  |  | \$955,825 |
|  | Landscaping |  |  |  |
| 41 | Native grassing/tube stock planting | 26,500 m ${ }^{2}$ | \$10 | \$265,000 |
| 4m | Large trees \& shrubs (provisional) |  |  | \$20,000 |
| 4 n | Rock scour protection (includes geotextile) | 2,500 m ${ }^{3}$ | \$70 | \$175,000 |
|  | SubTotal |  |  | \$460,000 |
|  | TOTAL |  |  | \$1,515,825 |
|  | Contingency (30\%) |  |  | \$454,747 |
|  | TOTAL |  |  | \$2,000,000 |

Creek rehabilitation between Orange Grove Road and Homepride Avenue, including removal of $4 \times 1200 \mathrm{~mm}$ diameter low flow pipes (approx 400m length)

| Item | Description | Quantity | Rate | Amount |
| :---: | :---: | :---: | :---: | :---: |
|  | General |  |  |  |
| 5a | Site establishment/removal |  |  | \$8,000 |
| 5b | Temporary construction fencing | 900 m | \$10 | \$9,000 |
| 5c | Traffic management |  |  | \$4,000 |
| 5d | Liaison with Service Authorities (assume no conflicts) |  |  | \$1,000 |
| 5 e | Erosion control measures |  |  | \$8,000 |
| 5 f | Protect existing trees and vegetation |  |  | \$500 |
|  | SubTotal |  |  | \$30,500 |
|  | Removal of Low Flow Pipes |  |  |  |
| 5 g | Remove and transport to Council depot (re PB proposal) | 1480m | \$500 | \$740,000 |
|  | Earthworks |  |  |  |
| 5h | Remove grass and vegetation from site | 16,000 m ${ }^{2}$ | \$0.60 | \$9,600 |
| 5 i | Strip topsoil and stockpile for respreading | 1,600 m ${ }^{3}$ | \$4.50 | \$7,200 |
| 5j | Remove large trees (provisional) | 5 | \$150 | \$750 |
| 5k | Excavate material from channel to disposal off site | $14,000 \mathrm{~m}^{3}$ | \$25 | \$350,000 |
| 51 | Respread topsoil, trim and compact | 16,000 m ${ }^{2}$ | \$1.00 | \$16,000 |
|  | SubTotal |  |  | \$383,550 |
|  | Landscaping |  |  |  |
| 5 m | Native grassing/tube stock planting | 16,000 m ${ }^{2}$ | \$10 | \$160,000 |
| 5 n | Large trees \& shrubs (provisional) |  |  | \$15,000 |
| 50 | Rock scour protection (includes geotextile) | 1,500 m ${ }^{3}$ | \$70 | \$105,000 |
|  | SubTotal |  |  | \$280,000 |
|  | TOTAL |  |  | \$1,434,050 |
|  | Contingency (30\%) |  |  | \$430,215 |
|  | TOTAL |  |  | \$1,900,000 |

## APPENDIX D

Fairfield Council - List of Houses and Commercial Buildings
Potentially affected by the 100 Year Flood in Cabramatta Creek
Fairfield Council - List of Houses and Commercial Buildings Potentially affected by the 100 Year Flood in Cabramatta Creek

| Property Description |  |  |  |  |  |  |  |  | Survey Information |  |  | Flood Levels (RMA, 96) |  |  |  | Depth above Floor |  |  | Flood Risk Precinct |  |  | Proposed Measure |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unit | No. | Street | Suburb | Lot | Sec. | DP | Zoning | Use | Floor Level | Remarks | Date | PMF | 100yr | 50yr | 20yr | 100yr | 50yr | 20 yr | High | Med | Low | Description | Priority |
|  | 172 | Broomfield St | Cabramatta | 1 |  | 785157 | Res A | house | 6.90 | Floor Level | Aug-86 | 11.6 | 7.4 | 7.1 | 6.6 | 0.50 | 0.20 |  | 1 |  |  | Voluntary HR | High |
|  | 172A | Broomfield St | Cabramatta | 2 | 0 | 785157 | Res A | house | 7.84 | Floor Level | Aug-86 | 11.6 | 7.4 | 7.1 | 6.6 | - | - | - | 1 |  |  |  |  |
|  | 174 | Broomfield St | Cabramatta | 13 | 17 | 1656 | Res A | house | 6.60 | Floor Level | Aug-86 | 11.6 | 7.4 | 7.1 | 6.6 | 0.80 | 0.50 | - | 1 |  |  | Voluntary HR | High |
|  | 176 | Broomfield St | Cabramatta | 14 | 17 | 1656 | Res A | house | 6.52 | Floor Level | Aug-86 | 11.6 | 7.4 | 7.1 | 6.6 | 0.88 | 0.58 | 0.08 | 1 |  |  | Voluntary HR | High |
|  | 41 | Cherrybrook Rd | Lansvale | 26 |  | 219193 | Res A | house | 6.74 | Floor Level | Aug-86 | 10.9 | 6.9 | 6.6 | 6.2 | 0.16 | - | - |  | 1 |  |  | - |
|  | 56 | Cherrybrook Rd | Lansvale | 262 |  | 219192 | Res A | house | 6.70 | Ground FL | Aug-86 | 10.6 | 6.9 | 0.0 | 0.0 | 0.20 | - | - |  | 1 |  |  | - |
|  | 54 | Church St | Cabramatta | 9 |  | 24929 | Res A | house | 7.00 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.2 | 6.7 | 0.50 | 0.20 |  | 1 |  |  | Voluntary HR | High |
|  | 56 | Church St | Cabramatta | 8 |  | 24929 | Res A | house | 6.67 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.83 | 0.53 | 0.03 | 1 |  |  | Voluntary HR | High |
|  | 57 | Church St | Cabramatta | 4 |  | 27792 | Res A | house | 8.73 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | - | - | - |  | 1 |  |  | - |
|  | 57A | Church St | Cabramatta | 3 |  | 27792 | Res A | house | 6.70 | Ground FL | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.80 | 0.50 | - | 1 |  |  | Voluntary HR | High |
|  | 58 | Church St | Cabramatta | 7 |  | 24929 | Res A | house | 6.48 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.02 | 0.72 | 0.22 | 1 |  |  | Voluntary HR | High |
|  | 59 | Church St | Cabramatta | 2 |  | 27792 | Res A | house | 6.58 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.92 | 0.62 | 0.12 | 1 |  |  | Voluntary HR | High |
|  | 60 | Church St | Cabramatta | 6 |  | 24929 | Res A | house | 6.34 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.16 | 0.86 | 0.36 | 1 |  |  | Voluntary HR | High |
|  | 61 | Church St | Cabramatta | 1 |  | 27792 | Res A | house | 6.32 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.18 | 0.88 | 0.38 | 1 |  |  | Voluntary HR | High |
|  | 62 | Church St | Cabramatta | 5 |  | 24929 | Res A | house | 6.18 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.32 | 1.02 | 0.52 | 1 |  |  | Voluntary HR | High |
|  | 63 | Church St | Cabramatta | 11 | 3 | 1656 | Res A | house | 6.71 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.79 | 0.49 | - | 1 |  |  | Voluntary HR | High |
|  | 64 | Church St | Cabramatta | 18 | 4 | 1656 | Res A | house | 6.33 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.17 | 0.87 | 0.37 | 1 |  |  | Voluntary HR | High |
|  | 65 | Church St | Cabramatta | 12 | 3 | 1656 | Res A | house | 6.13 | Ground FL | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.37 | 1.07 | 0.57 | 1 |  |  | Voluntary HR | High |
|  | 66 | Church St | Cabramatta | 17 | 4 | 1656 | Light Ind 4(b) | Vacant |  | Vacant | Jun-04 | 11.9 | 7.5 | 7.2 | 6.7 | - |  |  | 1 |  |  |  |  |
|  | 67 | Church St | Cabramatta | 13 | 3 | 1656 | Res A | house | 6.50 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.00 | 0.70 | 0.20 | 1 |  |  | Voluntary HR | High |
|  | 68 | Church St | Cabramatta | 16 | 4 | 1656 | Light Ind 4(b) | Business | 5.46 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 2.04 | 1.74 | 1.24 | 1 |  |  | Floodproofing | Medium |
|  | 69 | Church St | Cabramatta | 14 | 3 | 1656 | Res A | house | 7.00 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.50 | 0.20 | - | 1 |  |  | Voluntary HR | High |
|  | 1 | Fairlawn Cl | Lansvale | 285 |  | 241068 | Res A | house | 6.75 | Ground FL | Aug-86 | 10.6 | 6.9 | 6.6 | 6.2 | 0.15 |  | - |  | 1 |  |  |  |
|  | 7 | Fairlawn Cl | Lansvale | 288 |  | 241068 | Res A | house | 6.84 | Ground FL | Aug-86 | 10.6 | 6.9 | 6.6 | 6.2 | 0.06 | - | - |  | 1 |  |  | - |
|  | 9 | Fairlawn Cl | Lansvale | 289 |  | 241068 | Res A | house | 6.82 | Floor Level | Aug-86 | 10.6 | 6.9 | 6.6 | 6.2 | 0.08 | - | - |  | 1 |  |  |  |
|  | 8 | Florence St | Mt Pritchard | 58 |  | 216461 | Res A | house | 12.18 | Floor Level | Aug-86 | 16.0 | 12.2 | 11.8 | 11.5 | 0.02 | - | - |  | 1 |  |  |  |
|  | 9 | Florence St | Mt Pritchard | 57 |  | 216461 | Res A | house | 11.97 | Floor Level | Aug-86 | 15.9 | 12.0 | 11.7 | 11.5 | 0.03 | - | - |  | 1 |  | - | - |
|  | 10 | Florence St | Mt Pritchard | 59 |  | 216461 | Res A | house | 12.17 | Floor Level | Aug-86 | 16.0 | 12.2 | 11.8 | 11.5 | 0.03 | - | - |  | 1 |  | - | - |
|  | 11 | Florence St | Mt Pritchard | 56 |  | 216461 | Res A | house | 12.00 | Floor Level | Aug-86 | 15.8 | 12.0 | 11.7 | 11.5 | - | - | - |  | 1 |  |  | - |
|  | 21 | Florence St | Mt Pritchard | 51 |  | 216461 | Res A | house | 11.86 | Floor Level | Aug-86 | 15.7 | 11.9 | 11.6 | 11.4 | 0.04 | - | - |  | 1 |  |  |  |
|  | 22 | Garden St | Mt Pritchard | 11 |  | 216461 | Res A | house | 11.20 | Floor Level | May-90 | 15.1 | 11.5 | 11.2 | 11.0 | 0.30 | - | - |  | 1 |  | Voluntary HR | Low |
|  | 55 | Huntingdale Ave | Lansvale | 276 |  | 240066 | Res A | house | 6.80 |  | KH-91 | 10.6 | 6.9 | 6.6 | 6.2 | 0.10 | - | - |  | 1 |  |  | - |
|  | 60 | Huntingdale Ave | Lansvale | 208 |  | 219192 | Res A | house | 6.46 | Kitchen FL | Aug-86 | 10.6 | 6.9 | 6.6 | 6.2 | 0.44 | 0.14 | - |  | 1 |  | Voluntary HR | Low |
|  | 351-353 | Hume H'Way | Cabramatta | 1 |  | 583848 | Rec Tourism | Motel | 8.42 | Reception FL | Jun-04 | 11.5 | 7.3 | 7.0 | 6.5 |  | - | - | 1 |  |  |  |  |
|  | 48 | Huon St | Cabramatta | 273 |  | 25462 | Res A | house | 7.29 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.21 |  | - | 1 |  |  | Voluntary HR | Medium |
|  | 50 | Huon St | Cabramatta | 272 |  | 25462 | Res A | house | 7.01 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.49 | 0.19 | - | 1 |  |  | Voluntary HR | Medium |
|  | 52 | Huon St | Cabramatta | 271 |  | 25462 | Res A | house | 6.82 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.68 | 0.38 | - | 1 |  |  | Voluntary HR | Medium |
|  | 36 | Liverpool St | Lansvale | 3 |  | 548374 | Res A | house | 6.89 | Floor Level | Aug-86 | 11.0 | 6.9 | 6.6 | 6.2 | 0.01 | - | - |  | 1 |  |  |  |
|  | 40 | Liverpool St | Lansvale | 15 |  | 538885 | Res A | house | 6.67 | Laundry FL | Aug-86 | 11.0 | 6.9 | 6.6 | 6.2 | 0.23 | - | - |  | 1 |  | Voluntary HR | Low |
|  | 13 | Lunn Ct | Cabramatta | 145 |  | 226055 | Res A | house | 8.92 | Floor Level | Jun-04 | 11.9 | 7.5 | 7.2 | 6.7 | - | - | - |  | 1 |  |  | - |

Fairfield Council - List of Houses and Commercial Buildings Potentially affected by the 100 Year Flood in Cabramatta Creek

| Property Description |  |  |  |  |  |  |  |  | Survey Information |  |  | Flood Levels (RMA, 96) |  |  |  | Depth above Floor |  |  | Flood Risk Precinct |  |  | Proposed Measure |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unit | No. | Street | Suburb | Lot | Sec. | DP | Zoning | Use | Floor Level | Remarks | Date | PMF | 100yr | 50 yr | 20yr | 100yr | 50yr | 20yr | High | Med | Low | Description | Priority |
|  | 243 | Railway Pde | Cabramatta | 1 |  | 795812 | Light Ind 4(b) | Business | 7.03 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.1 | 0.0 | 0.47 | 0.07 |  |  | 1 |  | Floodproofing | Medium |
| 1 | 245 | Railway Pde | Cabramatta | 69 |  | 582527 | Light Ind 4(b) | Business | 7.1 |  | KH-91 | 11.8 | 7.5 | 7.1 | 0.0 | 0.40 | - | - |  | 1 |  | Floodproofing | Medium |
| 2 | 245 | Railway Pde | Cabramatta | 69 |  | 582527 | Light Ind 4(b) | Business | 7.1 |  | KH-91 | 11.8 | 7.5 | 7.1 | 0.0 | 0.40 |  | - |  | 1 |  | Floodproofing | Medium |
|  | 247 | Railway Pde | Cabramatta | 4 |  | 24929 | Light Ind 4(b) | Business | 6.9 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.2 | 6.7 | 0.60 | 0.30 | - |  | 1 |  | Floodproofing | Medium |
|  | 248 | Railway Pde | Cabramatta | 32 |  | 526149 | Light Ind 4(b) | Business | 6.59 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.1 | 6.7 | 0.91 | 0.51 | 0.11 | 1 |  |  | Floodproofing | Medium |
|  | 249 | Railway Pde | Cabramatta | 31 |  | 526149 | Light Ind 4(b) | Business | 6.68 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.1 | 6.7 | 0.82 | 0.42 | 0.02 | 1 |  |  | Floodproofing | Medium |
|  | 250 | Railway Pde | Cabramatta | 2 |  | 657057 | Light Ind 4(b) | Business | 6.8 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.2 | 6.7 | 0.70 | 0.40 | - | 1 |  |  | Floodproofing | Medium |
|  | 251 | Railway Pde | Cabramatta | 1 |  | 650461 | Light Ind 4(b) | Business | 6.7 | Floor Level | Aug-86 | 11.8 | 7.5 | 7.2 | 6.7 | 0.80 | 0.50 |  | 1 |  |  | Floodproofing | Medium |
| 1 | 252 | Railway Pde | Cabramatta | 11 |  | 869454 | Light Ind 4(b) | Business | 5.75 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.75 | 1.45 | 0.95 | 1 |  |  | Floodproofing | Medium |
| 2 | 252 | Railway Pde | Cabramatta | 11 |  | 869454 | Light Ind 4(b) | Business | 5.75 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.75 | 1.45 | 0.95 | 1 |  |  | Floodproofing | Medium |
| 3 | 252 | Railway Pde | Cabramatta | 11 |  | 869454 | Light Ind 4(b) | Business | 5.75 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.75 | 1.45 | 0.95 | 1 |  |  | Floodproofing | Medium |
| 1 | 253 | Railway Pde | Cabramatta | 12 | 4 | 1656 | Light Ind 4(b) | Business | 5.8 | Estimate |  | 11.9 | 7.5 | 7.2 | 6.7 | 1.70 | 1.40 | 0.90 | 1 |  |  | Floodproofing | Medium |
| 2 | 253 | Railway Pde | Cabramatta | 12 | 4 | 1656 | Light Ind 4(b) | Business | 5.8 | Estimate |  | 11.9 | 7.5 | 7.2 | 6.7 | 1.70 | 1.40 | 0.90 | 1 |  |  | Floodproofing | Medium |
| 3 | 253 | Railway Pde | Cabramatta | 12 | 4 | 1656 | Light Ind 4(b) | Business | 5.8 | Estimate |  | 11.9 | 7.5 | 7.2 | 6.7 | 1.70 | 1.40 | 0.90 | 1 |  |  | Floodproofing | Medium |
| 4 | 253 | Railway Pde | Cabramatta | 12 | 4 | 1656 | Light Ind 4(b) | Business | 5.8 | Estimate |  | 11.9 | 7.5 | 7.2 | 6.7 | 1.70 | 1.40 | 0.90 | 1 |  |  | Floodproofing | Medium |
| 5 | 253 | Railway Pde | Cabramatta | 12 | 4 | 1656 | Light Ind 4(b) | Business | 5.8 | Estimate |  | 11.9 | 7.5 | 7.2 | 6.7 | 1.70 | 1.40 | 0.90 | 1 |  |  | Floodproofing | Medium |
|  | 254 | Railway Pde | Cabramatta | 15 | 4 | 1656 | Light Ind 4(b) | Business | 5.23 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 2.27 | 1.97 | 1.47 | 1 |  |  | Floodproofing | Medium |
|  | 29 | Reservoir Rd | Mt Pritchard | 93 |  | 210349 | Res A | house | 12.86 | Floor Level | May-97 | 16.2 | 12.4 | 11.8 | 0.0 | - | - | - |  | 1 |  |  |  |
|  | 14 | Silverwater Cres | Lansvale | 299 |  | 241068 | Res A | house | 7.28 | Ground FL | Sep-02 | 10.6 | 6.9 | 6.6 | 6.2 |  | - |  |  | 1 |  |  |  |
|  | 24 | Silverwater Cres | Lansvale | 284 |  | 241068 | Res A | house | 6.80 |  | KH-91 | 10.6 | 6.9 | 6.6 | 6.2 | 0.10 | - | - |  | 1 |  | - |  |
|  | 4 | Sussex St | Cabramatta | 4 | 18 | 1656 | Res A | house | 7.03 | Floor Level | Aug-86 | 11.6 | 7.4 | 7.1 | 6.6 | 0.37 | 0.07 | - | 1 |  |  | Voluntary HR | Medium |
|  | 6 | Sussex St | Cabramatta | 1 |  | 982279 | Res A | house | 6.73 | Floor Level | Aug-86 | 11.6 | 7.4 | 7.0 | 6.6 | 0.67 | 0.27 | - | 1 |  |  | Voluntary HR | Medium |
|  | 8 | Sussex St | Cabramatta | 2 | 18 | 1656 | Res A | house | 7.18 | 1st Floor | Aug-86 | 11.6 | 7.4 | 7.1 | 6.6 | 0.22 | - | - | 1 |  |  | Voluntary HR | Medium |
|  | 10 | Sussex S | Cabramatta | 1 |  | 582555 | Res A | house | 6.24 | Floor Level | Aug-86 | 11.7 | 7.4 | 7.1 | 6.6 | 1.16 | 0.86 | 0.36 | 1 |  |  | Voluntary HR | Medium |
|  | 12 | Sussex St | Cabramatta | 24 |  | 869369 | Light Ind 4(b) | Business | 8.37 | Entry Door |  | 11.9 | 7.5 | 7.2 | 6.7 |  |  | - | 1 |  |  |  |  |
|  | 22 | Sussex St | Cabramatta | 7 |  | 224107 | Light Ind 4(b) | Business | 6.44 | Office Floor | Jun-04 | 11.9 | 7.5 | 7.2 | 6.7 | 1.06 | 0.76 | 0.26 | 1 |  |  | Floodproofing | Medium |
|  | 24-26 | Sussex St | Cabramatta | 10 |  | 634541 | Light Ind 4(b) | Business | 6.1 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.40 | 1.10 | 0.60 | 1 |  |  | Floodproofing | Medium |
|  | 30 | Sussex St | Cabramatta | 13 |  | 28088 | Res A | house | 6.97 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.53 | 0.23 | - | 1 |  |  | Voluntary HR | Medium |
|  | 32 | Sussex St | Cabramatta | 12 |  | 28088 | Res A | house | 6.73 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.77 | 0.47 | - | 1 |  |  | Voluntary HR | Medium |
|  | 34 | Sussex St | Cabramatta | 11 |  | 28088 | Res A | house | 6.47 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 1.03 | 0.73 | 0.23 | 1 |  |  | Voluntary HR | Medium |
|  | 36 | Sussex St | Cabramatta | 10 |  | 28088 | Res A | house | 7.17 | Floor Level | Aug-86 | 11.9 | 7.5 | 7.2 | 6.7 | 0.33 | 0.03 | - | 1 |  |  | Voluntary HR | Medium |
|  | 1 | The Creel | Lansvale | 277 |  | 241068 | Res A | house | 6.66 | Garage FL | Aug-86 | 10.6 | 6.9 | 6.6 | 6.2 | 0.24 | - | - |  | 1 |  |  |  |
|  | 4 | The Creel | Lansvale |  |  |  | Res A | house | 6.95 | Floor Level | Aug-86 | 10.6 | 6.9 | 6.6 | 6.2 | - | - | - |  | 1 |  | - | - |
|  | 5 | The Creel | Lansvale | 281 |  | 241068 | Res A | house | 6.80 |  | KH-91 | 10.6 | 6.9 | 6.6 | 6.2 | 0.10 | - | - |  | 1 |  | - | - |

## APPENDIX E

## Summary of Submissions Received from Public Exhibition of the Draft Report

## SUMMARY OF SUBMISSIONS RECEIVED FROM PUBLIC EXHIBITION OF DRAFT REPORT

| No. | Issues Raised | Response |
| :---: | :---: | :---: |
| 1 | Concerned that floods rarer than the 100 year flood are being considered. Also concerned over notations on Section 149 Certificates, availability of flood insurance and impact on property values. | The main purpose of the Plan is to try and reduce the risk from future floods. This considers all flood risks, up to what is termed the "probable maximum flood". As the likelihood of floods greater than 100 years is quite rare, this area has been classified as having a "low flood risk". There is no evidence that such a classification will devalue property values. In NSW, insurance against flooding is generally unavailable, regardless of flood affectation. These issues are also covered in the 'frequently asked questions' included in Appendix A of the report. |
| 2 | Submission from the NSW Department of Primary Industries, Fisheries Division, concerning the value of creeks for aquatic biodiversity, water quality issues within the creek, and proposals to construct detention basins as part of the Plan. The Fisheries Division recommends offline detention basins to avoid interference with fish passage. Further detail and evaluation of these basins were recommended. It was also noted that Council would require a permit for dredging and reclamation for certain works. | Basin details provided in the report are conceptual only, and will require further evaluation and detailed design prior to implementation. Wherever possible, opportunities for off-line basins will be pursued. Further clarification of this issue has been included in Section 10.1.8.8 of the report. |
| 3 | General letter from resident advising Council of contact details for any further advice. | Not required |
| 4 | Feedback form returned, supporting the floodplain management study and plan, but suggesting there are other measures that could also be considered. No details provided | Not required |
| 5 | Feedback form returned, supporting the floodplain management study and plan. Suggested other measures should be included and recommended that the creek be cleaned out to improve flow. | Further consideration of creek maintenance is recommended in the plan. |
| 6 | Feedback form returned, supporting the floodplain management study and plan. Also suggested that rails could be put around the creek, and that the creek could be lined with stone to improve its appearance. | Not required |
| 7 | Letter thanking Council for support in trying to alleviate flood problems for people within the catchment. Suggested that the exhibition period be extended to allow a public meeting for residents to participate in the determination of options to solve the problem. | The project has already had an extensive community consultation phase, including newsletters, questionnaires and two public meetings. There was also a relatively long exhibition period of over 8 weeks. |
| 8 | Letter questioning how the PMF can be about 1 m higher than the 100 year flood. Requested further consultation and noted that Basin 18 has recently been constructed, but not taken into account for this study. | Basin 18 has been provided in the report as compensation for the WSO highway and also to mitigate the impacts of future development within the catchment. Whilst there may be some improvement of flood |


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|  |  | behaviour now, this will diminish over time as the highway and further development is completed. |
| 9 | Submission from State Emergency Service, Liverpool Unit, endorsing the plan as an excellent document that addresses flooding issues in the Cabramatta Creek floodplain. Expressed some concern that the original plan for a large basin in the centre of the catchment (Basin 22) had been replaced with a smaller basin. Problems with Hoxton Park Road being inundated by floodwater and access difficulties for evacuation centers were also raised. | The original concept for Basin 22 (in the 1999 draft report) was for a large, multipurpose basin. This has not been possible due to high land acquisition costs and other technical difficulties, including a high saline water table that limits the permissible excavation depths. Recent improvements to Hoxton Park Road may slightly improve its susceptibility to flooding; however flooding problems here are still anticipated. Further consultation between Council's committee and the SES is recommended to further evaluate evacuation issues within the catchment. |
| 10 | Council's efforts in managing the flood risk within the catchment was acknowledged, A public meeting was suggested so that owners could participate in the determination of measures to alleviate flooding. It was also suggested that the exhibition period be extended so that any errors in the report could be corrected. | The project has already had an extensive community consultation phase, including newsletters, questionnaires and two public meetings. There was also a relatively long exhibition period of over 8 weeks. |
| 11 | Questioned the flood risk classification provided on a particular property. Was concerned that floods greater than the 100 year flood were being considered, and that such advice would be included on Section 149 Certificates. Concerned that this might impact on insurance, financial institutions and property values. Suggested that the exhibition period be extended. | The main purpose of the Plan is to try and reduce the risk from future floods. This considers all flood risks, up to what is termed the "probable maximum flood". As the likelihood of floods greater than 100 years is quite rare, this area has been classified as having a "low flood risk". There is no evidence that such a classification will devalue property values. In NSW, insurance against flooding is generally unavailable, regardless of flood affectation. These issues are also covered in the 'frequently asked questions' included in Appendix A of the report |
| 12 | Similar submission to LCC12 above | See comments above |
| 13 | Similar submission to LCC12 above | See comments above |
| 14 | Concerned that floods greater than the 100 year flood are now being considered. Concerned that this will impact on home insurance and property values. Also felt that little work had been undertaken within the catchment since 1981, despite new development that had occurred, and the creek no longer had sufficient capacity. Recommended flood mitigation works rather than flood risk assessment. | Whilst all floods are being considered, land between the 100 year flood and the PMF has been categorized as having a 'low' flood risk, and the flood related development controls are relatively minor. In NSW, insurance against flooding is generally unavailable, regardless of flood affectation. Appendix A provides further details. The recommended plan includes a mix of flood mitigation works and flood risk management measures. |
| 15 | Advice from Council officer that Basin 18 has recently been constructed on Maxwells Creek. | The Cabramatta Creek catchment is subject to rapid change with the construction of the WSO highway and other development. Flood levels in Maxwells Creek may now be reduced as a result of the construction of this basin. However, as the WSO highway and other development progresses, this impact will be diminished. The basin principally acts as compensation for both the WSO highway |


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|  |  | and development between1989 to 2026. |
| 16 | Advice from Council officer of some rain gauges recently installed in the upper catchment, as per study recommendations. | Not required. |
| 17 | Strongly disputes flood notation on a particular property, as there is now an effective retaining wall between this property and the creek (presumably due to the WSO highway). | This may require a site specific assessment which is beyond the scope of the current floodplain management study. |
| 18 | Endorses that recognition of floods greater than the 100 year flood provides an opportunity to identify and mitigate these risks on a proactive manner. However, concerned that notations of flood risk for property affected by the PMF will impact on property values, insurance premiums and development potential. Also notes that some measures recommended for Brickmakers Creek (in Appendix C) have not been included in the main study and plan. | Land between the 100 year flood and the PMF has been categorized as having a 'low' flood risk, and the flood related development controls are relatively minor. In NSW, insurance against flooding is generally unavailable, regardless of flood affectation. Appendix A provides further details. Measures for Brickmakers Creek recommended in Appendix $C$ are included in the recommended Plan (Table 10.1). Further reference to these works will be included in the report Summary. |
| 19 | Concerned that property has been identified as being within the PMF when historically such flooding has not been experienced. Supports measures to alleviate flooding. Stresses the need to ensure that creeks and drains are kept clear from rubbish and that potential for culvert blockage is minimized. | The PMF is a flood much rarer than the 100 year flood. Whilst many places in NSW have experienced floods larger than the 100 year flood, there are no records of similarly rare floods having occurred in the Cabramatta Creek catchment. This is not to say that such flooding is not possible in Cabramatta Creek. The Plan also endorses a program to keep the creek clear of debris. |
| 20 | Concerned over the reduced capacity of Brickmakers Creek, in the vicinity of the Cumberland Highway, due to weed growth and pollution. The culvert under the Hume Highway was also considered to be inadequate. | These comments are endorsed by the current study. Appropriate recommendations are included in the Plan for culvert amplification and other channel improvement measures. |
| 21 | Resident concerned that property purchased in 1999 had no flood classification, but is now shown to be within the PMF flood. Questions what the current Section 149 Certificate will show. | It is not Council's intention to sterilize land that is above the 100 year flood from development. Land between the 100 year flood and PMF is identified as having a 'low flood risk' and there are relatively minor flood-related development controls proposed as part of the plan. |
| 22 | Submission from the Bureau of Meteorology concerning flood warning matters | The Bureau provided further details concerning range of meteorologically-based warning services provided by the bureau, including Flood Watches, Severe Thunderstorm Warnings, and Severe Weather Warnings. Given the short time between rainfall and flooding within the Cabramatta Creek catchment, the Bureau recommended that any flood warning system strategically incorporates these meteorologically based warning services. Section 10.3.1.1 of the report has been amended to include these recommendations. |
| 23 | Submission concerned over consideration of the PMF flood and 'Low Flood Risk' precinct, and that inclusion of this on Section 149 Certificates would be detrimental due to | Many of the issues relating to the impact of the 'low flood risk' precinct (ie insurance, property values, finance) are discussed in the frequently asked questions in Appendix |


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|  | insurance, property values, finance and anguish. Also questioned whether areas that had recently been filled been taken into consideration with the mapping, and why the previously proposed basin on Maxwells Creek (between Kurrajong Road and Jedda Road) was not shown in the Plan. | A. Whilst the mapping included in the report is as up-to-date as possible, frequent review of the Plan and mapping is recommended, as new information or other changes become apparent. The basin originally proposed on Maxwells Creek has been relocated further upstream and incorporated with a dual-purpose RTA-Council basin. |
| 24 | Submission made by the Sydney Landscape Unit of the Department of Infrastructure Planning \& Natural Resources concerning the Department's preference for the construction of off-line detention basins rather than on-line basins. | Basin details provided in the report are conceptual only, and will require further evaluation and detailed design prior to implementation. Wherever possible, opportunities for off-line basins will be pursued. Further clarification of this issue has been included in Section 10.1.8.8 of the report. |
| 25 | Submission made by the Flood Group of the Department of Infrastructure, Planning \& Natural Resources concerning clarification on a number of issues. Included comments/clarification of basin design, cost estimates, damage calculations, accuracy of mapping, source of funding and other implementation measures. | These issues have been discussed with the Department, and several minor changes made to the draft report to provide further information/clarification, where required. |
| 26 | Feedback form supporting the floodplain management study and plan, but also concerned that property may be affected due to Section 149 notification. Requested further discussion on the implications of the study. | Many of the issues associated with Section 149 notifications and property values are examined in the 'frequently asked questions', included in Appendix $A$ of the report. |
| 27 | Question related to a particular property. Surrounding residents have reportedly been allowed to fill their properties above the 100 year flood. The respondent believes that he should be allowed to do the same. | This is a site specific issue beyond the scope of the floodplain management study. It is an issue for Council to consider should a formal request be submitted. |
| 28 | Feedback form not supporting the floodplain management study and plan. The owners have lived at a particular property since 1969 and have never experienced flooding. It appears they are now concerned that this property has been identified in one of the flood risk precincts. | The absence of floods over the last 30-40 years is not necessarily an indicator that a large or extreme flood may not occur some time in the future. |
| 29 | Letter received stating that property has not flooded since 1961. Some concern was expressed for other property affected by flooding. It was suggested that building a dam or reservoir was the only answer to the problem | Construction of a large, central dam (known as Basin 22) has been examined, but discounted due to financial and other technical issues. The construction of a number of smaller detention basins throughout the catchment does form a major component of the recommended floodplain management plan. |
| 30 | Phone call and meeting with resident who questioned whether there was any requirement for property owners to advise their insurance company concerning flood advice that may appear on a Section 149 Certificate. | Insurance for flooding is normally not provided by Insurance companies, regardless of the notation that may be included on a Section 149 Certificate. |
| 31 | Phone call from resident suggesting that rainwater tanks should be considered to stop flooding. | Rainwater tanks are a good measure to help conserve our water supplies. In the Cabramatta Creek Catchment, it has been |


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|  |  | considered that the construction of much <br> larger detention basins, strategically located <br> throughout the catchment, is likely to be <br> more effective in reducing flood flows. |
| 32 | Phone call from resident believing that it was <br> Council's fault that his property was now <br> shown to have a flood risk. | The study has attempted to identify the <br> various flood risks throughout the catchment, <br> and to develop strategies to reduce/manage <br> this flood risk. |
| 33 | Comment from Council staff that further <br> evaluation/consultation in relation to <br> measures proposed in the Tresalam Street <br> area should be undertaken as part of future <br> investigations. | The measures included in the Plan for <br> Tresalam Street are now noted as being <br> subject to further evaluation. |

