DOCUMENTS TO TENDER

First Statement of Russell Cuerel

26 September 2011

400 George Street Brisbane
GPO Box 1738 Brisbane
Queensland 4001 Australia
Telephone 1300 309 634
Facsimile +61 7 3405 9750

QUEENSLAND FLOODS COMMISSION OF INQUIRY

STATEMENT OF RUSSELL KEITH CUEREL

I, **RUSSELL KEITH CUEREL** of c/- 41 George Street Brisbane in the State of Queensland, Manager, Infrastructure Management, Office of the Water Supply Regulator, Department of Environment and Resource Management (DERM), solemnly and sincerely affirm and declare:

Requirement from Queensland Floods Commission of Inquiry

1. I have seen a copy of a letter dated 7 September 2011, which is attachment **RKC-01**, from the Commissioner, Queensland Floods Commission of Inquiry to me requiring a written statement under oath or affirmation, and which details the topics my statement should cover.

Item 1: His role and position within the Department of Environment and Resource Management (DERM).

2. I am a civil engineer. I graduated from the Queensland Institute of Technology (as it was then known) in 1981. I am not currently registered with a professional body nor am I required to be in my substantive position. My current substantive position is Manager, Infrastructure Management (PO6), reporting to the Director-Water Infrastructure Asset Management and Standards, Office of the Water Supply Regulator. I have been in this position since September 2009.

3. In this role my principal responsibility is the assessment of Drinking Water Quality Management Plans for drinking water service providers under the *Water Supply (Safety and Reliability) Act 2008*. However, I also oversee the work of one engineer providing advice to the Department of Community Safety (DCS) on:

   a. the implementation of flooding requirements of SPP1/03 in local government planning schemes; and

   b. the payment of government subsidy for flood mitigation projects.

4. Going back (from the most recent) my previous positions and responsibilities have been as follows:

   a. 2009: Project Manager, Metering (AO8), reporting to the Director, Implementation and Support Unit, Regional Service Delivery – a project managing the implementation of the department's rural water metering policy.

   b. 2004-2009: Project Manager, Metering (AO8), reporting to the Director, Water Use Unit, Water Allocation & Management – project managing the implementation of the department's rural water metering policy. Within this

period I also contributed to the industry focussed review and update of the Queensland Urban Drainage Manual.

c. 2002-2004: Principal Policy Officer - Floodplain and Stormwater Management (PO5), reporting to the Director, Water Use Unit, Water Allocation & Management –working on projects as directed (including the Rural Water Use Efficiency Program, State Flood Risk Management Policy project and administration of the Regional Flood Mitigation Program).

d. 2000-2002: Engineer (PO4), reporting to the Director, Water Use Unit, Water Allocation & Management –working on projects as directed (including the State Flood Risk Management Policy project and administration of the Regional Flood Mitigation Program).

e. mid-1990's-2000: Engineer (PO4), reporting to the Manager, Regional Planning, Regional Infrastructure Development - working on projects as directed (including the State Flood Risk Management Policy project and administration of the Regional Flood Mitigation Program)

Item 2: The role of DERM in drafting and administering the State Planning Policy 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03).

5. The role of DERM in drafting and administering the State Planning Policy 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03) is as follows:.

Drafting

It is my recollection that the SPP1/03 was drafted over the period between 2001 and 2003. DCS (then Department of Emergency Services, DES) was responsible for drafting SPP1/03 and, as I recall, set-up a DCS project team to develop the SPP. DCS also established a Government Advisory Committee to "*provide strategic and practical advice to the Department of Emergency Services at each stage of the development of the State Planning Policy and supporting Guidelines*". See Attachments **RKC – 02**.

The Committee had representation from a number of agencies (as they existed at the time) such as Main Roads, Environment Protection Agency, Dept. of Premier and Cabinet, Dept. of Local Government and Planning, State Development, Qld Transport, Public Works, and the Qld Fire and Rescue Authority and was chaired by the Director, Disaster Mitigation Unit, Counter Disaster and Rescue Services, Department of Emergency Services (DCS).

In my position as an Engineer (PO4), Water Use Unit, Water Allocation & Management, my role at that time was to prepare a draft discussion paper for public consultation on the development of a State Flood Risk Management Policy. Because of my work on that project, I was directed to attend the meetings of the Government Advisory Committee – initially in support of my then director (Water Use Unit), and subsequently as Water Management and Use's representative.

DCS also requested that the department provide some material for the SPP Guideline – specifically with respect to identifying a natural hazard management area for flooding and the options that could be used. Again, as I was a project officer working on the department's State Flood Risk Management Policy project at the time (and had earlier involvement with the development of floodplain management guidelines) I was directed by my manager to prepare an initial draft of some of the content of Appendix 2 for the DCS project team to develop into the guideline.

Administering
The former Water Management and Use business unit (and subsequently the Office of the Water Supply Regulator from about late 2006/early 2007) of the department provides high level technical advice to DCS, when requested, on whether planning schemes meet the requirements of SPP1/03 with respect to flood.

Item 3: How DERM interacted with the Department of Local Government and Planning (DLGP) and the Department of Community Safety (DCS) during the process of drafting the SPP 1/03.

6. As a PO4 engineer at the time, my interaction with the Department of Local Government and Planning (DLGP) and the Department of Community Safety (DCS) during the process of drafting the SPP 1/03 was as outlined above - i.e. participation on the Government Advisory Committee and the provision of strategic and practical advice to DCS. I was not responsible for any high-level discussions between the two departments.

   a. I was the project officer on an existing departmental project to develop a State Flood Risk Management Policy. The State Flood Risk Management Policy project was established by the then Regional Infrastructure Development (RID) business unit under the Manager, Infrastructure Planning and Management. It arose from recommendations made by the Queensland Flood Coordination Committee chaired by the Executive Director, RID – see attachments **RKC – 03**;

   b. By the time DCS launched its project to develop the SPP, an internal re-organisation of the department meant the State Flood Risk Management Policy project (and staff) was transferred to the Water Management and Use business unit under the Director, Water Use.

      Because of the similar nature and (at that stage) timing of the two projects, the state-wide public consultation for both was carried-out jointly. I attended all sessions to conduct the presentations on the State Flood Risk Management Policy proposal along with DCS staff (and their contractors) who conducted the SPP1/03 sessions.

Item 4: How DERM interacts with the DLGP and DCS to administer the SPP 1/03. Please explain by reference to the specific examples of:
a) The Brisbane City Plan;

b) **Bundaberg City Plan;**
c) **Ipswich Planning Scheme; and**
d) **Emerald Shire Council Planning Scheme.**

7. I cannot answer for the department generally, but so far as my current role in OWSR is concerned there is no interaction with DLGP. OWSR only interacts with DCS in their administration of SPP 1/03.

   It should be noted that planning scheme controls introduced by local governments in implementing SPP1/03 can only ensure *new* development has a reduced exposure to flooding. They cannot eliminate all flood risk nor can they reduce the number of existing properties already at risk of flooding – except when owners seek to redevelop those properties.

   With respect to the specific examples and OWSR's role in providing advice to DCS, departmental records indicate the following:

   a. *Brisbane City Plan* – no record of receiving the Plan for comments being provided by WM&U or OWSR to DCS on the Brisbane City Council City Plan. Comment has been provided to DCS on one or two specific development proposals – see attachment **RKC-04.**

   b. *Bundaberg City Plan* – record of comment provided to DCS by WM&U recommending Bundaberg City Council be required to justify its adoption of a defined flood event lower than the 1% AEP; and an administrative query regards how the map(s) defining the Natural hazard management area flood should be included in the Plan – see attachment **RKC – 05.**

   c. *Ipswich Planning Scheme* – no record of receiving the Plan for comments. Comment (date unknown) was provided to DCS on the Walloon-Thangoona Master Plan Amendment of this Plan – see attachment **RKC – 06.**

   d. *Emerald Shire Council Planning Scheme* – records indicate that WM&U provided input to a draft letter from DCS (then DES) to DLGP which states that the Emerald IPA Planning Scheme (at the first state interest check stage) was not considered to have implemented the SPP - see attachment **RKC – 07.**

Item 5: The role that DERM plays (in conjunction with DCS and DLGP) in monitoring whether each local government has:
a) **An adequate flood map;**
b) **Carried out adequate flood studies;**
c) **Identified an appropriate defined flood event in its planning scheme; and**
d) **Taken steps to appropriately reflect the SPP 1/03 with respect to flood in its planning scheme.**

8. To the best of my knowledge, the role DERM has is to advise DCS when they seek OWSR's comment at the time a local government submits their planning scheme to the State.

a) *An adequate flood map* - OWSR checks the flood map that has been included in the planning scheme – i.e. it is for the 1% AEP flood and whether it shows which areas and properties are affected. OWSR does not check the accuracy of any underlying modelling or other supporting studies;

b) *Carried out adequate flood studies* – e.g. OWSR confirms whether the flood information in the scheme appears to reflect what the Department knows about the most current information for the area (e.g. if a study has been funded by the government for that area, the outcomes of that study should be reflected in the plan)

c) *Identified an appropriate defined flood event in its planning scheme* – where a local government has adopted a DFE below the 1% AEP, OWSR will provide comments to DCS on how the local government might justify a lower AEP (e.g. they have assessed and understand the risks associated with impact of larger floods and the community understands that a more frequent, but less severe flood has been used as the DFE);

d) *Taken steps to appropriately reflect the SPP 1/03 with respect to flood in its planning scheme.* - OWSR will comment on whether the provisions applying to development within the natural hazard management area-flood reflect the "specific outcomes" stated in the SPP and are compatible with the proposed "solutions for development in a natural hazard management area – flood" in the SPP Guideline – see attachment **RKC-08.**

I am unaware of any other role that DERM has in monitoring local governments in this context.

Item 6: Whether DERM has any role in initiating flood studies for catchment areas or local government areas, and if so, a description of that role.

9. To the best of my knowledge, flood studies for catchment areas or local government areas are generally initiated by local governments or are a requirement placed on developers by local government.

   OWSR has no role in initiating flood studies for catchment areas or local government areas and I am not aware of other areas of DERM having a role in initiating flood studies for catchment areas or local government areas as part of their normal responsibilities.

   I am not aware of DERM initiating flood studies generally. Historically, I am aware that individual flood or flood-related studies have been undertaken or commissioned by DERM, however I only have direct knowledge of two (Warwick around 1994/5, and the Nogoa floodplain around 1996) and so can only comment on these.

   a. Warwick was undertaken by the department's surface water modelling group to support a departmental project under the Manager-Regional Planning, Regional Infrastructure Development for the development of a floodplain management guideline

b. Nogoa was also undertaken by the department's surface water modelling group to support the development of a Floodplain Management Plan developed by the department's Rockhampton office for the Nogoa Floodplain Management Board (a Joint Local Government comprising the then 3 local councils of Peak Downs, Emerald and Bauhinia Shires) to control the construction of rural levees .

Item 7: Whether DERM has any role in providing funding or other assistance for flood studies, flood models or flood maps and, if so: who such funding or assistance is provided to and the basis for such funding or assistance.

10. OWSR does not directly provide any funding or other assistance for flood studies, flood models or flood maps and I am not aware of the position of other parts of DERM in relation to provision of funding or other assistance.

    The current State - Commonwealth Natural Disaster Resilience Program provides funding to local and state agencies for disaster mitigation related activities - including flood. The administration (and state funding) of this program in Queensland is the responsibility of DCS. However, OWSR does have a role in assisting DCS administer the program. OWSR's assistance is in the form of determining whether flood mitigation related projects selected for funding (including flood studies) have met their project milestones and are hence eligible to receive payment.

    The process for selection of projects that receive funding under the Natural Disaster Resilience Program is the responsibility of DCS.

Item 8: With respect to the position described in SPP 1/03 that, generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1% Annual Exceedance Probability (AEP) flood;

a) Who or what body made the final decision as to that position;
b) Why a flood height standard was chosen rather than an approach that specifies areas of risk (such as high, medium or low risk of inundation);
c) Why a flood height standard was chosen as compared to other methods for identifying natural hazard management areas (flood);
d) Why the 1% AEP flood was chosen (as compared to a different AEP flood);
e) How the 1% flood was chosen, including a description of all relevant consideration;
f) Whether any advice was received from any other government department or agency regarding that position, and a description of that advice.

11. With respect to the position described in SPP 1/03 that, generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1% Annual Exceedance Probability (AEP) flood; my response is as follows:

    a. To the best of my recollection, the Government Advisory Committee (described under paragraphs 3 and 4 of this statement) discussed the issue based on information brought to the Committee by its members and would

have recommended this approach to the Chair (DES). I do not have minutes to confirm this.

b. As *risk of inundation* is inherent in the AEP assigned to a particular flood, I understand the question to mean high, medium or low risk with respect to the flood hazard? There are three parts to the response to this item:
   i. Firstly, it is my understanding that for an SPP to "take effect", the area to which it applies must be defined – hence the concept of a *natural hazard management area* had to be established (someone with expert knowledge of the legislated planning framework from DLGP or DCS would be best positioned to explain this).

   ii. Secondly, within the "natural hazard management area –flood" the specific outcomes of the SPP (e.g. people remain safe) are aimed at addressing the various levels of risk associated with the form of the flood hazard (e.g. deep or shallow, fast or slow flowing, etc). Appendix A also provides guidance on appropriate developments in the various flood hazard zones in Table A2.1 (adapted from the 2000 national guidelines[1])

   iii. Lastly, although there would have been suggestions in the literature that the defined flood event (or events) for planning purposes should be based on a locality specific "risk" basis, the 1% AEP flood was the most widely accepted standard nationally at that time. It should also be noted that the SPP does recommend higher levels of flood immunity for Community Infrastructure required to operate during or immediately following a flood event (refer Appendix 9 of the SPP Guideline).

c. I believe my response to (b.) addresses this question.

d. The 1% AEP flood was the most widely accepted standard nationally and, at the time, represented a significant improvement in flood immunity over past practices in many localities in Queensland.

e. As I understand it, information was put to the Government Advisory Committee on the adoption of variable flood standards by local governments around the state at that time and the general acceptance in other jurisdictions nationally of the 1% AEP flood.

f. I don't recall any other advice besides the issue being debated at meetings of the Government Advisory Committee. There may have been information sourced by the DES project team from other organisations seen to be taking a lead in the floodplain management field at the time (such as the Gold Coast City Council) but only DCS can confirm this.

[1] Floodplain Management in Australia: Best Practice Principles and Guidelines, SCARM Report No.73 2000

Item 9: In respect of item 8, please attach all relevant briefing notes, papers and records of decisions.

12. a). All the relevant briefing notes, papers and records of decisions that have been able to be retrieved at the time of this statement are attachments **RKC – 02** to **RKC – 07** inclusive. The search is continuing and whatever is retrieved will be provided to the Commission.

b). I have attached as attachments as **RKC – 09**, a draft memorandum of understanding correspondence and briefing note in relation to the provision of the specialist advice on flood issues. The MoU is incomplete and unsigned. However, the MoU does not need to be finalised for department staff involved in its administration to understand and carry out the function.

c). I refer to letter dated 02 Nov 2010 from EMQ to DERM confirming the arrangements through an exchange of letters. See the last document on Attachment RKC – 09. The letter also notes that Queensland is no longer represented on the National Flood Risk Advisory Group.

Item 10: The meaning and operation of section 6.6 of the SPP 1/03,including:

a) **Clarification of how the SPP 1/03 applies to a development application where the local government has not appropriately reflected the SPP 1/03 and has not adopted a defined flood event in its planning scheme; and**
b) **Examples of different ways in which local government area, and how different approaches are ultimately reflected in the relevant planning scheme.**

13. (a). The meaning and operation of section 6.6 of the SPP 1/03 relating to how it applies to a development application where the local government has not appropriately reflected the SPP 1/03 and has not adopted a defined flood event in its planning scheme is not a matter I am qualified to comment on.

(b) With respect to different ways in which local governments determine the defined flood event for their local government area, I am generally aware that local governments may use a number of methods to determine the defined flood event. Current best practice is to undertake a flood (numerical) modelling study that results in a range of floods being investigated to determine the areas affected. The range of floods is based on Annual Exceedence Probabilities and ideally should cover all theoretically possible floods including the Probable Maximum Flood. Such studies can be time consuming and expensive and rely heavily on adequate data being available (rainfall, stream-flow, terrain, etc) to give reliable results. Alternatives to this method are mostly based on using historic information (which is also usually used as a check against modelled results) such as analysing the stream-flow records or simply using the largest known flood (flood of record). Numerical flood modelling generally provides the most information (e.g. identification of significant flow paths at each level of inundation and an estimate of the probable maximum flood) and therefore allows a more confident implementation of mitigation measures – including planning measures.

Item 11: What involvement DERM has in commenting on or drafting the Queensland Planning Provisions.

14. I cannot answer for the department generally with respect to its involvement in commenting on or drafting the Queensland Planning Provisions. I have had no role in commenting on or drafting the Queensland Planning Provisions and only became aware they existed as the result of an internal email around mid-January 2011.

I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the *Oaths Act 1867*.

Sig[redacted]

Russell Keith Cuerel

Taken and declared before me, at Brisbane this 14th day of September 2011

[redacted]

~~Peace/Commissioner for Declarations~~

Our ref: Doc 1699605

7 September 2011

[redacted]
Assistant Crown Solicitor
Crown Law
GPO Box 5221
BRISBANE QLD 4001

Dear [redacted]

Please find enclosed a Requirement to provide a statement directed to Mr Russell Cuerell, Manager (Infrastructure Management), Water Industry Asset Management and Standards, Department of Environment and Resource Management.

Please note that the material is returnable to the Commission by 5 pm, Tuesday, 13 September 2011.

If you require further information or assistance, please contact [redacted] on telephone [redacted] or [redacted] on telephone [redacted]

We thank you for your assistance.

Yours sincerely

[redacted]
Jane Moynihan
Executive Director

Encl.

400 George Street Brisbane
GPO Box 1738 Brisbane
Queensland 4001 Australia
Telephone **1300 309 634**
Facsimile **+61 7 3405 9750**
www.floodcommission.qld.gov.au
ABN 82 696 762 534

Our ref: Doc 1697934

7 September 2011

Russell Cuerell
Manager (Infrastructure Management)
Water Industry Asset Management & Standards
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

REQUIREMENT TO PROVIDE STATEMENT TO COMMISSION OF INQUIRY

I, Justice Catherine E Holmes, Commissioner of Inquiry, pursuant to section 5(1)(d) of the *Commissions of Inquiry Act 1950* (Qld), require Mr Russell Cuerell to provide a written statement, under oath or affirmation, to the Queensland Floods Commission of Inquiry, in which the said Mr Cuerell gives an account of:

1. His role and position within the Department of Environment and Resource Management (DERM).

2. The role of DERM in drafting and administering the State Planning Policy 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03).

3. How DERM interacted with the Department of Local Government and Planning (DLGP) and the Department of Community Safety (DCS) during the process of drafting the SPP 1/03.

4. How DERM interacts with the DLGP and DCS to administer the SPP 1/03. Please explain by reference to the specific examples of:
   a) the Brisbane City Plan;
   b) Bundaberg City Plan;
   c) Ipswich Planning Scheme; and
   d) Emerald Shire Council Planning Scheme.

5. The role that DERM plays (in conjunction with DCS and DLGP) in monitoring whether each local government has:
   a) an adequate flood map;
   b) carried out adequate flood studies;
   c) identified an appropriate defined flood event in its planning scheme; and

400 George Street Brisbane
GPO Box 1738 Brisbane
Queensland 4001 Australia
Telephone **1300 309 634**
Facsimile **+61 7 3405 9750**
www.floodcommission.qld.gov.au
ABN 82 696 762 534

d) taken steps to appropriately reflect the SPP 1/03 with respect to flood in its planning scheme.

6. Whether DERM has any role in initiating flood studies for catchment areas or local government areas, and if so, a description of that role.

7. Whether DERM has any role in providing funding or other assistance for flood studies, flood models or flood maps and, if so: who such funding or assistance is provided to and the basis for such funding or assistance.

8. With respect to the position described in SPP 1/03 that, generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1% Annual Exceedance Probability (AEP) flood:
   a) who or what body made the final decision as to that position;
   b) why a flood height standard was chosen rather than an approach that specifies areas of risk (such as high, medium or low risk of inundation);
   c) why a flood height standard was chosen as compared to other methods for identifying natural hazard management areas (flood);
   d) why the 1% AEP flood was chosen (as compared to a different AEP flood);
   e) how the 1% AEP flood was chosen, including a description of all relevant considerations;
   f) whether any advice was received from any other government department or agency regarding that position, and a description of that advice.

9. In respect of item 8, please attach all relevant briefing notes, papers and records of decisions.

10. The meaning and operation of section 6.6 of the SPP 1/03, including:
    a) clarification of how the SPP 1/03 applies to a development application where the local government has not appropriately reflected the SPP 1/03 and has not adopted a defined flood event in its planning scheme; and
    b) examples of different ways in which local governments determine the defined flood event for their local government area, and how different approaches are ultimately reflected in the relevant planning scheme.

11. What involvement DERM has in commenting on or drafting the Queensland Planning Provisions.

In addressing these matters, Mr Cuerell is to:

- provide all information in his possession and identify the source or sources of that information;
- make commentary and provide opinions he is qualified to give as to the appropriateness of particular actions or decisions and the basis of that commentary or opinion.

Mr Cuerell may also address other topics relevant to the Terms of Reference of the Commission in the statement, if he wishes.

The statement is to be provided to the Queensland Floods Commission of Inquiry by 5 pm, Tuesday 13 September 2011.

The statement can be provided by post, email or by arranging delivery to the Commission by emailing info@floodcommission.qld.gov.au.

Commissioner
Justice C E Holmes

[redacted]

DEPARTMENT OF NATURAL RESOURCES
GENERAL BRIEFING NOTE

TO **THE DIRECTOR-GENERAL**

SUBJECT **FLOOD MITIGATION POLICY DISCUSSION PAPER**

RECOMMENDATION

It is recommended that you note that:

- a Flood Mitigation Policy Discussion Paper has been prepared on behalf of the State Disaster Mitigation Committee(SDMC) through a working group chaired by the Department.
- the Chair of the SDMC [redacted] Director-General, Department of Emergency Services) has requested that the final draft receive your endorsement prior to its release for official comment from other State agencies;
- a draft of the Paper is attached for your consideration;
- it is planned in due course that the paper be submitted to Cabinet for approval for public release for consultation to provide a basis for finalisation of a State flood mitigation policy.

DIRECTOR-GENERAL'S COMMENTS

BACKGROUND

For a number of years, the Department has endeavoured to promote the adoption of "best practice" in flood risk management in Queensland. From 1996 to 1999 NR&M was firstly joint Chair with the Department of Emergency Services (DES), and then the sole Chair of the Queensland Flood Coordination Committee (QFCC). The QFCC was a large interdepartmental committee formed under the Central Control Group to report on the status of flood risk management in Queensland and propose improvements.

A final version of a proposed QFCC report was never completed, however QFCC report material was incorporated in a presentation to the State Disaster Mitigation Committee (SDMC) at its August 1999 meeting. In addition, the findings of the QFCC were summarised as part of a response to a request from the Central Control Group for a status report on the deliberations of the committee.

The Department then put to a meeting of the SDMC in November 1999 a proposal that the Committee support the reconstitution of the QFCC (with membership better reflecting the core stakeholders) for the preparation of a flood mitigation policy discussion paper. The SDMC supported the proposal together with the Department's role as lead agency for the development of the paper, seeing it as a continuation of NR&M's previous responisibilities as Chair of the QFCC, as well as recognising the Department's efforts in promoting flood risk management, its responsibilities for water resource management and its expertise in flood management issue analysis.

A 16-member Working Group was formed to develop the discussion paper with representatives from State and local governments, as well as the Institute of Public Works Engineers of Australia,

---

Briefing Officer	Russell Cuerel, Senior Project officer, Water Use	Dr D G Gentle DDG IRM	Lee Rogers, GM WM&U DG NO: 11185/01
Telephone	[redacted]	9 August 2001	DATE: 10-08-01

Queensland and Urban Development Industry Association. The Working Group met twice before a first draft of the paper was presented to the September 2000 meeting of the SDMC.

With the incorporation of feedback on the first draft and further development, the paper now provides:

- a background to the flood risk situation in Queensland;
- a discussion of the obstacles to better flood risk management;
- possible actions to improve the management of floodplains to reduce risks; and
- a discussion of the options for appropriate policy instruments to reduce risks, together with the advantages and disadvantages of each option.

KEY ISSUES

- The paper is now at a near final draft stage, having incorporated final comments from the Working Group members and the SDMC. A copy of this draft is attached.
- The SDMC has proposed that NR&M's endorsement be sought and received by its next meeting prior to its distribution to relevant State Government agencies for formal comment.

Attachment:

Draft Flood Mitigation Policy Discussion Paper

Briefing Officer	Russell Cuerel, Senior Project officer, Water Use	Dr D G Gentle DDG IRM	[redacted] GM WM&U
Telephone	[redacted]	9 August 2001	

NO. 38 CABOOLTURE

FLOODPLAIN MANAGEMENT

"That the Local Government Association of Queensland Inc approach the Environmental Protection Agency to become a Lead Agency for floodplain management control and develop guidelines or stronger legislation to enable Local Government to control matters of floodplain management, now difficult to control."

BACKGROUND

There are numerous instances where the owner of a flood prone property has undertaken "non-approved" works to improve the flood immunity of their land. The concern is that such works may result in greater flood impacts on other properties and a loss In flood storage.

Several years ago Council adopted a by-law that required applicants for such work to demonstrate via a flood model, that the proposed works would not increase the flood levels on upstream and downstream properties and would not result in a loss of floodplain storage. The reasoning behind ensuring no increase in flood levels is self explanatory. No net loss in flood storage was to avoid the cumulative effect of several minor losses.

Where applicants complied with Council requirements then there has been minimal problems. Where applicants undertook non-approved works there were several concerns including:

- difficulty in having unauthorised material removed (the Court required very specific information about movement of trucks, etc)
- difficulty in establishing pre-development contours.
- potential impacts on other properties.
- use of inappropriate material.

Councillors have raised additional matters of concern:

- changing the hydrology of the watercourse (increased stream velocity causing faster runoff & greater potential for silt and erosion)
- the accuracy of flood models.
- uniformity of controls between local governments (& state agencies)

In one instance Council sought to control the chemical composition of the fill material where no such control standards were held by Council or the State. While Council's intentions were honourable in protecting the business interests of the downstream property owner the condition became virtually impossible to police and created a substantial cost impost on the applicant.

Where an application is lodged for consideration and approval by Council and the applicant carries out the work in a responsible manner then there are few problems.

SECURITY CLASSIFICATION "C" **SUBMISSION NO.**

POLICY SUBMISSION

COVER SHEET

TITLE

Compensation In Relation To The Resource Management Legislative Reform Agenda

MINISTER

Minister for Natural Resources

OBJECTIVE

Establishment of the Government's policy on the provision of compensation with respect to:

- the translation of current natural resource entitlements to newly established rights (including forestry property rights through RFA, water property rights through Water Allocation and Management Plans (WAMPs), and tree clearing permits under the State Broadscale Clearing Policy and local guidelines); and
- changes imposed during the term of authorities defining such rights.

SUMMARY

Legislation providing a statutory basis for planning processes such as Water Allocation and Management Plans (WAMPs) and tree management plans, and tradeable entitlements such as water property rights, forestry property rights and tree clearing permits, can not be finalised until it is decided and agreed with industry the extent and timing of the application of the Compensation Principles endorsed by Cabinet in December 1996 (attached).

The preferred option is that compensation should **not** apply to the translation of existing entitlements to new rights or to any future change of right resulting from a properly made change in a statutory plan such as a WAMP, RFA or the State Broadscale Tree Clearing Policy. Whilst this option has been discussed extensively with industry, industry is not generally conscious that it has been selected as the preferred position.

RESULTS OF CONSULTATION

There is likely to be significant opposition from industry to such a decision. Consultation with respect to the application of the Compensation Principles has been somewhat disrupted since December 1997, but discussions prior to then indicated that industry are unlikely to agree to compensation not applying to the translation of existing entitlements or the non-renewal of future authorities.

The position of most (if not all) industry representatives is that compensation should be granted to existing entitlement holders where there is a perceived reduction in their right at the time it is translated into a property right or other form of more secure tenure under the new resource management regimes to be introduced in the near future. Further, industry maintain

that non-renewal of an unfulfilled authority (in the case of a tree clearing permit) should be compensible, although this view is opposed by the Queensland Conservation Council.

In addition, industry maintain that any reduction in right in the future resulting from a re-assessment of resource availability as part of a review of a statutory plan (such as a WAMP) should be compensible.

The level of compensation payable in toto under such a scenario is unquantifiable, but potentially could be several hundred million dollars initially with an on-going commitment in the future as plans are reviewed. There are significant difficulties in justifying the payment of such compensation, both as a matter of principle and on the basis of the capacity of the State to afford to do so.

RECOMMENDATION

Cabinet decide that compensation should **not** apply to the translation of existing natural resource entitlements to new rights or to any future change of right resulting from a properly made change in a statutory natural resource management plan.

.....[redacted].....

Minister for Natural Resources

Date:

SECURITY CLASSIFICATION "C"

AUTHORITY TO INTRODUCE A BILL

COVER SHEET

TITLE

Lake Eyre Basin (Intergovernmental Agreement) Bill 2001

MINISTER

Natural Resources and Mines

OBJECTIVE

To seek Cabinet Authority to Introduce the Lake Eyre Basin (Intergovernmental Agreement) Bill 2001

SUMMARY

The Bill is required to ratify and approve the Lake Eyre Basin Intergovernmental Agreement (attached to the Bill). The Agreement, made by the Commonwealth and the States of Queensland and South Australia on 21 October 2000, provides for the establishment of arrangements for improved co-ordination in the management of water and related natural resources for the part of the Lake Eyre Basin in Queensland and South Australia. The Agreement seeks to facilitate the development, or adoption and implementation, of policies and strategies that address issues that may have cross-border impacts.

OPTIONS

The Lake Eyre Basin Agreement commits the State to use its best endeavours to secure the passage, through its Parliament, of legislation to underpin the Agreement.

The options are:

(i) to introduce ratifying legislation in accordance with the Agreement; or

(ii) to withdraw from the Agreement.

The costs associated with the Agreement are not substantial, but there are expected to be significant benefits to all stakeholders ensuing from better management of the water and related resources of the Basin. Withdrawal from the Agreement has no direct costs, but the benefits ensuing from better management of the water and related resources of the Basin would not be realised, and Queensland would be perceived as not being committed to the sustainable management and use of these resources.

RESULTS OF CONSULTATION

Yes, there is agreement to the introduction of the proposed Bill. See paragraph 11 of Body of Submission.

RECOMMENDATION

That the Lake Eyre Basin (Intergovernmental Agreement) Bill 2001, in accordance with the draft accompanying this Submission (refer Attachment), be introduced into the Legislative Assembly as soon as possible.

Stephen Robertson
Minister for Natural Resources
and Minister for Mines

Date: 18 June 2001

BODY OF SUBMISSION

OBJECTIVE

1. The objective of this Submission is to seek Cabinet Authority to Introduce the Lake Eyre Basin (Intergovernmental Agreement) Bill 2001, required to ratify and approve the Lake Eyre Basin Intergovernmental Agreement

BACKGROUND

- *Context*

2. The Heads of Agreement made on 26 May 1997 between the Commonwealth and the States of Queensland and South Australia agreed that the management of the Lake Eyre Basin, which will best serve the object of sustainability, required a joint co-operative approach between the States of Queensland and South Australia. The Heads of Agreement intended this approach to be embodied in a formal Agreement ratified by the Parliaments of each State. The formal Agreement (attached to the Bill) was subsequently prepared and, on 21 October 2000, signed by the then Minister for Environment and Heritage and Natural Resources. The Heads of Agreement and the Agreement were made particularly in regard to policies and strategies for the management of water and related natural resources that may have cross-border impacts. Seeking ratifying legislation is part of Queensland's agreed actions under the Agreement.

- ***Previous Consideration by Cabinet***

3. Cabinet Decision Number 02476 of 14 May 2001 approved the preparation of the Lake Eyre Basin (Intergovernmental Agreement) Bill 2001. The matter of ratifying legislation had not been considered previously by Cabinet. However, Cabinet had considered the matter of the Lake Eyre Basin Agreement on three previous occasions:
   (i) Decision No. 01280 on 5 May 1997 approving signing of the Heads of Agreement by the then Minister for Natural Resources;
   (ii) Decision No. 00573 on 15 March 1999 endorsing the release of the Lake Eyre Basin Discussion Paper; and
   (iii) Decision No. 01399 on 6 December 1999 noting the nature of the Agreement to be signed following an oral presentation by the then Minister for Environment and Heritage and Natural Resources in which he flagged his intention to sign the Agreement.

URGENCY

- ***Proposed Schedule for Introduction of the Legislation***

4. The proposed timetable for introduction of the legislation is: First and Second Readings during the Parliamentary Sittings of 19 – 22 June 2001

ISSUES

5. The Bill is essential because the Agreement signed by the then Minister for Environment and Heritage and Natural Resources requires ratification through legislation before the Agreement can commence.

- ***Is the Bill consistent with the Authority to Prepare approval?***

6. Yes

- ***Does the Bill infringe fundamental legislative principles (FLPs)?***

7. No

- ***Are there any unresolved policy issues?***

8. No

- ***Is the Bill ready for introduction (and passage)?***

9. Yes

CONSULTATION

10. There has been no consultation specific to the Bill undertaken with community stakeholders, but there was considerable consultation with all community stakeholders, both prior to and after the Agreement was signed. The Agreement provides for a Basin-wide community advisory group to advise the Ministerial Forum. Both the Lake Eyre Basin Agreement and the proposed Bill ratifying the Agreement have been the subject of considerable consultation with both officers and Ministers of the Commonwealth and South Australian Governments. All relevant Queensland Government agencies have been consulted, both previously in relation to the Heads of Agreement and the Agreement, and currently in relation to the Bill. The *Authority to Prepare* was referred to the Agencies listed in the Addendum.

RESULTS OF CONSULTATION

11. There is general community support for the Agreement. No objections were received from the other State Agencies to which the *Authority to Prepare* was referred.

RURAL/REGIONAL IMPACT STATEMENT

12. The Bill will meet the expectations of the rural communities within the Lake Eyre Basin. The legislation provides regional and rural communities with greater certainty that their interests and concerns will be fully considered and social condition enhanced through better water resource management.

EMPLOYMENT IMPACT STATEMENT

13. The adoption of the proposal contained in the Submission will have no direct impact on employment in Queensland. The development and implementation of policies and strategies under the Agreement will provide for better management of the water resources of the Basin, ensuring that the support that these resources provide rural industries will continue and current employment levels are maintained.

FINANCIAL CONSIDERATIONS

14. Formal arrangements have been established for the Ministerial Forum, with a permanent Secretariat and scientific support and a program of monitoring, research, and policy development activities, with an estimated total budget of $500,000 per year for 2001/02 and 2002/03. Based on the agreed cost sharing arrangements, Queensland's share is $125,000 per year. This will be provided from existing Departmental funds and no special appropriation will be necessary.

PUBLIC PRESENTATION

15. A Ministerial media release will be made following Cabinet's consideration of this matter.

ADDENDUM

CONSULTATION

NAME OF OFFICER AND POSITION	DEPARTMENT/ AGENCY	DATE OF CONSULTATION
[redacted] Principal Policy Officer Environment and Resources	Premier and Cabinet	2 April 2001
[redacted] Policy Officer Environment and Resources	Premier and Cabinet	2 April 2001
[redacted]	Treasury	2 April 2001
[redacted] Director, Business Regulation Reform Unit	State Development	2 April 2001
[redacted]	Local Government and Planning	2 April 2001
	State Development	2 April 2001
	Primary Industries	2 April 2001
	Environment Protection Agency	2 April 2001
	Office of Rural Communities	2 April 2001
	Employment, Training and Industrial Relations	2 April 2001

FILE COPY

18 APR 2000

«Salutation» «Name»
«Title_»
«Address»

Dear «Salutation» «Name»

DISCUSSION POLICY PAPER – FLOOD RISK MANAGEMENT IN QUEENSLAND

At the February meeting of the State Mitigation Committee, the Department gave an undertaking that it would proceed to prepare a discussion policy paper on legislative and administrative options for managing flood risk in Queensland. Given the recent flooding events, I am sure that you will agree that this is an important issue.

To progress this matter, I intend to establish a small working group to participate in the drafting of such a paper. I am hopeful that representatives from the Departments of Emergency Services and Communication and Information, Local Government, Planning and Sport, along with the Local Government Association and the Institute of Public Works Engineering Australia will be prepared to nominate members to such a group. I expect that the group will assist in guiding and overseeing the drafting of the paper by my Department.

When the paper is completed, it is proposed to circulate it widely and seek public comment before any recommendations are made to Government.

It would be appreciated if you could forward nominations for representation on the working group marked attention to the Departments' [redacted] can be contacted on [redacted] if further detail regarding this proposal is required.

Yours sincerely

[redacted]

for [redacted]
Director-General

Enquiries to: [redacted] Our Ref : \\MINHOUSE5\GROUPDIR\WIPD\Regional Planning\Floodplain Management\Policy\Development-QFCC\letter to establish policy group version 3.doc
Mineral House, 41 George Street, Brisbane Q 4000
GPO Box 2454, Brisbane Q 4001
Telephone: [redacted]

RRD/085/000(175)

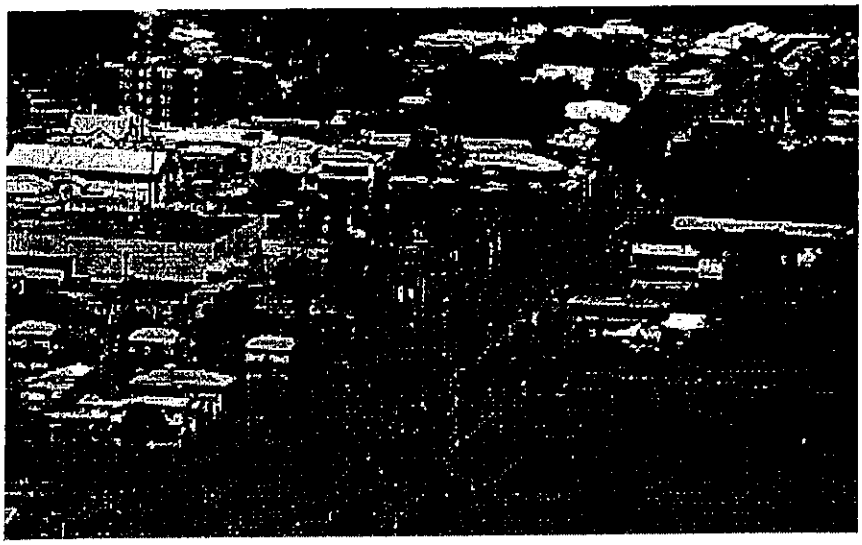
DG no. 7315/2000

[redacted]

Salutation	Title	Name	Address	
Mr	Director-General	[redacted]	Department of Communication and Information Local Government, Planning and Sport PO Box 187 BRISBANE ALBERT ST QLD 4002	
Mr	Director-General		Department of Emergency Services GPO Box 1425 BRISBANE QLD 4001	
Mr	Executive Director		IPWEAQ PO Box 2100 FORTITUDE VALLEY BC 4006	
Mr	Chief Executive Officer		Local Government Association PO Box 2230 FORTITUDE VALLEY BC QLD 4006	

Draft

State Flood Mitigation Policy Discussion Paper



Prepared for the State Disaster Mitigation Committee by Department of Natural Resources and Mines

---

Queensland Government
Natural Resources and Mines

STATE FLOOD MITIGATION POLICY DISCUSSION PAPER

EXECUTIVE SUMMARY

Currently, a best estimate is that 100,000 properties are at risk from a 1 in 100 year flood in Queensland. Nationally, Queensland has the highest exposure to damages from floods.

Response and recovery costs resulting from floods in Queensland represent the majority of National Disaster Relief expenditure every year, averaging $50 million/year in the period 1989 to 1998.

Considerable residential, commercial and industrial areas in Queensland were developed prior to the introduction of any floodplain management policies to regulate development in flood prone locations.

Floodplain management standards employed by local governments in Queensland have varied considerably, sometimes between adjacent administrations sharing the same floodplain.

Floods are probably the most predictable of natural disasters in terms of the areas they are likely to affect and also perhaps the best understood in terms of the methods available to estimate their size, likelihood and characteristics. This means that good planning and appropriate development controls by local government can be most effective in avoiding the creation of a future flood risk. However, existing at risk communities also need to be considered.

To date, the State has not provided local governments in Queensland with clear directions as to their responsibilities in flood risk management. There is no State flood policy or guidelines, nor has the State provided sufficient incentive or guidance to local governments on how best to manage floodplains to reduce flood risks.

Current legislation dealing with flood risk management is fragmented and is affected by a diverse range of issues. The principal legislation relevant to the management of flood risk includes the:

- Integrated Planning Act
- Local Government Act
- State Counter Disaster Organisation Act.

Other Acts including the Building Act, the Water Act 2000 and the Environment Protection Act have some relevance.

In terms of mitigation of flood risk, the above acts mostly have an impact at the planning or new development approval stage. Whilst this is a key to avoiding the creation of new flood risks, this legislation does not deal with existing risk. Additionally, the legislation gives no specific direction in terms of the type of planning necessary for floodplains.

Problems with the current arrangements have been identified in the areas of:

- current governance arrangements
- cooperation and coordination

- local government
- policy and legislation
- financial systems
- information
- insurance
- land transactions

Above all, the lack of complete and reliable information on the extent and frequency of flooding for Queensland communities generally, is a major obstacle to improvements in flood mitigation. Until there is a comprehensive understanding of the nature and extent of the flood risk in Queensland, its management will remain problematic.

The objective of a State flood mitigation policy should be to ensure that sustained action is taken to minimise long-term risk to life and property. Desirably, fewer Queenslanders will in future be victims of floods. Key principles to guide actions aimed at achieving this objective are:

- manage risks to public health and safety with consistent ESD principles;
- develop a full appreciation of the risks and benefits associated with any proposed floodplain use;
- ensure that individuals are able to make informed decisions;
- adopt a partnership approach between all levels of government (recognising that the costs of flood disasters affect all Australians);
- proactive prevention rather than reactive response;
- those who knowingly assume/create greater risk should accept the responsibility and costs associated with that risk.

Overall, an effective State Flood Mitigation Policy requires:

- a cohesive framework of measures; and
- effective implementation mechanisms.

Measures that could be considered for inclusion in a State Flood Mitigation Policy must deal with:

- policy consistency, cooperation and coordination
- promotion of best practice
- administrative systems
- legislation
- planning and development requirements
- flood records and mapping
- community awareness
- indemnification.

Options that have been identified to implement a State flood mitigation policy are:

- establishment of 'all hazards' prevention legislation;
- establishment of specific 'flood mitigation' legislation;
- amendment of existing planning legislation;
- formulation of a State Planning Policy under IPA;
- promotion of floodplain management issues through Regional Planning Advisory Councils .

These options fall into two groups:

- legislation; and
- statements of planning policy.

Implementation mechanisms which either cannot deal with all flood mitigation issues or rely on multiple instruments to manage all of the issues are unlikely to achieve policy consistency and co-ordination and could be considered only a marginal improvement on the current situation.

Whichever options are chosen, they must deal with the pivotal issue of making complete and reliable flood information available so that:

- the community can make informed decisions when purchasing property or when responding to flood disasters;
- local governments can prepare responsible planning schemes, development approval conditions and capital works programs; and
- the State can maintain a credible overview of the nature and extent of the flood risk in Queensland and facilitate targeted assistance.

Widespread availability of flood information has significant implications, both for State and local governments. These are likely to arise principally as a result of:

- the potential reactions from owners of land identified as flood prone; or
- any past decisions that may have been made without a proper consideration of the available data and the impact on the level of flood risk.

1 PURPOSE

The purpose of this paper is to outline options for improving the management of flood risk in Queensland.

After consultation within Government (through the State Disaster Mitigation Committee), the paper has been prepared to form the basis of a submission to Cabinet and then for wider consultation on the development of a preferred strategy for the State Government to bring about improved management of floodplains.

It is intended that the paper address the challenge that sustainable actions be taken in Queensland to minimise long-term risks to people and property from flooding and its effects.

This paper recognises that flood risk management involves four principal component activities, prevention, preparedness, response and recovery from flood events. The paper also recognises that flood risk management involves many stakeholders with a broad range of interests.

2 FLOODING IN QUEENSLAND

Each year floods in Queensland adversely affect the State's economy and the social well being of the community. Floods can cause loss of life and substantial disruption as a result of damage to property, the environment and infrastructure. National Disaster Relief Arrangements (NDRA) costs for flood damage averaged $50 million/year in Queensland between 1989 and 1998. Serious impacts are experienced by industries such as tourism, mining and agriculture due to the primary and secondary effects of floods.

In 1998, the Commonwealth Government released new guidelines for the National Disaster Relief Arrangements (NDRA) that linked the Commonwealth's continued provision of funding assistance with evidence of disaster mitigation. The extent to which local governments and the State practices disaster mitigation will directly affect the NDRA costs borne by the State and by Queenslanders.

Many Queensland communities are vulnerable to river flood, coastal surge, combinations of river flood and surge, and flooding where drainage is inadequate. These areas are generally referred to in this paper as 'flood risk' areas. In February 1998, the Department of Natural Resources and Mines (NR&M) - published a report entitled "Urban Flooding in Queensland – A Review" which presented the results of a flood impact and management survey questionnaire put to local governments. Information was sought on the range of floods studied, the adopted designated flood event for planning and development control, and the current level of exposure of communities to flood risk.

Typically, information was available for "1 in 100 year floods" - which implies very infrequent events. (The risk is actually a 1% annual probability that a flood the same or larger in size will occur). It should be noted however, that over a 70 year period the probability of at least one flood of this magnitude or larger occurring is 50%. The

following table has been reproduced from "Floodplain Management in Australia - Best Practice Principles and Guidelines" to give an indication of the likelihood that a particular event will occur in an individual's lifetime.

Probability of Experiencing a Given Size Flood One or More Times in a Lifetime(70 years)

Likelihood of occurrence in any year		Percentage probability of experiencing in a 70 year period (%)	
		At least once	At least twice
10%	(1 in 10)	99.9	99.3
5%	(1 in 20)	97.0	86.4
2%	(1 in 50)	75.3	40.8
1%	(1 in 100)	50.3	15.6
0.5%	(1 in 200)	29.5	4.9

Table K1 - Floodplain Management in Australia - Best Practice Principals and Guidelines

2.1 Floodplains

Floods are the most predictable of natural disasters in terms of the areas they are likely to affect and also perhaps the best understood in terms of the methods available to estimate their size, likelihood and characteristics. This means that good planning and appropriate development controls by local government can be most effective in avoiding the creation of a future flood risk. Existing at risk communities however also need to be considered.

Many communities in Queensland are located on floodplains adjacent to rivers and creeks. Considerable residential, commercial and industrial areas in Queensland were developed prior to the introduction of any floodplain management policies to regulate development in flood prone locations.

Floodplain management standards employed by local governments in Queensland have varied considerably, sometimes between adjacent administrations sharing the same floodplain.

The nature of the flood risk can differ markedly between rivers and creeks, because flood warning times (i.e. the time interval between rain falling and subsequent flooding) can vary substantially. Flash floods are common as are floods that develop several days after a rainfall event. In addition, the nature and size of the flood risk can vary considerably with the frequency of events depending on catchment and floodplain characteristics.

2.2 Surge Prone Areas

To a varying extent, most of the Queensland coastline is at risk from storm surge inundation (storm tides) associated with tropical cyclones. Storm surge will normally be a relatively localised occurrence impacting on ten kilometres or so of the coastline adjacent to the point where the eye of the cyclone crosses the coast. The risk to people and property from storm surge flooding is greatest in low lying coastal communities.

The effects of surge on buildings and services will usually be more severe than from river flooding because of the power of wave impacts on structures. Lightweight domestic or commercial structures are likely to fail completely if the depth of surge is over one metre above floor level. At lesser depths, severe damage can still be expected. The salinity of seawater also causes significant damage.

2.3 Combined Surge and River Flooding

Many coastal settlements in Queensland were originally sited on river estuaries and subsequent growth has led to further development in low lying coastal locations. Such communities may be vulnerable to both surge and river floods. These communities, if hit by a cyclone are potentially vulnerable to a surge followed by river flooding resulting from intense rainfall in the upstream river catchment.

For example, in 1918, much of the Mackay settlement was destroyed by a surge event followed by a record flood 12 to 24 hours later . From the contemporary accounts of the disaster, it is difficult to distinguish which buildings were destroyed by wind, surge or river flood.

2.4 Drainage Problem Areas

Many residential areas not subject to river, creek or surge flooding nevertheless experience overland flooding to depths that cause considerable hardship by inundating property and interfering with access. These problem areas are usually in drainage paths that have insufficient capacity to deal with local runoff. Sometimes this problem can be exacerbated by allotment filling without consideration of the reduction in availability of overland flow paths and loss of temporary flood storage.

In some cases, developed areas also experience changes in exposure to flood risk from the impacts of new developments in upstream areas of a catchment.

In other cases, recent flood events or changes in planning criteria such as increases in design rainfall intensities or changes in policy frameworks such as drainage design policies have changed either the understanding or the perception of the flood risk.

3 KNOWLEDGE OF FLOOD RISK

Many of the conclusions in the report "Urban Flooding in Queensland – A Review" relate to the "1 in 100 year" flood event as this has been the generally accepted industry standard for the designated flood level (i.e. the flood event used for planning and development control). The reports conclusions were:

(i) *Reliable estimates of the number of localities and the number of buildings subject to urban flooding in Queensland are severely hampered by the paucity of information on flood hydrology and the floor levels of dwellings.*

(ii) *It is best estimated that the number of buildings (residential, commercial and industrial) at risk from the 1 in 100 year flood event is 65,000.* (Note: With

later information obtained through the first two rounds of the Regional Flood Mitigation Program and updated information now available from the Brisbane area, it is estimated that this figure is closer to 100,000).

(iii) *The majority of councils in Queensland have little information available on the risks associated with extreme floods, i.e. those in excess of the 1 in 100 year flood event. Only eight councils have such information available in map form.*

(iv) *The tangible annual average urban damage (to private property) in Queensland, to the level of the 1 in 100 year flood event, is thought to be about $100 million. The paucity of information on flood hydrology and vulnerability is such that this estimate should be regarded as tentative; the data base for commercial and industrial losses is especially poor.* (Note: NDRA costs, damages to utilities and flow-on financial losses are not included in the above estimate and are likely to be more than the $100 million per year. For example, flood disasters in the 1999/2000 financial year resulted in $146 million in damages claimable from NDRA with carry-over commitments of $93 million in 2000/2001 and $18 million in 2001/2002.)

(v) *Notwithstanding the quality of the background data, Queensland has the highest average annual urban flood damage of any State in Australia.*

(vi) *Continued development in flood-prone areas is of special concern, this leads to an ever-increasing escalation in vulnerability and flood damage.*

(vii) *The warning time that can be provided for some 70% of urban floodplain locations within Queensland is less than 12 hours.*

(viii) *Compared with other Australian States, Queensland is unusual in that there is no clear or comprehensive State-wide policy to guide urban floodplain management.*

(ix) *Only thirty-five councils (out of 103 respondents) have a policy for urban floodplain management and, in many cases, these policies do not meet national or international best practice.* (Note Queensland has 125 local governments).

(x) *Twenty-five councils reported that they have urban areas at risk from storm surge (storm tide).* (Note: Around the time of the NR&M survey, the Department of Emergency Services canvassed coastal local governments about their storm surge risk. 40 local governments reported 117 communities exposed to storm surge risk).

(xi) *Overall, information available on liability for damage from storm surge, and the potential for catastrophic losses (including widespread building failure) are less well developed than those for riverine flooding. A guesstimate is that a total of some 40-50,000 buildings in the State are at risk from a 1 in 100 year storm surge event* (although the number of buildings affected by a particular surge event would be considerably smaller).

(xii) *Urban inundation from storm surge is essentially a Queensland problem; the risk likely exceeds that of all other Australian States.*

No estimates are available for the number of properties at risk of flooding in drainage problem areas although drainage problems in flat low lying coastal areas are known to be significant.

4 CURRENT ARRANGEMENTS

Responsibility for managing flood risk in Queensland is essentially delegated to local governments through their land use planning and development control functions and as a major service provider to their communities.

4.1 Legislation

There is no State legislation that defines State's policy on flood risk management and directly deals with the actions necessary to reduce or eliminate long-term risks to people and property from flooding. There are also no State-based guidelines or model policies to assist local governments formulate a flood risk management plan and development controls for their area. However, various pieces of legislation enable the State and local governments to implement preventative measures that reduce or eliminate flood risks to life and property.

The ***Integrated Planning Act 1997*** (IPA) is the principal statute that a local government can use to support the sound management of floodplains. Under this Act, floodplains can be managed through the control of land use in a planning scheme, and regulation of development through the Integrated Development Assessment System (IDAS) and related Codes.

In addition, under IPA, regional planning processes can be established for the coordination of development at a regional level. The regional planning process requires the formation of a Regional Planning Advisory Committee (RPAC) which is given statutory recognition under the Act to make recommendations on the regional dimensions of planning matters. This recognition means that local government are required to deal with any State or regional dimensions of matters in their planning schemes.

Regional plans may address floodplain management matters, particularly those that cannot be adequately addressed in individual local government planning schemes and/or transcend local government boundaries. Regional plans may coordinate and integrate floodplain management on the regional level and advise local governments in the preparation of their planning schemes and their capital expenditure plans for infrastructure, natural resource and environmental protection strategies, community education programs, etc.

In addition to regional plans under the IPA, the State may prepare a State Planning Policy about the management of floodplains. State Planning Policies must be considered by a RPAC during regional planning processes a local government in the preparation of a planning scheme and during development assessment under IDAS.

Local governments can prepare a local 'Planning Scheme Policy' to manage development on floodplains. In addition IPA 'codes' may be established for the assessment of such developments.

Finally, the IPA provides for benchmark sequencing of developments as a method that a local government can use to manage the progress of development so that the costs of providing infrastructure (eg flood mitigation) are minimised. However, benchmark development sequencing mechanisms have yet to become common practice.

Prior to the enactment of the IPA, a 'local law' could be established under the ***Local Government Act 1993*** (LGA) to assist in managing development on a floodplain, eg prohibiting construction of a levee bank without the local government's permission. Following the commencement of IPA on 30 March 1998, a local government cannot make a local law that contains 'development provisions' or 'establishes a process about development' (i.e. duplicates the process of IDAS). Such 'local laws' can only continue to have effect if they existed prior to 30 March 1998 and up until the local government prepares an IPA planning scheme. Local laws cannot be amended under the IPA, however they may be rescinded. Once an IPA planning scheme comes into effect, local laws affecting development must be rescinded and, if their function is to be preserved must be incorporated into planning scheme instruments.

All local government planning schemes which are not IPA planning schemes are considered transitional planning schemes. Under a transitional planning scheme, an existing local law about a development is still implemented through the local law process. Under an IPA planning scheme, local laws can be used to address non-development aspects such as management and operation. The Department of Local Government and Planning (DLGP) advises local governments preparing a new planning scheme under the IPA to review their local laws that contain development provisions and carry them forward to the IPA planning scheme.

The *Building Act 1975* (and *Standard Building Regulation 1993*) controls the standards to which building works are carried out in Queensland and over-rules local laws or planning instruments which are not consistent with the Act. The *Building Code of Australia* forms part of the *Standard Building Regulation 1993* and "is to be read as one" with the regulation. This has created some confusion as to a local government's ability to nominate design flood levels and freeboard for habitable floors.

The *Standard Building Regulation 1993, Part 4 – Site Works* states:

"Land liable to flooding

53.(1) *A local government, by resolution, may declare—*

(a) land to be liable to flooding (including by tidal surge or sewerage discharge); and

(b) the level to which the floor levels of habitable rooms must be built.

(2) The local government must—

(a) keep a register of the resolutions and the information supporting the resolution; and

(b) keep the resolutions available for inspection"

However the *Building Code of Australia, Part 2.2, Section P2.2.1 Surface Water* nominates the 100 year Average Recurrence Interval flood level as the flood which must not enter dwellings. The implications are that any challenge to a development condition that requires a more stringent control than in the *Building Code of Australia* might be successful.

Further, as local governments are required by statute to assess building applications against the *Standard Building Regulations* and have no power to alter the *Standard Building Regulation* (or the *Building Code of Australia*), there is concern that requirements such as the use of flood tolerant design and construction materials cannot be enforced.

The ***State Counter Disaster Organisation Act 1975*** regulates responses to disasters across the State and requires local government to:

- prepare a counter disaster plan; and
- establish and maintain a local emergency service.

Many other Acts (about 20) may affect to some degree the implementation of flood risk mitigation measures by requiring permits for certain activities or preventing harm in specific areas such as water courses, beaches, coastal areas, fisheries, forestry, the Great Barrier Reef, Marine Parks, cultural and heritage matters etc. They do not, however, provide a specific impetus for the management of flood risk in general and may be considered largely reactive in their ability to influence development on floodplains that increase the flood risk

Finally, the *Local Government Finance Standard 1994* outlines what is to be covered by a local government's corporate and operational plans. These plans are intended to identify the issues faced by the local government, the local government's objectives in dealing with the identified issues and how those objectives will be met. Hence the plans should provide the basis for all a local government's other activities including its planning scheme and development controls.

4.2 Subsidies and Grants

Local governments largely meet the costs of carrying out flood studies and of implementing structural and non-structural solutions to flooding problems . The Commonwealth and State Governments, through partnership arrangements such as the National Heritage Trust, and State subsidies may contribute towards the cost of capital works and some planning activities.

Commonwealth and State programs:

- **Provide disaster relief**

  Under National Disaster Relief Arrangements (NDRA), measures are in place to alleviate personal hardship, provide for restoration of public assets and provide assistance to primary producers and small businesses. The costs associated with recovery from flooding may be met through NDRA arrangements. These funds are available both from the State after threshold contributions from the Local Government, and from the Commonwealth Government after threshold contributions from the State. The funds are provided principally for public

works; however, discretionary amounts are available for private personal loss. Funds are generally provided to restore works to a condition equivalent to those which existed prior to the disaster but may be used to contribute to upgrades.

- **Subsidise disaster planning**

  Under the Natural Disaster Risk Management Study Program, the Commonwealth and the State contribute two thirds of the cost of an approved study.

- **Subsidise flood mitigation measures and works**

  Under the Regional Flood Mitigation Program, the Commonwealth and the State contribute two thirds of the cost of an approved project. Under the Local Governing Bodies Capital Works Subsidy Scheme flood mitigation works receive a 20% subsidy.

- **Subsidise infrastructure**

  Such as water supply and sewerage head-works by local governments that support community development.

- **Subsidise disaster mitigation and response projects with general application**

  Under Emergency Management Australia's Projects Program, projects such as development of community awareness programs, approaches for economic assessment of mitigation measures and understanding and assessment of community vulnerability and resilience are funded.

The Department of Natural Resources and Mines' traditional involvement with floodplain management subsidies has been through the technical assessment of flood mitigation projects submitted by local governments for State, and more recently State and Commonwealth subsidy.

4.3 Guidelines

Best practice and consistency of approach in most fields are typically fostered through the use of guidelines. In the case of floodplain management, New South Wales has had floodplain management guidelines (the blue book) since the mid 1980's.

Nationally, the Standing Committee on Agriculture and Resource Management (SCARM) has recently published "Best Practice Guidelines for Floodplain Management in Australia". These guidelines provide a lead to both local government and the States in the identification of issues and how they should be dealt with through floodplain management planning processes.

Other states (Victoria and New South Wales) have produced complementary State guidelines expanding on the national guidelines to cover issues of particular relevance to their States.

No State guidelines have yet been produced for Queensland. NR&M recognised that this task is a priority for the State.

The Department of Emergency Services has produced a Disaster Risk Management reference book based on the Australian and New Zealand standard for risk management (AS/NZS 4360) as a guide for local governments. This initiative was

supported under the Commonwealth's Local Government Development Program and the Disaster Awareness and Education Program. The program has a component aimed at raising the awareness of local government decision makers and another to introduce practitioners such as town planners and civil engineers to the use of the disaster risk management methodology as presented in the manual.

4.4 Policy Context

The Commonwealth has, under the NDRA, stated that prerequisites for the provision of assistance other than personal hardship and distress are:

(a) that natural disaster mitigation strategies are in place in respect of likely or recurring disasters, or

(b) that a commitment is made to develop and implement such strategies within a reasonable timeframe.

If local governments develop and proceed to implement mitigation strategies, the Commonwealth Government will not withhold payments for the restoration of assets under the NDRA.

The State's policy document, 'Whole-of Government Priorities and Outcomes' articulate the impact of policy and service delivery that the Government is trying to achieve. 'Priorities and Outcomes' that impact on hazard mitigation include:

Building Queensland's Regions

- improved liveability of cities, towns, regions and remote communities

Safer and more supportive communities

- improved personal and public safety, including in respect of emergencies and disasters
- socially responsible and safe industry practices

Valuing the Environment

- richness of the environment protected for the benefit of current and future generations
- responsible and sustainable access to and development of Queenslands natural and primary resources
- a clean environment

Strong Government Leadership

- high standards of accountability, consultation and ethics
- active and informed citizenship
- improved and integrated Government Services
- social and fiscal responsibility

5 PROBLEMS WITH THE CURRENT ARRANGEMENTS

5.1 Current Governance Arrangements

The Commonwealth and State Governments have a strong interest in reducing flood disaster outlays by promoting land use and development control measures that reduce exposure to flood hazard. However, the Commonwealth and the State largely rely on local government to put appropriate flood mitigation measures in place.

Only 35 local governments claimed to have a flood policy for urban floodplain management in the survey supporting the report 'Urban Flooding in Queensland - A Review'. In many cases, these policies did not fully meet national best practice standards.

5.2 Cooperation and Coordination

5.2.1 Between different levels of Government

The promotion of best practice through the use of policy and legislation, guidance and direct facilitation by the State and Commonwealth Governments is hindered by the lack of consistency between financial policies associated with taxation and subsidies, and the intent of planning legislation and best practice guidelines.

The tax write-offs (eg stock losses, building repairs) associated with disaster costs and subsidies which in effect support development on floodplains and disaster recovery may often be in conflict with the objective of ecological sustainability under IPA.

Further, although State Departments are now required to comply with planning schemes developed under IPA, State legislation generally overrides local government powers. Consequently, local government as the principal floodplain manager relies on the goodwill of State Government agencies such as the Department of Main Roads and Queensland Rail to comply with management plan objectives.

5.2.2 Between State Departments

The break up of responsibilities between State Government departments requires effective coordination to align policies and priorities. Until the formation of the State Disaster Mitigation Committee there was no high level group responsible for over-viewing risk management activities and policy development in Queensland. Consequently, there has been a lack of focussed attention at the State and local level of the real cost of disasters to the State including:

- actual property and infrastructure damage
- response and recovery costs
- emotional, health and social impacts
- economic losses, and
- environmental impacts.

There are difficulties in the coordination of floodplain management, counter disaster and strategic planning activities and community involvement and education. An example is the Charleville situation, where several studies were carried out in the early 1990s by a number of organisations, yet action to implement the recommendations

from these studies has generally been confined to the non-structural lower cost measures, such as town planning. This has been due to issues such as the community's capacity to pay for major structural measures and concerns as to equity for those not protected by the measures proposed.

5.2.3 Inter-jurisdictional Cooperation

Local governments sharing a floodplain have on occasions developed policies allowing different development standards. It is significant that this issue was partly responsible for the amalgamation of the former Albert Shire and Gold Coast City Council in 1995.

Regional Planning, as discussed in Section 4.1, has the potential to address flood mitigation issues where multiple local governments occupy the one floodplain. Although the role of regional planning processes has been strengthened under IPA, success in dealing with flood mitigation planning still relies on the initiative and will of the individual member councils. *Community Vulnerability and Planning: Opportunities to Mitigate Against Disaster* (David King, 1998) concluded:

> *"The regional planning process has not addressed disaster planning issues other than as a passing reference. In regional plans there is no guidance on risk management for local councils."*

5.2.4 Water Service Providers

Under the *Water Bill 2000*, an owner of a referable dam may be requested to provide information for the purpose of deciding license conditions about the safety of the dam. The relevant assessment information required is to be prescribed under a regulation and may include an emergency action plan and dam operation and maintenance procedures determined by the chief executive of NR&M on a case-by-case basis.

Dam failure scenarios have a very low probability of occurrence but are high consequence events and need to be put into perspective in relation to other hazards.

Emergency action planning activities associated with potential dam failures require coordination with the State Counter Disaster Organisation, DES and the relevant local government. The process requires local governments to respond to advice from dam owners about any threat of failure. This assumes that the relevant disaster management plans are properly formulated and associated systems are in place. While NR&M and DES have invested considerable effort in communicating the potential dam failure hazard on downstream areas, linkages between referable dam emergency action plans, local government planning schemes and local counter disaster plans need to be further developed.

It is not uncommon for dam break scenarios not to be included in studies for local counter disaster plans. In addition, planning schemes may be developed without recognition of dam break scenarios.

5.3 Local Government

5.3.1 Implementation of Policy Instruments/Commitment

Local governments have been reluctant to implement appropriate flood mitigation measures for a variety of reasons including, among other things:

- conflict within local government, between the responsibility for setting criteria which limit development to protect the public from the damaging effects of floods, the need to preserve individuals' property rights and a desire to encourage the economic growth that development brings. In particular, this affects the adoption of designated flood levels and leads to inconsistencies throughout the State.
- lack of financial resources.
- lack of staff resources - both in expertise and in staff numbers
- lack of information across the State on the both the characteristics and frequency of flood events and their impacts.
- concern with legal liability, compensation issues and the lack of indemnity (even when acting with due diligence)
- lack of statutory powers , and
- disparate statutory requirements and associated administrative arrangements.

Guidelines are regarded as insufficient to address these issues as, without some form of imperative, local governments generally are not incorporating existing guideline best practice advice into planning documents such as corporate plans, planning schemes and operational plans, and other specific floodplain management plans.

5.3.2 Resources

Flood risk assessment can be a complex task involving technical assessments about magnitude, return frequency, potential physical, social and economic impact in specific geographic settings and the presentation of the results in terms that are useful to decision-makers.

One of the significant problems faced by local governments in the implementation of flood mitigation and disaster management strategies is the lack of resources (both funds and skilled people) and the competition for funds from other activities which have a statutory basis or are considered more critical for the economic and social prosperity of the community.

Further, flood studies and mitigation strategies may involve significant costs not able to be borne by the local government alone. Subsidies may not be available even if there is a net benefit to the Commonwealth and the State in addressing the issues.

The joint Commonwealth and State funded Regional Flood Mitigation Program (RFMP) and Natural Disaster Risk Management Studies Program (NDRMSP) are useful initiatives, however demand for subsidies under the RFMP far exceeds the available funds. For example the RFMP is not able to fund a proposed $9 million levee in Charleville without significantly curtailing RFMP allocations to other areas of the State for two years or more.

The current RFMP will fund $21 million of flood mitigation measures in Queensland over three years ending in 2001/02, with costs shared between the Commonwealth, State and local government. In the first and second years of the program, there were eligible applications for projects with estimated costs of approximately $13 million and $6.9 million respectively. The estimated cost of works for which Round 3 applications have been invited totals $26.8 million.

The NDRMSP provides subsidy funds for 2/3 of the cost of eligible studies. Many of these studies lead to the identification of flood mitigation capital works proposals and hence a further demand on RFMP funds which the current program cannot meet.

5.3.3 Expertise

The technical capability of local governments to support the development and implementation of appropriate flood risk management policies and strategies varies widely. Some local governments, particularly those with smaller rate bases, will continue to require financial and technical support even if it is only to ensure that deliberative processes are robust and financial assistance from the State is used wisely.

5.4 Policy and Legislation

5.4.1 Variable Standards

There are considerable variations across the State in the definition used for the designated flood i.e. the flood event selected for planning purposes. These variations are summarised in Table 1 and are based on the results of the flood risk survey report completed in 1998.

Variation in Designated Floods

Designated floods (numbers of Local Governments)			
1 in 100 year	1 in 50 year	Below 1 in 50 year	Flood of record[1]
27	11	4	2

The four local governments that used a value below that of the 1 in 50 year have a variety of levels for the designated flood - to as low as 1 in 10 year. This variation is due to financial constraints, local policies, historical development, protection of existing land owners' interests and changes in the understanding of rainfall and resultant flood frequencies. The lower flood standards do not reflect current best practice philosophy or expectations.

A further complication is that within some local governments, the designated flood level varies, for instance different criteria apply for mainstream and creek flooding..

5.4.2 No Explicit Direction by the State

State legislation available to support flood risk management is fragmented. Effective floodplain management by local governments is possible within the existing

[1] 'Flood of record' refers to the largest flood experienced in the locality for which records are available.

framework, however leadership is needed from the State Government on floodplain management in terms of both policy development and guidelines.

Compared with other Australian States, Queensland is unusual in that there is no clear or comprehensive state-wide policy to guide urban flood risk management. It is important to note that Queensland's existing policy and legislative framework is not specific in requiring local governments (or indeed the State) to implement mitigation strategies. There is no State policy for managing development on floodplains. Further, legislation such as the *State Counter-Disaster Organisation Act 1975,* details responsibilities for counter-disaster operations but is not explicit about responsibilities for mitigation. The IPA does not provide a statutory obligation for development applications to be assessed in relation to risks from natural hazards.

The *Local Government Finance Standard 1994* broadly indicates the types of issues that should be considered in the preparation of a local government's Corporate and Operational Plans. Whilst flood risk management (or natural hazard management in general) could easily be included, it is not explicitly called for by the standard.

State development is unavoidably influenced by the way settlement first began in low-lying coastal and western areas. Much of the State's development is 'land-locked' into narrow coastal strips. Continuing growth is putting significant pressure on local governments to allow development or redevelopment in areas that will always be subject to recurring well-known natural hazards.

Regional and local government planning potentially can substantially address the problems, however local governments and RPACs need to be supported by a clear and consistent policy and legislative framework. Uncertainty exists over a range of issues under the existing policy and legislative framework, including:

- duty of care obligations
- liability for flood damages
- exposure to compensation associated with downgrading of land uses
- rights in common law
- statutory obligations
- potential conflicts in statutes eg IPA 1997 and Local Government Act 1993 provisions covering levees

For instance, there can be significant legal debate over when a duty of care is owed, when it is not, what triggers liability for flood damages, and what are an individual's rights to be protected by government from harm from recurring known hazards. The current approach of testing one's rights in a court of law is inefficient and beyond the financial capacity of most people likely to be affected by flooding unless through a class action.

While acknowledging the potential application of common law, such as duty of care, and the intention of statutes such as the IPA to achieve ecological sustainability, currently there is no overall policy or legislative framework requiring agencies with floodplain management and/or flood mitigation responsibilities to:

- develop or implement a relevant management or mitigation strategy, or

- implement best practice once a decision is made to develop and implement a management or mitigation strategy.

Under such arrangements, a planning scheme can be established allowing development to occur on a floodplain without knowing the full ramifications of such a development. In such circumstances, it is not possible for the planning scheme and associated development assessment processes to promote the IPA objective of ecological sustainability – a concept that incorporates the 'maintenance of the cultural, economic, physical and social wellbeing of people and communities'.

The planning process adopted by a local government is important. This is demonstrated by legal rulings subsequent to the major flood on the Bogan River which overtopped levees protecting the town of Nyngan in New South Wales. 720 houses were flooded causing damage estimated at $47 million. The use of appropriate engineering practices proved to be a legal defence for the authorities involved against damages sought by the townspeople. A significant lesson is that all flood mitigation measures can be overwhelmed if the design flood event is less than the probable maximum flood. Further, there are limits to the accuracy with which planning can be undertaken and it needs to be recognised that there may be potential shortcomings of which the public should be aware.

To be fully prepared for flooding, integration of pre- and post disaster planning needs to occur.

5.4.3 Land Planning and Development Approvals

Flood hazard issues, while integral to the concept of 'ecological sustainability' under the IPA, do not often figure significantly in the formulation of planning schemes. The formulation or amendment of land use plans (town plans, strategic plans (*Local Government (Planning and Environment) Act 1993*) and planning schemes (IPA)) has rarely been based on a rigorous assessment of social, economic and environmental impacts and the costs and benefits of developing on the floodplain. Further, unless local governments develop planning schemes supported by appropriate hydrologic, hydraulic and damage studies, and suitable guidelines, local government decisions will be open to challenge, easily influenced and possibly overturned by strong representations from developers.

In the past, town plans may have been formulated recognising the flood hazard on floodplains but have been amended over time to allow development on the basis of negligible increases in adverse flooding impacts when individual proposals have been assessed. Consequently, the cumulative impact of developments has not been recognised, resulting in 'development creep' and associated increased exposure to flooding over time.

In a recent case in the Queensland Planning and Environment Court (Nifsan vs. Gold Coast City Council, Sept 1997), the Judge's decision that the appeal should be dismissed on flooding issues was on the basis that he could *"not be persuaded that the proposed development would not adversely impact on flood behaviour in and near that development or elsewhere in the Merrimac-Carrara floodplain"*. In arriving at this conclusion the judge cited issues such as *"consideration of the cumulative effect of loss*

of storage on the floodplain" and upheld the Council's Urban Residential Objective 4 which among other things includes provisions:

- *"preservation of satisfactory floodplain storage capacity, and adequate floodways;*
- *no unacceptable adverse effect on any private property nor any local government or State Government property or works"*

This case demonstrates a number of issues with respect to the management of floodplain development including:

- the need to be able to provide good flood information, which in this case required extensive modelling;
- the need for Councils to have clear conditions for development on floodplains; and
- a recognition by the court of the need to consider the cumulative impacts of developments on flood levels

5.4.4 Legal Liability and Compensation

Local governments need to be able to:

- inform the public about flood risks on a floodplain (eg. through maps showing the likely extent of flooding) based either on flood modelling or recorded historical information;
- manage development through planning schemes and development controls; and
- carry-out appropriate flood mitigation works

Many local governments are however, reluctant to include flood map information in planning schemes since the risk to properties from flood hazard cannot be established precisely. This is due to the inherent limitations of flood modelling and inaccuracies in historically recorded flood heights, topographic data and in assumed property boundaries as well as the difficulty in predicting damaging peak velocities at a local scale. Consequently, the extent of flooding is uncertain both in terms of property location and flood height whilst flooding impacts can vary due to localised effects such as peak flow velocities and debris.

As a result, there is a strong concern within local government that publishing flood information could draw strong adverse responses from landholders who consider their property either incorrectly identified as potentially flood affected and/or that the information has significantly reduced the value of their property. This concern extends to the possibility of affected landholders being successful in extracting compensation from the local government (or at least involving council in costly court proceedings) even though, the legal obligations may be restricted (refer IPA Chapter 5, Part 4).

Whilst there may have been no negligence by the local government (and hence no common law basis for legal action) the concept of "injurious affection" is often promoted as a basis for such claims. Injurious affection is a non-legal term that refers to a loss that either has occurred or can be quantified and shown will occur as a result of Council's non-negligent actions (eg. indication of flood liability and hence a loss in

market value resulting in an actual loss on sale of a property). Although injurious affection is not recognised in the common law, it has been available as a basis for claims for compensation under some State statutes. The IPA now substantially reduces the scope for such claims with respect to natural hazards such as floods, however local governments may still feel morally obliged to satisfy such claims.

Local Governments also face potential legal liabilities in their management of floodplain development and the carrying out of flood management activities if not carried out in a responsible manner.

A local government has a responsibility when preparing a planning scheme to ensure that the scheme itself, or the development approval processes applying under the scheme, gives it the power to ensure:

- that the flood risk to new development, (including building approvals) is acceptable; and
- there are no adverse impacts on other properties as a result of a new development

However, it is not responsible for natural flood conditions and has no duty of care which requires it to build flood mitigation works to deal with natural flood conditions.

Legal claims for compensation under the law of negligence may arise where flood risk management related actions are not carried out in a manner that a reasonable local government could be expected to follow and result in an actual loss during a flood or whilst carrying out works.

In addition there is the issue of legal challenge to a council's development and building conditions.

Some examples of situations where compensation may be sought or a legal challenge to a council's action or decision may arise are given in Appendix A.

5.4.5 Emergency Management

The *State Counter-Disaster Organisation Act 1975* (SCDOA) provides for the establishment of a State Counter-Disaster Organisation and a State Emergency Service. The term 'counter-disaster' is interpreted to be 'the planning, organisation, coordination or implementation of measures that are necessary or desirable to prevent, minimise or overcome the effects of a disaster upon members of the public or any property in the State'.

The interpretation of the SCDOA could be broad and taken to include:

- disaster prevention, and
- preparedness, response and recovery (PRR) activities for a disaster event.

However, until recent times the major effort of the State Counter-Disaster Organisation (SCDO) and the State Emergency Services (SES) has been directed at PRR activities to deal with a disaster as it occurs.

Disaster prevention has largely been in the hands of implementing agencies such as local governments, transport departments, water authorities, and various regulators for dams, buildings, mines, hazardous chemicals and the like. Responsibilities relating to flood disaster prevention and management are not articulated and implemented through a recognisable system.

5.5 Financial Systems

5.5.1 Infrastructure Charges

Infrastructure charges to date have had little application in flood mitigation other than where such a charge is an additional cost of providing water supplies, i.e. the flood storage component of a dam may be included in a water supply infrastructure charge.

The Australian Auditor General has recognised that "*At the core of mitigation planning is the integration of regulatory processes of all three spheres of government so that, at the local level, land use decisions take into account the full cost of development and human settlement in risk-prone areas*" (Commonwealth Emergency Management Arrangements Performance Audit, Audit Report No. 41, 1999-2000, Section 9.14). The methods available to local government to reflect the full costs of a development at the development approval stage are:

- developer funded works; and
- infrastructure charges

Developers generally are required to provide (or pay the full capital cost of) infrastructure items required solely for their development. Infrastructure charges are generally levied on developers as a contribution to the capital cost of infrastructure that the development shares with other areas.

In either case, the ongoing costs associated with a development (eg. infrastructure operation and maintenance) are funded through regular charges levied on the purchasers of the lots created by the development. Hence, where a development increases the flood risk and creates an additional ongoing burden on the community (in terms of disaster damage and recovery costs), it is very difficult to reflect those costs in charges to the developer.

Further, under IPA, infrastructure charges have proven difficult to implement because of attempts to more rigorously reflect users pays principles in such charges. One possible ramification is that cost of mitigation works may be unaffordable if borne by a limited number of beneficiaries rather than being spread across the whole community.

Therefore, the 'infrastructure charges' instrument cannot readily, at this point in time, recover the life cycle costs of development decisions that impose unacceptable levels of flood risk on the community.

5.5.2 Development Sequencing

As part of the planning scheme and as a support for an infrastructure charging regime, IPA also provides for local governments to prepare a "benchmark development sequence(s)". Where a benchmark development sequence has been established, developers that wish to proceed "out of sequence" are obliged to pay any additional costs associated with bringing forward infrastructure or services to support their development.

However, where a developer undertakes an out-of-sequence development not covered by a benchmark sequence development strategy, it may be difficult for a local government to recover any imposed additional flood mitigation costs.

5.5.3 Subsidies/Grants

Funding for the management of floodplains is presently not effectively coordinated in its application. Current subsidies available for flood mitigation generally focus on individual capital works or investigation projects with the development of overall management plans only partially covered as part of project assessment criteria. It should be noted that the value of planning generally has been recognised in the past when local governments received State subsidies to assist in the preparation of their water supply and sewerage total management plans in the mid 1990s.

Current infrastructure subsidies for such matters as water, sewerage, erosion control etc. lower the costs of all development including inappropriate development. Further, the availability of disaster relief to communities, even if now conditional upon implementation of viable mitigation measures, continues to encourage poor development decisions because they can be taken in the knowledge that governments will not abandon a community in difficulty as a result of some natural disaster.

While funding may be provided under the NDRA to rebuild infrastructure to a standard equivalent to that which existed prior to the damage occurring, the objective of rebuilding should be to ensure that failures do not re-cur at an unacceptable frequency. Under the NDRA, a local government must meet costs additional to that of restoration to previous standards. Apart from road-base saturation damage, there is no requirement to rebuild to a higher level of immunity.

5.5.4 Tax

Tax write-offs of disaster related losses to property and business as a result of disasters sponsor inappropriate business activities and do not encourage proper consideration of the impacts of hazards.

5.6 Information

5.6.1 Guidance

'Floodplain Management in Australia - Best Practice Principles and Guidelines' is now available. Also, as mentioned in Section 4.3, the Department of Natural Resources and Mines is preparing guidelines for implementation in Queensland as priorities permit

and the Department of Emergency Services has published guidelines for local government on disaster risk management.

Limited technical support for implementation of these guidelines is provided by the State.

5.6.2 Communication and Awareness

Public awareness of the flood risks in their community and the steps to be followed during flood events is raised through public education and awareness campaigns, generally run by local governments.

Based on "Urban Flooding in Queensland – A Review" only 20% (21 out of 96 survey respondents) of local governments appear to have community awareness programs. In a number of instances, especially for coastal communities, such programs are associated with seasonal awareness campaigns for tropical cyclones rather than relating to flood risk. At the commencement of the cyclone season, public awareness programs are conducted by the Bureau of Meteorology in partnership with the Department of Emergency Services and local governments in all the major coastal population centres.

Flood awareness sessions are conducted on a less frequent basis at major inland population centres where riverine flooding is a significant threat.

Among the local governments with awareness programs are Brisbane, Ipswich ('limited'), Logan, Mirani, Rockhampton, Taroom, Townsville (linked to cyclone programs) and Warroo.

A number of local governments have prepared local awareness guides addressing their major natural hazards, however this is not a widespread practice. There appears to be a lack of such community awareness programs for many of the more flood prone communities. Where awareness programs do exist, their effectiveness is not known with any certainty as they are ad-hoc, being generally related to recent flood events.

In general, the *"Urban Flooding in Queensland – A Review"* report indicates, the level of awareness of flood threat is high among communities at risk primarily because of first hand (recent) experience.

The use of flood markers to promote flood awareness is limited, especially for many of the communities most at risk. About 25% (24 out of 102) of local governments responding to the survey replied that there were such flood markers. Among these were Brisbane, Dalby, Eacham, Emerald, Jericho, Isisford, Maryborough, Roma and Taroom.

"It is especially significant that many of the communities with a larger number of buildings at risk do not have flood markers."

This is common throughout much of Australia. Although there are no national statistics, it is likely that the situation reported for Queensland is better than for some other flood prone States. However, this may be an over-optimistic interpretation of the effectiveness of 'flood markers' in Queensland. To be effective in a large flood prone

community, there should be a series of such markers throughout the area at risk from inundation. Flood markers are an effective and inexpensive way of communicating flood risk and giving meaning to the forecasts of river gauge heights for individual buildings.

A lack of markers is usually due to the perceived adverse effect on house prices and future development.

5.6.3 Vulnerability Assessments

Vulnerability assessments are fundamental to comprehensive identification of the flood risk to communities. Such assessments involve a quantitative study to determine levels of exposure to flooding and provide a basis to develop relevant flood mitigation and disaster management policies.

For most localities with an urban flood risk problem, local governments include a consideration of vulnerability to flooding within their Counter Disaster Plan. Most local governments regard these plans as effective and they are revised after any activation. However according to "Urban Flooding in Queensland – A Review", only half (43 out of 83 respondents) indicated that their Counter Disaster Plans were based on information from flood studies, that is, hydrological and hydraulic studies of the magnitude and extent of floods and the vulnerability of flood prone communities.

"Urban Flooding in Queensland – A Review" revealed that in some areas there were minimal links between flood warning procedures and Counter Disaster Plans. A significant feature of flood warnings is that a very large proportion of flood prone communities in Queensland have warning times that are less than 12 or 24 hours. A complication is that often it is not until significant rain has fallen that the possible magnitude of the flood can be estimated. As a result, the time available to the flood threat is even less. This emphasises the need for locally based, ALERT-type, systems which take into account the magnitude of the flood risk and associated vulnerabilities.

However, a lack of hydrological and hydraulic studies that define the extent of flooding (for many local government areas) limits the usefulness of forecasting and warning, as it is unclear which areas are actually at risk for a particular forecast flood height.

Another concern is that most local governments adopt a designated flood level for the control of floodplain land use without a full appreciation of the potential impacts of larger, less frequent floods on the resulting development. The tendency is to adopt suggested designated floods from best practice guidelines and thereby avoid the financial costs of undertaking a hazard risk assessment. In doing so, an understanding of the relevance of recommendations in best practice guidelines to a given situation is not developed – with the consequence that inappropriate development can continue to occur on floodplains in spite of development decisions being based on a designated flood.

To responsibly set a designated flood level requires a comprehensive understanding of the flood risks based on the full range of potential flood hazards and vulnerabilities.

5.6.4 Flood Records

Flood studies can be costly and local governments generally are constrained in their investments in them. However, without such studies, it is difficult to establish community acceptance of appropriate development controls.

A lack of historical data and information systems on the risks and hazards associated with flooding increases the cost of such studies and reduces the reliability of their outcomes.

Currently there is not a consistent policy or process for recording flood levels and the costs of recovery following significant events. Such records would support improved flood risk management and the allocation of resources. Some possible measures include:

- establishment of a flood damage records database
- improved flood mapping/recording
- improved/more extensive stream gauging and rainfall recording particularly for smaller streams and catchments.

5.6.5 Flood and Surge Mapping

Mapping of flood inundation areas in Queensland has largely been left to local governments. An exception was the mapping undertaken following the 1974 Brisbane River floods which was a joint Brisbane City Council / State Co-ordinator General's Department initiative.

Generally the level of information across the State is highly variable and dependent on:

- recognition of the need for information by the relevant local governments;
- flood history at the locality; and
- conduct of specific flood studies.

Local government attitudes to providing flood map information to the public are equally variable due to:

- varying levels of confidence in the information (inaccuracies of base data and in plotting);
- a desire to promote economic growth and increase rate bases;
- legal liability issues and the potential for compensation payments where data is proven to be inaccurate (refer Section 5.4.4); and
- costs associated with the collection and maintenance of information.

The accuracy of flood map information ranges widely and is dependent on the quality of topographic information; the techniques used to acquire the data, the availability of calibration data and the techniques used to present information based on this data.

At a State level, a comprehensive and current formal flood mapping system does not exist. Various Departments hold flood data acquired on an ad hoc basis as particular flood issues have been addressed.

5.6.6 Performance Monitoring and Benchmarking

Currently, a national or State system similar to *WSAA (Water Services Association of Australia) Facts* does not exist to foster monitoring and benchmarking of the performance of local governments in managing development on floodplains. Informed decision making on issues of policy and effective regulation requires robust analysis of performance.

In the United States, a national overview of flood risk is maintained by the Federal Emergency Management Agency through the information it maintains for the National Flood Insurance Program (eg flood hazard maps).

5.7 Insurance

Flood insurance is not always available to individual householders at prices considered acceptable. An exception to this is Charleville where, under State Government direction, the then government insurer (SGIO/Suncorp) covered homes for a time at an affordable premium. More commonly, flood insurance is only available to large commercial/business undertakings as part of their overall insurance package. Higher premiums paid by these customers allow them some scope for covering flood risk.

Notwithstanding this, the insurance industry has sustained significant criticism from policyholders, politicians and the media following major flood events in 1998 in Wollongong, Katherine and Townsville. Insurance companies have significant exposure to flood insurance claims, as illustrated by these events which were estimated to have cost in excess of $170million in insurance payments. (Katherine - $60million, Wollongong - $40million, and Townsville - $70million).

In 1999, as a result of these events and an increasing call on insurance covers, the Insurance Council of Australia (ICA) created the Flood Issues Liaison Committee. Representatives of the Commonwealth Government and all State and Territory Governments attended the inaugural meeting, hosted by the ICA in Canberra in November 1999. The key issue from the insurance industry's perspective was that the only way flood insurance can be offered on a commercially viable basis is if the availability of insurance and the premium cost is firmly based on the assessed flood risk.

The difficulty for the insurance industry is that flood mapping and other flood risk data is not uniformly available. While Queensland has the highest flood risk of any State, a recent ICA national survey of local governments shows that the availability of information in Queensland is limited.

Flood insurance availability in Queensland on fair and equitable terms will be dependent on the insurance industry's access to flood risk information. However, the responsibility for flood mapping and risk assessment lies primarily with local governments, many of which are unable to accord this issue a high priority.

The second meeting of the Flood Issues Liaison Committee held in November 2000, identified that a number of insurers have extended their home and contents policies to

cover flood in various ways. They are also developing geo-coded databases which provide a more accurate location (rather than using postcodes) and can identify low, medium or high flood risk properties. These databases require accurate flood risk information from State or local governments to support informed underwriting decisions.

Key concerns from insurers are:

- the insurance industry alone cannot find solutions to the flood problem and Governments at all levels need to provide more resources for flood mapping based on national standards for measurement of flood risk;
- the insurance industry is unwilling to risk shareholders funds without access to accurate qualitative and quantitative data;
- there is a need for additional funding to address a conclusion from the recent Australian Securities and Investments Commission report that insurers need to put more effort into informing policy holders that they might need flood cover and whether it was available (Note. The Insurance Council of Australia have recently released a brochure aimed at raising community awareness of flooding and the limitations on the coverage of most domestic insurance policies);
- there is a lack of uniformly available flood mapping and other flood risk data. Queensland has a poor record of dealing with flood mapping, mitigation and policy issues regarding the availability of flood risk information. The responsibility for flood mapping and risk assessment lies primarily with local governments, few of which afford it a high priority;
- it is difficult to obtain flood information from local governments. It has been suggested that some local governments are uncooperative whilst many are not able to provide the information required because of lack of resources, incomplete studies, systems development needs or what might be political or legal barriers;
- it is difficulty to sell more expensive insurance cover to those most at risk and/or getting other policy holders with little or no risk to subsidise those at risk.

The insurance industry considers that without further attention to good land use planning and increased funding for mitigation, many Australians will continue to be vulnerable to flood related disasters and will continue to require government disaster relief. Further, the availability of flood insurance will be severely restricted by the lack of flood risk information.

The industry also sees that urgent action is required to raise awareness of the need for increased spending by all levels of government on flood information, development of flood mapping standards, a more cohesive policy framework and for mitigation measures.

The Insurance Council of Australia has identified itself as an interested stakeholder in the development of disaster mitigation measures, particularly in relation to flooding, and will continue lobbying for disaster mitigation issues to be further pursued by all levels of Government.

5.8 Land Transactions

It has been suggested that across the State searches for information concerning particular properties have resulted in inaccurate or false information on flooding being provided to prospective buyers. In some cases it has been suggested that a local government has possessed information indicating that a property is flood prone but has not forwarded this information to a buyer in a property search.

Interestingly, the *Standard Building Regulation 1993* Section 19(1) requires a local government to keep available for public inspection, information it has to assist in the making and assessing of development applications. This information includes documentation about:

- the physical characteristics and location of infrastructure
- easements, encumbrances or estates or interests in land likely to be relevant to development applications, and
- site characteristic information likely to affect the assessment of a development application.

Flood level information is given as an example of site characteristic information.

There are no requirements in regard to how the information is to be held and often the information will only be provided for a fee. These are potential flaws in the robustness of process in terms of availability of information.

6 PRINCIPLES FOR A STATE FLOOD MITIGATION POLICY

The objective of a State flood mitigation policy should be to ensure that sustained action is taken to minimise long-term risk to life and property. Desirably, fewer Queenslanders will in future be victims of flood impacts.

Key principles to guide actions aimed at achieving this objective are that:

- *risks to public health and safety should be managed within the ESD regime (as defined in IPA);*
- *a full appreciation of the risks and benefits associated with any proposed floodplain use should be developed;*
- *individuals should be able to make informed choices;*
- *a partnership approach between all levels of government (recognising that the costs of flood disasters affect all Australians) should be established;*
- *proactive prevention is preferred to reactive responses;*
- *those who knowingly assume/create greater risk should accept the responsibility and costs associated with that risk.*

In designing strategies to achieve the above objective, it is desirable to:

- *focus on actions that produce continuing benefits over time.*
- *encourage risk reduction strategies that promote long term benefits to the Queensland community as a whole rather than short-term benefits for particular interests.*

- *adopt an 'all-hazards' approach to the development of mitigation strategies, ensuring that mitigation of one hazard does not increase exposure to another hazard.*
- *ensure that risk assessments develop a full appreciation of the size, likelihood and potential impacts of flood events.*
- *encourage local action and responsibility for managing flood disaster impacts.*
- *improve the availability of information to foster improved decision-making and assist in transferring responsibility for risk to those who assume it.*
- *communicate levels of flood hazard and risk to the community.*
- *ensure that the private sector understands and accepts responsibility for being aware of flood risks and for reducing their vulnerability.*
- *ensure that individuals understand and accept responsibility for being aware of known flood risks and minimising their own exposure based on good information.*
- *permit development in hazardous areas only where supported by comprehensive impact assessment justifying such a development and informed agreement of all parties.*
- *restrict the practice of subsidising development in hazardous areas .*
- *provide sufficient resources to address priority flood problems.*
- *direct relief subsidies at achieving acceptable flood risk exposure for infrastructure, not rebuilding to pre-existing (flood prone) standards in proven hazardous areas.*
- *ensure that flood risk management and disaster response costs of development on floodplains are met at the time of development through charges and conditions on developers including costs of studies, hydraulic impacts, mitigation headworks/infrastructure charges, and possibly, flood disaster management and operations levies or other funding provisions.*

7 POSSIBLE MEASURES FOR IMPROVING FLOOD RISK MANAGEMENT

The following sections discuss possible measures that might be taken to improve flood mitigation in Queensland. Many of the low cost, easily implemented measures are already in progress to some degree. Others have been debated but have not been progressed further because of the fragmentation of responsibilities across State agencies. This suggests a need to identify and give a mandate to an agency to champion and coordinate progress.

The measures outlined below need to be developed further within an appropriate policy context before implementation. Some measures may prove to be difficult to fully implement because of the difficulties associated with them and local governments may require assistance because of this and/or because of the costs involved.

7.1 Policy Consistency, Cooperation and Coordination

Possible measures include:

- *the Commonwealth;*
  - *i. discontinue tax write-offs for flood disasters affecting new developments and possibly site redevelopments, after a specified time.*
  - *ii. provide additional tax incentives to relocate or undertake proactive flood mitigation activities (eg. negative gearing tax deductions be available only on investment properties considered an acceptable flood risk).*
- *the insurance industry provide flood insurance to property owners that have acted to mitigate impacts;*
- *the State withdraw subsidies which support development in areas vulnerable to floods unless any such development has been approved in a planning scheme after a comprehensive impact assessment process;*
- *the state ensure that its 'all hazards' interests are incorporated in planning schemes and regional plans with the support of relevant agencies.*

7.2 Promotion of Best Practice/Community Awareness

Possible measures include:

- *assessments of flood risks and the development and implementation of flood mitigation strategies be encouraged;*
- *an all hazards approach for implementation by the State and local governments be promoted;*
- *the State 'Flood Mitigation Planning' guidelines be finalised;*
- *hazard identification, risk assessment and mitigation concepts as well as consideration of all economic impacts (including indirect and secondary impacts) for the provision of infrastructure be promoted;*
- *a State performance monitoring and benchmarking system for flood risk management practices adopted by local governments be established;*
- *property buyers be encouraged to investigate the flood insurability of a property before purchase.*

7.3 Administrative Systems

Possible measures include:

a) *existing subsidy programs be reviewed and establishment of planning and mitigation assistance programs to complement existing national programs be considered. Assistance could be more directed towards communities on a 'needs and means' basis or where the State and Commonwealth would benefit directly from the measures implemented (including flood mapping and other non-structural measures);*

b) *an 'all hazards' levy or a specific 'flood' levy on all new developments be imposed with a view to directing the funds towards reduction of the vulnerability of developments to hazards;*

c) *low interest loans to owners for individual property modifications which reduce vulnerability to flooding be provided;*

d) *formal administrative processes to link the referable dam emergency action plans, the local government planning schemes and the local counter disaster plans be established (this action is currently in progress);*

e) *responsibilities relating to flood disaster prevention and management be clarified and these responsibilities be articulated and implemented through recognisable systems that encourage local ownership of actions;*

f) *a formal State system for mapping and recording flood level information on floods be established based primarily on data supplied by local government. Ultimately this might be expanded to capture information on all flood impacts.*

7.4 Legislation

Possible measures include:

7.4.1 Planning and Development Requirements

a) *impact assessment studies (including flood studies where relevant) be required to justify proposed land uses, permitted developments on floodplains and associated building controls in a planning scheme (Note: counter disaster impacts of the proposed land uses and development would also need to be assessed);*

b) *agreement be established between State agencies on State flood risk management interests and be reflected in local government planning and development decisions;*

c) *relevant local governments establish flood models to assess proposed development impacts on floodplains, specifically where more than one developer is likely to propose development. The model would assess impacts by comparing flood characteristics pre and post the proposed development and after the ultimate level of development on the floodplain. The purpose would be to reduce costs and provide for consistency in assessment processes. Cost could be recovered from developers;*

d) *local governments be required to undertake hazard risk assessments (and document these assessments for public inspection) to provide a basis for adoption of a designated design flood;*

e) *development control policies be established specific to particular floodplains for the purposes of mitigating flood impacts;*

f) *property redevelopment be required to incorporate feasible flood mitigation measures as assessed by the local government;*

g) *coordinated management by local government administrations sharing the same floodplain be required with necessary floodplain planning coordinated through regional planning processes;*

h) *all State Agencies be required to acknowledge local flood standards and where practical adhere to them. Where adherence to local standards is not considered*

practical, State agencies be required to consult with the relevant local government to achieve agreement as to standards;

i) *mechanisms be established to address potential conflicts of interest for local government in the selection of designated floods and the publication of flood information. In Victoria, a separate body (Catchment Management Authority) has responsibility for undertaking flood studies and setting development limits based on flood risk which local governments must then use to assess development applications;*

j) *IPA be modified to allow infrastructure/development charges to be levied to cover the life cycle development costs associated with response and recovery from hazards;*

k) *accountabilities be established for the CEO of local governments and other officers similar to those under the EPA*[2].

7.4.2 Flood Records and Mapping

Possible measures include:

a) *local governments be required to maintain publicly available records on floods, mitigation works and the assessed effect of them on flood levels;*

b) *local governments be required to register with the Titles Office flood heights for significant events on residential and industrial properties so that this data can be obtained through property searches. An alternative is to establish a mandatory disclosure requirement when a property is to be sold. The process in New South Wales requires a vendor to furnish a 'Section 149 Certificate' as part of the contract documentation, which, among other things, details the flood information held by the relevant council. A possible weakness in this process is the quality of information held by councils;*

c) *mapping of the highest recorded flood heights and flood study results in planning schemes be required;*

d) *publicly available maps showing approved and proposed development fill zones in otherwise flood prone areas be maintained.*

7.4.3 Community Awareness

Possible measures include:

a) *local governments be required to regularly reinforce public awareness of historical flood levels in their areas;*

---

[2] Environment Protection Act,1994 Chapter 5, Part 2 – Executive Officer Liability
Executive officers must ensure corporation complies with Act
183.(1) The executive officers of a corporation must ensure that the corporation complies with this Act.
(2) If a corporation commits an offence against a provision of this Act, each of the executive officers of the corporation also commits an offence, namely, the offence of failing to ensure the corporation complies with this Act

b) *local governments be required to facilitate the interpretation of flood warnings by installing flood markers in developed flood prone areas which clearly link local depths to flood warning heights;*

c) *local governments be supported in establishing flood warning systems as part of counter disaster plans/flood mitigation measures with the level of support based on exposure to flood risk.*

7.4.4 Indemnification

Possible measures include:

a) *indemnification be provided for local governments and for the State against possible legal actions arising from:*

- *inaccuracy or uncertainty in flood information provided in good faith*
- *undertaking or maintaining flood mitigation works with due diligence*

(Note: This could be on a similar basis to the existing indemnity provisions in the NSW *Local Government Act, Section 733* which gives exemption from liability to local governments for advice provided on flood liable land and land in coastal zones when acting in accordance the NSW best practice manual. A review of the indemnity needs of the current approval systems for the various types and possible locations of works is required.)

7.5 Discussion

The above section outline a range of measures that may be beneficial in mitigating the flood risk exposure of Queensland communities. Determining which of the identified measures would provide the greatest benefit and therefore should be progressed as a priority is some-what more difficult.

Based on the results in the 1998 report "Urban Flooding in Queensland – A Review", the lack of complete and reliable information on the extent and frequency of flooding for Queensland communities, is a major obstacle to improvements in flood mitigation. Until there is a clear and comprehensive understanding of the nature and extent of the flood risk in Queensland, its effective management will remain problematic. It follows that the generation of this information is fundamental in considering possible flood mitigation measures

Likewise, incorporation of flood information in local government planning schemes and availability of flood information to the public are critical to limiting the growth of flood risk in this State.

There are, however, significant implications for both the State and local governments in seeking to improve the flood information base in Queensland. They range from the cost of acquiring relevant data and the necessary flood studies, to the sensitivities of affected and landholders. Hence the need for measures such as in 7.3 (administrative systems) in 7.4.2 (flood records and mapping) and in 7.4.4 (indemnification), to be adopted in a complementary and integrated fashion.

The need for comprehensive flood information to be acquired, maintained and made readily available to the public (in an easily understandable form) should be considered the most basic requirement of any State Flood Mitigation Policy instrument. It is therefore, probably the most fundamental issue in considering implementation options. Almost all the other measures proposed above rely on good flood information to be effective.

To achieve effective State-wide coverage of comprehensive flood information, each local government area needs to determine the extent of flood inundation for the full range of flood events. This task is best performed by local government (with legislative and funding assistance and oversight by the State).

To date, a number of studies have been commenced or completed, either through the Natural Disaster Risk Management Studies Program or independently by local governments. The size of the further investment needed to collect the necessary detailed ground level data and perform the flood modelling not already available has not been estimated, however Smith (Urban Flooding in Queensland – A Review, 98) concludes it would be "*unrealistic,..., to expect that the total costs of flood studies and mitigation, essential to attain best practice floodplain management, can be borne by local governments alone*"..

The next most important action is probably, to ensure through a State flood mitigation policy instrument that local government planning schemes and State Government infrastructure plans are prepared only after appropriate consideration of the flood risks. (i.e., measures 7.4.1 (a) - *either through a State Planning Policy or through specific legislation, impact assessment studies be required to justify proposed land uses, permitted developments on floodplains and associated building controls in a planning scheme* and 7.4.1 (h) - *all State Agencies be required to acknowledge local flood standards and where practical adhere to them. Where adherence to local standards is not considered practical, State agencies be required to consult with the relevant local government to achieve agreement as to standards*).

This action of itself should not require any financial assistance from the State (although assistance with the costs of supporting studies to generate flood information (with indemnification), as mentioned above, is likely to be necessary for local government to be comfortable about implementing these measures).

Hence, requiring local governments to:

- generate useful flood inundation information;
- make flood inundation readily available publicly; and
- fully consider flood risks in preparing their planning scheme

are probably the core issues for a State flood mitigation policy instrument.

8 OPTIONS FOR IMPLEMENTATION

The above discussion suggests a range of possible measures that could reduce flood risk exposure of Queensland communities, principally from a prevention perspective. The discussion highlights the measures that are considered the most important. Some

measures should be readily implemented whilst some are complex and more difficult to implement. Others (as discussed above) are complementary and rely on being introduced together to be most effective.

Overall, an effective State Flood Mitigation Policy requires:

- a cohesive framework of measures; and
- appropriate implementation mechanisms.

The framework of measures and the implementation mechanisms are intimately linked (i.e. a measure is only as good as the system that ensures it is put into effect) and hence cannot be in isolation from the implementation process.

The measures proposed in Section 7 are wide ranging. Although effective planning scheme controls are considered as the key to limiting growth in exposure to flood risk, other elements not associated with future changes in the use of land (such as flood mapping and records collection, community education and awareness, state infrastructure subsidy programs and indemnities) are either not part of, or not well covered by the current local government strategic planning process.

Options that have been identified to implement a State flood mitigation policy are:

a) **Establishment of 'all hazards' prevention legislation**
b) **Establishment of specific 'flood mitigation' legislation**
c) **Amendment of existing planning legislation**
d) **Formulation of a State Planning Policy under IPA**
e) **Promotion of flood risk management issues through Regional Planning Advisory Council processes.**

These options fall into two groups:

- **legislative (a, b, and c); and**
- **statements of planning policy (d and e).**

8.1 Legislation

Legislation can provide a framework for addressing issues by being:

- facilitative, in that, legislation can set out a process designed to achieve an outcome; or
- prescriptive, in that, legislation can formally set out criteria, specifications and outputs

Additionally, legislation can also provide for ongoing management of a management framework, through reporting, compliance and enforcement provisions. Primary legislation generally sets out a framework and subordinate legislation, such as regulations, sets out detail. Legislation can formally set out rights and responsibilities of the two tiers of government – State and local government - and provide for integrated management of issues.

In the case of legislation to address flood risk management, the framework should also set out how a local government should integrate matters about flood risk management into its planning instruments, although the planning and regulation of development on floodplains would continue to be effected through the mechanisms of the IPA

The advantages and disadvantages of legislation include:

Advantages

- legislation is under the direct control and management of the Minister administering the legislation.
- legislation (and associated regulations) can set-out comprehensively the expectations of the State and its requirements of local government;
- local governments have a statutory obligation to comply
- given their obligation to comply, local governments have a strong argument for support from the State
- legislation can provide local governments with relief from liability

Disadvantages

- a lengthy process is involved in developing new legislation;
- legislation would obligate local government and the State to undertake certain actions and hence has resource implications for both; and
- if flood mitigation measures were included in an existing piece of legislation, it is possible that the Minister responsible for the existing legislation may not be the Minister with primary responsibility within the State Government for flood issues. As a result, effective administrative arrangements between two Departments could be required.

8.1.1 Establishment of 'all hazards' prevention legislation

Whilst a comprehensive "all hazards" legislative approach to disaster mitigation may be desirable, the development of such legislation would require very broad consultation across numerous disciplines, jurisdictions and interest groups.

Development of "all hazards" legislation would involve a consolidation of the requirements for each specific hazard and hence would essentially require the process to develop flood risk specific legislation to be replicated for each hazard type (eg cyclone, bush fire, land slip, etc.). Therefore the practical issue of managing a process even more complex than that required to develop flood mitigation specific legislation (and hence the likely timeframes) would be a major consideration.

Also, it is arguable that the basis for over-arching, "all hazards" legislation already exists in the form of the State Counter Disaster Organisation Act (or a reviewed/updated version). The Act requires local governments prepare counter disaster plans covering the "*...planning, organisation, coordination or implementation of measures that are necessary or desirable to prevent, minimise or overcome the effects of a disaster upon members of the public or any property of the State ....*"

Although originally considered to apply only in respect of disaster response activities, the scope of counter disaster planning is amplified in the Protocol establishing the roles of the State and local government in Queensland's disaster management system made between the Department of Emergency Services and the Local Government Association of Queensland in December 1997. The Protocol acknowledges local governments' role in "*....the development of comprehensive disaster management plans which include prevention, preparedness, response and recovery arrangements*" which "*should incorporate mitigation strategies such as those relating to land use planning*".

At this stage, these broad provisions appear not to have resulted in a significant effect on flood risk planning by local governments generally. This may occur in time, however as the specifics required by the State are not set out and as no additional powers or resources are provided, achievement of a particular level of good floodplain management practice is not assured.

8.1.2 Establishment of specific 'flood mitigation' legislation

The main advantage of specific flood legislation is in general; that flood mitigation can be established as a mandatory, explicit requirement of specific agencies rather than an implicit, optional activity carried out as an interpretation of other requirements (such as town planning under the IPA, good governance under the Local Government Act, or as a co-condition of an effective Counter Disaster Plan under the State Counter Disaster Act).

In addition, specific provisions can be made such as the availability of indemnification for responsible agencies undertaking flood mitigation actions in good faith, identification of accountabilities and the minimum obligations of responsible agencies.

8.1.3 Amendment to Existing Planning Legislation

Planning schemes under the IPA provide the policy and management framework for the Integrated Development Assessment System (IDAS). They can, therefore, only deal with future changes in the use of land. In other words, planning schemes can address flood risk management only to the extent it affects or is affected by proposed developments.

However, not all dimensions of flood risk management affect, or are affected by development that is subject to approval through the IDAS. Examples of these dimensions are:

- existing land use, such as historical flood prone urban development and;
- non-land use matters relating to the future of a local government area, such as the capital works programme of a local government (that could include the construction of flood mitigation works).

A planning scheme also cannot deal with matters outside the area of the local government to which the scheme applies. However, floods, tidal surges and other hazards do not necessarily respect local government boundaries. For example,

flooding in a local government area can be affected by the floodplain management practices of local governments upstream.

An important consideration under this option is the other numerous Acts, which may have some relevance to managing flood risk in certain circumstances. Therefore, it would seem sensible that this option should also aim, wherever possible, to consolidate all legislative provisions dealing with flood risk.

8.2 Statements of Planning Policy

8.2.1 Formulation of a State Planning Policy under IPA.

State Planning Policies may be made by the Minister for Local Government and Planning after a public consultation process. Alternatively, the Minister may make a State Planning Policy (SPP) that is to have effect for less than 12 months without engaging in public consultation. This shortened process can be used to achieve interim policy control pending public consultation on a permanent policy.

State planning policies can have effect in either or both of two possible ways:

- as a guide to making a planning scheme; and/or
- as an IDAS decision making tool.

In the first case, the approval of the Minister for Local Government and Planning for a new or amended planning scheme is conditional on the scheme meeting the objectives of the SPP. An approved scheme then acts as a stand-alone development assessment system.

In the second case, a SPP can be an IDAS decision making tool pending its reflection in a new or amended planning scheme and can include IDAS decision making criteria for new assessable development or codes for the assessment of proposed works on floodplains.

Usually it is the case that a SPP is of general application, that is, it is not area or location specific – it sets out the general intention and objectives of the State in relation to a particular matter. Therefore when a SPP is given effect through a planning scheme, the local government will attempt to achieve the intention and objectives of the State. However, achievements may be difficult to measure in that a SPP itself would not be very specific to a particular planning scheme area.

Key points about a SPP are:

- a SPP is a policy about a matter of State interest[3] or concern - it is not legislation.
- a SPP is given effect through IPA.

[3] **"State interest"** means—

(a) an interest that, in the Minister's opinion, affects an economic or environmental interest of the State or a region; or

(b) an interest in ensuring there is an efficient, effective and accountable planning and development assessment system.

- a SPP represents the whole or part of a dimension of a State interest in a planning scheme (*IPA Section 2.1.4(4)*)
- a SPP is of general application throughout the State
- in the preparation of a planning scheme, a local government and the Minister for Local Government and Planning must be satisfied that a planning scheme coordinates and integrates the 'core matters' (as defined in IPA to include land use & development; infrastructure and valuable features: schedule 1, s 4), including State and regional dimensions of the core matters, that is, a SPP or other State interest (*IPA Section 2.1.3(1)(a)*).
- Any proposed planning scheme must be submitted to the Minister for Local Government and Planning who must consider whether or not a State interest would be adversely affected by a planning scheme (*IPA Schedule 1, S 11*).
- Where a planning scheme does not take into account a SPP, an assessment manager must consider any relevant SPP when assessing a development application (*IPA Section 3.5.5(2)(c)*).

The Minister for Local Government and Planning administers the IPA, the legislative framework that gives effect to a SPP. Therefore where a SPP is developed by another Department, the policy is not managed or controlled by that Department when it is given effect through IPA. It is the Minister for Local Government and Planning who must be satisfied that a planning scheme does not adversely impact on a SPP.

The administrative arrangements between Local Government and Planning and the Department that develops a SPP need to be considered to ensure that the Department is provided the opportunity to fully and appropriately advise the Minister for Local Government and Planning on its expectations as to compliance of a planning scheme with a SPP. DLGP currently has a process to address this issue which seeks to coordinate consultation with State agencies that have an interest in local planning schemes generally as well as arrangements with those agencies that have existing SPPs.

The performance of whatever administrative arrangement is put in place would also require review to assess whether the objectives of the SPP are being achieved.

Advantages of using a SPP as the implementation mechanism for flood risk management best practice by local government are:

- quick implementation is possible (i.e. a 12 month SPP as explained above);
- a SPP can be integrated with existing State planning legislation (i.e. IPA)
- this approach allows the State to oversee floodplain management implementation through an existing approval system (i.e. approval of Planning Schemes)

Disadvantages are that:

- the public consultation process required for a permanent SPP could take as long as for developing legislation
- a SPP would only deal with planning and development issues affecting flood risk management. Non-planning scheme issues such as existing use, collection and publication of flood information, liability and community awareness would not be affected.

- Whilst local governments are obliged consider State Planning Policies in preparing their planning scheme, this does not necessarily guarantee appropriate adoption of the policy's intent.

8.2.2 Promotion of Regional Planning Advisory Committee Processes

IPA also provides for regional planning processes to address matters that transcend local government boundaries. It is up to the Minister for Local Government and Planning to determine the terms of reference for a Regional Planning Advisory Committee (RPAC).

A Regional Plan can deal with a single or multiple issues. The outcomes of the regional planning process can be presented in a number of formats, including reports and maps, which become the Regional Plan or Regional Planning Framework.

IPA gives statutory recognition to Regional Planning Advisory Committees (RPACs) and the outcomes of regional planning processes (*IPA Part 5*). IPA also requires local governments to address State and regional dimensions of matters in planning schemes (*IPA Section 2.1.3 (1) (a)*). In this regard, the Act describes a "*regional dimension of a planning scheme matter as a dimension:*

a.) about which a regional planning advisory committee report makes a recommendation; or

b.) that can be best dealt with by the co-operation of 2 or more local governments" *(IPA Section 2.1.3(3))*

In practical terms, this formal recognition means regional planning under the IPA can be expected to have greater relevance within the planning system and wider public administrative functions.

As with a SPP, the Minister for Local Government and Planning administers IPA, the legislative framework that gives effect to Regional Plans. It is therefore the Minister for Local Government and Planning who must be satisfied flood mitigation is a regional issue of sufficient importance that it requires a Regional Planning Advisory Committee to be established to address it.

Once again, the administrative arrangement between DLGP and the Department that develops the flood mitigation terms of reference for the RPAC needs to be considered to ensure that the Department is provided the opportunity to fully and appropriately advise the Minister for DLGP on:

- whether the Regional Plan delivers the flood mitigation outcomes required; and
- the degree of compliance of a planning scheme with the regional plan.

Advantages of using the regional planning process as the implementation mechanism for floodplain management best practice by local government are:

- the process is available in existing legislation, a number of RPACs already exist and local governments are familiar with their role;
- outcomes of the process can be integrated with existing State planning legislation (i.e. IPA)

- the process allows the State to oversee floodplain management implementation through an existing approval system (i.e. approval of Planning Schemes) and oversight of RPACs.

Disadvantages are:

- whilst an RPAC process can deal with any issue (within the terms of reference), a local government is only obliged to *"co-ordinate and integrate matters .... dealt with by the planning scheme"*; i.e. planning and development issues affecting flood risk management. Non-planning scheme issues such as existing use, collection and publication of flood information, liability and community awareness would not be addressed.
- whilst local governments are obliged consider regional dimensions of matters in preparing their planning scheme, this does not necessarily guarantee appropriate adoption of a regional plan's intent.
- effective inter-departmental administrative arrangements would need to be established to ensure that flood mitigation objectives are achieved.

8.3 Summary of Implementation Options

There are broad similarities as well as the significant differences between the options discussed above. Again, they can be grouped into legislative options and "planning policy statement" options.

Option (a) - all hazards' prevention legislation and Option (b) - specific new flood legislation - require a full public consultation process. Similarly, Option (c) - amendment to existing planning legislation and Option (d) - formulation of a State Planning Policy under IPA - would require a similar public consultation process (except for interim use of a State Planning Policy). Only Option (e) - promotion of flood risk management issues through RPACs - could be pursued under existing processes.

Both Options (d) and (e) can address the issue of growth in flood risk as a result of future developments on floodplains but cannot address non-development related aspects of managing flood risk.

Options (a) and (b) offer the capability to cover all of the identified issues necessary to improve flood mitigation in Queensland. Of these, Option (b) provides the most focused mechanism.

Option (c) would either be restricted to dealing with planning scheme issues unless other "flood mitigation" provisions were covered by legislation as a new part in say, the IPA and or other existing legislation.

Implementation mechanisms which either cannot deal with all flood mitigation issues or rely on multiple instruments to achieve coverage of all the issues will not promote policy consistency and co-ordination and could be considered only a marginal improvement on the current situation.

Whichever option might be chosen, it must deal with the pivotal issue of making complete and reliable flood information available so that:

- the community can make informed decisions when purchasing property or when responding to flood disasters;
- local govemments can prepare responsible planning schemes, development approval conditions and capital works programs; and
- the State Government can maintain a credible overview of the nature and extent of the flood risk in Queensland to facilitate targeted assistance.

Widespread availability of flood information has significant implications, for both the State and local governments but it is critically important that these implications not unduly impede the availability of reliable information.

ATTACHMENT 1 – LEGAL LIABILITY AND COMPENSATION - EXAMPLES

Some examples where compensation may be sought and or a legal challenge to a local government's action may be initiated include:

1. planning scheme changes which over time erode the level of protection available to existing residents;
2. the provision of flood mitigation works which have a detrimental effect on some property owners;
3. planning scheme changes which reduce the value of the interest held by a property owner;
4. building control changes which modify conditions over the past – being more restrictive (eg increase in minimum habitable floor levels between original development and new development)
5. provision of accurate information which indicates a change in the understanding of the susceptibility to flooding of a property and hence a drop in its market value;
6. provision of inaccurate information which indicates a change in the understanding of the susceptibility to flooding of a property and hence a drop in its market value;
7. withholding existing flood information.

Examples 1 & 2 - a local government is exposed to legal action on the basis of *negligence* with respect to its duty of care to the existing floodplain residents but can generally minimise its liability if it adopts reasonable and sound planning, design and construction practices e.g., accepted best practice at the time at which the decisions are made.

Example 3 - section 5.4.4 (1) (h) of the IPA rules out compensation for reduced value of interest in land as a result of planning scheme changes which *"affects development that, had it happened under the* superseded planning *scheme - would have led to significant risk to persons or property from natural processes (including flooding, land slippage or erosion) and the risk could not have been reduced by conditions attached to a development approval'.*

Example 4 – negligence is determined at the time the particular decision is made. If, as a result of newer or better information, a local government determines that the minimum habitable floor level for a building proposed for development should be higher than for buildings previously approved in the same locality, the local government will not be legally exposed by imposing new requirements. A local government could actually be exposed to an action where it chose not to act on information that showed that habitable floor levels should be raised.

In the past, such development approval conditions have been challenged and over-turned. This was in the quasi-legal situation of the Building and Development Tribunal and is not regarded as legal precedent, however it does demonstrate the potential difficulties in getting consistency in the current situation.

Example 5 - providing accurate flood information does not expose the local government's legal liability as whether a property floods or not is a question of fact, regardless of whether the information is published or not.

Example 6 - this scenario would likely result in compensation being payable to the property owner if he/she can establish loss or damage has accrued as a result of the publication of the inaccurate information. This is a claim in negligence or negligent misstatement. The Council by publishing the information is holding itself out as providing accurate flood information. Reliance on the information would likely result in a reduction in property value. It is this decrease in value that would be compensable.

Example 7 – currently there is no legal obligation under the Local Government Act or any other legislation by which councils are under a mandatory duty to supply flooding information. The supply of such information is a voluntary decision. Hence a council is free to determine whether it will supply information and the terms on which will supply the information.

Therefore, provided a properly worded disclaimer is attached to the information or Council has a documented policy setting out the basis for the non-supply of information (i.e. records not necessarily accurate or complete and therefore the non-supply cannot be taken as any indication that the property is or is not flood affected) there should be no basis for legal liability for the accuracy of the information or for any implied representation that the land is flood-free. (refer King & Co comments to LGAQ, 16 Oct 2000). Whilst this provides local government with an "out" for the non-supply of flood information, it is not in the interests of improved flood mitigation.

ATTACHMENT 2A – MEASURES THAT COULD BE INCLUDED IN LEGISLATIVE IMPLEMENTATION OPTIONS

Planning and Future Development Controls:

- Require flood risk studies/ impact assessment studies to support planning schemes & development controls.
- Provide State 'Flood Mitigation Planning' guidelines.
- Set out flood disaster prevention & management responsibilities & ensure agreement on State floodplain management interests to be reflected in planning schemes & development decisions.
- Establish formal links between referable dam emergency action plans, planning schemes & counter disaster plans.
- Require coordinated management by local government administrations sharing the same floodplain (using regional planning processes where necessary).
- Require development & redevelopment control policies to mitigate flood impacts.
- Require all State Agencies to acknowledge & where practical adhere to local flood standards.
- Require local governments to establish flood models to enable consistent assessment of development impacts on floodplains (especially where multiple developments are likely).
- Promote an all hazards approach for implementation by the State & local governments.
- Include hazard risk assessment and mitigation into the Queensland Treasury 'Project Evaluation Guidelines' (March 1997) & other State infrastructure guidelines.
- Address potential conflicts of interest for local government in the selection of designated floods and the publication of flood information.
- Allow infrastructure/development charges to cover the life cycle development costs associated with the response and recovery from hazards.
- Give local governments officers accountabilities similar to those under the EPA.

Operational Controls:

- Establish a State system for mapping & recording flood information, based on data supplied by local government.
- Establish a satisfactory State performance monitoring & benchmarking system for flood risk management practices adopted by local governments.
- Require local governments to maintain publicly available flood & mitigation works records.
- Require the registration of flood heights on property titles or mandatory disclosure of flood information when selling.
- Provide low interest loans to owners for individual property modifications which reduce vulnerability to flooding.
- Use State subsidies to promote public flood risk mitigation.
- Require mapping of the flood of record, flood study results & approved and proposed development fill zones in flood prone areas in planning schemes.
- Impose an 'all hazards' levy or a specific 'flood' levy on all new developments to raise funds for reducing the vulnerability of developments to hazards.
- Require regular education of residents about historical flood levels in their local areas.
- Require the establishment of flood warning systems & the installation of flood markers to allow interpretation.
- Provide indemnification for local governments & the State against possible legal actions arising from the inaccuracy in flood information and from undertaking or maintaining works with due diligence.

Works Controls:

- Require flood mitigation works programs.
- Authorise flood mitigation works.
- Subsidise flood mitigation works.
- Indemnify responsible actions.

ATTACHMENT 2B – MEASURES THAT COULD BE INCLUDED IN STATEMENTS OF PLANNING POLICY IMPLEMENTATION OPTIONS

Planning and Future Development Controls:

- Encourage flood risk/impact assessment studies to support planning schemes & development controls.
- Provide State 'Flood Mitigation Planning' guidelines.
- Clarify flood disaster prevention & management responsibilities & ensure agreement on State floodplain management interests to be reflected in planning schemes & development decisions.
- Encourage links between referable dam emergency action plans, planning schemes & counter disaster plans.
- Encourage coordinated management by local government administrations sharing the same floodplain (using regional planning processes where necessary).
- Encourage of development & redevelopment control policies to mitigate flood impacts.
- Encourage State Agencies to acknowledge & where practical adhere to local flood standards.
- Encourage local governments to establish flood models to enable consistent assessment of development impacts on floodplains (especially where multiple developments are likely).
- Promote an all hazards approach for implementation by the State & local governments.
- Include hazard risk assessment & mitigation into the Queensland Treasury 'Project Evaluation Guidelines' (March 1997) & other State infrastructure guidelines.

Operational Controls:

- Establish a formal State system for mapping & recording flood level information on floods, based primarily on data supplied by local government.
- Establish a satisfactory State performance monitoring & benchmarking system for flood risk management practices adopted by local governments.
- Encourage property buyers to investigate the flood insurability of a property before purchase
- Provide low interest loans to owners for individual property modifications which reduce vulnerability to flooding.
- Use State subsidies to promote public flood risk mitigation.
- Encourage mapping of the flood of record, flood study results and approved and proposed development fill zones in flood prone areas in planning schemes.
- Promote regular education of residents about historical flood levels in their local areas.
- Encourage the establishment of flood warning systems and the installation of flood markers to allow interpretation.

Works Controls:

- Subsidise flood mitigation works.

RRD/083/000(13/12).

NATURAL RESOURCES
Queensland

30 August 1999

[redacted]

(1) Please fol (DNR) and arrange a meeting with Rideal and me to discuss preparing it. B/f file until this [illegible] the meeting held 5.

20/9/99
11:00 - 11:30am.

Executive Officer
Central Control Group
State Counter Disaster Organisation
GPO BOX 1425
BRISBANE QLD 4001

ATTENTION: [redacted]

Dear [redacted]

QUEENSLAND FLOOD COORDINATION CC TTEE - SUMMARY OF DIRECTIONS

Thank you for your letter of 9 August advising of the Central Control Group's (CCG) desire for this Department to be solely responsible for chairing the Queensland Flood Co-ordination Committee (QFCC) and requesting a summary of the directions being pursued by the QFCC.

I am pleased to accept the sole chair of the QFCC and report on progress to date.

As you are aware, the QFCC was initiated by the CCG at its June 1996 meeting and agreed to by Cabinet on 9 September that year. The QFCC met on several occasions between November 1996 and May 1997. Two sub-committees (planning and response) of the QFCC were established to progress the development of a discussion paper. The planning and response subcommittees met and presented their respective reports to the QFCC in April 1997 which resolved to combine the reports for presentation to the CCG. Further work occurred and a smaller working group was formed to draft a report summarising the outcomes of the two sub-committees. This group met on several occasions the last being in February 1998.

For various reasons, the report was never submitted to the Central Control Group. I have attached for your information a summary report including the conclusions of the two sub-committees and the draft recommendations consolidated by the smaller working group.

While these recommendations were not forwarded to the Central Control Group, work has progressed on nearly all of the recommendations.

[redacted]

27/9/99

Enquiries to: [redacted] Your Ref: Our Ref :
Mineral House, 41 George Street, Brisbane Q 4000
GPO Box 2454, Brisbane Q 4001
Telephone: [redacted]

G:\Executive\ED_RID\Letters\QFCC Status

RID 2501/99

With regard to the shorter term recommendations the State Mitigation Committee has been established with a view to ensuring continued availability of funds for mitigation generally and under the NDRA in particular. In addition, my Department has completed a survey with a view to assessing the vulnerability of communities to flooding. The report (copy attached) concluded that approximately 65,000 houses are vulnerable to flooding in Queensland. However based on additional information supplied in applications for funding under the recently announced Regional Flood Mitigation Programme, it is considered that the figure is more likely to be around 80,000 houses.

With respect to the medium and longer term recommendations, considerable work has also occurred especially through the work to develop Total Management Planning Guidelines for Floodplain and Stormwater Management. These guidelines will complement the draft National Best Guidelines for Floodplain Management in Australia prepared by the Standing Committee on Agriculture and Resource Management. However, the scope of Queensland's Guidelines will be broader incorporating social, environmental and resource management considerations necessary in formulating a planning scheme under the Integrated Planning Act to control land use. Consultants have been engaged to undertake the work.

A large steering group has been formed to oversee this project and it comprises membership largely representative of the agencies making up the QFCC with many members being on both.

Finalising the guidelines project is an essential precursor to progressing some of the other recommendations such as provision of financial incentives for local government to prepare floodplain management plans and collect relevant information. The guidelines will provide a basis for establishing conditions for financial assistance if such assistance can be negotiated with Treasury at some point in the future. It will also provide a basis for education and training programs for local governments.

With regard to the establishment of good information systems for hydrologic information, risk and vulnerability assessments and post flood damage recording, the Department is moving to establish appropriate systems. I have recently engaged a relatively senior officer specialising in database and geographical information systems to assist in the development of the information systems and networks.

Some of the recommendations relating to establishment of a policy and legislative framework are more difficult to progress especially those relating to indemnity, compensation and floodplain planning obligations of agencies. In this regard, I enclose a copy of the paper on *Floodplain Management in Queensland* which was presented to the State Mitigation Committee at its 4th August meeting by Richard Priman. The paper essentially summarises most of the detailed considerations of the QFCC bringing it up to date with many of the recent developments such as the introduction of the Integrated Planning Act, the development of national best practice guidelines, and the introduction of new Commonwealth funding. The State Mitigation Committee resolved to accept the report as an

information report but did not act on the recommendation. With some development, this paper could form the basis of a policy discussion paper.

As can be seen from the preceding discussion, there is little point in progressing the original draft QFCC paper further. It would be more valuable if the QFCC is reconvened to develop a policy paper for discussion purposes that could form the basis of either legislative and/or administrative review. Given that the Department is currently reviewing its legislation as part of the water industry reforms, now is an appropriate time to develop and progress such a paper. This is especially the case now as I understand that the Department of Communication and Information, Local Government and Planning is in the process of reviewing the implementation of the Integrated Planning Act.

I propose to hold discussions with the Co-ordinator of the Water Reform Unit, [redacted] to see how this matter might be progressed further and subsequently brief the Minister to obtain his views.

Yours sincerely

[redacted]

EXECUTIVE DIRECTOR
REGIONAL INFRASTRUCTURE DEVELOPMENT

Enc.

Summary of Draft QFCC Conclusions and Recommendations
Report to the State Mitigation Committee on Floodplain Management in Queensland
Urban Flooding in Queensland – A Review by David Ingle Smith

SUMMARY OF DRAFT QFCC CONCLUSIONS AND RECOMMENDATIONS

Purpose

This report summarises the draft conclusions and recommendations of the Queensland Flood Coordination Committee (QFCC).

Background

The Queensland Flood Coordination Committee (QFCC) was proposed by the Central Control Group to improve the coordination of flood risk management activities in the State at its meeting of 19 June 1996. DNR was assigned the lead agency role for flooding in Queensland and chair (jointly with DES) of the new committee. The QFCC's terms of reference (see attached) address the broad aims of:

- assessing the current state of play regarding the management of the flood threat in Queensland, and
- recommending actions to reduce the hazard associated with floods.

The QFCC held its inaugural meeting in November 1996 and, as a first step in addressing it's terms of reference, set out to determine how effectively flood risk is currently managed in this State, identifying obstacles to reducing flood risk exposure. To achieve this, two sub-committees were formed to investigate and report on the issues affecting the two main components of flood risk management, namely:

- Prevention - the planning and control of development on floodplains to minimise the impact of floods; and
- Response - flood emergency response activities.

Sub-Committees

The two subcommittees held a number of meetings in late 1996 and early 1997 and presented their respective reports to the full committee on 1 April 1997. While a report combining the two subcommittee's findings has not been finalised, the conclusions from each sub committee report are summarised below.

Planning (Prevention) Sub-Committee Conclusions

1. There has been limited effective management of floodplains in Queensland to reduce flood hazard. The State has historically not taken a leadership role in floodplain management and the responsibility has fallen to local governments through their town planning and development approval functions.

2. Historically, funding has been available for flood recovery works, however, in future there is likely to be less funding (especially federal) for post-flood repairs particularly if no appropriate preventative action has been taken.

3. To implement effective floodplain management, a local government needs to be well resourced, possess knowledgable technical staff, and have the political will.

4. The State legislation available to implement floodplain management is fragmented, however, effective floodplain management by local governments is possible within the existing framework.

5. The impediments to better floodplain management in Queensland are:-
   - limited availability of flood studies due principally to a shortage of funds.
   - lack of appreciation of the problem (extent and impact of flooding)
   - lack of technical expertise in many (especially smaller) local governments
   - lack of hydrologic data, particularly on secondary watercourses, to facilitate flood estimation
   - a 'post-disaster' culture
   - lack of leadership by the State in floodplain management

Response Sub-Committee Conclusions

1. Queensland's arrangements for responding to and recovering from floods are part of the overall counter disaster arrangements *-however-* they do not provide 'best practice' protection because they are inadequately resourced, fragmented, uncoordinated and poorly understood.

2. The community's vulnerability is exacerbated by the lack of knowledge about the extent of the flood problem both within Local and State Governments and the community, and by confirmed development in flood prone areas.

Draft Recommendations

The State -

<u>in the short term:</u>

1. with respect to the changes to the NDRA requiring mitigation strategies, ensure continued availability of funds until agreement on appropriate strategies is reached *(Department of Emergency Services / State Mitigation Committee are pursuing this issue)*;

2. assess the cost of flooding in Queensland and identify high risk areas *(substantially addressed for urban areas by DNR's Queensland Urban Flood Risk Survey)*

<u>in the medium term</u>:

3. develop a State flood risk management policy including a detailed framework of responsibilities for:
   a) floodplain planning; and
   b) flood emergency response planning

   that ensures agencies include these in their programs and budgets.

4. provide a mechanism for local governments to be responsible for preparing flood risk management plans for vulnerable areas and enforcing their implementation,

5. assist local governments through the development of floodplain management best practice guidelines for Queensland (DNR's TMP project based on the National Best Practice Guidelines for Floodplain Management prepared by the Standing Committee on Agriculture and Resource Management (SCARM) addresses this recommendation);

6. provide financial incentives for local government for the:
    a) preparation of floodplain management plans
    b) for flood mitigation works subsidies - subject to a)
    c) collection of relevant rainfall and streamflow data.
    d) measures which reduce exposure of the community to flood risk (eg buy outs).

    and

    pursue reinstatement of the Commonwealth funds that were previously available to local governments under the National Landcare Program (*the RFMP addresses this issue in part).*

7. investigate the possibility of indemnity for local governments from legal action if planning is done following the recommended process as in NSW

in the longer term:

8. integrate flood risk management planning activities into regional planning initiatives, by way of catchment management authorities, local government planning schemes and other agencies' planning activities.

9. adopt a process for the preparation, review, administration and implementation of flood risk management plans.

10. require all developments on the floodplain to comply with the flood risk management plan.

11. deal with compensation issues.

12. establish good flood information systems for hydrologic information, risk and vulnerability assessments and post flood damage recording

13. raise the level of public awareness through the development and implementation of an education and training package for local governments.

State Mitigation Committee
4 August 1999

FLOODPLAIN MANAGEMENT IN QUEENSLAND

Purpose:

This paper provides information on:

- the current state of play regarding floodplain management in Queensland, and
- actions in train to foster implementation of best practice in Queensland.

Policy and Legislative Framework

Requirements to Plan and Implement Best Practice

While acknowledging the potential application of common law, eg duty of care requirements, and the intentions under statute such as the *Integrated Planning Act 1997 (IPA)* to achieve ecological sustainability, currently there is no overall policy or legislative framework **requiring** agencies with floodplain management and/or flood mitigation responsibilities to:

- develop or implement a relevant management or mitigation strategy, or
- implement best practice once a decision is made to develop and implement a management or mitigation strategy.

Neither is there any requirement for coordination between agencies having responsibilities impacting on the same floodplain. Existing legislative does not address these matters in an integrated way.

However, agencies with floodplain management and/or flood mitigation responsibilities are empowered to undertake these activities. Thus, the situation exists where:

- local governments may undertake floodplain management and flood mitigation activities as good government measure under the *Local Government Act 1993*
- Water Boards may as part of a coordinated strategy include flood mitigation storage in water storages (Note: Once a decision is made to provide flood mitigation, referable structures must be designed, constructed and operated in accordance with procedures determined by the Chief Executive of DNR.)
- River Improvement Trusts (under the *River Improvement Trust Act 1940*) may undertake river improvements which mitigate flood impacts on the community and enhance the stability of the river etc, and
- DNR may under the *Water Resources Act 1989* initiate action to manage overland flow and mitigate flood impacts on life and property - particularly on rural floodplains. The powers have previously been considered for application in managing the Condamine-Balonne floodplain but ultimately were not used.

Statutory Support for Implementing Local Floodplain Management Measures

Management strategies tailored to meet local needs can be enforced through statute. In particular, the provisions of the *IPA*, the *Local Government Act 1993* and the *Water Resources Act 1989* may be used to establish an enforceable local plan.

The *IPA* is the principal statute that a local government can use to support the sound management of floodplains. Under this Act, floodplains can be managed through the control of land use in a *planning scheme*, and regulation of development through *Integrated Development Assessment System (IDAS)* and *IPA Codes*.

Further, the State may prepare a *State Planning Policy* about the management of floodplains as a State interest that must be considered by a local government in the preparation of a *planning scheme* and during development assessment under *IDAS*.

Local governments can prepare a *Local Planning Policy* to manage development on floodplains. In addition *IPA codes* may be adopted to control such developments.

A *'local law'* may be established under the *Local Government Act 1993* to assist the managing of development on a floodplain, eg prohibiting construction of a levee bank without the local government's permission. However, *IPA* does not allow a local government to make a *local law* that contains 'development provisions' or 'establishes a process about development' (ie duplicates the process of *IDAS*) after the commencement of *IPA* on 30 March 1998. The reconciliation of the local law provision under the *Local Government Act 1993* and the *IPA* development provisions will be addressed in the future.

Under a transitional *planning scheme*, an existing *local law* about a development would still be implemented through the *local law* process. Under an *IPA planning scheme*, *local laws* will be used to address non-development aspects eg management and operation. The Department of Communication and Information, Local Government and Planning is advising local governments preparing a new *planning scheme* under *IPA* to review their *local laws* that contain development provisions and roll them over into the *IPA planning scheme*.

Under the *Water Resources Act 1989*, the Chief Executive of the Department of Natural Resources may declare a designated area under Section 104 and invoke conditions for development and management within that area. This power has been used infrequently. Under Section 8, the Chief Executive may also coordinate the 'investigation, evaluation and development of plans for the control of flood waters and mitigation of flood damage'.

Regulatory Controls on Floodplain Management and Flood Mitigation

In addition to the preparation of *planning schemes* and associated *local laws*, *planning policies* and *IPA codes*, there are a number of statutory requirements that impact on the implementation of structural and non-structural flood mitigation measures. These laws are not selective and apply in all relevant circumstances. Some of these include:

- regulation of developments through *IPA* under the *Integrated Development Assessment System (IDAS)*
- dam safety regulation under the provisions of the *Water Resources Act 1989* (Part 6)
- licensing of waterworks under the provisions of the *Water Resources Act 1989* (Part 4, Division 2)
- permits to destroy vegetation, or excavate or fill in a watercourse, lake or spring under the provisions of the *Water Resources Act 1989* (Section 70)
- diversion of watercourses under the provisions of the *Water Resources Act 1989* (Section 236)
- levee bank control under the provisions of Chapter 13 Part 5 of the *Local Government Act 1993* or under Section 38 of the *Water Resources Act 1989*
- environmental management plans required under the *Environmental Protection Act 1994* and the *Environmental Protection (Water) Policy 1997*
- protection of declared Fish Habitat Areas under the *Fisheries Act 1994* and the *Fisheries Regulation 1995*, and
- regulation of buildings under the *Building Act 1975.*

Other legislation such as that relating to coastal and beach protection, soil conservation and transport may also apply.

Most development approvals will now be rolled up into the *IDAS* process. This will include impact assessments other than for major developments. For larger developments, section 29 of the *State Development and Public Works Organisation Act 1971* may come into play upon declaration of a 'significant project' by the Coordinator-General.

Administrative Arrangements

Subsidies

The State offers a subsidy for approved flood mitigation and River Improvement Trust works.

Guidelines

Draft '*Best Practice Guidelines – Floodplain Management in Australia*' (*BPG-FMIA*) have been prepared under the auspices of ARMCANZ. This is a guideline that broadly details best practice for protection of life and property in Australia.

A consultancy has been let by DNR to help draft *Total Management Planning Guidelines for Floodplain and Stormwater Management* in Queensland. The guidelines will detail the floodplain management process and the steps in developing a management plan for floodplain development under the Queensland legislative and administrative system. In addition, the guidelines will highlight the significant social, environmental and resource management considerations necessary in formulating a floodplain management plan. These are elements that are not covered in the *BPG-FMIA*. The close links with disaster management planning will also be covered.

An expert panel comprising State and local government representatives is overseeing the development of the guideline.

Measures

Floodplains can be managed using a combination of structural and non-structural measures. Structural measures (which modify a flood) may include works such as:

- flood storage in water storages
- levees
- stream improvements and diversions, and
- land fill.

Non-structural measures (which modify the impact of a flood) include:

- flood warning systems
- awareness and education programs
- watercourse maintenance
- house raisings and voluntary purchases
- flood proofing buildings and flood access provisions
- land management, and
- building regulation.

Issues

A survey initiated in 1997 by DNR concluded that some 65,000 houses in Queensland were vulnerable to flooding in a 1 in 100 year ARI flood event. Based on the applications received for funding under the recently announced Regional Flood Mitigation Programme, it is estimated that the vulnerability to flooding in such an event is more likely to be around 80,000 houses.

Some areas in south east Queensland are known to have a flood immunity of less than a 1 in 20 year ARI.

The major impediments to improving the implementation of best practices on floodplains are perceived to be:

- the lack of a enunciated State policy including best practice guidelines
- the lack of indemnification for works implemented by local governments since the repeal of the City of Brisbane Flood Mitigation (Works Approval) Act
- the exposure to and potential cost of compensation when land uses for developed lands are downgraded to more appropriately reflect suitable land uses

  (Note: The new IPA compensation provisions for injurious affection are useful for dealing with new development situations but still exposes a local government to compensation when attempts are made to correct poor development decisions of the past by taking away an existing right. Under IPA compensation claims must be made within prescribed time limits or the right to claim is lost. The compensation claim must be made:

  - ❖ *within 6 months from the day a local government either refuses a development application or approves the development application with conditions, or*
  - ❖ *within two years where the planning scheme change means that the land can only be used for a public purpose.*

  A local government is not liable to pay compensation where the change to the planning scheme affects 'development' that, had it happened under the old planning scheme, could have led to a significant risk to persons or property from natural processes.)
- the paucity of data upon which to base planning decisions
- the lack of understanding of catchment behaviour in terms of risk/hazard relationships with most floodplain planning being based on either historical events or a 1 in 100 year ARI flood event (70% of localities with flood problems have less than 12 hours warning time.)
- the unwillingness of agencies with floodplain management responsibilities to invest in the costly studies (sometimes exceeding $1 M) necessary to develop robust floodplain management plans, and
- the inability of some neighbouring local governments to produce complementary floodplain management plans.

Current Activities

- The importance of managing development on floodplains to ensure that the risk of community exposure to floods (in terms of life and property damage) is minimised has been recognised for some time. Consequently, the Queensland Flood Coordination Committee (QFCC) was formed some time ago to advise on ways to reduce the cost of flooding in Queensland and improve public safety. The QFCC was to report to the Central Control Group (CCG) of the State Counter Disaster Organisation. Much of the QFCC's work towards this report has been completed, however for various reasons, the finalisation and presentation of the report to the CCG has not occurred. This is about to be addressed.

  A significant outcome of the QFCC has been support for the consultancy to draft *Total Management Planning Guidelines for Floodplain and Stormwater Management* in Queensland and the 1997 survey of flood risk published under the title 'Urban Flooding in Queensland – A Review, by David Ingle Smith, CRES, ANU, Canberra'.

- The *Regional Flood Mitigation Programme* provides a potential avenue for reducing flood impacts in Queensland.

- DNR is currently reviewing its policy framework for water supply planning, regulation of water service providers, governance arrangements for water boards, and the system of water allocation and management as part of the review of the *Water Resources Act 1989*. This review will include regulation of water service providers with flood mitigation responsibilities associated with water storages.

Future Considerations

A policy framework that would encourage a consistent approach to flood risk management in Queensland is required.

This would include:

- an enunciated State floodplain management policy
- clearly defined legislative and administrative processes
- best practice guidelines for managing the development of floodplains, and
- best practice guidelines for flood disaster/emergency management.

Work is currently in hand to develop the best practice guidelines.

As part of the development of a State policy framework, the following could be considered:

- introduction of a statutory requirement for the preparation of floodplain management plans prior to development being permitted on floodplains as part of a *planning scheme* (This requirement could be implemented either as a consequential amendment of the *Integrated Planning Act 1997* or incorporated in the redrafted *Water Resources Act.*)
- that the legislation also require complementary policy development by other and adjacent authorities having responsibilities on the same floodplain
- that authorities which derive and implement best practice management plans using recognised processes will be indemnified against legal action (covering the supply of information from floodplain management plans, impact of proposed works and the impact of building and maintaining the works)

In addition to the above, the potentially difficult issue of separating the combined responsibilities of agencies for identifying flood lines and planning for land use could be addressed so that there are reduced conflicts of interest. This has occurred in Victoria where each task is undertaken by separate agencies. In Queensland, this option is not likely to be feasible. An alternative might be the granting of an authority by the State to plan for development based of flood lines prepared by the responsible agency.

Recommendation

That the QFCC be reconvened to progress the development of a State policy framework for floodplain management.

QUEENSLAND GOVERNMENT

STATE COUNTER DISASTER ORGANISATION

Please Address Correspondence to:

THE EXECUTIVE OFFICER
CENTRAL CONTROL GROUP
STATE COUNTER DISASTER ORGANISATION
GPO BOX 1425
BRISBANE QLD 4001

TELEPHONE: [redacted]
FAX NO.
E-MAIL: [redacted]

19 August 1999

[redacted]
Director-General
Department of Natural Resouces
GPO Box 2454
BRISBANE QLD 4001

Dear [redacted]

The Queensland Flood Coordination Committee (QFCC) was established by a decision of the Central Control Group (CCG) at the meeting held on 19 June 1996, where the CCG agreed that the Department of Natural Resources (DNR) would be the lead agency for flooding in Queensland.

On 9 September 1996, Cabinet approved the lead agency role and the formation of the QFCC which was to have as its objective – 'To provide the Central Control Group of the State Counter Disaster Organisation with the means of reviewing information from a variety of sources and recommending practical measures for reducing the impact of flooding in Queensland.' The Terms of Reference of the QFCC are attached.

Since the establishment of the QFCC a joint Chair arrangement has existed between [redacted], your Executive Director, Regional Infrastructure Development and myself.

This issue was considered at a meeting of the CCG held on 3 December 1998, where it was decided that the Chair responsibility should reside solely with the Department of Natural Resources, as lead agency.

In considering the Chair arrangements, the CCG also examined the requirement, contained in the Terms of Reference, that regular reports should be provided to the CCG. These reports are of increasing significance with the establishing of the State Mitigation Committee and the importance of flooding in the overall context of disaster mitigation.

The next meeting of the CCG is scheduled for 1 September 1999, and it would be appreciated if a summary of the directions being pursued by the QFCC could be provided at that meeting. My staff have discussed this with Richard Priman from your Department and it is understood that he is preparing advice, in anticipation of this request.

Yours sincerely

[redacted]
Executive Officer
Central Control Group

Richard
to give me
a call this
afternoon. Thanks

Att: Terms of Reference QFCC

CC: [redacted] NR
DNR

State Mitigation Committee

Minutes of Meeting

No 4

16 November 1999

Room 5:19 Executive Building

[redacted] opened the meeting in the absence of the Chair, [redacted] and asked [redacted] to speak to Agenda Item 7

Agenda Item 7 - Natural Disaster Relief Arrangements (NDRA).

[redacted] introduced this agenda item and emphasised the strong representations made by the Minister for Emergency Services to the Commonwealth to have changes made to the NDRA to incorporate landslides as eligible events, and "trading assets" of small Local Governments as eligible assets.

The latest Draft Revision of NDRA Terms and Conditions has incorporated landslides, but has not made any special allowance for the "trading assets" of small Councils. These assets are still eligible for compensation under the NDRA "Special Circumstances" arrangements.

The committee noted that Treasury is responsible for negotiations with the Commonwealth in relation to the revised arrangements.

[redacted] assumed the Chair.

Agenda Item 1 Apologies (Refer State Mitigation Committee membership list attached.)

[redacted] (Environmental Protection Agency)
[redacted] (Department of Main Roads) with [redacted] in attendance.
[redacted] (Department of Premier and Cabinet) with [redacted] in attendance.
[redacted] (Department of Communication, Information, Local Government and Planning {DCILGP}) with [redacted] in attendance.
[redacted] (Local Government Association of Queensland) with [redacted] in attendance.

Agenda Item 2 – Confirmation of Minutes and Matters Arising from Minutes

Minutes confirmed.

Matters Arising from Minutes:

2.1 Dam Safety Policy

Wayne Ripper, Director Disaster Operations Department of Emergency Services (DES), advised that a package would be distributed soon to Disaster District Coordinators and DES District Managers to ensure Dam Emergency Action Plans were closely integrated with Local Government Counter Disaster Plans.

Discussion highlighted the state of floodplain management in Queensland and the need to keep and enhance the profile of disaster mitigation, particularly the threat of floods, on the State's agenda.

The discussion also identified that there were legal issues about providing flood information to the community and that there were a number of other stakeholders, such as the Master Builders Association, Lending and Insurance Institutions and the Infrastructure Association, that should be involved.

The Committee supported the preparation of a discussion paper through the Queensland Flood Coordination Committee and the maximum use of Cabinet Information Papers and Inter-Departmental Committee Reports to raise the profile of disaster mitigation.

Action **DNR**

10.2 Date of next Meeting

The date of the next meeting was confirmed for ***2pm to 4pm Thursday 3 February 2000***

The Meeting closed at 4pm.

Attachments

1. State Mitigation Committee membership list
2. Insurance Council of Australia presentation on flood insurance initiatives
3. Department of Natural Resources Paper on Managing Flood Risk In Queensland

State Mitigation Committee
Meeting 16 November 1999

Preparation of a Discussion Paper for Managing Flood Risk in Queensland

Proposal

That the State Mitigation Committee (SMC) support:

- the preparation of a discussion paper on legislative and administrative options for managing flood risk in Queensland
- the preparation of the discussion paper by the Queensland Flood Coordination Committee (QFCC)

Justification

Extent of the Flood Problem

- 1997 Queensland Urban Flood Risk survey identified **65,000 properties** liable to flooding in a 1 in 100 year event
- Some areas in SEQ are known to have a flood imunity of less than a 1 in 20 year event
- Recent information provided as part of Regional Flood Mitigation Program applications and further investigations by Councils in SEQ indicate that the actual number of properties liable to the 1 in 100 year flood may be **nearer to 100,000 properties**
- Estimated Average Annual Damage for the 65,000 properties is **$100 Million (highest in Australia)**
- Average annual NDRA costs covering public infrastructure is about **$50 Million**
- A **record flood occurs** somewhere in Queensland almost **every year**
- **Increasing exposure to flood risk** in Queensland

Problems with the existing legislative and administrative framework

- In 1997, **only 35 local governments** (there are 125) **indicated an urban flood policy**.
- Lack of enunciated State policy
- Concern about clarity of the legislative framework
- Uncertainty over a range of issues, including:
  - duty of care obligations
  - liability for flood damages
  - exposure to compensation associated with downgrading of land uses
  - rights in common law
  - statutory obligations
  - potential conflicts in statutes eg *IPA 1997* and *Local Government Act 1993* provisions covering levee banks (refer DNR information paper to SMC on 4 August)
- Need for more floodplain mapping and regular review of flood studies
- Paucity of data on which to base planning decisions
- Lack of flood damage assessments
- Lack of funding for flood studies, damage assessments etc
- Lack of awareness about flood risks
- Lack of commitment to prevent or minimise flood problems
- Growing burden born by governments because flood prone lands are either uninsurable or have excessive premiums
- Failure of some neighbouring local governments to produce complementary floodplain management plans

National Trends

- Commonwealth policy trends reflected in the changes to NDRA requirements requiring beneficiaries to establish appropriate policies and practices
- States such as NSW, Victoria and Tasmania have established legislative and administrative systems for the management of flood risks
- In NSW, local governments that implement a floodplain management plan in accordance with specified best practice procedures can gain indemnity
- In Victoria, Catchment Management Authorities are empowered to ensure that regional flooding issues are managed in an integrated way through the *CMA Act* and the *Water Act*. Flood affected land must be shown on planning scheme maps.

- The Department of Primary Industries, Water and Environment in Tasmania produces flood maps for local governments and the State Emergency Service.
- Other States have made commitments to develop floodplain management policy.
- In Western Australia, a discussion paper entitled 'A Framework for Floodplain Management in Western Australia' has been released
- The South Australia Government has committed to the preparation of a South Australian Floodplain Management Policy in its State Water Plan – Draft for Consultation October 1999
- All these States have committed to advance the principles of the *Draft National Best Practice Guidelines – Floodplain Management in Australia*

Risks/Implications of not establishing a Policy Framework

- Increased potential for inappropriate development on floodplains – increasing not only the flood risk to life and property but also the risk of environmental harm
- Possible ineligibility for Commonwealth NDRA assistance to affected local governments
- Growing financial burden on the State
- Potentially increased liability borne by local government and possibly the State
- Inability to obtain insurance cover for flood damage in Queensland

Possible Policy Framework

A State Flood Risk Management framework could comprise:

- an enunciated State floodplain management policy
- clearly defined legislative and administrative processes
- best practice guidelines for managing the development of floodplains, and
- best practice guidelines for flood disaster/emergency management

Work has progressed on the best practice guidelines

References

- State Mitigation Committee Information Paper 4 August 1999 – *Floodplain Management in Queensland*
- DNR letter to Central Control Group 26 August 1999 re Queensland Flood Coordination Committee – Summary of Directions.

Ref CBD/023764 (Pt 1)

7 June 2011

DOCUMENT DESPATCHED BY DERM
File No. CBD/023764
File Location. C3. Mineral House
07 JUN 2011
Action By [redacted]
Registered Y/N
Doc. Code K/1084865

[redacted]
Director (Planning and Resilience)
Policy and Legislative Reform Branch
Emergency Management Queensland
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Dear [redacted]

Planning Schemes

Review of Fitzgibbon Urban Development Scheme

Brisbane City Council (BCC)

State Planning Policy 01/03 (Flood)

The "Fitzgibbon Urban Development Scheme " prepared by the Urban Land Development Authority (ULDA) has been reviewed with respect to the incorporation of the natural hazard management (flood) requirements of State Planning Policy 01/03. As a result, the following comments are offered.

It has been noted that there is no discussion to determine whether the flood studies should have been performed for the combined effect of storm surge and terrestrial flooding related to Cabbage Creek, Fitzbiggon Drain and Castledine Drain. This Department also suggests that ULDA should do a detailed flood study of the site and include flood depth contour maps for on 5, 10, 20, 50,100, 200, 500 year average recurrence interval (ARI) and probable maximum flood (PMF) prior to the development of the proposed site. This range of average recurrence intervals is considered good practice as it not only meets the requirements of State Planning Policy 01/03 for new development, but will assist in the management of flood risks in existing areas.

Table 4.10 – Page 23 indicates that the railway embankment retains up to 293 Ml of flood waters (i.e. it performs as a detention basin). ULDA needs to determine whether this detention basin is captured under the Dam Safety provisions of the Water Supply (Safety and Reliability) Act 2008.

Street Address
Level 3, 41 George Street, Brisbane, QLD 4000
Postal Address
GPO Box 2454 Brisbane QLD 4001
Telephone + 61 7 3247 [redacted]
Facsimile + 61 7 3224 7999
Website www.derm.qld.gov.au
ABN 46 640 294 485

The Table 4.11 – Page 24 does not indicate the flow velocities of the Carseldine Drain. ULDA should include the flow velocities for the respective Average Recurrence Intervals – particularly for the larger events. This is to identify the risks to the public (i.e. specially children) of the open drain and retention basins systems in the developed areas.

This Department notes that, the cost of the proposed flood mitigation works to reduce the flood effects of the existing areas will be approximately $11.0M. Though the UDLA has considered several options there is no benefit-cost analysis presented to aide in the selection of the most appropriate option; nor is there any indication that the environmental and social aspects have been evaluated.

The local community infrastructure (such as evacuation routes, electrical substation, sewage facilities and water supply storages etc) that needs to be able to function effectively during and immediately after a flood event needs to be considered.

Please do not hesitate to contact [redacted] Senior Engineer (Flood Risk and Stormwater Management) on [redacted] if you have any further enquiries.

Yours sincerely

[redacted]

Russell Cuerel

Manager (Infrastructure Management)

Water Industry Asset Management & Standards

Office of the Water Supply Regulator

Environment and Natural Resource Regulation

Operations and Environmental Regulator

Ref CBD/023764 (Pt 1)

25 May 2011

DOCUMENT DESPATCHED BY DERM
File No. CBD/023764
File Location 43 Mineral House
25 MAY 2011
Action By [redacted]
Registered Y/N
Doc. Code K/1067610

[redacted]
Director (Planning and Resilience)
Policy and Legislative Reform Branch
Emergency Management Queensland
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Dear [redacted]

Planning Schemes

Review of Yeerongpilly Transit Orientated Development - Queensland

Brisbane City Council (BCC)

State Planning Policy 01/03 (Flood)

The "Yeerongpilly Transit Orientated Development – Detailed Plan of Development" published by the Department of Local Government, and the supporting report entitled "Conceptual Flooding and Stormwater Assessment, Proposed Transit Orientated Development, Yeerongpilly Queensland" by consultants Gilbert and Sutherland, have been reviewed with respect to the incorporation of the natural hazard management (flood) requirements of State Planning Policy 01/03. As a result, the following comments are offered.

It is noted that the two documents quote a range of habitable floor levels for the development. The Gilbert and Sutherland report (dated February 2011) quotes a level of 8.4 m Australian Height Datum (AHD) for habitable floors, based on a flood wise property report from BCC dated 19 March 2010. However, the Detailed Plan of Development quotes a pre January 2011 level 9.6 m AHD, which it then states needs to be increased to 9.8 m AHD as a result of the post January 2011 flood levels announced by BCC. The total increase in habitable floor level from pre January 2011 to post January 2011 is therefore either 1.4 m (ie. 9.8 m – 8.4 m) or 0.2 m (ie. 9.8 m – 9.6 m), whilst the quoted increase at the City Gauge is 0.76 m (ie 4.46 m – 3.70 m). Some explanation of these differences, and how the post January 2011 level for the site was determined from the City Gauge is required.

Street Address
Level 3, 41 George Street, Brisbane, QLD 4000
Postal Address
GPO Box 2454 Brisbane QLD 4001
Telephone + 61 7 3247 [redacted]
Facsimile + 61 7 3224 7999
Website www.derm.qld.gov.au
ABN 46 640 294 485

A map of flood inundation depth contours with property boundaries has not been attached to the consultants report whilst the "Detailed Plan of Development" document includes a map indicating 1 in 100 year average recurrence interval flood line within this site. However it is not clear whether this is the currently adopted Defined Flood Event in the Brisbane City area (i.e. the post January 2011 level).

With respect to stormwater flooding the Gilbert and Sutherland report seems to lack of details of the stormwater quantity assessment for all sub catchments nor does it discuss how co-incident local and regional flooding was considered. The report also estimates a discharge velocity for the 1500 mm diameter outlet pipe from catchment 2, that seems excessive.

Section 8.1 of Gilbert and Sutherland report implies the proposed development area is "flood storage", however this needs to be clearly confirmed, i.e. is the whole site flood storage; what flow velocities are likely to be experienced across the site, etc. It is noted that section 10 of the report quotes advice from BCC that flood storage at the site is not critical. Therefore any loss of storage at the site (e.g. due to filling) should have negligible effect on flood levels.

Flood hazard maps have not been included in either report. Mapping should include the flood level contours for this development area on 5, 10, 20, 50,100, 200, 500 year average recurrence interval (ARI) and probable maximum flood (PMF). In addition the mapping should include the January 2011 flood and its estimated AEP. This range of average recurrence intervals is considered good practice as it not only meets the requirements of State Planning Policy 01/03 for new development, but will assist in the management of flood risks in existing areas.

Community infrastructure for the site such as evacuation route/s, power supply, sewage and water supply etc. that need to be able to function effectively during and immediately after a flood event should also be considered.

Please do not hesitate to contact [redacted] Senior Engineer (Flood Risk and Stormwater Management) on [redacted] if you have any further enquiries.

Yours sincerely

[redacted]

Russell Cuerel

Manager (Infrastructure Management)

Water Industry Asset Management & Standards

Office of the Water Supply Regulator

Environment and Natural Resource Regulation

Operations and Environmental Regulator

FLOOD AND STORMWATER MANAGEMENT STUDIES FOR THE FITZGIBBON DEVELOPMENT SCHEME

Urban Land Development Authority
24 July 2009

www.wrmwater.com.au

WRM Water & Environment Pty Ltd
ABN: 96 107 404 544 ACN: 107 404 544
Level 5, Paddington Central,
107 Latrobe Terrace, PO Box 809,
Paddington Qld 4064 Australia
tel +61 7 3367 1279 fax +61 7 3367 1679
www.wrmwater.com.au

REPORT TITLE: Flood and Stormwater Management Studies for the Fitzgibbon Development Scheme

CLIENT: Urban Land Development Authority

REPORT NUMBER: 0541-01-G [Rev1]

Revision Number	Report Date	Report Author	Reviewer
Draft 1	5 June 2009	JO	DN
Draft 2	2 July 2009	JO	DN
0	15 July 2009	JO	DN
1	24 July 2009	JO	DN

For and on behalf of
WRM Water & Environment Pty Ltd

[redacted]

Director

EXECUTIVE SUMMARY

This report presents the results of hydrologic and hydraulic modelling studies undertaken to assess the potential impacts of flooding on development opportunities for the Fitzgibbon Urban Development Area (UDA). The Fitzgibbon UDA covers a total area of some 295 ha, mostly to the east of the North Coast Railway between Telegraph Road and Beams Road. Significant portions of the site are within the floodplain of Cabbage Tree Creek and its tributaries.

A flood modelling study of Cabbage Tree Creek and adjoining tributaries downstream of Dorville Road was undertaken to assess the flood impacts of the initial stages of development (Application 1) and the final development plan for the Fitzgibbon UDA. A TUFLOW 2D hydraulic model was used to simulate flood behaviour for existing and developed site conditions.

Existing development within the UDA is likely to be substantially affected by flooding as ongoing development occurs in the Cabbage Tree Creek catchment upstream of the UDA. The proposed development of the UDA, including construction of associated flood management infrastructure, provides an opportunity to improve a number of existing flood problems for existing development, as well as mitigating any impacts of the UDA development.

The proposed development plan for the UDA will have significant impacts on flow behaviour along Cabbage Tree Creek and its tributaries. A suite of flood mitigation works will be required to ensure no adverse flood impacts on adjoining properties and maximise the developable area of the site. Nine combinations of these management measures were modelled in TUFLOW to assess their likely impacts. Several components of the proposed flood management infrastructure are located outside of the Fitzgibbon UDA.

Flood management infrastructure investigated in the study included regional detention basins, levees and channel improvement/modification works. The preferred option for flood management infrastructure includes:

- Two major detention basins on currently vacant land within the UDA between Telegraph Road and Roghan Road,
- A flood protection levee along the upstream boundary of the railway easement between Cabbage Tree Creek and Beams Road,
- Substantial channel improvement works outside of the UDA along Cabbage Tree Creek extending from upstream of the North Coast Railway to upstream of Roghan Road.

Construction of this infrastructure will ensure no adverse impact from development of the UDA at most locations in the study area and will reduce existing flooding problems that are likely to be exacerbated by ongoing development further upstream in the Cabbage Tree Creek catchment. Construction costs for the proposed infrastructure are of the order of $5 million. Detailed design of the proposed infrastructure will require further detailed studies, including assessment of small adverse impacts at some locations, as well as potentially substantial environmental impacts.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

The Urban Land Development Authority (ULDA) is currently preparing a Development Scheme for the Fitzgibbon Urban Development Area (UDA). The Fitzgibbon UDA covers an area of approximately 295ha, as shown in Figure 1.1. Most of the UDA lies to the south of Telegraph Road and to the east of the North Coast Railway. The UDA includes the existing Queensland University of Technology (QUT) campus at Carseldine, Carseldine Railway Station and a 114 ha parcel of vacant land owned by the Department of Housing (DoH), as well as a number of other land parcels in private and government ownership.

The Fitzgibbon UDA is drained by Cabbage Tree Creek and a number of its tributaries, with a substantial portion of the site located on low-lying land within the Cabbage Tree Creek floodplain. Previous development in the area has significantly modified flow paths and flood behaviour across the floodplain. As a result, flood inundation represents a significant potential constraint to development of the UDA.

This report, prepared by WRM Water & Environment Pty Ltd (WRM), presents the results of hydrologic and hydraulic modelling studies undertaken to assess flood behaviour in the vicinity of the UDA for existing conditions and with future proposed development of the UDA. A suite of flood mitigation works are also proposed to ensure no adverse flood impacts on adjoining properties and to increase the developable area of the site. In addition, this report provides an assessment of stormwater management infrastructure required to meet appropriate water quality objectives for stormwater discharges from proposed development on the UDA site.

This report is structured as follows:

- Section 2 provides a description of the drainage network in the vicinity of the UDA.
- Sections 3 identifies previous flood investigations of the area relevant to the current study.
- Section 4 presents the methodology and results of hydrologic analyses undertaken to estimate design flows along the various waterways draining the area of interest.
- Section 5 presents the methodology and results of the hydraulic modelling studies to assess flood behaviour for existing site conditions.
- Section 6 assesses the flood impacts of the initial development phase for the site, Application 1 at 253 Telegraph Road.
- Section 7 describes the potential flood impacts of the overall development and assesses the effectiveness of a range of flood mitigation infrastructure options in reducing flood impacts of the development.
- Section 8 assesses the impact of a proposed bus way on flood levels in Cabbage Tree Creek.
- Section 9 provides information on necessary stormwater management infrastructure to meet water quality objectives for stormwater discharges from the site.
- Section 10 provides estimates of indicative infrastructure costs for the various components of flood mitigation infrastructure considered in the study.
- Section 11 presents the conclusions of the study.

- Appendix A shows the hydraulic roughness across the study area.
- Appendix B shows the TUFLOW 1D structures.

Figure 1.1 Locality Map, Fitzgibbon Urban Development Area

2 DRAINAGE NETWORK

2.1 OVERVIEW

Flooding behaviour within the Fitzgibbon UDA is influenced by three major drainage paths, as shown in Figure 2.1:

- Cabbage Tree Creek, which flows on the eastern side of the UDA;
- Fitzgibbon Drain which crosses the mid-section of the UDA; and
- Carseldine Drain which drains the northern portion of the UDA.

The following sections provide further details on the characteristics of each of these drainage paths.

2.2 CABBAGE TREE CREEK

Figure 2.1 provides an overview of the configuration of the Cabbage Tree Creek catchment. The upper reaches of the catchment extend into the Moreton Bay Regional Council local government area. Figure 2.2 shows local drainage features in the vicinity of the Fitzgibbon UDA.

Cabbage Tree Creek flows in a north-easterly direction, generally on the south-eastern side of the UDA. Cabbage Tree Creek has a catchment area of approximately:

- 19.5 km^2 to the North Coast Railway;
- 30.1 km^2 to the Gateway Arterial; and
- 42.9 km^2 to the mouth of the creek at Moreton Bay.

Little Cabbage Tree Creek, with a catchment area of 5.9 km^2, joins Cabbage Tree Creek a short distance upstream of the North Coast Railway near the upstream boundary of the Fitzgibbon UDA.

The main channel of Cabbage Tree Creek is generally incised within a wide, flat floodplain and has some mature riparian vegetation along most of the reach adjacent to the UDA. Figure 2.3 is a photograph showing a typical main channel section within the study area. The creek is tidal at its downstream end, with the tidal limit a short distance upstream of Lemke Road.

There are five major bridge structures crossing Cabbage Tree Creek within or adjacent to the UDA. These bridges are at the following locations:

- Gateway Motorway;
- Lemke Road;
- Roghan Road;
- Beams Road; and

- North Coast Railway.

Full details of the configuration of each of these bridges are provided in Brisbane City Council's Cabbage Tree Creek Flood Study (BCC, 2000).

2.3 CARSELDINE DRAIN

Carseldine Drain has a total catchment area of about 6.3 km^2 and extends to the west of Gympie Road (see Figure 2.1). The catchment topography is steep in the upper reaches flowing into a wide, flat floodplain downstream of Gympie Road.

To the immediate west of the North Coast Railway, the drain has been modified through excavation and rock lining. The drain discharges on to the Fitzgibbon UDA via a set of box culverts under the North Coast Railway. Within the UDA, the drain is poorly defined, with water spreading out to flow at shallow depth over a large area.

The natural drainage path of the Carseldine Drain catchment has been obstructed by the placement of landfill adjacent to Roghan Road and Telegraph Road (see Figure 2.2). The landfill site adjacent to Telegraph Road is now the Bill Brown Sports Fields. The flow path for water from the Carseldine Drain catchment around the Bill Brown Sports Fields is not well defined, with floodwaters flowing on both the northern and southern sides of the sports fields.

Stormwater runoff from the area to the north of Telegraph Road flows on to the Fitzgibbon UDA via culverts under Telegraph Road at a number of different locations. A significant portion of the urban area north of Telegraph Road drains to a large, shallow detention basin on the northern side of Telegraph Road. Piped outflows from the detention basin discharge to open drainage channels along the northern side of the Bill Brown Sports Fields which flow eastwards towards Cabbage Tree Creek.

2.4 FITZGIBBON DRAIN

The Fitzgibbon Drain has a catchment of 1.3 km^2. It collects stormwater runoff from an urban area on the western side of the North Coast Railway and discharges onto the Fitzgibbon UDA via a number of culverts through the railway embankment. The flow path from the railway to Cabbage Tree Creek has been heavily modified by previous urban development. Most of the drain on the eastern side of the railway has a V-shaped cross-section with a concrete-lined invert, as shown in Figure 2.4.

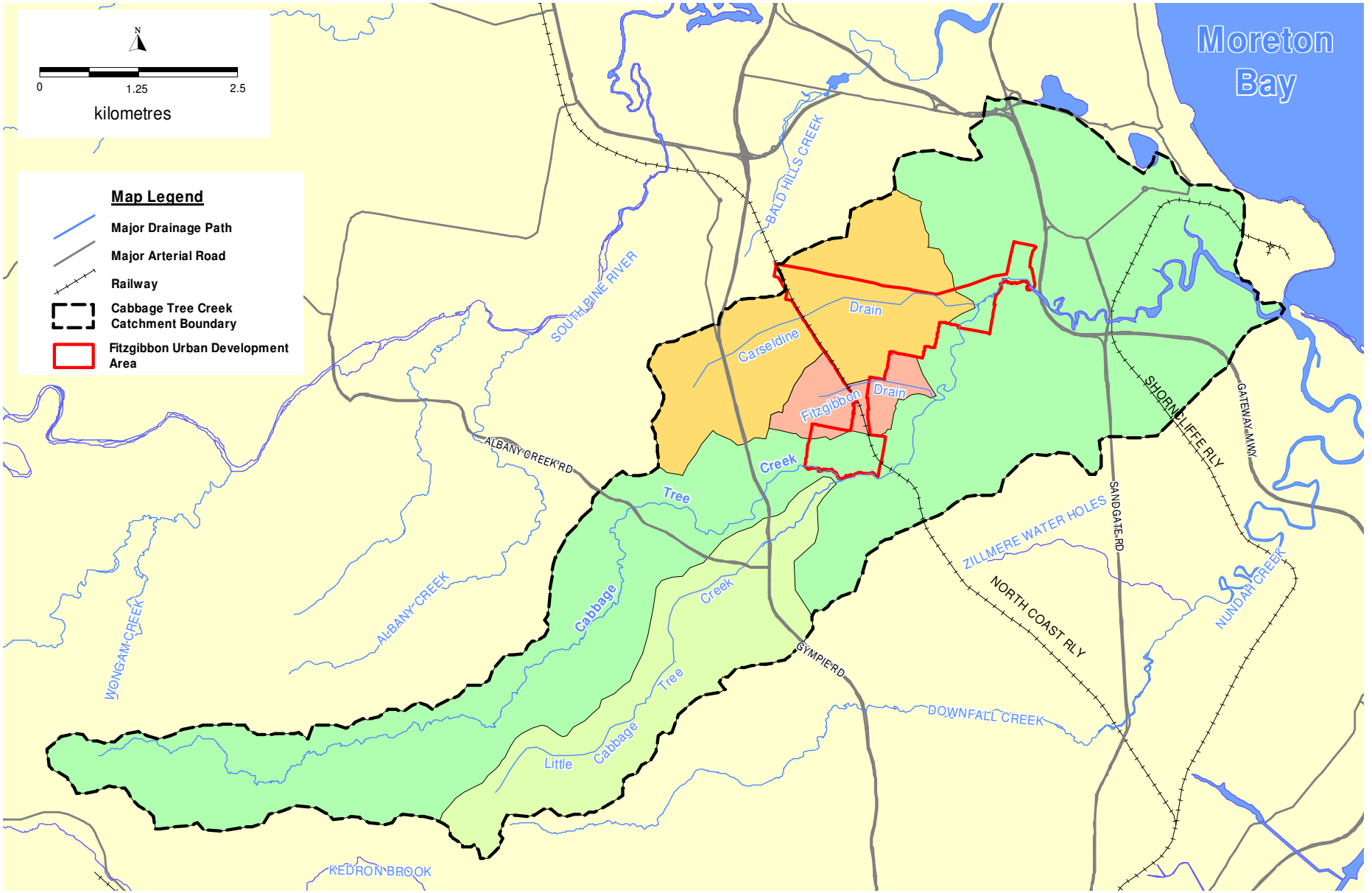


Figure 2.1 Cabbage Tree Creek Catchment

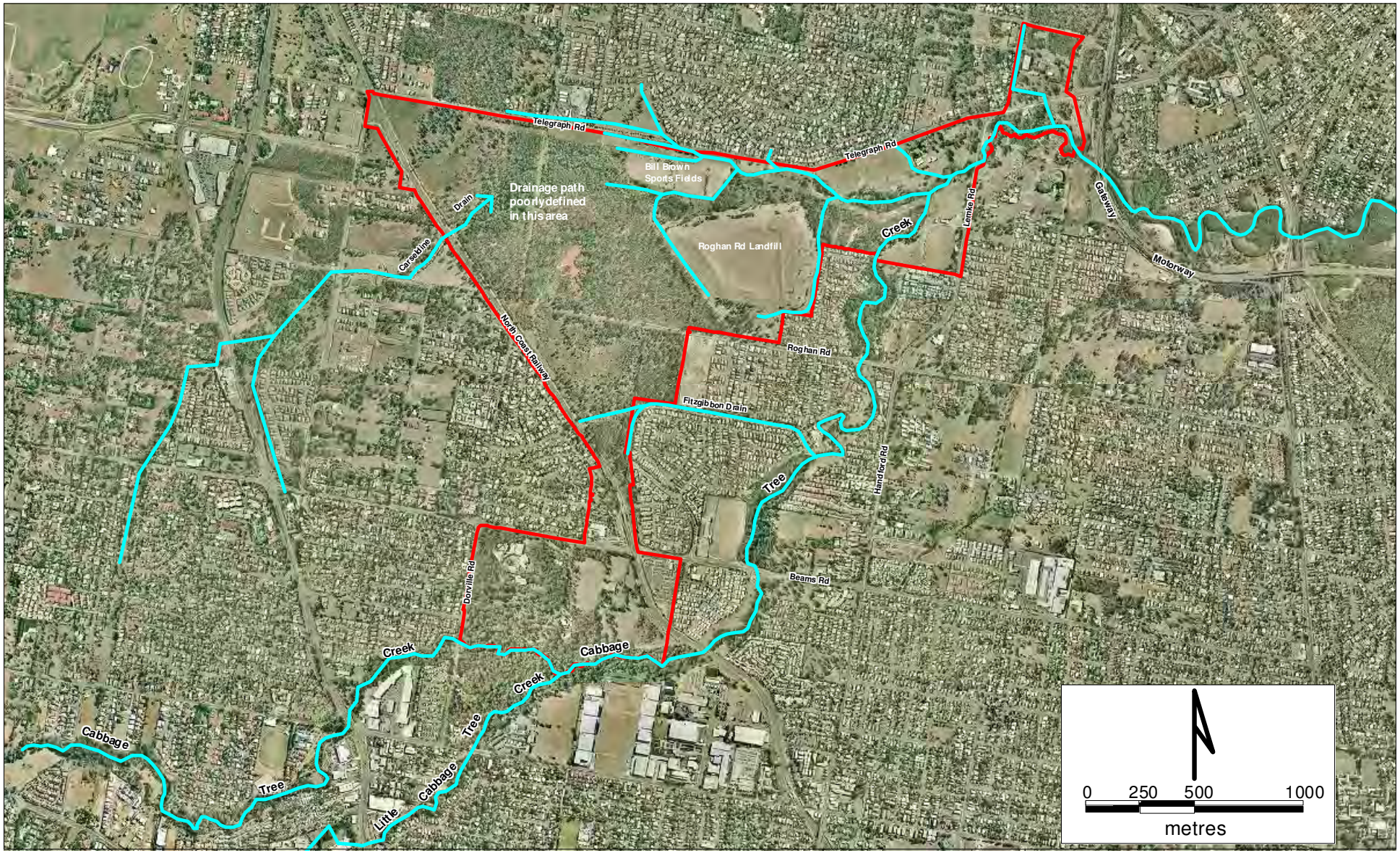


Figure 2.2 Fitzgibbon UDA Local Drainage Features

Figure 2.3 Photograph Showing Typical Cabbage Tree Creek Main Channel in Study Area

Figure 2.4 Photograph of Fitzgibbon Drain

3 PREVIOUS FLOOD INVESTIGATIONS

3.1 OVERVIEW

Numerous previous flood investigations have been undertaken of the various waterways draining the area of interest to this study. The following sections provide a brief summary of the following investigations which are of direct relevance to this study:

- Cabbage Tree Creek Flood Study Upgrade Report (BCC, 2000);
- 253 Telegraph Road Fitzgibbon, Stormwater Quantity and Quality Assessment Report (Storm, 2006);
- ULDA Fitzgibbon Development, Draft Stormwater Quantity and Quality Assessment Report (Storm, 2008).

3.2 CABBAGE TREE CREEK FLOOD STUDY

The Cabbage Tree Creek Flood Study Upgrade Report (BCC, 2000) represents the latest in a series of investigations of Cabbage Tree Creek which have been undertaken by Brisbane City Council (BCC). The study uses the URBS hydrologic model (Carroll, 2004) and the MIKE 11 unsteady flow hydraulic model to estimate design flood discharges and flood levels along Cabbage Tree Creek and Little Cabbage Tree Creek. Flood levels along Carseldine Drain and Fitzgibbon Drain are not estimated by the study. WRM's current study of the Fitzgibbon UDA has adopted BCC's calibrated URBS model to estimate flood discharges along Cabbage Tree Creek.

3.3 253 TELEGRAPH ROAD FITZGIBBON, STORMWATER QUANTITY AND QUALITY ASSESSMENT REPORT

Storm Water Consulting Pty Ltd (SWC) completed a report on the Department of Housing's property at 253 Telegraph Road, which now forms part of the Fitzgibbon UDA, in March 2006. The study assessed the Carseldine Drain catchment only, using a RAFTS model provided by Brisbane City Council, supplemented by an URBS model developed by SWC which provided more detail on the subject property. MIKE 11 was used to estimate flood levels along Carseldine Drain and its tributaries and to assess flood mitigation infrastructure required for a development proposal on the site. WRM's current study of the Fitzgibbon UDA has adopted the same RAFTS model to estimate flood discharges for Carseldine Drain.

3.4 ULDA FITZGIBBON DEVELOPMENT, DRAFT STORMWATER QUANTITY AND QUALITY ASSESSMENT REPORT

In August 2008, SWC completed a report for the ULDA which assessed the impact of proposed development of the southern portion of 253 Telegraph Road, referred to as the Application 1 area. The SWC study included an URBS hydrologic model of the Fitzgibbon Drain catchment and a MIKE 11 model of Fitzgibbon Drain. WRM's current study of the Fitzgibbon UDA has adopted the SWC URBS model of the Fitzgibbon Drain catchment on the western side of the North Coast Railway.

4 HYDROLOGIC ANALYSIS

4.1 OVERVIEW

Flood discharges and flood levels within the UDA were modelled using a detailed two-dimensional model of the entire UDA. Design inflows to the Fitzgibbon UDA hydraulic model were obtained from three existing hydrologic models, developed by others, which were modified for the purposes of this study:

- An URBS model of the entire Cabbage Tree Creek Catchment developed by BCC as part of the *Cabbage Tree Creek Flood Study* (BCC, 2000).
- An URBS model of the Fitzgibbon Drain developed by Storm Water Consulting as part of an initial flood investigation for the Application 1 area of the Fitzgibbon UDA (Storm, 2008).
- A RAFTS model of the Carseldine Drain catchment developed by BCC. Supporting documentation for this model was not provided by BCC.

Runoff from the Fitzgibbon UDA for pre-development, Application 1 development and Final development conditions was determined by applying direct rainfall over the surface of the two-dimensional model. Direct rainfall was also used over the surrounding areas to the south-east of the UDA and downstream of the North Coast Railway. Initial and continuing losses, and surface roughness were modified over development areas to represent the change in impervious area associated with the proposed development.

The extent of the three hydrologic models and inflow locations to the hydraulic model are shown in Figure 4.1.

Details of the adopted model configurations and parameters for each of the hydrologic models are provided in the following sections.

4.2 ADOPTED DESIGN RAINFALLS

Design rainfall depths and storm temporal patterns for the area were determined using standard procedures from Australian Rainfall and Runoff (IEAust, 1998).

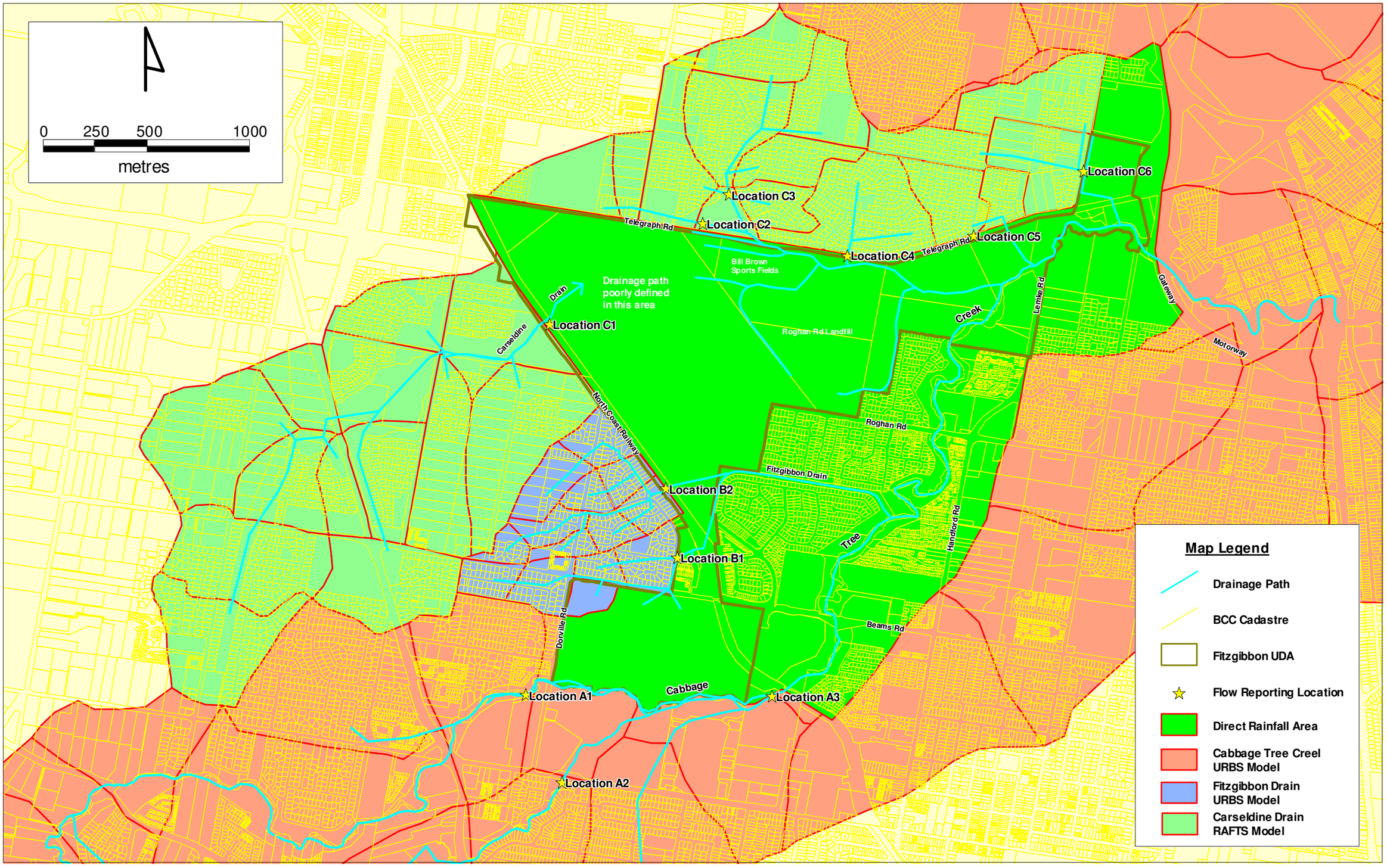


Figure 4.1 Hydrological Models and Discharge Reporting Locations across the Fitzgibbon UDA

4.3 CABBAGE TREE CREEK URBS MODEL

The BCC URBS model of Cabbage Tree Creek was used to estimate the main inflows to the two-dimensional hydraulic model. Four separate versions of the model were provided simulating the following catchment conditions:

- 1979 development conditions;
- 1992 development conditions;
- 1996 development conditions; and
- Ultimate development conditions.

Design inflows to the hydraulic model along Cabbage Tree Creek were determined using the 'ultimate development conditions' model scenario. Discharge hydrographs were produced at three locations (see Figure 4.2):

- Cabbage Tree Creek at Dorville Road (Location A1);
- Little Cabbage Tree Creek at Zillmere Road (Location A2); and
- Cabbage Tree Creek at Pineapple Street and the North Coast Railway (Location A3).

4.3.1 Model Configuration

Figure 4.2 shows the BCC Cabbage Tree Creek URBS model configuration to the North Coast Railway. It consists of 33 sub-catchment areas upstream of the North Coast Railway totalling 18.7 km^2. Table 4.2 shows the area for each sub-catchment in the model and the percent urbanisation for the 1996 and ultimate development model scenarios.

The URBS model was modified to allow for the estimation of runoff from the QUT Carseldine site using the direct rainfall method (see Section 4.6). Sub-catchments 12 and 20 overlap the direct rainfall area, so the area of these sub-catchments was set to zero and the portion of each of sub-catchment outside the direct rainfall area was added to sub-catchment 21, increasing its area from 0.88 km^2 to 1.54 km^2, as illustrated in Figure4.2.

4.3.2 Model Calibration

The URBS model was calibrated as part of the *Cabbage Tree Creek Flood Study* (BCC, 2000) to six historical flow events, as shown in Table 4.3. The calibrated URBS model was adopted for this study. Table 4.1 shows the URBS model parameters adopted by BCC (2000).

Table 4.1 Cabbage Tree Creek Calibrated URBS Model Parameters (BCC, 2000)

URBS Model Parameter	Value
m	0.8
beta	2.0
n	0.8
alpha	0.9
X	0.48

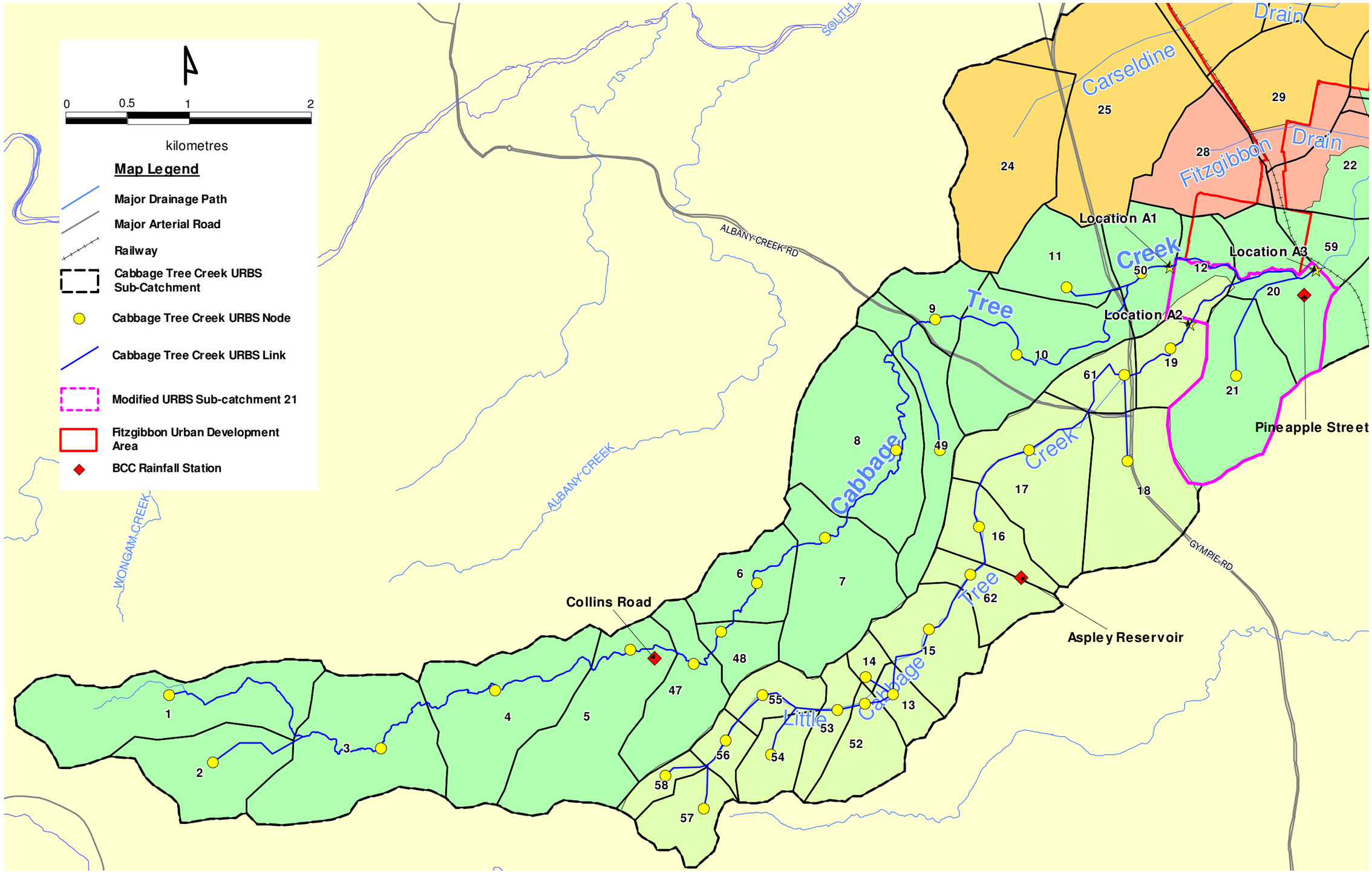


Figure 4.2 Cabbage Tree Creek URBS Model Configuration

Table 4.2 Cabbage Tree Creek URBS Sub-Catchment Areas

URBS Model Sub-catchment				URBS Model Sub-catchment			
ID	Area (km^2)	1996 Urbanisation (U%)	Ultimate Urbanisation (U%)	ID	Area (km^2)	1996 Urbanisation (U%)	Ultimate Urbanisation (U%)
1	1.17	6	40	18	0.89	97	97
2	0.63	80	85	19	0.36	55	94
3	1.18	14	95	20*	0.00	40	65
4	1.14	10	95	21*	1.54	90	92
5	1.02	20	90	47	0.60	24	90
6	0.42	0	100	48	0.24	20	100
7	0.92	15	100	49	0.67	2	100
8	1.28	4	100	50	0.50	50	100
9	0.30	7	100	52	0.35	60	70
10	1.02	30	100	53	0.32	65	100
11	0.60	95	100	54	0.29	17	100
12*	0.00	1	50	55	0.19	80	100
13	0.19	35	40	56	0.13	15	100
14	0.12	65	100	57	0.23	90	100
15	0.60	5	40	58	0.19	10	100
16	0.35	23	90	61	0.28	100	100
17	1.00	89	95				

* Area modified by WRM

Table 4.3 Cabbage Tree Creek URBS Model Calibration Events Adopted by BCC (2000)

Event Date	Peak Water Level at Pineapple Street Gauge (m AHD)	Estimated Peak Discharge [a] (m^3/s)	Approximate ARI Determined by BCC (years)
11 Jan 1974	12.10	103	3
25 Jan 1974	12.76	188	30
10 Mar 1974	12.01	93	3
22 Jun 1983	11.45	51	<2
21 Feb 1992	12.38	134	4
3 Jan 1996	11.64	66	<2

[a] Based on BCC (2000) rating curve

4.3.3 Verification Against 9 March 2001 Event

Following completion of the BCC flood study in 2000, Cabbage Tree Creek experienced a major flood event on 9 March 2001. The March 2001 flood event was used to undertake a joint verification of both the hydrologic and hydraulic models used in the current study.

Table 4.4 shows the total 1 hour, 2 hour, and 3 hour recorded rainfall depths and approximate ARI's at the Aspley Reservoir, Burralong Street, Collins Road and Pineapple Street Alert Rainfall Stations located within the Cabbage Tree Creek catchment. Figure 4.2 shows the location of these alert rainfall stations. Figure 4.3 shows the cumulative rainfall depths at these stations between 1200 hours on 9 March 2001 and 0000 hours on 10 March 2001. The following is of note:

- The estimated ARI of rainfalls recorded in to upper catchment including Aspley Reservoir, Collins Road and Pineapple Street were:
  - Equal to or greater than a 100 year event for the 2 and 3 hour duration storms; and
  - Between a 50 and 100 year event for the 1 hour duration storm;
- The estimated ARI of rainfalls recorded in the lower catchment at Burralong Street was between a 20 and 50 year ARI event for the 1, 2, and 3 hour duration storms.

Table 4.4 Total 1 hour, 2 hour and 3 hour Rainfall Depths and Estimated ARIs at Aspley Reservoir, Burralong Street, Collins Road and Pineapple Street Alert Rainfall Stations

Alert Station Name	1 Hour Rainfall Depth (mm)	2 Hour Rainfall Depth (mm)	3 Hour Rainfall Depth (mm)	Approximate ARI (years)
Aspley Reservoir	96	136	166	greater than 100
Burralong Street	83	121	127	20 to 50
Collins Road	116	152	170	greater than 100
Pineapple Street	101	148	159	greater than 100

The calibrated 1996 land use URBS model was used to estimate discharges along Cabbage Tree Creek for the 9 March 2001 event at the three inflow locations for input into the hydraulic model. Additional catchment development between 1996 and 2001 may have slightly increased peak stormwater discharges, compared to those predicted by the URBS model based on 1996 land use. Calibrating flood levels to the 2001 recorded values using discharges based on 1996 land use is a conservative assumption. To match recorded flood levels, any underestimation of flood discharges will need to be compensated for by increasing hydraulic resistance in the TUFLOW model. As a consequence, the correct (potentially slightly higher) discharges would, if anything, overestimate flood levels.

Initial and continuous losses of 70 mm and 1 mm/hr respectively where adopted for the March 2001 event. Details of the results of the joint model verification are presented and discussed in Section 5.3.

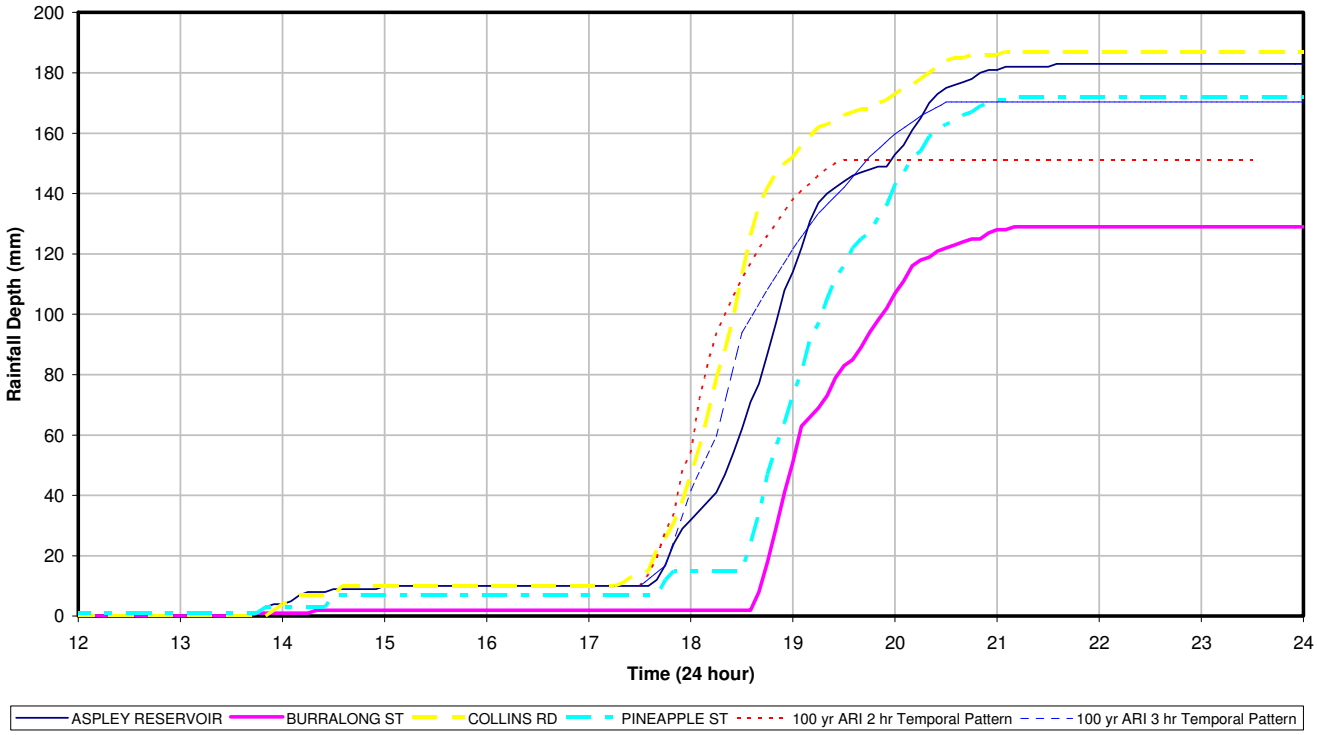


Figure 4.3 March 2001 Cumulative rainfall depths at Aspley Reservoir, Burralong St, Collins Rd, and Pineapple St Rainfall Stations and IEAust (1998) 100 yr ARI two and three hour duration storms

4.3.4 Design Discharges

Table 4.5 shows the adopted 2, 5, 10, 20, 50 and 100 year ARI discharges along Cabbage Tree Creek at Reporting Locations A1, A2 and A3 (see Figure 4.2 for locations). Note that an initial and continuing loss of 0 mm and 0 mm/hr over the entire catchment were adopted for all design events up to the 100 year ARI event.

Brisbane City Council's estimation of design discharges for the Cabbage Tree Creek catchment adopted an in-house methodology to derive design discharges. Using this method, the 100 year ARI discharges were significantly higher than the values shown in Table 4.5. Following discussions with BCC, it was agreed that assessment of development impacts for the UDA development would be undertaken using the 100 year ARI design discharges derived using the industry-standard methodology, but that final development levels would be based on a peak discharge of 264 m^3/s at the North Coast Railway Crossing of Cabbage Tree Creek (compared to 249 m^3/s from the industry standard method). Since zero rainfall losses were used to derive design discharges, the higher value was obtained by factoring up the inflow hydrographs for Cabbage Tree and Little Cabbage Tree Creeks by 1.06 (264/249).

Table 4.5 Cabbage Tree Creek Design Discharges for the 2, 5, 10, 20, 50 and 100 year ARI events at Reporting Locations A1, A2 and A3, Ultimate Catchment Development

ARI (years)	Reporting Location A1 Cabbage Tree Ck @ Dorville Rd Total Discharge (m^3/s)	Reporting Location A2 Little Cabbage Tree Ck @ Zillmere Rd Total Discharge (m^3/s)	Reporting Location A3 Cabbage Tree Ck @ North Coast Railway	
			Total Discharge (m^3/s)	Local Discharge (m^3/s)
2	52.9	35.1	89.1	18.7
5	73.5	48.6	124.3	25.4
10	86.8	57.2	146.8	29.7
20	104.7	68.7	177.4	35.5
50	126.4	83.2	215.8	42.4
100	148.7	96.3	248.9	48.6

4.4 FITZGIBBON DRAIN URBS MODEL

The URBS hydrologic model was used to estimate inflows to Fitzgibbon Drain across the North Coast Railway. The adopted model was based on the "Existing Site" URBS model developed by Storm Water Consulting (2008). The model was modified based on a more detailed assessment of catchment boundaries and flow paths. Discharge hydrographs were produced at two locations (see Figure 4.4):

- Fitzgibbon Drain (Southern Branch) at Balcara Avenue (Location B1); and
- Fitzgibbon Drain (Western Branch) at North Coast Railway (Location B2).

4.4.1 Model Configuration

Figure 4.4 shows the configuration of the Fitzgibbon Drain URBS model. It consists of 17 sub-catchments totalling 70.8 ha. The southern branch has been separated into 8 sub-catchments, and the western-branch into 9 sub-catchments.

Table 4.6 shows the area for each sub-catchment in the model. Areas for sub-catchments 104, 105 and 108 were reduced by WRM to zero because runoff from these sub-catchments was determined using the direct rainfall method (see Section 4.6).

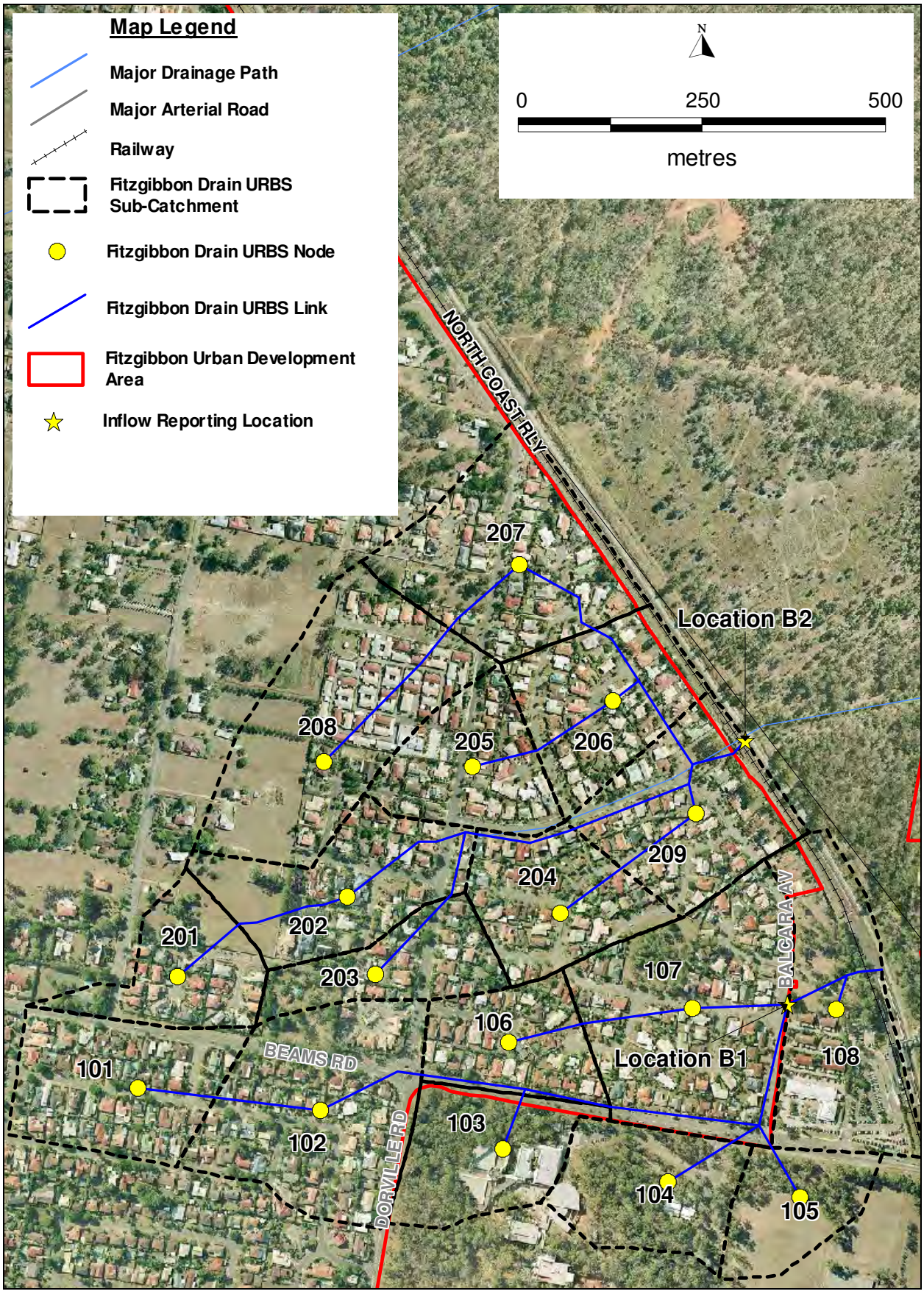


Figure 4.4 Fitzgibbon Drain URBS Model Configuration

Table 4.6 Fitzgibbon Drain URBS Sub-Catchment Areas

Fitzgibbon Drain (Southern Branch) Sub-catchment		Fitzgibbon Drain (Western Branch) Sub-catchment	
ID	Area (ha)	ID	Area (ha)
101	3.85	201	3.54
102	7.90	202	5.09
103	4.31	203	3.00
104*	0.00	204	3.68
105*	0.00	205	3.81
106	3.40	206	6.87
107	7.80	207	6.72
108*	0.00	208	4.89
-	-	209	5.93
TOTAL	**27.26**	**TOTAL**	**43.53**

* Area modified by WRM

4.4.2 Model Calibration

The "Existing Site" URBS model developed by Stormwater Consulting (Storm, 2008) was calibrated to Rational Method discharges for all storms up to the 100 year ARI event. The calibrated model was adopted for this study. The adopted URBS model parameters are shown in Table 4.7.

Table 4.7 Fitzgibbon Drain Calibrated URBS Model Parameters (Storm, 2008)

URBS Model Parameter	Value
m	0.8
beta	2.0
n	0.8
alpha	0.9
X	0.48

4.4.3 Design Discharges

Table 4.8 shows the peak 2, 5, 10, 20, 50 and 100 year ARI design discharges along the Fitzgibbon Drain at Reporting Locations B1 and B2 (see Figure 4.4).

Table 4.8 Fitzgibbon Drain Peak Discharges for the 2, 5, 10, 20, 50 and 100 year ARI events at Reporting Locations B1 and B2

ARI (years)	Reporting Location B1 Balcara Av Discharge (m^3/s)	Reporting Location B2 North Coast Railway Discharge (m^3/s)
2	5.46	7.33
5	7.79	10.57
10	9.28	12.68
20	11.32	15.53
50	14.52	20.02
100	16.79	22.95

4.5 CARSELDINE DRAIN RAFTS MODEL

Figure 4.5 shows the adopted RAFTS model configuration for Carseldine Drain and the adjoining catchment on the northern side of Telegraph Road. The RAFTS model supplied by BCC was originally developed by WBM Oceanics as part of the *Carseldine Drain and Taigum Master Drainage Study* (WBM, 2003). It is understood that City Design is currently undertaking further drainage investigations of the Carseldine Drain and have modified the original WBM (2003) model. Two model scenarios were supplied by City Design:

- "BCC2006Existing2" – this model is referred to as "existing conditions"; and
- "BCC2006Ultimate2_worst case" (Case 3) – this model is referred to as "developed conditions".

Design discharges along Carseldine Drain were determined using the "developed conditions" model at six locations (see Figure 4.2):

- Carseldine Drain at North Coast Railway (Location C1);
- Enbrook Heights Estate Basin West (Location C2);
- Enbrook Heights Estate Basin North (Location C3);
- Enbrook Heights Estate East A at Telegraph Road (Location C4);
- Enbrook Heights Estate East B at Telegraph Road (Location C5); and
- Hydraulics Laboratory Drain at Quinlan Street (Location C6).

The RAFTS model was extended to the east to include the catchment area discharging across Quinlan Street to the Queensland Government hydraulics laboratory. The same model parameters used in the Carseldine Drain model were adopted for the catchment drainage to the hydraulics laboratory.

4.5.1 Model Configuration

Figure 4.5 shows the BCC Carseldine Drain RAFTS model configuration. The model consists of 29 sub-catchment areas:

- 24 sub-catchment areas from the original BCC model upstream of the North Coast Railway and Telegraph Road including:
  - RAFTS sub-catchments 1 to 13 draining to Location C1;
  - RAFTS sub-catchments 16, 19 and 20 draining to Location C2;
  - RAFTS sub-catchments 21 to 27 draining to Location C3;
  - RAFTS sub-catchments 28 draining to Location C4;
- 5 additional urbanised sub-catchment areas were added to the model including:
  - RAFTS sub-catchments 35 and 36 draining to Location C5; and
  - RAFTS sub-catchments 37 to 39 draining to Location C6.

4.5.2 Model Calibration

Table 4.9 shows the area and impervious fraction for each sub-catchment in the model. The pervious fraction initial and continuing loss was 15 mm and 2.5 mm/hr respectively, while the impervious fraction was 0 mm and 0 mm/hr.

No information on the calibration of the RAFTS model was provided by BCC. In the absence of suitable recorded data, the model was calibrated by comparing "developed conditions" RAFTS model peak discharges at the North Coast Railway against the Rational Method discharges. Rational Method discharges were estimated based on the following parameters:

- Time of concentration = 29.2 minutes, comprising:
  - Standard inlet time of 10 minutes,
  - 300 m pipe flow @ 3.0 m/s = 3.33 minutes,
  - 1900 m open channel flow @ 2.0 m/s = 15.83 minutes.
- C10 = 0.8,
- I100 = 147 mm/hr.

A "B_x" factor of 1.1 was adopted to approximately match the RAFTS model 100 year ARI peak discharge (113 m^3/s) to the Rational Method peak discharge of 115 m^3/s.

4.5.3 North Coast Railway Crossing of Carseldine Drain

The substantial area of floodplain storage along Carseldine Drain upstream of the North Coast Railway embankment could have a significant impact in attenuating peak flows along Carseldine Drain. Hence, the railway culverts and upstream storage area were included in the RAFTS model as a detention basin. Stage-storage volumes were calculated from AAMHatch aerial laser survey (ALS) undertaken in 2004. The basin stage-storage characteristics are shown in Table 4.10.

The railway embankment has the following spillway and low level outlet configuration:

- A spillway at an elevation of 12.7 m AHD (Top of rail level),
- Low flow pipes: 3 x 3m (W) x 2.4m (H) box culverts at an invert level of 9.4m AHD,

The results of the RAFTS model confirmed that the railway crossing significantly attenuates peak flows along Carseldine Drain. For the 100 year ARI event, the peak flow along Carseldine Drain is reduced from 113 m^3/s to 56 m^3/s.

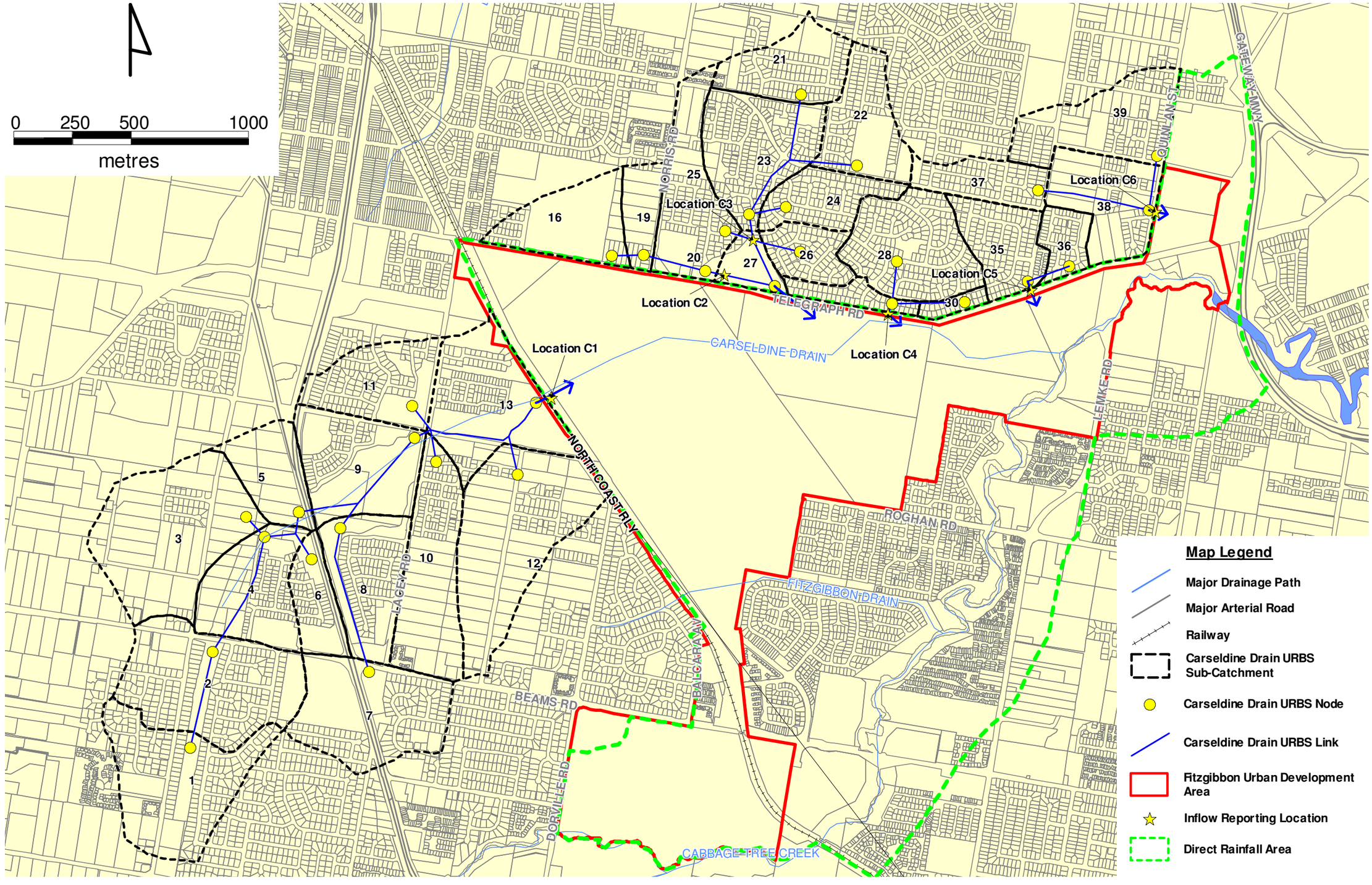


Figure 4.5 Carseldine Drain RAFTS Model Configuration and Extent of TUFLOW Model Direct Rainfall Area

Table 4.9 Carseldine Drain RAFTS Sub-Catchment Areas

RAFTS Sub-catchment				RAFTS Sub-catchment			
ID	Area (ha)	Fraction Impervious (%)	Slope (%)	ID	Area (ha)	Fraction Impervious (%)	Slope (%)
Carseldine Drain – Location C1				*Enbrook Estate Basin North – Location C3*			
1	27.3	0.45	3.0	21	14.5	0.45	8.4
2	31.1	0.45	8.8	22	15.3	0.45	8.0
3	33.0	0.75	2.2	23	20.9	0.45	2.5
4	17.2	0.75	1.9	24	10.4	0.45	4.8
5	10.0	0.75	1.1	25	13.5	0.45	2.9
6	8.4	0.75	1.6	26	7.5	0.26	4.1
7	24.1	0.45	7.2	27_Basin	4.9	0.10	0.5
8	18.0	0.45	1.8	*Enbrook Estate East A – Location C4*			
9	22.0	0.45	1.2	28	20.4	0.45	6.0
10	22.4	0.45	2.5	29_Offline	4.4	0.45	0.7
11	16.2	0.45	1.2	30	2.1	0.45	0.5
12	34.1	0.45	2.6	*Enbrook Estate East B – Location C5*			
13_Rail	25.2	0.45	1.2	35	11.9	0.45	3.0
Enbrook Estate Basin West – Location C2				36	5.5	0.45	1.0
16	15.1	0.45	1.0	*Hydraulics Laboratory – Location C6*			
19	6.7	0.45	2.0	37	9.3	0.45	1.7
20	6.2	0.6	1.3	38	16.5	0.45	1.0
				39	19.2	0.45	3.0

Table 4.10 Adopted Stage-Storage Curve for the North Coast Railway Embankment

Stage (m AHD)	Surface Area (m^2)	Volume (m^3)
9.5	0	0
10.0	191	27
10.5	3069	625
11.0	35442	9488
11.5	89468	39986
12.0	140366	97597
12.5	191759	179797
13.0	255706	292086

4.5.4 Design Discharges

Table 4.11 shows the peak 2, 5, 10, 20, 50 and 100 year ARI discharges at Reporting Locations C1, C2, C3, C4, C5 and C6. These flows include the attenuation provided by the railway embankment.

Table 4.11 Carseldine Drain Design Discharges for the 2, 5, 10, 20, 50 and 100 year ARI events at Reporting Locations C1 to C6

ARI (years)	Design Discharge (m^3/s)					
	Location C1 North Coast Railway	Location C2 Telegraph Rd Basin West	Location C3 Telegraph Rd Basin North	Location C4 Telegraph Rd West	Location C5 Telegraph Rd East	Location C6 Quinlan St
2	27.5	6.8	12.2	5.2	3.3	6.7
5	35.5	9.5	18.6	7.6	4.7	9.6
10	39.5	11.2	22.6	9.1	5.6	11.7
20	44.9	13.5	28.3	11.2	6.8	14.3
50	50.9	15.9	34.0	13.2	8.1	16.9
100	55.8	18.3	39.8	15.5	9.4	19.7

4.6 DIRECT RAINFALL

Figure 4.5 shows the TUFLOW model direct rainfall area. The TUFLOW direct rainfall method was used to determine the local runoff volumes within the Fitzgibbon UDA study area. The total rainfall depth at each time step is applied to all active cells within the rainfall boundary polygon. Initial and continuing losses are subtracted from the total depth of rainfall and the residual rainfall depth is converted to runoff.

Table 4.12 shows the impervious fraction and initial and continuing losses adopted for the land uses in the TUFLOW model. Aerial photographs of the area were used to determine the spatial location of the changes in land use. The losses were calculated based on a weighted average of the pervious and impervious fractions.

Under Application 1 and Final development conditions the proposed areas for development were modelled as Residential and High Density Residential/Commercial land uses.

Table 4.12 Adopted Land Use Fraction Impervious and Initial and Continuing Losses within the TUFLOW Model Direct Rainfall Area

Description	Fraction Impervious (%)	Initial Loss (mm)	Continuing Loss (mm/hr)
Pervious Areas	0	15	2.50
Railway Corridor	50	8	1.25
Residential	60	6.6	1.00
High Density Residential/Commercial	90	2.4	0.25
Major Road/Carpark	100	1	0.00

5 EXISTING CONDITIONS HYDRAULIC ANALYSIS

5.1 OVERVIEW

The TUFLOW fully two-dimensional hydrodynamic model (WBM, 2008) was used to estimate the 2, 5, 10, 20, 50, and 100 year ARI flood levels along Cabbage Tree Creek, Fitzgibbon Drain and Carseldine Drain across the Fitzgibbon UDA site. TUFLOW estimates flood levels on a fixed grid pattern by solving the full two-dimensional depth averaged momentum and continuity equations for free surface flow. The model automatically calculates breakout points and flow directions within the study area. A two dimensional model was considered more appropriate for the study given the complex interaction of flows between the creek, its tributaries and overbank areas.

Figure 5.1 shows the boundary extent of the Cabbage Tree Creek TUFLOW model. Model inflows were estimated as described in Section 4. Local rainfall was applied directly to the TUFLOW surface across the study area (including the development site) to account for local catchment runoff. The recorded 2001 flood event data at Pineapple Street gauge (Station No. 540122) was used to verify the estimated Cabbage Tree Creek flood levels.

5.2 MODEL CONFIGURATION

Figure 5.1 shows the extent of the Cabbage Tree Creek TUFLOW model and the location of the 2D inflow and outflow boundaries. The hydraulic model study area covers approximately 6.50 km^2 including:

- 5.24 km of Cabbage Tree Creek from the Dorville Road crossing to the Gateway Motorway crossing;
- 2.45 km of Carseldine Drain from the railway to its confluence with Cabbage Tree Creek; and
- 1.20 km of Fitzgibbon Drain from the railway to its confluence with Cabbage Tree Creek.

A 5 m grid size and a 2.5 second time step were adopted for the Cabbage Tree Creek model.

A one-dimensional reach was added downstream of the Gateway Motorway, based on cross-sections obtained from the Brisbane City Council MIKE 11 model (BCC, 2000).

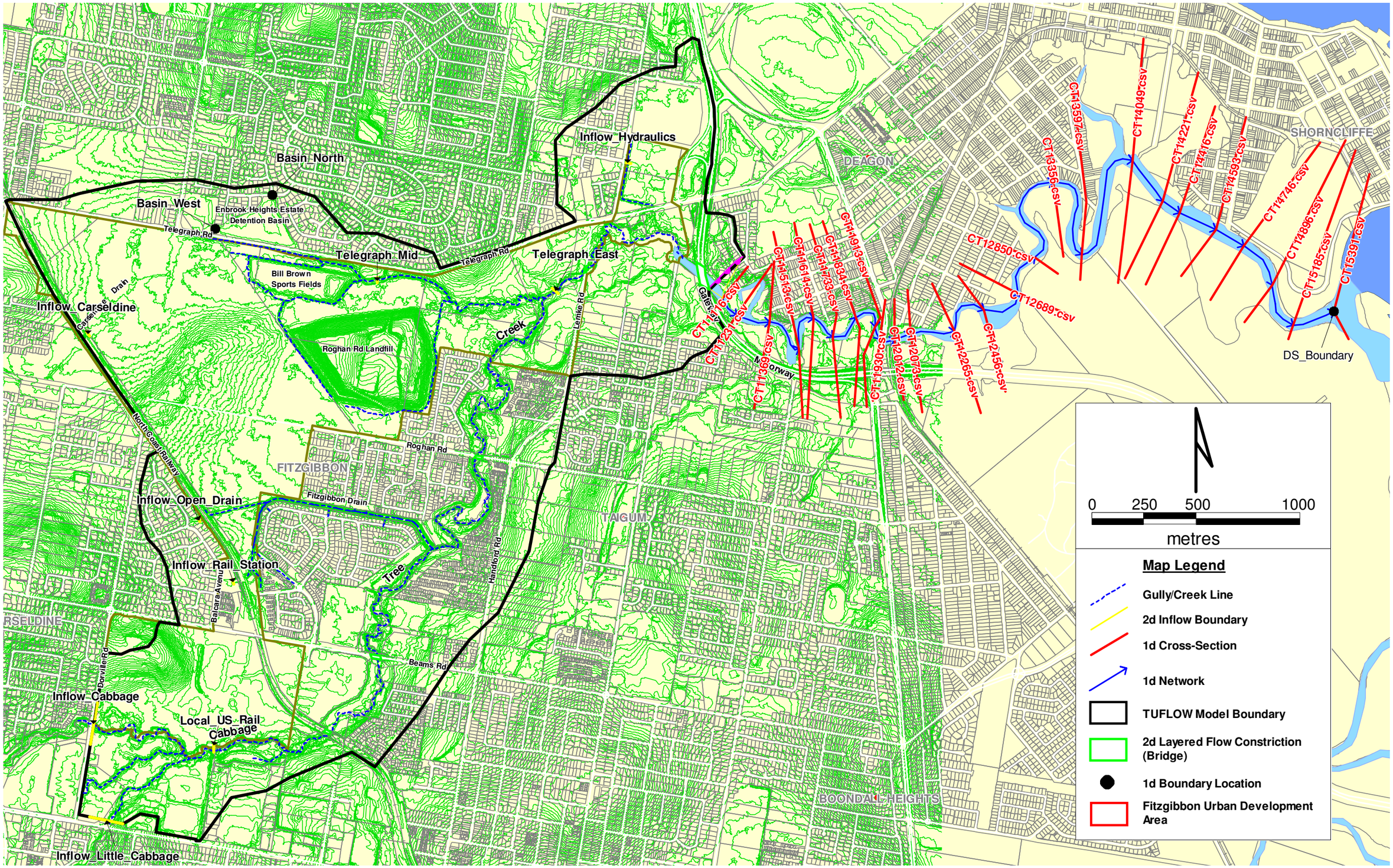


Figure 5.1 Cabbage Tree Creek TUFLOW Model Configuration

5.2.1 Topographic Data

Topographic data for the study area was provided by AAMHatch Pty Ltd. The following is of note:

- The survey was conducted using airborne laser survey (ALS);
- The survey was undertaken in June 2002; and
- The survey has a vertical accuracy of 0.15 m rms and a horizontal accuracy of 0.5 m rms.

Additional detailed ground survey, provided by Wolter Consulting Group, was used to supplement the ALS data. The detailed ground survey covered the following topographic features in the study area:

- the Fitzgibbon Drain invert and top of bank between the railway and Cabbage Tree Creek;
- the Beams Road crest level to the west of the North Coast Railway adjacent to the QUT Carseldine site; and
- the North Coast Railway top of rail level between Carseldine Station and Cabbage Tree Creek.

A number of new developments have been built in the study area since the aerial survey was undertaken. These developments have modified ground levels within the Cabbage Tree Creek floodplain. Where survey was available, these new development areas were included in the surface digital elevation model (DEM).

5.2.2 Hydraulic Roughness

Table 5.1 shows the Manning's 'n' values adopted for the land use and creek reaches in the TUFLOW model. An ortho-photograph of the area was used to determine the spatial location of the changes in land use and vegetation characteristics along the creek banks and the over bank areas. A site visit in September 2008 was used to assess the characteristics of the channel and riparian zone vegetation. The Manning's 'n' values for each land use description and creek section were first estimated according to guidelines given in Chow (1959) and subsequently revised during model calibration. Figure A1, Appendix A shows the roughness map in the TUFLOW study area.

Table 5.1 Adopted Manning's 'n' Values

Description	Manning's 'n'
Cabbage Tree Creek (Vegetated)	0.15
Fitzgibbon Drain (Grassed/Vegetated)	0.045/0.09
Carseldine Drain Channel along Telegraph Rd	0.055
Vegetation	0.10
Parks and Open Space	0.035
Roads and Car Parks	0.025
Power Link Easement	0.045

5.2.3 Hydraulic Structures

Five major bridge structures that cross Cabbage Tree Creek were added as layered flow constrictions within the 2D domain at the following locations:

- Gateway Motorway;

- Lemke Road;
- Roghan Road;
- Beams Road; and
- North Coast Railway.

Table 5.2 shows the adopted bridge characteristics at each crossing. Table 5.3 shows the adopted blockage factor and form loss co-efficient (FLC) within each layer at each structure. Four layers represent the flow across a bridge structure:

- Layer 1 represents the waterway area beneath the bridge deck;
- Layer 2 represents the bridge deck;
- Layer 3 represents the guard rail; and
- Layer 4 represents flow above the bridge (assumed to be unimpeded).

Note that Beams Road was not modelled as a 1D culvert crossing due to stability issues. The verification of the model against the March 2001 event (see section 5.3) shows that the layered flow constriction method provides a good representation of the flood behaviour across the Beams Road crossing.

Table 5.2 Adopted Bridge Crossing Properties

Description	Gateway Motorway	Lemke Road	Roghan Road	Beams Road	North Coast Railway
Bridge Deck Level (m AHD)	5.0	3.7	8.6	12.0	14.0
Deck Depth (m)	1	0.4	0.6	1.0	0.5
Approximate Bed Level (m AHD)	-1.18	-0.42	2.80	7.40	8.5
Guard Rail Height (m)	N/A	1.4	1.2	1.0	1.2
Bridge Length (m)	67.7	28.0	34.0	37.6	27.0
Number of Piers	11	1	1	9	3
Pier Diameter (m)	0.4	0.75	0.6	0.18	1.2
Approx Distance between Piers (m)	6.15	14	17	3.78	10.0

N/A - Not Applicable

Table 5.3 Layered Flow Constriction Properties, Cabbage Tree Creek Bridge Structures

Description	Gateway Motorway	Lemke Road	Roghan Road	Beams Road	North Coast Railway
Layer 1 Blockage	20	3	1	3	10
Layer 1 FLC[a]	0.3	0.1	0	0.1	0.2
Layer 2 Blockage	100	100	100	100	100
Layer 2 FLC[a]	0.3	0.2	0.05	0.3	0.3
Layer 3 Blockage	0	0	0	0	0
Layer 3 FLC[a]	0	0	0	0	0

[a] The FLC (ξ_a) is a calibration factor applied as an energy loss based on the equation: $\Delta h = \xi_a \frac{V^2}{2g}$

5.2.4 Inflow Boundaries

Table 5.4 shows the locations of the inflow and outflow boundaries in the TUFLOW model. The hydrological models (see Section 4) used to derive inflow hydrograph shape and the TUFLOW boundary type at each inflow location is also shown in Table 5.4, along with the 100 year ARI peak inflow discharge.

Table 5.4 TUFLOW Inflow Boundaries

Reporting Location	TUFLOW ID	Boundary Type	Hydrological Model		Q100 Peak Inflow (m^3/s)
			Name	Node ID	
A1	Inflow_Cabbage	Total Flow	BCC_URBS	50	148.7
A2	Inflow_Little_Cabbage	Total Flow	BCC_URBS	19	96.3
A3	Local_US_Rail	Local Flow	BCC_URBS	21	48.6
B1	Inflow_rail_station	Total Flow	Storm_URBS	107	16.79
B2	Inflow_open_drain	Total Flow	Storm_URBS	209	22.95
C1	Inflow_carseldine	Total Flow	BCC_RAFTS	13_Rail	55.8
C2	Basin_West	Total Flow	BCC_RAFTS	20	18.3
C3	Basin_North	Total Flow	BCC_RAFTS	27_Basin	39.8
C4	Telegraph_Mid	Total Flow	BCC_RAFTS	30	15.5
C5	Telegraph_East	Total Flow	WRM_RAFTS	36	9.4
C6	Inflow_Hydraulics	Total Flow	WRM_RAFTS	39	19.7

5.2.5 Outflow Boundaries

For the downstream boundary of the 2D model, a one dimensional channel with cross sections from the BCC (2000) MIKE 11 model was extended 3km to the west of the 2D model to the mouth of Cabbage Tree Creek. A constant tailwater level of 1.75 m AHD was used at the downstream boundary of the 1D channel for all ARIs.

5.2.6 1D Network

Stormwater culverts and major stormwater pipe networks were embedded within the 2D domain of the TUFLOW model. Table B1, Appendix B shows the hydraulic characteristics for each pipe in the model. Figure B1, Appendix B shows the locations of the 1D pipes in the TUFLOW model. The ESTURY 1D hydraulic model, a built-in feature of TUFLOW, was used to undertake the hydraulic calculations of structures within the 1D domain. Minor stormwater pipes were not included in the model.

5.3 MODEL CALIBRATION

5.3.1 Overview

A substantial amount of recorded flood data is available for the Cabbage Tree Creek catchment. However, recent development of the floodplain, as well as numerous upgrades to bridge and culvert crossings in the 1990s, has changed flood behaviour in the area of interest. The March 2001 event is the largest flood on record in the Cabbage Tree Creek catchment and it also occurred after most of the significant changes to the floodplain and hydraulic structures along

the creek. For this reason, the TUFLOW model was calibrated against the March 2001 flood event.

The TUFLOW model was calibrated by matching recorded water levels at the Pineapple Street stream gauge as well as Maximum Height Gauge (MHG) levels at Beams Road and Lemke Road for the March 2001 flood event. Debris levels were also recorded on the downstream side of Dorville and Rogan Roads. The water level data allows for a reasonable calibration of the Cabbage Tree Creek channel roughness characteristics. However, there is no data for the Fitzgibbon Drain or Carseldine Drain.

Model inflows for the calibration event were obtained from the hydrologic models described in Section 4, using recorded rainfalls for the March 2001 event. No revision to the model calibration of the hydrologic models was undertaken.

The current bridge configurations along Cabbage Tree Creek were upgraded prior to the March 2001 event. Hence no changes were required to the hydraulic characteristics of these structures.

5.3.2 March 2001 Recorded Rainfall Depths

Rainfall depths were recorded at 4 rainfall gauges within the Cabbage Tree Creek Catchment. The estimated ARI for the event was greater than 100 years based on rainfall data given in Australian Rainfall and Runoff (IEAust, 1998). See Section 4.3.3 for more details.

5.3.3 Pineapple Street Gauge

Figure 5.2 shows the recorded water levels at the Pineapple Street gauge and the TUFLOW model predicted water levels for the March 2001 event. Note that the recorded water levels at the Pineapple Street gauge have been increased by 0.628 m to account for a change in the datum of the gauge which may have been due to sewer construction in about 1987 (see Section 5.3 of BCC 2000). The peak water level predicted by the TUFLOW model (13.43 m AHD) is about 0.21 m higher and occurs about an hour earlier than the recorded water level at the gauge (13.22 m AHD).

Anecdotal information obtained by the ULDA indicates that during the March 2001 event, floodwaters from Cabbage Tree Creek overtopped Beams Road upstream of the North Coast Railway and flowed north inundating the Carseldine railway station car park (Phillip Kohn; email sent 7 Apr 2009). Recent detailed ground survey of levels along Beams Road in the vicinity of the railway crossing indicates a minimum road level of about 13.23 m AHD. Hence, the peak water level of 13.43 mAHD predicted by the TUFLOW model is sufficient to overtop the road, consistent with observed flooding behaviour.

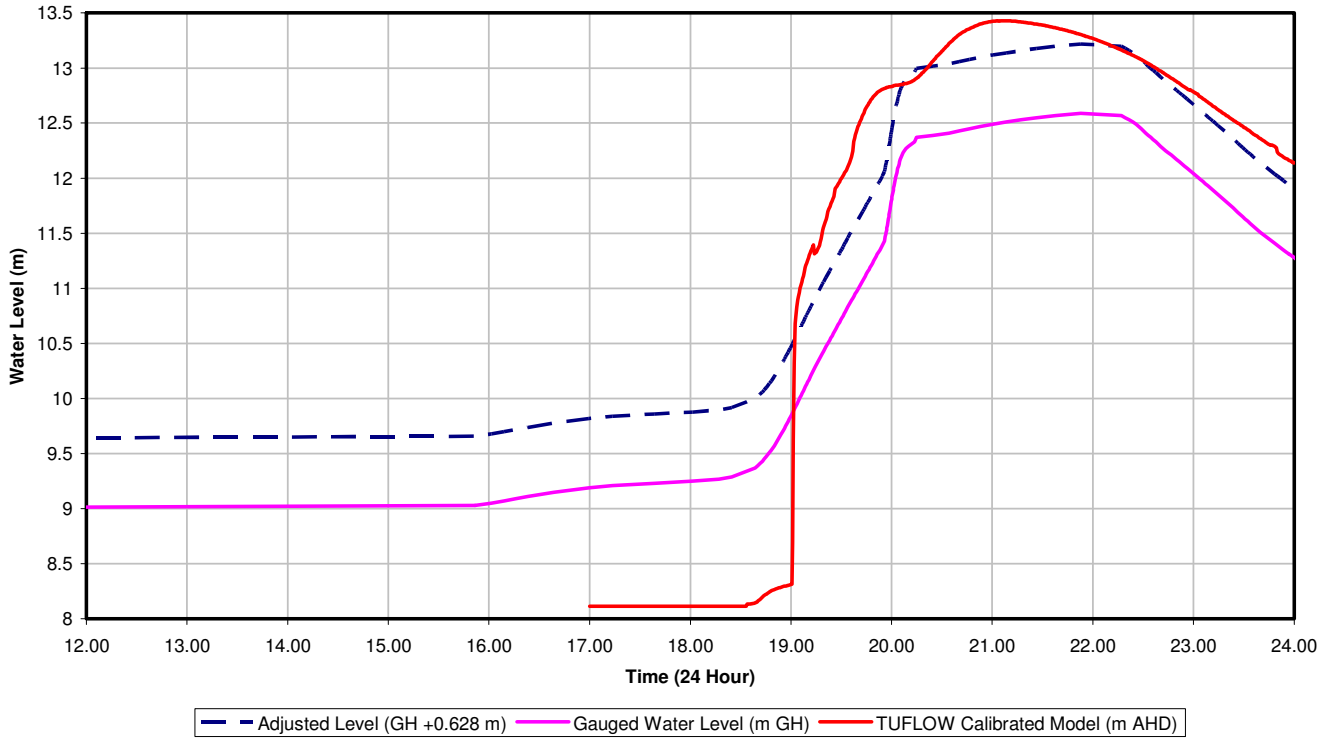


Figure 5.2 Pineapple Street Gauge Recorded Water Level and Adjusted Recorded Water Level Vs Predicted TUFLOW Model Water Levels, 9 March 2001 Calibration Event

5.3.4 March 2001 Peak Water Levels

Figure 5.3 shows a longitudinal section plot of Cabbage Tree Creek and March 2001 predicted and recorded peak water levels across the study area. Table 5.5 shows the peak water levels recorded at a number of locations along Cabbage Tree Creek within the study area. It is noted that:

- The predicted flood level peaks are generally within 0.30 m of the recorded flood level peak, except upstream of Lemke Road where the predicted water level is 0.37m higher than recorded levels; and
- Overall, the calibration of Cabbage Tree Creek across the study area is considered reasonable. It is expected that the Cabbage Tree Creek model will provide reasonable estimates of Cabbage Tree Creek design flood levels across the Fitzgibbon UDA.

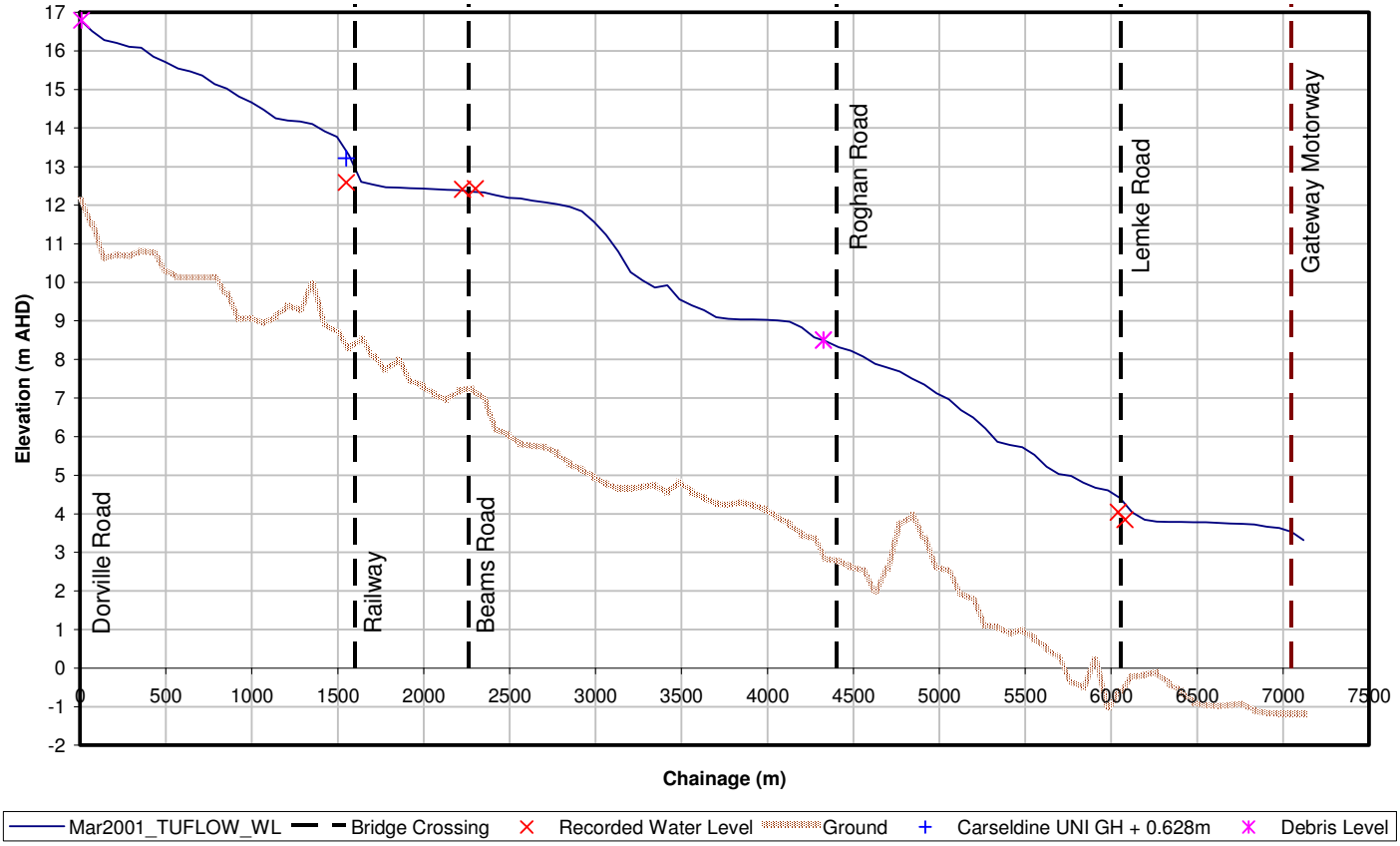


Figure 5.3 Cabbage Tree Creek Long Section Predicted and Recorded Peak Water Level, March 2001 Flood Level

Table 5.5 Recorded and Predicted Peak Water Levels, March 2001 flood event.

Location	Recorded Peak Level (m AHD)	Predicted Peak Level (m AHD)	Difference Difference in Peak Level (m)
Downstream of Dorville Road	16.79	16.81	+0.02
Pineapple Street Gauge	13.22[a]	13.43	+0.21
Upstream of Beams Road	12.41	12.39	-0.02
Downstream of Beams Road	>12.46	12.35	-0.11
Upstream of Roghan Road	8.5	8.46	-0.04
Upstream of Lemke Road	4.04	4.41	+0.37
Downstream of Lemke Road	3.83	4.04	+0.21

[a] Based on recorded Gauge Level + 0.628 m

5.4 MODEL RESULTS FOR EXISTING CONDITIONS

Figure 5.4 shows the estimated 100 year ARI flood depths and water level reporting locations in the study area for existing conditions, prior to development of the UDA. Figure 5.5 shows the 100 year ARI flood extent and 1m flood contours. Note that the hydrologic analysis is based on full development of the Cabbage Tree Creek catchment upstream of the UDA.

The 100 year ARI flooding behaviour in the study area can be summarised as follows:

- Cabbage Tree Creek overflows from its banks upstream of the North Coast Railway in a northerly and easterly direction across the eastern QUT Carseldine site.
  - The northerly flowing water overtops Beams Road and inundates the Carseldine Railway Station car park and before draining through culverts under the railway to Fitzgibbon Drain.
  - The easterly flowing water overtops the North Coast Railway (initial flow through the ballast underneath the rails may occur) and flows across the existing wreckers yards to a maximum depth of 0.4 m before flowing along Beams Road to rejoin Cabbage Tree Creek on the northern side of Beams Road.
- Beams Road is inundated for a length of 850 m up to a maximum depth of 0.7 m.
- Cabbage Tree Creek overflows from its left bank between The Big Easy Golf Range and Fitzgibbon drain, potentially affecting properties along Marigold Cl, Iris Pl, Azalea Cr, and Jarrah Pl. A natural levee hydraulically separates the Cabbage Tree Creek left bank from its main channel and right bank, as shown in Figure 5.6, resulting in flood level differences of up to 0.8 m higher on the left bank at the downstream end of this reach;
- Downstream of the confluence of the southern and western branches of Fitzgibbon drain, the peak water levels are dominated by Cabbage Tree Creek floodwaters;
- Fitzgibbon Drain overflows from its banks at Reporting Location FITZ_04 in a northerly direction across the proposed Application 1 development area along a wide and shallow flow path to a large area of undeveloped, low-lying land next to the Roghan Road landfill. Water is impounded behind the south-western landfill wall to depths of up 0.8 m within a triangular shaped storage area. Outflows from this storage area split in a northerly and easterly direction:
  - The northerly flowing water drains to Carseldine Drain adjacent to the Bill Brown Sports field;
  - The easterly flowing water splits on the southern side of the Roghan Road landfill into a northerly and easterly direction. The easterly flowing water overtops Roghan Road to Cabbage Tree Creek. The northerly flowing water is collected by a grassed drain along the eastern side of the Roghan Road landfill to Carseldine Drain 500 m downstream of the Bill Brown Sports Fields;
- Along Carseldine Drain between the railway culverts and the Bill Brown Sports field, water flows overland along a wide and shallow flowpath reaching depths of up to 1 m. Carseldine Drain overflows Telegraph Road in a northerly direction at a number of locations:
  - West of the Bracken Ridge Plaza Shopping Centre.
  - Into the south-western corner of the Enbrook Heights Estate Detention Basin. The northerly flowing water then turns eastward across the detention basin area before overflowing Telegraph Road a second time in the south-eastern corner of the detention basin, where the basin spillway is located, and rejoining Carseldine Drain.

- Telegraph Road is inundated for a length of 900 m up to a maximum depth of 0.8 m.

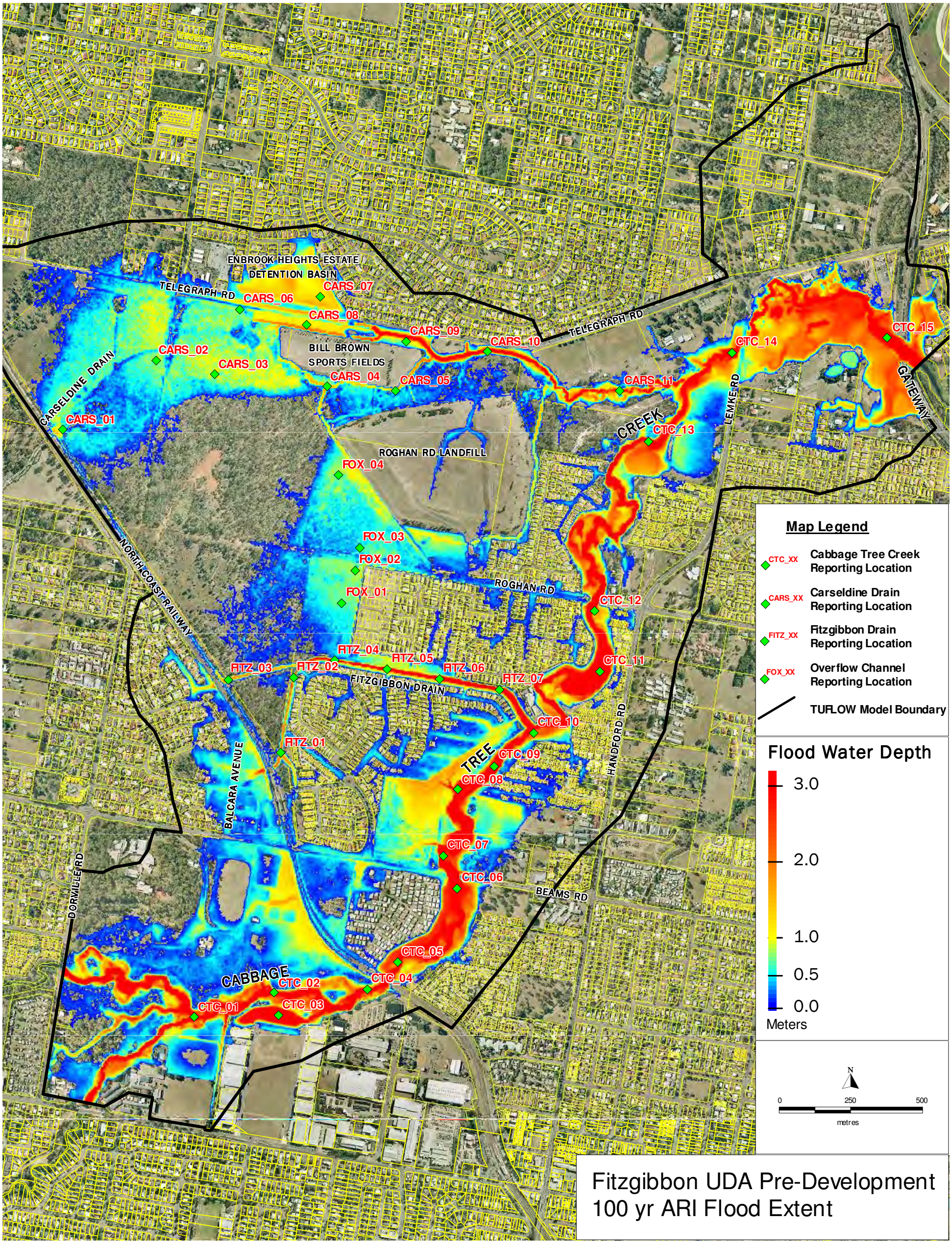


Figure 5.4 Pre-Development 100 year ARI Flood Extent and Reporting Locations, Fitzgibbon UDA site

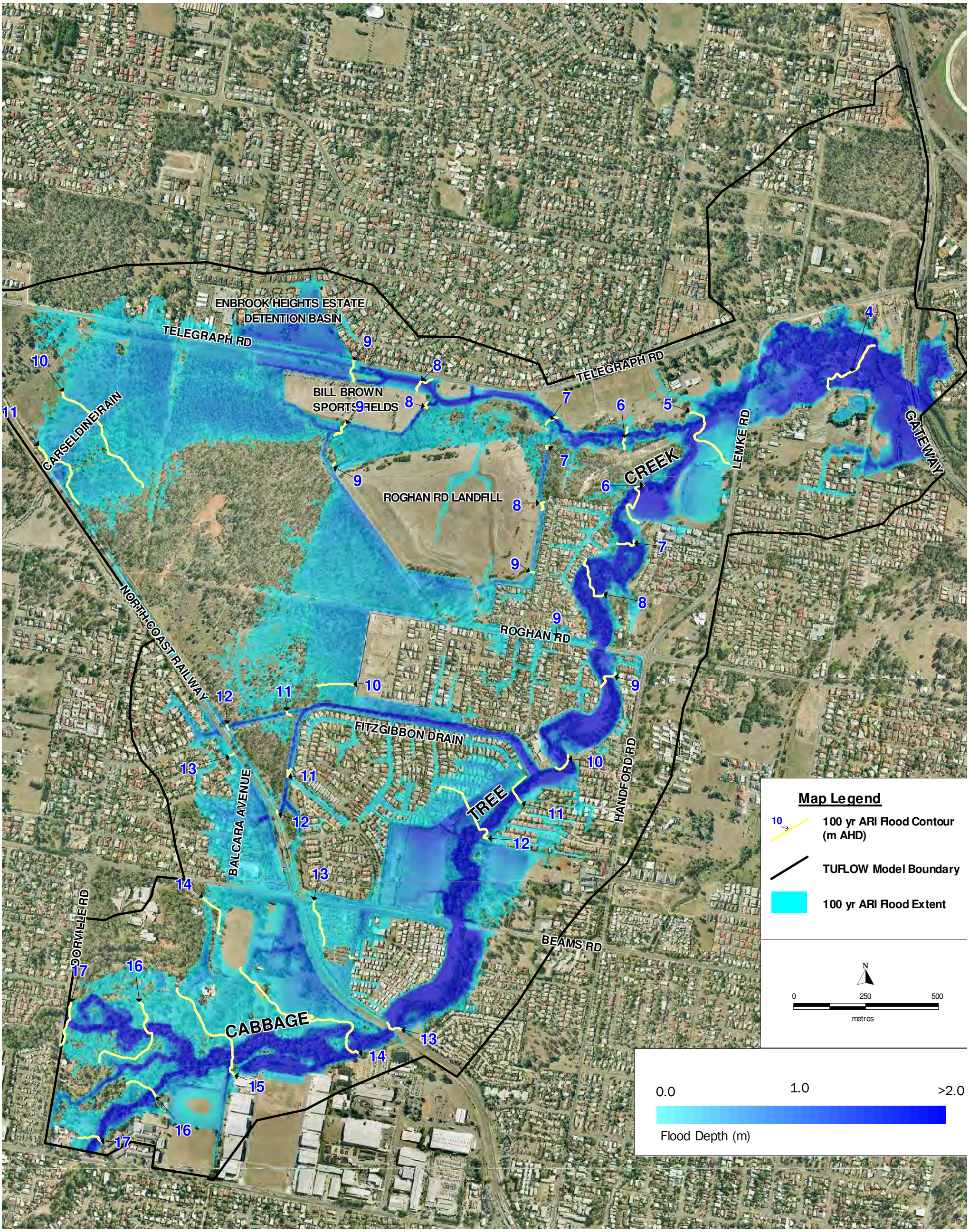


Figure 5.5 Pre-Development Cabbage Tree Creek 100 Year ARI Flood Extent and Flood Contours, Fitzgibbon UDA Site

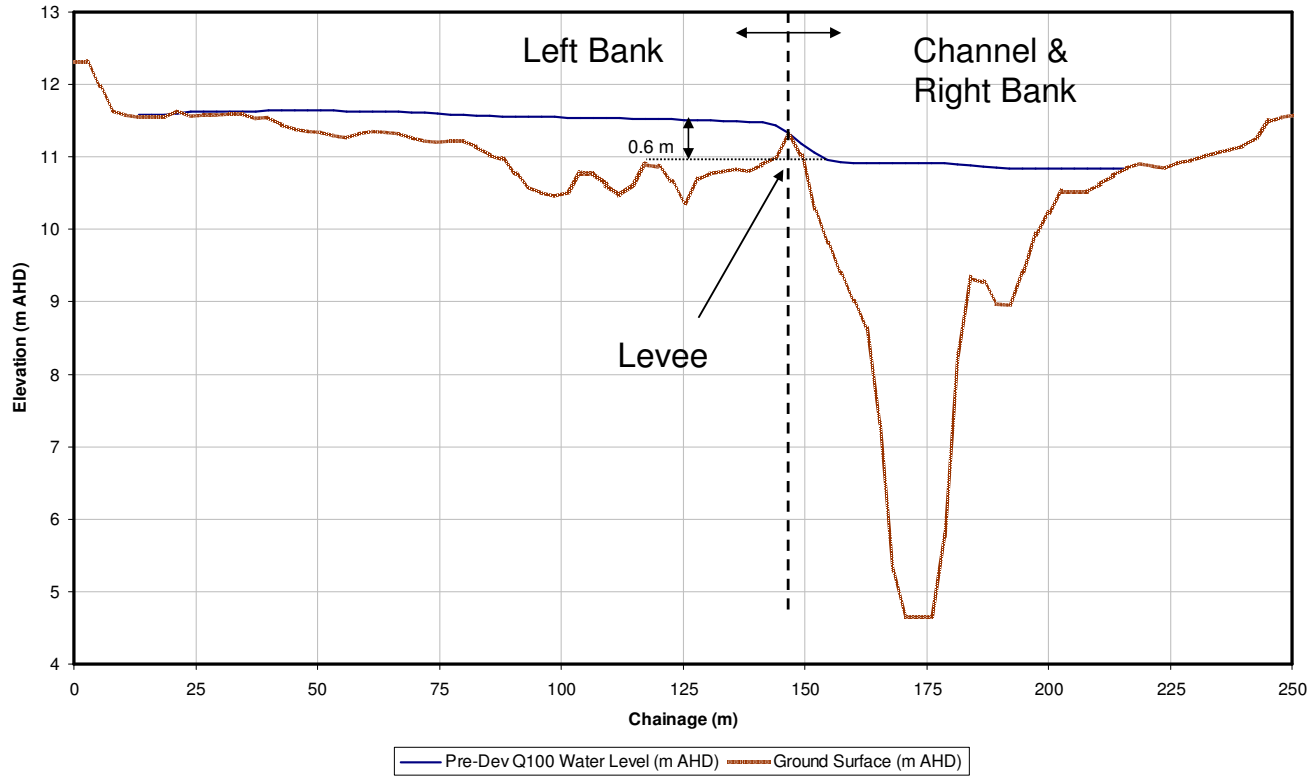


Figure 5.6 Typical Cabbage Tree Creek Cross Section between the Driving Range and Fitzgibbon Drain and 100 year ARI pre-development flood level

Table 5.6 shows the 2, 10, and 100 year ARI flood levels at a number of reporting locations within the study area (see Figure 5.4). The following is of note:

- 100 year ARI peak flood levels along Cabbage Tree Creek at the QUT Carseldine site range from 17.00 m AHD at Dorville Road (upstream end) to 13.71 m AHD at the North Coast Railway crossing;
- 100 year ARI peak flood levels along Fitzgibbon Drain at the Fitzgibbon UDA Application 1 development area range from 11.76 m AHD, and 11.93 m AHD in the southern and western branches, respectively, of the Fitzgibbon Drain (upstream end) to 10.47 m AHD at the downstream end;
- 100 year ARI peak flood levels along Carseldine Drain across the DoH land range from 11.65 m AHD at the railway culverts to 9.19 m AHD at the Bill Brown Sports Field;
- 100 year ARI peak flood levels across the wreckers yard range from 13.12 m AHD at the Railway to 12.85 m AHD at the downstream boundary;
- 100 year ARI peak flood levels along Balcara Avenue range from 13.38 m AHD at Beams Road to 13.35 m AHD at the North Coast Railway culverts;
- Beams Road is overtopped from Cabbage Tree Creek upstream of the North Coast Railway for ARI's equal to and greater than a 20 year event;
- The North Coast Railway is overtopped from Cabbage Tree Creek for ARI's equal to and greater than a 20 year event;
- Fitzgibbon Drain breaks its banks at Reporting Location FITZ_04 across the Application 1 area for ARI's equal to and greater than a 50 year event;
- Telegraph Road is overtopped from Carseldine Drain at the Enbrook Heights Estate Detention Basin for ARI's equal to and greater than a 5 year event.

Table 5.6 Existing Conditions TUFLOW Model 2, 10, and 100 yr ARI Flood Levels, Fitzgibbon UDA

Reporting Location	Pre-Development Conditions Peak Flood Level (m AHD)		
	2 yr ARI	10 yr ARI	100 yr ARI
CARS_01	11.43	11.54	11.65
CARS_02	9.39	9.46	9.55
CARS_03	8.97	9.09	9.24
CARS_04	8.84	8.93	9.08
CARS_05	8.32	8.44	8.58
CARS_06	8.92	9.02	9.19
CARS_07	8.03	8.85	9.15
CARS_08	8.66	8.85	9.15
CARS_09	7.10	7.52	8.01
CARS_10	6.71	7.07	7.47
CARS_11	5.28	5.59	5.96
CTC_01	14.52	15.06	15.48
CTC_02	13.59	14.13	14.47
CTC_03	13.39	14.00	14.37
CTC_04	12.65	13.27	13.71
CTC_05	11.74	12.30	12.65
CTC_06	11.61	12.17	12.50
CTC_07	11.50	12.02	12.38
CTC_08	10.99	11.62	12.11
CTC_09	10.43	11.01	11.56
CTC_10	9.30	9.70	10.31
CTC_11	8.10	8.58	9.26
CTC_12	7.52	7.97	8.69
CTC_13	4.91	5.37	5.95
CTC_14	4.15	4.37	4.69
CTC_15	2.57	3.06	3.90
FITZ_01	11.06	11.28	11.77
FITZ_02	9.81	10.05	10.62
FITZ_03	11.38	11.66	11.92
FITZ_04	9.35	9.76	10.47
FITZ_05	9.36	9.77	10.46
FITZ_06	9.34	9.76	10.46
FITZ_07	9.34	9.76	10.44
FOX_01	9.31	9.41	9.78
FOX_02	9.31	9.41	9.76
FOX_03	9.25	9.39	9.71
FOX_04	9.21	9.39	9.70

6 ASSESSMENT OF DEVELOPMENT IMPACTS – APPLICATION 1, 253 TELEGRAPH ROAD

6.1 PROPOSED DEVELOPMENT CONFIGURATION

Figure 6.1 shows the proposed Application 1 development on the DoH land. The following is of note:

- Application 1 will be developed in four stages and subdivided into approximately 152 lots varying in size from 250 m^2 to 1282 m^2.
- A detention basin (Db_1) will be constructed along the south-western side of the Roghan Road Landfill. An embankment (Le_2) will be constructed and low-flow culverts will be placed along the south-east and north boundary of the basin area.
- A 50 m wide overflow channel will be constructed from the Fitzgibbon Drain to the Roghan Road Landfill Detention Basin to the north. The purpose of this channel is to replicate the overflow of floodwaters from Fitzgibbon Drain to the north, as occurs under existing conditions.
- Box culverts will be placed at the northern end of the overflow channel across the proposed Roghan Road crossing. Rogan Road will be ramped up from its existing intersection with Odense Street to the culvert crossing.
- The western branch of Fitzgibbon Drain will be modified from the North Coast Railway to its confluence with the southern branch of Fitzgibbon Drain.
- Two culvert crossings will be placed under the proposed Carselgrove Avenue along the southern and western Fitzgibbon Drain branches;

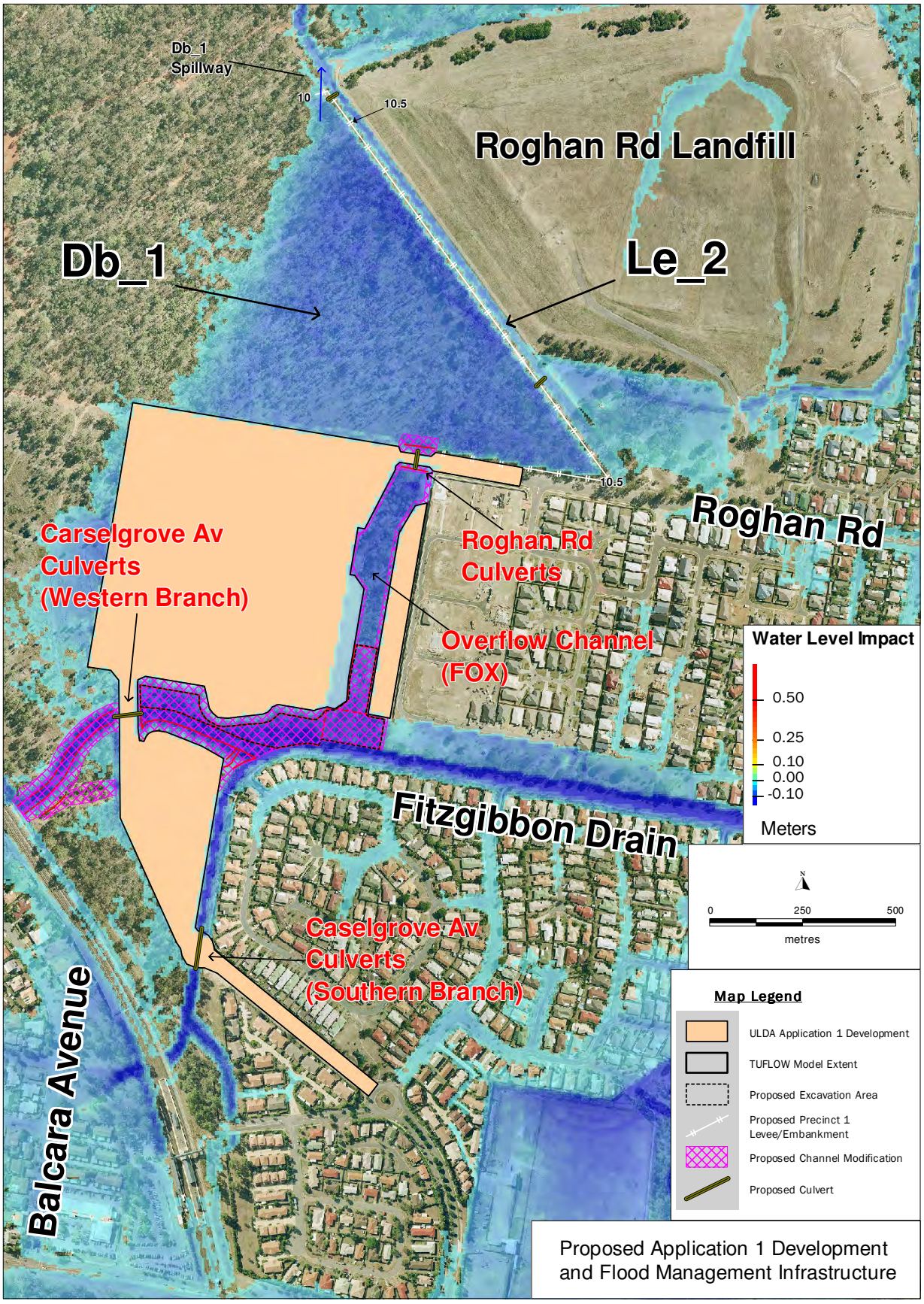


Figure 6.1 Proposed Fitzgibbon UDA Application 1 Development Extent

6.2 PROPOSED FLOOD MITIGATION INFRASTRUCTURE

6.2.1 Roghan Road Landfill Detention Basin

Figure 6.2 shows the Roghan Road Landfill Detention basin (Db_1) configuration. The detention basin will ensure that peak stormwater discharges from the development are not increased.

The basin storage area will be bounded by the Roghan Road Landfill to the north-east, Roghan Road to the south and a hill to the west. A flood protection bund (Le_2) will be constructed and low-flow culverts will be placed along the south-east and north-eastern sides of the basin to formalise the detention area. The ground surface within the detention basin will remain unaltered and the existing vegetation will remain. The basin stage-storage characteristics are shown in Table 4.10.

Table 6.1 Adopted Stage-Storage Curve – Roghan Road Landfill Detention Basin

Stage (m AHD)	Surface Area (m^2)	Volume (m^3)
8.0	0	0
8.5	370	20
9.0	26000	4200
9.5	102000	38000
10.0	115000	93000
10.5	126000	154000

The detention basin has the following spillway and low level outlet configuration:

- A 50 m wide spillway at an elevation of 10.0 m AHD;
- North wall low flow pipe: 1 x 0.9 m pipe at an invert level of 8.42 m AHD; and
- South-east wall low flow pipe: 1 x 0.9 m pipe at an invert level of 8.8 m AHD.

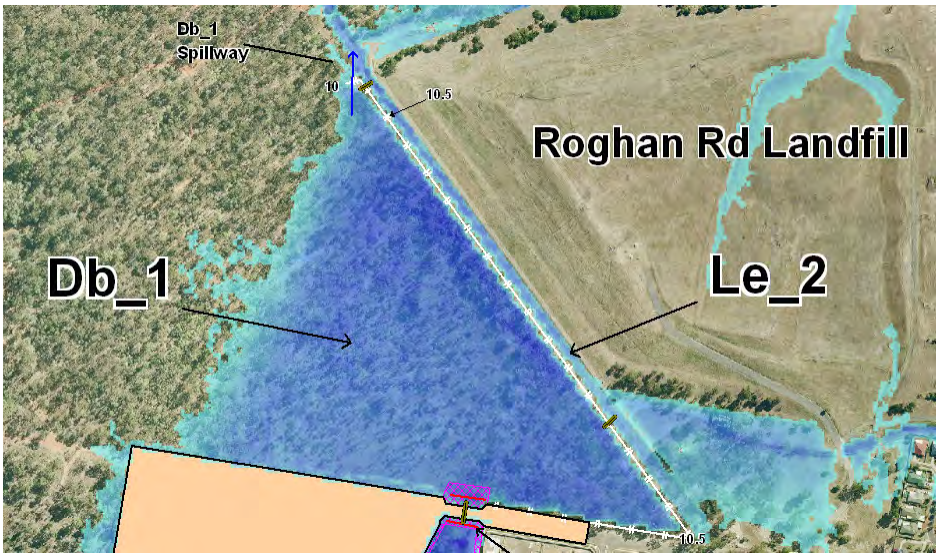


Figure 6.2 Roghan Road Landfill Detention Basin

6.2.2 Application 1 Overflow Channel

Figure 6.3 shows the proposed overflow channel through the Application 1 development. The northern part of the channel will fall in a northerly direction to Roghan Road, The existing ground levels and vegetation along this reach will remain in it current natural state. The southern end of the channel will reformed to fall south from the existing 9.5 m AHD contour to 9.0 m AHD in the Fitzgibbon Drain. A culvert crossing will be placed through the raised Roghan Road at the northern end of the channel.

The channel will be configured as follows:

- Base Width of 40 m;
- Side Batters of 1(V):6(H)to design levels;
- Maximum invert level of 9.5 m AHD; and
- Northern end: Longitudinal length of about 280 m falling to the north.
- Southern end: Longitudinal length of about 60 m falling to the south.

The Roghan Road culverts will be configured as follows:

- 8 x 2.1(W) x 0.6 (H) box culverts;
- Maximum road level of 10.5 m AHD;
- Upstream invert level of 9.05 m AHD; and
- Downstream invert level of 8.93 m AHD.

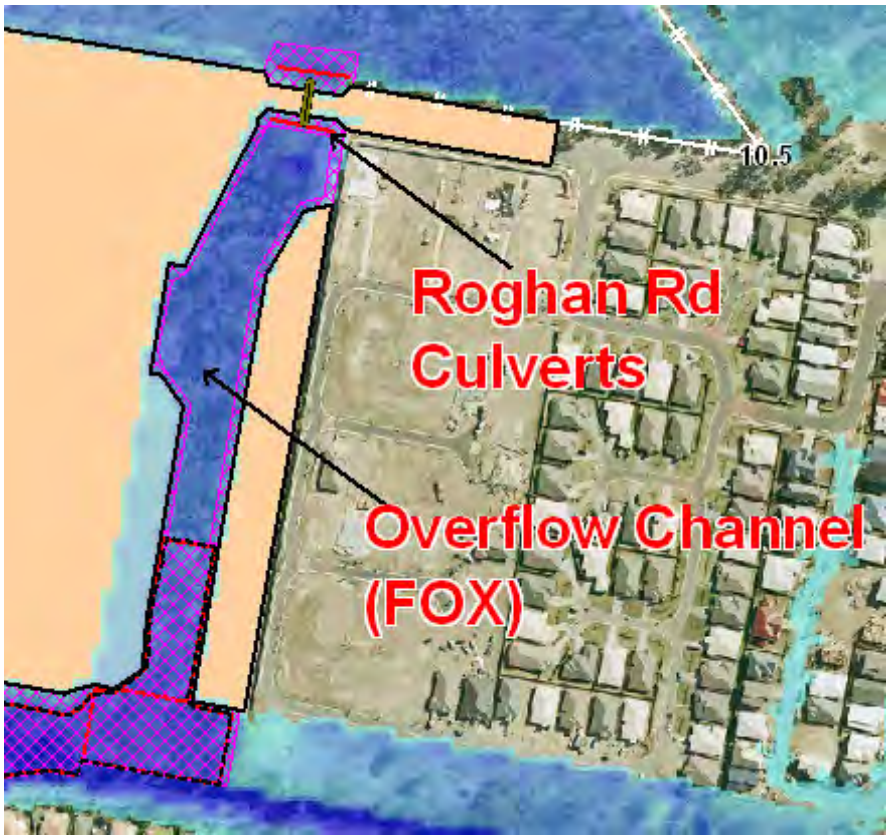


Figure 6.3 Application 1 Overflow Channel

6.2.3 Modified Fitzgibbon Drain and Flood Storage Area

Figure 6.4 shows the proposed realignment of the western branch of the Fitzgibbon Drain. The proposed realignment will be about 70 m north of its original location. A culvert crossing will be constructed under Carselgrove Avenue about 150 m downstream of the North Coast Railway.

The channel will be configured as follows:

- Base Width of 12 m;
- Side Batters of 1(V):6(H) to existing surface;
- Upstream invert of 9.51 m AHD; and
- Longitudinal length of 350 m at a slope of 0.5%.

The Carselgrove Avenue culverts will be configured as follows:

- 5 x 2.1(W) x 1.8 (H) box culverts;
- Upstream invert level of 8.87 m AHD; and
- Downstream invert level of 8.77 m AHD.

Proposed earthworks downstream of the culvert crossing will ensure that sufficient flood storage is maintained to mitigate the flood impacts of the development. The proposed flood storage area will be graded from the base of the channel to 9 m AHD.

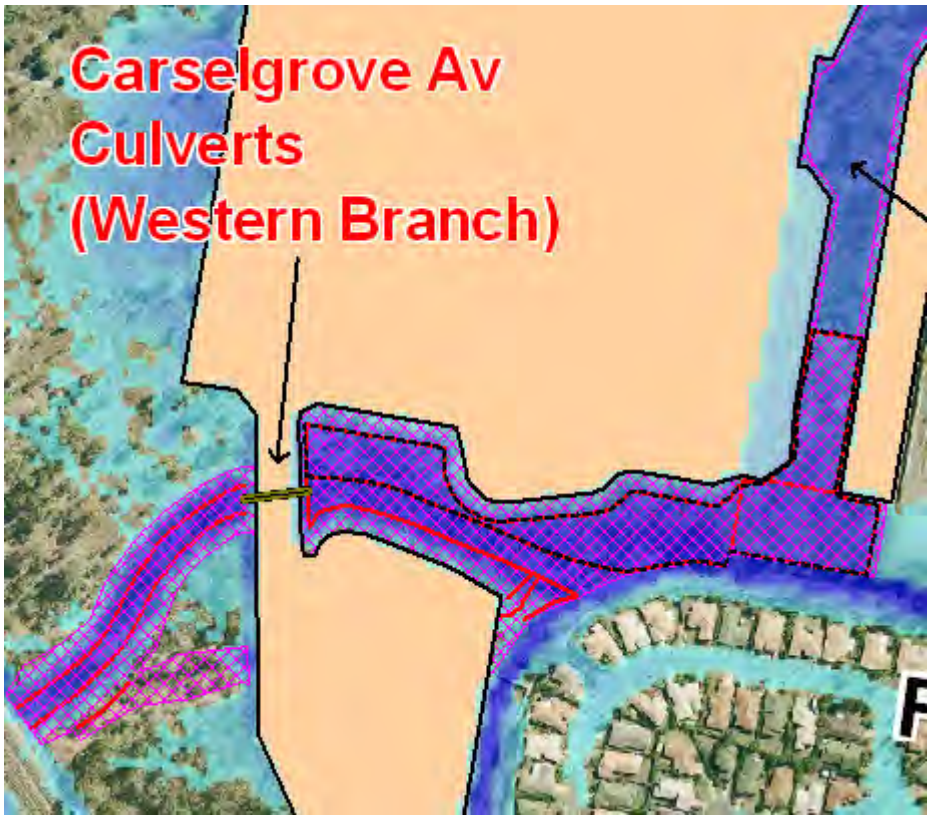


Figure 6.4 Fitzgibbon Drain (Western Branch) Realignment

6.2.4 Carselgrove Avenue Fitzgibbon Drain (Southern Branch) Culverts

The Carselgrove Avenue culvert crossing across the Southern Branch of the Fitzgibbon Drain will be configured as follows:

- 6 x 1.65 m diameter pipes;
- Upstream invert level of 9.36 m AHD; and
- Downstream invert level of 8.75 m AHD.

6.3 IMPACT ASSESSMENT OF PROPOSED DEVELOPMENT

6.3.1 Methodology

The Cabbage Tree Creek TUFLOW model (see section 5) was used to determine design flood levels and assess the impacts of the proposed Application 1 development and mitigation measures. The impacts were assessed by comparing the 100 year ARI Application 1 developed conditions flood levels to existing (pre-development) conditions.

6.3.2 2 to 100 year ARI TUFLOW Model Results

Figure 6.5 shows the Application 1 Development Conditions 100 year ARI flood depths and reporting locations. Table 6.2 shows the 2, 10, and 100 year ARI water levels at a number of reporting locations within the TUFLOW study area. The following is of note:

- The 2 year ARI peak flood levels at the Application 1 development vary from 11.07 m AHD and 10.30 m AHD at reporting locations FITZ_1 and FITZ_3, respectively, to 9.35 m AHD at the proposed overflow channel;
- The 10 year ARI peak flood levels at the Application 1 development vary from 11.48 m AHD and 10.55 m AHD at reporting locations FITZ_1 and FITZ_3, respectively, to 9.76 m AHD at the proposed overflow channel;
- The 100 year ARI peak flood levels at the Application 1 development vary from 11.73 m AHD and 11.01 m AHD at reporting locations FITZ_1 and FITZ_3, respectively, to 10.47 m AHD at the proposed overflow channel;
- The 10 and 100 year ARI water level in the Roghan Road Landfill Detention Basin are 9.44 m AHD and 10.28 m AHD, respectively; and
- Fitzgibbon Drain floodwaters overflow into the northern part of the proposed overflow channel for ARI events greater than 2 years.

6.3.3 100 year ARI Flood Impacts

Figure 6.6 shows the Application 1 Development Conditions 100 year ARI flood extent and water level impacts across the study area. Table 6.2 shows the 100 year ARI water level impacts due to the Application 1 development and the proposed flood mitigation infrastructure. The proposed Application 1 development water levels are less than or equal to pre-development conditions at all reporting locations in the study area.

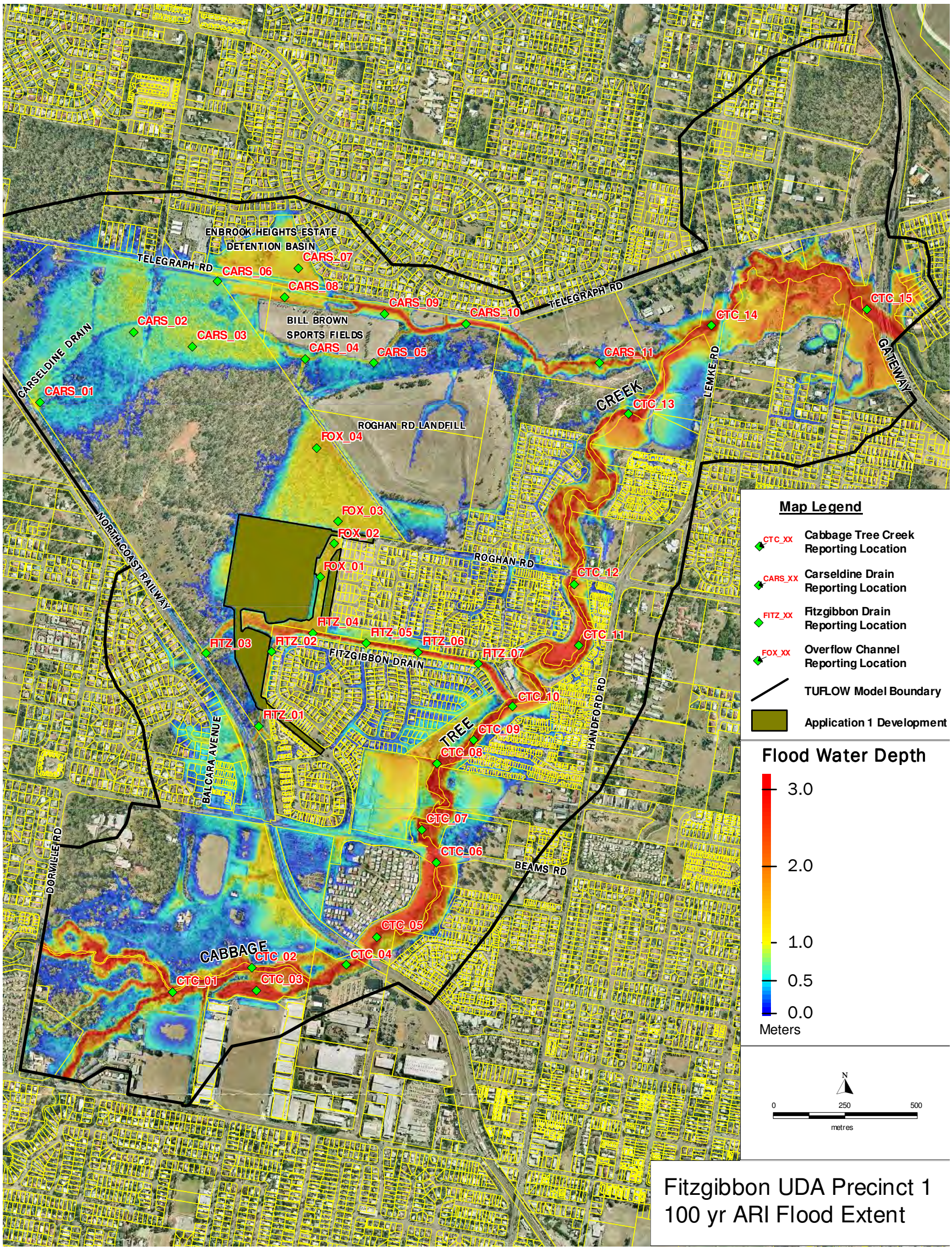


Figure 6.5 Application 1 Development 100 year ARI Flood Depths and Reporting Locations, Fitzgibbon UDA site

Table 6.2 Application 1 Development Conditions TUFLOW Model 2, 10, and 100 yr ARI Flood Levels and 100 yr ARI Flood Level Impacts

Reporting Location	Application 1 Development Conditions Peak Flood Level (m AHD)			100 yr ARI Water Level Impacts (m)
	2 yr ARI	10 yr ARI	100 yr ARI*	
CARS_01	11.43	11.54	11.65	0.00
CARS_02	9.39	9.46	9.55	0.00
CARS_03	8.97	9.09	9.24	0.00
CARS_04	8.84	8.93	9.08	0.00
CARS_05	8.32	8.43	8.57	-0.01
CARS_06	8.92	9.02	9.19	0.00
CARS_07	8.02	8.85	9.15	0.00
CARS_08	8.66	8.85	9.15	0.00
CARS_09	7.10	7.52	8.01	0.00
CARS_10	6.71	7.07	7.47	0.00
CARS_11	5.28	5.59	5.95	0.00
CTC_01	14.52	15.06	15.48	0.00
CTC_02	13.60	14.13	14.46	0.00
CTC_03	13.39	14.00	14.37	0.00
CTC_04	12.65	13.27	13.71	0.00
CTC_05	11.74	12.30	12.65	0.00
CTC_06	11.61	12.17	12.50	0.00
CTC_07	11.50	12.02	12.37	0.00
CTC_08	10.99	11.62	12.11	0.00
CTC_09	10.43	11.01	11.55	-0.01
CTC_10	9.30	9.69	10.31	-0.01
CTC_11	8.10	8.57	9.25	-0.01
CTC_12	7.52	7.96	8.69	0.00
CTC_13	4.91	5.36	5.94	-0.01
CTC_14	4.15	4.36	4.69	0.00
CTC_15	2.57	3.05	3.87	-0.03
FITZ_01	11.07	11.48	11.73	-0.03
FITZ_02	9.55	9.93	10.57	-0.05
FITZ_03	10.30	10.55	11.01	-0.91
FITZ_04	9.35	9.76	10.47	0.00
FITZ_05	9.37	9.77	10.46	0.00
FITZ_06	9.35	9.75	10.45	-0.01
FITZ_07	9.35	9.75	10.44	-0.01
FOX_01	9.31	9.50	10.36	0.58
FOX_02	9.29	9.46	10.33	0.58
FOX_03	9.26	9.44	10.28	0.57
FOX_04	9.24	9.44	10.28	0.58

* The 100 year ARI water levels in this table must **not** be used to determine development fill levels. Minimum fill and floor levels for the development must be determined using Section 6.4 water levels.

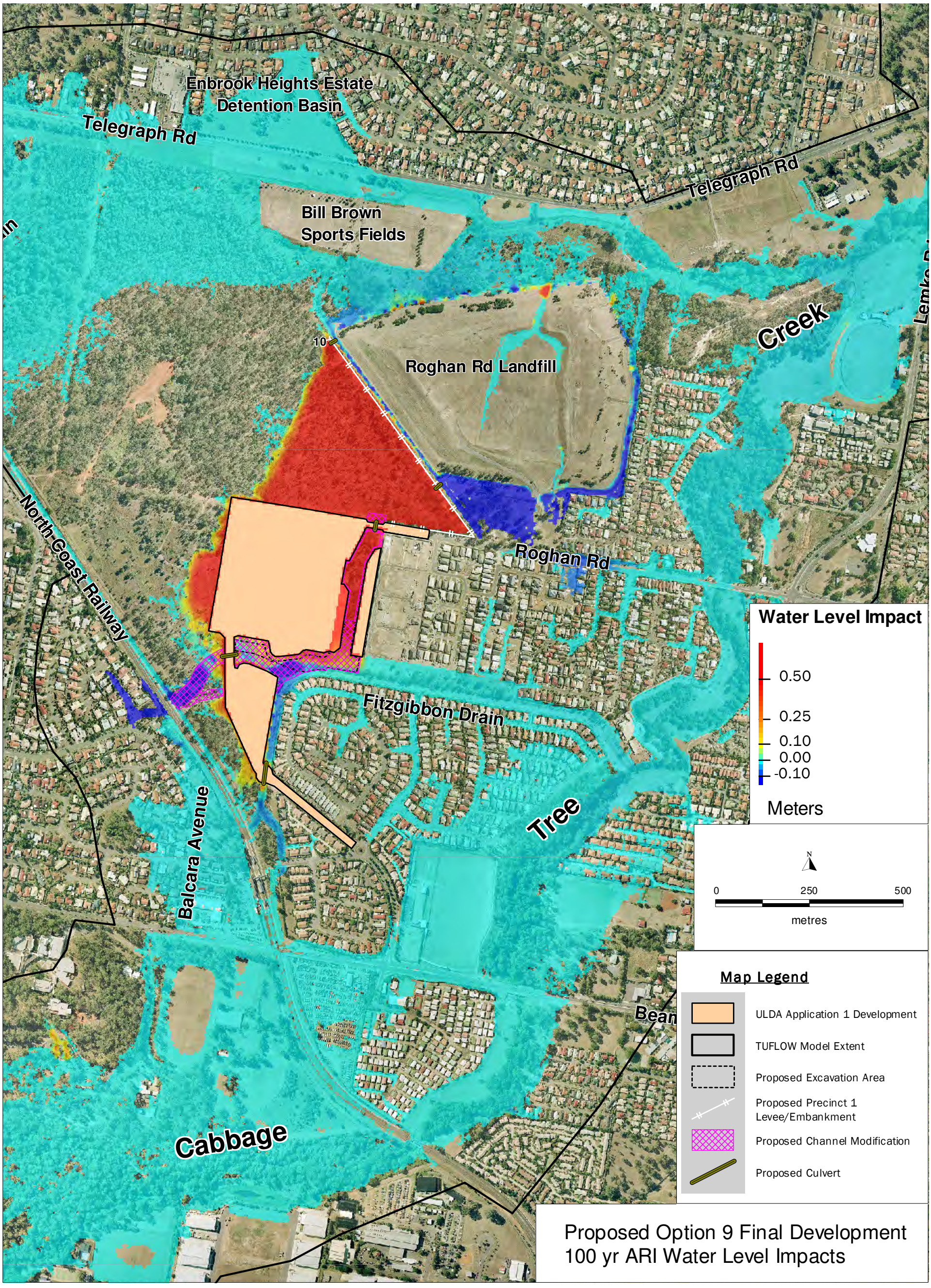


Figure 6.6 Application 1 Development 100 year ARI Flood Extent and Development Impacts, Fitzgibbon UDA site

6.4 PROPOSED FILL LEVELS

The Application 1 developed conditions Cabbage Tree Creek TUFLOW model (see previous section) was used to determine minimum fill levels around the site. BCC requested that fill levels be determined using Cabbage Tree Creek 100 year ARI peak discharge of 264 m^3/s (instead of 249m^3/s as determined by the Cabbage Tree Creek URBS model). The Cabbage Tree Creek inflow hydrographs at inflow locations A1, A2 and A3 (see Section 4.3) were factored up by 1.06 (6%).

Table 6.3 tabulates the 100 year ARI water levels for determining fill levels at a number of reporting locations around the Application 1 development site. Figure 6.7 shows the Application 1 fill reporting locations.

Table 6.3 Application 1 Development 100 year ARI Flood Levels assuming 264 m^3/s Peak Flow along Cabbage Tree Creek for Determining Fill Levels

Reporting Location	100 year ARI Flood Level (m AHD)
Fitzgibbon Main Channel	
1	10.52
2	10.53
3	10.54
4	10.54
5	10.63
6	10.78
7	11.59
New Drain	
8	10.55
9	10.60
10	11.08
11	11.13
Side Drain	
12	10.52
13	10.40
14	10.34

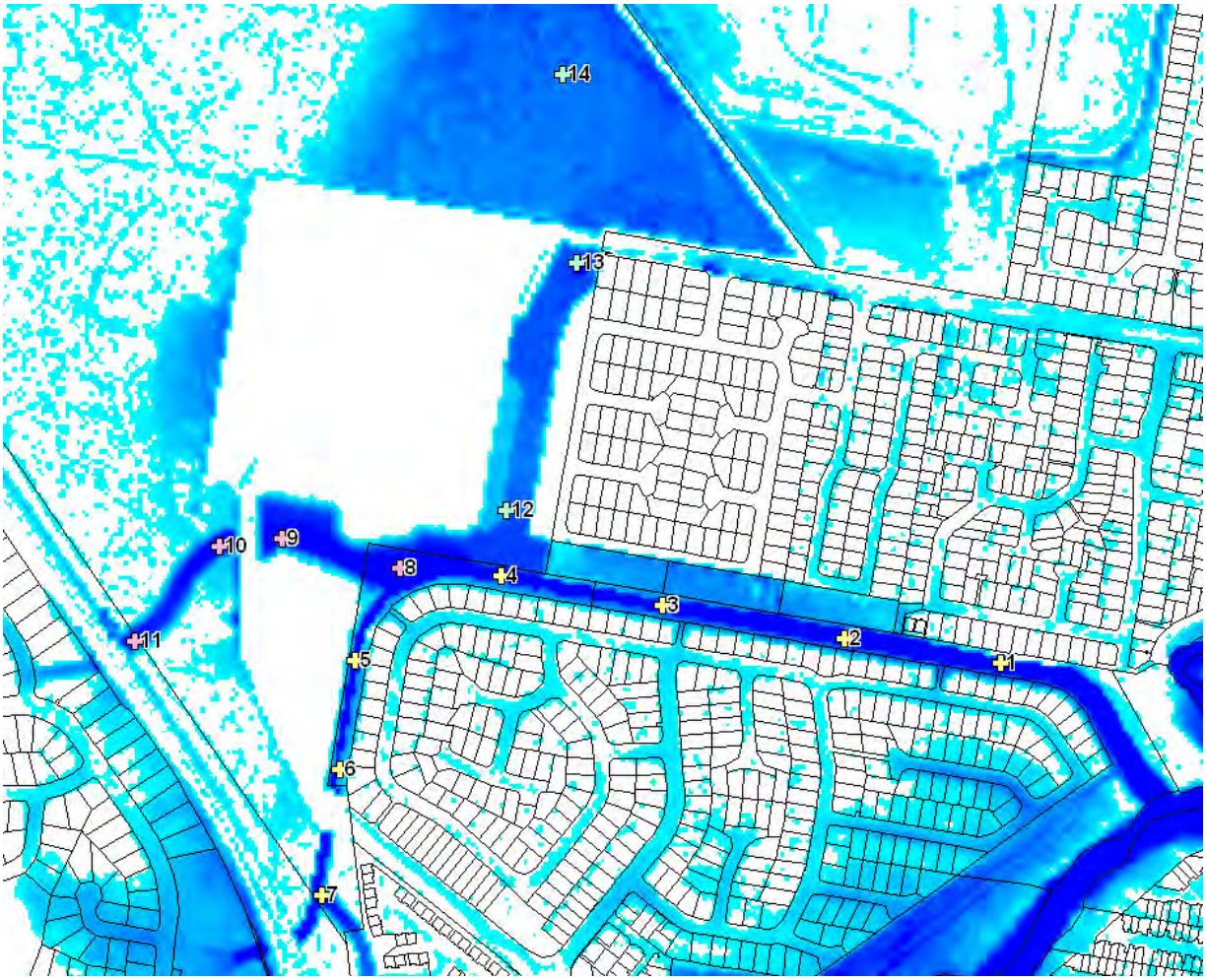


Figure 6.7 Application 1 Development Reporting Locations of 100 year ARI Flood Levels for Determining Fill Levels

7 IMPACTS OF FULL DEVELOPMENT OF THE FITZGIBBON UDA

7.1 OVERVIEW

7.1.1 Proposed Development configuration

Figure 7.1 shows the areas proposed for urban development within the Fitzgibbon UDA. A total area of 55 ha has been identified for future development. Key features of the proposed land use for the site are as follows:

- The remaining 80 ha of the DoH land (after development of the Application 1 area) will be divided into approximately 35 ha of urban residential development, while 45 ha will remain undisturbed;
- The western portion of the QUT Carseldine site (approximately 13.5 ha) is proposed to be developed into a high density residential and commercial precinct;
- Carseldine Railway Station car park (approximately 3.1 ha) is proposed to be developed for high density unit dwellings;
- The existing wrecking yard site along Beams Road (approximately 3.7 ha) has been identified as potentially suitable for high density residential development.

7.1.2 Management of Flooding and Flood Impacts

As discussed in Section 5.4, existing development within the UDA is likely to be substantially affected by flooding as ongoing development occurs in the Cabbage Tree Creek catchment upstream of the UDA. The proposed development of the UDA, and construction of associated flood management infrastructure, provides an opportunity to reduce flood problems of existing development, as well as mitigating any impacts of the UDA development.

Achieving the proposed development planned for the site will have significant impacts on the flood behaviour of Cabbage Tree Creek and its tributaries within the UDA. The most significant of these impacts is the prevention of any overflows across Beams Road and the North Coast Railway near the Beams Road railway crossing. Flood overflows through this area will be prevented by the proposed development plan. As a result, the floodwaters which would have overflowed at this location will, after development, need to travel along the main branch of Cabbage Tree Creek.

To mitigate this and other impacts of the proposed development and manage flood flows through the development will require a suite of flood management infrastructure to be constructed both within and outside the UDA. The TUFLOW model was used to assess the effectiveness of 9 different combinations of flood management infrastructure (see Figure 7.1) in conveying flood flows through the UDA and ensuring no adverse impacts on the flood immunity of existing properties in the study area.

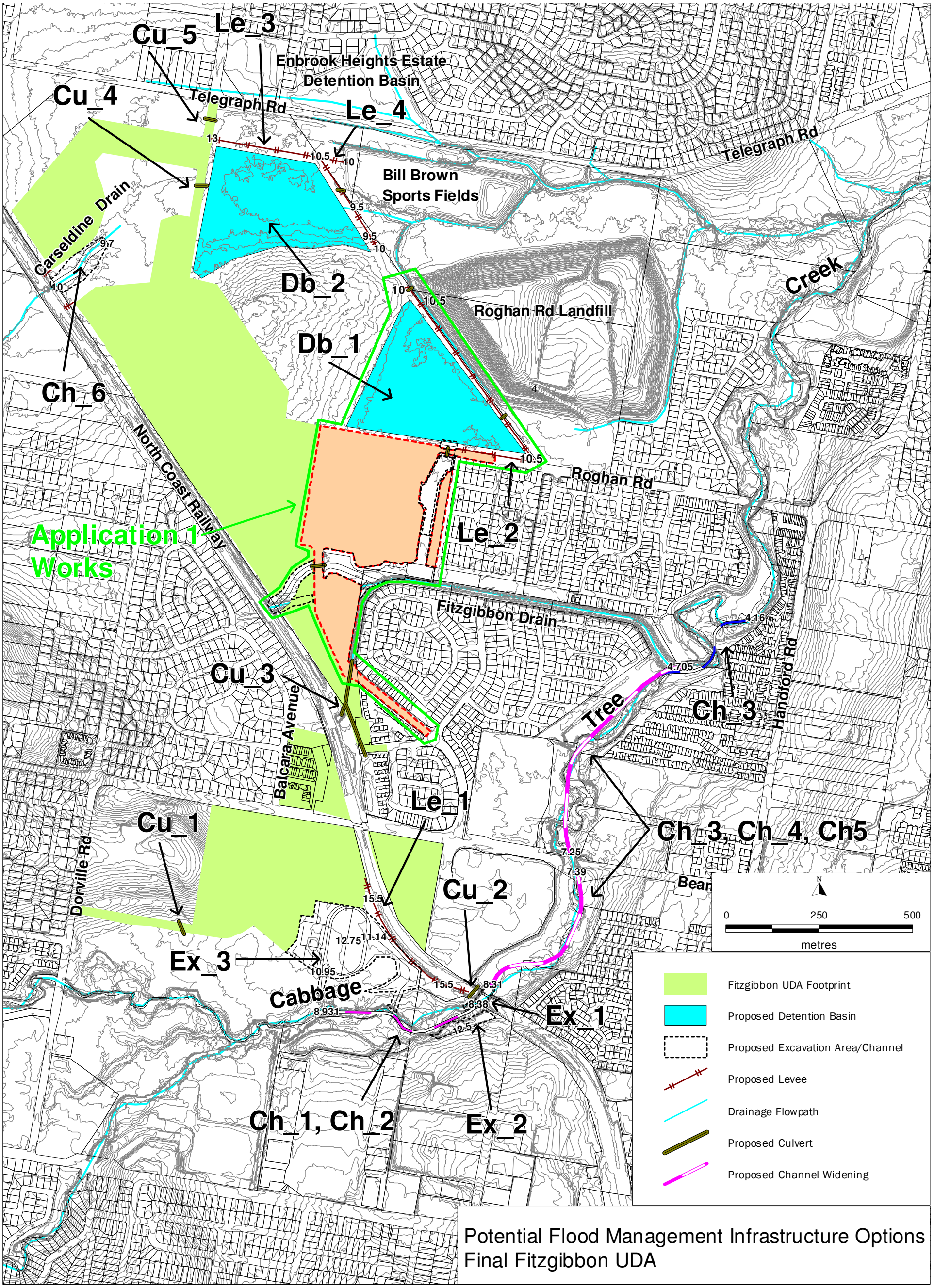


Figure 7.1 Proposed Fitzgibbon UDA Final Development Layout and Potential Flood Management Infrastructure Options

7.2 POTENTIAL FLOOD IMPACTS AND FLOOD MANAGEMENT INFRASTRUCTURE OPTIONS

Table 7.1 provides a summary of the potential impacts of the proposed development and also summarises flood management infrastructure options investigated. A wide range of potential options are available to manage flood impacts along Cabbage Tree Creek and Carseldine Drain, including:

- Channel widening;
- Excavation areas;
- Bridge/Culvert upgrades;
- Waterway clearing; and
- Levees.

The suite of flood mitigation infrastructure presented in this report does not include all options investigated in the study. Various other options were modelled, but were considered, for a range of reasons, to be less suitable for implementation. The additional options modelled but not reported include:

- Levees along the Cabbage Tree Creek bank between the North Coast Railway and the Fitzgibbon Drain;
- Excavation the golf driving range and State school land downstream of Beams Road;
- Reducing the roughness of the Cabbage Tree Creek channel; and
- Excavation on private property immediately downstream of the confluence of Fitzgibbon Drain and Cabbage Tree Creek.

Further details of flood management infrastructure investigated in this study are provided in Sections 7.3 and 7.4.

Table 7.1 Potential Flood Impacts and Flood Management Infrastructure Options

Potential Flood Impact	Flood Management Infrastructure Investigated		Potential Flood Benefits with Management Infrastructure in Place
	ID	Description	
Increased flood levels along Cabbage Tree Creek upstream of the railway line adjacent to the QUT Carseldine site due to filling of floodplain.	Ch_1, Ch_2	Channel widening/re-alignment upstream of the railway.	- Lower flood levels upstream of the railway.
	Ex_1	Excavation under the railway bridge to increase waterway area.	- Lower flood levels upstream of the railway.
	Ex_2	Excavation of the Cabbage Tree Creek channel upstream of the railway, adjacent to Pineapple Street.	- Lower flood levels upstream of the railway.
	Ex_3	Excavation of QUT sports fields.	
	Cu_1	Extra culverts jacked through the railway embankment	- Lower flood levels upstream of the railway.
Prevention of flow across Beams Rd and railway line from Cabbage Tree Creek upstream of the Railway.	Le_1	Levee along western boundary of North Coast Railway easement.	- Reduction in existing flood problems for existing development west of Beams Road. - Reduction in existing flood problems for existing development to the south of Beams Road, east of the railway. - Reduced inflows to Fitzgibbon Drain from Cabbage Tree Creek overflows.
Additional flow in Cabbage Tree Creek between railway and Fitzgibbon Drain confluence due to prevention of flow across Beams Rd and railway line.	Ch_3, Ch_4, Ch_5	Channel widening/re-alignment from the railway to the Fitzgibbon Drain/300 m downstream of the Fitzgibbon Drain.	- Lower flood levels between the railway and Fitzgibbon Drain.
Increased flood levels and discharges along Carseldine Drain due to filling of floodplain to the east of the railway line.	Ch_6	Channel excavation along Carseldine Drain immediately downstream of railway line.	- Reduced flood levels at the North Coast Railway.
	Db_2, Le_4	Detention basin and low east-west floodplain levee between the Bill Brown Sports Fields and the Carseldine Drain Detention Basin.	- Reduced flooding of Telegraph Road due to overflows from Carseldine Drain. - Reduced discharges along Carseldine Drain.

7.3 FLOOD MANAGEMENT INFRASTRUCTURE WITHIN THE UDA

The following sections provide further details of flood management infrastructure proposed within the Fitzgibbon UDA.

7.3.1 Rogan Road Detention Basin

Details of this detention basin are provided in Section 6.2.1. The Rogan Road Detention basin will be constructed as part of Application 1 development.

7.3.2 Carseldine Drain Detention Basin

An on-line detention basin will be constructed along Carseldine Drain along the downstream boundary of the DoH land. The detention basin will mitigate some of the impacts of the UDA development on flood discharges along Carseldine Drain.

The detention basin storage area will be bounded by a proposed levee along the northern boundary of the DoH land, the north-eastern boundary of the DoH land, and a hill slope to the south. An earthen embankment will be constructed and low-flow culverts will be placed along the eastern side of the basin. The ground surface within the detention basin will remain unaltered and the existing vegetation will remain. The basin stage-storage characteristics are shown in Table 7.2.

Table 7.2 Adopted Stage-Storage Curve – Carseldine Drain Detention Basin

Stage (m AHD)	Surface Area (m^2)	Volume (m^3)
8	61	3
8.5	44852	8047
9	85713	42855
9.5	98392	89170
10	109679	141447
10.5	118102	198561

The detention basin has the following spillway and low level outlet configuration:

- A 110 m wide spillway at an elevation of 9.5 m AHD; and
- Low flow pipe: 5 x 0.9 m pipe at an invert level of 8.6 m AHD.

7.3.3 Flood Protection Levees

Three flood protection levees are proposed within the Fitzgibbon UDA:

- Along the DoH land boundaries adjoining Roghan Road and the Roghan Road Landfill ranging in elevation from 10.5 m AHD to 10.0 m AHD (Le_1). This levee will form the northern, north-eastern, and part of the southern walls of the Roghan Road Landfill detention basin (see Sections 6.2.1 and 7.3.1) which will be constructed during Application 1 development.

- The upstream side of the railway to an elevation of 15 m AHD (Le_2). This levee will prevent flow across the railway line near Beams Road for a 100 year ARI event.
- Along the northern and north-western boundaries of the DoH land between the proposed development extent and the DoH boundary ranging in elevation from 13 m AHD to 10.5 m AHD (Le_3). This levee will form the northern side of the Carseldine Drain detention basin (see Section 7.3.2).
- Along Carseldine Drain downstream of the Carseldine Drain detention basin (Le_4) within BCC owned land. The levee will extend from the north-eastern corner of the Carseldine Drain detention basin to the Bill Brown Sports Fields and ranges in elevation from 10.5 m AHD to 10.0 m AHD. This levee will prevent water from Carseldine Drain flowing on to Telegraph Road.

7.3.4 Carseldine Drain Channel

A channel will be excavated along Carseldine Drain downstream of the railway culverts with the following characteristics:

- Base Width = 20 m;
- Top of Bank width = 50 to 70 m;
- Longitudinal Length = 180 m; and
- Upstream Invert = 10 m AHD and downstream Invert = 9.7 m AHD.

7.3.5 QUT Carseldine Sports Field Excavation area

The proposed excavated area adjacent to Pineapple Street has the following characteristics:

- Minimum Elevation of 11.00 m AHD;
- Maximum Elevation of 12.75 m AHD; and
- Approximate Volume of Excavation of 8000 m^3.

7.3.6 Culvert Crossings

Table 7.3 shows the configuration of the proposed culverts. The proposed culvert crossings include:

- A culvert (Cu_1) will be installed across the collector road that extends around the southern side of the QUT Carseldine development area to join with Dorville Road.
- The Carselgrove Avenue culverts (Cu_3) along the southern Fitzgibbon Drain branch will be extended upstream under the proposed development; and
- Roghan Road will be extended to the north to join with Telegraph Road. A series of box culverts (Cu_4) will be constructed under Roghan Road at the Carseldine Drain crossing.

Culverts proposed within Application 1 have been described in sections 6.2.1, 6.2.2, and 6.2.4.

Table 7.3 Final Development Culvert Crossing Configurations

Location	ID	Length (m)	US Invert (m AHD)	DS Invert (m AHD)	Dimensions (m)	Number
QUT Road Culvert	Cu_1	20	15.2	14.7	0.6 dia.	1
Fitzgibbon Drain A	Cu_3	25	9.90	9.75	1.5 dia.	4
Fitzgibbon Drain B	Cu_3	120	9.75	9.03	1.5 dia	5
Fitzgibbon Drain C	Cu_3	150	10.51	9.75	1.5 dia	1
Roghan Rd at Carseldine Drn	Cu_4	20	8.8	8.7	1.8 (W) x 0.9 (H)	15

7.4 FLOOD MANAGEMENT INFRASTRUCTURE OUTSIDE THE UDA

7.4.1 General

Due to the nature of the development proposal, mitigation of development flood impacts will require additional works outside the UDA area. The following structural measures outside of the Fitzgibbon UDA were investigated:

- Cabbage Tree Creek channel widening;
- Excavation immediately upstream of the North Coast Railway.
- Culvert Crossings; and
- Flood Protection Levee.

7.4.2 Cabbage Tree Creek Channel Widening Options

The proposed channel widening options, which would substantially mitigate flooding along Cabbage Tree Creek, involve increasing the waterway area of the Cabbage Tree Creek main channel along a number of reaches. Table 7.4 shows the proposed channel characteristics modelled in TUFLOW.

Note that the modelled channel configurations are indicative only and would require further detailed design, including assessment of environmental impacts.

7.4.3 Pineapple Street Excavation area

The proposed excavated area adjacent to Pineapple Street has the following characteristics:

- Minimum Elevation of 12.00 m AHD;
- Maximum Elevation of 12.50 m AHD; and
- Approximate Volume of Excavation of 60, 000 m^3.

Table 7.4 Proposed Channel Widening Options along Cabbage Tree Creek

Channel Reach	Flood Mitigation ID	Width (m)	Length (m)	Upstream Invert (m AHD)	Downstream Invert (m AHD)	Slope (%)
Upstream of the Railway	Ch_1	17	440	8.93	8.38	0.13
""	Ch_2	10	440	8.93	8.38	0.13
Railway to Beams Road	Ch_3	17	445	8.31	7.39	0.21
""	Ch_4	17	445	8.31	7.39	0.21
""	Ch_5	10	445	8.31	7.39	0.21
Beams Road to 300 m downstream of the Fitzgibbon Drain	Ch_3	17	925	7.25	4.16	0.33
Beams Road to Fitzgibbon Drain	Ch_4	17	640	7.25	4.71	0.40
""	Ch_5	10	640	7.25	4.71	0.40

7.4.4 Culvert Crossings

Table 7.3 shows the configuration of the proposed culverts. The proposed culvert crossings include:

- A series of box culverts (Cu_1) will be jacked through the railway embankment next to the Cabbage Tree Creek crossing; and
- Roghan Road will be extended to the north to join with Telegraph Road. A culvert (Cu_4) will be installed under Roghan Road within the power link easement.

Table 7.5 Final Development Culvert Crossing Configurations

Location	ID	Length (m)	US Invert (m AHD)	DS Invert (m AHD)	Dimensions (m)	Number
Cabbage Tree Creek	Cu_2	20	11.50	11.35	3 (W) x 1.5 (H)	4
Roghan Road	Cu_5	20	9.21	8.75	0.6 dia	1

7.5 OPTIONS MODELLED IN TUFLOW – UDA FULL DEVELOPMENT

Table 7.6 shows the combinations of various flood management infrastructure components modelled in TUFLOW. The various infrastructure elements have been combined into 9 flood mitigation options.

Table 7.6 TUFLOW Model 100 year ARI Final Development Flood Mitigation Options

Flood Mitigation ID	Flood Mitigation Description	Op1	Op2	Op3	Op4	Op5	Op6	Op7	Op8	Op9
	Within Fitzgibbon UDA									
Db_1	Roghan Road Landfill detention basin	X	X	X	X	X	X	X	X	X
Db_2	Carseldine Drain detention basin	X	X	X	X	X	X	X	X	X
Le_1	Flood Protection Levee along the upstream boundary of the railway easement	X	X	X	X	X	X	X	X	X
Le_2	Roghan Road Landfill detention basin wall	X	X	X	X	X	X	X	X	X
Le_3	Carseldine Drain detention basin wall	X	X	X	X	X	X	X	X	X
Le_4	Flood Protection Levee along northern boundary between Carseldine Drain detention basin and the Bill Brown Sports Field	X	X	X	X	X	X	X	X	X
Ch_6	Carseldine Drain channel excavation	X	X	X	X	X	X	X	X	X
Ex_3	Excavation of the QUT sports field	X	X	X	X	X				
Cu_1, Cu_3, Cu_4, Cu_5	Road crossing culverts for QUT access road, Carselgrove Avenue (southern branch of the Fitzgibbon Drain), and Roghan Road at Carseldine Drain	X	X	X	X	X	X	X	X	X
	Outside Fitzgibbon UDA									
Ch_1	17 m wide channel upstream of the railway			X				X		
Ch_2	10 m wide channel upstream of the railway								X	
Ch_3	17 m wide channel from the railway to 300 m downstream of the Fitzgibbon Drain	X	X	X	X		X			
Ch_4	17 m wide channel from railway to the Fitzgibbon Drain					X		X		X
Ch_5	10 m wide channel from railway to the Fitzgibbon Drain								X	
Ex_1	Excavation to increase waterway area under the railway bridge				X					
Ex_2	Excavation upstream of the railway near Pineapple Street			X				X	X	X
Cu_2	Extra culverts jacked through the railway embankment		X							

7.6 IMPACT ASSESSMENT OF PROPOSED MITIGATION OPTIONS

The TUFLOW model was used to assess the impacts of the proposed development and the various flood mitigation options on the 2, 5, 10, 20, 50, and 100 year ARI flood behaviour within the study area.

Table 7.7 shows 100 year ARI water levels for existing development and final development, as well as water level impacts at a number of reporting locations in the study area (see Figure 7.2). The results of the flood modelling indicate that:

- Option 1 substantially reduces flood levels along CTC between the railway and the confluence with Fitzgibbon Drain. However, flood levels upstream of the railway adjacent to the industrial site (Location CTC_03) and downstream of the Fitzgibbon Drain are increased by up to 0.28 m and 0.02 m, respectively.
- The additional railway culverts (Option 2) reduces flood levels by 0.06 m upstream of the railway compared with Option 1.
- Channel works upstream of the railway (Option 3) will reduce flooding upstream of the railway to pre-development levels except for at the railway crossing.
- Option 4 (increasing the waterway area of the railway bridge) does not have any significant benefit upstream of the railway crossing.
- Option 5 reduces all CTC flood levels downstream of the railway crossing to below pre-development levels.
- The benefit of excavating the QUT sports field (Option 6) is a reduction in CTC flood levels by up to 0.03 m.
- Option 7 reduces Cabbage Tree Creek flood levels everywhere except at the railway crossing adjacent to state owned land (CTC_04), however, the proposed channel upstream of the railway may have significant environmental impacts.
- Option 8 reduces Cabbage Tree Creek flood levels at all locations downstream of Beams Road. However, flood levels upstream of Beams Road and the Railway are increased adjacent to existing development by up to 0.06 m and 0.11 m, respectively.
- Option 9 reduces Cabbage Tree Creek (CTC) flood levels at all reporting locations downstream of the railway crossing compared to existing development conditions. Flood levels adjacent to the existing industrial development upstream of the railway are increased by up to 0.22 m.

7.7 SUMMARY OF PREFERRED FLOOD MANAGEMENT SCENARIO - OPTION 9

Based on an assessment of flood impacts and benefits only, Option 9 represents the preferred option for managing impacts of the UDA development and reducing existing flood problems for existing development along Cabbage Tree Creek in the study area. The proposed suite of flood management infrastructure for Option 9 (in addition to Application 1 works (see section 6.2), including the Roghan Road Landfill detention basin (Db_1)and the Roghan Road Landfill detention basin wall (Le_2)) includes:

- Within the Fitzgibbon UDA:
  - A culvert across the collector road that extends around the southern side of the QUT Carseldine development area to join with Dorville Road (Cu_1).
  - A flood protection levee along the upstream boundary of the railway easement between the proposed QUT Carseldine development and the North Coast Railway crossing of Cabbage Tree Creek (Le_1);
  - Extension of the Carselgrove Avenue culverts along the southern Fitzgibbon Drain branch (Cu_3);
  - A series of box culverts across Roghan Road at the Carseldine Drain crossing (Cu_4).
  - A new channel immediately downstream of the Railway Crossing of Carseldine Drain (Ch_6);
  - A flood protection levee along the northern and north-western boundaries of the DoH land between the proposed development extent and the DoH boundary (Le_3 This flood protection levee forms the wall for the Carseldine Drain detention basin (Db_2); and
  - A flood protection levee south of Telegraph Road between the proposed Carseldine Drain detention basin and the Bill Brown Sports Field (Le_4),
- Outside the Fitzgibbon UDA:
  - A 17 m wide channel along Cabbage Tree Creek from North Coast Railway to the Fitzgibbon Drain (Ch_4);
  - Excavation along Cabbage Tree Creek upstream of the railway near Pineapple Street (Ex_2); and

7.8 OPTION 9 100 YEAR ARI FLOOD EXTENT AND IMPACT ASSESSMENT

Figure 7.2 shows the Option 9 Final Development Conditions 100 year ARI flood extent and water level impacts across the study area. This option successfully mitigates most development impacts, although there is a potential flood level increase adjacent to the existing industrial estate upstream of the railway.

Figure 7.3 shows a cross section of the pre-development and Final Development Conditions (Option 9) 100 year ARI flood levels adjacent to the existing industrial development to the south of the QUT development. The proposed Option 9 final development is expected to increase the 100 year ARI flood level at the existing industrial development by 0.23 m to 14.60m AHD. Part of the existing industrial development is within the pre-development flood extent. Based on the available survey data, it appears that the road along the industrial estate's northern boundary, which is at an elevation of 13.75 m AHD, is lower than the rest of the development which is at a minimum elevation of 14.75 m AHD. Assuming these levels are correct, only this part of the road along the industrial estate's northern boundary will be affected by the increase in flood levels. All buildings in the industrial estate will remain above the 100 year ARI flood Level and will retain existing flood free access. Refinement of flood mitigation options for the Fitzgibbon UDA should include detailed assessment of potential flood impacts in this area, including additional ground survey.

Table 7.7 Final Development 100 year ARI Flood Level Impacts for 9 Mitigation Options Modelled in TUFLOW

Reporting Location	Pre_Dev Water Level (m AHD)	Option 1 Water Level (m AHD)	Option 1 Impact (m)	Option 2 Water Level (m AHD)	Option 2 Impact (m)	Option 3 Water Level (m AHD)	Option 3 Impact (m)	Option 4 Water Level (m AHD)	Option 4 Impact (m)	Option 5 Water Level (m AHD)	Option 5 Impact (m)	Option 6 Water Level (m AHD)	Option 6 Impact (m)	Option 7 Water Level (m AHD)	Option 7 Impact (m)	Option 8 Water Level (m AHD)	Option 8 Impact (m)	Option 9 Water Level (m AHD)	Option 9 Impact (m)	Op9 WL 264 m³/s (m AHD)
CARS_01	11.65	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20	-0.45	11.20
CARS_02	9.55	10.54	0.99	10.54	0.99	10.54	0.99	10.54	0.99	10.54	0.99	10.54	0.99	10.54	0.99	10.54	0.99	10.54	0.99	10.54
CARS_03	9.24	10.05	0.81	10.05	0.81	10.05	0.81	10.05	0.81	10.05	0.81	10.05	0.81	10.05	0.81	10.05	0.81	10.05	0.81	10.05
CARS_04	9.08	9.53	0.45	9.53	0.45	9.53	0.45	9.53	0.45	9.53	0.45	9.53	0.45	9.53	0.45	9.53	0.45	9.53	0.45	9.53
CARS_05	8.58	9.05	0.47	9.05	0.47	9.06	0.48	9.05	0.47	9.05	0.47	9.05	0.47	9.05	0.48	9.06	0.48	9.05	0.47	9.05
CARS_06	9.19	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67	-0.51	8.67
CARS_07	9.15	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76	-0.39	8.76
CARS_08	9.15	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68	-0.47	8.68
CARS_09	8.01	7.86	-0.16	7.86	-0.16	7.86	-0.15	7.86	-0.15	7.86	-0.16	7.86	-0.16	7.86	-0.15	7.86	-0.15	7.86	-0.15	7.86
CARS_10	7.47	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43	-0.05	7.43
CARS_11	5.96	5.91	-0.05	5.91	-0.05	5.91	-0.04	5.91	-0.05	5.91	-0.05	5.91	-0.05	5.91	-0.04	5.91	-0.05	5.91	-0.04	5.91
CTC_01	15.48	15.49	0.00	15.48	0.00	15.46	-0.02	15.49	0.00	15.49	0.00	15.49	0.01	15.47	-0.02	15.48	-0.01	15.49	0.01	15.52
CTC_02	14.47	14.68	0.22	14.63	0.17	14.39	-0.08	14.71	0.24	14.68	0.22	14.71	0.24	14.42	-0.04	14.52	0.05	14.64	0.17	14.73
CTC_03	14.37	14.66	0.28	14.60	0.22	14.34	-0.03	14.68	0.31	14.66	0.28	14.67	0.30	14.37	0.00	14.49	0.12	14.60	0.22	14.70
CTC_04	13.71	14.11	0.40	13.92	0.21	13.95	0.24	14.20	0.49	14.11	0.40	14.12	0.41	13.96	0.25	14.07	0.36	14.08	0.38	14.24
CTC_05	12.65	12.57	-0.07	12.60	-0.05	12.56	-0.09	12.55	-0.10	12.58	-0.07	12.58	-0.07	12.55	-0.10	12.70	0.06	12.58	-0.06	12.63
CTC_06	12.50	12.32	-0.18	12.34	-0.16	12.32	-0.19	12.30	-0.20	12.33	-0.17	12.33	-0.17	12.29	-0.21	12.48	-0.02	12.33	-0.17	12.37
CTC_07	12.38	12.06	-0.32	12.07	-0.30	12.05	-0.33	12.03	-0.35	12.06	-0.31	12.05	-0.32	12.06	-0.32	12.30	-0.08	12.06	-0.31	12.13
CTC_08	12.11	11.53	-0.58	11.55	-0.56	11.51	-0.60	11.49	-0.61	11.55	-0.55	11.53	-0.58	11.55	-0.56	11.92	-0.19	11.56	-0.55	11.64
CTC_09	11.56	10.93	-0.63	10.95	-0.61	10.91	-0.65	10.89	-0.67	11.02	-0.54	10.93	-0.63	11.02	-0.54	11.39	-0.17	11.03	-0.53	11.11
CTC_10	10.31	9.92	-0.39	9.93	-0.38	9.91	-0.40	9.91	-0.41	10.29	-0.02	9.92	-0.39	10.29	-0.02	10.27	-0.04	10.29	-0.02	10.35
CTC_11	9.26	9.28	0.03	9.30	0.04	9.28	0.02	9.27	0.02	9.23	-0.03	9.28	0.03	9.23	-0.03	9.23	-0.03	9.24	-0.02	9.30
CTC_12	8.69	8.73	0.04	8.74	0.05	8.72	0.03	8.73	0.04	8.68	-0.01	8.73	0.04	8.67	-0.02	8.67	-0.02	8.68	-0.01	8.75
CTC_13	5.95	5.98	0.02	5.99	0.03	5.96	0.01	5.98	0.02	5.95	-0.01	5.98	0.03	5.95	-0.01	5.94	-0.01	5.95	0.00	5.99
CTC_14	4.69	4.70	0.01	4.70	0.01	4.70	0.00	4.70	0.01	4.69	0.00	4.70	0.01	4.69	0.00	4.69	0.00	4.70	0.00	4.72
CTC_15	3.90	3.92	0.02	3.92	0.03	3.91	0.01	3.91	0.02	3.88	-0.02	3.92	0.03	3.89	-0.01	3.88	-0.02	3.89	-0.01	3.97
FITZ_01	11.77	11.61	-0.15	11.61	-0.15	11.61	-0.16	11.61	-0.16	11.61	-0.16	11.61	-0.16	11.61	-0.16	11.61	-0.16	11.61	-0.16	11.61
FITZ_02	10.62	10.25	-0.37	10.25	-0.37	10.26	-0.37	10.25	-0.37	10.47	-0.15	10.25	-0.37	10.48	-0.14	10.48	-0.14	10.46	-0.16	10.52
FITZ_03	11.92	10.85	-1.07	10.85	-1.07	10.85	-1.07	10.85	-1.07	10.85	-1.07	10.85	-1.07	10.85	-1.07	10.85	-1.07	10.85	-1.05	10.85
FITZ_04	10.47	10.00	-0.47	10.00	-0.47	10.00	-0.47	10.00	-0.47	10.36	-0.11	10.00	-0.47	10.37	-0.10	10.37	-0.10	10.37	-0.10	10.43
FITZ_05	10.46	9.97	-0.49	9.98	-0.48	9.97	-0.50	9.97	-0.50	10.37	-0.10	9.97	-0.49	10.37	-0.10	10.37	-0.09	10.37	-0.09	10.43
FITZ_06	10.46	9.97	-0.48	9.98	-0.47	9.97	-0.49	9.97	-0.49	10.37	-0.09	9.97	-0.48	10.37	-0.09	10.38	-0.08	10.37	-0.08	10.43
FITZ_07	10.44	9.97	-0.47	9.98	-0.46	9.97	-0.48	9.97	-0.48	10.37	-0.07	9.97	-0.47	10.37	-0.07	10.38	-0.07	10.38	-0.07	10.44
FOX_01	9.78	9.89	0.12	9.88	0.10	9.87	0.09	9.87	0.09	10.30	0.52	9.88	0.10	10.31	0.53	10.30	0.53	10.31	0.53	10.40
FOX_02	9.76	9.89	0.13	9.87	0.11	9.86	0.10	9.86	0.11	10.28	0.53	9.87	0.11	10.29	0.54	10.29	0.53	10.29	0.54	10.37
FOX_03	9.71	9.86	0.16	9.87	0.17	9.87	0.16	9.87	0.16	10.26	0.55	9.87	0.17	10.27	0.56	10.26	0.55	10.27	0.56	10.29
FOX_04	9.70	9.86	0.17	9.87	0.17	9.87	0.17	9.87	0.17	10.26	0.56	9.87	0.17	10.27	0.57	10.26	0.56	10.26	0.57	10.29

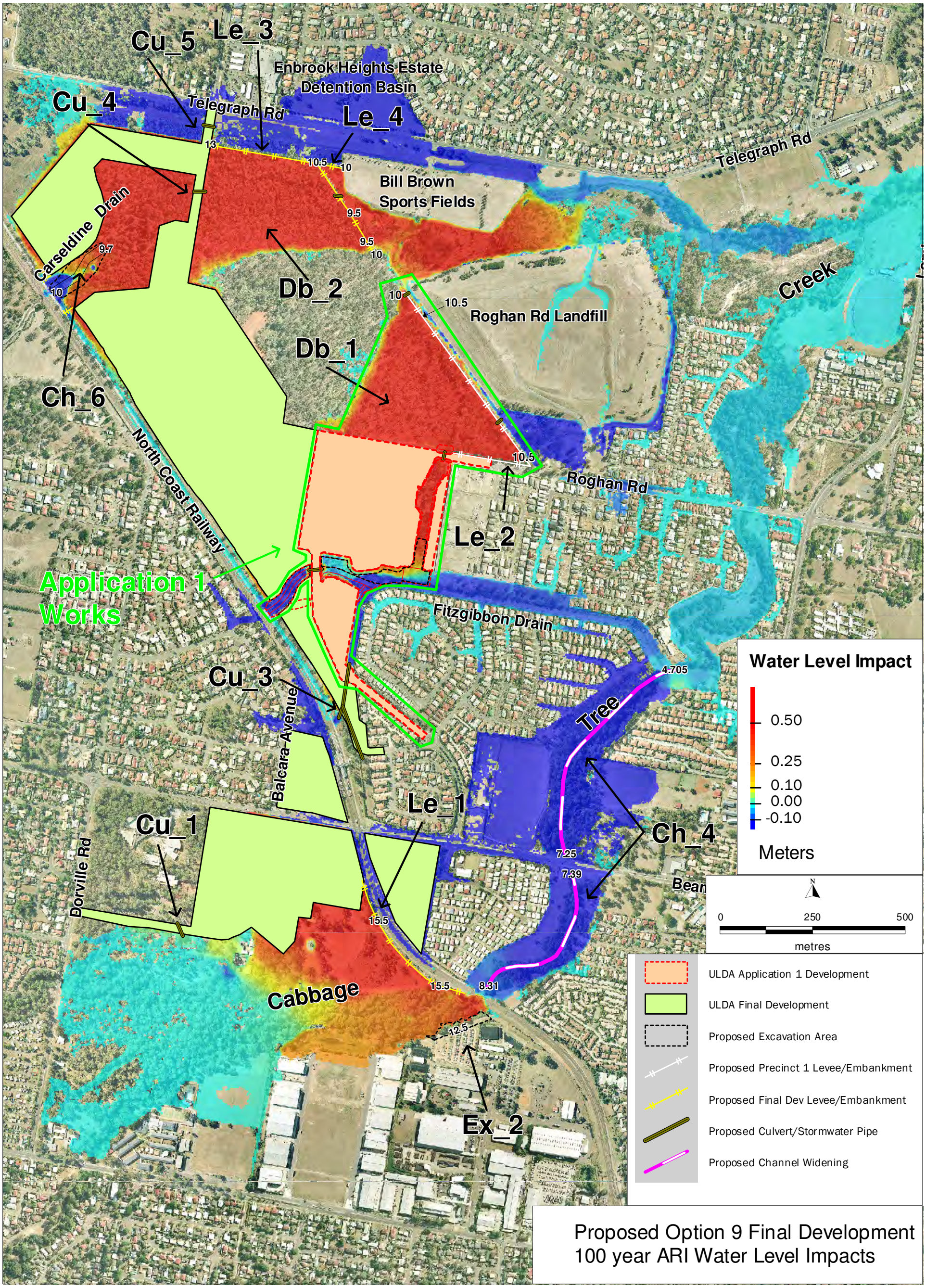


Figure 7.2 Option 9 Final Development 100 year ARI Flood Extent and Development Impacts, Fitzgibbon UDA site

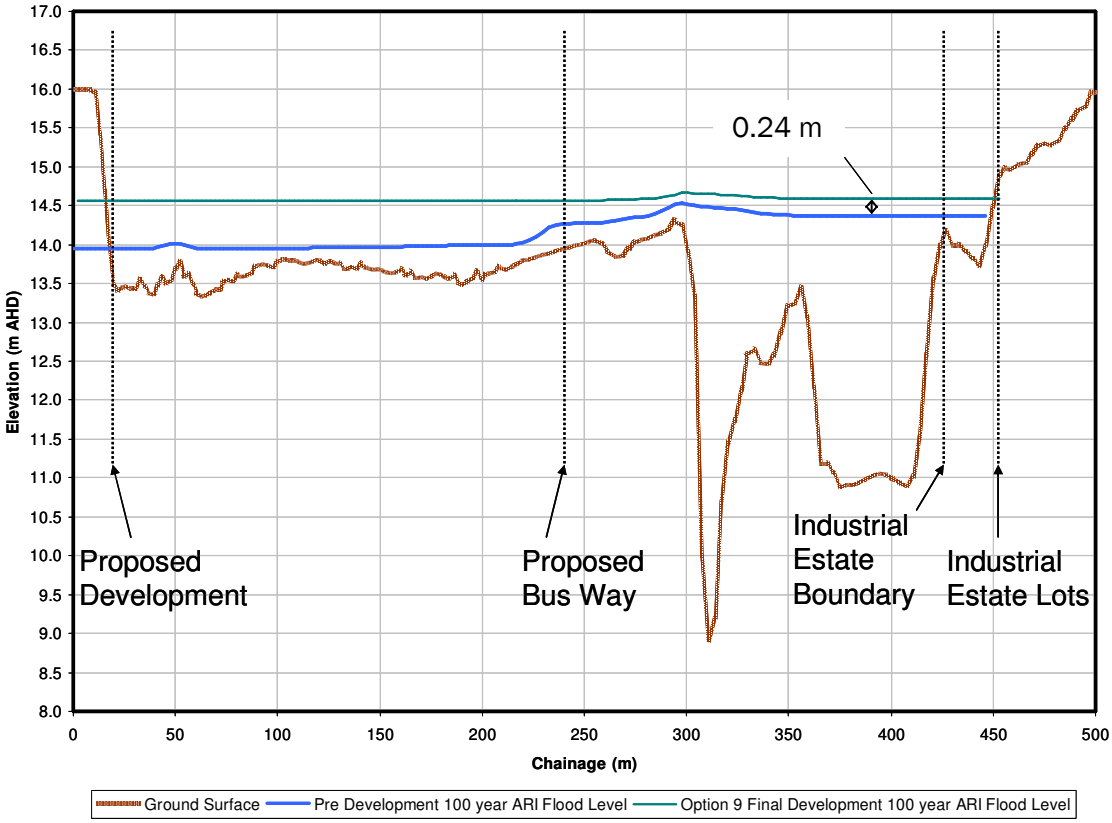


Figure 7.3 **Typical Cabbage Tree Creek Cross Section at the Existing Industrial Estate and 100 year ARI for Pre-Development and Option 9 Final Development Flood Level**

7.9 OPTION 9 FINAL DEVELOPMENT FILL LEVELS

The Option 9 final development conditions Cabbage Tree Creek TUFLOW model (see previous section) inflows were modified to determine conservative flood level estimates for the purpose of setting development fill levels. BCC requested that fill levels be determined using Cabbage Tree Creek 100 year ARI peak discharge of 264 m^3/s (instead of 249m^3/s as determined by the Cabbage Tree Creek URBS model). The Cabbage Tree Creek inflow hydrographs at inflow locations A1, A2 and A3 (see Section 4.3) were factored up by 1.06 (6%).

Table 7.7 tabulates the 100 year ARI water levels for determining fill levels at the reporting locations shown in Figure 6.5.

8 PROPOSED BUS WAY IMPACT ASSESSMENT

8.1 PROPOSED CONFIGURATION

The Queensland Department of Transport and Main Roads is currently investigating a bus way connection from Telegraph Road to QUT Carseldine. Figure 8.1 shows the proposed alignment of the Bus Way. The bus way will be aligned along the eastern boundary of the North Coast Railway. A flyover will be constructed to cross the North Coast Railway 14 m above the ground and an embankment constructed on the QUT Carseldine land on its descent to existing ground level. Four culvert crossings of the North Coast Railway will be extended through the bus way. These railway culvert crossings include the Southern and Western Branch of the Fitzgibbon Drain and the Carseldine Drain.

8.2 POTENTIAL FLOOD IMPACTS OF THE BUS WAY

The most significant impact of the bus way is the proposed embankment as it descends from the North Coast Railway to the QUT Carseldine development area. The proposed embankment alignment is located within the Cabbage Tree Creek 100 year ARI flood extent. The embankment will reduce the Cabbage Tree Creek flood storage and part of the active flow area which could result in increased water levels along Cabbage Tree Creek adjacent to and upstream of the embankment.

8.3 TUFLOW MODEL IMPACT ASSESSMENT

The TUFLOW model was used to assess the impacts of the bus way on the 100 year ARI flood event within the study area. The adopted hydraulic openings through the bus way embankment on the QUT site consisted of a five meter wide open channel between the proposed levee and the bus way embankment. Depending on the cost, a culvert could be installed instead.

Table 8.1 shows the 100 year ARI peak water levels for existing conditions (full development of the upstream Cabbage Tree Creek catchment), Final Fitzgibbon UDA for Option 9 (without the bus way), and Final Fitzgibbon UDA for Option 9 (with the bus way). Table 8.1 also shows the 100 year ARI water level impacts due to the final development and the Bus Way and the estimated impact due to the bus way alone. The following is of note:

- 100 year ARI peak flood levels along Cabbage Tree Creek at the QUT Carseldine site range from 15.50 m AHD at Reporting Location CTC_01 to 14.05 m AHD at Reporting Location CTC_04;

- Construction of the bus way embankment will increase the maximum 100 year ARI water level along Cabbage Tree Creek adjacent to the QUT Carseldine site by 0.06 m;
- Construction of the bus way embankment will increase water levels at the existing industrial estate by 0.05 m. The 100 year ARI flood level at the industrial estate of 14.64 m AHD is lower than the lowest point of lots on the estate by 0.11 m; and
- The 100 year ARI flood impacts of the bus way downstream of the North Coast Railway are insignificant.

8.4 FILL LEVELS

Table 8.1 tabulates the 100 year ARI water levels, including the impacts of the bus way, for determining fill levels at the reporting locations shown in Figure 6.5.

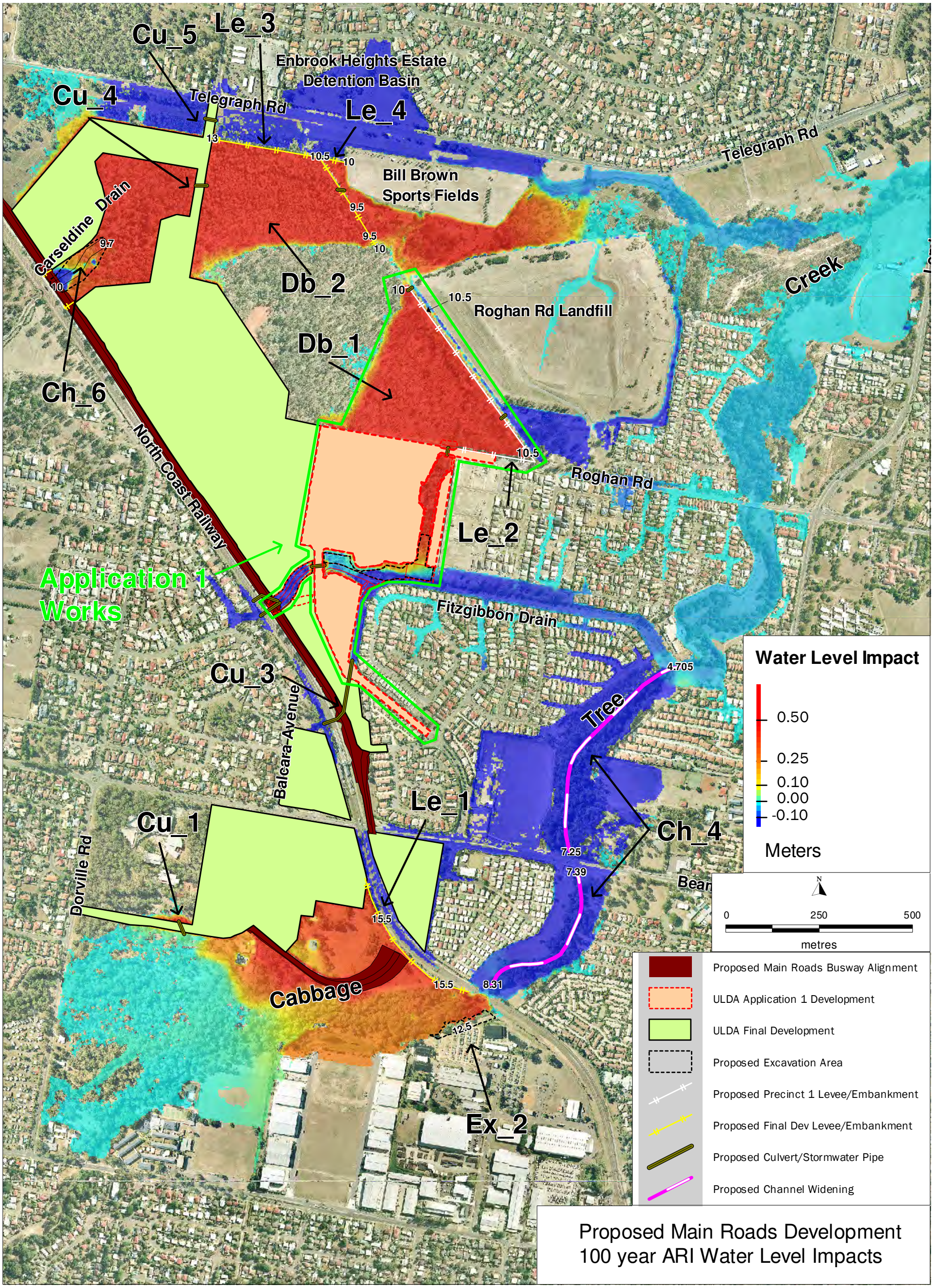


Figure 8.1 **Bus Way Development 100 year ARI Flood Extent and Development Impacts, Fitzgibbon UDA site**

Table 8.1 TUFLOW Model 100 yr ARI Flood Levels and 100 yr ARI Flood Level Impacts – Pre-Development, Final Fitzgibbon UDA with and without Bus Way

Reporting Location	100 Year ARI Peak Flood Level (m AHD)			100 yr ARI Water Level Impacts (m)		100 yr ARI Water Levels for Fill Level Calculations (m AHD)
	Existing	Final Fitzgibbon UDA (without Bus Way)	Final Fitzgibbon UDA (with Bus Way)	Final Development + Bus Way	Bus Way	
CARS_01	11.65	11.20	11.21	-0.44	0.01	11.21
CARS_02	9.55	10.54	10.54	0.99	0.00	10.54
CARS_03	9.24	10.05	10.05	0.81	0.00	10.05
CARS_04	9.08	9.53	9.53	0.45	0.00	9.53
CARS_05	8.58	9.05	9.05	0.47	0.00	9.05
CARS_06	9.19	8.67	8.67	-0.52	0.00	8.67
CARS_07	9.15	8.76	8.76	-0.39	0.00	8.76
CARS_08	9.15	8.68	8.68	-0.47	0.00	8.68
CARS_09	8.01	7.86	7.86	-0.15	0.00	7.86
CARS_10	7.47	7.43	7.43	-0.04	0.00	7.43
CARS_11	5.96	5.91	5.92	-0.04	0.01	5.92
CTC_01	15.48	15.49	15.50	0.02	0.01	15.54
CTC_02	14.47	14.64	14.70	0.23	0.06	14.78
CTC_03	14.37	14.60	14.64	0.27	0.04	14.73
CTC_04	13.71	14.08	14.06	0.35	-0.02	14.20
CTC_05	12.65	12.58	12.57	-0.08	-0.01	12.61
CTC_06	12.50	12.33	12.32	-0.18	-0.01	12.36
CTC_07	12.38	12.06	12.05	-0.33	-0.01	12.12
CTC_08	12.11	11.56	11.54	-0.57	-0.02	11.63
CTC_09	11.56	11.03	11.02	-0.54	-0.01	11.10
CTC_10	10.31	10.29	10.29	-0.02	0.00	10.34
CTC_11	9.26	9.24	9.23	-0.03	-0.01	9.30
CTC_12	8.69	8.68	8.67	-0.02	-0.01	8.75
CTC_13	5.95	5.95	5.94	-0.01	-0.01	5.99
CTC_14	4.69	4.69	4.69	0.00	0.00	4.71
CTC_15	3.90	3.89	3.88	-0.02	-0.01	3.94
FITZ_01	N/A	N/A	N/A	N/A	N/A	N/A
FITZ_02	10.62	10.46	10.42	-0.20	-0.04	10.48
FITZ_03	11.92	10.85	10.94	-0.98	0.09	10.94
FITZ_04	10.47	10.37	10.36	-0.11	-0.01	10.42
FITZ_05	10.46	10.37	10.37	-0.09	0.00	10.42
FITZ_06	10.46	10.37	10.37	-0.09	0.00	10.42
FITZ_07	10.44	10.38	10.37	-0.07	-0.01	10.43
FOX_01	9.78	10.31	10.30	0.52	-0.01	10.36
FOX_02	9.76	10.29	10.29	0.53	0.00	10.35
FOX_03	9.71	10.27	10.26	0.55	-0.01	10.31
FOX_04	9.70	10.26	10.26	0.56	0.00	10.31

9 WATER SENSITIVE URBAN DESIGN

9.1 DESIGN OBJECTIVES

Development within the Fitzgibbon UDA will be designed to meet current best practice design objectives for Water Sensitive Urban Design (WSUD), including management of stormwater quantity and quality, as well as source substitution for non-potable water supply.

Current WSUD design objectives for stormwater management are provided in the South East Queensland Regional Plan Implementation Guideline No. 7: Water Sensitive Urban Design (DIP 2008). The design objectives include:

- A frequent-flow management design objective. This objective requires the first 15 mm of runoff from impervious surfaces (for sites with > 40% imperviousness) to be captured and managed to minimise the impacts on downstream ecosystems associated with the increased frequency of runoff from impervious surfaces.
- A waterway stability management design objective. The objective aims to protect downstream waterways from increases in in-stream erosion by ensuring that the peak 1 year ARI stormwater discharge from the site to the receiving waterway is not increased by the proposed development.
- A stormwater quality management design objective. This objective requires the following reductions in total load of key stormwater pollutants discharging from the site, compared to untreated stormwater runoff:
  - 80% reduction in total suspended solids,
  - 60% reduction in total phosphorus,
  - 45% reduction in total nitrogen, and
  - 90% reduction in gross pollutants.

Requirements for source substitution are provided in the South East Queensland Water Strategy (QWC 2008) which requires all new dwellings to provide 70,000 L per year from alternative (non-grid) water sources.

Design objectives for stormwater quality management and water source substitution should be met for all developable areas in the UDA. Meeting the frequent flow management and waterway stability management objectives is most important for development areas draining to tributaries of Cabbage Tree Creek, in particular Carseldine Drain. Managing the frequency and magnitude of stormwater which discharges directly to Cabbage Tree Creek will be of less benefit due to the very large impervious area already established within the Cabbage Tree Creek catchment.

9.2 PROPOSED WSUD INFRASTRUCTURE

9.2.1 Overview

Appropriate WSUD infrastructure required to meet the above design objectives for the UDA is given in Table 9.1. Table 9.1 also shows the indicative required land allocation for the various infrastructure components. Further discussion on the potential implementation of each of the infrastructure components is provided in the following sections.

Note that constructed stormwater treatment wetlands could also be used effectively on the site. However, the required footprint area is typically of the order of 5% of the contributing catchment, which is substantially more than required for bioretention basins. Stormwater treatment wetlands offer a potential advantage on flat sites since they typically produce a smaller loss of hydraulic head from inlet to outlet.

Table 9.1 Proposed WSUD Infrastructure, Fitzgibbon UDA

WSUD Design Objective	Proposed Infrastructure	Area Required Within Developable Area Footprint [a]	Location
Frequent Flow Management	Bioretention	70 – 130 m²/ha [b] 210 m²/ha [c]	May be implemented at a range of spatial scales depending on desired urban form and streetscape.
	Stormwater capture basins	30 – 60 m²/ha	Adjacent or connected to bioretention basins.
Waterway Stability Management	Stormwater detention basins	Nil.	Regional detention basins north of Fitzgibbon Drain.
	Flow dissipation at stormwater outlets	Nil.	Downstream of stormwater outlets to open space areas.
Stormwater Quality Management	Swales (optional where site conditions permit)	50 – 100 m²/ha	Distributed along road corridors.
	Bioretention	As per Frequent Flow Management	
Water Source Substitution	Option 1: Lot-scale rainwater tanks	Nil. Located within allotments.	
	Option 2: Regional rainwater tanks	0.5% (Indicative estimate only)	

[a] Required area depends on development density and whether lot-scale rainwater tanks are adopted.
[b] With lot-scale rainwater tanks.
[c] With regional rainwater tanks.

9.2.2 Bioretention

Bioretention systems collect stormwater runoff in a shallow storage area for filtration through planted filter media and are an effective method of removing particulate pollutants and dissolved nutrients from stormwater. Pre-treatment of inflows is required using either grass swales or a sediment or gross pollutant trap.

Bioretention systems can be implemented at a range of spatial scales and adapted to different types of urban development as shown in Figure 9.1. They can be used at the inlet of a stormwater system (in place of traditional gully-pit inlets), as a linear feature in road medians, or as an end-of-line treatment system. The performance of a bioretention basin increases with the

surface area of the filter media. The total footprint area required for bioretention is usually larger than the required filter media area to accommodate the small embankments necessary to form the storage area. Hence the total footprint area for multiple small basins is larger than the footprint area for a smaller number of larger basins.

Figure 9.1 Optional Configuration of Bioretention Systems (source: www.wsud.org)

Indicative filter media areas and footprint areas for bioretention to treat stormwater from residential development within the UDA were estimated using the MUSIC model. Bioretention sizing was estimated for dwelling densities of 15 dwelling per hectare and 30 dwellings per hectare. Bioretention sizes were estimated with and without lot-scale rainwater tanks to assess the impact on bioretention sizing if a regional-scale stormwater harvesting strategy is adopted.

Under this scenario the bioretention systems would be used to pre-treat stormwater prior to further purification and storage at a regional scale for subsequent reticulation as non-potable water. The adopted parameters and model results are shown in Table 9.2.

The results of the MUSIC model show that lot-scale rainwater tanks significantly reduce the required footprint area of bioretention. Without lot-scale rainwater tanks, bioretention would require a space allocation of about 2% of the development area. With lot-scale tanks, low density development would require an area of about 1.3%, and higher density development would require only about 0.7% due to the reduction in stormwater volume from harvesting of roofwater.

Table 9.2 Indicative Bioretention Sizing for Residential Development

Parameter	15 Dwellings / ha	30 Dwellings / ha
Road impervious	15%	25%
Roof impervious	30%	40%
Other impervious	10%	5%
Pervious	45%	30%
Water demand (0.326 kL/dw/d) [a]	4.9 kL/ha/d	9.8 kL/ha/d
Rainwater tank size [b]	75 kL/ha	90 kL/ha
With individual rainwater tanks		
- Required bioretention filter area	55 m^2/ha	20 m^2/ha
- Required bioretention footprint area	130 m^2/ha	70 m^2/ha
Without individual rainwater tanks		
- Required bioretention filter area	100 m^2/ha	110 m^2/ha
- Required bioretention footprint area	200 m^2/ha	210 m^2/ha
Rainwater yield	1.6 ML/ha/yr	2.1 ML/ha/yr
	107,000 L/dwelling/yr	70,000 L/dwelling/yr

[a] Taken from GCCC, 2006
[b] Based on 5 kL per dwelling for 15 dwellings per ha and 3 kL per dwelling for 30 dwellings per ha

9.2.3 Stormwater Capture Basins

It is likely that rainwater tanks will be sufficient to meet the frequent flow management objective (capture of the first 15 mm runoff) for roof areas.

The storage available within bioretention areas can be used to capture runoff from ground-level impervious areas. However it is unlikely that this volume alone will be sufficient to meet the frequent flow management objective. Based on the assumed areas of roads and other impervious areas in Table 9.2, a capture volume of 38 m^3/ha will be required for 15 dwellings per hectare (compared to about 29 m^3/ha available in bioretention) and 45 m^3/ha for 30 dwellings per hectare (compared to about 14 m^3/ha available in bioretention). Hence an additional 10 to 30 m^3/ha will be required to achieve the frequent flow management objective.

This additional storage could be provided by enlarging bioretention basins, or by constructing separate adjoining stormwater capture basins. The stormwater capture basins would perform a similar function to bioretention, capturing low flows for slow release, but are not designed to reduce peak flow rates during large storm events. A separate stormwater capture basin provides the opportunity to increase the storage depth compared to the maximum of about 0.4 m for bioretention basins, allowing a potential reduction in footprint area. Note however that this approach requires adequate fall from the bioretention inlet to the capture basin outlet and may not be suitable in flat areas.

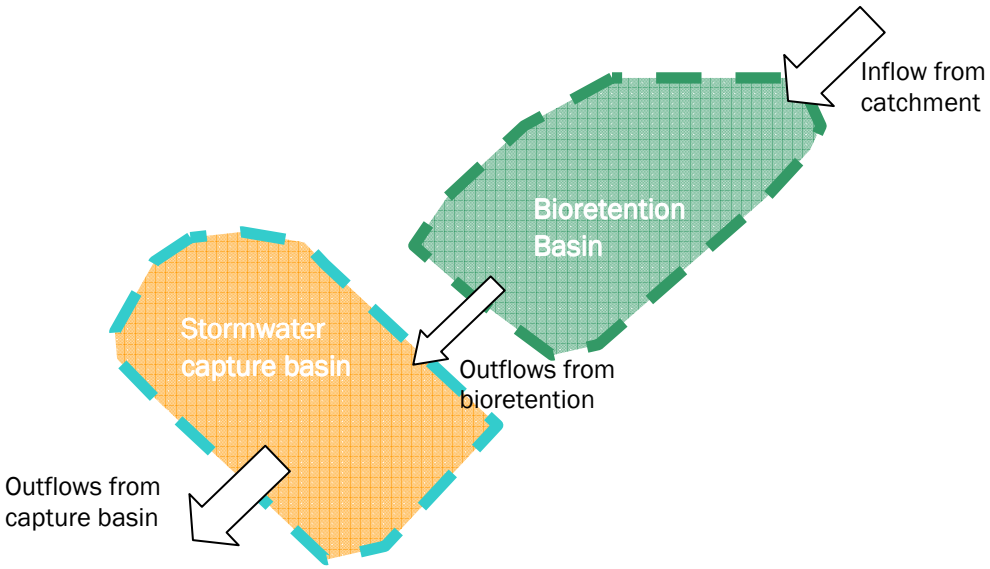


Figure 9.2 Indicative Arrangement of Stormwater Capture Basin

9.2.4 Stormwater Detention Basins

Stormwater detention basins are storage areas with a restricted outlet capacity designed to reduce peak flow rates during large storm events. The proposed development north of Fitzgibbon Drain will drain to two large regional detention basins (see Figure 7.1) that will ensure that peak stormwater discharges to Carseldine Drain are not increased.

9.2.5 Flow Dissipation at Stormwater Outlets

Appropriate energy dissipation measures should be implemented to minimise the potential for erosion at outlets from the stormwater pipe system. Particular attention is required for stormwater outlets that are concentrating stormwater discharges onto flat land (such as proposed discharges on the northern side of Roghan Road), rather than discharging to an existing channel. Appropriate treatment for these outlets would include a shallow rock-lined outlet channel, as illustrated conceptually in Figure 9.3, which would provide protection from erosion at the pipe outlet and extend far enough downstream to allow stormwater to spread over the land surface. Figure 9.3 also illustrates an alternative approach using a shorter rock apron with concrete blocks used for energy dissipation. Suitable landscape planting adjacent to the outlet works should be used to minimise visual impacts.

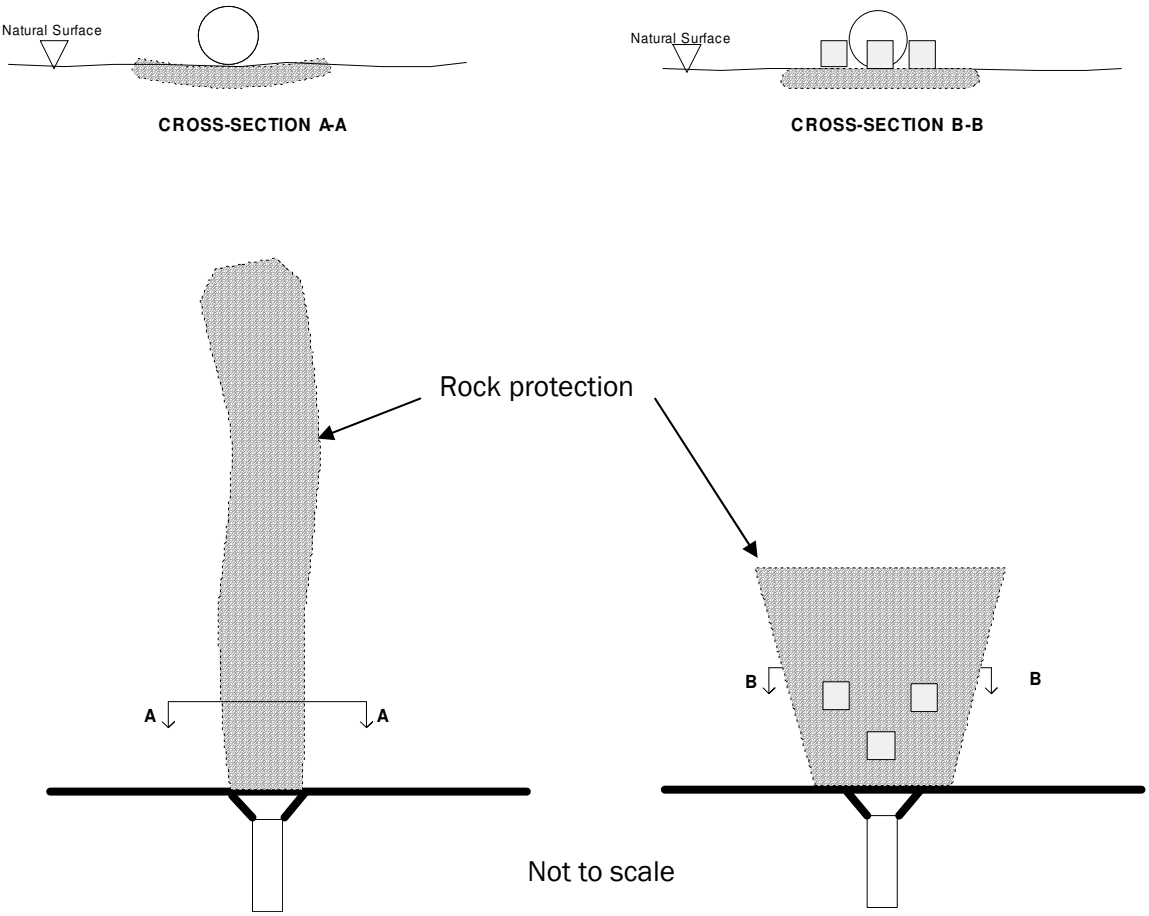


Figure 9.3 Conceptual Illustration of Erosion Protection Options for Stormwater Pipe Outlets to Flat Land

9.2.6 Swales

Swales are shallow grass-lined channels designed to remove some particulate pollutants and promote stormwater infiltration and can be useful as a pre-treatment measure for bioretention. Swales are typically incorporated in roadside drainage, replacing kerb and channel (see Figure 9.4). Since swales require additional width to be allocated to the road reserve, areas where the use of swales may be appropriate need to identified early in the planning process so that adequate space can be allocated. Swales are best suited to locations with longitudinal gradients of 2 to 5% and where the number of driveway crossovers can be minimised.

Figure 9.4 Example Applications of Swales (source: www.wsud.org)

9.2.7 Rainwater Tanks

Individual rainwater tanks are an effective method of meeting requirements for non-potable water source substitution. However, potential may also exist within the Fitzgibbon UDA for the implementation of a regional stormwater harvesting approach. Figure 9.5 illustrates a conceptual approach that could be suitable for the UDA site. Stormwater is directed to bioretention systems for treatment and then pumped to a stormwater purification facility for further treatment prior to storage in above-ground tanks. The purified stormwater is then reticulated through the development in a "third-pipe" system for non-potable use. Further investigation is required to confirm whether stormwater harvesting is a viable option for the UDA.

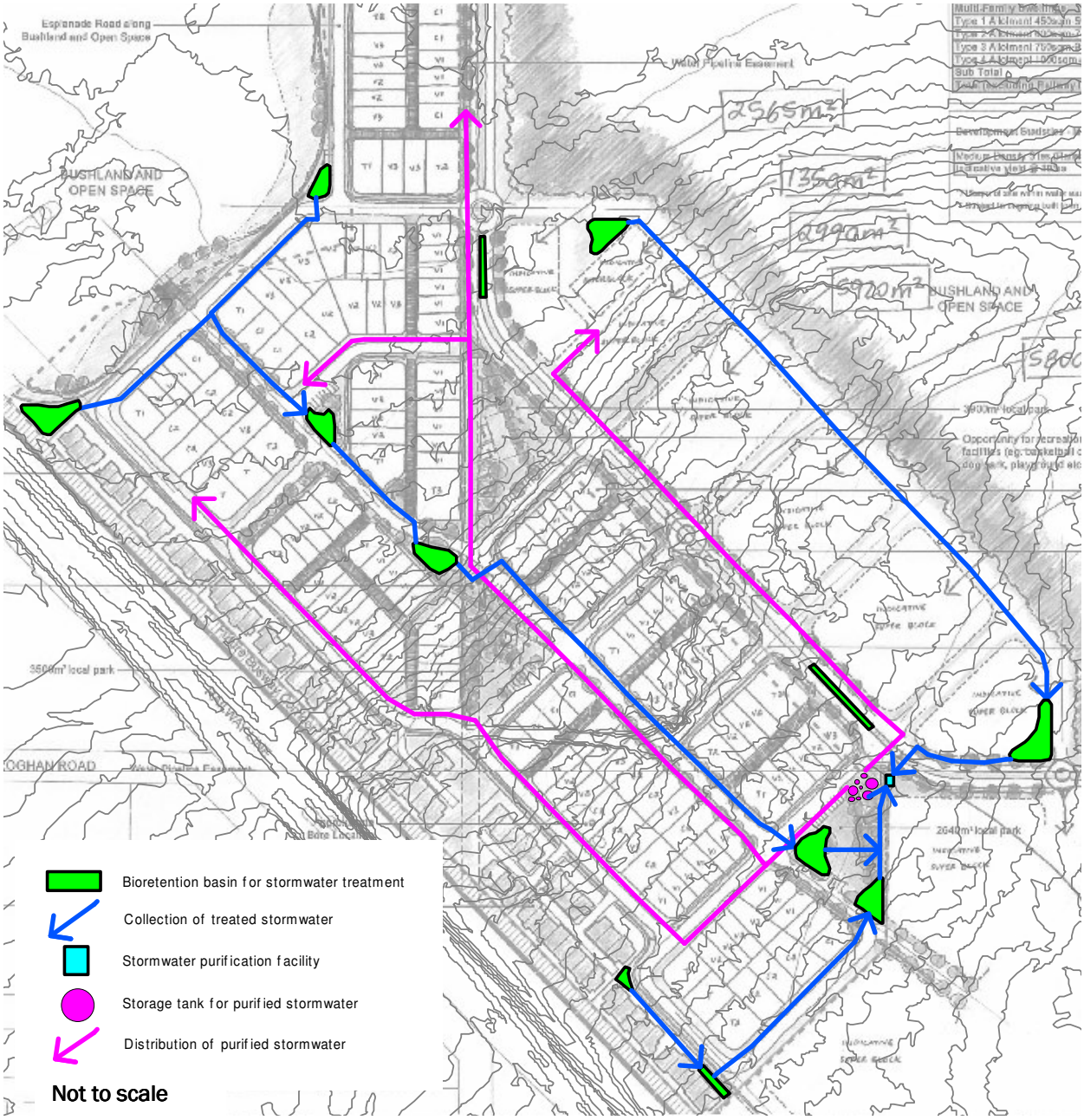


Figure 9.5 Indicative Stormwater Harvesting Concept

10 INFRASTRUCTURE COSTING

Table C1 in Appendix C provides indicative cost estimates of civil construction costs for the flood management infrastructure investigated for the Fitzgibbon UDA. The following points should be noted:

- All costs shown in Table C1 are exclusive of GST.
- The costs shown in Table C1 have been developed to assist in broad-scale planning and should be regarded as indicative only. They should not be regarded as actual construction costs.
- All costings are based on conceptual design only. All infrastructure components will be subject to detailed design that could result in substantial design changes which could, in turn, substantially change estimated costs.
- No allowance has been made for the potential offset of cut and fill costs by balancing earthworks quantities across the site. This could substantially reduce the costs associated with some infrastructure components.
- Additional costs for civil/structural design would be in the range of 7% to 9% (depending upon the complexity) of the construction cost and additional to it.
- No allowance has been made for costs of other services such as project management or environmental investigations.
- For budget purposes it is recommended that a contingency sum of up to 30% over the estimated costs be allowed for.

Table 10.1 provides indicative total construction costs for the 9 flood mitigation options considered in Section 7. Costs are provided with and without the cost of road culverts, which could be considered as general civil infrastructure for the site. The costs of any culverts associated with the Application 1 development are not included. Note also that bioretention costs are included for all options.

Table 10.1 Indicative Construction Cost Estimates for Preferred Flood Mitigation Option

Flood Mitigation Component	Indicative Construction Cost (M$) [a]	
	Including Road Culverts	Excluding Road Culverts
Precinct 4		
Cu_3	0.59	0
Cu_4	0.69	0
Ch_6	0.21	0.21
Db_1	0.83	0.83
Db_2	0.11	0.11
Le_3	0.14	0.14
Le_4	0.03	0.03
Bioretention (40 ha)	0.80	0.80
Total Precinct 4	**3.40**	**2.12**
Precincts 1,2 & 3		
Cu_1	0.02	0
Le_1	0.22	0.22
Ex_2	0.29	0.29
Ch_4	1.18	1.18
Bioretention (20 ha)	0.40	0.40
Total Precincts 1,2 & 3	**2.11**	**2.09**

[a] Refer to notes above for basis of cost estimates

11 CONCLUSIONS

The Urban Land Development Authority (ULDA) is currently preparing a Development Scheme for the Fitzgibbon Urban Development Area (UDA) which covers an area of 295 ha. Most of the UDA lies to the south of Telegraph Road and to the east of the North Coast Railway. The UDA includes the existing Queensland University of Technology (QUT) campus at Carseldine, Carseldine Railway Station and a 114 ha parcel of vacant land owned by the Department of Housing (DoH), as well as a number of other land parcels in private and government ownership.

A flood modelling study of Cabbage Tree Creek and adjoining tributaries downstream of Dorville Road was undertaken to assess the flood impacts of the initial stages of development (Application 1) and the final development plan for the Fitzgibbon UDA. A TUFLOW 2D hydraulic model was used to simulate flood behaviour for existing and developed site conditions.

Existing development within the UDA is likely to be substantially affected by flooding as ongoing development occurs in the Cabbage Tree Creek catchment upstream of the UDA. The proposed development of the UDA, and construction of associated flood management infrastructure, provides an opportunity to reduce flood problems of existing development, as well as mitigating any impacts of the UDA development.

The proposed development plan for the UDA will have significant impacts on flow behaviour along Cabbage Tree Creek and its tributaries. A suite of flood mitigation works will be required to ensure no adverse flood impacts on adjoining properties and to increase the developable area of the site. Nine combinations of these management measures were modelled in TUFLOW to assess their likely impacts. Several components of the proposed flood management infrastructure are located outside of the Fitzgibbon UDA.

Application 1 development proposes a number of flood management infrastructure including:

- The Rogan Road detention basin will be constructed in the DoH land to the north of Application 1. The proposed detention basin ensures that post development 100 year ARI discharges to the north of the Application 1 development are equal to or less than pre-development conditions;
- A flood protection levee along the DoH land boundaries adjoining Roghan Road and the Roghan Road Landfill. This levee will form the northern, north-eastern, and part of the southern walls of the Roghan Road Landfill detention basin;
- A 50 m wide overflow channel will be constructed through the development area joining the Fitzgibbon Drain with the proposed Roghan Road Landfill detention basin;
- The western branch of the Fitzgibbon Drain will be modified between the North Coast Railway and its confluence with the southern branch of the Fitzgibbon Drain;
- Culverts will be installed along the proposed Carselgrove Avenue where the road crosses the southern and western branches of the Fitzgibbon Drain; and
- A series of box culverts across Roghan Road along the southern boundary of the Roghan Road Landfill detention basin.

Based on the results of the flood modelling undertaken for the site, the following flood mitigation infrastructure (Option 9) in addition to the Application 1 works successfully mitigates most development impacts:

- Within the Fitzgibbon UDA:
  - A culvert across the collector road that extends around the southern side of the QUT Carseldine development area to join with Dorville Road;
  - A flood protection levee along the upstream boundary of the railway easement between the proposed QUT Carseldine development and the North Coast Railway crossing of Cabbage Tree Creek;
  - Extension of the Carselgrove Avenue culverts along the southern Fitzgibbon Drain branch;
  - A series of box culverts across Roghan Road at the Carseldine Drain crossing;
  - A new channel immediately downstream of the Railway Crossing of Carseldine Drain; and
  - A flood protection levee along the northern and north-western boundaries of the DoH land between the proposed development extent and the DoH boundary. This flood protection levee forms the wall for the Carseldine Drain detention basin.
- Outside the Fitzgibbon UDA:
  - A 17 m wide channel along Cabbage Tree Creek from North Coast Railway to the Fitzgibbon Drain;
  - Excavation along Cabbage Tree Creek upstream of the railway near Pineapple Street; and
  - A flood protection levee south of Telegraph Road between the proposed Carseldine Drain detention basin and the Bill Brown Sports Field.

Detailed design of this infrastructure will require further detailed studies, including assessment of potentially substantial environmental impacts.

The Department of Transport and Main Roads have proposed a bus way linking Telegraph Road with Dorville and Beams Roads. The final Fitzgibbon UDA scenario TUFLOW model was used to assess the impacts of the bus way on Cabbage Tree Creek flood levels. The bus way embankment will increase adjacent flood levels in Cabbage Tree Creek by about 0.06 m.

12 REFERENCES

BCC (2000) *Cabbage Tree Creek Flood Study Upgrade Report*, Waterways Section Design Branch, Brisbane City Council, Updated by BCC City Design, January 2000

Carroll (2004) *URBS – A Rainfall Runoff Routing Model for Flood Forecasting and Design*, URBS User Manual Version 4, November 2004.

Chow (1959) *Open Channel Hydraulics*, written by V.T. Chow, McGraw-Hill Book Company, NY, 1959.

IEAust (1998) *Australian Rainfall and Runoff: A guide to Flood Estimation*, Institution of Engineers, Australia

QWC (200) *Queensland Water Commission (QWC),* South-east Queensland Water Strategy.

Storm (2006) *253 Telegraph Road, Stormwater Quantity and Quality Assessment Report*, Storm Water Consulting Pty Ltd, March 2006

Storm (2008) *ULDA Fitzgibbon Development, Draft Stormwater Quantity and Quality Assessment Report*, Storm Water Consulting Pty Ltd, August 2006

WBM (2003) *Carseldine Drain and Taigum Master Drainage Study*, Prepared for Brisbane City Council, WBM Pty. Ltd.

WBM (2008) *TUFLOW User Manual - GIS Based 2D/1D Hydrodynamic Modelling*, WBM Pty Ltd., November 2008.

APPENDIX A

TUFLOW ROUGHNESS MAP

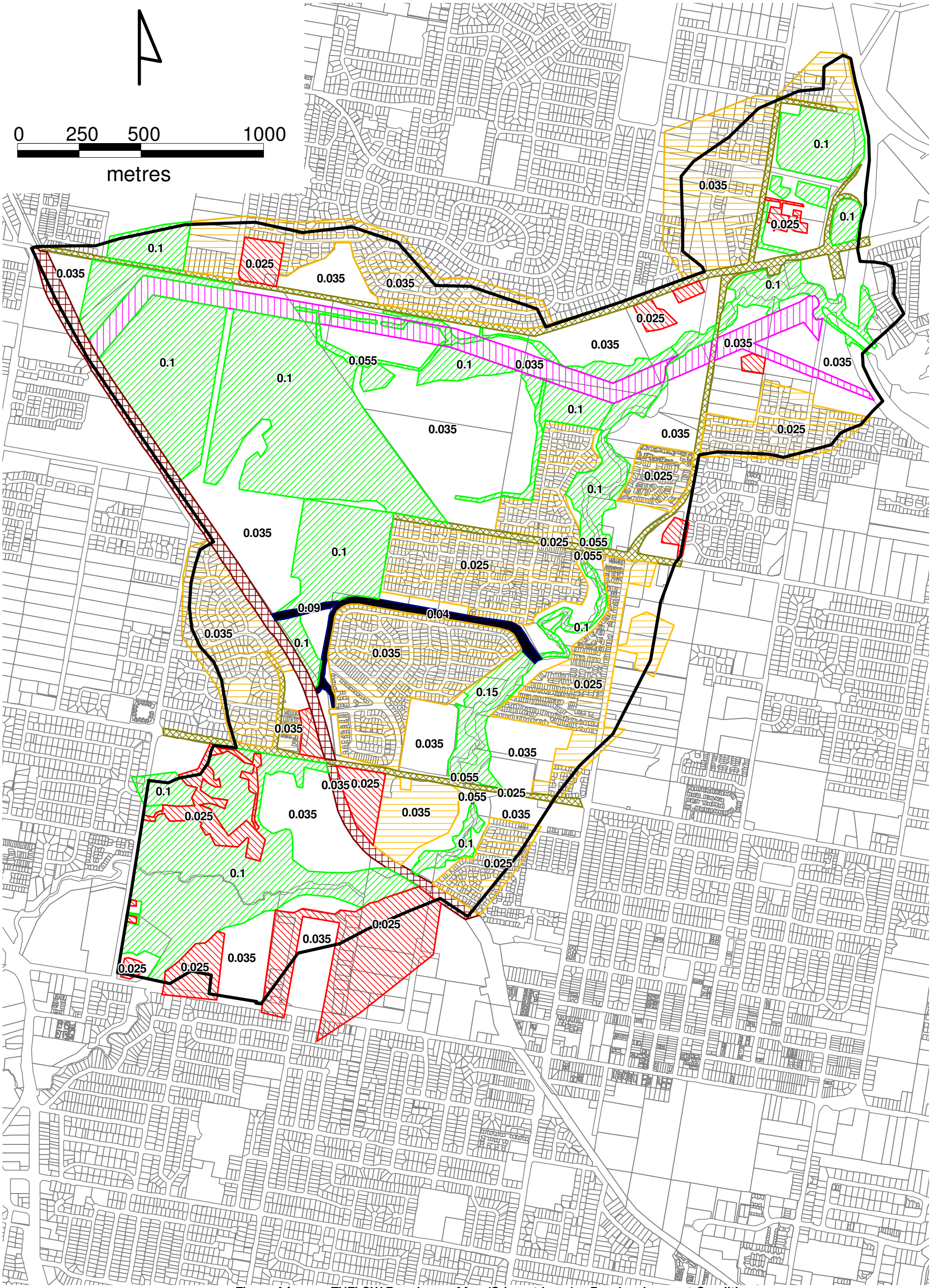


Figure A1 TUFLOW Roughness Map (2d_mat layer) – Pre-development Conditions

APPENDIX B

TUFLOW 1D NETWORK

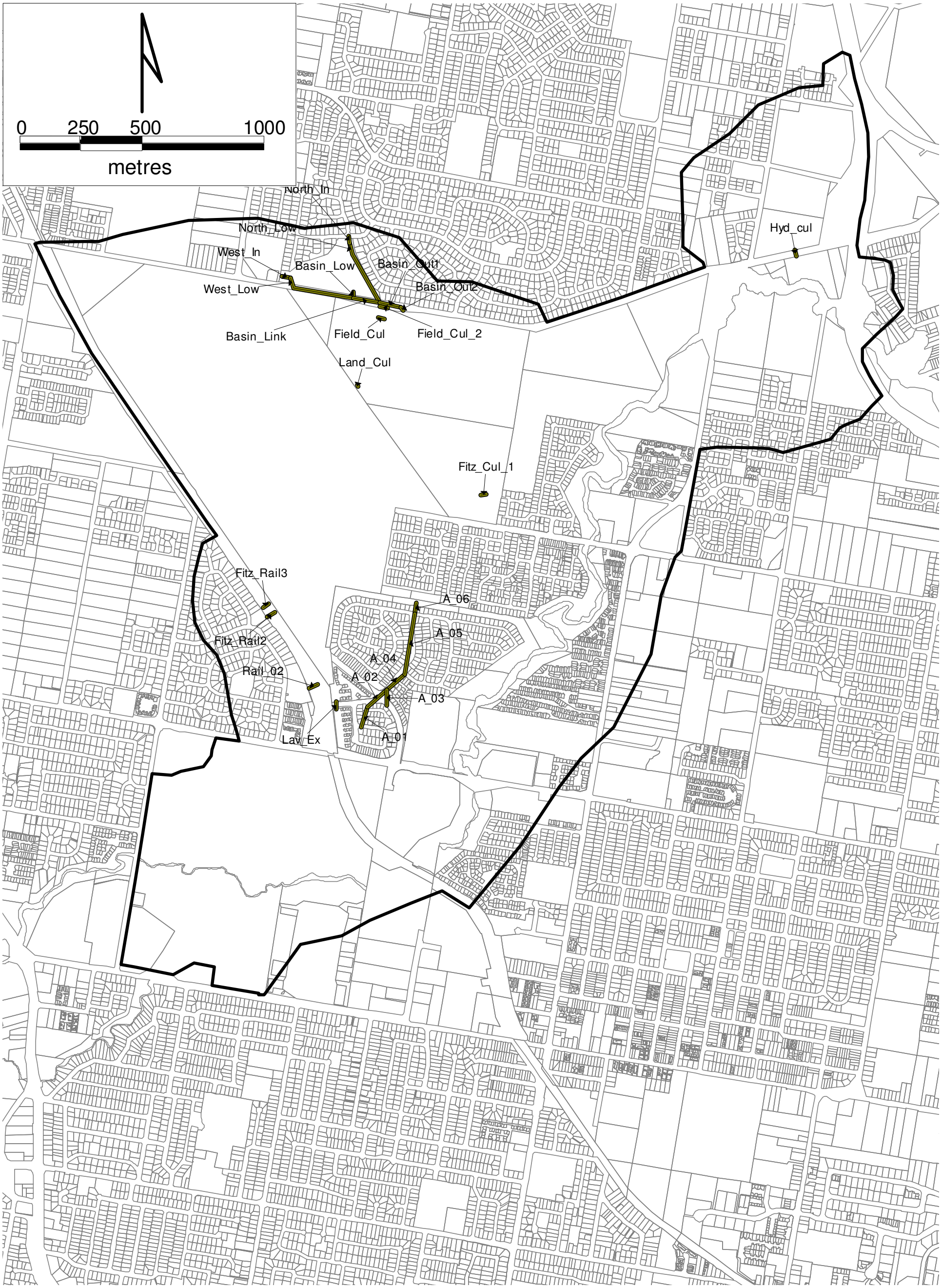


Figure B1 TUFLOW 1D Culvert Locations – Pre-development Conditions

Table B1 Details of 1D Hydraulic Structures in the TUFLOW model

ID	Channel Type	Ignore	Channel Storage at Nodes	Length or ANA	Manning's n	U/S Invert	D/S Invert	Form or Bend Loss	Blockage	Branch	Topo_ID	Xsect ID or Chainage	Diameter or Width	Weir Factor or Height	No of Culverts	Culv H Contraction Coeff	Culv W Contraction Coeff	Culvert Entry Loss	Culvert Exit Loss
A_01	C	F	T	90	0.015	10	9.7	0	0			0	1.05	0	1	0.6	0.9	0.5	1
A_01_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
A_02	C	F	T	105	0.015	9.7	9.4	0	0			0	1.3	0	1	0.6	0.9	0.5	1
A_02_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
A_03	C	F	T	60	0.015	9.6	9.4	0	0			0	0.9	0	1	0.6	0.9	0.5	1
A_03_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
A_04	C	F	T	100	0.015	9.4	9.1	0	0			0	1.35	0	1	0.6	0.9	0.5	1
A_04_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
A_05	C	F	T	250	0.015	9.1	8	0	0			0	1.65	0	1	0.6	0.9	0.5	1
A_05_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
A_06	C	F	T	20	0.015	7.7	7.5	0	0			0	1.95	0	1	0.6	0.9	0.5	1
A_06_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
Basin_Link	C	F	T	70	0.015	5.4	4.9	0	0			0	1.8	0	1	0.6	0.9	0.5	1
Basin_Low	C	F	T	47	0.015	5.19	5.096	0	0			0	1.05	0	1	0.6	0.9	0.5	1
Basin_Out1	R	F	T	100	0.015	4.88	4.68	0	0			0	3.3	1.5	1	0.6	0.9	0.5	1
Basin_Out2	R	F	T	30	0.015	4.66	4.6	0	0			0	3.6	1.2	1	0.6	0.9	0.5	1
Basin_Pit	R	F	F	0	0	-99999	5.15	0	0		SXZ	1	3	3	1	0.62	0.62	0.5	0.5
Field_Cul	C	F	T	25	0.015	7.7	6.9	0	0			0	0.9	0	1	0.6	0.9	0.5	1
Field_Cul_2	C	F	T	25	0.015	7.6	7.2	0	0			0	0.9	0	1	0.6	0.9	0.5	1
Fitz_Cul_1	C	F	T	15	0.015	8.8	8.5	0	0.4			0	0.6	0	2	0.6	0.9	0.5	1
Fitz_Rail2	C	F	T	30	0.015	9.61	9.52	0	0			0	1.5	0	3	0.6	0.9	0.5	1
Fitz_Rail3	C	F	T	23	0.015	11.63	11.22	0	0			0	0.6	0	6	0.6	0.9	0.5	1
Hyd_cul	R	F	T	17	0.015	3.29	3.11	0	0			0	2.4	1.5	1	0.6	0.9	0.5	1
Land_Cul	C	F	T	7	0.015	8.17	8	0	0			0	0.6	0	1	0.6	0.9	0.5	1
Lav_Ex	C	F	T	25	0.015	10.65	10.51	0	0			0	0.75	0	2	0.6	0.9	0.5	1
North_In	R	F	T	10	0.015	5.55	5.51	0	0			0	3.6	1.8	3	0.6	0.9	0.5	1
North_Low	R	F	T	282	0.015	5.504	4.9	0	0			0	2.4	1.8	1	0.6	0.9	0.5	1
North_Pit	R	F	F	0	0	8.5	5.45	0	0		SX	1	2	0.45	7	0.62	0.62	0.5	0.5
Rail_01	C	T	T	30	0.015	12.5	12.4	0	0			0	0.45	0	6	0.6	0.9	0.5	1
Rail_02	C	F	T	30	0.015	10.5	9.9	0	0			0	1.4	0	3	0.6	0.9	0.5	1
West_In	C	F	T	10	0.015	5.9	5.86	0	0			0	3.6	1.8	3	0.6	0.9	0.5	1
West_Low	C	F	T	360	0.015	5.84	5.06	0	0			0	1.65	0	1	0.6	0.9	0.5	1
West_Pit	R	F	F	0	0	-99999	5.8	0	0		SX	1	2	0.45	8	0.62	0.62	0.5	0.5
A_01	C	F	T	90	0.015	10	9.7	0	0			0	1.05	0	1	0.6	0.9	0.5	1
A_01_Pit	R	F	T	0	0	-99999	-99999	0	0		SXZ	0	5	0.5	1	0.62	0.62	0.2	0.2
A_02	C	F	T	105	0.015	9.7	9.4	0	0			0	1.3	0	1	0.6	0.9	0.5	1

APPENDIX C

INFRASTRUCTURE COSTING

Table C1 Indicative Construction Cost Estimates for Flood Mitigation Infrastructure

ID	Description	UNIT	RATE ($)	QTY	ITEM COST ($)	TOTAL
Ch_1	**17 m wide channel upstream of the railway (L~ 450 m)**					**$ 460,000**
	Earthworks - Cut to spoil	m^3	17	11500	195,500	
	Trim and profiling to banks	m^2	5	7650	38,250	
	Bank treatment / revegetation	m^2	30	7650	229,500	
Ch_2	**10 m wide channel upstream of the railway (L~ 450 m)**					**$ 270,000**
	Earthworks - Cut to spoil	m^3	17	6500	110,500	
	Trim and profiling to banks	m^2	5	4500	22,500	
	Bank treatment / revegetation	m^2	30	4500	135,000	
Ch_3	**17 m wide channel from the railway to 300 m downstream of the Fitzgibbon Drain (L~1450 m)**					**$ 1,490,000**
	Earthworks - Cut to spoil	m^3	17	37000	629,000	
	Trim and profiling to banks	m^2	5	24650	123,250	
	Bank treatment / revegetation	m^2	30	24650	739,500	
Ch_4	**17 m wide channel from railway to the Fitzgibbon Drain (L~ 1150 m)**					**$ 1,180,000**
	Earthworks - Cut to spoil	m^3	17	29000	493,000	
	Trim and profiling to banks	m^2	5	19550	97,750	
	Bank treatment / revegetation	m^2	30	19550	586,500	
Ch_5	**10 m wide channel from railway to the Fitzgibbon Drain (L~ 1150 m)**					**$ 700,000**
	Earthworks - Cut to spoil	m^3	17	17250	293,250	
	Trim and profiling to banks	m^2	5	11500	57,500	
	Bank treatment / revegetation	m^2	30	11500	345,000	
Ch_6	**Carseldine Drain channel excavation**					**$ 210,000**
	Earthworks - Cut to spoil	m^3	17	3000	51,000	
	Trim and profiling to banks	m^2	5	2000	10,000	
	Revegetation	m^2	15	10000	150,000	
Cu_1	**Culvert under new road on QUT site from Dorville Rd**					**$ 18,000**
	Concrete base	m^3	775	3	2,325	
	600mm dia. concrete pipe Class 2	m	280	30	8,400	
	End Structures(Head wall, Wing wall etc.)	No.	5500	1	5,500	
	Aprons	m^3	1100	1.5	1,650	
Cu_2	**Extra culverts jacked through the railway embankment**					**$ 980,000**
	Tunnel boring by jacking pipe	m	5000	160	800,000	
	1800mm dia. Class 4 pipe	m	800	160	128,000	
	End structures (Headwall, Wing wall etc.)	m^3	1100	40	44,000	
	Aprons	m^3	1100	8	8,800	

ID	Description	UNIT	RATE ($)	QTY	ITEM COST ($)	TOTAL
Cu_3	**Trunk stormwater pipes along southern branch of Fitzgibbon Drain**					**$ 590,000**
	1500mm dia. concrete pipe Class 2, 5 x 150 m	m	650	750	487,500	
	1500mm dia. concrete pipe Class 2, 1 x 150 m	m	650	150	97,500	
Cu_4	**New culverts under Roghan Rd at Carseldine Drain**					**$ 690,000**
	8 x 1800mm x 900mm box culvert + 7 x link slab	m	1000	450	450,000	
	End Structures(Head wall, Wing wall etc.)	m^3	1100	25	27,500	
	Base slab	m^3	775	270	209,250	
Cu_5	**New culvert under Roghan Rd near Telegraph Rd**					**$ 37,000**
	Concrete base	m^3	775	6	4,650	
	600mm dia. concrete pipe Class 2	m	280	90	25,200	
	End Structures(Head wall, Wing wall etc.)	No.	5500	1	5,500	
	Aprons	m^3	1100	1.5	1,650	
Db_1	**Roghan Road detention basin**					**$ 830,000**
	Strip, stockpile and respread topsoil (100mm thick)	m^3	15	13600	204,000	
	Earthworks - Imported fill	m^3	35	14400	504,000	
	Trim and Profiling	m^2	3	13600	40,800	
	Turfing	m^2	5	13600	68,000	
	Concrete base	m^3	775	2	1,550	
	900mm dia. concrete pipe Class 2	m	350	12	4,200	
	End Structures(Head wall, Wing wall etc.)	No.	2500	2	5,000	
	Aprons	m^3	1100	2	2,200	
Db_2	**Carseldine Drain detention basin outlet**					**$ 107,000**
	Strip, stockpile and respread topsoil (100mm thick)	m^3	15	170	2,550	
	Earthworks - Imported fill	m^3	35	2200	77,000	
	Trim and Profiling	m^2	3	1680	5,040	
	Turfing	m^2	5	1680	8,400	
	Concrete base	m^3	775	5	3,875	
	1500mm dia. concrete pipe Class 2	m	660	6	3,960	
	End Structures(Head wall, Wing wall etc.)	No.	2500	1	2,500	
	Aprons	m^3	1100	3	3,300	
Ex_1	**Excavation to increase waterway area under the railway bridge**					**$ 23,000**
	Earthworks - Cut to spoil	m^3	17	300	5,100	
	Trim and profiling to banks	m^2	5	500	2,500	
	Bank treatment / revegetation	m^2	30	500	15,000	
Ex_2	**Excavation upstream of the railway near Pineapple Street**					**$ 290,000**
	Earthworks - Cut to spoil	m^3	17	10000	170,000	
	Trim and profiling to banks	m^2	5	3400	17,000	
	Bank treatment / revegetation	m^2	30	3400	102,000	

ID	Description	UNIT	RATE ($)	QTY	ITEM COST ($)	TOTAL
Ex_3	**Excavation of the QUT sports field**					**$ 1,350,000**
	Strip, stockpile and respread topsoil (100mm thick)	m^3	15	5100	76,500	
	Earthworks - Cut to spoil	m^3	17	60000	1,020,000	
	Turfing	m^2	5	51000	255,000	
Le_1	**Flood Protection Levee along the upstream boundary of the railway easement (L~425 m)**					**$ 220,000**
	Strip, stockpile and respread topsoil (100mm thick)	m^3	15	900	13,500	
	Earthworks - Cut to fill	m^3	15	9000	135,000	
	Trim and Profiling	m^2	3	9300	27,900	
	Turfing	m^2	5	9300	46,500	
Le_2	**Roghan Road detention basin wall - see Db_1**					
Le_3	**Carseldine Drain detention basin wall**					**$ 137,000**
	Strip, stockpile and respread topsoil (100mm thick)	m^3	15	377	5,655	
	Earthworks - Imported fill	m^3	35	2900	101,500	
	Trim and Profiling	m^2	3	3770	11,310	
	Turfing	m^2	5	3770	18,850	
Le_4	**Flood protection levee between Db_2 & Bill Brown Sports Fields**					**$ 33,000**
	Strip, stockpile and respread topsoil (100mm thick)	m^3	15	91	1,365	
	Earthworks - Imported fill	m^3	35	700	24,500	
	Trim and Profiling	m^2	3	900	2,700	
	Turfing	m^2	5	900	4,500	
	Bioretention					**$ 1,200,000**
	60ha @ 50 m^2 per ha	m^2	$400	3000	1,200,000	

PROJECT

CONCEPTUAL FLOODING AND STORMWATER ASSESSMENT, PROPOSED TRANSIT ORIENTATED DEVELOPMENT, YEERONGPILLY QUEENSLAND

PREPARED FOR

DEICKE RICHARDS

DATE

FEBRUARY 2011

GILBERT SUTHERLAND

DOCUMENT CONTROL

DOCUMENT 10443_SWA_RKS1F.pages
TITLE Conceptual Flooding and Stormwater Assessment, Proposed Transit Orientated Development, Yeerongpilly, Queensland

[redacted]

CLIENT [redacted]
CLIENT CONTACT [redacted] (DMA Partners)
CLIENT REFERENCE

SYNOPSIS This report describes conceptual assessments of the flooding and stormwater management regime for a proposed Transit Orientated Development (TOD) at Yeerongpilly, Queensland. This report will inform the subsequent preparation of a State Planning Regulatory Provision (SPRP) for the TOD.

REVISION HISTORY

REVISION #	DATE	EDITION BY	APPROVED BY
1	2/2011	[redacted]	
2			
3			

DISTRIBUTION

	REVISION NUMBER									
Distribution	1	2	3	4	5	6	7	8	9	10
Deicke Richards	1									
DMA Partners	1									
G&S library and file	2									

CAIRNS
KAWANA
ROBINA

BRISBANE
20 /115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

www.access.gs

GILBERT SUTHERLAND

SUMMARY

Deicke Richards commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare a Conceptual Flooding and Stormwater Assessment of a proposed Transit Orientated Development (TOD) at 681 Fairfield Road, Yeerongpilly, Queensland.

This Conceptual Flooding and Stormwater Assessment considers the flooding and stormwater regime at the site and examines water quality and quantity treatment measures required to satisfy appropriate water management objectives. This report will inform the subsequent preparation of a State Planning Regulatory Provision (SPRP) for the TOD.

Stormwater quality modelling (using MUSIC) was undertaken to demonstrate that the BCC's water quality objectives could be achieved with the proposed conceptual treatment measures detailed in sections 4 and 5. The proposed treatment measures include bioretention basins, Gross Pollutant Traps (GPTs) and rainwater tanks.

The MUSIC model was used to form a basic model of the stormwater treatment system simulating the anticipated environment subsequent to the change in land use. The modelling was based on the current design layout with the site modelled for 'Commercial' and 'Residential' land uses. The assessment demonstrates that the proposed residential development can satisfy the BCC operational phase mean annual load performance criteria of an 80% reduction for Suspended Solids, a 60% reduction for Total Phosphorus and a 45% reduction for Total Nitrogen, provided the recommended treatment devices are properly installed and maintained.

Stormwater quantity calculations and modelling were carried out to assess the capacity of the existing drainage and stormwater conveyance infrastructure, both onsite and downstream, to determine whether onsite detention is necessary for the TOD site.

To do this, pipe calculations were undertaking using Manning's equation, with the outputs used as an input for hydrological modelling using the Watershed Bounded Network Model (WBNM). The WBNM modelling demonstrated that the estimated discharge capacity of these pipes exceeded the Q100 discharge rate from each catchment, indicating that no detention is required under these conditions.

A desktop assessment of the local flooding characteristics under regional flood conditions was carried out to determine the flooding behaviour of the site and to inform the TOD design fundamentals. Advice from Brisbane City Council is that the maintenance of flood storage at this location is not a concern.

All floor areas will be set at Defined Flood Level (DFL) in accordance with BCC requirements. For this site, the residential components requires a habitable floor level of at least 7.9m AHD, with an additional 500mm freeboard (i.e. 8.4m AHD). Floor levels within the commercial and retail precincts can be slightly lower in regards to flood immunity requirements, as no freeboard is required in addition to the DFL.

BCC mapping currently indicates a waterway corridor and wetland area within the central/northwest portion of the development site. However, historic land uses, previous development works, filling and other anthropogenic influences have significantly altered the landform such that the area retains none of its previous natural waterway/wetland function.

A component of the proposed TOD development is the recreation of an area that would function as a freshwater wetland and reflect some of the original character and condition of the area.

+GILBERT SUTHERLAND

CONTENTS

LIST OF DRAWINGS

DRAWING NO.	DESCRIPTION
10443.1.1	Site location
10443.1.2	Development layout
10443.1.3	Typical bioretention basin layout
10443.1.4	Proposed conceptual stormwater treatment layout
10443.1.5	Developed sub-catchments

GLOSSARY

Australian Height Datum (AHD)	National reference for relative height measurement in Australia.
Average Recurrence Interval (ARI)	The average or expected length of time between exceedances of a given variable, such as rainfall.
Bund	An embankment constructed around an area to prevent the inflow or outflow of liquids. Also called Bunding.
Catchment	The area above a given point which contributes to the runoff.
Clay	Very fine-grained sediment or soil (often defined as having a particle size less than 0.002 mm, or 2 microns, in diameter).
Ephemeral	A stream that flows briefly only in direct response to precipitation in the immediate locality and the channel of which is at all times above the watertable.
Erosion	The process by which material (such as rock or soil) is worn away or removed (as by wind or water).
Groundwater	The water contained in interconnected pores located below the watertable in an unconfined aquifer or located in a confined aquifer.
Intermittent	A stream in which the flow is seasonal, usually in response to rainfall in the immediate area (see ephemeral).
Loam	Medium-textured soil composed of approximately 10% to 25% clay, 25% to 50% silt and less than 50% sand.
pH	The degree of acidity or alkalinity measured on a scale of 1 to 14 with 7 as neutral. From 0 to 7 is acidic; from 7 to 14 is alkaline.
Sand	Sediment composed of particles within the size range 63 microns to 2 millimetres.
Scouring	The action of removing sediment from stream banks, particle by particle. This is a more destructive process than collapse when viewed over time due to incremental effects.
Sediment	Unconsolidated, fine-grained material (typically derived from the weathering of rocks), that is transported by water and settles on the floor of seas, rivers streams and other bodies of water.
Silt	A sediment with particles finer than sand and coarser than clay (i.e. 2 to 63 microns).
Subcatchment	A smaller area within a catchment drained by one or more tributaries of the main water body.
Suspended Solids (SS)	The concentration of filterable particles in water (retained on a 1.2μm filter) and reported by volume (mg/L).
Total Nitrogen (TN)	Total nitrogen is the sum of the nitrogen present in all nitrogen-containing components in the water column. The nutrients, nitrogen and phosphorus are essential for plant growth. High concentrations indicate potential for excessive weed and algal growth.
Total Phosphorus (TP)	Total phosphorus is the sum of the phosphorus present in all phosphorus-containing components in the water column. The nutrients, nitrogen and phosphorus are essential for plant growth. High concentrations indicate potential for excessive weed and algal growth.
Turbidity	A measure of the cloudiness of water which is determined by the amount of light scattered by suspended particles.

1. Introduction

Deicke Richards commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare a Conceptual Flooding and Stormwater Assessment of a proposed Transit Orientated Development (TOD) at 681 Fairfield Road, Yeerongpilly Queensland. The location of the proposed development is shown on Drawing No. 10443.1.1.

This Conceptual Flooding and Stormwater Assessment is divided into sections detailing the proposal, a description of the physical characteristics of the site, a description of the flooding regime, conceptual assessment of water quality and quantity at the site and consideration of the TOD design requirements for the subsequent preparation of a State Planning Regulatory Provision (SPRP) for the site.

1.1. Proposed development

The site is described as Lot 566 on SP214202 and has a total area of approximately 16.78ha. The site is located at 681 Fairfield Road, Yeerongpilly, in the Parish of Tennyson within the Brisbane City Council local government area.

Based on the information provided, the proposed development (as shown on Drawing No 10443.1.2) would comprise of two (2) stages as follows.

Stage 1 (Early Release Area) (approximately 2.10ha) would consist of:

- 1 lower density (2-3 storey) residential development
- approximately 3200m^2 of open space/parklands.

Stage 2 (approximately 14.68ha) would consist of:

- 3 lower density (2-3 storey) residential developments
- 6 medium density (4-6 storey) residential developments
- 5 higher density (6-12 storey) residential developments
- commercial office developments
- community facilities
- retail/mixed use developments
- approximately 14,000m^2 of open space/ parklands.

100 200 300 400
metres

SCALE
1:8 000

ORIENTATION
NORTH

LEGEND

Site boundaries

SOURCES

Image base: Nearmap Pty Ltd 2011, imagery date 07 September 2010

GILBERT SUTHERLAND

PROJECT
FAIRFIELD ROAD
YEERONGPILLY

CLIENT
DEICKE RICHARDS

DRAWING
SITE LOCATION

DATE 25/02/2011		**DRAWN** SPD
SCALE 1:8 000		**CHECKED** KSS
PROJECT NO 10443	**DRAWING NO** 1.1	**REVISION** ORIGIN

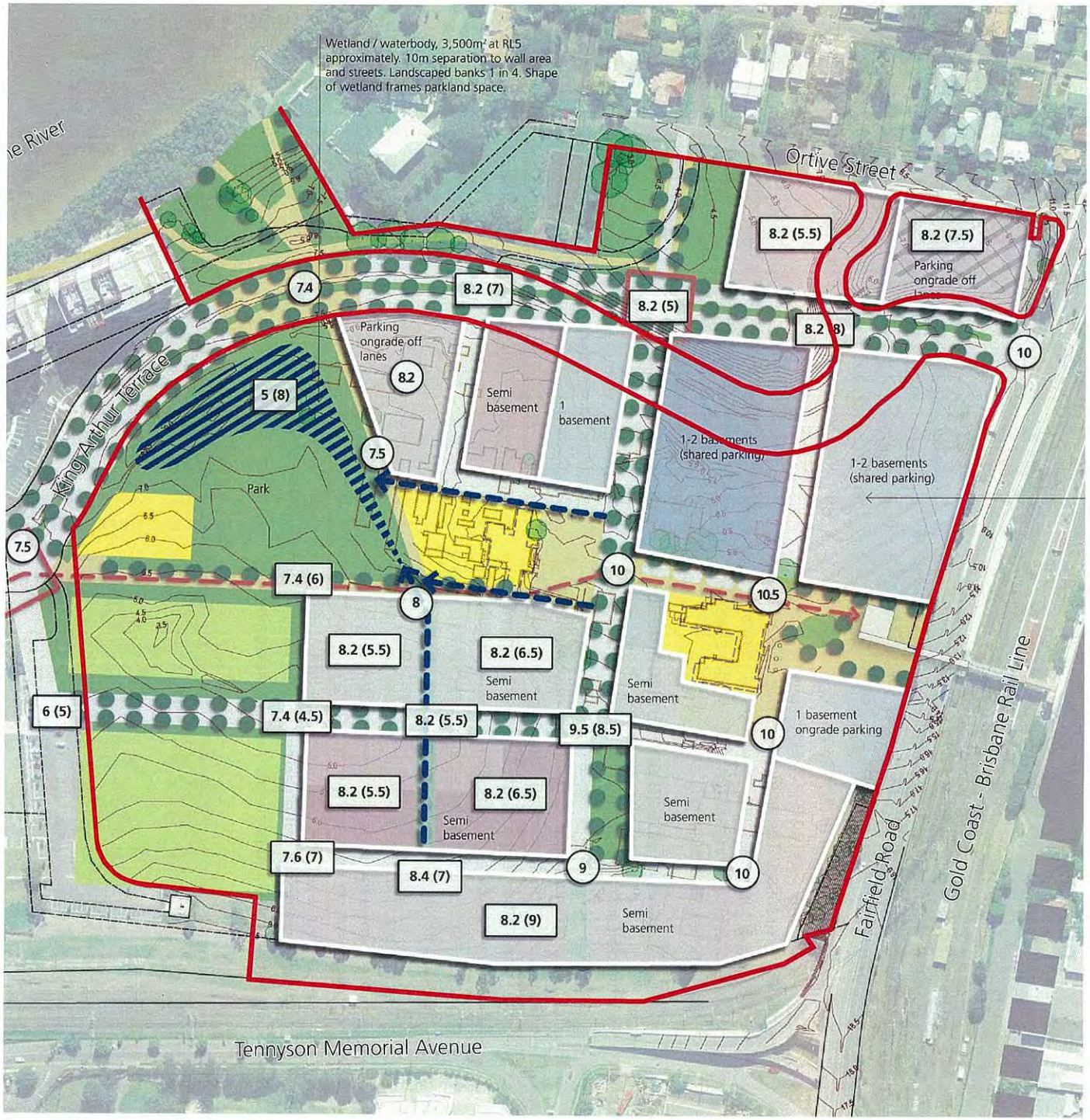
CAIRNS
KAWANA
ROBINA

BRISBANE
20 / 115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

www.access.gs

AGRICULTURE WATER ENVIRONMENT



20 40 60 80 100 metres

SCALE
1:2 000

ORIENTATION
NORTH

LEGEND

- Site boundaries
- (10) Existing levels
- 9.5 (8.5) Proposed levels / existing levels
- Wetland / waterbody approximately 3 500m²
- Stormwater - linear corridors, urban character reeds, water etc

SOURCES

Base plan: Queensland Government, Brisbane City, Toward Tomorrow's Queensland, Yeeronpilly TOD, Draft RL Site Plan, drawing No. 100601-UD34A, 29 September 2010

CAIRNS
KAWANA
ROBINA

BRISBANE
20 / 115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

www.access.gs

AGRICULTURE WATER ENVIRONMENT

GILBERT SUTHERLAND

PROJECT
FAIRFIELD ROAD
YEERONGPILLY

CLIENT
DEICKE RICHARDS

DRAWING
DEVELOPMENT LAYOUT

DATE 25/02/2011		**DRAWN** SPD
SCALE 1:2 000		**CHECKED** KSS
PROJECT NO 10443	**DRAWING NO** 1.2	**REVISION** ORIGIN

2. Site description and proposal

2.1. Location

The proposed Transit Orientated Development (TOD) is located at 681 Fairfield Road, Yeerongpilly and is described as Lot 566 on SP214202. The site location is shown on Drawing No. 10443.1.1.

The western portion of the site has been predominantly cleared of vegetation and is currently grassed. The eastern portion of the site consists of the previous Department of Primary Industries 'Animal Research Institute' development, including existing buildings and carparks.

2.2. Natural drainage and environment

Brisbane City Council (BCC) mapping indicates a waterway corridor and wetland areas within the central/north-west portion of the development site. Historic land uses, previous development works, filling and other anthropogenic influences have significantly altered the landform such that the area retains none of its previous natural waterway/ wetland function.

Despite the cumulative effects of previous changes to site's drainage regime, overland flowpaths generally in accordance with the BCC mapping remain. However, the recent construction of King Arthur Terrace within the northern portion of the site has interrupted the previous overland flowpaths.

2.3. Current drainage and environment

Following construction of King Arthur Terrace, site runoff is directed through the low lying areas to a field inlet in the trunk drainage system, which directly discharges into the Brisbane River.

An existing 1050mm diameter pipe that runs from midway along the western site boundary previously serviced a wider upstream catchment. The development of the adjacent tennis centre complex modified and reduced the upstream catchment that required serviced by this pipeline. A new drainage alignment was provided for the majority of the upstream catchment, with the effect that this existing pipe now services a relatively small area of car park and road. This pipe varies between 1250mm and 1500mm diameter within the site and represents substantial additional drainage capacity for the TOD site.

An existing 900mm diameter pipe, servicing the eastern and southern external catchments, is to remain. This pipe directly discharges into the Brisbane River. The reference drawings for these existing pipes are attached as Appendix 1.

3. Conceptual issues

Gilbert & Sutherland reviewed the project documentation to identify the conceptual issues that may result from the construction of the TOD as proposed. The pertinent issues associated with stormwater and flooding are discussed below.

3.1. Stormwater management

The development will be required to provide safe conveyance of stormwater through the site, appropriate detention and/or retention (if necessary) and appropriate discharge into the Brisbane River.

Water Sensitive Urban Design (WSUD) principles would guide the detailed design of stormwater management measures in the subsequent SPRP process. However for conceptual assessment of Final Plan of Development for the TOD site, it is necessary to conceptually assess stormwater runoff quality and any associated treatment requirements to demonstrate the ability to satisfy the BCC stormwater quality objectives.

3.2. Flooding constraints

The site is identified by BCC mapping as partially impacted by Brisbane River regional flooding. However consideration of local flooding characteristics under regional flooding conditions is necessary to asses the appropriate design considerations for the TOD site.

3.3. Mapped wetlands/waterway corridor

As noted, BCC mapping shows a waterway corridor and wetland on the site, however site history, land use and other known anthropogenic influence suggested these areas were unlikely to now exhibit their previous natural waterway/wetland function.

4. Stormwater quality assessment method

To conceptually assess the likely impacts of the proposed development on water quality, the CRC for Catchment Hydrology Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 3.01 computer model was used.

MUSIC is a water resources package with components for generating surface and subsurface runoff, non-point source pollutant export and pollutant transporting and routing. It is specifically designed for the analysis of the effects of planned land use changes and for the evaluation of stormwater quality improvement devices. The input data requirements are described below.

4.1. Model input data

In accordance with the Healthy Waterways 'MUSIC Modelling Guidelines for South East Queensland', July 2010, a 6 minute time-step pluviometer record for the Brisbane Aero rainfall station location from 01/01/1980 to 31/12/1989 was selected. The average annual rainfall for this period was 1,149mm.

Average monthly potential areal evapotranspiration values are in accordance with the Healthy Waterways Council 'MUSIC Modelling Guidelines for South East Queensland', July 2010. These values are presented in Table 4.1.1.

Table 4.1.1 Evapotranspiration data

Month	Evapotranspiration(mm)
Jan	193
Feb	151
Mar	150
Apr	109
May	75
Jun	63
Jul	65
Aug	84
Sept	112
Oct	148
Nov	175
Dec	199
Total	1,524

4.2. Runoff parameters

Runoff Parameter values for the land uses, relevant to the proposed TOD were sourced from Healthy Waterways 'MUSIC Modelling Guidelines for South East Queensland', July 2010 and are presented in Table 4.2.1.

Table 4.2.1. Adopted runoff parameters

Parameter	Rural land use	Urban land use	Commercial land use
Impervious Area Properties			
Rainfall threshold (mm)	1	1	1
Pervious Area Properties			
Soil storage capacity (mm)	98	500	18
Initial storage (%)	10	10	10
Field capacity (mm)	80	200	80
Infiltration coefficient	84	211	243
Infiltration exponent	3.3	5.0	0.6
Groundwater Properties			
Initial depth (mm)	50	50	50
Daily recharge rate (%)	100	28	0
Daily drainage rate (%)	22	27	31

4.3. Water quality parameters

For the purposes of this conceptual assessment, BCC's standard water quality parameter were modelled. These are :

- Suspended Sediment (SS)
- Total Nitrogen (TN)
- Total Phosphorus (TP)

Sediment and nutrient export characteristics were adopted from the Healthy Waterways 'MUSIC Modelling Guidelines for South East Queensland', July 2010 (Table 4.3.1, following page).

It should be noted that the rainfall/runoff model and the pollutant export expressions have not been calibrated for local catchments. This means the modelling results can not be expected to produce accurate assessments of the amount of pollutants likely to be exported from the proposed development. However, the results do facilitate the comparison of the effectiveness of various stormwater management strategies.

Table 4.3.1 Adopted Pollutant Export Parameters (Log_{10}mg/L)

Land use	Parameter	Suspended Solids		Total Nitrogen		Total Phosphorus	
		Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow
Rural	Mean	0.53	2.26	-0.52	0.32	-1.54	-0.56
	Std Deviation	0.24	0.51	0.39	0.30	0.38	0.28
Urban Road	Mean	1.00	2.43	0.20	0.26	-0.97	-0.30
	Std Deviation	0.34	0.39	0.20	0.23	0.31	0.31
Urban Roof	Mean	1.00	1.30	0.20	0.26	-0.97	-0.89
	Std Deviation	0.34	0.39	0.20	0.23	0.31	0.31
Urban Balance	Mean	1.00	2.18	0.20	0.26	-0.97	-0.47
	Std Deviation	0.34	0.39	0.20	0.23	0.31	0.31
Commercial Road	Mean	0.78	2.43	-0.60	-0.30	0.32	0.37
	Std Deviation	0.39	0.38	0.50	0.34	0.30	0.34
Commercial Roof	Mean	0.78	1.30	-0.60	-0.89	0.32	0.37
	Std Deviation	0.39	0.38	0.50	0.34	0.30	0.34
Commercial Balance	Mean	0.78	2.16	-0.60	-0.39	0.32	0.37
	Std Deviation	0.39	0.38	0.50	0.34	0.30	0.34

Assessment of pervious and impervious proportions of the site in both current and developed states was carried out to provide input for the model.

In accordance with the Healthy Waterways 'MUSIC Modelling Guidelines for South East Queensland' July 2010, a delineated approach has been selected for modelling. Impervious percentages adopted in the modelling are summarised in Table 4.3.2 and were selected in accordance with Table 3.5 of the Healthy Waterways MUSIC Modelling Guidelines.

Table 4.3.2 Effective Impervious Proportion

Land use	Effective Impervious percentage
Urban/Commercial - Roof	100%
Urban - Road	70%
Commercial - Road	75%
Urban/Commercial - Impervious Balance	100%
Urban - Pervious Balance	30%
Park	0%

4.4. Modelling undertaken

The MUSIC model was used to form a basic model of the stormwater treatment system simulating the anticipated environment subsequent to the change in land use (Developed Case, after completion of the construction phase). Scenarios modelled comprise:

- Developed Case WITHOUT treatment measures
- Developed Case WITH treatment measures.

The developed case without treatment measures was modelled to provide a benchmark to calculate the BCC pollutant reduction percentages during the developed 'treated' case. These pollutant reductions percentages are:

Total Suspended Solids	80%
Total Phosphorus	60%
Total Nitrogen	45%.

Proposed treatment measures modelled for the TOD site include rainwater tanks and bioretention basins and Gross Pollutant Traps (GPTs). The particular characteristics and assumptions for the treatment devices used for the modelling are described below.

Rainwater tanks

Modelling has been cognisant of the fact that rainwater storage tanks for the development would be required to meet State Government policy. This being the case, the assumptions used to size the tanks considered that 50m² of any roof area would

be required to contribute to a pedestal, with a minimum of 1,500L being avialable for each. The modelling also considered the need for additional water to be available for outdoor uses, such as irrigation and washdown of paved areas.

The rainwater tanks will be used to store rainfall that is captured from the roof areas that would otherwise have been conveyed to a point of discharge. The collection, storage and utilisation of rainwater would reduce the demand for water from the reticulated supply system.

The rainwater tanks will be covered, thus providing no exposed surface area over which evaporation can take place. As the tank water would be used for toilet flushing, water would be drawn from the tanks on a daily basis, which ensures that the tanks more frequently have some capacity to store rainfall runoff.

A first flush diversion device or filtration unit should be installed in accordance with Council's policy.

A summary of the tank array characteristics for the entire TOD as proposed is included in Table 5.2.1.

Gross Pollutant traps

It is intended that GPTs would be located upstream of the bioretention systems. A GPT is generally defined as a sediment trap incorporating a litter or trash rack. A GPT has the ability to remove sediment, litter and hydrocarbons.

While the published literature is quite clear about what comprises a GPT, the term is widely used to encompass a broad range of proprietary devices such as CSR Hume's Humeceptor and Litter Guard, Rocla's Downstream Defender, and Ecosol's various units to name but a few.

The GPT may be a proprietary make (having performance characteristics similar to the Fox Environmental BGPCT, Ecosol 4000 Series or CDS units) or purposefully designed and built to suit the particular conditions.

The adopted pollutant removal efficiency of the GPTs was as follows:

- 50% removal Suspended Sediment
- 10% removal Total Phosphorus
- 0% removal Total Nitrogen

The selected unit should have the above performance characteristics as a minimum.

Bioretention basins

Vegetated non-conveyance bio-retention devices are to be provided to treat runoff from the site before it is discharged into the receiving environment.

It is envisaged that the devices would generally be dry. However during (and for a short period after) wet weather, the devices may be filled with water.

The bioretention devices would have a filter section, filled with sand of appropriate size to filter the water, and a swale section to pond water above the filter so that the volume of treated runoff is maximised. Vegetation in the swale section would include appropriate shrubs, sedges, rushes and grasses.

The sand in the basin section allows stormwater to infiltrate, be treated then drain through an agricultural pipe to the outlet.

The adopted bioretention basin characteristics are described in Table 5.2.2 and a typical bioretention basin detail is shown in Drawing No. 10443.1.3.

4.5. Catchment description

This assessment is based on the conceptual plan and provides conceptual details of the treatment measures likely to be adopted and their performance in mitigating the impacts of stormwater runoff from the completed development.

The areas of the various land uses included in the model to represent the site when fully developed, are shown in Table 4.5.1.

Table 4.5.1 Stage characteristics

Stage No.	Rural Area (ha)	Urban Area (ha)	Commercial Area (ha)	Total Area (ha)
1	0.322	1.777	--	2.099
2	1.415	9.450	3.812	14.677

Generally 'urban' land use has been used to represent roads, driveway and pathway areas within the development. 'Commercial' land use has been used to represent retail and commercial precincts. 'Rural' land use has been used to represent open space and parkland areas.

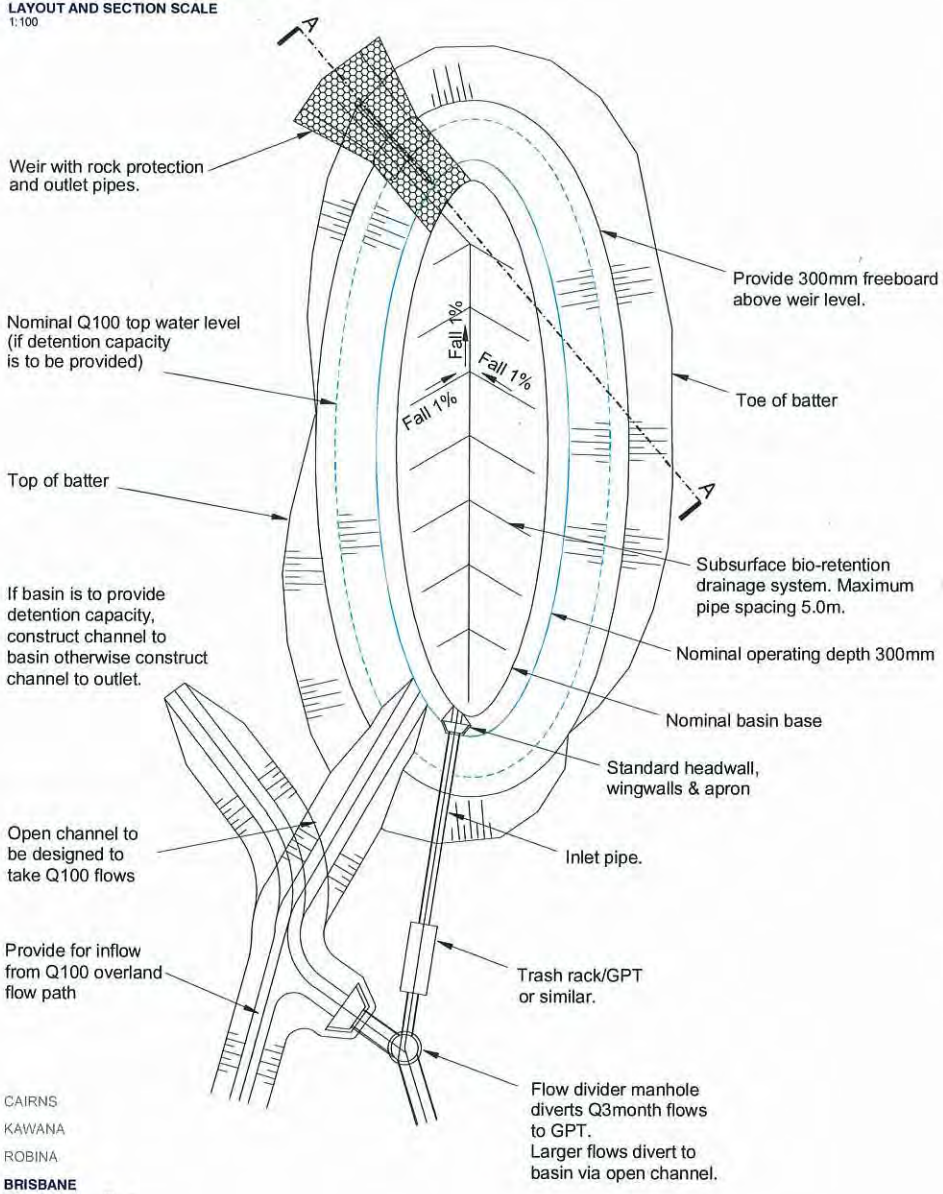
Estimated impervious and effective impervious fractions for the above catchments are set out in Table 4.5.2.

Table 4.5.2 Post developed urban catchment impervious fractions

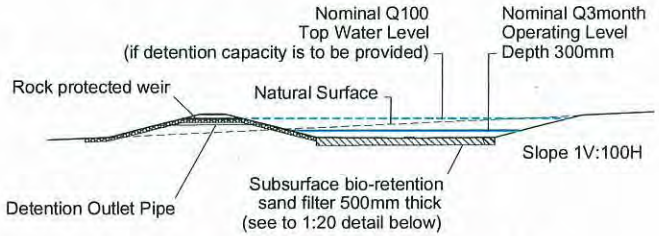
Catchment	Area (ha)	Impervious Area (ha)	Effective Fraction Impervious
Stage 1			
Urban - Roof	0.799	0.799	100
Urban - Road	0.498	0.349	70
Urban Balance - Impervious	0.096	0.096	100
Urban Balance - Pervious	0.384	0.115	30
Park	0.322	0	0
Stage 2			
Urban - Roof	3.860	3.860	100
Commercial - Roof	2.867	2.867	100
Urban - Road	2.570	1.799	70
Commercial - Road	0.262	0.197	75
Urban Balance - Impervious	1.964	1.964	100
Commercial Balance - Impervious	0.683	0.683	100
Urban Balance - Pervious	1.056	0.317	30
Park	1.415	0	0

1 2 3 4 5 metres

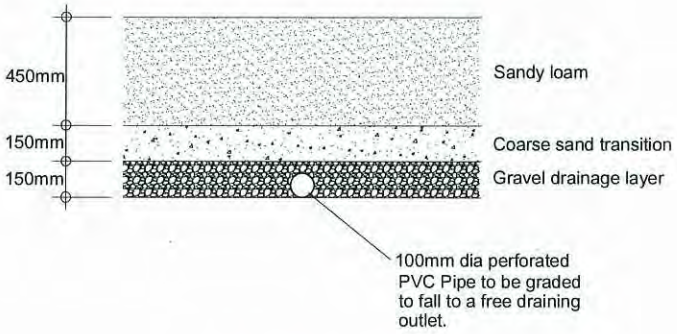
LAYOUT AND SECTION SCALE
1:100



TYPICAL BASIN LAYOUT



TYPICAL BASIN SECTION AA



FILTER ZONE DETAIL
Scale 1:20

CAIRNS
KAWANA
ROBINA

BRISBANE
20 / 115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

www.access.gs

AGRICULTURE WATER ENVIRONMENT

GILBERT SUTHERLAND

PROJECT
FAIRFIELD ROAD
YEERONGPILLY

CLIENT
DEICKE RICHARDS

DRAWING
TYPICAL BIORETENTION BASIN LAYOUT

DATE 25/02/2011		DRAWN SPD
SCALE 1:100 & 1:20		CHECKED KSS
PROJECT NO 10443	DRAWING NO 1.3	REVISION ORIGIN

5. Stormwater quality assessment results

Details of the MUSIC model and the catchments have been provided in Section 4.

5.1. Developed (Untreated) Case

Table 5.1.1 summarises simulated average annual runoff volumes and quantities of suspended sediment, nitrogen and phosphorus predicted to be exported from the proposed development site if it was completed without stormwater management or treatment measures.

Table 5.1.1. Developed Case (without treatment measures) average annual loads

Runoff (ML/yr)	Pollutant loads (kg/year)			
	SS	TP	TN	GP
Stage 1				
17.1	2,920	5.74	36.4	385
Stage 2				
137	20,800	45.3	334	3,120

5.2. Developed (Treated) Case

To provide quantification of the effectiveness of the proposed treatment, the Developed Case was then modelled under the same rainfall conditions with the addition of proposed water quality treatment measures.

Proposed treatment measures include a combination of rainwater tanks and bioretention basins and Gross Pollutant Traps (GPTs). Input parameters and properties for these treatment measures are discussed below.

Rainwater tanks

All residential buildings within the development are required to install rainwater tanks.

Adopted rainwater tank properties used as input for the MUSIC model are as follows.

Table 5.2.1 Adopted rainwater tank properties for the development

Parameter	Stage 1	Stage 2
Inlet Properties		
Low Flow By-pass (m^3/s)	0.00	0.00
High Flow By-pass (m^3/s)	100.00	100.00
Storage Properties		
Volume below overflow pipe (KL)	266	2,030
Depth above overflow (m)	0.20	0.2
Surface Area (m^2)	133	1,015
Outlet properties		
Overflow pipe diameter (mm)	848	2,341
Re-use Properties		
Use stored water for irrigation or other purpose	✓	✓
Annual demand (kL/year) scaled by daily PET	675	4,770

Bioretention basins

Conceptual bioretention basin locations are shown on Drawing No. 10443.1.4. Operating characteristics adopted for assessment of the treatment effectiveness of each device are set out in Table 5.2.2.

Table 5.2.2 Adopted bioretention basin properties

Parameter	Stage 1	Stage 2
Storage properties		
Extended detention depth	0.30	0.30
Surface area (m^2)	425	2,430
Seepage loss (mm/hr)	0.00	0.00
Infiltration properties		
Filter area (m^2)	343	2,237
Filter depth (m)	0.40	0.40
Filter particle effective diameter (mm)	0.45	0.45
Saturation hydraulic conductivity (mm/hr)	180	180
Outlet properties		
Overflow weir width (m)	2.0	2.0

Details of appropriate plant species selection, size and spacing is detailed in Chapter 12 of the Water Sensitive Urban Design – Technical Design Guidelines for South East Queensland, June 2006. It is recommended that care be taken to protect the filter media from excessive sediment loads during the construction phase.

MUSIC modelling results for the developed (treated) case are shown in Table 5.2.3.

Table 5.2.3 Developed (Treated) Case average annual loads and pollutant load reductions

Runoff (ML/yr)	Pollutant loads (kg/year) SS	TP	TN	GP
Stage 1				
16.5	579	2.16	20.0	0
Stage 2				
132	4,150	17.3	180	0

The estimated load reductions for the entire development attributable to the proposed treatment approach are shown in Table 5.2.4 along with BCC performance criteria.

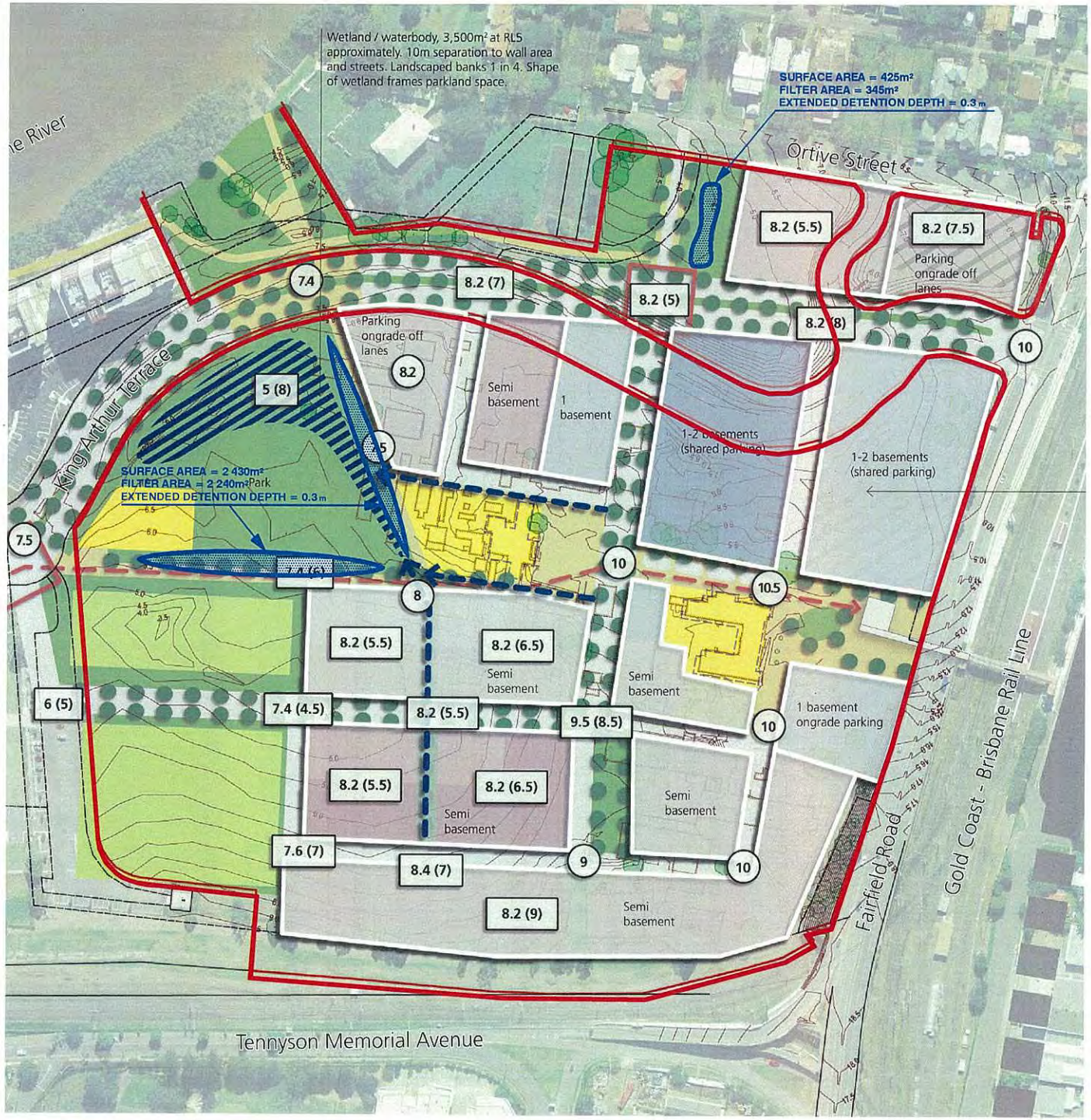
Table 5.2.4 Developed (treated) case pollutant load reduction statistics

	Pollutants SS	TN	TP
BCC criteria	80%	60%	45%
Stage 1			
Load reduction	80%	62%	45%
Stage 2			
Load reduction	80%	62%	46%

Pollutant load reduction results for SS, TN and TP all meet the adopted BCC performance criteria.

5.3. Water quality assessment summary

The conceptual design assessment carried out shows that the proposed development can satisfy the adopted BCC operational phase mean annual load reduction performance criteria of 80% for Suspended Solids, 60% for Total Phosphorus and 45% for Total Nitrogen, provided the recommended treatment devices are properly installed and maintained.



20 40 60 80 100 metres

SCALE
1:2 000

ORIENTATION
NORTH

LEGEND

- Site boundaries
- 10 — Existing levels
- 9.5 (8.5) — Ptroposed levels / existing levels
- Wetland / waterbody approximately 3 500m²
- Stormwater - linear corridors, urban character reeds, water etc
- Bio-retention basins

SOURCES

Base plan: Queensland Government, Brisbane City, Toward Tomorrow's Queensland, Yeeronpilly TOD, Draft RL Site Plan, drawing No. 100601-UD34A, 29 September 2010

CAIRNS
KAWANA
ROBINA

BRISBANE
20 / 115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

www.access.gs

AGRICULTURE WATER ENVIRONMENT

GILBERT SUTHERLAND

PROJECT
FAIRFIELD ROAD
YEERONGPILLY

CLIENT
DEICKE RICHARDS

DRAWING
TREATMENT LOCATIONS

DATE 25/02/2011	**DRAWN** SPD
SCALE 1:2 000	**CHECKED** KSS
PROJECT NO 10443	**DRAWING NO** 1.4
REVISION ORIGIN	

6. Stormwater quantity assessment method

A conceptual stormwater assessment of the site was undertaken to determine:

- design rainfall/runoff events
- maximum discharge rates via the existing trunk drainage system, and
- the net effect of the existing and developed event/discharge characteristics on potential stormwater system behaviour for the site and potential attenuation works required.

A hydrologic assessment was undertaken using the Rational Method and the Watershed Bounded Network Model (WBNM) as described in sections 6.1 and 6.3. An estimation of discharge characteristics of the trunk drainage infrastructure has been based on Manning's equation as described in Section 6.2.

6.1. Rational Method

The Rational Method (Section 5.02 QUDM) is flexible in its data requirements and is used to provides preliminary estimates of peak discharges form a site based on the following data input:

- local intensity frequency duration data for site specific time of concentration (t_c)
- catchment areas
- runoff coefficients

Discharge using the Rational Method is calculated via the formula:

$$Q = \frac{F_Y C_{10} I A}{360}$$

where: Q = Peak flow (m^3/s)
F_Y = Frequency factor
C_{10} = Runoff coefficient (10yr)
I = Rainfall intensity (mm/hr) for site specific t_c
A = Catchment area (ha)

Peak discharges were estimated for the pre-development cases for events with average recurrence intervals (ARI) between 1 and 100 years.

6.1.1. Pre-development t_c
Time of concentration for the undeveloped site was calculated using the Bransby Williams Equation in accordance with the recommendations contained in QUDM.

$$t_c = \frac{58\ L}{A^{0.1}\ S^{0.2}}$$

where t_c = Time of concentration (min)
L = Flow path length (km)
A = Catchment area (ha)
S = Equal area slope (%)

6.1.2. Runoff coefficient
The runoff coefficient for the 10 year (C_{10}) average recurrence interval (ARI) based on recommendations in QUDM.

6.1.3. Local intensity frequency
Rainfall intensities for the simulation of design rainfall events as stated in Table 3.3.6 of the BCC Subdivision and Development Guidelines Part B, Chapter 2 - Stormwater Drainage.

6.2. Manning's Equation

Manning's Equation is used to calculate the discharge capacity and flow velocity for an open channel with a uniform slope, with modifications for pipes flowing at full capacity.

Manning's Equation is:

$$Q = A/n * R^{2/3} * S^{1/2}$$

where R = Hydraulic radius
S = slope
A = area of the pipe cross section
n = the Manning's friction coefficient.

In accordance with Section 3.4 of the BCC Subdivision and Development Guidelines,

calculations for site discharge have been based on a downstream assumption of Mean High Water Springs (MHWS), with correction of 0.3m to offset the potential effects of climate change.

The MHWS was obtained from the Maritime Safety Queensland for the location at Tennyson (Long Pocket). With correction to Australian Height Datum (AHD) by 1.15 (as recommended in the Semidiurnal Tidal Plans 2010), the MHWS is 1.22m AHD + 0.3m, giving a water level of 1.52m AHD.

Manning's equation was used to calculate the discharge capacity of the pipes that constitute the existing site drainage regime.

The output of the analysis of these existing pipes was used as input to the WBNM modelling undertaken as described below.

6.3. WBNM modelling

The Watershed Bounded Network Model (WBNM) is an event-based hydrologic model which calculates flood hydrographs from storm rainfall hyetographs. It can be used for modelling natural, partially developed and fully developed catchments.

For developed catchments, WBNM calculates runoff from pervious and impervious surfaces with routing through the defined system of open water courses. It can be used to generate hydrographs from an actual storm event and or a design storm utilising Intensity – Frequency – Duration data together with dimensionless storm temporal patterns.

The WBNM model is flexible in its data requirements and is able to produce satisfactory results with the following data input:

- local intensity frequency duration data
- design temporal patterns
- subcatchment areas
- impervious areas.

Model estimated peak flow outcomes were reviewed against estimates obtained via the Rational Method. This information was incorporated into a final adopted value of the WBNM lag parameter (C).

6.3.1. Storm data

Rainfall intensities for the simulation of design rainfall events have been adopted based on the BCC Subdivision and Development Guidelines.

Rainfall intensity-frequency-duration data for Brisbane was produced using AUSIFD 2.0, using parameters as described in Australian Rainfall &Runoff Guidelines (AR&R). Adopted temporal patterns are as provided in AR&R.

Adopted loss assumptions are shown in Table 6.2.1.1.

Table 6.2.1.1 Model losses

Storm ARI (yrs)	Pervious initial loss (mm)	Pervious continuing loss (mm)	Impervious initial loss (mm)	Impervious continuing loss (mm)
1	10.0	2.5	0.5	0.0
2	10.0	2.5	0.5	0.0
5	10.0	2.5	0.5	0.0
10	10.0	2.5	0.5	0.0
20	5.0	2.5	0.5	0.0
50	2.5	2.5	0.5	0.0
100	0.0	2.5	0.5	0.0

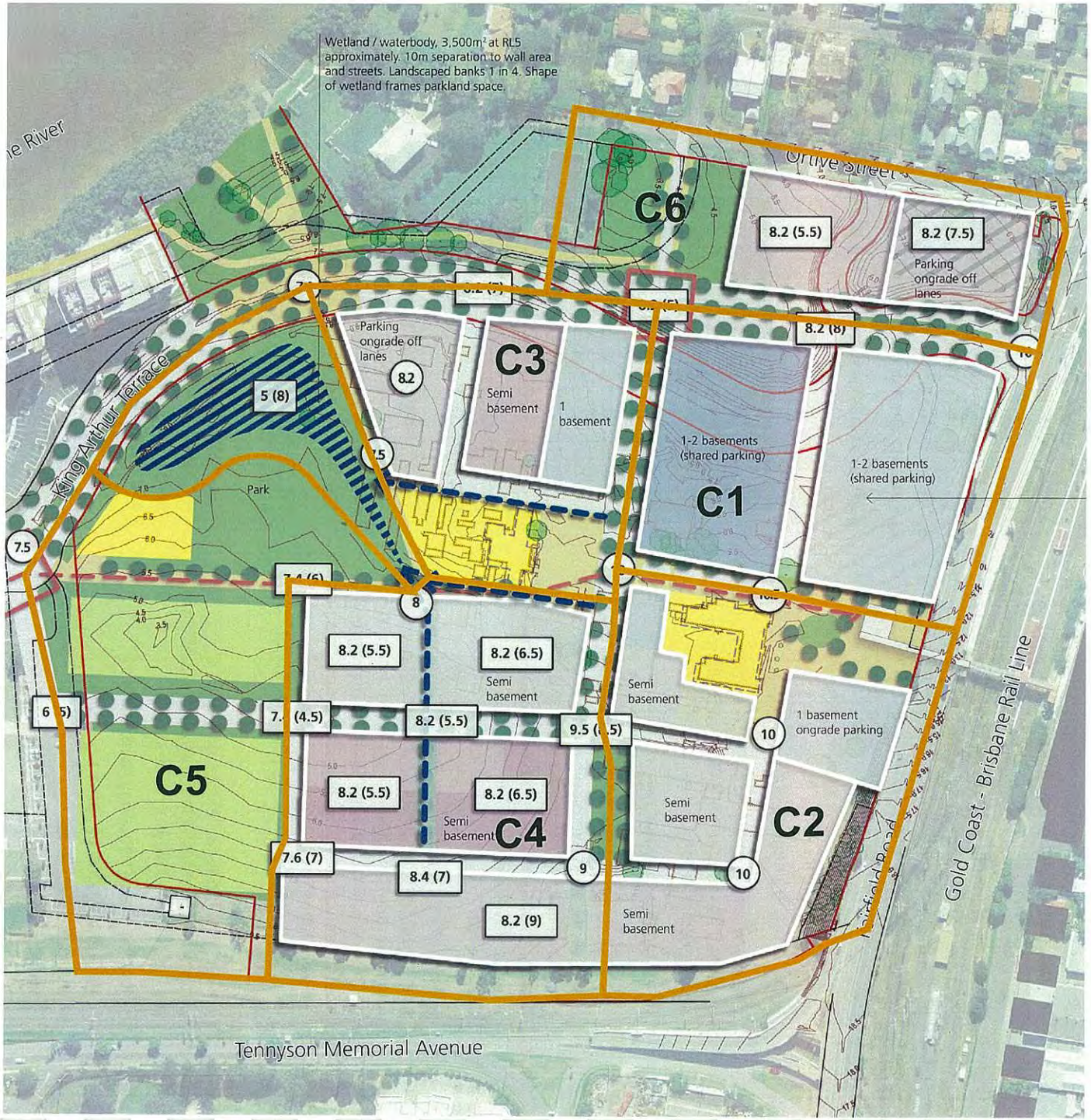
6.4. Peak flow site characteristics

The physical characteristics of the catchment were described in Section 2 of this report. The sub-catchments used to model the site are shown on Drawing 10443.1.5.

For the developed case model, the impervious fraction for the site area has been increased to 70% for sub-catchments C2 and C3 and to 80% for sub-catchments C1 and C4 to represent the proposed development. These impervious percentages are based on the proportion of roof and paved area to the balance for each sub-catchment.

Rainfall storage tanks are to be installed to collect rainfall from roof areas, however for the purposes of this assessment it has been assumed that the tanks are full at the start of the critical storm and do not provide detention/flow attenuation storage under design event conditions.

Details of simulated detention storage outcomes are provided in Section 7.3.



20 40 60 80 100 metres

SCALE
1:2 000

ORIENTATION
NORTH

CATCHMENT AREAS

C1 = 25 466m²
C2 = 28 371m²
C3 = 20 077m²
C4 = 33 211m²
C5 = 30 049m²
C6 = 21 016m²

LEGEND

- Catchment area boubaries
- 10 — Existing levels
- 9.5 (8.5) — Proposed levels / existing levels
- Wetland / waterbody approximately 3 500m²
- Stormwater - linear corridors, urban character reeds, water etc

SOURCES

Base plan: Queensland Government, Brisbane City, Toward Tomorrow's Queensland, Yeeronpilly TOD, Draft RL Site Plan, drawing No. 100601-UD34A, 29 September 2010

CAIRNS
KAWANA
ROBINA

BRISBANE
20 / 115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

www.access.gs

AGRICULTURE WATER ENVIRONMENT

GILBERT SUTHERLAND

PROJECT
FAIRFIELD ROAD
YEERONGPILLY

CLIENT
DEICKE RICHARDS

DRAWING
DEVELOPED
SUB-CATCHMENT

DATE 25/02/2011	**DRAWN** SPD
SCALE 1:2 000	**CHECKED** KSS
PROJECT NO 10443	**DRAWING NO** 1.5
	REVISION ORIGIN

7. Stormwater quantity assessment results

7.1. Rational Method

7.1.1. Catchment 1

Modelling assumptions for peak flow estimation for a pre-development (i.e. current state) Catchment 1 are listed in Table 7.1.1.1.

Table 7.1.1.1 Adopted parameters for Bransby Williams equation for Catchment 1

Parameter	Value
Runoff coefficient, C_{10}	0.74
Catchment area, A (ha)	2.1
Equal area slope (%)	3.3
Drainage length (km)	0.15
Time of concentration, t_c (mins)	6.4

A runoff coefficient (C_{10}) of 0.74 was adopted from QUDM Table 4.05.3b for 20% fraction impervious land with bare soil and poor grass coverage.

Table 7.1.1.2 summarises estimated peak flow for standard ARI events for Catchment 1.

Table 7.1.1.2 Catchment 1 - Peak flows by Rational Method

ARI (yrs)	$C_Y=F_Y.C_{10}$	I (mm/hr)	Q (m^3/s)
1	0.592	107	0.37
2	0.629	138	0.51
5	0.703	175	0.72
10	0.740	197	0.85
20	0.777	227	1.03
50	0.851	266	1.32
100	0.888	297	1.54

7.1.2. Catchment 2

Modelling assumptions for peak flow estimation for a pre-development (i.e. current state) Catchment 2 are listed in Table 7.1.2.1.

Table 7.1.2.1 Adopted parameters for Bransby Williams equation for Catchment 2

Parameter	Value
Runoff coefficient, C_{10}	0.74
Catchment area, A (ha)	14.7
Equal area slope (%)	3
Drainage length (km)	0.375
Time of concentration, t_c (mins)	13.4

Table 7.1.2.2 shows the resultant peak flow rates over the standard ARI events for Catchment 2.

Table 7.1.2.2 Catchment 2 – Peak flows by Rational Method

ARI (yrs)	$C_Y=F_Y.C_{10}$	I (mm/hr)	Q (m^3/s)
1	0.592	80	1.80
2	0.629	104	2.49
5	0.703	133	3.56
10	0.740	150	4.23
20	0.777	175	5.15
50	0.851	205	6.64
100	0.888	229	7.74

7.2. Manning's equation

7.2.1. Catchment 1

The invert of the site discharge is approximately 3.0m AHD. Site specific adjusted MHWS water level is 1.52m AHD, leading to a head difference of 1.48m AHD under these conditions.

Manning's Equation was used to calculate the discharge capacity of the existing 1,200mm pipe, with a length of approximately 250m. The parameters used are shown in Table 7.2.1.1.

Table 7.2.1.1 Parameters used for Manning's Equation for MHWS water level - Catchment 1

Parameter	Value
Hydraulic Radius, R (m)	0.300
Slope, S (m/m)	0.0378
Area of pipe cross section, A (m^2)	1.131
Manning's friction coefficient, n	0.013

Table 7.2.1.2 shows the resultant discharge capacity and velocity for the existing pipe for Mean High Water Springs (MHWS) level of the River.

Table 7.2.1.2 Discharge capacity and velocity of 1200mm pipe for MHWS water level

Parameter	Value
Discharge capacity (m^3/s)	3.26
Velocity (m/s)	2.88

7.2.2. Catchment 2

Manning's Equation was used to calculate the discharge capacity of the existing 1,500mm pipe, with a length of approximately 100m.

The level of the base of the proposed detention basin is approximately 5.0m AHD. Site specific MHWS water level is 1.52m AHD, giving a head difference of 3.48m AHD under these conditions.

The parameters adopted to determine the existing pipe's discharge capacity and velocity for Catchment 2 are listed in Table 7.2.2.1.

Table 7.2.2.1 Parameters used for Manning's Equation for MHWS water level - Catchment 2

Parameter	Value
Hydraulic Radius, R (m)	0.375
Slope, S (m/m)	0.007
Area of pipe cross section, A (m^2)	1.767
Manning's friction coefficient, n	0.013

Table 7.2.2.2 shows the resultant discharge capacity and velocity within the existing pipe.

Table 7.2.2.2 Discharge capacity and velocity of 1500mm pipe for MHWS water level

Parameter	Value
Discharge capacity (m^3/s)	13.7
Velocity (m/s)	7.77

7.3. WBNM modelling results

Input and assumptions detailed above have been adopted within WBNM to generate hydrographs for the site under current and developmed conditions.

Peak discharges were estimated for storms with durations ranging from 5 minutes to 2 hours for all storm events.

WBNM does not directly model the hydraulic behaviour of piped drainage systems and the discharge characteristics adopted within the modelling are based on Manning's Equation as described above.

7.3.1. Catchment 1

Based on consideration of peak flow results from the Rational Method and WBNM recommended parameter values for ungauged catchments, a lag parameter (C) of 1.60 has been adopted for modelling of Catchment 1.

WBNM estimated peak flow rates for the 'Existing Case' model under a range of rainfall events are shown in Table 7.3.1.1 and compared to the peak flows previously estimated via the Rational Method.

Table 7.3.1.1 WBNM modelled peak flow

ARI (years)	Rational Method calculated flow (m^3/s)	WBNM modelled flow (m^3/s)
1	0.37	0.29
2	0.51	0.42
5	0.72	0.59
10	0.85	0.73
20	1.03	0.95
50	1.32	1.08
100	1.54	1.25

The WBNM model was then modified and rerun to incorporate an increase in impervious area to represents catchment conditions under the proposed development. Estimated peak flows for the developed case are shown in Table 7.3.1.2.

Table 7.3.1.2 WBNM modelled peak flow

ARI (years)	Peak flow (m^3/s)
1	0.53
2	0.71
5	0.94
10	1.08
20	1.28
50	1.38
100	1.56

Under MHWS tailwater conditions the estimated discharge capacity (of 3.26m³/s) exceeds the estimated maximum Q100 Catchment 1 discharge of 1.56m³/s. Under these conditions no detention is required.

7.3.2. Catchment 2

Based on consideration of peak flow results from the rational Method and WBNM recommended parameter values for ungauged catchments, a lag parameter (C) of 1.60 has been adopted for modelling of Catchment 2. Estimated peak flows for the 'Existing Case' under a range of rainfall events are shown in Table 7.3.2.1 with comparison against peak flow rates determined via the Rational Method.

Table 7.3.2.1 WBNM modelled peak flow

ARI (years)	Rational Method calculated flow (m³/s)	WBNM modelled flow (m³/s)
1	1.80	1.68
2	2.49	2.52
5	3.56	3.60
10	4.23	4.28
20	5.15	5.60
50	6.64	6.43
100	7.74	7.47

The model was then modified and rerun to incorporate an increase in impervious area to represent catchment conditions under the proposed development.

For modelling purposes a delay for catchments C1 and C2 of 1.8 minutes and 1.3 minutes was used respectively to represent likely travel time associated with piped drainage from these areas. Estimated peak flows for the Developed Case under a range of rainfall events are shown in Table 7.3.2.2.

Table 7.3.2.2 WBNM modelled peak flow

ARI (years)	Peak flow (m³/s)
1	2.68
2	3.66
5	4.98
10	5.78
20	6.99
50	7.74
100	8.82

Under MHWS tailwater conditions the estimated discharge capacity (of 13.7m³/s) exceeds the estimated maximum Q100 Catchment 2 discharge of 8.8m³/s. Under these conditions no detention is required.

Where are the other catchments?

8. Flooding assessment

8.1. Flood storage

Flood storage is the portion of floodwaters flowing in a water course that are transferred (generally as backwater) into storage areas of the floodplain during a flood events.

A desktop assessment of the local flooding characteristics under regional flood conditions was carried out to determine the flooding behaviour of the site and to inform the TOD design fundamentals. Advice from Brisbane City Council is that the maintenance of flood storage at this location is not a concern.

8.2. Flood immunity

All floor areas will be set at Defined Flood Level (DFL) in accordance with BCC requirements. Council's FloodWise Property Report for 681 Fairfield Rd, (summarised in Table 8.2.1 and provided in Appendix 2) shows the flood levels experienced in the Brisbane River, adjacent to the development site.

Table 8.2.1 Flood levels of Brisbane River

ARI (years)	Flood level
20	4.4m AHD*
50	6.6m AHD*
100	7.9m AHD*

* current as at March 19, 2010

Table 8.2.2 summarises the specific minimum floor levels considering the BCC freeboard requirements for the development of the residential and commercial precincts.

In accordance with Table 8.2.2, all residential habitable floor areas will be set at 8.4m AHD, being the Defined Flood Level (DFL) (which is at 7.9m AHD for this development) with an additional 500mm freeboard. Habitable rooms are those used for normal domestic activities, including bedroom, living room, dining room, kitchen, study and family/ rumpus room. Undercroft carparks associated with

Table 8.2.2 Minimum floor levels required for the development

Category	Minimum floor level	Constraining condition
Residential		
Habitable floor	8.4m AHD	Brisbane River Defined Flood Level (DFL) + 500mm
Carpark (undercroft)	8.2m AHD	Brisbane River DFL + 300mm
Carpark (unroofed)	4.4m AHD	Brisbane River Q20
Commercial		
Retail floor	7.9m AHD	Brisbane River DFL
Carpark (undercroft)	7.9m AHD	Brisbane River DFL
Carpark (unroofed)	4.4m AHD	Brisbane River Q20

the residential precincts will required a flood immunity of 8.2m AHD.

Floor levels within the commercial and retail precincts have slightly lower flood immunity, as no freeboard is required in addition to the DFL.

Current BCC codes define flood immunity levels for new roads within a subdivision. BCC minimum design levels at the crown of the road are summarised specified in Table 8.2.3.

Table 8.2.3 Minimum levels required for new roads within a subdivision

Category	Minimum design level at crown of road	Constraining condition
Residential	7.9m AHD	Brisbane River Q100
Commercial	6.6m AHD	Brisbane River Q50

Required design road crown levels specified in BCC codes state that any new roads are to be constructed to the DFL (7.9m AHD). It should be noted that the flood immunity level for King Arthur Terrace, which was constructed during works for a previous development, was approved by Council at a reduced level (6.5m AHD, comparable to the Q50) relative to the required 7.9m AHD (DFL).

This represents an appropriate precedent for neighbourhood access road flood immunity for this area. It is recommended that internal roads within the TOD be constructed at Q50, which is in accordance with flood immunity levels for existing dedicated roads providing access to or fronting a development.

8.2.1. Flood warning system

The Brisbane River Alert flood warning system uses real time rainfall and river height data to provide warnings to the surrounding communities. The Bureau of Meteorology (BoM) Flood Warning Centre issues regular flood warnings and river height bulletins for the Brisbane River via its website. Additionally, flood warnings are broadcast on radio stations, sent to Council, emergency services and other relevant agencies involved in managing flood response activities.

The estimated time for a flood to travel from Wivenhoe Dam to the development site is approximately 24 hours, thus providing ample warning.

9. Waterway corridor and wetlands

BCC mapping currently indicates a waterway corridor and wetland area within the central/ northwest portion of the development site. However, historic land uses, previous development works, filling and other anthropogenic influences have significantly altered the landform such that the area retains none of its previous natural waterway/ wetland function.

An inspection of the site by BCC on 7 July 2010 concluded that:

- Due to King Arthur Terrace and previous anthropogenic influences, the wetlands/ waterway corridor no longer traverses natural flowpaths to arrive at the Brisbane River. Instead, runoff from the majority of the site is conveyed to the Brisbane River via the trunk drainage system.

BCC accepts that appropriately sized stormwater treatment devices (i.e. bioretention basins and constructed wetlands) may prove suitable. A copy of the relevant BCC correspondence is attached as Appendix 3.

The recreation of an area that would function as a freshwater wetland, and reflect some of the original character and condition of the area, is a component of the proposed TOD. Freshwater wetlands would be constructed within the north-west corner of the site. These wetlands will be recharged with the runoff from the upslope catchments ensuring adequate flow entering the wetlands system to maintain regimes and turnover requirements. These wetlands would receive treated runoff discharging from the bioretention basins, meaning wetland inflows and overall site discharge through the wetland system will be of a high standard.

It is acknowledged that during subsequent detailed design, the performance and design characteristics of the wetland system would need to be quantified and qualified as part of a detailed constructed wetland design.

Similarly, the site's stormwater conveyance characteristics would required careful consideration, assessment and modelling as part of a localised drainage design assessment, at the detailed design phase.

10. Conclusions

Conceptual stormwater quality assessment for the modelled scenarios demonstrates that the adopted Brisbane City Council criteria for mean annual pollutant load reduction in runoff from the site can be achieved by implementing appropriate management measures (such as those selected for the conceptual treatment train modelling). In any event, careful management will be required to ensure that the projected quality levels are achieved and maintained.

Similarly, the stormwater quantity assessment described herein finds that the modelled increases in peak flows are not a concern for the developed case (MHWS) scenario as the existing pipe system exhibits adequate capacity to convey flows from the developed site to the Brisbane River without the need for any intervention.

In terms of floodplain management, Brisbane City Council has confirmed that flood storage capacity is not a concern for this site.

The flooding assessment and flood immunity levels are based on the current Brisbane River modelling levels provided by Council. These levels represent theoretical minima to inform the TOD design, however it is acknowledged that further detailed drainage and conveyance designs is necessary following confirmation of the final development form.

Freshwater wetlands are proposed in the low lying areas of the site. Although these wetlands will not be required as a stormwater treatment measure, they render aesthetic and ecological benefits that generally reflect the original conditions of the site prior to anthropogenic influences. During subsequent detailed design, the performance and design characteristics of the wetland system would need to be quantified and qualified as part of a detailed constructed wetland design.

11. Limitations of reporting

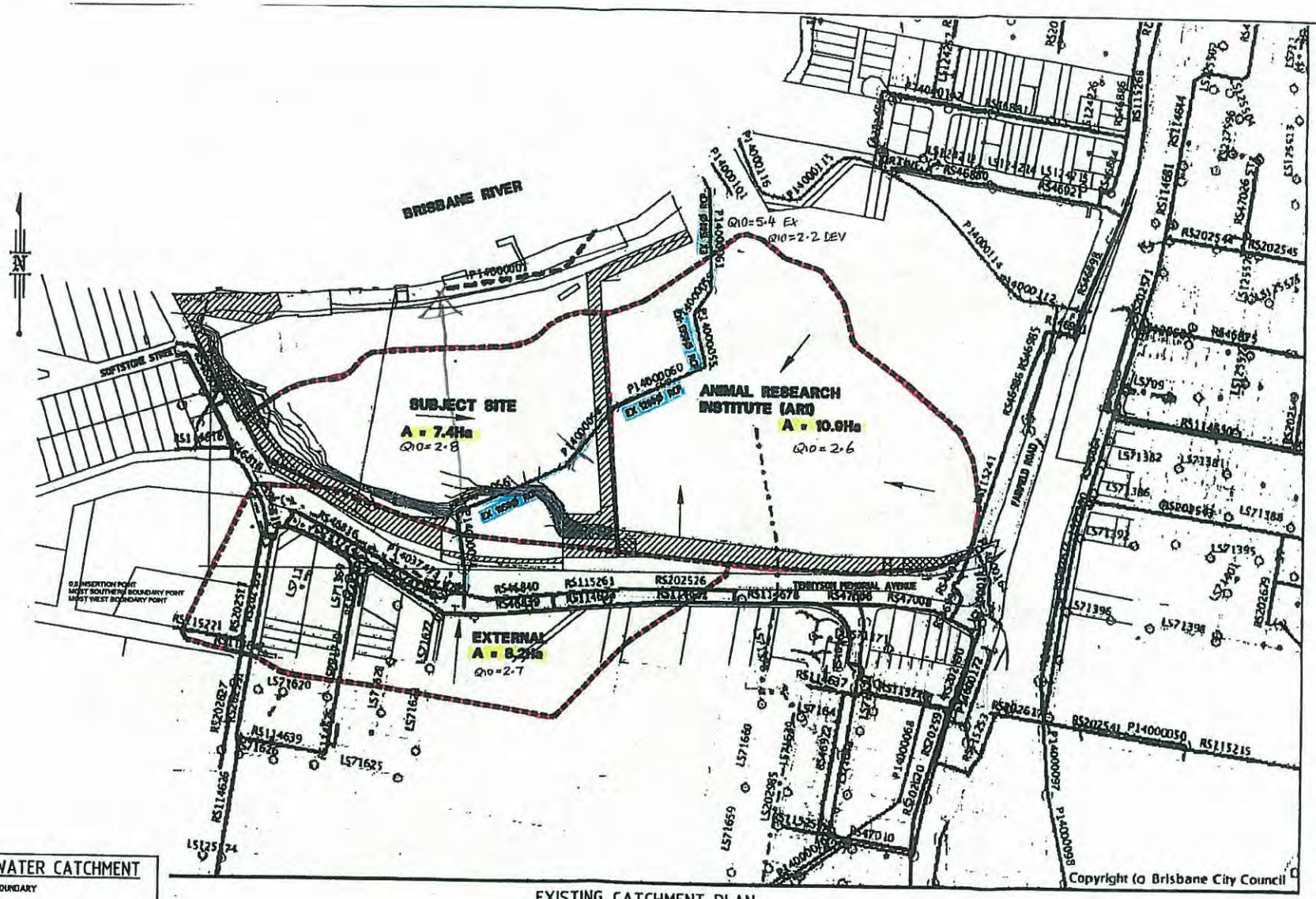
Gilbert & Sutherland Pty Ltd has attempted to be accurate providing this information. The interpretation of scientific data, however, involves professional judgement. As such, interpretation is open to error.

In recognising the potential for errors in scientific interpretation, Gilbert & Sutherland Pty Ltd does not guarantee that the information is totally accurate or complete and clients are advised not to rely solely on this information when making commercial decisions. Any representation, statement, opinion or advice, expressed or implied is made in good faith and on the basis that the authors, Gilbert & Sutherland Pty Ltd, their agents or employees are not liable (whether by reason of lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement or advice referred to above.

Furthermore, this information should not be relied upon by any other persons than the client for whom this information was compiled. This information reflects the specific brief and the budget of the client concerned, who enjoys an individual tolerance of risk.

12. Appendixes

12.1. Appendix 1 – Existing drainage network



LEGEND - STORMWATER CATCHMENT

- CATCHMENT BOUNDARY
- SURFACE FLOW
- EXISTING STORMWATER DRAINAGE
- EXISTING SURFACE CONTOUR

EXISTING CATCHMENT PLAN

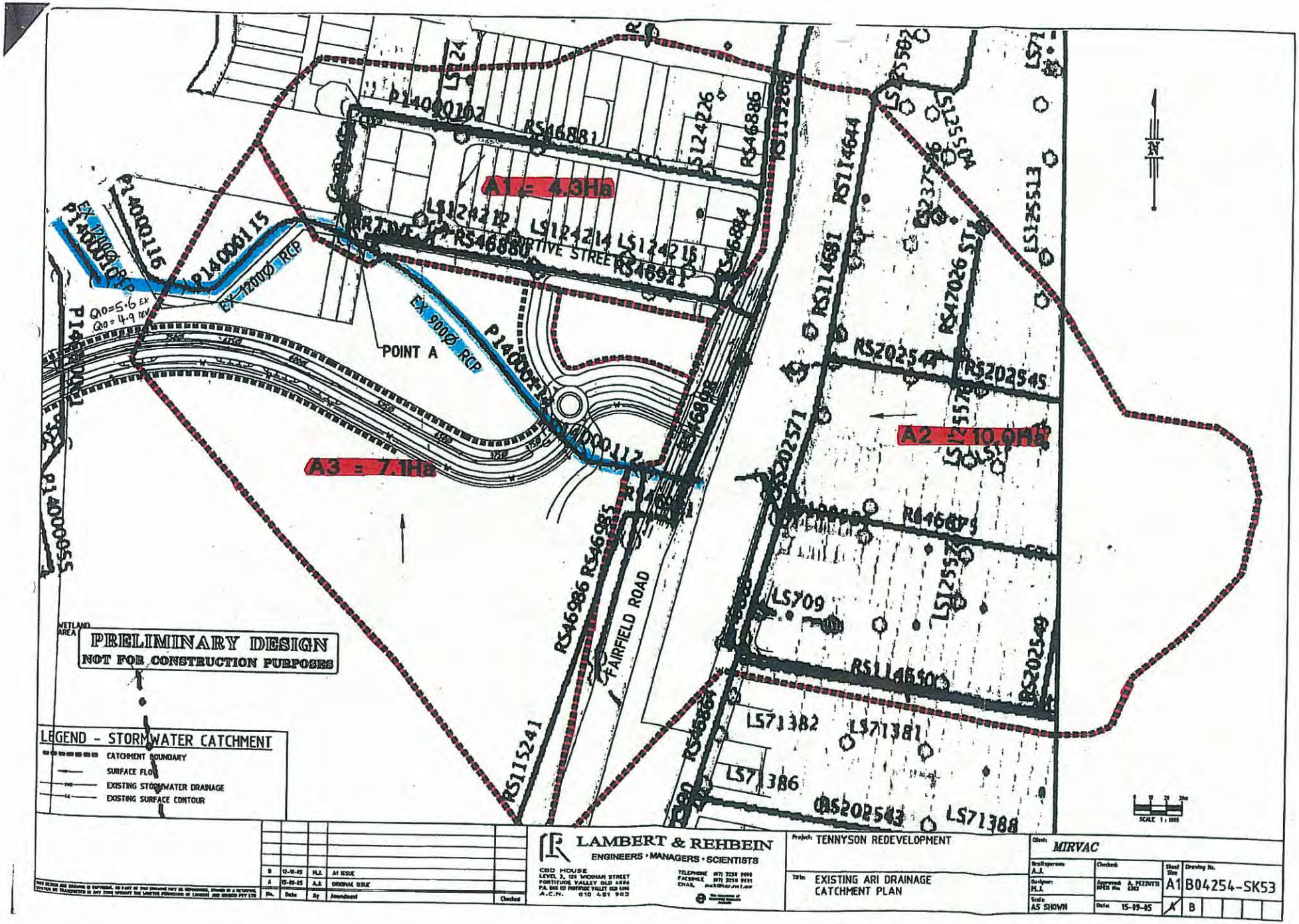
SCALE 1 : 2000

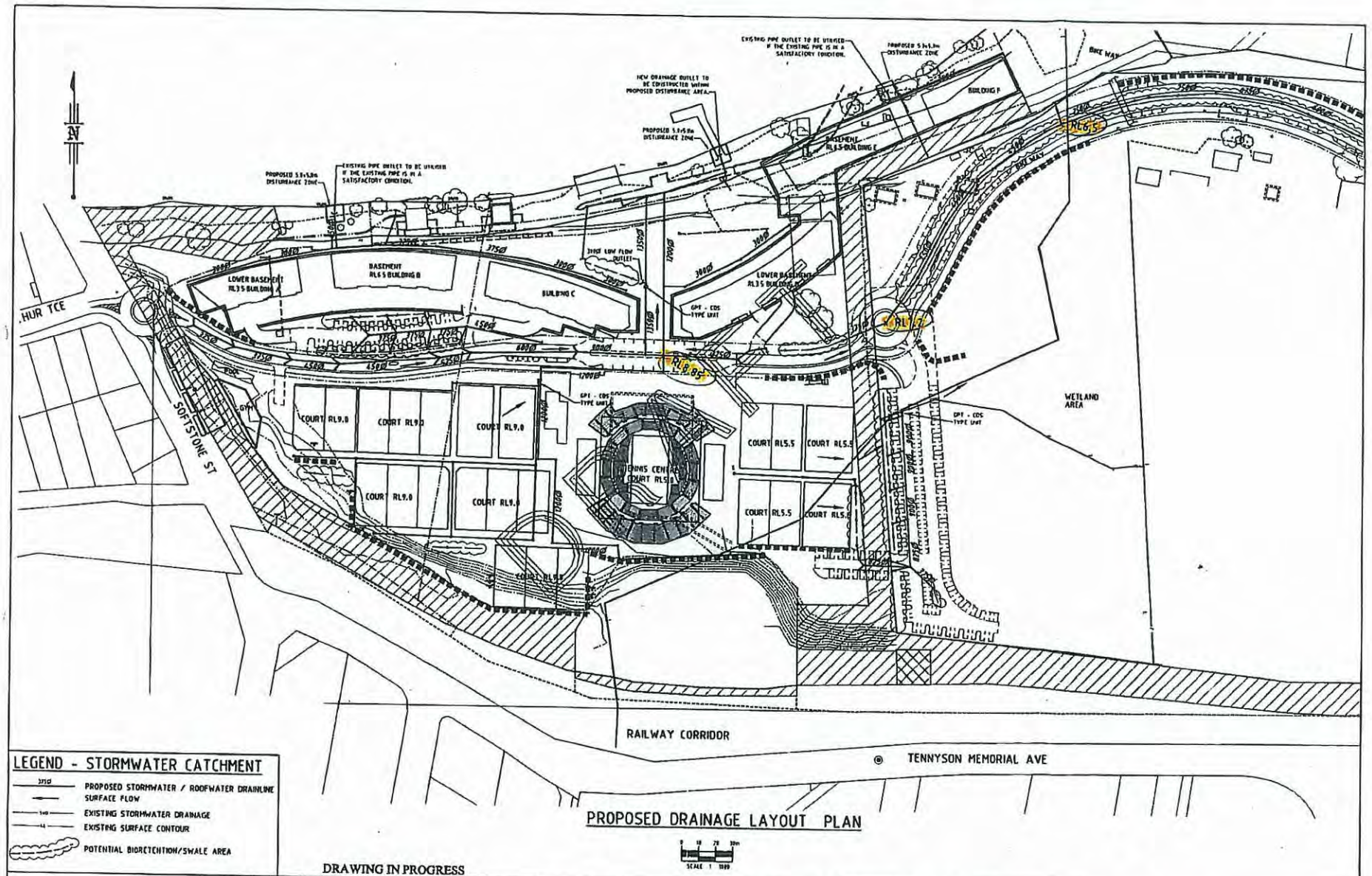
PRELIMINARY DESIGN
NOT FOR CONSTRUCTION PURPOSES

No.	Date	By	Amendment	Checked
B	17-11-95	M.L.	AT ISSUE	
A	15-09-95	A.J.	ORIGINAL ISSUE	

LAMBERT & REHBEIN
ENGINEERS · MANAGERS · SCIENTISTS
CBD HOUSE
LEVEL 3, 178 WICKHAM STREET
FORTITUDE VALLEY QLD 4006
P.A. BOX 10 FORTITUDE VALLEY QLD 4006
A.C.N. 010 451 982
TELEPHONE (07) 3259 1000
FACSIMILE (07) 3721 9991
EMAIL melb@lambert.com.au

Project: TENNYSON REDEVELOPMENT
Title: EXISTING CATCHMENT PLAN
Client: MIRVAC
Drafting: A.J.
Designed: M.L.
Scale: AS SHOWN
Checked:
Approved: A. PEZZUTTI RPEQ No. 6382
Date: 15-09-95
Sheet Size: A1
Drawing No.: B04254-SK52
A B


A1 = 4.3Ha
A2 = 10.0Ha
A3 = 7.1Ha
POINT A
EX 1200Ø RCP
EX 900Ø RCP
Q10=5.6 Ex
Q10=4.9 fut
FAIRFIELD ROAD
WETLAND AREA
PRELIMINARY DESIGN
NOT FOR CONSTRUCTION PURPOSES
LEGEND - STORMWATER CATCHMENT
CATCHMENT BOUNDARY
SURFACE FLOW
EXISTING STORMWATER DRAINAGE
EXISTING SURFACE CONTOUR
LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS
CBD HOUSE
LEVEL 3, 128 MOGHAM STREET
FORTITUDE VALLEY QLD 4006
P.O. BOX 62 FORTITUDE VALLEY QLD 4006
A.C.N. 010 451 902
TELEPHONE (07) 3258 9088
FACSIMILE (07) 3258 9191
EMAIL mail@lrbrisbane.com.au
Project: TENNYSON REDEVELOPMENT
Title: EXISTING ARI DRAINAGE CATCHMENT PLAN
Client: MIRVAC
Drawn: A.J.
Designer: M.J.
Scale: AS SHOWN
Checked:
Approved: PETER HEIN 4362
Date: 15-09-05
Sheet Size: A1
Drawing No.: B04254-SK53
B 12-10-05 M.J. AS ISSUE
A 15-09-05 A.J. ORIGINAL ISSUE
No. Date By Amendment
Checked



LEGEND - STORMWATER CATCHMENT

- PROPOSED STORMWATER / ROOFWATER DRAINLINE
- SURFACE FLOW
- EXISTING STORMWATER DRAINAGE
- EXISTING SURFACE CONTOUR
- POTENTIAL BIORETCHTION/SWALE AREA

PROPOSED DRAINAGE LAYOUT PLAN

SCALE 1 : 1000

DRAWING IN PROGRESS

No.	Date	By	Amendment	Checked
A	15-09-05	A.J.	ORIGINAL ISSUE	

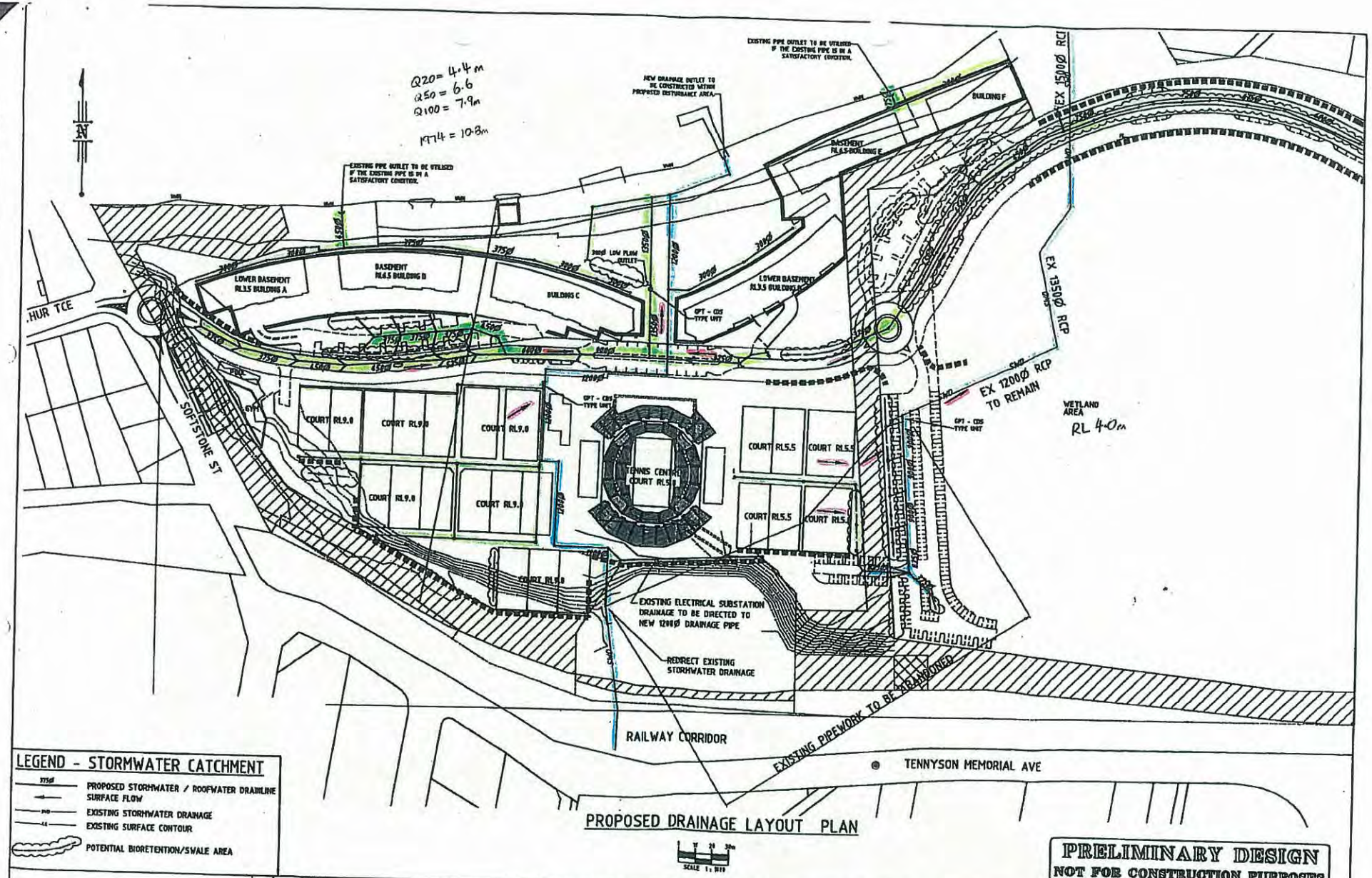
LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS
COD HOUSE
LEVEL 1 120 WICKHAM STREET
FORTITUDE VALLEY QLD 4006
P.O. BOX 112 FORTITUDE VALLEY QLD 4006
A.C.N. 010 451 893
TELEPHONE (07) 3250 9000
FACSIMILE (07) 3250 9001
EMAIL mail@lar.net.au

Project: TENNYSON REDEVELOPMENT

Title: PROPOSED SITE DRAINAGE LAYOUT & OUTLET PLAN

Client: MIRVAC

Draftsperson: A.J.	Checked	Sheet Size: A1	Drawing No.: B04254-SK60
Designer: M.J.	Approved: A. PEZZUTTI		
Scale: AS SHOWN	Date: 15-09-05	A	



No.	Date	By	Amendment	Checked
B	12-11-15	M.J.	BIORETENTION AREA AMENDED	
A	15-09-15	A.J.	ORIGINAL ISSUE	

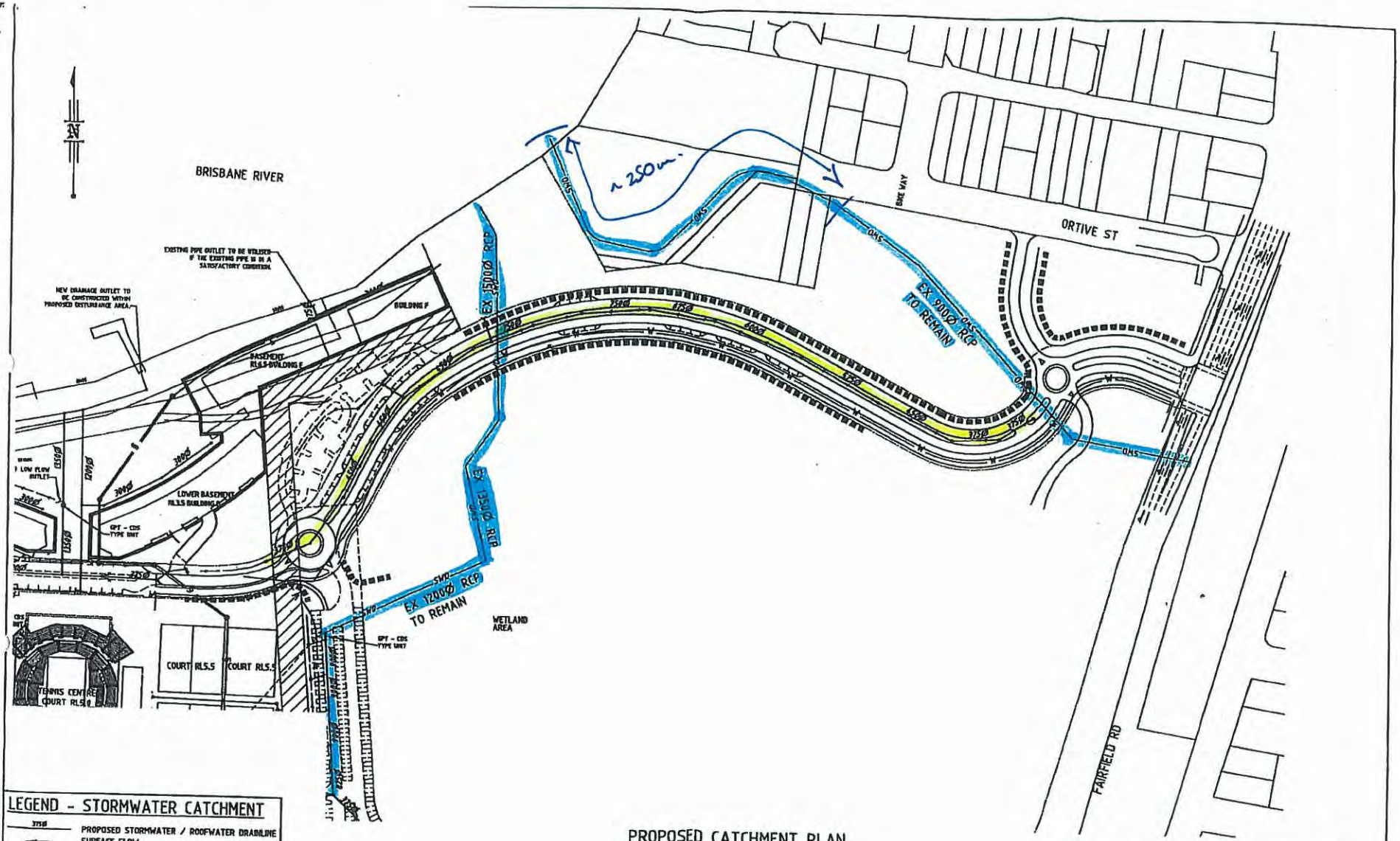
LAMBERT & REHBEIN
ENGINEERS · MANAGERS · SCIENTISTS
CBD HOUSE
LEVEL 2, 128 WICKHAM STREET
FORTITUDE VALLEY QLD 4006
PO BOX 112 FORTITUDE VALLEY QLD 4006
A.C.N. 010 451 903
TELEPHONE (07) 3259 8000
FACSIMILE (07) 3252 9691
EMAIL mail@lr.net.au

Project: TENNYSON REDEVELOPMENT

Title: PROPOSED SITE DRAINAGE LAYOUT PLAN SHEET 1 OF 2

Client: MIRVAC

Drafting: A.J.	Checked:	Sheet Size: A1	Drawing No.: B04254-SK55
Designed: M.J.	Approved: A. MCINNES RPEQ No. 6362		
Scale: AS SHOWN	Date: 15-09-15	A	B



LEGEND - STORMWATER CATCHMENT

- PROPOSED STORMWATER / ROOFWATER DRAINLINE
- SURFACE FLOW
- EXISTING STORMWATER DRAINAGE
- EXISTING SURFACE CONTOUR

PROPOSED CATCHMENT PLAN

SCALE 1 : 1000

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION PURPOSES

No.	Date	By	Amendment	Checked
B	13-11-15	M.J.	A1 ISSUE	
A	15-09-15	A.J.	ORIGINAL ISSUE	

LAMBERT & REHBEIN
ENGINEERS · MANAGERS · SCIENTISTS
CBD HOUSE
LEVEL 3, 126 WICKHAM STREET
FORTITUDE VALLEY QLD 4006
P.O. BOX 112 FORTITUDE VALLEY QLD 4006
A.C.N. 010 451 902
TELEPHONE (07) 3250 9900
FACSIMILE (07) 3250 9901
EMAIL mail@lar.net.au

Project: TENNYSON REDEVELOPMENT

Title: PROPOSED SITE DRAINAGE LAYOUT PLAN SHEET 2 OF 2

Client: MIRVAC

Draftsperson: A.J.	Checked:	Sheet Size: A1	Drawing No.: B04254-SK56
Designer: M.J.	Approved: A. PIZZUTO RPEQ No. 4312		
Scale: AS SHOWN	Date: 15-09-15	A	B

12.2. Appendix 2 – Brisbane City Council Floodwise search results

10443

BRISBANE CITY COUNCIL

FloodWise Property Report

ABN 72 002 765 795

Dedicated to a better Brisbane

Report Reference
995980

19/03/2010 15:52:09

DISCLAIMER

1 This FloodWise Property Report provides defined flood levels from river, creek, waterway and storm tide flooding and ground levels and whether a property is mapped as being in an overland flow path.

2 Defined flood levels are determined from the information available to Council at the date of issue. The defined flood level for a particular property may change if more detailed information becomes available, or changes are made in the method of calculating flood levels.

3 For these reasons, Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property Report. Council disclaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.

EXPLANATIONS

1 The flood information supplied does not represent the highest possible flood level that could occur on this property. A flood level more severe than the defined flood level can occur, although, such events are rare.

2 A property may be affected by several sources of flooding (e.g. river, creek, waterway, storm tide, and or overland flow). Council provides flood information on the highest known source.

3 Council receives ground level information from a number of sources, including design plans, as-constructed drawings, ground surveys and airborne laser scanning. This report contains Council's most recent received ground levels but there is still a possibility that Council's records may show ground levels prior to recent development. A registered surveyor can confirm exact ground levels.

4 If your property is flagged as being in a waterway corridor, development is controlled to preserve the capacity of the land to meet the waterway objectives. For further information contact the Development Assessment Customer Liaison Officer on 3403 8888.

5 Any proposed filling of land must be undertaken in accordance with both legal responsibilities and the requirements specified in the *Brisbane City Plan 2000*. Habitable floor levels are to be in accordance with the *Brisbane City Plan 2000*.

6 This FloodWise Property Report is a guide only and should not be used or relied upon for development purposes. The information provided may not take into account recent building and development which may impact on overland flow paths. If you intend to build or develop it is recommended that a Registered Surveyor or Registered Professional Engineer in Queensland (RPEQ) be engaged to undertake the appropriate assessments.

This FloodWise Property Report shows the type of flooding that may occur at the property address selected below. It shows the maximum height that flood water may reach in the table titled "Flood Level Information".

PROPERTY DETAILS

Street Address	[redacted] FAIRFIELD RD YEERONGPILLY QLD 4105
Lot on Plan	[redacted]

FLOOD LEVEL INFORMATION

Note: Please read the Disclaimer, Explanations and Terms and Definitions to help you understand and interpret the information contained in this report.

Minimum Ground Level based on most recent Council information	**3.2 m AHD**
Maximum Ground Level based on most recent Council information	**18.4 m AHD**
Highest defined flood level (DFL) (or 100 Year ARI Flood Level)	**7.9 m AHD**
Highest flooding source from	**RIVER**
Flooding may also occur from *	**OVERLAND FLOW**
Approximate depth of flooding on this property defined flood level (DFL) less the minimum ground level	**4.7 m**
Minimum habitable floor level Highest defined flood level (DFL) in metres + 500 mm	**8.4 m AHD**

**If flooding also occurs from an overland flow path, see the information below:*

Flood levels from overland flow path flooding are difficult to predict and may result in a higher overall flood level than that indicated from other sources. Please read the information about overland flow given in the Definitions section. Please note that the depth of a potential overland flow path cannot be determined in this report.

FURTHER FLOOD LEVEL INFORMATION

If you are planning a subdivision, building a new dwelling, extending an existing dwelling, and/or other similar development, the following information may also apply:

ARI Flood Level

Highest 100 Year or DFL	**7.9 m AHD**	Flooding from: **RIVER**
Highest 50 Year	**6.6 m AHD**	Flooding from: **RIVER**
Highest 20 Year	**4.4 m AHD**	Flooding from: **RIVER**
Highest 5 Year	**Not available**	Flooding from: **Not available**
		Flooding may also occur from: **OVERLAND FLOW**

Property Development Flags

The following may impact on development of your chosen site:

Large Allotment Flag	This property is flagged as a Large Allotment of over 1000 squares metres. Flood levels may vary significantly within this site. Further information and advice may be obtained by consulting a Registered Professional Engineer of Queensland.
Waterway Corridor	This property is flagged as being wholly or partially within a waterway corridor. The Waterway Corridor indicates where building work and development are controlled to preserve environmental values. Further information is available on Council's website under Brisbane City Plan 2000 or by contacting a Development Assessment Customer Liaison Officer on 3403 8888.

FURTHER INFORMATION ABOUT FLOODING

Council's *Be FloodWise* program has a range of publications available that provide information on flooding in Brisbane, how to prepare your home and yard to reduce the impact of flooding and flooding considerations when buying or renting, or building or renovating. This information is available by visiting www.brisbane.qld.gov.au/floodwise or from the Contact Centre by phoning Council on (07) 3403 8888.

TERMS AND DEFINITIONS

Australian Height Datum (AHD)	The Australian Height Datum is the reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.
Average Recurrence Interval (ARI)	The probability of experiencing a flood of a particular magnitude is expressed as an Average Recurrence Interval (ARI). ARI is a statistical estimate of the average period (in years) between the occurrences of a flood event of a given size or greater (based on long term averages). For example, a 5 Year ARI means that during a five-year period there is a chance that a flood event of this size or greater may occur at least once. The ARI gives no indication of when a flood of this size may occur next.
Defined flood level (DFL)	A water level derived through mathematical modelling of the defined flood event that is adopted by a local authority for management of development. The DFL does not indicate the full extent of flood-prone land. Generally the standard used is the 100 Year ARI. The DFL is used for determining the development levels for various types of development e.g. houses, subdivisions etc. For further information, refer to the House Code in *Brisbane City Plan 2000*, specifically Table 1: House Flood Immunity Levels for residential property. For all other development refer to Council's Subdivision and Development Guidelines.
Maximum Ground Level	The highest ground level on the property based on most recent ground level information. Check with a Registered Surveyor for further information.
Minimum Ground Level	The lowest ground level on the property based on most recent ground level information. Check with a Registered Surveyor for further information.
Minimum Habitable Floor	The minimum level at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.
Overland flow paths	The stormwater runoff which exceeds the capacity of the underground drainage system (if present) and which concentrates in surface depressions, yards and gullies as it flows down a catchment. Such flooding may result from a severe thunderstorm or periods of prolonged rain. Using the characteristics of areas for which detailed flood modelling and mapping has been collated, Council has developed computer generated mapping to indicate the potential for flooding in other areas. These are called overland flow paths. As this mapping is not derived from a study of individual geographical areas, it can only indicate the possibility of flooding rather than a depth.
Storm Tide	The water level which results from the rise above the normal tide level due to the combined effects of wind and atmospheric pressure caused by severe weather conditions such as tropical cyclones or storms. Such rises may lead to flooding in coastal and bayside areas of the city.
Waterway Corridor	The corridors are defined in *Brisbane City Plan 2000*, along waterways (being a river, creek or creek tributary) to protect water flow, water quality, biodiversity, and recreation values. The potential to build or extend a home situated within a waterway corridor is restricted.
Brisbane City Plan 2000	The *Brisbane City Plan 2000* is a planning scheme which directs all building and development in Brisbane. Council assesses proposed new development against the City Plan. The City Plan can be downloaded to your PC in an electronic version available from Council's website at http://www.brisbane.qld.gov.au

12.3. Appendix 3 – Brisbane City Council wetlands correspondence

Dedicated to a better Brisbane

MEMORANDUM

Brisbane City Council

Water Resources
City Planning and Sustainability Division

Brisbane Square Level 8
266 George Street Brisbane Qld 4000
GPO Box 1434
Brisbane Qld 4001

Phone [redacted]
Fax: 07 3334 0079
Email:
Internet www.brisbane.qld.gov.au

To: [redacted] **Urban Planner** Date: **12/08/2010**
Urban Renewal Brisbane

CC: [redacted]
Senior Urban Planner

From: [redacted]
Water Resources Branch

Re: **Water Resources input into Yeerongpilly TOD**

Thanks for giving the opportunity to be involved into conceptual stage of Yeerongpilly TOD.

Waterway Corridor:

With respect to the waterway area discussed, past poor development practices have severely compromised its ability to function as a natural waterway. The site does however still provide some functions of a waterway and wetland and as such this functionality should be represented within the development foot print.

Paul McAntee has been to the site to ground truth the Waterway corridor (07/07/2010) and noted following:

- Construction of King Arthur Tce near river has cut the Waterway corridor - No longer flows to River, flows back into main site.
- Trunk drainage taking stormwater from Tennis Centre to Brisbane River decreases overland flow through the Waterway corridor.
- The wetland (centre of Waterway corridor) is drained by the drainage.
- Due to surrounding topography, stormwater will accumulate at centre-line of Waterway corridor.

It is recommendation that the development be allowed to encroach into the waterway corridor provided the footprint provide appropriately sized biorention or constructed wetland to treat the entire catchment prior to discharge into the piped drainage network. This is to be located within the mapped waterway corridor.

Water Resources Branch agrees that Waterway corridor can be modified, not removed.

- Western & Northern sections of Waterway corridor are no longer required due to the car park & road respectively.
- Possibility to reduce Eastern section of Waterway corridor in accordance with overland flow path.

Waterway Corridor Enhancement

- Enhancement of overland flow path flagged. Similar to WSUD treatment along King Arthur Tce.
- Enhancement of land <4m similar to on-site detention/wetland.

Water Smart Initiatives:

From Water Resources perspective I would recommend that as part of any future development of the area, that consideration be given to incorporation of Integrated Water Cycle Management (IWCM) principles in buildings, open space areas and sporting facility.

Particular focus could be provided in terms of incorporation of Water Sensitive Urban Design (WSUD) into any landscape, road design, park etc.

Buildings should also consider IWCM outcomes e.g. alternative water sources, storm water harvesting, grey water recycling etc.

Consideration should be given to incorporate Best Management Practices eg. New park/open space, sporting venues could be used for stormwater harvesting, collection and reuse it in building etc.

[redacted]
Acting Program Officer
Water Resources
CITY PLANNING & SUSTAINABILITY

S 04487/03

DGM, FYI
2 TOM H / Russell C
3 Sec-file

N/03/11770

[redacted]

Advisor ..
Dated

Furthe

Minister ..
Dated 8 / 7 / 3

☐ MINISTER
☑ SPA
☑ POL ADV MS
☑ MEDIA COPIES
☐ PERS SEC
☐ ADMIN
for
☐ INFORMATION
☐ ACTION
☐ FILING

To Dept. for:
☐ REPLY
☐ BRIEF
☐ INFORMATION

...../...../.....

Department of Natural Resources and Mines
BRIEFING NOTE FOR INFORMATION

TO **The Honourable Minister**

SUBJECT **Implications for Departmental Flood Risk Policy of Courier Mail Report on Brisbane City Council Flood Information**

PURPOSE

To inform the Minister of NR&M's activities aimed at improving the management of flood risk throughout Queensland.

BACKGROUND

The reports in the Courier Mail, beginning on 24 June, regarding the way Brisbane City Council (BCC) has handled information on the potential vulnerability of Brisbane to a major flood has highlighted issues raised in NR&M's State Flood Risk Management Policy Discussion Paper.

A separate briefing note has been prepared by the Natural Resource Sciences unit regarding the extent of NR&M's involvement with the BCC's 1998 flood study (that is, advice on flood flow derivation methodologies) and the subsequent 1999 BCC internal report.

Public consultation on the Discussion Paper was completed earlier this year and a report and recommendations on development of a State Flood Risk Management Policy are expected to be completed for consideration by the Minister in the next few weeks.

A story, on page two of the "Courier Mail" newspaper on 2 July 2003, has quoted from NR&M's Public Discussion Paper; a public report prepared for NR&M *"Urban Flooding in Queensland – A Review"* in February 1998 and an interview yesterday afternoon with the General Manager, Water Management and Use, Graeme Milligan.

CURRENT ISSUES

- Brisbane uses the "1 in 100 year flood level" to manage new development so that the risk from flooding is held at an acceptable level. It should be noted that floods larger than "1 in 100 year" can occur. Hence the adoption of the "1 in 100 year flood" as a development control does not eliminate flood risks. An increase in the "1 in 100 year flood level" means that, in addition to those properties already at risk, many recent developments could be subject to inundation as a result of a flood of this magnitude.
- BCC withheld both the 1998 and 1999 reports because it was not convinced the new increased "1 in 100 year flood flows" were correct; and because of the potential impact of such revelations, that is:
  a) residents that would be considered at greater risk of flooding and would hold BCC responsible (that is, the tone of the first "Courier Mail" story); and
  b) developers who might seek compensation as a result of lost development potential because increasing the flood planning level would reduce their ability to make profits, even though legally they may not be entitled to such compensation because of Chapter 5, Part 4 of the Integrated Planning Act 1997 (which limits compensation for development which is refused on the basis that, *"had it happened under the superseded planning scheme—(i) would have led to significant risk to*

Briefing Officer R K Cuerel, Principal Policy Officer
Telephone [redacted]
Approved [redacted]
Date 2 July 2003

persons or property from natural processes (including flooding, land slippage or erosion) and the risk could not have been reduced by conditions attached to a development approval")

- The report in the "Courier Mail" (2 July 2003) highlights issues raised in NR&M's Public Discussion Paper on the proposal for a State Flood Risk Management Policy. The "Courier Mail" also quotes estimates of Queensland's flood risk exposure and recommendations from the February 1998 report prepared for NR&M entitled *"Urban Flooding in Queensland – A Review"*.
- The "Courier Mail" contacted NR&M on 1 July 2003 to speak about these two documents. [redacted] General Manager, Water Management and Use and [redacted] Manager, Water Use were interviewed. They took the opportunity to point out the commitment NR&M had made over the last four years to flood mitigation activities across the State through the Regional Flood Mitigation Program (that is, approximately $20 million in State and Commonwealth assistance has been spent or committed to 80 flood mitigation projects through NR&M since 1999/2000).
- [redacted] also advised that NR&M is finalising a report to the Minister on the outcome of the Public Discussion Paper that will make recommendations on proceeding with the policy proposal.
- NR&M's State Flood Risk Management Policy Discussion Paper identified the issue of the availability and accuracy of flood information being a significant constraint both on local governments' capacity to properly manage the flood risk in their area and on individuals' ability to make informed decisions about the flood risk they are prepared to accept.
- As a result, a key aspect of the proposed State Flood Risk Management Policy is specific provisions for ensuring the availability of flood information to address this sort of situation.
- The Department of Emergency Services have developed a *State Planning Policy for Mitigating the Adverse Impacts of Flood, Bushfire & Landslide (SPP 1/03)* with significant assistance from NR&M (particularly with respect to flood, but also landslide). The SPP is aimed at limiting the growth in flood risk (that is, future flood risk – not existing flood risk) through local government planning scheme controls and development assessment controls.
- Complementary measures, which provide State and Commonwealth funding to address flood risk in Queensland, include the Natural Disaster Risk Management Studies Program (administered by Department of Emergency Services) and the Regional Flood Mitigation Program (RFMP) (in the process of being moved from this Department to Department of Local Government and Planning as a result of a CBRC directive).
- The RFMP is a program aimed at reducing the impacts of flooding on regional communities throughout the State. It thus addresses, in a regional context, many of the concerns raised in response to the recently released flood information pertaining to Brisbane. It should be noted that RFMP funding is limited. To date BCC has not been eligible to apply for funding assistance under the RFMP.
- BCC may apply for a 20 percent subsidy for flood mitigation works under the Department of Local Government and Planning's Local Governing Bodies Capital Works Subsidy Scheme, which NR&M assists in administering for water related infrastructure.

RECOMMENDATION

It is recommended that the Minister note the above information.

MINISTER'S COMMENTS

Briefing Officer	R K Cuerel, Principal Policy Officer	Approved	[redacted]
Telephone	[redacted]	Date	2 July 2003

Ministerial Correspondence

FINALISED - GENERAL VIEW

CTS No: 04487/03
Currently Assigned To:
Ministers Office No:
Concerning: Implications for departmental Flood Risk Policy of Courier Mail Report on Brisbane City Council Flood Information
Author(requestor): Russell Cuerel / Graeme Milligan
Author Type: NR&M - Dept of Natural Resources & Mines
Hard Copy Attachments: No
Action Officer: [redacted]
Group/Region: Water Management & Use
Action Type: Brief for Noting
Reply Required: Yes
Template:
Classification: Providing Information
Locality: South East - Brisbane 4000-4209
Related CTS No:
Departmental File No:
Author(response): Russell Cuerel
For Input / Information:

DATES

Date of Letter: 02/07/2003
Received (Minister's Office):
Your Due:
Draft Received ECT:
To Minister's Office: 02/07/2003
Returned (from Minister's Office): 09/07/2003
Finalised: 08/07/2003

COMMENTS

COMMENT HISTORY

28/07/2003 10:22:31 AM [redacted] Signed hardcopy to Tony Horton for information
25/07/2003 4:01:51 PM [redacted] Signed hardcopy to GM for information
09/07/2003 4:06:39 PM [redacted] sed by Executive Correspondence Team
02/07/2003 1:15:26 PM [redacted] Sent for Minister's Approval by ECT

Flood academics warn of risky urban practices

Hedley Thomas

URBAN flooding in Queensland would cause more damage and pose greater risks to life unless the State Government provided funds or a legislative framework for effective floodplain management.

This was a key finding of *Urban Flooding in Queensland*, a study commissioned by the Department of Natural Resources five years ago.

The study, by flood experts from Australian National University in Canberra, warned that Queensland had not reduced flood vulnerability and that for many urban flood-prone communities, the lack of land-use controls or building regulations was such that potential damages increased each year.

It stated: "Actions to improve current practices are necessary to prevent the occurrence of major disasters with extensive damage and loss of life. Overall, the current state of knowledge of flood risk in Queensland is poor and far below the standard of that elsewhere in Australia."

The Department of Natural Resources is gauging public responses to a discussion paper on a proposed state flood-risk management policy to address shortcomings in urban floodplain management.

The DNR paper concedes State Government help to local governments on flood management has been limited and there are no overall guidelines. "With no clear or comprehensive policy to guide local government decision making in Queensland, there is considerable variation in flood-risk management practices," DNR says.

"Given that Queensland has the highest exposure to damages from floods nationally – 100,000 properties are estimated at risk from a one-in-100-year flood, with an estimated average annual damage bill of at least $100 million per year – it is clear the current fragmented approach is no longer satisfactory."

Graeme Milligan, DNR's general manager for water management and use, said the department had directed about $20 million into 80 projects to reduce the number of people and properties at risk of flooding since 1999.

He said public consultation arising from the discussion paper ended in February and a report with recommendations was being finalised.

The 1998 study project's leader, David Ingle Smith, reported that Queensland was unusual among Australian states as it did not have a statewide policy for urban floodplain management.

He found that action was left to individual councils and the burden of costs for necessary flood studies and subsequent mitigation had been frequently borne solely by local councils.

"This is in marked contrast to NSW where the contribution of state funding is close to 40 per cent of the total costs, normally matched by similar federal funding."

He urged the State Government to pitch in with funding for councils and to produce a flood manual for use by local government authorities to lessen the risks.

The earlier ANU study found that "until Queensland adopts an acceptable policy for new urban developments in flood-prone areas, the damage bill will continue to escalate".

WOMAN for all seasons . . . PR guru Marina Vit was hired to ensure Tim Quinn's smooth transition into the lord mayor role.

Spin doctor smoothes the waters

THE former chief media adviser to former lord mayor Jim Soorley had been hired at ratepayers' expense to help Tim Quinn weather the flood crisis.

Marina Vit, now a public relations executive with CPR Communications, was brought in to ensure the new lord mayor's smooth transition into the city's top job.

A spokeswoman for Cr Quinn last night confirmed CPR was engaged during the transition period to give "specialised media advice" on a whole range of issues, including the floods matter.

Dianne Butler of CONFIDENTIAL

The spokeswoman said she could not say how much Ms Vit's consultancy work cost nor the precise length of the contract, which was now over.

"We haven't received an invoice from Marina yet," the spokeswoman said.

Vit was hired despite the the Lord Mayor having a large media office at his disposal.

CPR general manager Jim Carden confirmed that his firm had been employed around the time Soorley announced his early retirement.

Mr Carden said it was not generally company policy to comment on clients.

"But I can confirm we were asked by council to assist them and their advisers in the transitional stage of the lord mayoralty, during which this river issue arose," he said.

Mr Carden said it was logical that Ms Vit was involved. "She knows the place," he said.

Mr Carden said CPR was still employed by the council. As chief of staff, Ms Vit became one of the most important non-elected officials in the council.

She quit on March 3 this year to take up a PR role at CPR Communications.

Expert damns study cover-up

From Page 1

Mr Brimble said: "Ratepayers had a right to know the council were reviewing flood projection levels.

"We will await the findings of the review committee ... when it will confirm whether or not council's assessment of the one-in-100 year levels are indeed accurate."

Professor Apelt was asked last week by *The Courier-Mail* to analyse the leaked 1999 flood study. He found that the document was conclusive, of significant concern and should have been made available to ratepayers.

He said last night his view had changed as he believed the leaked document was too pessimistic in its analysis of issues such as rainfall run-off and the magnitude of serious floods in 1893.

From Discussion Paper ✓

From Discussion Paper ✓

40

From 1998 Report

* I told [redacted] Dept of Local Govt & Planning grants & subsidies program & that [redacted] local authorities could access $ for flood works – & he ought to contact [redacted] for full details.

[redacted] Swapping from 1998 report & Policy Discussion Paper

[redacted]

The House of Representatives

Ref CBD/023764 (Pt 1)

25 May 2011

DOCUMENT DESPATCHED BY DERM
File No. CBD/023764
File Location 43 Mineral House
25 MAY 2011
Action By [redacted]
Registered Y/N
Doc. Code K/1067610

[redacted]
Director (Planning and Resilience)
Policy and Legislative Reform Branch
Emergency Management Queensland
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Dear [redacted]

Planning Schemes

Review of Yeerongpilly Transit Orientated Development - Queensland

Brisbane City Council (BCC)

State Planning Policy 01/03 (Flood)

The "Yeerongpilly Transit Orientated Development – Detailed Plan of Development" published by the Department of Local Government, and the supporting report entitled "Conceptual Flooding and Stormwater Assessment, Proposed Transit Orientated Development, Yeerongpilly Queensland" by consultants Gilbert and Sutherland, have been reviewed with respect to the incorporation of the natural hazard management (flood) requirements of State Planning Policy 01/03. As a result, the following comments are offered.

It is noted that the two documents quote a range of habitable floor levels for the development. The Gilbert and Sutherland report (dated February 2011) quotes a level of 8.4 m Australian Height Datum (AHD) for habitable floors, based on a flood wise property report from BCC dated 19 March 2010. However, the Detailed Plan of Development quotes a pre January 2011 level 9.6 m AHD, which it then states needs to be increased to 9.8 m AHD as a result of the post January 2011 flood levels announced by BCC. The total increase in habitable floor level from pre January 2011 to post January 2011 is therefore either 1.4 m (ie. 9.8 m – 8.4 m) or 0.2 m (ie. 9.8 m – 9.6 m), whilst the quoted increase at the City Gauge is 0.76 m (ie 4.46 m – 3.70 m). Some explanation of these differences, and how the post January 2011 level for the site was determined from the City Gauge is required.

Street Address
Level 3, 41 George Street, Brisbane, QLD 4000
Postal Address
GPO Box 2454 Brisbane QLD 4001
Telephone + 61 7 3247 [redacted]
Facsimile + 61 7 3224 7999
Website www.derm.qld.gov.au
ABN 46 640 294 485

A map of flood inundation depth contours with property boundaries has not been attached to the consultants report whilst the "Detailed Plan of Development" document includes a map indicating 1 in 100 year average recurrence interval flood line within this site. However it is not clear whether this is the currently adopted Defined Flood Event in the Brisbane City area (i.e. the post January 2011 level).

With respect to stormwater flooding the Gilbert and Sutherland report seems to lack of details of the stormwater quantity assessment for all sub catchments nor does it discuss how co-incident local and regional flooding was considered. The report also estimates a discharge velocity for the 1500 mm diameter outlet pipe from catchment 2, that seems excessive.

Section 8.1 of Gilbert and Sutherland report implies the proposed development area is "flood storage", however this needs to be clearly confirmed, i.e. is the whole site flood storage; what flow velocities are likely to be experienced across the site, etc. It is noted that section 10 of the report quotes advice from BCC that flood storage at the site is not critical. Therefore any loss of storage at the site (e.g. due to filling) should have negligible effect on flood levels.

Flood hazard maps have not been included in either report. Mapping should include the flood level contours for this development area on 5, 10, 20, 50,100, 200, 500 year average recurrence interval (ARI) and probable maximum flood (PMF). In addition the mapping should include the January 2011 flood and its estimated AEP. This range of average recurrence intervals is considered good practice as it not only meets the requirements of State Planning Policy 01/03 for new development, but will assist in the management of flood risks in existing areas.

Community infrastructure for the site such as evacuation route/s, power supply, sewage and water supply etc. that need to be able to function effectively during and immediately after a flood event should also be considered.

Please do not hesitate to contact [redacted] Senior Engineer (Flood Risk and Stormwater Management) on [redacted] if you have any further enquiries.

Yours sincerely

[redacted]

Russell Cuerel

Manager (Infrastructure Management)

Water Industry Asset Management & Standards

Office of the Water Supply Regulator

Environment and Natural Resource Regulation

Operations and Environmental Regulator

Ref CBD/023764 (Pt 1)

7 June 2011

DOCUMENT DESPATCHED BY DERM
File No. CBD/023764
File Location. C3. Mineral House
07 JUN 2011
Action By [redacted]
Registered Y/N
Doc. Code K/1084865

[redacted]
Director (Planning and Resilience)
Policy and Legislative Reform Branch
Emergency Management Queensland
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Dear [redacted]

Planning Schemes

Review of Fitzgibbon Urban Development Scheme

Brisbane City Council (BCC)

State Planning Policy 01/03 (Flood)

The "Fitzgibbon Urban Development Scheme " prepared by the Urban Land Development Authority (ULDA) has been reviewed with respect to the incorporation of the natural hazard management (flood) requirements of State Planning Policy 01/03. As a result, the following comments are offered.

It has been noted that there is no discussion to determine whether the flood studies should have been performed for the combined effect of storm surge and terrestrial flooding related to Cabbage Creek, Fitzbiggon Drain and Castledine Drain. This Department also suggests that ULDA should do a detailed flood study of the site and include flood depth contour maps for on 5, 10, 20, 50,100, 200, 500 year average recurrence interval (ARI) and probable maximum flood (PMF) prior to the development of the proposed site. This range of average recurrence intervals is considered good practice as it not only meets the requirements of State Planning Policy 01/03 for new development, but will assist in the management of flood risks in existing areas.

Table 4.10 – Page 23 indicates that the railway embankment retains up to 293 Ml of flood waters (i.e. it performs as a detention basin). ULDA needs to determine whether this detention basin is captured under the Dam Safety provisions of the Water Supply (Safety and Reliability) Act 2008.

Street Address
Level 3, 41 George Street, Brisbane, QLD 4000
Postal Address
GPO Box 2454 Brisbane QLD 4001
Telephone + 61 7 3247 [redacted]
Facsimile + 61 7 3224 7999
Website www.derm.qld.gov.au
ABN 46 640 294 485

The Table 4.11 – Page 24 does not indicate the flow velocities of the Carseldine Drain. ULDA should include the flow velocities for the respective Average Recurrence Intervals – particularly for the larger events. This is to identify the risks to the public (i.e. specially children) of the open drain and retention basins systems in the developed areas.

This Department notes that, the cost of the proposed flood mitigation works to reduce the flood effects of the existing areas will be approximately $11.0M. Though the UDLA has considered several options there is no benefit-cost analysis presented to aide in the selection of the most appropriate option; nor is there any indication that the environmental and social aspects have been evaluated.

The local community infrastructure (such as evacuation routes, electrical substation, sewage facilities and water supply storages etc) that needs to be able to function effectively during and immediately after a flood event needs to be considered.

Please do not hesitate to contact [redacted] Senior Engineer (Flood Risk and Stormwater Management) on [redacted]26 if you have any further enquiries.

Yours sincerely

[redacted]

Russell Cuerel

Manager (Infrastructure Management)

Water Industry Asset Management & Standards

Office of the Water Supply Regulator

Environment and Natural Resource Regulation

Operations and Environmental Regulator

File CBD/023764 (Pt1)

19 August 2011

[redacted]
Director (Planning and Resilience)
Policy and Legislative Reform Branch
Emergency Management Queensland
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Dear [redacted]

Flood and Stormwater Management for Fitzgibbon Development Scheme - ULDA

Further to this department's letter of 7 June providing comments on the above; and the subsequent response from WRM Water and Environment; I can advise as follows:

Flooding Issues (WRM letter point 2)

- WRM's response to the issue of joint probability of flooding and storm surge is considered reasonable. However, it is worth noting that the Queensland Climate Change Centre of Excellence is currently investigating the issues of joint probability for flood and storm-surge as well as sea level rise and may be able to comment further.
- WRM's response confirms that larger (i.e. less frequent than 1% AEP) flood events have not been assessed. Hence, this department's previous comments stand.

Dam Safety (WRM letter point 3)

- The department's Dam Safety group have clarified that railway embankments generally are outside the scope of the Water Supply (Safety and Reliability) Act 2008 - unless they are part of a "dual purpose" structure that is actually intended to store water. Therefore, whilst WRM's response regards the size of a structure being the sole determinant of whether it is captured under the dam safety provisions of the Act is not correct, the department's previous comments regards the embankment have been satisfied.
- Dam Safety group have also highlighted that proposed detention basins 1 and 2 referred to in section 6 of the report may require further scrutiny. In particular, detention basin 1 (see section 6.2 – Proposed Flood Mitigation Infrastructure) that could have a dam crest volume of 154 mega-litres and an embankment height of 2.5 metres. The concern is

Level 3 Mineral House 41 George Street Brisbane 4000
GPO Box 2454 Brisbane Q 4001

Telephone + 61 7 3247[redacted]
Facsimile + 61 7 32247999

Website www.derm.qld.gov.au

ABN 46 640 294 485

that some of the downstream dwellings in Oxford Place and also Cambridge Crescent may be at risk. The proponents should conduct a suitable assessment in accordance with the *Guidelines for Failure Impact Assessment of Water Dams, 2010* (refer the department's web site) prior to commencement of construction.

Velocities in Carseldine Drain (WRM letter point 4)

- WRM's response is considered adequate.

Should you have any further enquiries, please do not hesitate to contact [redacted] Senior Engineer (Flood Risk and Stormwater Management) on [redacted]

Yours sincerely

[redacted]

Russell Cuerel
Manager, Infrastructure Management
Water Industry Asset Management and Standards
Office of the Water Supply Regulator
Environment and Natural Resource Regulation
Department of Environment and Resource Management

Author [redacted]
File number IRM/085/000(0184)
Directorate / Unit Water Industry Asset Management & Standards/Office of Water Supply Regulator
Phone (07) 3239 [redacted]

11 February 2009

[redacted]
Assistant Director (Strategic Policy Unit)
Department of Emergency Services
GPO Box 1425
BRISBANE QLD 4001

[redacted]

Dear M[redacted]

Redevelopment of Queensland Emergency Operation Centre Site – Kedron, Brisbane
Review of the 1 in 500 Annual Exceedance Probability Flood Level Assessment

The above flood level assessment report has been reviewed by Department of Natural Resources and Water and the methodology adopted for the assessment of the flood level at the proposed site for 1 in 500 Annual Exceedance Probability event is considered acceptable.

The modelling and calculations performed by the consultant in this study have not been checked by this Department and therefore the consultant is responsible for the calculations and modelling results.

Since there is an uncertinity associated with the future development of Gympie Road Crossing, the Department suggests an additional 200 mm should be added to the calculated or modelled flood level. This would allow for the future dredging work of the up stream of Gympie Road Bridge, which increases the water level at the Emergency Operation Centre site..The Department suggests an allowance of a minimum of 300 mm free board should be added to the final calculated or modelled flood level as required under SPP 1/03.

Please do not hesitate to contact [redacted] Senior Engineer (Flood Risk and Stormwater Management) on [redacted] if you have any further enquiries.

Yours sincerely

Street Address
Level 7
200 Mary Street
BRISBANE QLD 4000
Postal Address
GPO Box 2454
BRISBANE QLD 4001
Telephone + 61 7 3224 [redacted]
Facsimile + 61 7 3224 7999
Website www.nrm.qld.gov.au
ABN 83 705 537 586Street

[redacted]
A/Director (Water Industry Asset Management & Standards)
Office of the Water Supply Regulator
Water & Catchment Services

Cu[illegible] Russell

From: [redacted]
Sent: Wednesday, 12 November 2003 9:40 AM
To: [redacted]
Cc:
Subject: Bundaberg Flood mapping

InterScan_Disclaimer.txt

About a month or two ago I spoke to you about the Bundaberg City Council's adopted Burnett River Flood level of 2% (Q50). DES provided comments on this issue to Council, which has resulted in the following comments from Bundaberg City Council. Russell, could you determine whether the information Council has provided in regards to adequately determining whether a 2% flood level for the Burnett River is appropriate to your specifications. This is crucial as Bundaberg will be wanting approval from DES to sign off on their Scheme that states SPP 1/03 has been appropriately reflected.

DES comments:

To ensure that SPP 1/03 applies for development assessment purposes, the Flood Management Overlay - Map 3.11 must meet the criteria for a NHMA for flood. This can be achieved by:

* identifying the flood level or levels of the DFE, as was indicated as Australian Height Datum levels on Map FM1 in the draft Bundaberg City Plan. This will ensure Council can pinpoint an appropriate freeboard height above the DFE, for, e.g. residential developments; and

* providing the DES with the additional information that is required to identify, through consultation with the Department of Natural Resources and Mines, if the current Burnett River flood level is appropriate.

Bundaberg City Council Comments:

As you are aware Council has had considerable discussions with respect to this matter and it has been determined that the purpose of the map in the Planning Scheme is to trigger assessment against the flood management code. The actual flood mapping is of extensive detail and will occupy numerous maps which it is felt are best outside of the scheme to allow for easy amendment, eg. The flood mapping will map every individual allotment and the associated house floor level. This work is currently being undertaken and is not yet complete. When complete it will be adopted by Council for purposes of the Standard Building Regulation.

Bundaberg City Council has proposed a 2% AEP flood immunity level associated with flooding at the Burnett River and a 1% AEP flood for localized flooding

* The Council has adopted the 2% AEP level because:

* An extensive flood warning system is in place on the Burnett River;

* There is historical acceptance of the 1942 flood level as being an acceptable level for flood plain management.The 1942 current flood level is in most cases slightly below the 2% AEP flood proposed in the Planning Scheme. The communities acceptance of the 1942 flood level is reflected in the strong public reaction against increases in flood levels above the 1942 flood level by the proposed 2% AEP.

* The Burnett Basin Flood Hydrograph at Bundaberg is relatively flat as shown on the attached hydrograph. The approach of a flood is thus not rapid and unexpected

There is a considerable lead time, triggered by upstream flood warning stations, associated with a flood reaching Bundaberg eg. the flood peak measured at Gayndah is approximately 36 hours prior to the flood peak at Bundaberg. A point halfway up the

flood rise on the Mundubbera hydrograph is some 60 hours before the flood peak in Bundaberg . The nature of the flood hydrograph in Bundaberg, the flat local topography and nature of escape routes,together, result in a significant amount of time being available for the movement of persons and chattels to safety, if necessary. The majority of affected urban land in Bundaberg is affected only in major flood events.

In regards to Council not providing all flood data on their overlay map, it has been raised that Council may include this information as Planning Scheme Policy to support the overlay map in the Scheme. This would make the amendment process easier.

Thanks

Give me a call if you wish to discuss any issue or need clarification.

P.S I understand that a meeting has been set up with NRM on the 26th Nov to discuss the on-the-ground implementation of the MoU between DES and NRM. I assume you will be involved in this meeting.

[redacted]
Assistant Project Officer
Strategic Management and Policy Unit
Strategic and Executive Services Division
Department of Emergency Services
Level 3 Block F, Healy Wing
Cnr Kedron Park & Park Rds, Kedron Q 4031
GPO Box 1425 Brisbane Q 4001
Telephone: [redacted]
email: [redacted]

610731095064

Queensland Government
Counter Disaster and Rescue Services
Department of Emergency Services

Fax

Disaster Mitigation Unit

To	**Russell Cuerel**	**Fax**	[redacted]
Subject	**Advice to Bundaberg City Council – re: DFE**		
From	[redacted] **Senior Project Officer, Disaster Mitigation Unit, Counter Disaster and Rescue Services**		
Telephone	[redacted]	**Fax**	3109 5060
Date	**14 April 2003**	**Pages (inc)**	5

Russell,

Attached for your consideration is a:

- The letter from Bundaberg City Council regarding adopting the 1:50 flood event for the Burnett River, and
- The response provided by [redacted] and myself in December 2002.

Regards

[redacted]

GPO Box 1425 Brisbane Qld 4001

610731095064

Bundaberg City Council

P 131200

346:AWF:ES

All enquiries to [redacted]

2nd April 2003

[redacted]
Policy Officer
Department of Emergency Services
GPO Box 1425
BRISBANE QLD 4001

Dear Madam

RE: Draft Bundaberg Planning Scheme – Adoption of Flood Map

Bundaberg City Council by correspondence dated 4th December 2002 requested advice with respect to the Department's position concerning the level of flood immunity it considers appropriate for the Bundaberg Community. To date no response has been received.

Attached is Council's letter of the 4th December 2002 for your information. The Council would appreciate a response concerning this matter.

Yours faithfully

[redacted]

Chief Executive Officer

All communications to be addressed to the Chief Executive Officer

U:\Eids\TOWNPLAN\STATE EMERGENCY SERVICE[illegible]

Postal Address: P.O. Box 536, Bundaberg, Qld., 4670
Street Address: 188-190 Bourbong Street, Bundaberg, 4670
Website: www.bundabergcity.qld.gov.au
E-mail: [redacted]

A.B.N. 45 538 587 160
Telephone: (07) 4153 [redacted]
(07) 4153
Facsimile: (07) 4152 9155

610731095064

346:AWF:ES

All enquiries to
Mr A Fulton

4th December 2002

[redacted]
Policy Officer
Department of Emergency Services
GPO Box 1425
BRISBANE QLD 4001

Dear Madam

RE: Draft Bundaberg Planning Scheme – Adoption of Flood Map

As you may be aware Bundaberg City Council has recently completed its public notification stage for its Draft Planning Scheme. Bundaberg City historically has been significantly affected by flooding of the Burnett River, and the draft Planning Scheme included a 50 year ARI flood map, representing it's defined flood event for flooding emanating from the Burnett River.

Previously, Council had used historical data to compile a map pertaining to the 1942 flood event, this event having an average recurrence interval of between 1 in 40 and 1 in 50 years. Considerable inconsistencies existed with the 1942 data and hence Council instigated a consultancy to define a 50 year ARI flood event using computer modelling. Considerable public resistance has resulted from the public notification pertaining to the new proposed 50 year ARI flood map. Whilst the impact of the new flood heights varies across the city, in general terms, approximately 300 to 400 mm extra flood depth is added and numerous extra properties are inundated as compared to Council's previously used 1942 data.

Council is aware that generally State Government Policy is that a 100 year ARI event be used for flood as the defined flood event. However, Council is seeking a balance between community expectations and risk. It is considered that because of the considerable time delay, measured in number of days, between a rainfall event and the resultant flood impacting on the City of Bundaberg a defined flood event of less than 100 year ARI is appropriate to the City. Hence Council proposed a 50 year ARI flood.

However, community perception from those most affected considers that such a flood event maybe excessive and significant pressure exists on the Council to consider the 1942 event, this event being somewhat less than a 50 year ARI flood event.

As this matter impinges significantly on Council's Draft Planning Scheme, Council seeks advice from the Department of Emergency Services as to what that Department considers is the minimum ARI flood event appropriate to the City of Bundaberg given the mitigating factors detailed above.

If you wish to discuss this matter further you may wish to contact Council's Manager of Planning and Development on [redacted] or in his absence the Chief Executive Officer, [redacted]

Any assistance you can give would be gratefully appreciated.

Yours faithfully

[redacted]
Chief Executive Officer

From: [redacted]
To:
Date: 12/13/02 3:16pm
Subject: Re: Bundaberg City advice

[redacted]
I could not have said it better!
I would add that the counter disaster plan should be visited to ensure that it reflects the additional properties that may be flooded above the 1:42 (or whatever their past design flood was) and the new 1:50 flood. It should also reflect the additional number of properties up to the 1:100 flood event (local draingae design flood level).
Regards
Ken
----- Original Message -----
From: [redacted]
To: [redacted]NDALL@emergency.qld.gov.au>
Sent: Thursday, December 12, 2002 12:05 PM
Subject: Bundaberg City advice

Hi [redacted]

I have a better look at the letter from Bundaberg City regarding their flood levels.

Given the reasons outlined in the letter, in particular, the considerable time delay for a rainfall event and resultant flood to impact on the City, and the expections of the community, the Department considers the 1:50 year ARI flood is appropriate for Bundaberg City Council to adopt for the Burnett River.

The Department also considers the planning scheme including the Q100 ARI local event for localised rainfall flooding, as appropriate for the Bundaberg City area.

Regards

[redacted]

AGENDA

Government Advisory Committee
State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment

9.30 – 12.30 Thursday 2 August

Department of Emergency Services Main Building on the corner of Park and Kedron Park Roads in the Liaison Room, level 2 Block E

Item number	Issue	Person	Information (I) Decision (D)
1	Welcome	[redacted]	I
2	Background on the development of the Discussion Paper		I
3	Outcomes of the focus workshop on 5 July		I
4	Content of the Discussion Paper		I
5	Feedback from GAC members on content of Discussion Paper		I
6	Next steps		I
7	Staff / Management Arrangements		I
8	Next meeting –purpose		I
9	Close		

STATE PLANNING POLICY – LAND USE PLANNING FOR NATURAL DISASTER MITIGATION AND DEVELOPMENT ASSESSMENT

Discussion Paper

For:
DEPARTMENT OF EMERGENCY SERVICES

July 2001
8010165RP1 Draft 27 7 01

Report No: 8010165RP1/ DRAFT 27 7 01

Approved by:	[redacted]
Position:	Project Director
Signed:	
Date:	*28 July, 2001*

Environmental Resources Management Australia Pty Ltd Quality System

TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS

Page No.

ENVIRONMENTAL RESOURCES MANAGEMENT AUSTRALIA
8010165RP1/ DRAFT 27 7 01/DRAFT 1/28 JULY 2001

GLOSSARY OF ACRONYMS

- AGSO - Australian Geological Survey Organisation
- BoM - Bureau of Meteorology
- DATSIP - Department of Aboriginal and Torres Strait Islander Policy
- DEET - Department of Employment, Education and Training
- DES - Department of Emergency Services
- DLGP - Department of Local Government and Planning
- DMR - Department of Main Roads
- DNRM - Department of Natural Resources and Mines
- DOFA - Federal Department of Finance and Administration
- DSD - Department of State Development
- DTRS – Federal Department of Transport and Regional Services
- EMA - Emergency Management Australia
- EPA - Environmental Protection Agency
- IPA – Integrated Planning Act 1997
- LGCDCs - Local Government Counter Disaster Committees
- LGCDPs - Local Government Counter Disaster Plans
- NDRA - Natural Disaster Relief Arrangements
- NDRMSP - Natural Disaster Risk Management Studies Program
- PPRR – Prevention, Preparation, Response, Recovery
- QH - Queensland Housing
- QR - Queensland Rail
- QT - Queensland Transport
- RFMP - Regional Flood Mitigation Program
- SCDO - State Counter Disaster Organisation
- SCDO Act - State Counter-Disaster Organisation Act 1975
- SDCG - State Disaster Coordination Group
- SDMC - State Disaster Mitigation Committee
- SES – State Emergency Service

Chapter 1

INTRODUCTION

This Chapter introduces the Discussion Paper and its purpose.

1.1 INTRODUCTION

Natural disasters affect every State and Territory in Australia and directly affect the everyday lives of residents in communities vulnerable to those hazards. In the past 25 years, Australia has experienced a major disaster on average every four years. These have included Cyclone Tracy, Ash Wednesday Bushfires, Newcastle Earthquake, Thredbo Landslide and major flooding around Brisbane, Nyngan, Charleville, Katherine and Benalla. There are other significant disasters which occur throughout Australia on an annual basis. These are conservatively estimated to have cost $1.14 billion per year between 1967 and 1999.

Although plans for responding to and recovering from natural disasters are usually well developed, measures for the prevention, forward planning and mitigation of impacts are generally less well developed. Land use planning and planning standards can make a significant contribution to minimising or reducing risks to the community and the natural environment from these types of events.

This Discussion Paper investigates the possibility of developing a State Planning Policy – Land Use Planning for Natural Disaster Mitigation and Development Assessment. The policy would be used to guide development in advance of a disaster, thus aiming at decreasing or eliminating its impacts on society, infrastructure, the economy and the environment.

1.2 PURPOSE AND SCOPE OF DISCUSSION PAPER

The purpose of this Discussion Paper is to provide a catalyst during the first round of public consultation, to identify the interests of the various stakeholders and provide input to facilitate the drafting of a State Planning Policy – Land Use Planning for Natural Disaster Mitigation and Development Assessment. This may ultimately include supporting guidelines, State Planning Codes and explanatory notes which are acceptable to the Queensland Government, Local Government and other identified stakeholders.

There are six natural hazards of importance to Queensland being considered for inclusion in the State Planning Policy.

- **Cyclones** are giant whirlwinds of air and dense cloud spiralling at over 120 km/hr around a central 'eye' of extreme low pressure. Cyclones often cause severe damage due to the high speed winds and consequential impacts such as storm surge and flooding. Storm surge will be dealt with in the State Coastal Management Plan and that plan will be called up by this proposed State Planning Policy.
- **Flooding** is the inundation of land by expanses of water, where the land is normally dry. It may result from prolonged or very heavy rainfall, severe thunderstorms, monsoonal rains in the tropics, or tropical cyclone.
- **Landslides** are the downslope movement of a soil or rock mass as a result of shear failure at the boundaries of the mass. These slips can include land occupied by development, or the slips may damage key infrastructure such as roads.
- **Bushfires** are the uncontrolled burning of forest or wooded areas, usually occurring over vast expanses of land on multiple fronts and as the result of dry and hot weather conditions.
- **Severe storms** develop when dense, cold air overlies less dense, warm, moist air. They are triggered by solar heat, a front or a trough.
- **Earthquakes** are a shaking or trembling of the Earth's crust caused by the release of huge stresses due to underground volcanic forces, the breaking of rock between the surface, or by a sudden movement along an existing fault line.

In considering natural hazards within Queensland, this Discussion Paper has addressed the following questions:

- What are natural hazards and how are they to be identified and defined?
- Who is involved in planning for natural hazards mitigation and management within Queensland? What are and should be their roles?
- Are there basic principles which should be the foundation of a State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment?
- How can urban development and disaster mitigation and management be made more compatible?
- What should be the future for land use planning for disaster management and mitigation within Queensland and what options are available?

- What land use planning and development assessment measures could be taken to ensure that future urban development is undertaken in a manner that minimises the potential for disastrous impacts from natural hazards?

This Discussion Paper considers these matters at a broad level. The 'Planning' associated with a State Planning Policy used in the context of this Discussion Paper refers to 'land use' or 'town planning' matters. Whilst it is acknowledged that planning for natural hazards management includes disaster management programs and committees and disaster response preparation and planning, these aspects of natural hazards management cannot be dealt with by a State Planning Policy, because they do not involve land use planning. These issues are dealt with in other established ways.

This Discussion Paper builds on the views and knowledge of authorities and groups responsible for natural hazard planning and/or response. A preliminary targeted consultation workshop to identify land use planning issues was held prior to drafting this Discussion Paper. A list of authorities and groups represented at this workshop and/or consulted is included in *Chapter 8*.

Stakeholders are encouraged to make a written submission on this Discussion Paper as outlined within *Chapter 7*.

Chapter 2

NATURAL HAZARDS

This Chapter outlines the nature of natural hazards in a Queensland context.

2.1 NATURAL HAZARDS

Natural hazards are meteorological or geological phenomena that have the potential to negatively impact on communities and the environment. Natural hazard events can create disaster situations for communities and the environment. Even relatively minor impacts of natural hazards can become significant over time and in terms of the ongoing economic, social and environmental costs. The cumulative impacts of natural hazards are magnified if these events repeatedly affect the same areas.

There are direct and indirect costs associated with natural hazards and natural disasters. These costs include:

- loss of life;
- physical suffering;
- emotional suffering;
- damage to property;
- reduced productivity;
- degraded environment;
- loss of species and habitats;
- damaged infrastructure;
- weakened economy;
- loss of employment;
- increased costs of insurance; and
- reduced quality of life.

2.2 SIGNIFICANCE OF NATURAL HAZARDS

Each year natural hazards have the potential to affect the State's economy, the social wellbeing of Queensland residents, and to cause significant loss of life and disruption as a result of damage to property, the environment and infrastructure. It is estimated that, for every dollar spent on natural disaster mitigation, at least two to three dollars are saved in response and recovery costs.

Nationally, the average annual cost of disasters has been estimated to be $1.14 billion with the total cost of most disasters being between ten and fifty million dollars. The Federal Government, under the Natural Disaster Relief Arrangements, provides funding assistance to States, Territories and Local Governments to alleviate the financial burden by providing natural disaster relief payments and infrastructure restoration. In 1999/2000 National Disaster Relief Arrangements funding for Queensland was $102.3 million. These figures do not represent the total cost of disasters. Funds under the Natural Disaster Relief Arrangements only partly reimburse States, Territories and Local Governments. For example, in 1999/2000 the funding for Queensland was $102.3 million while the actual cost of natural disasters to public infrastructure restoration costs alone was $150 million. These figures exclude the costs of personal financial hardship, environmental damage, insurance payouts and other costs borne by individuals. These excluded costs are estimated to be three to four times the infrastructure restoration costs. There are also social and human costs: deaths, injuries, social disruption, shattered lives and mental anguish.

Financially and socially it is in everyone's best interests to mitigate natural disasters. Clearly, it is in the State's interest to manage the risks to provide for safer communities and minimise financial, social, cultural and environmental costs.

While natural phenomena such as cyclones, severe rain and earthquakes cannot be prevented, it is increasingly clear that disaster losses – rather than stemming from unexpected and uncontrollable events – are the predictable result of the interactions between three major systems. These systems are:

- the natural physical environment, including natural hazards;
- the social and demographic characteristics of communities experiencing disasters; and
- the constructed environment, including buildings, roads and bridges.

More and more, effects of disasters are the result of human action or inaction. Settlement patterns have changed, resulting in significant populations locating in areas subject to potential hazards such as low-lying land prone to flooding, coastal areas exposed to cyclones and storm surge, and fire hazardous areas.

2.3 NATURAL HAZARDS

By disaster type, the most costly natural disasters for Queensland between 1967 and 1999 were floods (46.7% of costs), cyclones (37.6%), severe storms (15.6%) and bushfires (0.2%).

The following sections describe each of the natural hazards listed in *Chapter 1* in more detail.

2.4 CYCLONES AND STORM SURGE

Tropical cyclones (also known as hurricanes in North America and typhoons in Asia) are like giant whirlwinds of air and dense cloud spiralling at over 120 km/hr around a central 'eye' of extreme low pressure. The cyclone season is usually from December to April and affects all of the Queensland Coast, with the greatest threat north of the Tropic of Capricorn. Cyclones occur frequently in the Southern Hemisphere with an average of 10 cyclones per year.

Cyclones often produce winds in excess of 200km/h which can cause extensive damage to property and turn debris into dangerous missiles. They can also bring flood rains, which cause further damage to property and can cause huge seas, putting vessels in danger both in harbour and out at sea.

Cyclones are often accompanied by storm surges. A storm surge is a raised dome of seawater typically 60km to 80km across and 2 metres to 5 metres above the normal sea level. As a cyclone reaches the coast the huge winds whip up the sea and push the dome of water over low-lying coastal areas. A storm surge is not the same as a tidal wave, which is a towering wall of seawater that comes crashing into shore. A storm surge comes in like a rapidly rising tide except it can be extremely dangerous and destructive. Storm surges are most dangerous when accompanied by a high tide because they raise the sealevel up to five metres and can cause significant damage to infrastructure, buildings, human life and the environment. When a storm surge occurs at high tide it is known as a storm tide.

2.5 FLOODING

Floods occur when water covers land which is normally dry. They may result from prolonged or very heavy rainfall, severe thunderstorms, monsoonal (wet season) rains in the tropics, or tropical cyclones. People who live near rivers or in low-lying coastal areas live with the greatest threat of floods.

The 1974 Brisbane Flood was triggered by the weakening Cyclone Wanda which crossed the Queensland coast on 24 January some 150 kilometres north of Brisbane. The cyclone only caused minor wind damage but added heavy rainfall to an already saturated river catchment. It also triggered the monsoonal air mass over southern Queensland into periods of intense rain over a five day period. Among the highest recordings were 1,318 mm (almost 60 inches), whilst in Brisbane itself 819 mm of

rain fell, producing the worst city flooding in Australian history. Sixteen people died and three hundred were injured. Eight thousand people were made homeless. Fifty-six homes were swept away and 1,600 homes were largely submerged. Thirteen thousand buildings were affected.

Common types of flooding in Australia include the following.

Slow-onset floods - Flooding of rivers in the vast flat areas of Queensland may last for one or more weeks. Floods in these areas can lead to major losses of livestock and damage to crops as well as extensive damage to towns.

Rapid- onset floods - These floods are generally much more damaging and can pose a greater risk of loss of life and property. This is because there is generally much less time to take preventative action, and the flow of water is more dangerous.

Flash floods- Flash flooding results from relatively short, intense bursts of rainfall, often from thunderstorms. It can occur in almost all parts of Australia, poses the greatest threat of loss of life and can result in significant property damage and social disruption.

2.6 LANDSLIDES

A landslide (or landslip) is a downslope movement of a soil or rock mass as a result of shear failure at the boundaries of the mass. The dominant movement is lateral and failure takes place over a relatively short period of time. The displaced material mass can be large or small and may move an extensive distance at considerable velocity. Soil creep, which is slow and occurs without a well defined failure surface, is not classified as a landslide.

Landslide movement occurs in three main forms:

- by sliding along a failure surface;
- by falling down a steep slope; and
- by flowing as suspended mass, usually in water, for example mudslide or debris flow.

The stability of sloping ground is controlled by three main factors: the angle of the ground surface, the strength of the materials below the ground surface and the level of water within the slope. The potential that a landslide may be present or may occur requires consideration of the factors that contribute to landsliding, which involves a geotechnical assessment of site conditions. This geotechnical study

should provide an evaluation of the level of site hazards in relation to landsliding and in particular classify those into a hazard rating.

The classification of landslide hazards can be used in the planning of proposed development, the design of proposed development, the reduction of the likelihood of landsliding in existing development and the design of landslide remedial works.

2.7 BUSHFIRES

Fire is an integral component of the environment of Queensland. Bushfires have taken a terrible toll throughout Australia and it has been a common misconception that there is often little that can be done to contain the risk and to minimise damage. Bushfire prone areas are areas that can support a bushfire or are likely to be subject to bushfire attack.

For a fire to start and to continue burning, three things (in balance) are necessary: there must be fuel available to burn, sufficient heat to cause and maintain ignition and sufficient oxygen to sustain combustion. All fire fighting methods aim at breaking the fire triangle in one way or another and basically involve removing fuel from the path of the fire, cooling the fuel below ignition temperature or covering the fuel to cut it off from the oxygen supply. Passive protection measures incorporating siting, layout design and construction of buildings and landscaping are the most reliable and effective ways of reducing the impact and damage of bushfires.

2.8 SEVERE STORMS

Severe storms are the most frequently occurring hazard in Australia, particularly Queensland. Severe thunderstorms develop when dense, cold air overlies less dense, warm, moist air. They are triggered by solar heat, a front or a trough. Most severe storms in Queensland occur between the months of September and March, and can be divided into two categories - severe thunderstorms and land gales. Severe storms can occur anywhere in Australia and cause more damage than any other natural hazard. Severe storms normally occur in localised areas and don't usually affect large areas as do cyclones or floods.

In 1996, of the 23 natural disasters in Australia, each with total estimated costs of $5 million or more, 15 were severe storms, accounting for $772 million of the total $1,258 million. In Brisbane on 18 January 1985, a severe hailstorm and tornado passed over Brisbane breaking thousands of windows, damaging many cars and tearing off many roofs. In just 30 minutes it caused insured losses of $299 million and a total estimated cost of $385 million.

Severe thunderstorms occur when strong rising currents of air develop and heat energy stored in the air and water vapour is converted into electrical energy. When the atmosphere is particularly unstable and the wind flow provides an efficient input of energy to a growing cloud, a severe thunderstorm develops with accompanying updrafts and downdrafts. The Bureau of Meteorology defines severe thunderstorms as those which produce hailstones with a diameter of 2 centimetres or more, wind gusts of 90 km/hr or more, flash floods and/or tornadoes.

Most thunderstorms are not severe enough to produce these phenomena, but they all produce lightning.

Heavy rain occurs when intense updrafts produce raindrops through condensation of moist air. As raindrops become too large to be supported they fall, producing heavy rain which can exceed 200 mm per hour, causing flash floods.

Hail forms in a thunderstorm when raindrops freeze at high levels and are then recycled through up and down drafts, growing all the time. Hailstones larger than cricket balls have been observed in Australia. Such large, jagged ice hazards can inflict serious damage or even fatal injury.

Lightning and thunder: Lightning is the discharge produced when differences in ground and atmospheric electrical charges are large enough (several hundred-million volts) to overcome the insulating effect of air. An average thunderstorm can release several hundred megawatts of electrical power. Lightning strokes may occur within a cloud, between clouds, or between the cloud and the ground. Statistically, lightning poses a greater threat to individuals than most other natural hazards. On average lightning causes 5 to 10 deaths and over 100 injuries in Australia each year.

Land gales are gale force winds over land with a speed of 62 km/hr or more. They are caused when large differences in atmospheric pressure are concentrated over a small distance. This can occur between a low pressure system and strong high pressure systems, or near intense cold fronts.

2.9 EARTHQUAKES

Earthquakes are a shaking or trembling of the Earth's crust caused by the release of huge stresses due to underground volcanic forces, the breaking of rock between the surface, or by a sudden movement along an existing fault line. Earthquakes are unpredictable and strike without warning. They range in strength from slight tremors to great shocks lasting from a few seconds to a few minutes.

In the last 80 years there have been 17 earthquakes in Australia registering 6 or more on the Richter Scale. Australia's rate of earthquakes is about 1 every 5 five years,

compared to a world average of about 140 per year. At 10:27am on 28 December 1989, Newcastle was partially devastated by a moderate earthquake measuring 5.6 on the Richter Scale. Newcastle was the first 'lethal' earthquake in Australia claiming 13 lives and injuring 150 others. It caused extensive damage to about 35,000 homes and 3,000 buildings with 70,000 buildings in the region suffering some form of damage. Insured losses reached $1,124 million while the estimated total damage to Newcastle was $4,480 million.

The Newcastle experience showed that a lethal earthquake can occur in parts of Australia considered to be of low seismic risk. It has resulted in improved building codes and practices, and closer monitoring of seismic activity. Since 1994, all buildings in Australia (including homes) are now required to be constructed to resist earthquakes. In addition electricity and telephone lines, gas, sewer and water mains can be damaged; landslides, faults, subsidence and even tsunamis can be caused.

Chapter 3

PLANNING FOR NATURAL DISASTER MITIGATION - ROLES AND RESPONSIBILITIES

The key stakeholder groups in relation to Natural Disaster Mitigation and Development Assessment in Queensland include:

- **Local Governments, including Aboriginal and Torres Strait Islander Community Councils;**
- **State Government Departments and Agencies;**
- **Federal Government Departments and Agencies** such as Department of Transport and Regional Services (DTRS), Department of Finance and Administration (DOFA), Emergency Management Australia (EMA), Bureau of Meteorology (BoM), and Australian Geological Survey Organisation (AGSO);
- **Educational and Research Institutions** such as University of Queensland, Queensland University of Technology, Griffith University, James Cook University and Centre for Disaster Studies;
- **Property Owners and Peak Bodies** such as business, residents, community associations Insurance Council of Australia, Property Council of Australia, Urban Development Institute of Australia, Queensland Tourism Industry Corporation, Royal Australian Planning Institute, Local Government Association of Queensland, Chambers of Commerce, Standards Australia and Building Codes Authority; Conservation Council and the Queensland Council of Social Services.

3.1 ROLE OF STAKEHOLDER GROUPS

Each stakeholder group has a range of roles in natural hazard management and planning.

3.1.1 Local Government

Local Government has the primary responsibility under the *Integrated Planning Act 1997* for land use planning and would have a primary role in implementing the proposed State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment. Specific responsibilities with which Local Government is charged under IPA include the preparation of IPA-compliant

planning schemes and assessment of development applications. Additionally, every Local Government is to ensure that arrangements are in place to deal with any disaster event that is considered likely to impact upon its area of responsibility.

i. Responsibilities

Local Governments are responsible for a number of key land use planning tasks in relation to natural hazards. These include:

- drafting and implementation of planning scheme provisions;
- development assessment; and
- disaster risk assessment as an input into the development of planning scheme and development assessment requirements.

ii. Planning Schemes and Strategic Planning

The *Integrated Planning Act 1997* (IPA) requires all Queensland Local Governments to prepare planning schemes in accordance with IPA by 2003.

Strategic planning at a land use planning level generally occurs as part of the review of planning schemes. Strategic planning provides a significant opportunity for Local Governments to designate land that is and is not appropriate for development for specific land uses. During these phases, Local Governments carefully consider the land development options for land and designate land for appropriate use based on demand and land suitability (including assessing risks for natural hazards). It is at this stage that development standards are formulated to apply across the Local Government Area.

iii. Development Assessment

IPA delegates the responsibility of assessing development applications to Local Government. It is through this development application and assessment process that the greatest site-specific opportunities exist for the control and prevention of inappropriate land use planning in relation to natural hazards management.

iv. Disaster Risk Assessment and Development of Mitigation Strategies

It is a responsibility of Local Governments to assess disaster risk and develop and implement appropriate disaster mitigation strategies for their Local Government area. Risk assessment and hazard mapping is often best done by two or more Local

Governments in combination especially when natural features such as rivers flow through adjoining Local Governments.

Department of Emergency Services (DES) has developed guidelines to assist Local Governments in the undertaking of Disaster Risk Management. DES recommends that Local Governments apply the Australian and New Zealand Standard AS/NZS 4360 to assess disaster risk within their Local Government Area. This can provides a basis for addressing natural hazards within planning schemes and development conditions.

The responsibility for hazard mapping lies primarily with Local Governments and Aboriginal and Torres Strait Islander Community Councils. Hazard mapping is an essential step in assessing disaster risk in a community and determining where land use planning can be used as a mechanism for reducing risk. Without accurate information on hazard and risk, effective land use planning cannot be undertaken.

A number of Local Governments have undertaken hazard mapping, particularly for flood. Less prevalent is hazard mapping for other hazards, such as storm surge, earthquake, landslip and bushfire. The Natural Disaster Risk Management Studies Program (NDRMSP) provides funding for hazard mapping and risk assessment and is proving a major impetus for risk assessment (including hazard mapping) for Local Governments in Queensland. Some hazard mapping and other related information is available through AGSO, the Department of Natural Resources and Mines (DNRM) and the Rural Fires Division of the Queensland Fire and Rescue Authority.

3.1.2 *State Government*

IPA provides a framework for the development of State Planning Policies to address matters of State interest. State Government has a number of significant roles in the planning, prevention, mitigation of and response to natural hazards and disasters. These include legislative abilities such as those associated with State Planning Policies as well as administrative and control functions through official organisations and committees. The role of the State Government and its agencies is outlined below.

Land use planning related tasks and roles in relation to natural hazards include:

- Policy formulation;
- Program funding;
- Disaster mitigation activities through the State Disaster Mitigation Committee; and
- Specific Departmental planning roles and functions.

i. Policy Formulation

State Government departments and agencies are responsible under IPA for ensuring the protection and management of State assets and the provision of policy direction and comment on matters of State interest. Departments and agencies are required to draft policies and legislation that address these issues and undertake investigations that feed into State Planning Policies as well as legislation and planning schemes.

ii. Program funding

The State Government in its role as primary controller of State funding has the opportunity to further develop specific aspects and issues of State interest, by increasing or decreasing funding for that issue. Sometimes funding is jointly provided by the Federal Government and the relevant Local Government. The State Government also provides funding to facilitate education programs associated with the introduction and implementation of State Planning Policies.

a. Natural Disaster Risk Management Studies Program (NDRMSP)

The NDRMSP was introduced by the Federal Government in 1999-2000, with the support of State Governments. This Program offers significant funding support to Local Governments, Aboriginal and Torres Strait Islander Community Councils and River Improvement Trusts to undertake hazard mapping, risk assessments and technical studies relating to all the hazards identified in this paper. The Federal and State Governments each provide a third of the necessary project funding to successful applicants, who are also required to provide a third of the resources.

The Department of Emergency Services (DES) actively promotes and administers the NDRMSP in Queensland. The NDRMSP has been well received by Queensland Local Governments, which have attracted about 60% of Federal Government annual funding nationally to date. 89 projects have successfully applied for funding so far (July 2001), with the value of the projects totalling $7.5 million.

b. Regional Flood Mitigation Program (RFMP)

The Federal Government provides funding for flood mitigation works, warning systems and land resumptions. The Federal and State each provide one third of project funds, with the applicant (usually Local Government) providing the remaining third. While this program mostly funds mitigation capital works, it can also fund resumptions of flood prone land and is therefore supportive of appropriate land use planning.

c. Local Government Mitigation Plans

DES promotes all Local Governments developing Mitigation Plans by March 2003. Financial incentives are in place to encourage lower rate base Local Governments to undertake mitigation plan development.

d. Local Governing Bodies Capital Works Subsidy Scheme and Transport Infrastructure Development Scheme

Consultation is underway with the Local Government Association of Queensland and Local Governments to tie receipt of funding from these schemes to disaster risk management. The intention is to encourage Local Governments to mainstream natural disaster risk management principles into everyday capital works and infrastructure development.

iii. Disaster Mitigation Activities

a. The State Counter Disaster Organisation

The State Counter Disaster Organisation Act 1975 establishes the State Counter Disaster Organisation, which is the peak counter-disaster policy and planning advisory group in Queensland. The role of the SCDO is to:

- coordinate the resources necessary to ensure that all steps are taken to plan for and counter the effects of a disaster; and
- give advice and assistance to the Minister for Emergency Services on all matters with respect to counter disaster.

The DES, on behalf of the SCDO, develops the disaster management policy for Queensland.

b. The State Disaster Mitigation Committee

The State Disaster Mitigation Committee (SDMC) was established in 1999 by the Queensland Government pursuant to the provisions of PART 2 of the *SCDO Act* to provide advice to the Minister for Emergency Services. It comprises representatives from 10 State Government Departments, the Local Government Association of Queensland and two Local Governments and is chaired by the Director-General, Department of Emergency Services. The role of the SDMC is to advance disaster mitigation practices in Queensland. Mitigation through effective land use planning has been one of several key issues of interest to and promoted by the SDMC.

iv. Department and Agency Activities

a. Department of Emergency Services

The *State Counter-Disaster Organisation Act 1975 (SCDO Act)* is the primary legislation dealing with disasters in Queensland. The Act is administered by the Minister for Emergency Services. The Act establishes the State Counter-Disaster Organisation, the functions of which are to co-ordinate the resources necessary to ensure that all steps are taken to plan for and counter the effects of a disaster, and to give advice and assistance to the Minister with respect to counter disaster.

DES provides funding to Local Governments for the NDRMSP as well as incentives for Local Government Mitigation Plans. In addition, DES has undertaken a State-wide Local Government Education and Awareness Program and developed publications to educate Local Governments in the disaster risk management process and mitigation plan development. Land use planning is an integral aspect of these processes. DES reviews Local Government planning schemes for effective inclusion of natural disaster mitigation measures.

b. Department of Natural Resources and Mines

The Department of Natural Resources and Mines (DNRM) administers the Regional Flood Mitigation Program (RFMP) in Queensland. In addition, DNRM has the prime responsibility for management of rivers and dams and is currently preparing a draft flood plain policy. Response plans for dam break are overseen by DNRM in consultation with DES. DNRM is a member of the SDMC.

c. Environmental Protection Agency

The Environmental Protection Agency (EPA) is a member of the SDMC. The *Coastal Protection and Management Act 1995* provides the EPA with jurisdiction over coastal areas of Queensland. The draft State Coastal Management Plan, which will have the effect of a State Planning Policy, has implications for land use in coastal areas. It is likely that the issues of land use in storm tide areas will be dealt with through the Coastal Management Plan, and reference to this document would be made in the proposed State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment.

d. The Department of Local Government and Planning and the Department of Main Roads

Both the Department of Local Government and Planning (DLGP) and the Department of Main Roads (DMR) are members of the SDMC, and are developing initiatives to incorporate mitigation criteria in their respective Departmental funding

What about State Infrastructure → roads rail hospitals schools

programs which support Local Government infrastructure development. This is described under Program Funding above.

The DLGP is responsible for the review and implementation of State Planning Policies and as such plays an important role in the implementation and success of any future State Planning Policy Land Use Planning for Natural Disaster Mitigation and Development Assessment.

e. Department of Public Works

This Department of Public Works (DPW) is a SDMC member. DPW is cognisant of land use planning and design considerations in public buildings such as hospitals, schools and emergency services buildings and efforts are being made to develop departmental policy guidelines regarding these issues.

f. Department of State Development

The Department of State Development (DSD) has incorporated considerations of disaster resilience of infrastructure, including land use planning, in its State Infrastructure Plan. DSD is a SDMC member agency.

3.1.3 Federal Government

The Federal Government is interested in the broader protection and management of natural hazards. The potential impacts of natural hazards on national assets such as heritage protected reserves and significant ecosystems, as well as the Australian community, have broad implications for this tier of government.

The Commonwealth Government actively promotes disaster mitigation through several agencies including:

- Emergency Management Australia (EMA);
- The Department of Transport and Regional Services (DTRS);
- The Department of Finance and Administration (DOFA);
- The Australian Geological Survey Organisation (AGSO); and
- Bureau of Meteorology (BoM).

i. Emergency Management Australia

EMA has been influential in providing an increased focus on disaster mitigation in the last 5-10 years. It has developed guidelines on disaster risk management and provided training on these techniques. EMA has been active in information

exchange and advocacy of disaster mitigation through the Mitigation Working Party, comprising Commonwealth, State and Territory Governments and industry representatives (Royal Australian Planning Institute (RAPI), Master Builders Association and the Insurance Council of Australia.) EMA provides ongoing research support on mitigation matters and has worked with RAPI to develop draft Land Use Planning Guidelines for disaster mitigation.

ii. The Department of Transport and Regional Services

DTRS administers the Regional Flood Mitigation Program (RFMP) for the Commonwealth Government. From time to time DTRS administers ad hoc disaster relief funds in response to significant regional disasters.

iii. The Department of Finance and Administration

DOFA administers the Natural Disaster Relief Arrangements (NDRA) for the Commonwealth Government. The NDRA is a long established joint funding arrangement between the Commonwealth and State Government to provide "safety net" funding relief to disaster affected individuals, Local Governments, primary producers and small businesses. Since July 1998, the Commonwealth Terms and Conditions administering NDRA has made the continued receipt of disaster relief funds by Local Governments for likely and recurrent natural disasters conditional on evidence of mitigation.

DOFA also administers the Natural Disaster Risk Management Studies Program (NDRMSP) for the Commonwealth Government.

iv. The Australian Geological Survey Organisation

AGSO has demonstrated an increasing interest in disaster risk assessment techniques in the past several years, particularly within the Cities Project. AGSO personnel has expertise in a large range of geohazards, including earthquake, landslip and also has significant geographic information systems and risk management skills and experience. Cities Project studies undertaken in Queensland include those in Cairns, Gladstone, Mackay and South East Queensland. These have provided some excellent hazard mapping and risk assessments which are available to Local Governments.

v. Bureau of Meteorology

BoM has a primary role of weather forecasting. It contains significant expertise in flood warnings and hydrology, storms, cyclones and storm surge. Representatives from BoM provide expert input into disaster studies and have led major studies, on topics such as Vulnerability of Queensland Coastal Communities to Storm Surge Impact under Greenhouse Conditions. These studies are very relevant to future land use planning.

3.1.4 *Educational and Research Institutions*

These include Tertiary institutions that educate professionals in town planning, land use management, climatology and disaster mitigation. Research can assist in understanding more about disaster mitigation.

3.1.5 *Property Industry and Owners*

These include:

- **Local communities** –have an intimate knowledge of their local area and its environmental conditions, and many residents have directly experienced the impacts of natural disasters. As a result, community concerns have escalated about development that conflicts with community safety. Local communities are critical in the implementation of key policies and programs to minimise any potential impacts as a result of natural hazards;
- **Property developers** - have an interest in planning and development regulations that provide clarity, certainty, and a range of options to achieve a desired outcome to avert disasters or minimise their impacts;
- **Property owners** - have an interest in knowing what hazards may impact on their property. They also have an interest in knowing that new developments or infrastructure will not place their property at risk;
- **Insurance industry** - has an interest in linking commercial risk with hazard risk. When these links are made, the industry can assess the financial viability of potential insurance products and calculate premiums for these products. The industry will be interested in the implementation of planning measures that will reduce the hazard risk of properties that they are insuring;
- **Professional and peak bodies** - Professional organisations represent key stakeholders such as town planners, engineers, property developers and managers. These groups often develop policies and advice for their members. RAPI has prepared a land use planning guidelines on natural hazards in conjunction with EMA. It may be possible for other authorities to assist in research and policy directives;

- **Tourism Bodies**- These bodies and Councils are responsible for the overall tourism directions and industry as a whole. The tourism industry is often one of the most heavily affected by natural disasters and also one of the most risk prone activities, due to the location of the tourism in what is often high risk areas. These groups and Councils can make comments and recommendations on policies and controls that will influence the tourism industry as a whole;

- **Conservation groups** - Natural disasters and town planning affect the natural and built environment. Conservation and environmental groups have an interest in the effects of mitigating natural disasters.

Chapter 4

RISK REDUCTION AND LAND USE PLANNING

This chapter considers the Queensland planning context and the potential link between land use planning and natural hazard mitigation.

4.1 INTRODUCTION

Land use planning and planning standards can make a significant contribution to minimising or reducing risk to the community and to the natural environment from natural hazards. Emergency Management Australia (EMA) has developed a document entitled "Planning Safer Communities - Land Use Planning for Natural Hazards". That document considers the significance of land use planning in reducing risk to both the community and the natural environment. This chapter draws upon key findings from the EMA document in describing the role of land use planning in natural hazard management.

4.2 LAND USE PLANNING AND NATURAL HAZARDS

The impact of natural hazards is dependent upon the interaction of three systems:

- *Physical systems:* geophysical and climatic conditions at the local, regional, national and international levels along with the overall health of the environment;
- *Social systems:* socio-demographic characteristics, such as income, age, mobility and education, of communities impacted by natural hazards; and
- *Built systems:* quantity, quality and location of buildings and infrastructure, including roads, bridges and communication networks.

The risk of increased impacts as a result of natural hazards is increasing because of changes in the interaction between communities, hazards and the environment. Global warming may be increasing the frequency and severity of certain natural hazards such as bushfires, cyclones and storm surges in many areas. At the same time, regional and local changes to the environment have decreased the ability of natural systems and communities to cope with the impacts of those hazards.

The increasing desire for people to live in established urban areas is seeing increased demand for urban land, and associated shortages in the stocks of suitable land. This has resulted in increased pressure on urban settlement patterns, with many people moving to areas more potentially hazardous. This includes associated interference with natural processes and landforms, such as the draining of swamps that serve as natural flood retention basins, and the removal of vegetation to facilitate development and rural activities.

Changes in the socio-economic makeup of communities have also increased the risk of natural hazards. There has been an increase in the inequality of wealth, particularly between regions, which has made certain populations more vulnerable to losses from natural hazards, particularly economically disadvantaged communities who cannot afford adequate risk reduction measures.

Land use planning can play a key part in reducing current and future community risk by identifying in advance the areas with increased risk and ensuring that new development does not occur or occurs in a controlled manner within those areas. It requires the balancing of many competing interests: private sector needs, public policy requirements, equity, long-term economic development, environmental conservation, amenity, community safety and well-being. It also requires careful community planning, education and considered environmental and resource management strategies.

4.3 CURRENT PLANNING CONTEXT

In Queensland, Local Governments plan for and control development through planning schemes prepared under the *Integrated Planning Act 1997* (IPA). Most existing planning schemes include little guidance or control in relation to land use planning for natural disaster mitigation and development assessment.

As part of their wider planning responsibilities, the planning control of natural hazards is the responsibility of Local Governments under IPA. There are no formal policy or guidelines providing direction or consistency across the State and this has resulted in a varied approach to natural hazards planning throughout the State. Some Local Governments have adopted quite extensive and stringent planning controls dealing with matters such as flooding, bushfires and landslips and how development may occur in areas prone to impact from those hazards. Others have few or no planning mechanisms or controls. One reason for the differences in level of planning and planning controls between Local Governments is the differences in the baseline data available for each Local Government area. Detailed information is available for some areas whilst in other no data is available. In recent years, this situation has ~~been able~~ begun to to be redressed by the provision of ongoing funding through

the Natural Disaster Risk Management Studies Program described further in *Section 3.1.2 ii.*

4.4 NATURAL HAZARD MANAGEMENT AND THE *INTEGRATED PLANNING ACT 1997*

The principal land use control and management framework for the State is the *Integrated Planning Act 1997* (IPA) which controls the forward planning and development assessment processes. IPA has created a system that provides for comprehensive and integrated assessment and decision making, whilst seeking to achieve ecological sustainability. All powers and functions under IPA must be exercised in ways that advance this purpose. For this reason, any State Planning Policy that may be developed must seek to achieve ecological sustainability which is defined as a balance that integrates protection of ecological processes and natural systems, economic development and maintenance of community well-being. Natural disaster mitigation is fundamental to ecological sustainability principles as it involves minimising negative and maximising positive economic, environmental and social outcomes for communities.

The ecological sustainability principles and associated text within IPA recognise that the Act's purpose can be advanced through State Government controls as well as Local Government Planning Schemes. The purpose of the Act includes 'coordinating and integrating planning at the local, regional and State levels' as a way of seeking to achieve ecological sustainability. This includes the drafting of supporting State Planning Policies such as that being contemplated in this Discussion Paper.

4.5 ROLE AND FUNCTION OF STATE PLANNING POLICIES

The purpose of a State Planning Policy is to provide a means by which the State can control and guide matters of State interest. State Planning Policies are statutory instruments in their own right and are enforceable upon all persons, including the State and Local Governments. State Planning policies are not subordinate legislation, but rather an integral component of IPA. They have the ability to provide direction and guidance on any number of matters of State interest, and hence are significant documents within the overall context of planning control for the State.

The purpose of the proposed State Planning Policy would be to:

- make clear the State's interest in land use planning as it relates to natural hazards;

- reduce the community's vulnerability to the impacts of natural hazards;
- encourage consistency across Queensland in land use planning for natural hazard mitigation; and
- assist Local Government decision making processes concerning development applications in areas subject to natural hazards.

A State Planning Policy cannot:

- directly resolve issues associated with established urban areas and existing development; or
- direct Local Governments to adopt specific mitigation methods.

To July 2001, four State Planning Policies covering issues of State interest have been created. These are:

- **Development and Conservation of Agricultural Land** -State Planning Policy 1/92, which sets out broad principles for the protection of good quality agricultural land from inappropriate developments;
- **Planning for Aerodromes and other Aeronautical Facilities** - State Planning Policy 2/92, which sets out broad principles for protecting airports and associated aeronautical facilities from encroachment by incompatible developments in the interests of maintaining operational integrity and community safety;
- **Conservation of Koalas in the Koala Coast** - State Planning Policy 1/97, which sets out the broad principles for the protection of koala habitat in the Koala Coast from inappropriate development.
- **Planning and Management of Coastal Development Involving Acid Sulfate Soils** -State Planning Policy 1/00, which considers that coastal development involving acid sulfate soils should be planned and managed to avoid potential adverse effects on the natural and built environment (including infrastructure), and human health.

State Planning Policies can and do cover a diverse range of issues and matters of State interest. Each policy outlines key planning control criteria that should prevent, manage or mitigate the impacts of the particular issue covered by that policy. State Planning Policies have effect throughout the State unless the policy states otherwise, such as the Koala Coast policy.

A State Planning Policy is one way to ensure that planning and development proposals consider the benefits of forward planning, to prevent and minimise the impact from natural hazards in a proactive rather than reactive manner. Matters of

State policy and criteria for assessment may also be incorporated directly within individual Local Government planning schemes, and State criteria for assessment may be incorporated within the State or local codes.

4.6 PLANNING SCHEMES AND PLANNING SCHEME CODES

It is anticipated within IPA that State Planning Policies will be appropriately reflected in the planning schemes of each Local Government within Queensland. This is consistent with the approach adopted in the Act for Local Government planning schemes, whereby they are to be the principal instruments for consolidating and expressing planning policies relating to an area.

The introduction of IPA has required that all Queensland Local Governments redraft their planning schemes into a format consistent with the desired outcomes of IPA prior to March 2003. To date, only a handful of IPA Planning Schemes are in operation throughout Queensland. Most Local Government are commencing their Planning Scheme reviews. IPA Planning Schemes are required to specifically address and to be consistent with all State planning directions and policies.

Planning Schemes can be drafted to address and ensure compliance with a State Planning Policy in a number of ways, including:

- inclusion of Strategic Policy directives as part of a Desired Environmental Outcome for the scheme;
- completion of natural hazard mapping, identifying at risk or 'prone' areas for use in development control;
- identification of land which is particularly at risk to damage from natural hazards. This would be supported by provisions directing and controlling the form and limits of development in those areas. An example would be the prevention or limiting of urban development in areas of known potential threat from bush fires;
- inclusion of area specific planning provisions preventing or making future development conditional upon specific measures such as building control measures relating to building location, design and construction. This would ensure buildings are designed to minimise the potential impacts of a natural hazard;
- creation of planning scheme codes specifically addressing natural hazards such as "Bush Fire Prone Areas Codes"; and
- inclusion of requirements for development to produce site specific plans for identified natural hazards, eg. a bush fire management plan.

5.2.2 *Comprehensive Planning*

Appropriate management of land and resources can reduce risks from natural hazards. Listed below are characteristics of a comprehensive approach to planning for natural hazards that could be addressed in a State Planning Policy.

Inclusive - Addressing as many factors that impact on natural hazard risks as possible while looking at community, environmental issues and the constructed environment.

Long term - Cumulative impacts of natural hazards can be substantial, so it is essential to look at the long term impacts of natural hazards, development patterns, planning requirements and social changes.

Flexible - Risks from natural hazards can change quickly and unexpectedly, so processes must be easily and readily adaptable to changing situations.

Multi-process - Prevention, mitigation, emergency response and monitoring are all important steps in managing risk.

Multi-sectoral - Agencies with specified focus areas need to work together as efficiently and effectively as possible in terms of sharing information and coordinating their management of natural resource risks.

Action focused - Workable strategies that have practical steps for managing the impacts of natural hazards can be developed through public consultation and input from relevant agencies.

Empowering individuals – Individuals' responses to natural hazards are shaped by their personal risk assessments, which are based on past experiences, responsibilities, resources, personal beliefs and values.

Ultimately any one of the above management techniques by itself, or a combination of techniques may be utilised in the formulation of the State Planning Policy – Land Use Planning for Natural Disaster Mitigation and Development Assessment.

5.3 PLANNING MEASURES

This section outlines the key mitigation and management measures that could be applied to natural hazards through a State Planning Policy.

5.3.1 *Land Use Planning*

Land use planning can be employed to control where and how development occurs, thereby effectively reducing the amount of development in at risk areas. By controlling the form of development in at risk areas, the potential for damage should a disaster occur can be further reduced. A State Planning Policy can limit the location of development in at risk areas through use of hazard/risk mapping. It can include provisions and controls that further regulate development in at risk areas.

5.3.2 *Management Plans*

Management plans outline the site specific characteristics and risks that specific natural hazards may impose, the most appropriate management techniques for the site, and emergency response plans to deal with specific hazards and disasters.

5.3.3 *Mitigation Infrastructure*

Increasingly, mitigation infrastructure, such as construction of dams, and mitigation measures to control flooding and stormwater run-off, is being used in established urban areas and emerging urban areas to assist in the mitigation of impacts. However, there is residual risk where design standards are exceeded by the impact of the natural hazards. A State Planning Policy can recommend approaches to the consideration of appropriate mitigation measures.

5.3.4 *Building Design*

The design and construction of buildings can increase ability to withstand natural hazards. Buildings can be designed to withstand the winds from cyclones and storms, or to withstand ground movements as a result of earthquake activity. This can be used as an effective management technique, by controlling the form of development in areas where development is to occur in at risk areas. The State Planning Policy could recommend which specific Australian Standards can or should be adopted as part of building design and construction.

5.4 NATURAL HAZARD SPECIFIC MANAGEMENT MEASURES

The following section outlines the current stakeholder issues and key planning and mitigation measures for each of the natural hazards.

5.4.1 Cyclones and Storm surge

At present, mitigation and control measures for cyclones and storm surges are more reactive and are very short term in nature and include cyclone watches and cyclone warnings. These are issued by the Bureau of Meteorology when a cyclone or developing cyclone is likely to affect coastal or inland communities. The warnings identify the communities likely to be affected, the name of the cyclone, its position, intensity, severity and movement. While these systems are growing in sophistication, opportunities were identified to improve community education and awareness in relation to timing and preparedness for cyclones.

From a land use planning perspective, it is very difficult to effectively control and reduce the risks of damage. A number of stakeholders identified key control measures that can be implemented through Building Code of Australia amendment. These related to specific building site practices for reducing building site debris and controlling the use of window shutters in high wind zone areas. These issues can only be applied in a very limited way in a land use planning context.

Stakeholders, particularly Local Government, have identified a need for risk mapping that provides reliable and realistic information not currently available on a State wide basis.

Key management and mitigation techniques relating to urban planning and development include the following.

Land use planning can limit the amount and intensity of development in areas with the greatest risk of impact from a storm surge. In addition, development should ensure non worsening of the ability of areas to drain as a result of heavy rain caused by a cyclone, thereby reducing the risk for cyclone relating flooding. *The issue of storm surge will be covered and managed through the State Coastal Management Plan and will not be included in this State Planning Policy. This State Planning Policy will refer to the State Coastal Management Plan to ensure consistency in Queensland Government policy.*

Site specific management plans can outline the site specific characteristics and risks that natural hazards may pose, the most appropriate management techniques for the site, and emergency response plans.

Building design: Specific building regulations exist requiring houses and other residential buildings in identified cyclone prone areas to be built with specific cyclone design criteria in mind. These Australian Standards could be further developed and adopted as part of any future planning policy.

5.4.2 Flooding

A range of stakeholders, including State and Local Government and the property industry, raised inconsistency in approaches to flood level development limits that are used by Local Governments. Varying flood levels are used. For example, in some areas Local Governments regulate development based on the 1 in 100 year flood level whilst others base it on different levels such as the 1 in 50 year flood level. Inconsistency issues were also raised in relation to flood modelling and that there was no standard agreed approach across Local Government. This was considered to be resulting in unnecessary costs and inefficiencies to the property industry. The accuracy and availability of flood data to make informed planning decisions to reduce Local Government legal liability and provide better protection for communities was considered fundamental to improving land use planning mitigation approaches. There was general stakeholder agreement that community understanding of the issue could be improved, specifically in relation to the issuing of warnings, as flood water rise and the risk of flooding increases. Flood warnings are classified as minor flooding, moderate flooding, major flooding, local flooding and significant river rises.

Key management and mitigation techniques relating to urban planning and development include:

Flood mitigation infrastructure: Increasing amounts of flood mitigation infrastructure around and throughout the State particularly control dams, weirs and levees. Flood mitigation infrastructure is built to a design level and there is residual risk.

Land use planning can limit the amount and intensity of development in areas with the greatest risk of impact from flooding particularly low lying and flood plain areas. This is of particular concern as the decreasing stock of land available for urban development is seeing increasing pressure on the further development of such areas. In addition, development should specifically ensure that it does not reduce the drainage and flood retention ability of an area as a result of heavy rain. There is a need for increased mapping and development of consistent planning standards.

Site specific management plans outline the site specific characteristics and risks that specific natural hazards may pose, the most appropriate management techniques for the site and emergency response plans.

Building design: Buildings can be designed to minimise the impact of flooding upon the structures should flooding occur. This includes the construction of high set housing, and if lower storey development is required, the minimisation of habitable use areas in that lower level.

5.4.3 *Landslides*

Quantitative risk assessment was considered by stakeholders to be a critical component of the land use planning response to landslides. The use of hazard ratings for evaluating landslide risk within Local Governments based on consistent criteria such as ground surface slope, sub surface profile, depth of groundwater etc was considered a necessary planning tool to be used in planning schemes by a range of stakeholders. The Gold Coast City Council *"Guidelines for Control of Slope Stability within the City of Gold Coast"* was put forward as a good best practice example.

Key management and mitigation techniques relating to urban planning and development include:

Land use controls: Through the limiting of development to areas of appropriate slope and site conditions, the risk of landslips affecting development can be reduced.

Site specific management plans: Such plans outline the site specific characteristics and risks that specific natural hazards may pose, the most appropriate management techniques for the site and emergency response plans.

Building criteria: Criteria relating to maximum slopes for buildings and construction techniques such as piling of foundations into underlying stone and correct benching and retaining of building pads for house sites and roadways, need to be investigated and limited to recognised safe standards.

5.4.4 *Bushfires*

Key issues raised by stakeholders of relevance to land use planning included the provision of passive protection measures incorporating siting, layout design and construction of buildings and landscaping. This was considered to be the most reliable and effective way of reducing the impact and damage of bushfires. Response agencies in particular raised the issue of the need to declare bushfire prone areas and the consequence impact on development rights which need to be balanced with overall community safety.

Key management and mitigation techniques relating to urban planning and development include:

Risk identification and planning: Areas subject to the threat of bushfires should be identified and ranked for low, medium or high bushfire risk. Development should be excluded from areas identified as having a high bushfire risk unless the development demonstrate the implementation of appropriate management and mitigation measures. Development within medium and low risk areas should be appropriately designed and located to minimise the risk from both the direct and indirect impacts of bushfire.

Firebreaks: Ideally, development should be designed so that a road is located immediately between the outside building blocks and the bushland which should have a minimum cleared width of 20 metres. A peripheral fire trail system should be provided to permit satisfactory vegetation management.

Water supply: Planning of urban areas must ensure that there is sufficient water for domestic and firefighting purposes and that this should be taken into account when providing a reticulated water supply scheme. Where reticulated water is not available, development should only be approved where a significant supply of water from tanks is available.

Fire service availability: The designation of land and the development of housing in at risk areas should only occur where adequate protection and service can be provided by fire services.

Site specific management plans: Such plans outline the site specific characteristics and risks that specific natural hazards may impose, the most appropriate management techniques for the site and emergency response plans.

Building design: Specific building regulations exist requiring houses and other residential buildings in designated bushfire prone areas to be built with specific bushfire design criteria in mind. These Australian Standards could be further developed and adopted as part of any future planning control device.

While Queensland does not have the wildfire problem of other parts of Australia, bushfire damage does occur. With increasing demand for rural residential and rural retreats it is likely that fire-prone areas will continue to experience development pressure and the likelihood of property damage from bushfires is likely to increase. Risk factors need to be appropriately managed if bushfire devastation is to be avoided. It is important that bushfires are recognised as a real and relevant constraint to urban development and are given due consideration in the development process.

5.4.5 *Severe storms*

At present, mitigation and control measures for severe storms are more reactive and short term in nature. The nature and unpredictability of storms means that it is very difficult to effectively control and reduce the risks of damage. At present the only control measure is the issuing of warnings and predictions. These give residents a short period of time to prepare for storms, thus marginally minimising some impacts like damage to portable items such as cars and garden furniture. Unfortunately these warnings do little to reduce the impacts upon fixed infrastructure such as buildings.

Site specific planning controls were seen as the key planning measure to mitigate the impacts of severe storms. For example, planning measures relating to appropriately designed ingress/egress routes for new residential layouts to provide safe routes for evacuation are important. Such principles can be applied to land use planning for all natural disasters. Information availability is another key constraint to addressing this issue. There is a need for appropriate baseline information to determine threshold values to assess the risk from severe storms given their widespread occurrences.

The nature and unpredictability of storms means that it is very difficult to effectively control and reduce the risks of damage. At present the only control measure is the issuing of warnings and predictions. These give residents a short period of time to prepare for storms, thus marginally minimising some impacts like damage to portable items such as cars, and garden furniture. Unfortunately these warnings do little to reduce the impacts upon fixed infrastructure such as buildings.

Little can be done in relation to land use planning to prevent damage as a result of storm activity. The following strategies can be used to mitigate the effects of severe storms:

Building design: buildings and structures are designed to appropriately minimise the potential for damage.

Local development design: Development can be designed on a site specific level to ensure that impacts such as strong winds and flash flooding are not impeded by the design of the development. Development can be designed to allow the flow of waters and prevent the tunnelling of winds.

5.4.6 *Earthquakes*

There was a general perception by a number of stakeholders that earthquakes pose a relatively long term low risk. There was agreement that earthquake exposure can be

planned for, however, more information is required prior to assess land use options which balance safety, development and the environment. Susceptibility mapping was viewed as the key data source to be developed for Local Governments to adequately assess risks.

Key management and mitigation techniques relating to urban planning and development include:

Land use planning: Development can be excluded from identified areas of higher earthquake risk, perhaps along identified fault lines and known unstable areas;

Infrastructure planning should ensure that these infrastructure items are designed to resist damage by minor to moderate earth movement activity as well as being located and designed so as to minimise the time required to repair and replace any necessary infrastructure as a result of any earthquake activity;

Building design: Buildings should be designed in accordance with improved building codes and practices relating to the standard and ability of structures and buildings to withstand earth movements.

5.4.7 *Summary*

From the above discussion it can be seen that a number of common mitigation and management techniques can be used to address natural hazards. A summary of these is outlined in *Table 5.1*.

Table 5.1 KEY HAZARDS AND MANAGEMENT MEASURES

	Land Use Planning	Building Design	Mitigation Infrastructure	Site Specific Management Plans
Cyclones		X		X
Flooding	X	X	X	X
Land slides	X	X		X
Bushfires	X	X		X
Severe Storms		X	X	X
Earthquakes	X	X		X

Chapter 6

OPTIONS FOR DISCUSSION

6.1 OPTIONS

The purpose of the Discussion Paper is to provide a catalyst during the first round of public consultation, to identify the interests of the various stakeholders and provide input to facilitate the drafting of a State Planning Policy for Land Use Planning for Natural Disaster Mitigation and Development Assessment.

The options discussed in this Chapter are:

- Maintain and support the current approaches; and
- Develop a State Planning Policy for Natural Disaster Mitigation and Development Assessment.

The relative disadvantages and advantages associated with each option are discussed. The section concludes with discussion on the scope, limitations and administration of a State Planning Policy.

6.1.1 Maintain and Support the Current Approaches

It is possible to continue with the current multiple approaches to natural hazards planning and management. These could be supplemented by the development of State-wide planning guidelines to assist Local Governments in preparing Planning Schemes that take natural hazards into account. This option could also be supported by training and education programs as well as specific amendments to existing legislation such as the Local Government Act to minimise Local Government liabilities with respect public access to flood information.

There are a number of problems and deficiencies that are apparent in the current approaches. These include:

- lack of land use planning for disaster mitigation and development assessment;
- inconsistent approaches across the State, for example in relation to flood level modelling and use;
- lack of baseline information;

- lack of comprehensive support and guidance on how to incorporate planning for natural disaster mitigation and development assessment in planning schemes and with State activities; and
- lack of compulsion to consider mitigation of the effects of natural disasters in Queensland.

Maintaining the current approaches and not developing a State Planning Policy is a limited option. Research and targeted consultation undertaken to date indicates that there is an identified need for a comprehensive and consistent approach to land use planning for natural disaster mitigation and development assessment. The lack of a State wide policy framework to deal with land use planning for natural disaster mitigation appears to be currently limiting the scope of IPA planning schemes.

Key issues to be considered in relation to this approach relate to the apparent multiplicity of and conflict between current approaches and provisions and whether continuation of these approaches achieves the best planning outcomes for Queensland.

6.1.2 State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment

The development of a State Planning Policy would allow for the common elements of natural hazards planning and mitigation management to be drawn together into a comprehensive document. This would result in a consolidated resource which could be used by Local Governments and the State Government in the preparation of planning schemes and the assessment of development applications.

In relation to specific areas of State Government responsibility, a State Planning Policy could define areas of State interest and policy direction and address planning for State infrastructure.

The State Planning Policy would provide a framework, support and guidance to address land use planning for natural disaster mitigation and development assessment. A State Planning Policy would also provide a level of consistency for Local Governments to apply standards (risk mapping and model siting requirements for development etc) for each of the natural hazards. *Chapter 5* discusses in some detail the likely nature of planning measures that could be covered in the proposed State Planning Policy, including:

- **Land use planning** - A State Planning Policy could seek to limit the location of development in at risk areas through its hazard/risk mapping. It could also include provisions and controls that further regulate development in at risk areas.

- **Mitigation infrastructure** - A State Planning Policy could recommend approaches to the location of and planning implications of mitigation measures (such as construction of dams, and mitigation measures to control flooding and stormwater run-off).
- **Management plans** - A State Planning Policy could consider the most appropriate management measures for the site; emergency response plans to deal with specific hazards and disasters measures in the drafting of the specific land use and mitigation provisions.
- **Building design** - A State Planning Policy could recommend specific Australian Standards that should be adopted as part of building design and construction.

These could be used in developing natural hazard mitigation frameworks into planning schemes as well as triggers for natural hazard risk assessments to be undertaken at a development application stage. A State Planning Policy for natural disasters would need to have some flexibility to allow for the incorporation of additional baseline information as it becomes available. A State Planning Policy would also need to provide flexibility for local circumstances to be addressed within an overall framework.

In addition, a State Planning Policy would provide an opportunity to address issues such as planning for climate change (greenhouse), assessment of disaster risk and development of mitigation strategies which may be required as a basis for NDRA funding for likely or recurring natural disasters.

6.2 SCOPE OF A STATE PLANNING POLICY OR POLICIES

The aim of a State Planning Policy or Policies would be to address natural disaster mitigation through land use planning and development assessment. The purpose would be to reduce the community's vulnerability to the impacts of natural disasters. Planning guidelines could support and provide Local Governments with technical advice and information on how to implement the policy.

Local Governments would be supported in their decision-making processes concerning development applications in areas subject to natural hazards. Local Government planning schemes would:

- identify hazard prone areas;
- develop appropriate desired environmental outcomes and performance criteria for these areas; and
- apply appropriate development policies and standards to hazard prone areas.

Through Local Government planning schemes and in the assessment of development applications, the State Planning Policy would influence decisions on the location and/or requirements for future development, including infrastructure in the Local Government area. After assessing the impact of a proposed development on the safety of the community, Local Government may, where appropriate, require the development application to be amended or refuse an application.

As natural hazards exist throughout Queensland, it would be reasonable that the policies apply State-wide. The policy could, as provided for in IPA, be binding on the Crown. Thus all State Departments and Authorities would be required to consider the implications of the policy for community infrastructure projects.

6.3 WHAT ARE THE LIMITATIONS OF A STATE PLANNING POLICY?

A State Planning Policy cannot eliminate all risks to communities associated with natural disasters or past land use decisions. There are important limits on the scope of a State Planning Policy. For example:

- A State Planning Policy could consider addressing natural hazards such as cyclone, flooding, landslides, bushfires, severe storms and earthquake. These natural hazards, however, can only be addressed in terms of land use planning and development assessment. It is possible that direct and effective land use planning and development control measures may only appropriately be developed to deal with bushfires, flooding, landslip and earthquake. It may not be possible to develop any meaningful controls other than building standard recommendations to control the impacts of cyclones and storms. This would need to be further investigated.
- A State Planning Policy cannot resolve directly issues associated with established urban areas and existing developments.
- A State Planning Policy cannot direct Local Government to adopt specific mitigation methods such as a 'no development in a floodplain' strategy or require Local Government to build levees to protect development in a floodplain. Rather, a State Planning Policy may require Local Governments to implement methods to reach mitigation outcomes based on the intent of the State Planning Policy and appropriate to the natural hazard risks identified in the Local Government area.
- A State Planning Policy would place the responsibility on Local Governments to identify and manage risks associated with natural disasters.
- A State Planning Policy will not address technological hazards such as chemical spills, exotic diseases, bridge collapse, space debris and other

incidents not related to natural disasters. However, the policy may make provision for dealing with flooding caused by a dam break.

- A State Planning Policy does not replace other initiatives Local Government can take to mitigate natural disasters. Other supplementary initiatives could include, for example, early warning systems, public education programs, counter disaster plans, disaster mitigation plans, relocation or acquisition of properties, and building levees and culverts.

6.4 ADMINISTRATION OF THE STATE PLANNING POLICY

The Department of Local Government and Planning is responsible for administering State Planning Policies. In relation to this proposed policy, the Department of Local Government and Planning's responsibilities would include ensuring that advice from the Department of Emergency Services about interpreting the State Planning Policy is integrated with Local Governments' planning schemes in a way that is balanced with other relevant planning considerations in the local area.

Local Governments would be required to consider the State Planning Policy when making decisions on applications for new developments as specified in the State Planning Policy.

The Department of Emergency Services would be available to provide advice to Local Governments on interpreting the State Planning Policy in particular situations.

Chapter 7

WHERE TO FROM HERE

7.1 THE NEXT STEP

This Discussion Paper has been primarily prepared as a resource document for key stakeholders to respond to during the public consultation process. It should assist in identifying the interests of the various stakeholders and input to facilitate the drafting of a State Planning Policy – Land Use Planning for Natural Disaster Mitigation and Development Assessment.

The Department of Emergency Services welcomes comments during the development of the State Planning Policy which will address land use planning as it relates to natural disaster risk management issues in planning and the development assessment. You are invited to make comment during the upcoming consultation program detailed below:

STAGE	PURPOSE	TIMING
State Planning Policy **Preparation Phase**	▫ For stakeholders to comment on the subject matter and scope of the proposed policy. ▫ A series of regional workshops will be undertaken to promote discussion on this Discussion Paper.	18 August – 12 October 2001 10 September –5 October
State Planning Policy **Consultation Phase**	▫ For stakeholders to comment on the purpose and general effect of the proposed policy. ▫ Copies of the proposed policy will be available for inspection and purchase. Stakeholders will have forty business days to comment during both phases. Comments can be made by participating at advertised public consultation meetings and/or in a written submission within the advertised timeframe for comment.	April 2002 (approx)

The intention of public consultation is to encourage as many stakeholders as possible to contribute to the development of the State Planning Policy within publicly advertised timeframes.

Government Advisory Committee Meeting Minutes 29 ~~July~~ June 2001

Queensland Government Agency	Nominated Representative	Attendee
Department of Main Roads	[redacted]	
Environmental Protection Agency		
Department of Premier and Cabinet		
Department of Local Government and Planning		
Department of Natural Resources and Mines		
Department of State Development		
Queensland Transport		
Department of Public Works		
Queensland Fire and Rescue Authority		
Strategic Management and Policy, Department of Emergency Services		
Disaster Mitigation Unit		
Disaster Mitigation Unit		

Agenda Item 1: Welcome

[redacted] Director Disaster Mitigation Unit, welcomed and thanked attendees and outlined the importance of developing a State Planning Policy for Land Use Planning for Natural Disaster Mitigation and Development Assessment [redacted] welcomed the involvement of State Departments with an interest in land use planning and management or development.

Discussion: There was no discussion on this agenda item

Action: No action required.

Agenda Item 2: Background on the State Planning Policy

[redacted] outlined the rationale, purpose, scope, limitations, and administration of the State Planning Policy and outlined the perceived stakeholders, consultation processes, progress, next steps and timeframes. A copy of [redacted] presentation is attached.

Discussion: There was no discussion on this agenda item

Action: No action required.

Agenda Item 3: Existing Support to Local Government

[redacted] provided a context for the development of the State Planning Policy. [redacted] explained changes in:

(a) The insurance industry which link hazard risks with financial risks and place an importance on flood mapping and flood mitigation efforts

(b) Natural Disaster Relief Arrangements (NDRA) funding (Commonwealth funding) which link receipt of Commonwealth NDRA funding to evidence of mitigation for funding eligible recurrent or predictable natural disasters

(c) Reduced 'trigger' points for Local Governments with a small rate base to receive Queensland Government funding under NDRA if mitigation studies are in place.

[redacted] explained the role and purpose of two funding programs available to Local Government:
(a) Natural Disaster Risk Management Studies Program (NDRMSP), and
(b) Regional Flood Mitigation Program (RFMP).
[redacted] stated that these two programs, funded equally by the Commonwealth, Queensland, and funded Local Governments, provided resources which are available to assist Local Governments identify the natural disaster risks for their areas and to assist Local Governments fund flood mitigation capital works.

The NDRMSP provides ongoing funding to Local Governments. The Department of Emergency Services will target specific Local Governments in the next funding round to encourage them to apply for funding. Currently 89 studies have been funded under this program.

The RFMP will provide funds for the next four years.

[redacted] provided printed information on both these programs as well as spreadsheet information on which Local Governments have been funded under both these programs for specific studies or capital works.

Discussion: There was discussion about the role and charter of the Office of Community Engagement in the Department of Premier and Cabinet [redacted] stated that the charter was being developed.

Action: Attendees will read provided information on NDRMSP and RFMP prior to the focus workshop on 5 July so that they are aware of funding sources for Local Governments which will assist them identify natural Disaster Risks in their area and mitigate floods.

Agenda Item 4 Membership of the Government Advisory Committee

[redacted] outlined the membership of the Government Advisory Committee, explaining that it involved State Government agencies with responsibility for land use planning or management, or development.

Discussion: There was no discussion on this topic

Action: No action required.

Agenda Item 5 Purpose / role of the Government Advisory Committee

[redacted] provided attendees with a statement of the objectives and membership of the Government Advisory Committee.

Discussion: There was no discussion on this topic.

Action: No action required.

Agenda Item 6: Questions

Attendees were given the opportunity to ask questions and raise issues.

Discussion:

There was general discussion about:
(a) whether or not a State Planning Policy was the best tool to achieve the outcomes desired by the Department of Emergency Services
(b) the usefulness of a 'mapping' exercise to place the State Planning Policy in context eg existing legislation and planning policies

(c) the possibility of flood mitigation legislation and its links with this State Planning Policy
(d) a review of the State Counter Disaster Organisation Act
(e) the scope of the State Planning Policy, and
(f) the role of State Interest Policies.

The development of a State Planning Policy was supported and it was acknowledged that other mechanisms / tools may be appropriate to ensure that the desired outcomes are achieved.

Action: Agencies to email to [redacted] by 2 July appropriate legislation, policies etc to be 'mapped' for the development of the State Planning Policy.

Agenda Item 7: Next meeting

It was agreed that the **next meeting will be between 1 and 3 pm on Wednesday 25 July** at the Department of Emergency Services Main Building on the corner of Park and Kedron Park "Roads in the Media Room , level 2 Block e. The purpose of this meeting will be to provide comment on the Discussion Paper concerning the development of the State Planning Policy. It was explained that the document would be circulated to attendees a few days prior to that meeting so that agencies would have the opportunity to comment at the meeting.

Discussion: There was no discussion on this agenda item

Action:

1. [redacted] to circulate the Discussion Paper to Government Advisory Committee (GAC) representatives a few days before the next GAC meeting on 25 July 2001.
2. Government Advisory Committee representatives to provide comment on the Discussion Paper at the next meeting on 25 July 2001.

Agenda Item 8: Close

[redacted] thanked participants for their input.

The meeting closed at 12.10 pm

Agenda

Government Advisory Committee
State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment

10 am – 11.30 am Friday 29 June 2001

Department of Emergency Services Main Building on the corner of Park and Kedron Park Roads in the Media Room level 2 Block E

Item number	Issue	Person	Information (I) Decision (D)
1	Welcome	[redacted]	I
2	Background on the State Planning Policy – rationale, purpose, scope, limitations, administration, stakeholders, consultation processes, progress, next steps, timeframes etc		I
3	Existing support to Local Government		I
4	Membership of the Government Advisory Committee		I
5	Purpose / role of the Government Advisory Committee		I
6	Questions		I
7	Next meeting – date and purpose		I
7	Close		

[redacted]

Agenda

Government Advisory Committee
State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment

10 am – 11.30 am Friday 29 June 2001

Department of Emergency Services Main Building on the corner of Park and Kedron Park Roads in the Media Room level 2 Block E

Item number	Issue	Person	Information (I) Decision (D)
1	Welcome	[redacted]	I
2	Background on the State Planning Policy – rationale, purpose, scope, limitations, administration, stakeholders, consultation processes, progress, next steps, timeframes etc		I
3	Membership of the Government Advisory Committee		I
4	Purpose / role of the Government Advisory Committee		I
5	Questions		I
6	Next meeting – date and purpose		I
7	Close		

Queensland Government
Counter Disaster and Rescue Services
Department of Emergency Services

State Planning Policy

Land Use Planning for Natural Disaster Mitigation and Development Assessment

Presentatio

Government Advisory ee

Friday 29 July 2

Disaster M

What is a State Planning Policy?

A State Planning Policy:

- describes the position of the Queensland Government on plann and development matters of State significance, and
- is developed under the *Integrated Planning Act 1997.*

What is the purpose of this State Planning Policy?

The purpose of this State Planning Po y is to:

- make clear the State's interest in land t lanning as it relates to natural disasters
- reduce the community's vulnerability to the impacts of natural disasters,
- encourage consistency across Queensland in natural disaster mitigation management, and
- assist Local Government decision making processes concerning development applications in areas subject to natural hazards.

Why develop this State Planning Policy?

- Queensland Government comm ment
  - One of the seven priorities of the Que land Government is safer and more supporti communities, including improved perso public safety, and
  - Funds have been dedicated over three years to fund disaster mitigation programs in the State.

- Costs of natural disasters:
  - Cost of restoration and rehabilitation has due to:
    - population increase
    - community having more assets,and
    - more development in disaster prone areas.
  - In Australia, N.S.W. and Queensland accounted for:
    - 66 per cent* of total disaster costs, and
    - 53 per cent* of the total number of disasters.

    * (figures are for 1967 – 1999)

  - The average annual cost of natural disasters in Queensland was $239.2 m between 7 & 1999. ← direct cost
  - Intangible costs are estimated to be at least equivalent to, but most likely substantially more than, direct and indirect costs (BTE Report 103, 2001).

- Commonwealth Natural Disaster Relief Arrangements funding
  - Costs are increasing
  - Guidelines link ongoing financial assistance to evidence of mitigation (from July 1998)
  - If evidence of mitigation is not apparent, the Queensland Government faces the risk of meeting recovery and rescue costs throughout Queensland without Commonwealth assistance
  - Local Governments are the primary beneficiaries of NDRA funding.

What is the scope of the State Planning Policy?

The State Planning Policy will:

- Address natural disaster risk management issues in land use planning and development assessment, and
- Apply State-wide
- Affect Local Government and State Government.

How does the State Planning Policy fit with disaster management?

Disaster Management 'Mantra'

- Prevention
- Preparedness
- Response
- Recovery

The State Planning Policy will focus on the two P's:

- Prevention and
- Preparedness.

What are the limitations on the State Planning Policy?

The State Planning Policy:

- Will address natural hazards (geological hazards) but not technological hazards, and may make provision for dealing with flooding caused by a dam break.

The State Planning Policy cannot:

- Resolve directly issues associated with established urban areas and existing development, or
- Direct Local Governments to adopt specific mitigation methods.

How is a State Planning Policy administered?

The Department of Local Government and Planning:

- Is responsible for administering State Planning Policies, and
- Will ensure advice from DES about interpreting the State Planning Policy is integrated with Local Governments' planning schemes in a way that is balanced with other relevant planning considerations.

The Department of Emergency Services will be available to provide advice to Local Governments and State Government interpreting the State Planning Policy in particular situations.

Guidelines

Who are the key stakeholders?

- Local communities
- Local Governments
- Property developers and owners
- Insurance industry
- Commonwealth and State Government agencies
- LGAQ & Aboriginal and Islander Co-ordinating Councils
- Consultants and advisors (planning & development)
- Various industries e.g. tourism, farming and mining
- Not-for-profit charitable and voluntary organisations
- Professional bodies
- Tertiary institutions
- Conservation groups
- Other groups.

??. any more ???

What is the consultation process?

- Steering Committee (DES and DLGP)
- Government Advisory Group*
- Targetted focus workshop*
- First public consultation ('Preparation phase')
- Second pnblic consultation ('Consultation phase')
- Written submissions during first and second consultation phases
- Targetted consultations*
- Requested consultations.*

* Additional to requirements of *IPA 1997*

Focus Workshop 5 July 2001

- To define which natural disaster mitigation issues can be investigated under a State Planning Policy
- To identify key planning and management issues in relation to each natural hazard
- To identify common ground and planning solutions for dealing with each natural hazard
- To develop a range of options for moving forward on identified issues
- To arrive at a preferred direction for progressing the development of a State Planning Policy
- To identify stakeholders
- To identify preferred communication methods.

What is the role of the Government Advisory Committee?

- Provide strategic and practical advice and input to Department of Emergency Services at each stage of the development of the State Planning Policy eg:
  - Discussion Paper
  - Draft State Planning Policy
  - Draft supporting Guidelines.

Where will public consultations be held?

Public consultations will be held in each Counter Disaster and Rescue Services District

- Beenleigh
- Brisbane
- Bundaberg
- Cairns
- Gympie
- Longreach
- Rockhampton
- Roma
- Mackay
- Mt Isa
- Toowoomba
- Townsville.

What progress has been made?

- A Business Case has been approved by the Executive Director, CDRS to engage a town planning consultancy
- Monies have been committed to engage a town planning consultancy
- A draft Intention to Prepare a State Planning Policy has been developed
- An internal communication strategy has been developed and is being implemented
- Discussions have been held with other government departments which have / are preparing State Planning Policies

- Meetings with Department of Local Government and Planning occur as required
- A Steering Committee has been established and met
- A Government Advisory Committee has been established and met
- Targetted briefings have occurred
- Research is underway.

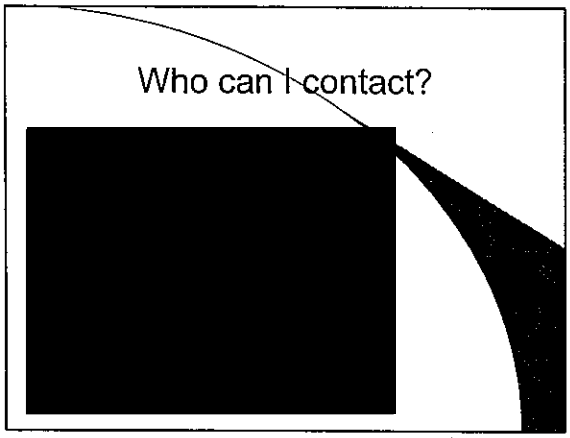
What are the next steps?

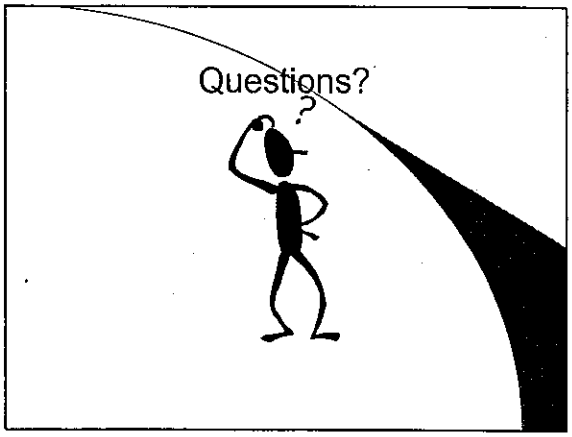
- Focus workshop on 5 July
- Develop a Discussion Paper and finalise approval of the Intention to Prepare document
- Undertake the first public consultation phase
- Develop a proposed State Planning Policy, supporting guidelines and explanatory notes
- Undertake the second public consultation phase
- Finalise the State Planning Policy and supporting guidelines
- Undertake targetted consultations as required
- Handover documentation to Department of Local Government and Planning.

(Ministerial/Cabinet processes & publishing processes are planned at most stages)

What is the timeframe?

The development and finalisation of the State Planning Policy, supporting guidelines and explanatory notes are expected to take up to three years.


Who can I contact?


Questions?

Government Advisory Committee

State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment

Name: Government Advisory Committee for State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment

Type of Committee: Inter-agency working group comprising of Queensland Government Departments with responsibility for planning, land use or development

May include a representative from LGAQ from time-to-time, as required.

Objectives: To provide strategic and practical advice to the Department of Emergency Services at each stage of the development of the State Planning Policy and supporting Guidelines.

To provide ongoing consistent membership to ensure a consistent contact for involved Departments

Chair: Director, Disaster Mitigation Unit, Counter Disaster and Rescue Services, Department of Emergency Services

Working Program and Timetable:

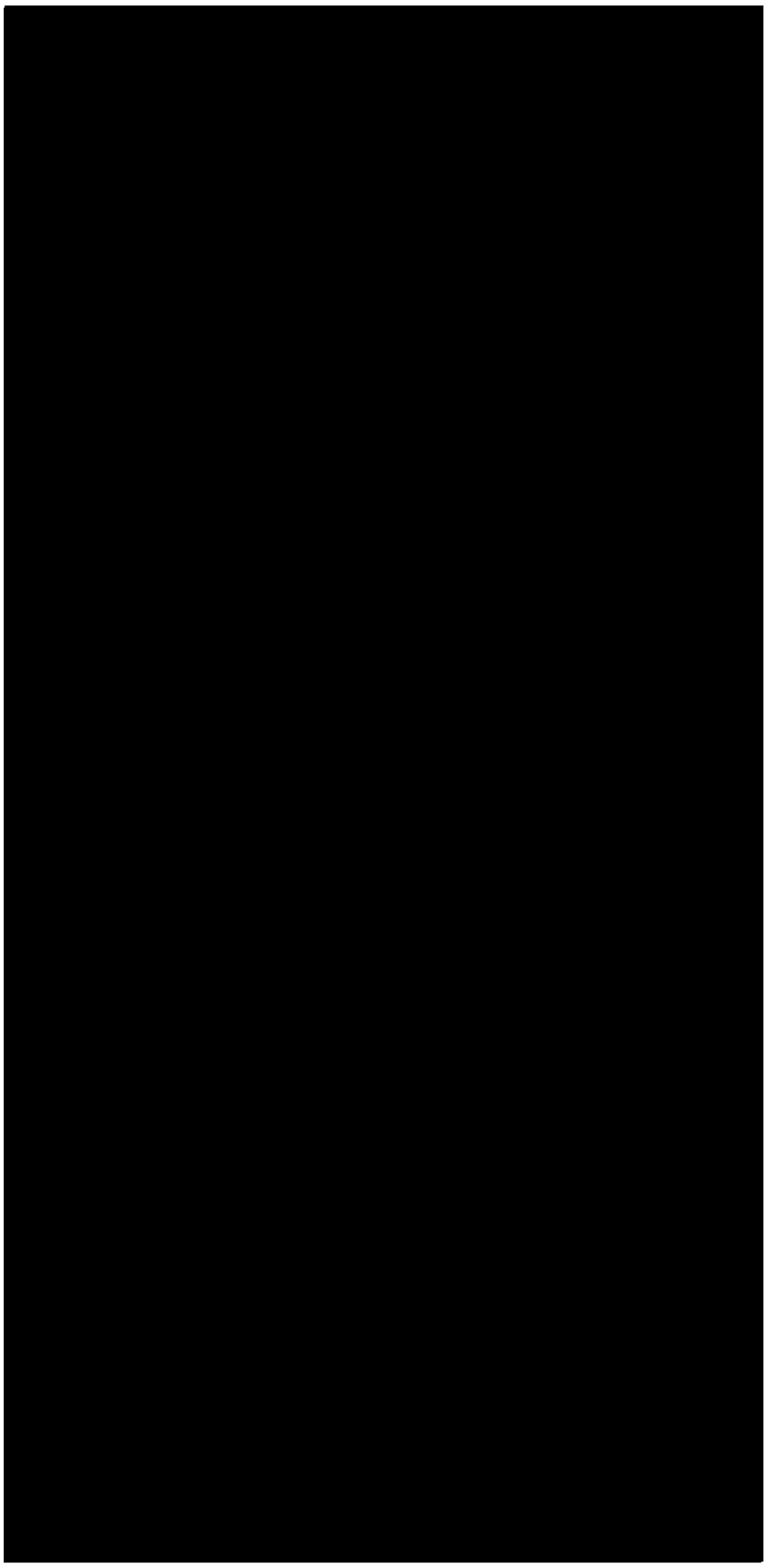
10 – 11.30 am Friday 29 July 2001

Tentative:
1 – 4 pm Wednesday 25 July to discuss Discussion Paper

Members: [redacted]
[redacted]r, Road Network Management
Department of Main Roads

[redacted]
Assistant Manager
Coastal Planning, Environmental Planning
Environmental Protection Agency

Members (cont'd)



From the Office of the Director-General

1. DDG(R) 2. GM-WMU 3.
4. 5. COM(C&RD) 6.

☐ Prepare reply for my signature by 10/1/2001

☐ Prepare speech notes/briefing notes by

☑ For appropriate action

☐ For discussion

☐ Please provide comments

☐ For your information

☐ Note and retain

☐ Please liaise with

FURTHER COMMENTS:

Note: Please ensure information requested is received by the Senior Executive Coordinator to the Director-General by the date specified.

Date: 2016 From: Director-General [redacted] Phone: 63356

Faxed 18.06.01

[redacted]

DOCUMENT RECEIVED BY DNR
23 MAY 2002
File No. IRM/085/000(0033)
File Location R. CUEREL
Action By N.F.A.
Registered Y/ N Doc. Code IR02/01364
MOVEMENT INSTRUCTIONS MUST BE SHOWN ON FRONT COVER.

Queensland Government

Counter Disaster and Rescue Services
Department of Emergency Services

[redacted]
Our Ref: cds00789/2
cdrs dpru/projects/spp/govtadvcttee/govtadcttenominationltrNRMv2

15 June 2001

Mr [redacted]
Director-General
Department of Natural Resources and Mines
GPO Box 2454
BRISBANE QLD 4001

how senior?

Dear [redacted]
I am writing to invite you to nominate a senior member of your organisation to be a member of a Government Advisory Committee relating to the development of a State Planning Policy on Land Use Planning for Natural Disaster Management and Development Assessment which will take effect under the *Integrated Planning Act 1997*.

The role of the Government Advisory Committee will be to provide advice and input to the Department of Emergency Services at each stage of the development of the State Planning Policy and supporting Guidelines to ensure that the interests of the Queensland Government are met. It is anticipated that meetings will be both strategic and practical and will involve five or six meetings over the two to three years it will take to develop the State Planning Policy. If you are able to involve a senior staff member on this committee, it would be appreciated if, as far as can be assessed, their availability would be ongoing through the development of the Policy.

The first meeting of the Government Advisory Group will be held between **10 and 11.30 am on 29 June** at the Department of Emergency Services Main Building on the corner of Park and Kedron Park Roads in the Media Room level 2 Block E. It would be appreciated if your nomination be made by **Tuesday 26 June 2001**.

As you are aware a focus workshop on the State Planning Policy is being held on 5 July with representatives of a wide number of key stakeholders beyond the membership of the Government Advisory Committee to discuss the scope, issues and possible solutions associated with the development of this Policy. This workshop is a one-off event additional to the requirements of the *Integrated Planning Act 1997* for the development of a State Planning Policy. **Mr Russell Cuerel** has been nominated from your Department to attend this workshop. It is viewed as important that the Government Advisory Committee members meet prior to this workshop so that these key government departments are aware of the implications of this State Planning Policy.

C&RP/IRM
DATE ENTERED: 31/5/2001
DOC REF 2001/838(842)
ACTION: GM(CRP)

2001 - International Year of Volunteers
Acknowledging our most valuable asset

DG NO: 11352/01
DATE: 20-06-01

Disaster Policy and Research Unit

Emergency Services Complex
Cnr Kedron Park Road & Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 [redacted]
Facsimile +61 7 3247 8480
Website www.emergency.qld.gov.au

ABN 92 265 149 823

Organisations being invited to nominate a member of the Government Advisory Committee include State Government departments with responsibilities for land use (e.g. Department of Local Government and Planning, Department of Natural Resources and Mines, Environmental Protection Agency) and development (e.g. Department of Premier and Cabinet, Department of State Development, Department of Transport, Department of Main Roads, Department of Public Works). From time to time, the Local Government Association of Queensland Incorporated will be invited.

The purpose of this State Planning Policy is to reduce the community's vulnerability to the impacts of natural hazards which have significant direct, indirect and intangible costs to the community. The natural hazards which the Policy may address are: cyclone; riverine flooding, including flash flooding; landslide; and bushfire. The Policy may also address earthquake and flooding caused by dam break.

The Department of Emergency Services will develop the State Planning Policy and supporting Guidelines through research, and public and targetted consultations.

If you or your officers require further information on this committee, please contact [redacted]

Nominations to the Government Advisory Group should be addressed to:

[redacted]
Senior Policy Officer
Disaster Mitigation Unit
Counter Disaster and Rescue Services
Department of Emergency Services
GPO Box 1425
Brisbane Queensland 4001

Alternatively nominations can be emailed to [redacted]
or facsimiled to [redacted]0.

I trust that you can commit a senior staff member to this committee to further the development of the State Planning Policy on Land Use for Natural Disaster Mitigation and Development Assessment which will help provide for safer and more supportive communities in relation to improved personal and public safety.

Yours sincerely

[redacted]

Director
Disaster Mitigation Unit

AGENDA

Meeting of the **Government Advisory Committee (GAC)** for the
STATE PLANNING POLICY FOR NATURAL DISASTER MITIGATION AND ASSOCIATED SPP GUIDELINE

To be held in the
Liaison room, level 2, block E, of the Emergency Services Complex, Kedron

5 JULY 2002 starting at 9:00 am

The purpose of this meeting is to seek feedback and comment from GAC members on the draft SPP Guidelines.

~ Proposed Program ~

1. **Welcome and Apologies** (9:00am – 9:10am)
2. **Confirmation of Notes of 24 May 2002 Meeting** (9:10am - 9:20am)
3. **Changes to draft SPP since last meeting** [redacted] 9:20am - 9:40am).
4. **Overview Presentation of the Draft SPP Guidelines – (ERM- Sandy Vigar)** (9:40am - 10:10am).

Morning Tea (10:10am – 10:20am)

5. **Detailed Presentations and Discussion Forums on specific topics / issues within the Draft SPP Guidelines (ERM)** (10:20am – 11:45am):
   - Outcome 1 flowchart
   - Hazard specific performance criteria
   - Making and amending planning schemes
   - Methodologies for hazard specific studies
   - Community infrastructure provisions and performance criteria
6. **Agency suggestions** (11:45am – 12:15pm):
   - Additional information to be included
   - Sources of funding
   - Useful reference or links
7. **Government process prior to seeking approval to publicly consult on the draft (DES)** (12:15pm – 12:45pm)
8. **Other Business** (12:45pm - 1:00pm)
9. **Close** (1pm)

DRAFT STATE PLANNING POLICY FOR NATURAL DISASTER MITIGATION

TABLE OF CONTENTS (GUIDELINES)

Facsimile message

Level 1, 60 Leichhardt Street
Spring Hill QLD 4000
AUSTRALIA

PO Box 1400
Spring Hill QLD 4004
AUSTRALIA

www.erm.com

Telephone: 61 7 3839-[redacted]
Facsimile: 61 7 3839-8381

ERM

To Russell Cuevel

Fax Number [redacted]

From [redacted]

Ref/Job Number 0020361

Subject Flooding - Comments

Date 12/07/02

Page 1 of 8

Russell,

Pages as requested

Regards,

[redacted]

SPP file.

Brief Comments in response to consultation on proposed State Planning Policy for Natural Disaster Mitigation, DNR&M Central West Region

General:

Central West Region supports the development of a State Planning Policy for Natural Disaster Mitigation.

Floods bushfires and cyclones present the greatest natural disaster risk to Central West Region.

A State Planning Policy (SPP) should be a statement of general issues, principles and a process for risk assessment and land use planning response written in plain English with any necessary technical detail contained in planning guidelines.

The precautionary principle should be adopted as a core principle of the SPP

A background paper identifying types and characteristics of natural disasters, that addresses preliminary identification of indicative areas of likely high risk, should be prepared as a step in the process.

During preparation of the SPP, the adequacy of existing natural resource data, modelling techniques and exercises and interpretation for land use planning for natural disaster mitigation should be investigated and priorities established to provide additional data, eg, topographical data for coastal areas and floodplains and analysis.

Biogeographical variation across the state means that no one detailed set of prescriptive planning requirements (such as compulsory adoption of a Q100 flood as the designated flood event) will be relevant or desirable.

The SPP itself will not provide the opportunity to develop detailed mitigation strategies, but it could identify areas of the State where such strategies should be developed and some priorities. This may assist local government obtaining funds from the National Disaster Risk Management Studies Program (NDRMSP) and the Regional Flood Mitigation Program (RFMP) to assess hazards and develop and implement mitigation strategies.

Given the time required for research, drafting, public consultation and cabinet approval it is expected that this SPP will not be in place for the first round of planning schemes to be prepared by March 2003, under the *Integrated Planning Act* 1997.

Is a State Planning Policy appropriate:

Natural disasters have significant economic and social costs. Those costs can be reduced by land planning that [1] restricts or controls land uses or activities likely to increase the scale or intensity of the natural hazard (such as increasing the likelihood of landslip through clearing on steep slopes or increasing flood peaks through reducing natural infiltration or retention basins) AND [2] preventing the building of vulnerable facilities in known or extrapolated inundation areas OR [3] requiring structural measures in building and construction that limit damage and danger.

The options appear to be:

[A] a single SPP based on natural disaster mitigation as the overarching purpose regardless of the type of natural disaster (potentially supported by technical guidelines)

OR

[B] business as usual i.e. no State Planning Policy

OR

[C] some other approach such as individual SPP's addressing each natural disaster type approached from a natural phenomenon or natural resource angle. Given the complexity of each natural disaster type inherent in natural phenomena, individual SPP's could possibly more easily deal with additional planning implications of individual natural phenomena ie a floodplain management SPP that considers impacts on life, property and economic activity, benefits of floods on maintenance of ecosystems and flood irrigated pasture AND the impact of landuse,

irrigation and water supply infrastructure, building construction and earthworks etc on flood extent, depth and velocity.

The extent to which any disaster mitigation planning policy should address related natural resource management issues, such as the implications of flood mitigation objectives for integrated catchment management, will require careful consideration to avoid duplication and conflicting planning advice.

And should the proposed state planning policy address man-made disasters?

Provided an overarching disaster mitigation focussed SPP adequately addresses natural resource and environmental management planning aspects of natural phenomena that are related to disaster mitigation (either cross referenced to other planning instruments or within the SPP) option [A] is supported.

What natural hazards should be included:

Cyclones, floods, landslips and bushfires all clearly have a predictable spatial dimension. The location of severe storms and earthquakes are harder to predict.

Tsunamis and storm surge should be considered for inclusion

Planning measures can be applied to defined geographic areas or the whole of a local government area or State.

Each natural phenomenon / natural disaster type is briefly discussed considering local examples and departmental expertise.

Cyclones

Building regulations already use locational criteria (such as within 50km of the coast and north of a certain latitude) to identify levels of damage risk from cyclones. Storm surge can be a significant multiplier of damage associated with cyclones on the coast. It is considered that should a natural disaster mitigation planning policy proceed that for completeness storm surge should be addressed regardless of any Coastal Management Plan.

This department has some expertise in storm surge through the Queensland Centre for Climate Applications. DNR&M's [redacted] has completed stage one of "Queensland Climate Change and Community Vulnerability to Tropical Cyclones and Ocean Hazard Assessment" which addresses storm surge and proposes a methodology for updating existing storm surge studies undertaken since the late 1970's for all major Queensland coastal centres.

Smith and Greenaway (1994) investigate damage and assessment and emergency planning for tropical storm surge in Mackay. The Australian Geological Survey Organisation (AGSO) in association with the Bureau of Meteorology have undertaken city specific multi-hazard risk assessment studies for Mackay and Gladstone that consider tropical cyclone-severe wind, storm tide, earthquake, flooding, severe thunderstorm, heatwave, bushfire and landslide (Middelmann and Granger 2000; Granger and Michael-Leiba 2001).

Floods

Floods are generally associated with streams and their floodplains which can be mapped or modelled.

A Designated Flood Event chosen as the most cost effective level below which planning controls apply, can be based on: the flood of record, a selected recurrence interval flood or a flood study that models the inundation, depth and velocity of floodwaters based on model runs of rainfall intensities, durations and areal extent.

No one flood recurrence interval should be adopted for all of Queensland. The individual characteristics of streams and their floodplains result in vastly differing stage damage curves for different streams. Thus a Q100 in one stream (in a confined valley) may represent a deep fast flowing destructive flood with damage orders of magnitude higher than a Q50 whereas a Q100 in

another stream (in a broad shallow floodplain) may be little deeper and cause no more damage than a Q50.

This Department (as the State water resources agency) has been involved along with the Bureau of Meteorology in many studies of flooding (Scott & Furphy Pty Ltd 1991a; Scott & Furphy Pty Ltd 1991b; Bureau of Meteorology 1990; Smith 1998a; DNR&M 2001) and has experience, skills and jurisdiction that should be utilised in the preparation of any SPP for flooding.

While the emphasis of the SSP will likely be the avoidance of exposure to risk of flooding, it is important to note that flood levels can be drastically increased by changes to upstream land use and even works intended to ameliorate flooding. Cleared catchments are more flashy hydrologically than vegetated catchments i.e. a higher and quicker flood peak. Flood mitigation works such as dams (DNR&M, 2001c), stream straightening, removal of in-stream vegetation, levees, flood channels and the like have been constructed in response to damage. Some have demonstrated an ability to exacerbate the damage from flooding either because the design flood was exceeded OR because the cumulative impact of multiple works increases flow rates and/or flood height (Department of Water Resources 1990; Smith1998b). Floodplain management plans such as the *Interim Flood Plain Management Plan- Nogoa River Flood Plain* demonstrate responses to concerns over the cumulative impact of multiple works constructed over time.

Publications such as *Natural Channel Design Guidelines* (Brisbane City Council 2000) discuss restoration of the natural hydraulic and ecological benefits of urban waterways including design to ameliorate the effects of flooding.

The Agriculture and Resource Management Council of Australia and New Zealand have produced *Floodplain Management in Australia Best Practice Principles and Guidelines* the Australian reference document . It sets out detailed guidelines for planning, flood studies etc.

Links to and implications of the Queensland Safety Management Guidelines for Referable Dams and guidelines for failure impact assessment of water dams should be explicit in the SPP or supporting guidelines for flooding (DNR&M 2001a; DNR&M 2001b). Similarly this department's proposed approach to floodplain management will need to be complementary and cross referenced and/or integrated with any disaster mitigation SPP concerned with flooding.

Bushfire

The likelihood, intensity and speed of bushfires are correlated with the type of vegetation (fuel characteristics), weather/seasonality (drought index, temperature and wind) and slope, as well as human factors such as malicious or recreational use of fire, escaped hazard reduction or land management burns, rubbish tip fires, etc. Mapping of potential hazard can incorporate all these factors. Some publications by Queensland Department of Local Government and Planning (QDHLG&P n.d.; DCILGPS 2000), CSIRO (CSIRO and Standards Australia 1993), and Australian Standard AS 3959- 1999 provide some guidelines for planning and design and construction of buildings in bushfire prone areas and could form the basis of code provisions.

Resource management considerations for bushfire include maintenance of biological diversity and ecological processes (Stanton 1991; Bird Rose 1995; Merrick 1996; Logan City Council 1996), fire as a land management tool (Pressland et al 1991) and protection of productivity of land for timber, crops and pasture. Essential as they may be, land management fires are the source of many wildfires (Luke and McArthur 1977). EPA and DNR&M have some expertise in broadacre fire management..

Grass fires are excluded from the discussion paper's definition of fire yet fires can travel far faster across grassland than forest or woodland and can cause houses and other structures to burn (Luke and McArthur 1977).

Luke and McArthur (1977) state that Queensland is highly varied with seven vegetation/fuel types recognised and three bushfire zones designated (Northern Zone = Gulf of Carpentaria and Cape York Peninsula; Eastern Zone = east of the Great Dividing Range from the NSW border north to Cooktown and the Western Zone = west of the divide and south of the gulf country). Fires have occurred in every month of the year with eastern zone experiencing most fires in Spring (Luke and McArthur 1977. The occurrence of fire "blow up" weather is the critical indicator of immediate fire danger rather than a nominated season.

Landslips

Landslips by definition cannot occur on flat land. Slope, rainfall, soil/geology and vegetation interact to create a level of risk of landslip. Various studies have mapped landslip risk in limited areas (Anon 1983; Willmott 1978, 1983, 1984; Hofmann 1984). With funding, similar studies could be extended to other areas. Some risk assessments have been undertaken by AGSO.

Methods are available for assessing slope for engineering, building and stability (Taylor et al 1977); computer aided design for construction on slopes (Donald 1989), assessing soils for urban land use capability and landslip potential (Hicks and Hird 2000; Rosewell et al 2000).

This department has expertise in soil science and landslip risk assessment, especially with integration with the former Mines Department.

Earthquakes

Earthquakes may be more likely in the eastern fold belt than the inland cratons and sedimentary basins, however no discrete tectonic fault zones on the scale of Japan or California exist in Australia, meaning that location is a less significant indicator of risk. 95% of all earthquakes occur at the boundaries of two converging tectonic plates. The nearest boundaries run through Indonesia, New Guinea and to the west of New Zealand. (note that plate tectonic processes build elastic strain energy at faults causing earthquakes not volcanic activity as stated in the discussion paper). The remaining 5% of earthquakes are associated with older less active former plate boundaries. Very few occur along faults in more stable geologies (Merritts et al 1998, AGSO Fact Sheet on Earthquakes). Nonetheless, University of Queensland's Russell Cuthbertson has undertaken some assessment of earthquake risk including mapping (Jeff Lloyd pers. comm.). AGSO has published preliminary earthquake assessments for Mackay and Gladstone (Middelmann and Granger 2000; Granger and Michael-Leiba 2001).

Earthquakes (tremors) have occurred in central Queensland including Monto in the 1930's and Yeppoon early 1990's (Jeff Lloyd pers. comm.). The Aldoga/Yarwun area is considered to have an elevated earthquake risk, which has implications for major industrial developments, mining and water supply. Damage from earthquakes is increased for buildings and infrastructure located on 'soft sediment' in comparison to 'hard rock' or consolidated sediment as soft sediments can become plastic and deform more readily or even 'liquify' (especially with a high water content) in response to shaking on the scale caused by tremors.

Severe storms can happen anywhere that meteorological conditions occur.

However it can be argued that risk of damage from earthquakes and severe storms will increase with density of settlement. Some areas experience a higher frequency of lightning strikes which can pose hazards especially to overhead wires. Some mapping has been conducted by electricity utilities and Telstra.

Feedback was requested on the Table in 2.7.7 of the discussion paper, see Table 1 below.

Table1 Summary of Possible Planning Measures

Natural Phenomenon/ Disaster	Land Use Planning	Mitigation Infrastructure	Development Assessment
Cyclones	Windspeeds decrease with distance inland, ie high risk areas can be mapped	Damage protection eg underground utilities (power, phone, etc)	Building Code (wind ratings, tie down etc)
Storm Surge	Risk assessment and mapping can map areas likely to be affected (by a range of low atmospheric pressures and return intervals)	Damage protection eg underground utilities (power, phone, etc) Sea walls, levees etc	Areas at risk designated for types of development that reduce exposure of people (and property) to hazard
Tsunami	Risk assessment can help identify coastal areas at risk (see AGSO fact sheet)		
Flooding	Catchment upstream measures that seek no increase in runoff (maintain natural hydrology), Determination and mapping of designated flood extent. Could be linked with planning for dam-break flooding Needs to consider work and plans of River Improvement Trusts (Consider benefits of flooding)	Flood mitigation structures eg dams, levees, retention basins, vegetation management, levees, flood channels. Design and location of infrastructure on floodplains to avoid exacerbating flood flows and impacts.	Assessment must be in context of cumulative impact of developments already approved. Approval (of say a residential subdivision) does not guarantee flood free status (the maximum probable flood will exceed the designated flood event).
Landslip	High risk areas are mappable either at a strategic (whole of shire) level or required case by case for material change of use/reconfiguration of a lot towards closer settlement. Alternatively an area can be surveyed and mapped into 'urban capability classes' (Hicks and Hird 2000)	Vegetation retention, road engineering standards, retaining wall standards	Site specific geotechnical investigations relevant to risk areas or appropriate to urban land capability class, appropriate engineering requirements for roads and site works (eg avoiding cut-and-fill) or building design
Bushfires	Mapping of risk ratings can be achieved through survey of vegetation, climate, topography/slope, aspect, known fire history and behaviour etc (Luke and McArthur 1977) Need to consider maintenance of biodiversity (Stanton 1991, Debra Bird Rose 1995, Merrick 1996) and property management application (Pressland et al 1991) of fire.	Adequate water supply with hydrants compatible with bushfire brigade or metropolitan service, Roads or 'drive-over' landscaping routes that allow emergency access Fire breaks or machinery access.	Subdivision and road layout, house envelopes, individual or community fire fighting water supply and equipment. Siting, design and construction (CSIRO are developing a Fire Safety Design Code for future inclusion in Building Code of Australia and Australian Standard AS 3959-1999) Fire management plans with rural/metropolitan bushfire brigade involvement
Severe Storms	Can happen virtually anywhere		Building Code of Australia
Earthquakes	Low probability, fault zones/fold belts more vulnerable than inland cratons and sedimentary basins. Some preliminary coarse risk assessment has been made by AGSO.	Earthquake building standards	Avoid high risk sties underlain by soft sediments. Building Code of Australia

REFERENCES

Anon, 1983, *Slope stability and its constraints on closer settlement on the Mapleton-Maleny plateau, southeast Queensland*, The Survey, Brisbane.

Agriculture and Resource Management Council of Australia and New Zealand, 2000, *Floodplain Management in Australia- Best Practice Principles and Guidelines*, SCARM Report 73, CSIRO Publishing, Collingwood

Brisbane City Council, 2000, *Natural Channel Design Guidelines,* Brisbane City Council (in co-operation with Grant Witheridge, Catchments and Creeks Pty Ltd)

Bureau of Meteorology, 1990, *April 1990 floods Inland Queensland,* Bureau of Meteorology, Brisbane

Crimp, S., 2000, *Queensland Climate Change and Community Vulnerability to Tropical Cyclones – Ocean Hazard Assessment Stage One,*

CSIRO and Standards Australia, 1993, *Building in bushfire-prone areas - information and advice* SAA HB 36 - 1993

D. K. Taylor, J. G. Hawley and B. W. Riddolls (compilers), 1977, *Slope stability in urban development: a handbook*, Science Information Division DSIR, Wellington, New Zealand

Deborah Bird Rose (ed.), 1995, *Country in Flames - Proceedings of the 1994 symposium on biodiversity and fire in North Australia*, Biodiversity Series, Paper No 3, Biodiversity Unit, Department of the Environment, Sport and Territories, Canberra

Department of Natural Resources and Mines, 2001a, *Draft Guidelines: Failure Impact Assessment of Water Dams*, DNR&M, Brisbane

Department of Natural Resources and Mines, 2001b, *Queensland Safety Management Guidelines for Referable Dams,* DNR&M Brisbane

Department of Water Resources, 1990, *Flood Investigation, Nyngan, April 1990,* Department of Water Resources New South Wales

DNR&M, 2001c, *Proserpine River at Peter Faust Dam: Revised Flood Study*, Surface Water Assessment Group, Department of Natural Resources and Mines, Brisbane

Donald, I. B., 1989, *Soil slope programs review*, Association for Computer Aided Design, Melbourne

Ken Granger and Marion Michael-Leiba (eds.) 2001, *Community risk in Gladstone: a multi-hazard risk assessment*, AGSO – Geoscience Australia, Canberra

Hicks, R. W. and Hird, C., 2000, "Soils and Urban Land Use", Chapter 21 in P. E. V. Charman and B. W. Murphy (eds.) *Soils: Their Properties and Management,* Oxford University Press, Oxford

Hofmann, G. W., 1984, *Slope stability and its constraints on closer settlement in the Cairns area,* Geological Survey of Queensland, Brisbane.

J. R. Merrick (ed.), 1996, *Fire and Biodiversity The Effects and Effectiveness of Fire Management - Proceedings of a Conference held 8 – 9 October 1994, Footscray Melbourne,* Biodiversity Paper No 8, Biodiversity Unit, Department of the Environment, Sport and Territories, Canberra

Logan City Council, 1996, *Bushfire Management Conference – Proceedings April 1996 Kimberley Park Community Centre*, Logan City Council

Luke, R. H. and McArthur, A. G., 1977, *Bushfires in Australia,* Australian Government Publishing Service, Canberra

M. G. Anderson and K. S. Richards, (eds.) 1987, *Slope stability; geotechnical engineering and geomorphology,* Wiley, New York

Merritts, D., De Wet, A. and Menking, K., 1998, *Environmental Geology: An Earth Systems Science Approach,* W. H. Freeman and Company, New York

Miriam Middelmann and Ken Granger (eds.), 2000, *Community Risk in Mackay: A multi-hazard risk assessment*, Australian Geological Survey Organisation, Canberra

Pressland, A. J., Stanton, J. C. and McLennan, S., 1991, "The Role of Fire in the Grazing Lands of Queensland", pp237 – 249 in B. R. Roberts (ed) *Fire Research in Rural Queensland*, Land Use Study Centre, USQ, Toowoomba

Queensland Department of Communication and Information, Local Government, Planning and Sport, 1995, *Protecting your home against bushfire attack* (reprinted 2000)

Queensland Department of Housing, Local Government and Planning, (n.d.), *Bushfire-prone areas – Siting and design of residential buildings*

Rosewell, C. J., Crouch, R. J., Morse, R. J., Leys, J. F., Hicks, R. W. and Stanley, R. J., 2000, "Forms of Erosion", Chapter 2 in P. E. V. Charman and B. W. Murphy (eds.) *Soils: Their Properties and Management,* Oxford University Press, Oxford

Scott & Furphy Pty Ltd, 1991a, *Western Queensland Towns Flood Study Volume 1 Report*, Water Resources Commission, Brisbane

Scott & Furphy Pty Ltd, 1991b, *Western Queensland Towns Flood Study Volume 2 Appendices,* Water Resources Commission, Brisbane

Smith, D. I. 1998a, *Urban Flooding in Queensland- A Review,* Department of Natural Resources, Queensland, Brisbane

Smith, D. I., 1998b, *Water in Australia: Resources and Management*, Oxford University Press

Smith, D. I. and Greenaway, M. A., 1994, *Tropical storm surge, damage assessment and emergency planning: a pilot study for Mackay, Queensland*, Centre for Resource and Environmental Studies, Australian National University, Canberra

Standards Australia, 1999, *AS 3959 Construction of buildings in bushfire-prone areas,* Standards Australia, Sydney

Stanton, J. P., 1991, "Fire Management on National Parks in a Range of Tropical Environments – A Manager's Perspective", pp412 – 415 in B. R. Roberts (ed) *Fire Research in Rural Queensland*, Land Use Study Centre, USQ, Toowoomba

Willmott, W. F., 1978, *Slope stability and its constraints on building in the Rosewood-Marburg area*, Geological Survey of Queensland, Brisbane.

Willmott, W. F., 1983, *Slope stability and its constraints on closer settlement in the Canungra-Beechmont-Numinbah area, southeast Queensland*, Geological Survey of Queensland, Brisbane.

Willmott, W. F., 1984, *Slope stability and its constraints on closer settlement in the foothills of the Toowoomba Range, Gatton Shire*, Geological Survey of Queensland, Brisbane.

GOVERNMENT ADVISORY COMMITTEE MEETING
State Planning Policy
Natural Disaster Mitigation

9:30 am – 12:30 pm Thursday 7 March 2002

Media Room, Block E, Emergency Services Complex,
Cnr Kedron Park Road and Park Road, Kedron

AGENDA

1. Introduction
2. Apologies
3. Confirmation of previous minutes
4. Progress against project timetable, including status report
5. Engagement of consultant for Stage 2 of the development of the State Planning Policy
6. Lifeline infrastructure issues
7. Progress on preparation of draft State Planning Policy
8. State Coastal Management Plan guidelines
9. Flood mitigation issues
10. Other Business
11. Next meeting.

GOVERNMENT ADVISORY COMMITTEE MEETING
State Planning Policy
Natural Disaster Mitigation

9:30 am – 12:30 pm Thursday 7 March 2002

Media Room, Block E, Emergency Services Complex,
Cnr Kedron Park Road and Park Road, Kedron

AGENDA

1. Introduction
2. Apologies
3. Confirmation of previous minutes
4. Progress against project timetable, including status report
5. Engagement of consultant for Stage 2 of the development of the State Planning Policy
6. Lifeline infrastructure issues
7. Progress on preparation of draft State Planning Policy
8. State Coastal Management Plan guidelines
9. Flood mitigation issues
10. Other Business
11. Next meeting.

Carol Russell

From: [redacted]
Sent: Friday, 8 February 2002 11:03 AM
To: [redacted]

Subject: Government Advisory Committee minutes for State PlanningPolicy


GAC Minutes 6Dec01.doc


InterScan_Disclaimer.txt

Dear Government Advisory Committee members / representatives

Attached are the minutes from the last Government Advisory Committee (GAC) meeting. Please inform me by 3pm Thursday 14 February if there are any amendments you recommend.

You may contact me by return email or by telephoning [redacted] or [redacted]

I will contact you within the next week or two concerning the agenda for the next GAC meeting.

Many thanks.

[redacted] I AM UNABLE TO DELIVER THIS BY EMAIL TO [redacted] WOULD YOU PLEASE FORWARD IT TO HIM? MANY THANKS. [redacted]

[redacted]
Principal Policy Officer
Disaster Mitigation Unit
Counter Disaster and Rescue Services
Department of Emergency Services
Telephone: [redacted]

Government Advisory Committee Meeting Minutes 6 December 2001
State Planning Policy for Natural Disaster Mitigation

Queensland Government Agency	Nominated Representative	Attendee
Department of Local Government and Planning	[redacted]	
Department of Main Roads		
Department of Natural Resources and Mines		
Department of Premier and Cabinet		
Department of Primary Industry		
Department of Public Works		
Department of State Development		
Environmental Protection Agency		
Queensland Transport		
Queensland Fire and Rescue Service		
Department of Emergency Services		
Guest: Environmental Resources Management Australia (consultant)		

Agenda Item 1: Introduction

[redacted] Acting Director Disaster Mitigation Unit, welcomed and thanked attendees. [redacted] introduced [redacted] the SPP Project Team Leader, and explained that the purpose of the meeting was to receive feedback from other Government agencies concerning the outcomes of the public consultation for Stage 1 and discuss timing and preparation for Stage 2.

Action: No action required.

Agenda Item 2: Apologies

Apologies were received from [redacted]

Action: No action required.

Agenda Item 3: Confirmation of previous Minutes

The Chair confirmed that all actions noted in the Minutes of the meeting on 2 August 2001 were completed. [redacted] advised that he had attended the last meeting as the representative from Queensland Transport, not [redacted] proposed that the Minutes be confirmed as a true and accurate record. The Minutes were accepted by the Committee.

Action: Note change of attendee name for Queensland Transport.

Agenda Item 4: Project timetable

[redacted] presented a work program and outlined the important milestones as:

- Preparation of a draft State Planning Policy (SPP) and Guidelines by 31 May 2002;
- Cabinet agreement of a draft SPP in August 2002;
- Public consultation on draft SPP in September/October 2002; and
- Cabinet approval and Minister for Local Government and Planning adoption of the SPP in February 2003.

The major uncertainties in the project timetable are expected to be the response of Local and State Governments during the consultation period and prior to Cabinet approval of the final SPP.

Action: No action required.

Agenda Item 5: Presentation by the consultant

The draft Preparation Stage Consultation Report had been circulated to members [redacted] Environmental Resources Management Australia, made a presentation to the meeting reviewing the consultation process, response, workshops, submissions, report and recommendations.

Action: No action required.

Agenda Item 6: Review of written submissions

[redacted] presented a report on the forty-two (42) written submissions about the proposal to prepare a SPP. [redacted] (DLGP) requested that the response to Sarina Shire Council (no. 31) should clarify that NDRA requirements do not stipulate development controls, and that the term "noted" be expanded to include any necessary action[redacted] EPA) requested that references to CMP be changed to SCMP to accurately refer to the State Coastal Management Plan. DNRM and EPA representatives advised that their Departments were still intending to forward written submissions.

Action: DNRM and EPA to lodge submissions with DES.
DES to make amendments noted.

Agenda Item 7: Draft report to Ministers

Richard Wood briefed the Committee on the draft report to the Ministers for Local Government and Planning and the Minister for Emergency Services regarding the public consultation process and the scope of the proposed SPP.

Action: DES to amend the Analysis Report as follows:

1. A recommendation to proceed with drafting a SPP be included in the report to the Minister for Local Government and Planning and the Minister for Emergency Services and that the name of the policy be State Planning Policy for Natural Disaster Mitigation.
2. Further research is needed to include consideration of earthquakes and wind eg for structures not covered by Building Codes of Australia.
3. Sections 5.8 Litigation and 5.10 Intra-Government Relationships should include reference to DNRM's draft Discussion Paper on a State Flood Mitigation Policy.
4. The Conclusion be changed to reflect that the SPP addresses planning scheme amendments and development applications.

Agenda Item 8: Consultant's brief for Stage 2

There was a general discussion about the contents of the draft consultant's brief for the preparation of the draft SPP and associated guidelines.

Action: DES to amend the brief to include preparation of guidelines, where necessary (flood mitigation guideline to be provided by DNRM); preparation of codes, where necessary; and Department of Public Works added to GAC members in attachment 2.

Agenda Item 9: Intra-government relationship – flood mitigation

[redacted] advised GAC members that DNRM had developed a draft Discussion Paper on a State Flood Mitigation Policy (SFMP) and that DNRM and DES were currently in the process of clarifying the possible roles of the SPP and the SFMP.

Action: [redacted] to request the Director-General of DES to sign a letter to the Director-General of DNRM to seek support for a whole-of-Government approach.

Agenda Item 10: Other business

[redacted] (DLGP) advised that the Integrated Planning and Other Legislation Amendment Bill 2001 was introduced to Parliament on 28 November 2001.

Action: No action required.

[redacted] (EPA) advised that draft Guidelines for the State Coastal Management Plan had been released for State agency comment.

Action: DES to review and comment on draft Guidelines before the end of December 2001.

Agenda Item 11: Next meeting

It was agreed that the next meeting will be held at Kedron at 9.30am on Thursday, 7 March 2002.

Action: GAC members to note date.

Close

[redacted] thanked participants for attending and for their significant contribution.

[redacted]
Project Team Leader, SPP
Disaster Mitigation Unit
Counter Disaster and Rescue Services
Department of Emergency Services

Ph: [redacted]
email [redacted]

Queensland Government

Counter Disaster and Rescue Services

Department of Emergency Services

Ph: [redacted]
Our Ref: CDS 4894

30 November 2001

DOCUMENT RECEIVED BY DNR

22 MAY 2002

File No. IRM/085/000(0033)2

File Location R. CUEREL

Action By N.F.A.

Registered Y / N Doc. Code IR02/01337

MOVEMENT INSTRUCTIONS MUST BE SHOWN ON FRONT COVER.

Mr Russell Cuerel
Senior Project Officer, Water Use
Department of Natural Resources and Mines
GPO Box 2454
BRISBANE QLD 4001

Dear Mr Cuerel

Please find enclosed the Agenda papers for the next Government Advisory Committee Meeting for the State Planning Policy on Land Use Planning for Natural Disaster Mitigation and Development Assessment. The meeting is to be held on Thursday 6 December 2001 from 9.30am – 12.30pm in the Media Room, Level 2, Block E, Emergency Services Complex, cnr Park and Kedron Park Roads, Kedron.

Car parking has been arranged in the lower visitor's car park. Entry into this car park is off Gympie Road. Please use the visitor's intercom to ring through to security.

[redacted]

A/Director
Disaster Mitigation Unit

Disaster Mitigation Unit

Emergency Services Complex
Cnr Kedron Park Road & Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 [redacted]
Facsimile +61 7 3247 8480
Website www.emergency.qld.gov.au

ABN 92 265 149 823

Queensland Government
Department of Emergency Services
Counter Disaster and Rescue Services

GOVERNMENT ADVISORY COMMITTEE MEETING
State Planning Policy
Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP)

9:30 – 12:00pm Thursday 3 April 2003

Liaison Room, Block E, Emergency Services Complex,
Cnr Kedron Park Road and Park Road, Kedron

MEETING NOTES

ATTENDEES

Organisation	Nominated Representative	Attendee
Department of Local Government and Planning (DLGP)	[redacted]	
Department of Main Roads (DMR)		
Department of Natural Resources and Mines (NR&M)		
Department of Premier and Cabinet (DPC)		
Department of Primary Industries (DPI)		
Department of Public Works (DPW)		
Department of State Development (DSD)		
Environmental Protection Agency (EPA)		
Queensland Transport (QT)		
Local Government Association of Queensland (LGAQ)		
Planning Institute of Australia (Qld Division) (PIA)		
Department of Emergency Services (DES)		

1. Welcome and Apologies

The meeting Chair [redacted] of the SPP Team, welcomed meeting attendees. [redacted] explained that the purpose of the meeting is to review the results of the consultation program, proposed amendments to the SPP and Guideline, and the program of activities leading to the formal adoption of the SPP and Guideline. [redacted] advised of the apologies noted above, and advised that DMR, DPW, DSD and PIA have provided advice in support of the Final Draft State Planning Policy (SPP) and Guideline. .

2. Confirmation of Minutes of 19 December 2002 Meeting

Meeting attendees accepted the minutes of the GAC meeting held on 19 December 2002.

3. Consultation Stage

Raelene Corner of the SPP Team provided meeting attendees with a presentation on the key outcomes of the Consultation Stage that occurred from 19 October 2002 to 13 December 2003 .

- Sixty-eight (68) written submissions were received with 64 in support of the Draft SPP.
- Workshops were attended by approximately 350 people, with more than 340 people in support of the draft SPP.
- Significant issues raised focused on improving the clarity and operation of the SPP and Guideline.
- All GAC members had been provided with a copy of the revised Final Draft SPP including amendments resulting from the consultation stage.
- The next stage of the SPP is the Adoption Stage – The Minister for Local Government and Planning must:
  - consider every properly made submission about the proposed SPP;
  - adopt the notified SPP, adopt a modified SPP or not adopt the SPP; and
  - advise each principal submitter of the decision and the reasons for the decision.

4. Cabinet Submission and timing of activities

- Cabinet endorsement will be sought for the decision of the Minister for Local Government and Planning to adopt the SPP and Guideline, and for some related issues [amendments to the Standard Building Regulations (SBR) and a proposed Memorandum of Understanding (MOU) between DES and NR&M].
- The Cabinet submission will be first lodged on 28 April, with second lodgement on 6 May 2002. The submission will be considered at the Cabinet meeting of 12 May 2003.
- It is hoped that formal adoption of the SPP by the Minister for Local Government and Planning will occur in early June 2003.
- It is anticipated that the SPP would become operational at the end of August following a three month administration period to allow for production and dissemination of the SPP, and a training program.

5. Purpose of this meeting

The purpose of this GAC meeting is:

- to consider issues arising from the Consultation Stage and proposed responses; and
- to seek the formal agreement of the GAC to the Final Draft SPP and Guideline prior to lodgement of the Cabinet Submission.

6. Key issues arising from consultation stage

1. **Range of Natural Hazards** - should the SPP address a broader range of issues including storm tide, strong winds and earthquakes?
   - Proposed Response:
     - Storm tide inundation - SCP Guideline being prepared by EPA.

- Strong winds/earthquake – design and construction standards including SBR.
- Change title to "Mitigating the Adverse Impacts of Flood, Bushfire and Landslide"

2. **Default Flood and Timelines:** Default NHMA for flood and no mandatory timeframe for addressing flood hazard. Suggested defaults – highest recorded flood and the 1% AEP flood.

- Proposed Response:
  - Lack of reliable State-wide flood data and the cost/time required to generate reliable flood data resulted in retaining draft SPP approach;
  - Flood definition amended; and
  - Using Annual Exceedance Probability (AEP) now instead of ARI.
- Other possible tools being considered:
  - linking funding assistance under the Natural Disaster Risk Management Studies Program (NDRMSP) with a requirement that the results of the studies are translated into practical amendments to local government planning schemes within a reasonable time frame.

Agreed: Changes made to the Final Draft SPP in relation to flood are satisfactory.

3. **Conflict with other Values**: Concern that SPP requirements to ensure safety of people and property (e.g. fire breaks) would override other values (e.g. conservation, heritage and amenity values).Proposed Response:

- SPP/Guideline amended to clarify relationship with other policy considerations (see para 3.2 of SPP, and para 3.9 and 3.10 and General Note to Appendix 5B of SPP Guideline).

Agreed.

4. **Vegetation Clearing**: Application of the SPP to vegetation clearing in an NHMA (landslide) was excessively broad and would overlap with the *Vegetation Management Act* (VMA).Proposed Response:

- VMA protects native vegetation, whilst SPP addresses clearing of any vegetation that could adversely affect landslide or flood hazard.
- SPP/Guideline now includes definition of vegetation clearing consistent with VMA (see SPP, p11).
- Explanatory footnote (See Attachment 1 to these minutes which is a handout provided at the meeting) on vegetation clearing definition as requested by EPA.

Agreed.

5. **Unacceptable Risk:** Further guidance was sought on how to determine whether a development would result in an "unacceptable risk to people or property" as required by Outcome 2.

- Proposed response:
  - Annexure 5 of the SPP identifies the minimum requirements that must be achieved to satisfy the "unacceptable risk" test.
  - Matter for consideration: Should the minimum requirements for flood also include specific outcome 2 (see Annexure 4).

Agree: subject to following action.

Action: DES to contact DMR and Queensland Transport to seek their comments on this issue.

6. **Evacuation Requirements:** Evacuation routes identified as unworkable (especially for community infrastructure) in many parts of Queensland (e.g. Townsville City) have virtually no

roads that would meet the standard and it was difficult to specify the required extent of the evacuation route.

- Proposed response - Amendments to:avoid reliance on permanent road access;
  - ensure key community infrastructure has an emergency rescue area;
  - SBR to require habitable floor levels to be 300 mm above DFE;
  - include options (e.g. adequate flood levels, access routes, flood warning time, safe refuge areas) as acceptable means of ensuring personal safety in non-residential development; and
  - Explanatory footnote (see the handout Attachment 1) for Solution 1.3 to be added to the comments column of Appendix 5a.

Agreed.

- Discussion: The question was raised on any discrepancy between the definition for Community Infrastructure in the SPP and the Building Code of Australia. It was noted that the SPP operates under the *Integrated Planning Act 1997* (IPA) and therefore uses IPA definitions. The issue is whether IPA is consistent with the Building Code of Australia.

7. **Development Commitment:** Definition of development commitment (used in Outcome 1) was confusing and required clarification.Proposed response - definition clarified by:
   - removing exempt development and certain other development to which the SPP would not apply in any case; and
   - making it clear that forward planning designations (e.g. in a strategic plan or DCP under a transitional planning scheme) do not constitute a development commitment for the purposes of the SPP.

   Agreed.

8. **Lower Level of Risk:** The assessment of "lower level of risk than generally applies to development in the vicinity" required (under certain circumstances) under Outcome 1 of the SPP would be difficult to undertake in practice.Proposed response:
   - Requirement removed from SPP,
   - Development under relevant circumstances still required to achieve Outcome 2 (i.e. minimising adverse impacts and avoiding unacceptable risk) so the SPP effectiveness remains.

   Agreed.

9. **Development and Assessment Thresholds**: Wanted more precise thresholds to identify the development to which the SPP applies for assessment purposes.
   - Proposed Response:
     - SPP/Guideline made more specific wherever possible, e.g:
       - $50m^3$ threshold for net filling in NHMA (flood) (with flexibility for local governments to adopt lower levels);
       - Uses more precise terminology (i.e. no increase in the number of people); and
       - More precise definition of vegetation clearing and floodway (with flexibility for local governments).

   Agreed.

10. **Compatible Development**: Need for more detailed advice in interpreting the SPP on what is compatible development.

- Proposed response:
  - A refined version of Appendix 5 including the specific outcomes and solutions with explanatory comments improves the interpretation of compatible development.

Agreed.

Other issues

- Queensland Fire and Rescue Service (QFRS) representatives [redacted] advised that they were satisfied that QFRS interests could be met within the existing process framework provided by the SPP.
- [redacted] of the Department of Primary Industries agreed with QFRS comments. Barry expressed some concern regarding Page 58, Solution 1.2a. However, after some discussion GAC members agreed that no change was required.
- [redacted] (QT) raised the issue that 'overriding need' could be included in the glossary. It was discussed and agreed that the issue is adequately covered in 6.18 of the Guidelines.
- [redacted] (LGAQ) raised an issue on behalf of a local government without a DFE. The local government was proposing to use a 1:55 event as the DFE. Meeting attendees agreed that it would be preferable for the local government to seek the advice of an engineer and approximate the 1:100 event.
- Russell Cuerel (NR&M) raised the following issues:
  - NR&M is a concurrence agency for works in a watercourse (Table 5). Agreed to add this as a note in the Comments column of the table.
  - Request that the glossary definition of PMF uses the term 'reasonably' rather than 'conceivably'. Agreed to amend as proposed.
  - Page 12, Annex 1, paragraph A1.1c refers to note 25, which should be 26. Agreed to correct this reference.

7. What next?

Meeting attendees were requested to provide [redacted] with written expressions of support for the Final Draft SPP and Guideline.

- [redacted] advised that QT supported the Final Draft SPP following further consideration on the need for a definition of 'overriding need' in the glossary and the action item relating to key outcome number 5 'Unnacceptable Risk'.

[redacted] (DLGP) requested the progression of the MOU between DES and NR&M before the SPP becomes operational and progression on the Building Code amendments. Agreed that action on these is important, but that the SPP and Guideline should be given priority at this stage.

Action: DES to email a draft of the MOU to Russell Cuerel (NR&M)

- [redacted] advised that the LGAQ supports the Final Draft SPP and will provide a letter of support.

8. Close

[redacted] thanked everybody for their participation and assistance in the development of the SPP and Guidelines. The meeting closed at 11:30am.

End

Enclosure – Attachment 1

Additional
amendments to Final Draft of the SPP and Guideline

HANDOUT
for Government Advisory Committee to consider at meeting held on 3 April 2003.

Key issue 4: Vegetation Clearing

At EPA's request, propose to add the following explanatory footnote to the "vegetation clearing" definition:

"Proposals that involve vegetation clearing may also be required to address relevant requirements of the VMA, as well as local laws and the planning scheme. Information and advice on these matters should be sought from NR&M and the local government".
(SPP, page 11; Guideline, page 28).

Key issue 6: Evacuation requirements

Proposed to add the following explanatory note for 1.3 to the Comments column of Appendix 5A:

"No minimum access requirements are being required for residential development because the nature and impacts of flooding vary widely throughout the State, as do the expectations and abilities of communities to cope with flood events. Local governments should consider specifying minimum access requirements that are appropriate to the flooding characteristics of particular localities, including the likely duration of inundation and the susceptibility of the wider road network to flooding at the DFE."
(Guideline, page 53).

Ipswich Planning Scheme (Walloon Thagoona Master Plan Amendements) –State Interest Check – Comments relating to SPP1/03 (Flood)

The proposed planning scheme amendments for Ipswich City Council in relation to the Walloon Thagoona Master Plan does appropriately reflect SPP1/03 in relation to flooding.

The proposed planning scheme amendments explicitly identify flooding as a constraint on future urban development and identify the possible need for more detailed studies to define which land is suitable for future development.

It is also noted that the proposed zone amendment map for Walloon – Thagoona, has nominated land that is subject to inundation by the 1% AEP flood event (as identified on the existing Planning Scheme Overlay Map OV5) as Recreation Zone.

EMERALD

Cuerel Russell

From: [redacted]
Sent: Tuesday, 19 October 2004 9:37 AM
To: [redacted]
Cc:
Subject: RE: State interest concerns over inadequacy of draft Emerald planning scheme re flooding

[redacted]

DES response for EMerald was completed on 6 Oct and forwarded to DLGP. Comments on flood issues, particularly from SPP 1/03 perspective, were provided by [redacted] and were incorporated into the DES response. A copy of the final DES coordinated response was forwarded to Peter who was relieving for Upali at the time.

To ensure consistency of advice, you may like to follow up with Upali as to what comments regarding flood were provided to DLGP.

Regards

[redacted]

Senior Project Officer
Disaster Management Services
Counter Disaster and Rescue Services
Department of Emergency Services
email: [redacted] telephone: [redacted]

-----Original Message-----
From: [redacted]
Sent: Monday, 11 October 2004 12:19 PM
To: [redacted]
Cc: [redacted]
Subject: State interest concerns over inadequacy of draft Emerald planning scheme re flooding

Gentlemen

I am nearly finished NR&M's first State interest check of Emerald's draft Planning scheme.

Flooding is poorly addressed. This is curious because in 1996: Emerald Shire Council said that nearly 3,000 residences are at risk from flood (the PMF?), 20 were damaged in the flood of November 1950 and 200 would be affected by the adopted event.

Flood mapping is available in the form of paper plans (from historic events) and model runs undertaken for the Nogoa Flood Plain Board.

The draft plan has a Natural Disaster overlay which doesn't mention flooding.

No flood immunity level is adopted (apart from some ARI's for conveyance of stormwater in Schedule J and some references to QUDM). Flood immunity for new or redeveloped buildings/areas is to be determined on a case by case basis. Intensive animal industry, as an example of a land use with potential to pollute water supplies, is required to not use land "prone to flooding" but no guidance to levels or ARI's is given (no solutions are specified).

See attachment for details

<<Emerald flood vulnerability_ DI Smith 1998_BoM_Nogoa Plan.doc>>

Your advice is welcome

Cheers

[redacted]

Regional Resource Planning Officer
Department of Natural Resources and Mines Central West Region Phone [redacted]
[redacted] P O Box 1762 Level 2, 209 Bolsover Street Rockhampton 4700

[redacted] 004 4:05 PM

Subject: RE: Emerald response

Attachments: DLGP ltr re Emerald 1st SI check1 PNver.doc

[redacted]

Please find amendments on flood (highlighted in blue) to your original response.

DLGP ltr re Emerald 1st SI che...

[redacted]

Engineer, Water Use, Water Management & Use
Department of Natural Resources and Mines
Level 8 Mineral House 41 George St BRISBANE QLD 4000
GPO Box 2454 BRISBANE QLD 4001

Ph: (0[redacted]
Qnet:
Fax: (
Email

-----Original Message-----
From: [redacted]
Sent: Wednesday, 6 October 2004 9:11 AM
To: [redacted]
Subject: Emerald response

As discussed, please look at Flood and add requirements appropriate for SPP 1/03 and known flood studies.

Will need your response back asap as this is very overdue.

Thanks
<<DLGP ltr re Emerald 1st SI check.doc>>

No confidentiality or privilege is waived or lost by any mis transmission.

If you receive this correspondence in error please delete it from your system immediately and notify the sender.

You must not disclose, copy or relay on any part of this correspondence, if you are not the intended recipient.

Any opinions expressed in this message are those of the individual sender except where the sender expressly,

and with the authority, states them to be the opinions of the Department of Emergency Services, Queensland. << File: DLGP ltr re Emerald 1st SI check.doc >>

[redacted]

1 October 2004

Counter Disaster and Rescue Services

Department of
Emergency Services

[redacted]
Principal Planner
Western and Central Qld Planning Division
Department of Local Government, Planning, Sport and Women
PO Box 113
ROCKHAMPTON QLD 4700

[redacted]

1st State Interest Check – Emerald Shire IPA Planning Scheme

I refer to your request seeking comments from this Agency on the draft Emerald Shire IPA planning scheme prior to the public notification period.

The Department of Emergency Services' (DES) responsibilities include the Queensland Ambulance Service (QAS); Queensland Fire and Rescue Service (QFRS) including the Rural Fire Service; Counter Disaster and Rescue Services (CDRS) including the SES and Volunteer Marine Rescue Support; Chemical Hazards and Emergency Management; Aviation Services, and Disaster Mitigation. This is a coordinated whole of Department response.

The Department's interests in plan making and amending relate to natural disaster mitigation and emergency management issues. DES is responsible for the implementation of State Planning Policy 1/03 *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (SPP 1/03). The review of the draft Emerald planning scheme has been undertaken according to these interests.

SPP 1/03 requires planning schemes to achieve specific outcomes that ensure development minimises the impacts on people, property, economic activity and the environment. With regard to the Emerald draft IPA planning scheme, Council should be aware of the following SPP 1/03 requirements for making and/or amending a planning scheme.

- To appropriately reflect SPP 1/03 in the Emerald IPA planning scheme it should aim to achieve outcomes 1 to 6 outlined in the policy. Outcomes 1, 2 and 3 relate to development outcomes and development assessment. Outcomes 4, 5 and 6 address Natural Hazard Management Areas (NHMAs), planning strategies and planning scheme measures.

Disaster Mitigation Unit

Emergency Services Complex
Cnr Kedron Park Road & Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 [redacted]
Facsimile +61 7 3247 8480
Website www.emergency.qld.gov.au

ABN 92 265 149 823

- The SPP 1/03 Guideline provides assistance in how a planning scheme may achieve the specific outcomes and Appendix 5 provides a guide for detailed measures for achieving Outcome 1. For further information refer to SPP 1/03 Guideline.

- Until NHMAs are identified in the Emerald planning scheme, the default NHMAs outlined in Annex 3 of SPP 1/03 should be used for development assessment.

Part 5 of the draft Emerald Planning Scheme contains a Natural Disaster Overlay Code for bushfire and landslide. A number of changes are suggested at 5.4.2(2) to more accurately reflect the requirements of SPP 1/03.

- At 2, community infrastructure is stated as being listed at point 4. It should read 5;
- At 3, the SPP requires development to be compatible with the nature of the natural hazard not the NHMA; and
- At 4, remove management area and include a reference to the State Planning Policy 1/03 *Mitigating the Adverse impacts of Flood, Bushfire* not the draft policy.

Flood

The Emerald draft planning scheme has not addressed the natural hazard associated with flooding. The intention of the SPP 1/03 is to minimise the adverse impacts of flooding (amongst other natural hazards) to people, property, economic activity and the environment. This is done via the identification of NHMA (flood) for parts of the Shire that have existing development or are likely to be developed during the life of the planning scheme. This will enable SPP 1/03 to apply to development assessments in flood prone areas, providing appropriate measures to ensure the safety of community and property.

Emerald Council should be aware that SPP 1/03 recommends as an appropriate flood event the 1% Annual Exceedance Probability (AEP) flood as the Defined Flood Event (DFE) for determining a NHMA (flood). From the draft planning scheme it is not clear whether the Council has adopted a DFE for the Shire. It is noted that a Nogoa River Flood Plain Study was completed in 1996 and this study in conjunction with other future studies may assist Council in adopting an appropriate DFE. Council should adopt a Defined Flood Event (DFE) and map the DFE in developed areas and areas likely to be developed during the life of the planning scheme. Overlay flood mapping should also show the flood level or levels of the DFE to ensure an appropriate freeboard height can be determined therefore appropriately reflecting the requirements of Appendix 5A of the SPP 1/03 Guideline.

Deleted: adopted a flood immunity level

Deleted: is to identify and map the areas

Deleted: are

Deleted: developed

Deleted: flood mitigation

Deleted: sets

Deleted: of

Deleted: rather than an average recurrence interval, eg 1 in 100

An overlay code for flood outlining the specific outcomes and probable solutions for development in flood prone areas of the Shire, linked to a flood map, should be added to Part 5 of the Emerald planning scheme.

Bushfire

Map NDIS 1

It is noted the mapping data acknowledges being provided by the Queensland Fire and Rescue Service. Council should be aware that this data was provided as a guide only for Council to identify bushfire risk in the Emerald Shire. It was not intended to identify site specific lots. Map NDIS 1 makes reference to Planning Policy No.1 which provides descriptions of lots affected by bushfire. This policy was not available to this Agency for inspection at the time of this review. However DES recommends Council consider the implications of identifying site specific lots and attributing a specific bushfire risk. DES is not aware of any other local government that has chosen to identify site specific lots.

It could prove problematic for Council as bushfire hazard is not static and where specific lots have been attributed a medium or high risk, this may change over time. The intent of the mapping information provided by QFRS is that the indication of medium or high bushfire hazard in a development area triggers a site specific assessment of the hazard existing at the time of the development proposal. DES strongly recommends removing Planning Policy No.1 and deleting any reference to it on Map NDIS 1.

Council should also be aware that for the purposes of the *Standard Building Regulation*, local governments declare an area "bushfire prone". This will then trigger certain building requirements for that area. However, SPP 1/03 requires specific building design requirements in areas of high bushfire hazard only. To ensure that stringent building design requirements are not applied to areas of low and medium and therefore placing onerous requirements on building in these areas, DES recommends that two overlay maps are included in the Emerald Planning Scheme as follows:

- *Bushfire hazard* map indicating areas within the Shire that have a medium and high bushfire risk; and
- *Bushfire prone* map indicating areas with the Shire that have a high bushfire risk to satisfy the requirements of the *Standing Building Regulation.*

Bushfire Prone Land Overlay
It is recommended that the title of the overlay be changed from "bushfire prone" for the reasons stated above.

It appears as though Council has combined previous superseded bushfire methodology with the draft SPP to produce probable/acceptable solutions. The danger in this approach is that much of the previous bushfire requirements have been superseded and replaced with updated requirements outlined in SPP Guideline 1/03 and in the policy. It is acknowledged that Council has attempted to reflect the specific outcomes of SPP 1/03 in its Natural Disaster Overlay however some parts, particularly, the Bushfire Prone Land Overlay, is overly complex and difficult to follow.

The following changes are recommended:

- Changes need to be made throughout the overlay where reference has been made to the "draft" state planning policy. Reference should be made to State Planning Policy *Mitigating the adverse impacts of Flood, Bushfire and Landslide* (SPP 1/03).

- Table 5.4.1 lists all development as being bound by the bushfire overlay. However, SPP 1/03 states development to which the policy applies includes material changes of use and associated reconfigurations of a lot. In addition, for areas prone to flood and landslide, earthworks, vegetation clearing, filling and redirecting the existing flow of surface or groundwater are also included. Refer to Annex 1 of SPP 1/03 for further details.

- Part 5.4.2 (2) 3 states *Development is compatible with the nature of a natural hazard management area...* SPP 1.03 states that development should be compatible with the nature of the natural hazard <u>not</u> the natural hazard management area. Refer to Annex 4 for further details on how the Emerald Bushfire Prone Overlay can simply achieve the specific outcomes for bushfire.

- P/A 6.1 3 slope should read less than 15% not 20%. The SPP default of 15% is now the preferred slope gradient. Council is reminded that SPP 1/03 supersedes any previous QFRS or DLGP documents on siting and design. The diagrams shown at P/A6.1 should be removed. Refer to SPP Guideline 1/03 Appendix 5B for information on detailed measures that may be used.

- P/A 6.1 4 and P/A 6.2 1 are conflicting. P/A6.2 comes from SPP 1/03 and is the preferred setback. Again, Council should check Appendix 5B as it states *all development* not non-residential buildings.

- No requirements for accessible water supply for fire fighting in medium bushfire hazard areas. Refer to Appendix 5B.

- Reword S5 and P5 to reflect SPP 1/03. Refer Appendix 5B.

Having two bushfire maps would simplify this section and only require a building code response for the high hazard areas. The provisions within 5.4.2 may be arranged in order of the following:

- Avoid building in high hazard areas but if this is not possible then separate development from the hazard by roads, firebreaks and clearing of building envelopes plus provision for water supply. Only in high hazard areas, is there the additional requirement for building design response and bushfire management plans.

Generally, this section is problematic because of mixing of terminology and failing to step up requirements from medium to high bushfire risk areas. Overall, the Emerald Shire has mostly low and medium, with pockets of high, bushfire risk areas. SPP 1/03 requires only those areas with medium and high bushfire risk and with types of development that are likely to increase the number of people living or working there or involve the manufacture of storage of hazardous materials in bulk, to be protected from the impacts of natural hazards.

Council could simplify this overlay by ensuring development proposed in the medium and high bushfire risk areas is compatible with the nature of bushfire hazard. This information is available from Annex 4 of SPP 1/03 and Appendix 5B SPP Guideline.

Landslide

The Landslip Prone Land Overlay regulates all uses and works occurring on slopes greater that 15%. Council is reminded that development to which the SPP 1/03 applies includes material changes of use and associated reconfigurations of a lot and for landslide, building or other work that involves earthworks exceeding 50 cubic metres or vegetation clearing or redirecting the existing flow of surface or groundwater (Appendix 5 C:SPP Guideline). SPP 1/03 requires development to be compatible with the nature of the natural hazard, Council may want to consider that the application of the code to *all* uses and works may be excessive.

It is noted that Division 4 Schedule C contains information regarding how to determine slope analysis. This information appears to reflect the information contained in Appendix 10 of SPP Guideline 1/03. Rather than duplicate this information and to keep this section succinct, Council may like to consider removing Division 4 Schedule C and rewording P10.2 accordingly.

Conclusion

Prior to this scheme being publicly notified, DES requires the following issues to be addressed:

- DES recommends Council not to publicly notify the site specific lots affected by the Bushfire Prone Land Overlay. If agreed, Planning Policy No 1 should be removed and reference to it deleted from Map NDIS 1; and

- The inconsistencies outlined in the Bushfire Prone Land Overlay need to be addressed. Ideally, this overlay should be rewritten to better reflect the specific outcomes of SPP 1/03.

It is acknowledged the outstanding matters relating to flood will be addressed by Council as information becomes available.

[redacted]u wish to discuss these matters further please contac[redacted]

Thank you for the opportunity to be involved in the development of the Emerald IPA planning scheme. We look forward to our continued involvement.

Yours sincerely

[redacted]

A/Assistant Director
Disaster Management Services

Emerald.

Cuerel Russell

From: [redacted]
Sent: [redacted]
To: Cuerel Russell
Subject: RE: Emerald flooding

Hi again

My email program has been fixed! I can put subject lines in once again

Policeman's Creek flows through Rubyvale in the Gemfields and the study is not connected with flooding in Emerald township but is directed at determining flood levels against return periods FOR TOWN PLANNING PURPOSES in Rubyvale! This was then ignored in the Planning Scheme and I have suggested they pay attention to its findings and not just waste all the money and effort that went into it.

I have had several discussions with Kev Bickhoff and indeed he is also a bit concerned with assessment of flood impacts under the (Interim) Nogoa Flood Plain Plan when he departs. His departure and the potential vacuum left was his only reason in favour of rolling the Interim Plan into the planning scheme. Reasons against ended up prevailling. However as you are aware the Plan specifically mentions that the same model with better surveyed levels for the town of Emerald could be used to produce levels against return intervals (or AEP's) for urban Emerald... this bit I quoted back at the Council and their planners.

I hope your metering project is going smoothly

[redacted]

-----Original Message-----
From: Cuerel Russell
Sent: [redacted]
To: [redacted]
Cc:
Subject: RE:

Geoff,

All good stuff.

The department undertook the Nogoa flood study for Emerald SC around 1996/97 and produced an Interim (rural) Floodplain Management Plan. Emerald township was supposed to be modelled next and another plan developed, however it didn't happen (no more NHT $$). Upali should be able to check whether any further work has been done through the DMAP studies $$.

I understand the Nogoa River is the principal source of flooding in Emerald and there were also issues with railway culverts having a backwater effect within the town. The Shire Engineer [redacted] was the main driver behind all this and is a "font" of knowledge on Emerald flooding - but I hear is is soon to retire. I have not heard of teh policemans creek stuff and am bnnot aware of its significance (compaed with the river flooding) - unless it is associated with the railway issue and local runoff.

Appreciate you continuing to keep Upali in the loop.

cheers

-----Original Messa[redacted]
From:
Sent: [redacted]
To: Cuerel Russell
Subject: RE:

Hi Russell,
Sorry about lack of a subject line

My outlook email is malfunctioning and I can't input a subject!

So confirming that I am communicating with Upali (the email you have responded to was addressed to him). I have also spoken with Judy Randall.

While questionnaires answered in 1996 are now some years old there appears to be no single State-wide update. (If there has been an update, please let me know.) Statements made in 1996 should indicate where Councils were at then with an assumption that planning for flooding has improved (rather than gone backwards). A look at Emerald's flood measures in place in 1996 (including selection of the DFE, and measures to assess upstream effects of filling) shows that the draft planning scheme has indeed gone backwards with no DFE levels even mentioned, no flood immunity sought, no flood prone land identified etc. Thus this "out-of-date" info can be highly relevant to any argument with Shires.

We appear to have knowledge of some flood studies (or their details and relevance to urban flooding) here that you guys may not be (eg Policeman's Creek). So all that has been given to Emerald simply expands on and adds value to (Peter Nardi's)CHQ/DES comments. Not contradictions!

Your efforts to find the database are much appreciated

[redacted]

-----Original Message-----
From: Cuerel Russell
Sent: Wednesday, 27 October 2004 10:08 AM
To: [redacted]
Cc: Nardi Peter (DNR)
Subject: RE:

Folks,

we should have it somewhere, either of the network or a disk [redacted] check the file).

[redacted] this survey will be old data now. Also I hope you are keeping [redacted] up to date on any advices you are proposing to give to Emerald (or other shires) so as it is not contradictory to any advice they are giving to DES through our (ie Brisbane Office) SPP1/03 obligations..

cheers

-----Original Message-----
From: [redacted]
Sent: Wednesday, 27 October 2004 9:13 AM
To: [redacted]
Cc: Cuerel Russell
Subject:

Greetings [redacted]

Further to our discussion about flooding in Emerald I am hoping that the database containing the responses of most of Queensland's local governments to the urban flooding questionnaire of 1996 and summarised in David Ingle Smith's Feb 1998 "Urban Flooding in Queensland - a Review", (Prepared for DNR Qld) Centre for Resource and Environmental Studies, ANU, Canberra.

Using this hard copy summary takes time to assemble flood survey info for any one local authority. As you may recall, the book advises that DNR retains the answers to the survey in an electronic database.

Did you have any success in tracking down this electronic version?

I am now looking at planning schemes for Barcoo, Illfracombe, Isisford, Longreach, Diamantina, Boulia and Winton.

Hoping the database has come to light

Cheers

[redacted]
Regional Resource Planning Officer

Department of Natural Resources and Mines
Central West Region
Pho[redacted]2
Fax
P O Box 1762
Level 2, 209 Bolsover Street
Rockhampton 4700

A. NATURAL HAZARD MANAGEMENT AREAS (FLOOD):

Type of development made assessable or self-assessable	Specific outcomes	Solutions	Comments [if applicable]
a) ***material changes of use** and associated **reconfigurations of a lot** that:* • increase the number of people living or working in the natural hazard management area (e.g. residential development, shopping centres, tourist facilities, industrial or commercial uses) except where the premises are occupied on a short-term or intermittent basis (e.g. by construction/maintenance workers, certain agricultural and forestry workers); **or** • involve institutional uses where evacuating people may be particularly difficult (e.g. hospitals, education establishments, child care, aged care, nursing homes and high security correctional centres); **or** • involve the manufacture or storage of hazardous materials in bulk; **or** • would involve the building or other work described in (b) as an intrinsic element of the development proposal; **and** b) ***building** or other **work*** that involves any physical alteration to a watercourse or floodway including vegetation clearing, or involves net filling exceeding 50 cubic metres.	**1.** Development maintains the safety of people on the development site from all floods up to and including the DFE.	**1.1** Development is sited on land that would not be subject to flooding during the DFE. **OR** **1.2** There is no increase in the number of people living or working on the site, except where the premises are occupied on a short-term or intermittent basis (e.g. by construction/maintenance workers, certain agricultural and forestry workers). **OR** **1.3** ***For residential development:*** dwellings are sited so that the floors of all habitable rooms can be located above the DFE flood level. **OR** **1.4** ***For non-residential development and development involving temporary or moveable residential structures (e.g. caravan parks and camping grounds):*** **a)** buildings are located and designed so that floor levels (except areas used for car parking) are at or above the DFE flood level; **or** **b)** there is at least one evacuation route that remains passable for emergency evacuations during all floods up to and including the DFE; **or** **c)** the premises are located in an area where there is sufficient flood warning time to enable safe evacuation; **or** **d)** a safe refuge is available for people within the development site.	**Notes for b) in column 1:** Local governments may adopt lower thresholds than 50 m^3 to reflect the particular flood characteristics of different localities. Vegetation clearing is defined in Section 9, Glossary of this SPP Guideline. **Note for 1.1:** If the development proposal complies with this solution no further assessment is required in relation to flood hazard. **Note for 1.1 and 1.4:** A flood assessment report may be necessary to demonstrate compliance to the satisfaction of the assessment manager (or designator). A flood assessment report should include an assessment of the development proposal against these outcomes and solutions, and may require a specific hydraulic and hydrologic investigation undertaken by a suitably qualified professional engineer. **Notes for 1.3:** The *Standard Building Regulation* and associated *Queensland Development Code* address the floor levels of habitable rooms in relation to flood levels. The definition of habitable rooms is in the Building Code of Australia. Designing dwellings to achieve this requirement may have siting and height implications addressed by separate codes in the planning scheme.

Type of development made assessable or self-assessable	Specific outcomes	Solutions	Comments [if applicable]
	2. Development does not result in adverse impacts on people's safety or the capacity to use land within the floodplain.	**2.1** Works do not involve: **a)** any physical alteration to a watercourse or floodway including vegetation clearing; **or** **b)** net filling exceeding 50 cubic metres. **OR** **2.2** The development complies with any applicable development criteria set out in a floodplain management plan. **OR** **2.3** Where a floodplain management plan does not exist, the proposed works either: **a)** avoid any reductions of on-site flood storage capacity and contain within the subject site any changes to depth/duration/velocity of flood waters of all floods up to and including the DFE; **or** **b)** do not change the flood characteristics at the DFE outside the subject site in ways that result in: • loss of flood storage; • loss of/changes to flow paths; • acceleration or retardation of flows; **or** • any reduction in flood warning times elsewhere on the floodplain.	**Note for 2.1 a):** See Section 9, Glossary for definitions of floodway and vegetation clearing. Local governments should identify floodways in their planning scheme (e.g. on the natural hazard management area (flood) overlay) wherever possible. Where this information is not available the applicant may need to conduct a specific study to identify how the development proposal impacts on any existing floodways. NR&M is a concurrence agency for works in watercourses. **Note for 2.1 b):** Local governments may adopt a lower threshold for net filling as appropriate to the particular flood characteristics of a locality. **Note for 2.2:** A floodplain management plan should be prepared in accordance with the guidance provided in Appendix 2 of this SPP Guideline. Development criteria set out in such a management plan should be incorporated in the planning scheme or planning scheme policy. NR&M can provide further advice on the conduct of floodplain management studies and the preparation of floodplain management plans. **Note for 2.3:** A flood assessment report should be provided to demonstrate compliance to the satisfaction of the assessment manager (or designator). A flood

Type of development made assessable or self-assessable	Specific outcomes	Solutions	Comments [if applicable]
			assessment report should include an assessment of the development proposal against these outcomes and solutions, and may require a specific hydraulic and hydrologic investigation undertaken by a suitably qualified professional engineer.
	3. Development minimises the potential damage from flooding to property on the development site.	3.1 Dwellings are sited so that the floors of all habitable rooms can be located above the DFE flood level.	**Note for Specific Outcome 3:** No minimum floor levels are being **required** for commercial and industrial development [although placing floor levels above the DFE is an option for achieving specific outcome 1 – see solution 1.4a]. There may be commercial considerations that justify the 'commercial risk' associated with the potential damage to property. Such commercial risk considerations are best addressed through a comprehensive floodplain management plan. Local governments may specify minimum floor levels for non-habitable rooms where this is considered appropriate to the flood characteristics of the locality. However, the freeboard levels should not exceed those for habitable rooms. **Note for 3.1:** The *Standard Building Regulation* and associated *Queensland Development Code* address the floor levels of habitable rooms in relation to flood levels. The definition of habitable rooms is in the Building Code of Australia. Designing dwellings to achieve this requirement may have siting and height implications addressed by separate codes in the planning scheme.

Type of development made assessable or self-assessable	Specific outcomes	Solutions	Comments [if applicable]
	4. Public safety and the environment are not adversely affected by the detrimental impacts of floodwater on hazardous materials manufactured or stored in bulk.	**4.1** The manufacture or storage in bulk of hazardous materials takes place above the DFE flood level. **OR** **4.2** Structures used for the manufacture or storage of hazardous materials in bulk are designed to prevent the intrusion of floodwaters.	**Note for 4:** 'Hazardous materials in bulk' is defined in Section 9, Glossary of this SPP Guideline.
	5. Essential services infrastructure (e.g. on-site electricity, gas, water supply, sewerage and telecommunications) maintains its function during a DFE.	**5.1** Any components of the infrastructure that are likely to fail to function or may result in contamination when inundated by flood water (e.g. electrical switchgear and motors, water supply pipeline air valves) are: **a)** located above the DFE; **or** **b)** designed and constructed to exclude floodwater intrusion/infiltration. **AND** **5.2** Infrastructure is designed and constructed to resist hydrostatic and hydrodynamic forces as a result of inundation by the DFE.	

OWSR - 00839

Emergency Management EMQ Queensland

Queensland Government

[redacted]

Emergency Management Queensland

Department of
Community Safety

7 December 2009

Ms Debbie Best
Deputy Director-General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4000

Dear Ms Best

I am writing in relation to the long established arrangement that stands between the Department of Community Safety (DCS) and the Department of Environment and Resource Management (DERM) with the Natural Disaster Mitigation Programme (NDMP) and the Natural Disaster Risk Management Studies Programme (NDRMSP).

The DCS is the lead agency for administering the joint Australian and State Government funding program the NDMP and NDRMSP in Queensland.

The DERM has provided specialist advice on flood issues in relation to NDMP and NDRMSP projects for a number of years throughout the application and assessment process. This advice has been invaluable and I endeavour to continue this arrangement into the future.

A Memorandum of Understanding (MOU) has been developed in consultation with your department and the contents have been agreed upon, however further discussion is required to finalise the matter of timeframes. Please find attached a draft version of the MOU.

In the interim, I seek your endorsement to continue the existing arrangement until resolution of the MOU is finalised.

Should you wish to discuss this matter further, please contact [redacted] Director, Volunteer Management, Emergency Management Queensland on telephone (07) [redacted]

[redacted]

Executive Director
Emergency Management Queensland

Enc

001591/10

Office of the Executive Director

Emergency Services Complex
Cnr Kedron Park Road and Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 8511
Facsimile +61 7 3247 8505
Website www.emergency.qld.gov.au

ABN 92 265 149 823

Memorandum of Understanding

For

The provision of specialist advice on Flood Issues with respect to implementation of the State Planning Policy 1/03: Mitigating the adverse impacts of flood, bushfire and landslide; and administration of the Natural Disaster Risk Management Studies Program (NDRMSP), and Natural Disaster Mitigation Program (NDMP).

Between

The Queensland Department of Community Safety (DCS)

and

The Queensland Department of Environment and Resource Management (DERM)

1. PURPOSE

To establish the roles and responsibilities of the parties with respect to the flood issues associated with the implementation of *State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03)* the *Natural Disaster Risk Management Studies Program* (NDRMSP), and the *Natural Disaster Mitigation Program.*

This Agreement supersedes all communications, negotiations and arrangements, either oral or written, between the parties with respect to the subject matter referred to.

2. BACKGROUND

As part of the decision to adopt SPP 1/03 in 2003 the Minister for Local Government, Planning, Sport and Recreation a Memorandum of Understanding between DES and NRW (now Department of Environment and Resource Management (DERM))to document the responsibility of each agency for providing information and advice on particular aspects of flood.

The Department of Community Safety has the lead agency role for the implementation of SPP 1/03. The Department also has responsibility for administering the joint Commonwealth/State NDRMSP and NDMP in Queensland.

The Department of Environment and Resource Management has the lead agency role for the provision of technical advice relating to flood matters in Queensland.

3. INTERPRETATION

Unless the context otherwise requires:

- "Advice" means technical information on flood matters provided in response to a request from DCS seeking comments on the following:
  SPP 1/03 or Planning Schemes of Local Government Schemes -a development application, making or amending a local government planning scheme, and DCSignation of land for community infrastructure under the *Integrated Planning Act 1997*; or
  -major development proposals under the *State Development and Public Works Organisation Act 1971*;
  -, the Natural Disaster Mitigation Program.

  Natural Disaster Risk Management Studies Program (NDRMSP)

Natural hazard assessment reports with related to floods submitted under the Natural Disaster Risk Management Studies Program.

Natural Disaster Mitigation Program (NDMP)
Natural hazard assessment reports with related to floods submitted under the Natural Disaster Mitigation Program.

Flood mitigation works submitted under the Natural Disaster Mitigation Program.

- "Consult" means to seek any information or advice required by the parties to this Memorandum in order to meet their responsibilities with the aim of developing a coordinated agreed approach.

4. TERM

This Memorandum will commence on the date of signing and continue indefinitely, unless terminated earlier in accordance with Clause 10.

5. AGREEMENT

The Parties:

a. Agree to perform the roles assigned to them in this Memorandum.
b. Appoint the person(s) specified in clause 7 as the Manager responsible for the administration of this Memorandum, on their behalf.
c. Will participate constructively in implementing the flood aspects of SPP 1/03.
d. Will participate constructively in managing the flood aspects of the NDRMSP, and the Natural Disaster Mitigation Program (NDMP).
e. Agree to share information about applications for projects, development assessment and planning schemes.
f. Commit to acting in a competent, ethical, professional and timely manner in the resolution of matters concerning the flood aspects of SPP 1/03; and
g. Agree to support decisions on flood aspects of SPP 1/03, NDRMSP, and NDMP.
h. Agree to respond to requests for advice about each planning scheme as early as possible.
i. Agree to respond within the time frames agreed in this MOU.

6. ROLES

Department of Community Safety

DES will:

- Provide advice to local governments, state agencies and the development community on interpreting and implementing SPP 1/03. Review draft planning instruments and documents; in consultation with officers of the Department of Environment and Resource Management, to determine whether SPP 1/03 has been appropriately reflected.
- Review draft planning instruments and documents; and natural disaster risk management study reports in consultation with officers of the Department of Environment and Resource Management, to determine whether SPP 1/03 has been appropriately reflected.
- Review Natural Disaster Mitigation Program project proposals and project proposals in consultation with officers of the Department of Environment and Resource Management to determine whether the project proposals have been prepared according to current professional standards and completion of construction work according to professional standards.
- Forward relevant documentation DERM Brisbane office seeking comment in a timely manner.
- Consult with the Department of Environment and Resource Management on the technical aspects of flood matters as associated with the implementation of SPP 1/03, the NDRMSP, and NDMP.
- Convey co-ordinated DCS and DERM responses to relevant stakeholders in a timely manner and within negotiated time frames.
- Administer the joint State/Commonwealth NDRMSP, and NDMP in Queensland.

Department of Environment and Resource Management

DERM will:

- Consult with DCS on requests seeking DERM advice.
- Provide advice to DCS as early as possible any project proposals or any planning scheme. This advice may include but is not limited to:
    - adequacy of the methodology and the resultant outcomes in hazard assessment studies for flood.
    - adequacy of site specific hazard assessments conducted for particular development proposals; and
    - suitability of Defined Flood Events proposed to be adopted for the purpose of identifying natural hazard management areas (flood) in local government planning schemes.

- Any relevant legislative or policy changes to flood matters.

- Attend meetings as required to ensure an appropriate resolution of specific flood issues associated with the implementation of SPP 1/03.
- Participate on steering committees as required for NDMP funded flood studies.

7. NOMINATED POSITIONS TO ADMINISTER THE AGREEMENT

Department of Community Safety

SPP 1/03, NDRMSP, and NDMP issues -

Director
Special Projects
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Phone: [redacted]
Fax:
Email:

Department of Environment and Resource Management

Flood issues

Director
Water Industry Asset Management & Standards
Office of Water Supply Regulator
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

Phone: [redacted]
Fax:
Email:

8. REVIEW

The nominated Managers in Section 7 will review this Memorandum within 12 months of the date of commencement. The review will take into account all current and relevant policies and statutory instruments.

9. VARIATION

This Memorandum may be varied at any time provided the amendment is in writing and signed by all parties.

10. TERMINATION

This Memorandum may be terminated at any time by notice in writing signed by either party.

11. SIGNATORIES

SIGNED on behalf of the Department of Community Safety
.....

by [redacted] Director-General, this
.....day of 2009

SIGNED on behalf of the Department of Environment and Resource Management .....

by John Bradley, Director-General, this
..... day of 2009

SCHEDULE 1 – Activities of Department of Environment and Resource on NDMP

Overall Process Step	DCScription
	PHASE 1 – Project Application and Approval
	DERM receives a copy of the project applications from DCS a month prior to the State Assessment Panel Meeting, reviews them and forms a preliminary assessment of the projects' eligibilities (may include either site inspections or obtaining further information from the proponent) and priority.
	DERM provi DCS this preliminary assessment to the State Assessment Panel.
	DERMdoes follow-up work in terms of further inquiries with applicants or additional site inspections to address any concerns raised by State Assessment Panel.
	PHASE 2 – Recommendation to Minister and Commonwealth and Announcement of Successful Projects
	No Activities for DERM
	PHASE 4 – Advice to Successful Applicants and Preparation of Project Agreements
	No Activities for DERM
	PHASE 5 – Project Monitoring and Payment
	On request from DCS, DERM verifies that claim is complete, correct and in accordance with the Statement of Work and/or that project progress has actually been achieved
	Project completion and final certification of works projects. DERM arranges for suitable officers to inspect works for practical completion before final payment by DCS.
	PHASE 6 – Program Monitoring and Reporting to Commonwealth. (Finance and Overall Project Progress)
	No Actions for DERM

SCHEDULE 1 (Continued)
Activities of Department of Natural Resources & Water on NDMP

Overall Process Step	DCScription
	PHASE 7 – Evaluation of Program (Under the agreement with Commonwealth, State and Commonwealth are to carryout an evaluation of the Program to determine how effective it has been)
	Advise DCS in regard to suitable evaluation methodology
	Reassess projects based on agreed methodology
	Provide assessment to DCS for reporting to Commonwealth
	MISCELLANEOUS ACTIVITIES
	Attend Program meetings with Commonwealth and attend Flood Advisory Committee Meetings of flood studies of individual councils and River Trust Boards etc.

SCHEDULE 2 – Activities of Department of Community Safety

Overall Process Step	DCScription
	PHASE 1 – Project Application and Approval
	DCS prepares a CD of project applications and distributes to members of State Assessment Panel and the Commonwealth a month prior to the State Assessment Panel meeting for preparation..
	DCS convenes and chairs State Assessment Panel meeting to assess project applications. Meeting uses assessment methodology and score and rank projects
	DCS finalises Minutes of State Assessment Panel meeting (with DERM assistance) and distributes to State Assessment Panel for confirmation before recommending projects to Minister.
	PHASE 2 – Recommendation to Minister and Commonwealth and Announcement of Successful Projects
	DCS prepares a briefing note for Minister. BN incluDCS Minutes of State Assessment Panel meeting, project assessments and draft recommendation letter to Commonwealth.
	DCS responds to any queries from Minister's office regarding recommended projects and responds to any concerns of the Minister before Minister's letter recommending Queensland's projects goes to Commonwealth
	Minister sends letter to Commonwealth
	DCS responds to queries from Commonwealth regarding recommended projects and addresses-out any concerns from Commonwealth
	Projects are announced "jointly" by Minister and Commonwealth Minister

SCHEDULE 2 (Continued)
Activities of Department of Community Safety

Overall Process Step	DCScription
PHASE 3 – Advice to Successful Applicants & Preparation of Project Agreements	
	DCS sends letter to successful applicants offering funding and requesting that they prepare and forward a project Statement of Work to DCS for inclusion in the Project Agreement.
	DCS maintains the Standard Project Agreement by ensuring the content is up to date in consultation with DERM.
	DCS prepares two copies of a Project Agreement for each project. These are signed on behalf of the DCS and forwarded to project proponents for signing.
	The proponent retains one copy of the signed Project Agreement while the other is returned to DCS for filing. DCS makes a copy of the executed project agreement and forwards to DERM for reference when assessing progress claims.
PHASE 4 – Project Monitoring and Payment	
	DCS processes claims for payment. This involves: • Verification that each claim is complete, correct and in accordance with the Statement of Work • Forward to DERM for verification that project progress has actually been achieved and approval of payment • Payment of approved claim.
	DCS receives any proposed changes to the scope of a project as a result of finalising DCSign, land acquisition issues, co-ordination with other infrastructure projects. DCS may seek DERM advice on proposed changes. DCS arranges for agreed changes to the Statement of Work, increases/decreases in allocation deferment etc.
	DCS pursues projects which fall behind agreed timeline, assists in the removal of obstructions to the project's progress and/or sets deadlines
	Project completion, Final certification and Payment. Note, in flood warning projects a written declaration from a BoM officer is accepted.

SCHEDULE 2 (Continued)
Activities of Department of Community Safety

Overall Process Step	DCScription
PHASE 5 – Evaluation of Program (not yet undertaken) (Under the agreement with Commonwealth, State and Commonwealth are to carry-out an evaluation of the Program to determine how effective it has been)	
	Agree evaluation methodology with Commonwealth
	Request evaluation of completed Projects by DERM
	Report to Commonwealth on evaluation of Program
MISCELLANEOUS ACTIVITIES	
	Prepare Briefings/Respond to Ministerials
	Get Project Database operational
	Promote Program
	Report on NDMP to State Disaster Management Committee
	Report internally on Program expenditure
	Liaise with DCS on NDRMSP projects linked to NDMP applications
	Attend Program meetings with Commonwealth
	Assist applicants and successful proponents with problems associated with the program funding

SCHEDULE 3 – Responsible Officers

Department of Environment and Resource Management

[redacted]
Senior Engineer (Flood Risk & Stormwater Management)
Asset Management and Standards
Office of Water Supply Regulator
Department of Environment and Resource Management
Floor 7,
200 Mary Street Brisbane QLD 4001
[redacted]

Department of Community Safety

[redacted]
Program Administration Officer
Volunteer Management Unit
Emergency Management Queensland
Department of Community Safety
Level 2, Block C, Emergency Services Complex
Cnr Park & Kedron Park Road Kedron QLD 4003
[redacted]

SCHEDULE 4 – Commonwealth Contacts

[redacted]
A/Assistant Director (Disaster Mitigation)
Emergency Management Australia
University of Canberra Innovation Centre
Building 23
University Drive South Bruce ACT 2617
[redacted]

CTS 00159/10

☐ Approved ☐ Not Approved ☑ Noted
☐ Further information required
DDG..... [redacted] ...
Dated 7/2/10

Department of Environment and Resource Management
DEPUTY DIRECTOR-GENERAL BRIEFING NOTE

TO: **Deputy Director-General, Water and Corporate Services**

SUBJECT: **Memorandum of Understanding for provision of specialist advice on flood issues**

TIMEFRAME

- Noting of this briefing note is required at your earliest convenience in order to progress the finalisation of the Memorandum of Understanding (MOU) for provision of specialist advice on flood issues.

RECOMMENDATION

- It is recommended the Deputy Director-General **sign** the attached letter to Emergency Management Queensland which recommends the inclusion of two additional items for the draft MOU for provision of specialist advice on flood issues, prior to the MOU being finalised.

BACKGROUND

- Historically, government departments, such as the Department of Community Safety (DCS) and the Department of Infrastructure and Planning (DIP), have relied on the engineering expertise provided by Department of Environment and Resource Management (DERM) engineers, to provide advice on water, sewerage, and flooding issues and to provide recommendations on applications for funding.
- DCS now coordinates funding under the Natural Disaster Mitigation Program and for State Planning Policy 1/03, and DERM provides technical advice on these projects.

Natural Disaster Mitigation Program (NDMP)

- This program is a joint State/Commonwealth Government funded program for natural disaster studies and mitigation works such as floods, bushfire, storm tides, earthquakes and cyclones.
- The program is open to state government departments, local governments and river improvement trusts on the basis of an annual call for applications by the Commonwealth Government, followed by their assessment, priority ranking and recommendation to the Commonwealth Government for funding by the Queensland Minister for Community Safety.
- Although the program is managed by DCS, DERM has a key role in providing technical assistance to the DCS, especially when dealing with flooding issues arising from other state government departments, local government councils and river improvement trusts of the State.
- Annually, DERM provides technical advice on approximately 40 to 50 flood related projects under this program. Advice provided is comprised of:
  - reviewing project proposals prior to States Assessment Panel meeting
  - attending State Assessment Panel meeting
  - reviewing project programs of approved projects
  - attending flood advisory committee meetings of flood studies projects
  - interim inspection of flood mitigation project works for the recommendation of interim payments
  - reviewing final reports of flood studies and flood risk management projects

Author	Cleared by	Cleared by	Recommended:
Name [redacted]	Name [redacted]		Name [redacted]
Posit	Position: Director WIAM&S	Position: GM OWSR	Positi
Tel N		Date:	Tel No
Date: 22 January 2010			Date: 27 January 2010

File Ref:

- final inspection of flood mitigation project works for the recommendation of final payments, and
- attending any Natural Disaster Mitigation conferences and meetings in Queensland and interstate.

State Planning Policy 1/03 (SPP 1/03) – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide – Planning Schemes of Local Government Bodies

- DERM provides technical services to DCS in reviewing individual local government planning schemes to determine whether they satisfactorily address the flood related requirements of SPP 1/03.
- DCS is responsible for responding to DIP on the overall compliance of local government planning schemes with the SPP 1/03; however, DCS relies on DERM's flood expertise for assistance in fulfilling the role.

CURRENT ISSUES

- DERM's involvement in the NDMP ensures the program benefits from DERM's flooding expertise and that government funds go to worthwhile projects.
- DERM's support for DCS in reviewing local government planning schemes under the SPP 1/03 ensures the State's requirements for local government planning schemes on flood related matters are in line with best practice.
- In order to minimise DERM's costs in supporting DCS, it is appropriate that travelling and accommodation costs for project inspections with Queensland, and attending meetings within Queensland and interstate, be met by DCS.

RESOURCE/IMPLEMENTATION IMPLICATIONS

DERM supports one FTE (PO4 Senior Engineer) to provide the advice for all current NDMP and SPP 1/03 projects.

DEPUTY DIRECTOR–GENERAL'S COMMENTS

ATTACHMENTS

- Letter to Mr [redacted] Executive Director, Emergency Management Queensland

Author	Cleared by	Cleared by	[redacted]

Queensland Government

Ref CTS 00159/10

2 FEB 2010

Department of
Environment and Resource Management

Mr [redacted]
Executive Director
Emergency Management Queensland
GPO Box 1425
BRISBANE QLD 4001

Dear [redacted]

Thank you for your letter dated 7 December 2009 regarding the draft Memorandum of Understanding (MOU) for provision of specialist advice on flood issues.

With regard to the role of the Department of Environment and Resource Management (DERM), it is recommended that an additional clause be included in the MOU to state that, whenever the Department of Community Safety (DCS) requests DERM to attend any flood related conferences, flood related discussions, or meeting with other state government agencies or federal government agencies, a responsible officer from DERM may represent DCS and/or the Queensland Government.

It is further recommended that a new clause entitled, Financial Dealings, be added to state that, DERM officers' travelling and accommodation costs for inspection of projects within Queensland and attendance at meetings within Queensland and also interstate, will be met by DCS.

In addition, DERM will support the equivalent of one full time person for the activities outlined in the MOU. The support provided will be commensurate with this level of resourcing. A clause has been added to the MOU regarding this issue.

A copy of the department's suggested amendments is attached.

Should you have any further enquiries, please do not hesitate to contact Mr Peter Artemieff of the department on telephone [redacted]

Yours sincerely

[redacted]

Debbie Best
Deputy Director-General
Water and Corporate Services

Att

Level 13
400 George Street Brisbane Qld 4000
GPO Box 2454 Brisbane
Queensland 4001 Australia
Telephone + [redacted]
Facsimile + 61 7 3330 6306
Website www.derm.qld.gov.au
ABN 46 640 294 485

Memorandum of Understanding

For

The provision of specialist advice on Flood Issues with respect to implementation of the State Planning Policy 1/03: Mitigating the adverse impacts of flood, bushfire and landslide; and administration of the Natural Disaster Risk Management Studies Program (NDRMSP), and Natural Disaster Mitigation Program (NDMP),

Deleted: and Regional Flood Mitigation Program

Between

The Queensland Department of Community Safety (DCS)

Deleted: Department of Emergency Services

Deleted: S

and

The Queensland Department of Environment and Resource Management (DERM)

Deleted: Natural

Deleted: s

Deleted: and Water (NRW)

1. PURPOSE

To establish the roles and responsibilities of the parties with respect to the flood issues associated with the implementation of *State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03)* the *Natural Disaster Risk Management Studies Program* (NDRMSP), and the *Natural Disaster Mitigation Program*.

This Agreement supersedes all communications, negotiations and arrangements, either oral or written, between the parties with respect to the subject matter referred to.

2. BACKGROUND

As part of the decision to adopt SPP 1/03 in 2003 the then Minister for Local Government, Planning, Sport and Recreation prepared a Memorandum of Understanding between DES (now DCS) and NRW (now DERM) to document the responsibility of each agency for providing information and advice on particular aspects of flood.

DCS has the lead agency role for the implementation of SPP 1/03. The Department also has responsibility for administering the joint Commonwealth/State NDRMSP and NDMP in Queensland.

DERM has the lead agency role for the provision of technical advice relating to flood matters in Queensland.

3. INTERPRETATION

Unless the context otherwise requires:

- "Advice" means technical information on flood matters provided in response to a request from DCS seeking comments on the following:
  SPP 1/03 or Planning Schemes of Local Government Schemes
  -a development application, making or amending a local government planning scheme, and designation of land for community infrastructure under the *Integrated Planning Act 1997*; or
  -major development proposals under the *State Development and Public Works Organisation Act 1971*;
  -the Natural Disaster Mitigation Program.

  Natural Disaster Risk Management Studies Program (NDRMSP)
  Natural hazard assessment reports with related to floods submitted under the Natural Disaster Risk Management Studies Program.

  Natural Disaster Mitigation Program (NDMP)

Formatted: Font: Italic
Formatted: Font: Italic
Deleted: (NDMP) and Regional Flood Mitigation Program (RFMP).
Formatted: Font: Italic
Deleted: des
Deleted: DCS
Deleted: Following Cabinet endorsement by Decision Number 4154 in May 2003, the Minister for Local Government and Planning, Sport and Recreation adopted SPP 1/03.
Deleted: ¶
Deleted: provision was included to prepare
Deleted: ¶ The Cabinet Decision also noted that
Deleted: would be developed
Deleted: DES
Deleted: DNR&W
Deleted: Department of Environment and Resource Management (
Deleted:)
Deleted: regarding
Deleted: the responsibility
Deleted: The
Deleted: Department of Emergency Services
Deleted: Department of Community Safety
Deleted: and RFMP
Deleted: The Department of Environment and Resource Management
Deleted: Natural Resources and Water
Deleted: DES
Formatted: Indent: Left: 2.54 cm
Deleted: des
Deleted: DCS
Deleted: natural hazard assessment reports submitted under the Natural Disaste ... [1]
Deleted:
Deleted: and Regional F ... [2]
Formatted ... [3]
Deleted: means
Deleted: n
Formatted ... [4]

Natural hazard assessment reports with related to floods submitted under the Natural Disaster Mitigation Program.

Flood mitigation works submitted under the Natural Disaster Mitigation Program.

- "Consult" means to seek any information or advice required by the parties to this Memorandum in order to meet their responsibilities with the aim of developing a coordinated agreed approach.

4. TERM

This Memorandum will commence on the date of signing and continue indefinitely, unless terminated earlier in accordance with Clause 10.

5. AGREEMENT

The Parties;

a. Agree to perform the roles assigned to them in this Memorandum.
b. Appoint the person(s) specified in clause 8 as the Manager responsible for the administration of this Memorandum, on their behalf.
c. Will participate constructively in implementing the flood aspects of SPP 1/03.
d. Will participate constructively in managing the flood aspects of the NDRMSP, and the Natural Disaster Mitigation Program (NDMP).
e. Agree to share information about applications for projects, development assessment and planning schemes.
f. Commit to acting in a competent, ethical, professional and timely manner in the resolution of matters concerning the flood aspects of SPP 1/03; and
g. Agree to support decisions on flood aspects of SPP 1/03, NDRMSP, and NDMP.
h. Agree to respond to requests for advice about each planning scheme as early as possible.
i. Agree to respond within the time frames agreed in this MOU.

Deleted: n
Deleted: f
Deleted: <#>means¶
Formatted: Indent: Left: 1.27 cm, First line: 1.27 cm
Deleted: <#>Regional Flood Mitigation Program means¶
Deleted: will
Deleted: 7
Deleted: a
Deleted: to be
Deleted: P
Deleted: P
Deleted: and Regional Flood Mitigation Program (RFMP).
Deleted: and RFMP.
Deleted: a time frame of at
Deleted: least 10 working days for
Deleted: to
Deleted: respond
Deleted: no later than
Deleted: .
Deleted: 10 working days from receipt of the request
Deleted: to

6. ROLES

Department of Community Safety

DCS will:

- Provide advice to local governments, state agencies and the development community on interpreting and implementing SPP 1/03. Review draft planning instruments and documents; in consultation with officers of DERM, to determine whether SPP 1/03 has been appropriately reflected.
- Review draft planning instruments and documents; and natural disaster risk management study reports in consultation with officers of DERM, to determine whether SPP 1/03 has been appropriately reflected.
- Review Natural Disaster Mitigation Program project proposals and project proposals in consultation with officers of DERM to determine whether the project proposals have been prepared according to current professional standards and completion of construction work according to professional standards.
- Forward relevant documentation DERM Brisbane office seeking comment in a timely manner.
- Consult with DERM on the technical aspects of flood matters as associated with the implementation of SPP 1/03, the NDRMSP, and NDMP. Convey co-ordinated DCS and DERM responses to relevant stakeholders in a timely manner and within negotiated time frames.
- Administer the joint State/Commonwealth NDRMSP, and NDMP in Queensland.
- A DERM officer may represent DCS and/or Queensland Government, when DCS is required to attend any flood related conferences, flood related discussions or meeting with other State Government Agencies or Federal Government Agencies.

Department of Environment and Resource Management

DERM will:

- Consult with DCS on requests seeking DERM advice.
- Provide advice to DCS as early as possible any project proposals or any planning scheme. This advice may include but is not limited to:
  - adequacy of the methodology and the resultant outcomes in hazard assessment studies for flood.
  - adequacy of site specific hazard assessments conducted for particular development proposals; and
  - suitability of Defined Flood Events proposed to be adopted for the purpose of identifying natural hazard

Deleted: Department of Emergency Services
Deleted: E
Deleted: S
Deleted: the Department of Environment and Resource Management
Deleted: Natural Resources and Water
Deleted: the Departmer... [5]
Deleted: Natural Resou... [6]
Deleted: ¶
Deleted: Regional Flood... [7]
Deleted: the Departmer... [8]
Deleted: Natural Resou... [9]
Deleted: Arrange timely f
Deleted: ing
Deleted: of
Deleted: seeking D
Deleted: NR&W
Deleted: to their Brisba... [10]
Deleted: <#>Allow 10 ... [11]
Deleted: <#>M
Deleted: <#> to respor... [12]
Deleted: the
Deleted: Department o... [13]
Deleted: Department o... [14]
Deleted: and RFMP.¶
Deleted: DES
Deleted: DNR
Deleted: M&
Deleted: W
Deleted: and RFMP
Formatted: Bullets and Numbering ... [15]
Deleted: Natural Reso... [16]
Formatted ... [17]
Formatted: Normal
Formatted ... [18]
Deleted: NRW
Formatted ... [19]
Formatted ... [20]
Deleted: DES
Deleted: DNR
Deleted: &
Deleted: W
Deleted: DES
Deleted: within 10 wor... [21]

management areas (flood) in local government planning schemes.

- Any relevant legislative or policy changes to flood matters.

- Attend meetings as required to ensure an appropriate resolution of specific flood issues associated with the implementation of SPP 1/03.
- Participate on steering committees as required for NDMP funded flood studies.
- DCS acknowledges that DERM will support the equivalent of one FTE to these activities and that the activities will commensurate with the level of resources.

7. FINANCIAL DEALINGS

DERM officers' travelling and accommodation costs in relation to inspection of projects within Queensland, attending conferences and meetings within Queensland and interstate, will be met by DCS.

8. NOMINATED POSITIONS TO ADMINISTER THE AGREEMENT

Department of Community Safety

SPP 1/03, NDRMSP, and NDMP Issues -

Director
Special Projects
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Phone: [redacted]
Fax:
Email:

Department of Environment and Resource Management

Flood Issues

Director
Water Industry Asset Management & Standards
Office of Water Supply Regulator
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

Phone: [redacted]
Fax:

Deleted: Interpretation
Deleted: NDRMSP,
Deleted: and RFMP
Formatted: Font: (Default) Arial
Formatted: Indent: Left: 1.27 cm, Tabs: 1.9 cm, List tab + Not at 5.08 cm
Formatted: Bullets and Numbering
Formatted: Font: (Default) Arial
Formatted: Font: (Default) Arial
Formatted: Font: Bold
Formatted: Indent: Hanging: 1.9 cm, Tabs: 1.27 cm, List tab + Not at 1.9 cm
Formatted: Bullets and Numbering
Formatted: Indent: Left: 0.63 cm
Formatted: Font: Not Bold
Formatted: Indent: Left: 1.27 cm
Formatted: Bullets and Numbering
Deleted: Department of Emergency Services
Deleted: and RFMP
Deleted: Department of Emergency Services
Formatted: Font: Bold
Deleted: Natural Resources and Water
Deleted: Water Industry Regulation
Formatted: Font: Not Bold
Deleted: Natural Resources and Water
Deleted: 3224 2733
Deleted: 8762

Email: [redacted]

Deleted: rolf.rose

Deleted: nrw

9. REVIEW

Formatted: Bullets and Numbering

The nominated Managers in Section 8 will review this Memorandum within 12 months of the date of commencement. The review will take into account all current and relevant policies and statutory instruments.

Deleted: 7

10. VARIATION

Formatted: Bullets and Numbering

This Memorandum may be varied at any time provided the amendment is in writing and signed by all parties.

11. TERMINATION

Deleted: 10

This Memorandum may be terminated at any time by notice in writing signed by either party.

Deleted: agreement

Deleted: all parties

11. SIGNATORIES

SIGNED on behalf of the Department of Community Safety .....

Deleted: Emergency Services

by [redacted] Director-General, this .....day of 2010

Formatted: Indent: First line: 1.27 cm

Deleted: 2009

SIGNED on behalf of the Department of Environment and Resource Management .....

Deleted: Natural Resources

by John Bradley, Director-General, this ..... day of 2010

Deleted: Scott Spencer

Deleted: 2009

SCHEDULE 1 – Activities of Department of Environment and Resource Management on NDMP

Overall Process Step	Description
	PHASE 1 – Project Application and Approval
	DERM receives a copy of the project applications from DCS a month prior to the State Assessment Panel Meeting, reviews them and forms a preliminary assessment of the projects' eligibilities (may include either site inspections or obtaining further information from the proponent) and priority.
	DERM provides this preliminary assessment to the State Assessment Panel.
	DERM does follow-up work in terms of further inquiries with applicants or additional site inspections to address any concerns raised by State Assessment Panel.
	PHASE 2 – Recommendation to Minister and Commonwealth and Announcement of Successful Projects
	No Activities for DERM
	PHASE 4 – Advice to Successful Applicants and Preparation of Project Agreements
	No Activities for DERM
	PHASE 5 – Project Monitoring and Payment
	On request from DCS, DERM verifies that claim is complete, correct and in accordance with the Statement of Work and/or that project progress has actually been achieved
	Project completion and final certification of works projects. DERM arranges for suitable officers to inspect works for practical completion before final payment by DCS.
	PHASE 6 – Program Monitoring and Reporting to Commonwealth. (Finance and Overall Project Progress)
	No Actions for DERM

Deleted: CS

Deleted: DCS

SCHEDULE 1 (Continued)
Activities of Department of Environment and Resource Management on NDMP

Deleted: Natural Resources & Water

Overall Process Step	Description
	PHASE 7 – Evaluation of Program (Under the agreement with Commonwealth, State and Commonwealth are to carryout an evaluation of the Program to determine how effective it has been)
	Advise DCS in regard to suitable evaluation methodology
	Reassess projects based on agreed methodology
	Provide assessment to DCS for reporting to Commonwealth
	MISCELLANEOUS ACTIVITIES
	Attend Program meetings with Commonwealth and attend Flood Advisory Committee Meetings of flood studies of individual councils and River Trust Boards etc.

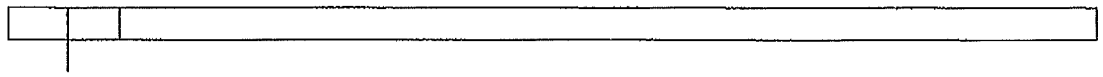
Deleted: CS

SCHEDULE 2 – Activities of Department of Community Safety

Overall Process Step	Description
	PHASE 1 – Project Application and Approval
	DCS prepares a CD of project applications and distributes to members of State Assessment Panel and the Commonwealth a month prior to the State Assessment Panel meeting for preparation..
	DCS convenes and chairs State Assessment Panel meeting to assess project applications. Meeting uses assessment methodology and score and rank projects
	DCS finalises Minutes of State Assessment Panel meeting (with DERM assistance) and distributes to State Assessment Panel for confirmation before recommending projects to Minister.
	PHASE 2 – Recommendation to Minister and Commonwealth and Announcement of Successful Projects
	DCS prepares a briefing note for Minister. BN includes Minutes of State Assessment Panel meeting, project assessments and draft recommendation letter to Commonwealth.
	DCS responds to any queries from Minister's office regarding recommended projects and responds to any concerns of the Minister before Minister's letter recommending Queensland's projects goes to Commonwealth
	Minister sends letter to Commonwealth
	DCS responds to queries from Commonwealth regarding recommended projects and addresses-out any concerns from Commonwealth
	Projects are announced "jointly" by Minister and Commonwealth Minister

Deleted: CS

Deleted: DCS



SCHEDULE 2 (Continued)
Activities of Department of Community Safety

Overall Process Step	Description
	PHASE 3 – Advice to Successful Applicants & Preparation of Project Agreements
	DCS sends letter to successful applicants offering funding and requesting that they prepare and forward a project Statement of Work to DCS for inclusion in the Project Agreement.
	DCS maintains the Standard Project Agreement by ensuring the content is up to date in consultation with DERM.
	DCS prepares two copies of a Project Agreement for each project. These are signed on behalf of the DCS and forwarded to project proponents for signing.
	The proponent retains one copy of the signed Project Agreement while the other is returned to DCS for filing. DCS makes a copy of the executed project agreement and forwards to DERM for reference when assessing progress claims.
	PHASE 4 – Project Monitoring and Payment
	DCS processes claims for payment. This involves: • Verification that each claim is complete, correct and in accordance with the Statement of Work • Forward to DERM for verification that project progress has actually been achieved and approval of payment • Payment of approved claim.
	DCS receives any proposed changes to the scope of a project as a result of finalising Design, land acquisition issues, co-ordination with other infrastructure projects. DCS may seek DERM advice on proposed changes. DCS arranges for agreed changes to the Statement of Work, increases/decreases in allocation deferment etc.
	DCS pursues projects which fall behind agreed timeline, assists in the removal of obstructions to the project's progress and/or sets deadlines
	Project completion, Final certification and Payment. Note, in flood warning projects a written declaration from a BoM officer is accepted.

Deleted: CS

Formatted: Bullets and Numbering

Deleted: CS

SCHEDULE 2 (Continued)
Activities of Department of Community Safety

Deleted: CS

Overall Process Step	Description
	PHASE 5 – Evaluation of Program (not yet undertaken) (Under the agreement with Commonwealth, State and Commonwealth are to carry-out an evaluation of the Program to determine how effective it has been)
	Agree evaluation methodology with Commonwealth
	Request evaluation of completed Projects by DERM
	Report to Commonwealth on evaluation of Program
	MISCELLANEOUS ACTIVITIES
	Prepare Briefings/Respond to Ministerials
	Get Project Database operational
	Promote Program
	Report on NDMP to State Disaster Management Committee
	Report internally on Program expenditure
	Liaise with DCS on NDRMSP projects linked to NDMP applications
	Attend Program meetings with Commonwealth
	Assist applicants and successful proponents with problems associated with the program funding

SCHEDULE 3 – Responsible Officers

Department of Environment and Resource Management

[redacted]
Senior Engineer (Flood Risk & Stormwater Management)
Water Industry Asset Management and Standards
Office of the Water Supply Regulator
Department of Environment and Resource Management
Floor 3,
41 George Street Brisbane QLD 4000
[redacted]

Deleted: 7
Deleted: 200 Mary
Deleted: 1
Deleted: DERM

Department of Community Safety

[redacted]
Program Administration Officer
Volunteer Management Unit
Emergency Management Queensland
Department of Community Safety
Level 2, Block C, Emergency Services Complex
Cnr Park & Kedron Park Road Kedron QLD 4003
[redacted]

Deleted: 1
Deleted: ul
Deleted: 3247 8766
Field Code Changed
Deleted: g

SCHEDULE 4 – Commonwealth Contacts

[redacted]
A/Assistant Director (Disaster Mitigation)
Emergency Management Australia
University of Canberra Innovation Centre
Building 23
University Drive South Bruce ACT 2617
[redacted]

CTS 05841/10

Emergency Management EMQ Queensland

Queensland Government

[redacted]
Our Ref:

Emergency Management Queensland

Department of
Community Safety

[redacted]

1 March 2010

- advice please.

[redacted]

Ms Debbie Best
Deputy Director General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4000

Dear Debbie

Thank you for your letter dated 2 February 2010 regarding the draft Memorandum of Understanding for provision of specialist advice on flood issues on Natural Disaster Mitigation Program (NDMP) and Natural Disaster Risk Management Studies Programme (NDRMSP) projects.

Emergency Management Queensland (EMQ) does not accept the additional clause entitled Financial Dealings, as suggested within recent correspondence.

The engagement of agencies in disaster management related matters within their area of expertise is part of all agencies responsibility. EMQ does not expect to pay agencies for meeting their portfolio responsibilities under the Disaster Management Act and the State Disaster Management Group associated activities.

DERM has provided specialist advice on flood issues in relation to NDMP and NDRMSP projects for a number of years throughout the application and assessment process. This advice has been invaluable and I ask you to reconsider and continue this arrangement into the future.

Should you wish to discuss this matter further, please contact [redacted] Director, Volunteer Management, Emergency Management Queensland [redacted]

Yours sincerely

[redacted]

Acting Chief Officer
Emergency Management Queensland

RECEIVED
- 3 MAR 2010

EMQ Directorate

Emergency Services Complex
Cnr Kedron Park Road and Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 8511
Facsimile +61 7 3247 8505
Website www.emergency.qld.gov.au

ABN 92 265 149 823

CTS 03891/10

☑ Approved ☐ Not Approved ☐ Noted
☐ Further information required
ADG... [redacted] .....
Dated 07/04/10

Department of Environment and Resource Management
ASSISTANT DIRECTOR-GENERAL BRIEFING NOTE

TO: **Assistant Director-General, Environment and Natural Resource Regulation**

SUBJECT: **Memorandum of Understanding for provision of specialist advice on flood issues.**

TIMEFRAME

- Signing of the attached letter is required at your earliest convenience in order to progress the finalisation of the Memorandum of Understanding (MOU) with the Department of Community Safety (DCS) for provision of specialist (technical) advice on flood issues.

RECOMMENDATION

- It is recommended that the Assistant Director-General sign the attached letter to Emergency Management Queensland (EMQ) (a division of DCS) suggesting a review of the activities associated with the provision of specialist (technical) advice on flood issues prior to signing the MOU.

BACKGROUND

- As outlined in briefing note CTS 00159/10, the Department of Environment and Resource Management (DERM) has historically provided technical support to schemes that provide Government subsidy to local government for water related infrastructure – including flood mitigation works.
- The technical support currently provided to EMQ has its origins in two joint State/Commonwealth subsidy programs that began around 2000;
  - the Regional Flood Mitigation Program (RFMP) providing subsidy for flood mitigation works; and
  - the Natural Disaster Risk Management Studies Program (NDRMSP) providing subsidy for studies aimed at quantifying natural hazard risks - including flood.
- In accordance with an agreement between the then Minister and the Commonwealth, DERM was originally responsible for funding the RFMP, specialist evaluation of projects for subsidy eligibility and progress payment, and administration of the funds.
- In 2004 the financial responsibility for the RFMP moved to the then Department of Local Government and today, currently rests with DCS. However, the responsibility for providing technical support and advice in the evaluation of projects and assessment of progress still remains with DERM.
- Both the RFMP and the NDRMSP have since been re-packaged into the current State/Commonwealth funded Natural Disaster Mitigation Program (NDMP) and from April 2010 the NDMP will become known as the Natural Disaster Resilience Program with about 30 projects commencing under the new Program.
- Generally the funding for approved projects continues to be on the basis of one-third from the Commonwealth, one-third from the State and one-third from the local government undertaking the project.
- DERM has also provided EMQ with specialist advice on flood issues in support of the development and implementation of State Planning Policy 1/03 (mitigating the adverse impacts of flood, bushfire and landslide).

Author	Cleared by	Cleared by	Recommended
Name [redacted] Positi Tel N Date: 15 March 2010	Name: [redacted] Position: Director, WIAMS Date: 15 March 2010	Name: Position: Date:	Name [redacted] Positi Tel N Date: 15 March 2010
	Name: Position: Date:	Name: Position: Date:	

- At the present time DERM provides support equivalent to one FTE to the activities of the Program and has included a clause in the MOU, that the support for any activities under the Program will be commensurate with the current level of resources.
- Annually, DERM provides technical advice on approximately 40 to 50 flood related projects under the program and DERM expenditure is approximately $10,000 to $15,000 for travel related to the projects, although this is dependent on the actual level of flooding and any subsequent activities.
- *Consultation:* N/A
- *Legislation:* N/A.

CURRENT ISSUES

- EMQ, recently requested endorsement of a MOU, for the provision of specialist advice on flood issues (refer to CTS 00159/10).
- In the light of current departmental budgetary situation, DERM's response to EMQ included the suggestion that, a clause be added to the MOU requesting DCS meet the costs related to any site inspections required (e.g. to verify claims for payment) and also the cost related to attendance at project steering committee meetings and national meetings concerning the management of the NDMP.
- EMQ have responded negatively to the suggested clause, as historically, DERM have funded any costs associated with providing specialist flood advice on the program.
- DERM's current participation in the Program extends to
  - technical assessment of subsidy applications and advice to the State Assessment Panel on projects considered eligible for subsidy
  - approval of project plans
  - site inspections and/or advice verifying claims for project progress/final payments
  - attendance at project steering committee meetings
  - approving works for payment (progress and final)
  - attendance at national meetings concerning the management of the NDMP.
- The number and frequency of site inspection visits that may be required is highly variable as they are dependant on project timeframes and the value of work claimed. Likewise, project steering committee meetings and national advisory meetings are very difficult to predict on any long-term basis.
- Depending on the location of the project, suitable regional staff may be used to reduce the cost associated with site inspections when/where available.
- A consultation with EMQ has been suggested in the attached response, with the aim of reviewing the list of activities DERM currently provides advice or input on, to establish if the activities are being managed in the most efficient and effective way.
- After a consultation has taken place with EMQ, and the list of activities on which DERM provides support has been reviewed, DERM would then be prepared to review and sign the MOU.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- The budgetary impact of DERM continuing to fund costs associated with site inspection visits, attending project steering committee meetings and attending national advisory group meetings to support EMQ's administration of the NDMP is considered minor.
- The proposal to seek costs from EMQ was considered consistent with DERM's efforts to make budget savings.

PROPOSED ACTION

- The Assistant Director-General sign the attached letter to EMQ, recommending a review of the activities associated with the provision of specialist (technical) advice on flood issues on

Author Name [redacted] Position Tel No Date: 15 March 2010	Cleared by Name: [redacted] Position: Director, WIAMS Date: 15 March 2010 Name: Position: Date:	Cleared by Name: Position: Date: Name: Position: Date:	Recommended: Name: [redacted] Position Tel No Date: 15 March 2010

which DERM provides advice and support.

ASSISTANT DIRECTOR–GENERAL'S COMMENTS

ATTACHMENTS

- Letter to [redacted] Acting Chief Officer, EMQ

Author Name: [redacted] Positio Tel No Date: 15 March 2010	Cleare[redacted] Name: [redacted] Position: Director, WIAMS Date: 15 March 2010	Cleared by Name: Position: Date:	Recommended: Name: [redacted] Positio Tel No Date:15 March 2010
	Name: Position: Date:	Name: Position: Date:	

Queensland Government

Posted 8/4/10

Ref CTS 03891/10

Department of
Environment and Resource Management

0 8 APR 2010

Mr Bruce Grady
Acting Chief Officer
Emergency Management Queensland
GPO Box 1425
BRISBANE QLD 4001

Dear Mr Grady

Thank you for your letter dated 1 March 2010 regarding the draft Memorandum of Understanding for provision of specialist advice on flood issues on Natural Disaster Mitigation Program (NDMP) and Natural Disaster Risk Management Studies Programme (NDRMSP) projects.

It is noted that Emergency Management Queensland (EMQ) does not accept the additional clause entitled Financial Dealings which suggests, Department of Environment and Resource Management (DERM) officers' travelling and accommodation costs in relation to inspection of projects within Queensland, including conference and meeting attendance both within Queensland and interstate, be met by the Department of Community Safety (DCS).

DERM currently provides advice and support on a range of activities for the NDMP and NDRMSP, such as:

- reviewing project proposals prior to States Assessment Panel meeting;
- attending State Assessment Panel meetings;
- reviewing project programs of approved projects;
- attending flood advisory committee meeting of flood studies projects;
- interim inspections of flood mitigation project works for the recommendation of interim payments;
- reviewing final report of flood studies and flood risk management projects; and
- final inspection of flood mitigation project works for the recommendation of final payment.

The scope of, and manner in which, DERM provides advice and support on these matters has not been reviewed in some years. Consequently, DERM wishes to undertake a review, in conjunction with EMQ, of these matters, prior to finalising the MOU.

Level 7
400 George Street Brisbane Qld 4000
GPO Box 2454 Brisbane
Queensland 4001 Australia
Telephone + 61 7 3330 5550
Facsimile + 61 7 3330 5634
Website www.derm.qld.gov.au
ABN 46 640 294 485

If you are agreeable to this review, or would like to suggest an alternative approach, could you please contact [redacted] Director, Water Industry Asset Management and Standards of the department on telephone [redacted]

Yours sincerely

[redacted]

Lindsay Delzoppo
A/Assistant Director-General
Environment and Natural Resource Regulation

Emergency Management EMQ Queensland

Queensland Government

[redacted]

Emergency Management Queensland

Department of
Community Safety

29 June 2010

LD 7/7/10

Mr Lindsay Delzoppo
Acting Assistant Director-General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

Dear Mr Delzoppo

Thank you for your letter dated 8 April 2010 regarding the draft Memorandum of Understanding (MoU) for provision of specialist advice on flood issues on Natural Disaster Mitigation Program (NDMP) and Natural Disaster Risk Management Studies Programme (NDRMSP) projects.

The State Disaster Management Group (SDMG) comprises of Directors-General who represent government departments that have significant roles and services that they provide to support the overall disaster management arrangements. Please refer to the attached minutes from the SDMG which emphasises that each agency has a responsibility on behalf of the Queensland Government in providing disaster management services for activities that fall within its portfolio responsibilities.

The Department of Community Safety (DCS) has a coordinating role in Queensland for disaster management. This coordination role does not infer nor does DCS have the capability or budget to pay for the delivery of disaster management services provided by other State Government agencies.

The State plan clearly identifies individual state agencies and its roles and responsibilities related to particular events. For example, shipping disaster in the state plan is the responsibility of the Department of Main Roads and Transport, and flooding is a responsibility of the Department of Environment and Resource Management (DERM).

Rather than a MoU, our preference is a simple exchange in letters of consent in continuing the current service arrangements together with an agreed timeframe. It is requested that DERM considers the aspect of timeframes surrounding the review of reports relating to flood issues and this advice is provided to DCS within 20 working days from receipt the request.

The advice DERM has provided for a number of years throughout the application and assessment process has been invaluable and I ask that DERM continue this arrangement into the future.

.../2

EMQ Directorate

Emergency Services Complex
Cnr Kedron Park Road and Park Road
Kedron Qld 4031

GPO Box 1425 Brisbane
Queensland 4001 Australia

Telephone +61 7 3247 8511
Facsimile +61 7 3247 8505
Website www.emergency.qld.gov.au

ABN 92 265 149 823

Should you wish to discuss this matter further, please contact [redacted] Director, Volunteer Management, Emergency Management Queensland on telephone number [redacted]

Yours sincerely

[redacted]

Bruce Grady
Acting Chief Officer
Emergency Management Queensland

Enc

COPY
posted 2011/0/10

Queensland Government

Ref CTS 12228/10

Department of
Environment and Resource
Management

Mr Bruce Grady
Acting Chief Officer
Emergency Management Queensland
Department of Community Safety
GPO Box 1425
BRISBANE QLD 4001

Dear Mr Grady Bruce

Thank you for your letter dated 29 June 2010 regarding the provision of advice on flood proposals relating to the administration of the Natural Disaster Mitigation Program (NDMP) and the Natural Disaster Risk Management Studies Programme (NDRMSP) projects.

I advise that a meeting was held on 26 August 2010, between the Department of Community Safety (DCS) and the Department of Environment and Resource Management (DERM) to discuss the proposed service arrangements for providing advice on flood issues. The meeting was attended by [redacted] Director, Volunteer Management, Emergency Management Queensland and [redacted] Director, Disaster Management within DCS; and [redacted] Director, Water Industry Asset Management and Standards and Mr Russell Cuerel, Manager, Infrastructure Management, within DERM's Office of the Water Supply Regulator (OWSR).

At the meeting, it was noted that DERM has historically provided technical support for the administration of schemes that provide government subsidy to local government for water related infrastructure, including flood mitigation works; and that DERM has also historically supported DCS in the formulation and implementation of the flood aspects of State Planning Policy 1/03 - *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (SPP 1/03).

Consequently it was agreed that DERM would continue to support DCS as follows:

- assessment of local government projects, seeking subsidy under the NDMP, the NDRMSP and also the Regional Flood Mitigation Program (RFMP);
- support for the assessment of the progress of approved projects under the NDMP, the NDRMSP and the RFMP;
- confirming that local governments have met milestones to allow payment of subsidy, based on progress reported against their project plan (note: site inspections to verify that works have been constructed, will not be undertaken);
- determining if local government planning schemes have satisfactorily implemented the flood elements of SPP 1/03; and
- assessment of individual development applications against the flood elements of SPP1/03, where a planning scheme has not yet implemented SPP1/03.

Level 13
400 George Street Brisbane Qld 4000
GPO Box 2454 Brisbane
Queensland 4001 Australia
Telephone + 61 7 3330 6240
Facsimile + 61 7 3330 6306
Website www.derm.qld.gov.au
ABN 46 640 294 485

It was further noted at the meeting that, from time to time OWSR has been encouraged to provide representation and participate in policy type activities, such as state-wide or national forums discussing flooding, and possible government actions required to better manage flood risks. The opportunity to participate is appreciated, however since OWSR is an operational rather than policy area of DERM, OWSR will not be involved in flood policy activities on behalf of DERM and/or the State, such as the National Flood Risk Advisory Group. I advise that while DERM's position with regard to state flood policy is yet to be finalised, the primary point of contact for flood risk information is [redacted] (Assistant Director-General, Environment and Resource Sciences) on telephone [redacted]

OWSR will continue to provide resources up to the equivalent of 1 FTE for the provision of advice to DCS, with oversight by Mr Russell Cuerel, Manager, Infrastructure Management.

Should you have any further enquiries, please do not hesitate to contact Mr Russell Cuerel, Manager, Infrastructure Management of the department on telephone [redacted]

Yours sincerely

[redacted]

Mr Terry Wall
Associate Director General
Operations and Environmental Regulator

Level 13
400 George Street Brisbane Qld 4000
GPO Box 2454 Brisbane
[redacted]
Website www.derm.qld.gov.au
ABN 46 640 294 485

Emergency Management EMQ Queensland

Queensland Government

[redacted]

Emergency Management Queensland

Department of
Community Safety

⇒ Terry - fyi.

⇒ [redacted]

response if required

Rec'd - OER

11 NOV 2010

2 November 2010

copy to ⇒ [redacted]

Mr Terry Wall
Associate Director General
Operations and Environmental Regulator
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

Terry

Dear Mr Wall

Thank you for your letter received on 28 October 2010 regarding support from the Department of Environment and Resource Management (DERM). This letter in reply completes the exchange of letters agreed at the meeting on 26 August 2010 to formalise such arrangements in place of a Memorandum of Understanding.

20960-10

I welcome your continued support to Natural Disaster Mitigation Programs. Your advice will be sought particularly as part of assessment panels, as we continue to refine our approach to the jointly funded Federal and State Natural Disaster Resilience Package.

I note that the Office of the Water Supply Regulator, as an operational body, no longer feels it is able to represent state interests at national forums, such as the National Flood Risk Advisory Group.

I am aware that Queensland is, therefore, no longer represented on this particularly body, and ask that you might raise the issue within DERM with a view to a policy oriented representation, while the Department is finalising its position on state flood issues.

[redacted]

I am, again, grateful for your commitment to our assessment process.

Should you have any further issues please contact [redacted] Director Disaster Management on telephone numbe[redacted]

Yours sincerely

[redacted]

Bruce Grady
Acting Chief Officer
Emergency Management Queensland

EMQ Directorate
Emergency Services Complex
Cnr Park and Kedron Park Roads Kedron
Queensland 4031
GPO Box 1425 Brisbane
[redacted]
Website www.emergency.qld.gov.au/emq
ABN 19 823 962 345