



CLARENCE RIVER COUNTY COUNCIL
Floodplain Management

Ulmarra Riverbank



Ulmarra Riverbank – During 1996 Flood

Management Plan

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General Manager

ROCK PLACEMENT TO SUPPORT LOWER BANK	“RIVERBANK BUFFER ZONE”
VOLUNTARY PURCHASE	HAZARD MONITORING AND MANAGEMENT REVIEW

**ULMARRA RIVERBANK
MANAGEMENT PLAN**

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1 INTRODUCTION

1.1 CITATION

This plan shall be referred to as the Ulmarra Riverbank Management Plan (*the Plan*).

1.2 RESPONSIBILITY OF AUTHORITIES

The management of the riverbank at Ulmarra is the responsibility of the Clarence River County Council (CRCC), while the control and management of land use and development along the riverbank is the responsibility of Ulmarra Shire Council (*Shire Council*).

The ownership, preparation and review of the Ulmarra Riverbank Management Plan is the responsibility of the Clarence River County Council. Implementation of the Plan is the responsibility of CRCC and the relevant authority for each aspect of the Plan.

1.3 DISCLAIMER

It is not suggested that the Plan wholly addresses the problems that face owners or occupiers of affected riverbank land at Ulmarra, either now or in the future. It is recommended that all such owners and occupiers actively seek advice to assess the present level of risk and monitor that level of risk from time to time, and also take such steps as they are advised or think fit for the safety and protection of persons or property.

Ulmarra Shire Council and the CRCC do not accept or undertake any responsibility for any future injury or property damage that might occur if any part of the riverbank collapses.

1.4 BACKGROUND

The settlement of Ulmarra is situated on the south bank of the Clarence River some 15 km downstream of Grafton in north-eastern New South Wales. Located on the outside of a bend in the river, the riverbank at Ulmarra is exposed to ongoing erosion.

To counteract the erosion problem, approximately 600 metres of riverbank immediately downstream of Ulmarra was rock protected in 1969. During relatively minor flooding in 1988 and 1989, the bank protection suffered damage with significant repair costs. The threat of erosion poses a risk to life and property at Ulmarra which cannot be quantified with absolute certainty.

1.4.1 Bank Erosion Investigations

CRCC undertook a series of bank erosion investigations of the Ulmarra riverbank. The Study Area is shown in **Figure 1**. A data collection program was established to monitor the erosion problem. Studies included a survey of river cross-sections, Sidescan sonar to identify existing below water conditions, engineer diving inspection to visually assess critical sections of riverbank, vibrocoring in the bed of the river to provide information on composition and scour levels, and boreholes drilled along the crest of the riverbank,

laboratory testing of the strength of soils and slope stability analyses to quantify the extent of the immediate bank failure hazard.

The bank erosion investigations found that the section of riverbank at Ulmarra, extending from about the Butter Factory to downstream of the Ferry Crossing, had experienced the largest recession over the last century, and that today this same section of bank still occupies a high stress zone through Ulmarra Bend (**Figure 1**).

Riverbank recession at Ulmarra was found to depend on two discrete processes:

- erosion due to current shear acting over the full bank height during major floods, and concentrating in the lower sections of the bank at times of freshes and smaller-scale flood events; and
- localised slip failures mostly triggered by high pore pressures developed during sustained periods of heavy rainfall and/or rapid drawdown following floods.

The Ulmarra bank erosion investigations have provided a detailed model of the short and long-term behaviour of the Ulmarra riverbank (*CRCC 1993, 1994 and 1997a*).

1.4.2 Interim Riverbank Management Policy

CRCC prepared an Interim Riverbank Management Policy in January 1997 to permit ongoing development and land use decisions compatible with riverbank hazard, bridging the time needed to develop and implement a long-term management plan (*CRCC, 1997b*).

1.4.3 Ulmarra Riverbank Consultative Committee

The Ulmarra Riverbank Consultative Committee, a committee of Clarence River County Council, was formed in 1996 to facilitate the joint involvement of all stakeholders in the development of a management plan for Ulmarra. Groups represented on the Consultative Committee included the Shire Council, CRCC, the Department of Land and Water Conservation (*DLWC*) and riverbank property owners.

Meetings of the Ulmarra Riverbank Consultative Committee held in late 1998 and early 1999 resolved to pursue a management plan for Ulmarra which embraced four key measures:

- (1) Rock Placement
- (2) Riverbank Buffer Zone (*RBZ*)
- (3) Voluntary Purchase
- (4) Monitoring and Review

1.5 AIM AND TIMING

The aim of the Plan is to address the threat posed by the erosion of the riverbank adjacent to Ulmarra Village. The Ulmarra Riverbank Management Interim Policy will remain in force until such time as the Plan is adopted and fully implemented by each relevant authority, ie all rock in

Precinct A is placed, the Riverbank Buffer Zone is formally adopted, a voluntary purchase scheme is formally constituted, and a monitoring and review program is set up.

1.6 EXTENT OF PLAN

The Plan applies to all riverbank land on the south bank of the Clarence River at Ulmarra, commencing upstream of the village opposite the old mouth of Alummy Creek, and extending approximately seven kilometres downstream.

Given that limited resources are available to implement the Plan, priority would be given to the Ulmarra Village area generally (*namely the section of riverbank from Ulmarra Drain to the Ferry Crossing*), and to the high stress zone in particular (*hereinafter referred to as Precinct A, between building numbers 51 and 81 inclusive*), for the following reasons:

- the high rate of erosion; and
- the high density of residential and commercial properties.

The upstream and downstream limits of the Plan, the priority area through Ulmarra Village, and the high stress zone (*Precinct A*), are shown in **Figure 1**.

2 DEFINITIONS

The following definitions apply to words and phrases used in the Plan:

- bank** - lateral boundary of a river or stream taken to extend from beyond the crest of the bank at natural ground level down to the toe at the base of the bank
- buffer zone** - a width of land extending from Mean High Water Mark and determined for the purpose of managing bank erosion hazard
- Clarence River County Council (CRCC)** - regional flood mitigation authority for the Clarence Valley
- crest (of bank)** - top of the bank located where the general slope of the bank intersects the general natural ground surface. The current crest line along the riverbank shall be taken as the crest line determined from the 1992 photogrammetric analysis prepared by the Public Works Department (refer **Figure 2 to 9**) or by direct measurement, whichever is located further away from the river, as interpreted by Ulmarra Shire Council.
- development application (DA)** - an application for consent to carry out development under Division 1 of Part 4 of the Environmental Planning and Assessment Act
- development categories** - the following development categories are recognised in the Plan to facilitate merit decisions by Ulmarra Shire Council on development proposals
- additions** - extension of existing residential or commercial/industrial development; can be major additions (*eg. new habitable rooms, addition of second storey etc.*) or minor additions (*eg. swimming pools, fencing, storage areas, sheds, carports, domestic garages – refer Appendix A for full schedule*)
- existing development** - current development which may already be at risk from bank hazard
- maintenance** - work essentially to keep an existing structure in serviceable condition; may include minor upgrade
- new development** - development which previously did not exist; major new development would include a new dwelling, new warehouse etc

redevelopment	-	involves demolition and reconstruction of an existing development on a relatively large scale; generally does not require major extension to services
repairs	-	work essentially to keep an existing structure in serviceable condition; may include minor upgrade
replacement <i>(of infrastructure)</i>	-	new development to substitute for existing development; may or may not involve an upgrade
duty of care	-	generally a council owes a duty of care to avoid damage to property or injury to a person when carrying out its operational functions
Environmental Impact Statement (EIS)		“An assessment of the impact of a proposed development” in the context of the Environmental Planning and Assessment Act
erosion <i>(of bank)</i>	-	progressive process by which the surface of a bank is worn away by the action of water
failure <i>(of bank)</i>	-	mass failure; sudden destabilisation of a bank which occurs when activating forces due to weight overcome stabilising forces due to the strength of the soil
Floodplain Management Committee	-	committee comprising representatives from Ulmarra Shire Council, local community, and other government agencies and departments, with the principal objective to assist Council to develop and implement a Floodplain <i>(and Riverbank)</i> Management Plan
geotechnical investigation	-	engineering investigation dealing with the mechanics of soil and rock
hazard <i>(bank)</i>	-	risk associated with bank erosion and/or failure
hazard zone <i>(bank)</i>	-	zone which extends landwards from the crest of a bank within which there is an unacceptably high risk of being affected by bank erosion and/or failure
Interim Policy	-	policy for use until such time as the Riverbank Management Plan is adopted and implemented
land use categories	-	the following land use categories are recognised in the Plan to facilitate merit decisions by Ulmarra Shire Council on development proposals:

agricultural	-	refers to all non-habitable development related to farming operations. "Intensive use" facilities include storage sheds and bins for storage of high capital cost plant and machinery or extensive goods or produce, product processing buildings and structures, animal shelters, milking sheds, etc. "Non-intensive use" facilities include cattle dips, farm tracks (<i>unsealed</i>), fencing, etc.
commercial	-	refers to shops, offices, petrol stations, motels, etc.
industrial	-	refers to all industrial related activities including factories, engineering workshops, warehouses etc.
infrastructure	-	refers to all roads and services related to electricity, gas, water, sewerage and telephone. Local infrastructure services only the village of Ulmarra and its immediate surrounds. Communities of neighbouring towns and further afield will use infrastructure of Regional, State or National significance (<i>eg. Pacific Highway</i>). The continued function of infrastructure would be important in reducing social disruption in the aftermath of a bank failure
residential	-	refers to habitable development including houses, duplexes, flats, units and homes for the aged
Local Environmental Plan	-	a plan made by the Minister for Urban Affairs and Planning under section 70 of the Environmental Planning and Assessment Act
management plan (<i>bank</i>)	-	document which describes how riverside property is to be used and managed in order to reduce the impact of riverbank hazard and hazard liability
photogrammetry	-	survey technique utilising photographs to determine position and levels
planning period	-	period of time within which planning decisions would apply. Whereas residential, commercial/industrial and agricultural development would normally be designed for a 50 year planning period, infrastructure would normally be designed for a 50 to 100 year planning period.
planned retreat	-	option for managing hazard at a receding bank utilising a rolling setback line
protection (<i>of bank</i>)	-	method of stabilising against bank erosion and failure by physical works, eg. rock armouring, spur walls etc

- recession (of bank)** - long term retreat of a riverbank; recession rate refers to recession averaged over a period of time commonly established in metres per year
- retreat (of bank)** - lateral movement landward of a riverbank due to bank erosion and mass failure
- riverbank** - see bank
- rock armouring** - method of bank protection involving placement of rocks along the face of the bank
- scarp (bank)** - top of a steepened face on a bank attributed to a previous failure; the scarp typically coincides with the crest of a receding riverbank
- Shire Council** - Ulmarra Shire Council
- slip (bank)** - relatively small bank failure
- slope stability analysis** - engineering analytical technique for establishing the relative stability of a slope (*eg. bank*) involving calculation of activating and stabilising forces
- slump (bank)** - relatively large bank failure
- stabilisation (of bank)** - see bank protection
- toe (of bank)** - base of the bank located underwater where the general slope of the bank intersects the general surface of the bed of the channel
- voluntary purchase** - option for managing bank hazard whereby threatened property is voluntarily purchased by government at equitable prices; commonly involves government making a standing offer as a basis for negotiation and purchase over a period of time

3 MANAGEMENT MEASURES

The Ulmarra Riverbank Consultative Committee has resolved to have a Riverbank Management Plan based on the following elements:

- Rock Placement
- Riverbank Buffer Zone
- Voluntary Purchase
- Monitoring and Review

These, together with emergency measures, community education and riverbank maintenance, comprise the Plan.

3.1 ROCK PLACEMENT

Properly designed and maintained rock protection placed on the riverbank would limit direct erosion of the bank by river currents, and improve bank stability. The placement of rock on the lower submerged portion of the bank is one of the adopted management measures for Ulmarra.

Rock would be placed in two ways, under the Plan, namely:

- (i) from the toe of the bank up to Mean High Water Mark (*MHWM*), after a bank failure has occurred and where there are irregularities in the alignment of the bank; and
- (ii) in Precinct A (*between building numbers 51 and 81*), support to the toe of the bank would be created by continuous rock placement from the toe of the bank up to *MHWM*.

Riverbank areas for rock placement are referred to in **Figures 2 to 9**.

A placement concept for toe rock protection is presented in **Figure 10**. The concept includes a wide berm set at the *MHWM*, with subaqueous slope no steeper than 1(v):1.7(h). A self launching rock apron to accommodate toe scour is also included.

Based on previous bank erosion investigations (*CRCC 1993, 1994 and 1997(a)*), it is recognised that the placement of rock as above would not remove the risk of bank failure, and the area within 10 metres of the crest of the riverbank would remain under unacceptable threat of failure, and hence any existing structure and new development in that area would be at risk. Furthermore, the Ulmarra Riverbank Interim Policy will remain in force until such time that the rock is in place (refer **Section 1.5**).

The crest of the riverbank shall be as defined in **Section 2**.

3.2 RIVERBANK BUFFER ZONE (RBZ)

Given the threat to development along the Ulmarra riverbank, a RBZ is introduced under the Plan.

The RBZ recognises the changing nature of the river channel and riverbank. Its objective is to contain the threat of riverbank hazard, whilst allowing the Ulmarra community and landowners to achieve reasonable life goals within a cost-effective planning framework. Development restrictions will apply to properties affected by the RBZ, subject to land use and degree of development.

A 10 metre wide RBZ shall currently apply to all riverfront land covered by the Plan (refer **Figures 2 to 9**). The Plan recognises that the effects of riverbank erosion could involve land outside of a 10 metre RBZ and therefore makes it mandatory that Clarence River County Council implements a "quality assured" program of monitoring and review. The RBZ shall be measured from the crest of the riverbank, at right angles to the general local alignment of the waterline. Clarence River County Council surveyors would peg out the RBZ on a property by property basis as required.

The width of the RBZ may be revised from time to time, as a consequence of monitoring and review actions (refer **Section 3.4**).

Outside of Precinct A, where a relatively gentle riverbank slope is encountered, local reductions in the width of the RBZ from 10 metres to 5 metres could be considered by the Shire Council for individual properties in accordance with advice from CRCC in each case. The procedure to establish whether or not a 5 metre wide RBZ could apply to an individual property is detailed in **Appendix B**.

Ulmarra Shire Council, CRCC and DLWC recognise that by keeping the RBZ to an absolute minimum, there is a risk that the effects of riverbank erosion could involve land outside of the RBZ. An important component of the Plan is therefore to involve thorough monitoring and review (**Section 3.4**) and other appropriate responses to riverbank failures (**Sections 3.5, 3.6 and 3.7**).

3.3 VOLUNTARY PURCHASE

Voluntary Purchase of existing residential properties affected by the RBZ will be offered by CRCC on the basis of the priority determined by the Shire Council, in consultation with CRCC and DLWC.

The main elements of this measure would be as follows:

- (i) a priority listing of threatened residential properties would be developed by the Shire Council in consultation with CRCC and DLWC;
- (ii) from time to time and subject to availability of federal and state government subsidies, purchase offers would be made by CRCC to owners of "priority" properties. A funding appraisal in respect of current flood mitigation measures is set out in **Appendix C**;

- (iii) the offer price would be the “market valuation” established by the Valuer General. This valuation would disregard the riverbank hazard and any existing building or development controls related to riverbank hazard;
- (iv) if in the opinion of Clarence River County Council, any property improvement made after the date of adoption of the Plan is considered to be affected by riverbank hazard, the value of that improvement will not be taken into account in setting property values for buy-back;
- (v) building structures on properties which are bought out would be demolished and the land placed in the care and control of Ulmarra Shire Council; and
- (vi) commercial properties would not be eligible for Voluntary Purchase.

3.4 MONITORING AND REVIEW

As much of the Ulmarra riverbank would remain susceptible to erosion and failure, mandatory “quality assured” monitoring is included as the fourth and final key management measure. The aim of monitoring is to confront the Shire Council with a decision to retain or modify the currently adopted management approach.

The monitoring and review procedure is outlined below in **Table 3.1**.

Table 3.1 MONITORING AND REVIEW PROCEDURE

Item	Frequency of Monitoring Action	Monitoring Action
(i)	After every flood or at least annually	A suitably experienced professional engineer shall inspect the riverbank and prepare a report (<i>with photos</i>). Any evidence of scour and failure to be located on plans and measured by at least hand survey methods. Archive report
(ii)	Dependent on the results of (i)	If (i) shows signs of bank instability such as new tension cracks or reworking of old cracks, slumps, loss of rocks at the waterline etc., then undertake bank surveys. Bank cross-sections should coincide with the permanent river cross-sections established as part of the Ulmarra Bank Erosion Investigations (<i>CRCC, 1993, 1994 and 1997a</i>).
(iii)	After each major overbank flood	Repeat riverbank surveys in accordance with (ii).
(iv)	At least every 5 years	Carry out riverbank surveys in accordance with (ii) and reassess management actions.
(v)	Every 10 years	Give consideration to carrying out full channel surveys and aerial photography, for inclusion in the engineer assessments.

Item	Frequency of Monitoring Action	Monitoring Action
(vi)	Dependent on the results of (ii), (iii), (iv) and (v)	Compare all surveys from (ii), (iii), (iv) and (v) with historical surveys to determine whether there has been any scouring and/or steepening of the riverbank at the permanent river cross-sections. If the survey comparison indicates significant change, a slope stability analysis shall be undertaken to examine the effect of the changed condition, and determine whether the current management approach can be retained, or should be modified. Assessment of bank changes slope stability analysis and validity of management approach shall be made by a suitably experience professional engineer(s), in the form of a written report.

3.5 EMERGENCIES

3.5.1 Responsibilities

It shall be the responsibility of the Local Emergency Management Committee comprising representatives of each of the emergency services organisations operating in the Ulmarra Local Government Area to prepare plans for the prevention of, preparation for, response to and recovery from any emergency arising in the event of a riverbank failure.

North Power, Telstra, CRCC and RTA will each be responsible for securing their own services.

3.5.2 Evacuation

Evacuation will proceed at the direction of the SES Controller. Results of all surveys and assessments relating to riverbank monitoring shall be made available to the SES Controller.

Should an evacuation occur, the SES shall determine when residents may return to their dwellings. The Local Emergency Management Committee may request that any return be delayed until a survey has been undertaken to examine the effect of any scouring and/or bank steepening.

3.6 COMMUNITY EDUCATION

On-going community education will be undertaken on a regular basis, particularly following the results and reporting of monitoring and review activities. All affected residents would be consulted by the Shire Council prior to any changes to the Plan.

3.7 RIVERBANK MAINTENANCE

Within the area covered by the Plan, CRCC's current riverbank maintenance program which includes rock protection in critical areas and monitoring and restriction of building activity close to the riverbank remains.

3.8 ADVICE ON SECTION 149 CERTIFICATES

Section 149(2) and 149(5) Certificates for all riverfront properties covered by the Plan shall disclose that the Plan restricts the development of land by reason of the likelihood of riverbank erosion and instability. The current width of the RBZ as it applies to individual properties shall be disclosed on the certificates.

4 DEVELOPMENT RESTRICTIONS

4.1 IMPLICATIONS OF RIVERBANK BUFFER ZONE FOR DEVELOPMENT

Riverbank failures have occurred in the past at Ulmarra. Detailed investigations have shown that similar failures are likely to occur in the future, particularly during and/or following wet or high river flow periods. Future instability may impact on existing development, and restrictions on future development located along the riverbank are required.

4.2 BUILDING ASSETS ALONG ULMARRA RIVERBANK

The Ulmarra Riverbank Management Options Report (*CRCC, 1998*) established that there were 109 building structures, located within the Study Area (*same area covered by the Plan*), predicted to be affected by riverbank hazard within the next 50 years. Of these structures, 45 were residential dwellings, with the remaining comprising either commercial premises, sheds or detached garages or carports. The affected building structures are shown in **Figures 2 to 9**. A listing of the property owners affected by the Plan, established from Ulmarra Shire Council records as at October 1997, is attached in **Appendix D**. The building structure numbers shown in the figures are cross-referenced to the property owner in the appendix listing.

The distribution of dwelling types in Ulmarra reflects the age of the structures and also location relative to the town and areas of recent subdivision. Generally older dwellings are timber, founded on brick piers. Timber dwellings are most common downstream of the Ferry Crossing and between the New Subdivision and the Commercial Hotel. All recently constructed dwellings would appear to be brick, notably in the New Subdivision.

4.3 DEVELOPMENT RESTRICTIONS UNDER ULMARRA RIVERBANK MANAGEMENT PLAN

Restrictions for structural development along Ulmarra riverbank adopted under the Ulmarra Riverbank Management Plan are set out in **Table 4.1**. Further explanation of the development restrictions are provided below in relation to land use and development categories.

4.3.1 Residential

All owners and occupiers of existing and proposed residential development affected by the Riverbank Buffer Zone (*RBZ*) should be formally advised of:

- the Ulmarra Riverbank Management Plan, its objectives and status of implementation; and
- the riverbank hazard and the implications of riverbank hazard for development.

Repairs, maintenance, and minor additions, shall be permitted to residential dwellings affected by the RBZ. A full listing of permissible "minor additions" to residential properties is provided in **Appendix A**.

New development, redevelopment and major additions for residential use shall not be permitted where affected by the RBZ. Structures within these development categories shall be permitted where not affected by the RBZ.

4.3.2 Commercial and Industrial

All owners and occupiers of existing and proposed commercial and industrial development affected by the RBZ should be formally advised of:

- the Ulmarra Riverbank Management Plan, its objectives and status of implementation; and
- the riverbank hazard and the implications of riverbank hazard for development.

Repairs and maintenance shall be permitted to commercial and industrial buildings where affected by the RBZ. A full listing of permissible "minor additions" to commercial and industrial properties is provided in **Appendix A**.

New development, redevelopment and additions for commercial and industrial use shall not be permitted where affected by the RBZ. Structures within these development categories shall be permitted where not affected by the RBZ.

Repairs and maintenance would be permitted to commercial and industrial buildings within the RBZ.

4.3.3 Agricultural

All owners and occupiers of existing and proposed agricultural development affected by the RBZ should be formally advised of:

- the Ulmarra Riverbank Management Plan, its objectives and status of implementation; and
- the riverbank hazard and the implications of riverbank hazard for development.

Repairs and maintenance, and new non-intensive use facilities, shall be permitted to agricultural buildings where affected by the RBZ.

New development and redevelopment of intensive use facilities for agricultural use shall not be permitted where affected by the RBZ. Structures within these development categories shall be permitted where not affected by the RBZ.

4.3.4 Infrastructure

All relevant authorities involved in the provision and maintenance of existing and proposed infrastructure affected by the RBZ should be formally advised of:

- the Ulmarra Riverbank Management Plan, its objectives and status of implementation; and
- the riverbank hazard and the implications of riverbank hazard for development.

Local Infrastructure

Maintenance of Existing Infrastructure

Maintenance work involving local infrastructure should be permitted where affected by the RBZ subject to the work not exacerbating existing riverbank hazard. Ulmarra Shire Council should encourage the relevant authorities to investigate alternatives and to develop a long-term strategy.

Maintenance work involving local infrastructure should be permitted where not affected by the RBZ.

New Infrastructure and Replacement of Existing Infrastructure

New local infrastructure and the replacement of existing local infrastructure should not be permitted where affected by the RBZ.

Where not affected by the RBZ, these development categories could be permitted, subject to the investigation by the relevant authorities of alternatives and adoption of a satisfactory long-term strategy. Restrictions on new and replacement infrastructure, where not affected by the RBZ, recognise the relatively long planning periods associated with infrastructure land use.

Regional, State and National Infrastructure

Maintenance of Existing Infrastructure

Maintenance work involving infrastructure forming part of a Regional, State or National network could be permitted where affected by the RBZ, subject to the work not exacerbating riverbank hazard. The Shire Council should encourage the relevant authorities to investigate alternatives and a long-term strategy.

Maintenance work involving infrastructure forming part of a Regional, State or National network should be permitted where not affected by the RBZ.

New Infrastructure and Replacement of Existing Infrastructure

New and replacement infrastructure forming part of a Regional, State or National network, where affected by the RBZ, should be refused where Ulmarra Shire Council is a consent authority unless there are other overriding and compelling issues of community need. It would be prudent for Ulmarra Shire Council to seek legal advice in relation to any proposal to introduce new and replacement infrastructure in areas affected by the RBZ.

Where not affected by the RBZ, any new and replacement infrastructure could be permitted where the Shire Council is a consent authority, subject to an investigation of the alternatives and adoption of a satisfactory long-term strategy. Restrictions on new and replacement infrastructure, where not affected by the RBZ, recognise the relatively long planning periods associated with infrastructure land use.

Table 4.1 DEVELOPMENT RESTRICTIONS UNDER ULMARRA RIVERBANK MANAGEMENT PLAN

Land Use Category	Development Category	Riverbank Land affected by RBZ	Riverbank Land not affected by RBZ
Residential	Existing Development	Formally advise owners and occupiers of the Plan, and riverbank hazard	
	Repairs and Maintenance, and Minor Additions	Permitted	Permitted
	New Development, Redevelopment, and Major Additions	Not permitted. Ensure new owners and occupiers are formally advised of the Plan, and riverbank hazard	Permitted. Ensure new owners and occupiers are formally advised of the Plan, and riverbank hazard
Commercial and Industrial	Existing Development	Formally advise owners and occupiers of the Plan, and riverbank hazard	
	Repairs and Maintenance, and Minor Additions	Permitted	Permitted
	New Development, Redevelopment, and Major Additions	Not permitted. Ensure new owners and occupiers are formally advised of the Plan, and riverbank hazard	Permitted. Ensure new owners and occupiers are formally advised of the Plan, and riverbank hazard
Agricultural	Existing Development	Formally advise owners and occupiers of the Plan, and riverbank hazard	
	Repairs and Maintenance, and New Non-intensive Use Facilities	Permitted	Permitted
	New Development, Redevelopment, and Additions	Not permitted. Ensure new owners and occupiers are formally advised of the Plan, and riverbank hazard	Permitted. Ensure new owners and occupiers are formally advised of the Plan, and riverbank hazard.

Continued

Table 4.1 Development Restrictions Under Ulmarra Riverbank Management Plan (cont'd)

Land Use Category	Development Category	Riverbank Land affected by RBZ	Riverbank Land not affected by RBZ
Infrastructure			
(i) Local	Existing Infrastructure	Formally advise relevant authorities of the Plan, and riverbank hazard	
	Maintenance	Maintenance work should be permitted, subject to work not exacerbating riverbank hazard. Investigation of alternatives and long-term strategy should be encouraged	Permitted
	New and Replacement Infrastructure	Not permitted. Ensure relevant authorities proposing new infrastructure are formally advised of the Plan, and riverbank hazard	Could be permitted, subject to investigation and consideration on merit of alternatives and adoption of a long-term strategy. Ensure relevant authorities proposing new infrastructure are formally advised of the Plan, and riverbank hazard
(i) Regional, State and National	Existing Infrastructure	Formally advise relevant authorities of the Plan, and riverbank hazard	
	Maintenance	Maintenance work could be permitted, subject to work not exacerbating riverbank hazard. Investigation of alternatives and long-term strategy encouraged.	Permitted
	New and Replacement Infrastructure	Should be refused where Ulmarra Shire Council is a consent authority, unless there are other overriding and compelling issues of community need. Prudent for Ulmarra Shire Council to seek legal advice. Ensure relevant authorities proposing new infrastructure are formally advised of the Plan, and riverbank hazard	Could be permitted, subject to investigation and consideration on merit of alternatives and adoption of a long-term strategy. Ensure relevant authorities proposing new infrastructure are formally advised of the Plan, and riverbank hazard

5 COST AND IMPLEMENTATION OF THE PLAN

5.1 COST ESTIMATE

The cost of implementing the Riverbank Plan is set out in **Appendix E**. It is not possible to determine a firm estimate of cost because it is not possible to determine the timing and size of future bank slumps, which will dictate the need for supplementary toe rock outside of Precinct A.

The likely participation in the Voluntary Purchase program (**Section 3.3**) and the consequential uptake rate are also unknown. Consequently reasonable assumptions have been made to assess the cost and cash flow implications of the Plan. These assumptions are discussed in **Appendix E**.

The estimated cost of the main components of the Plan are as follows:

1. Rock Replacement

- | | | |
|-----|---|---|
| 1.1 | Placement of toe rock in Precinct A | |
| | • capital cost | \$2.22M |
| | • maintenance cost | \$33,000 pa |
| 1.2 | Placement of supplementary toe rock after a bank failure or as required | |
| | • capital cost | \$500,000 |
| | | every 5 yrs |
| | • maintenance costs | \$10,000 pa (<i>for each \$500,000</i>) |

2. Riverbank Buffer Zone (RBZ)

- | | | |
|---|---|----------|
| • | RBZ surveys to closely define bank slopes on individual lots | \$20,000 |
| • | engineering review of RBZ width including additional slope stability analysis to confirm Table B.1 | \$20,000 |

3. Voluntary Purchase

- | | | |
|---|---------------------------------|------------------------------|
| • | based on an assumed uptake rate | \$3.5 M spread over 50 years |
|---|---------------------------------|------------------------------|

4. Monitoring and Review

- | | | |
|---|--|---------------------------------|
| • | annual inspection & report | \$5,000 pa |
| • | regular surveys of permanent bank cross-sections | \$10,000 every 5 yrs |
| • | post major flood survey | 4 off \$10,000 each over 50 yrs |
| • | aerial photography and photogrammetry | \$25,000 every 10 yrs |

- engineering review \$20,000 every 10 yrs

The total cost of the Plan, when discounted over 50 years to a present value (6% discount rate) is estimated to be \$5.4M.

5.2 FUNDING

Assuming that the Plan is eligible for funds from both state and federal grant schemes in respect of both capital works and voluntary purchases (*ie. 2:2:1, state:federal:council*) and it is eligible for funds from the state grant scheme in respect of maintenance and monitoring (*ie 2:1, state:council*), the following approximate annual funds allocations will be required:

	Council Contribution	State Gov't Grant	Federal Gov't Grant	Total Annual Allocation
Years 1-3	\$150,000 pa	\$300,000 pa	\$300,000 pa	\$750,000 pa
Years 4-10	\$57,000 pa	\$115,000 pa	\$78,000 pa	\$250,000 pa
Years 11-50	\$64,000 pa	\$133,000 pa	\$78,000 pa	\$275,000 pa

5.3 IMPLEMENTATION PROGRAM

A program of the activities required to implement the Plan is shown in **Table 5.1**. A brief discussion of the individual program elements is provided below.

Plan Acceptance

The Riverbank Management Plan must be formally adopted by both Ulmarra Shire Council and the Clarence River County Council.

Funds for implementation of the Plan will need to be approved by both the State and Federal Governments on a rolling budgetting basis.

Rock Replacement

Preliminary Activities – Before any works can be carried out, an environmental assessment will need to be carried out (*Statement of Environmental Effects*) and development consent obtained.

Detailed designs, documentation and tenders for all works will need to be prepared as a necessary prerequisite for the calling of tenders and the awarding of a contract.

These preliminary activities would be carried out by the Clarence River County Council.

Table 5.1 ULMARRA RIVERBANK MANAGEMENT PLAN - IMPLEMENTATION SCHEDULE

Activity	YEARS																																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50							
1. Plan Acceptance																																																									
1.1 Adoption of Management Plan	█																																																								
1.2 Allocation of Funds	-----																																																								
2. Rock Replacement																																																									
2.1 Preliminary Activities																																																									
- environmental assessment and approval	█																																																								
- detailed design, documentation and tendering	█	█																																																							
- award contract	█																																																								
2.2 Place toe rock in Precinct A (see Figure 5)	█	█	█																																																						
2.3 Place supplementary toe rock				█						█						█						█																																			
2.4 Annual rock maintenance				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3. Riverbank Buffer Zone																																																									
3.1 Carry out detailed bank surveys	█																																																								
3.2 Reduce width of RBZ where appropriate	█																																																								
4. Voluntary Purchase Program																																																									
4.1 Set up program	█																																																								
4.2 Acquire properties when offered					◆					◆					◆						◆																																				
5. Monitoring and Review																																																									
- Annual bank inspection and report																																																									
- Bank surveys (permanent sections)				○						○												○																																			
- Post major floor surveys											X												X																																		
- Aerial photography				□																																																					
- Hydrographic survey				+																																																					
- Engineering review of Plan					⊛																																																				

Placement of Toe Rock in Precinct A – Toe rock would be carried out under contract, supervised by the Clarence River County Council. The rock could be placed in stages to suite the availability of funds.

Placement of Supplementary Toe Rock – Supplementary toe rock would be placed (*under contract*) along areas upstream and downstream of Precinct A, after a bank failure has occurred and where there are irregularities in the alignment of the bank (refer **Section 3.1**).

The timing of supplementary toe rock placement, and the quantities involved, are shown indicatively in **Table 5.1** because they will depend on the timing, number and size of future bank slumps.

Maintenance Costs – It will be necessary to maintain the integrity of all rock protection by periodic maintenance. The rock protection will deteriorate otherwise, through fretting by flood action and bank slips.

Riverbank Buffer Zone

When the Plan has been adopted, a Registered Surveyor will be commissioned to carry out surveys of individual properties. The surveys are required to determine bank details in accordance with the survey brief in **Appendix B.2**.

Once surveys have been carried out, a practicing Civil Engineer, experienced in the area of riverbank stability, will be commissioned to evaluate the potential for reducing the width of the RBZ in accordance with the provisions of **Appendix B.1**.

Establish Voluntary Purchase Programme

When the Plan has been adopted, Ulmarra Shire Council will prepare a list of all structures and dwellings in the RBZ. These structures and dwellings would be prioritised according to the perceived risk of being involved in or affected by a bank slump.

Properties would be acquired as they are offered by landowners, subject to the availability of funds (refer **Section 3.3**). The uptake rate will be entirely at landowner discretion. Hence the timing and number of purchases over time is uncertain and is shown indicatively in **Table 5.1**.

Council will inform landowners of the purpose, the procedures involved and the benefits of the Programme on a regular basis.

Monitoring and Review

Regular monitoring and review of the adequacy of the Plan is essential and will involve several activities as outlined in **Table 3.1**.

5.4 BENEFIT COST ASSESSMENT

5.4.1 Reduction of Long Term Impacts of Erosion

The Riverbank Management Plan aims to maintain the RBZ. Consequently, a direct benefit of the Plan is the prevention of erosion outside of the RBZ. This means that structures/dwellings which are located outside of the RBZ, and which would have been threatened by erosion in the long term, will be protected. Based on a detailed assessment of the long term threat to structures/dwellings under a policy of planned retreat with no capital works (PBP, 1998), the value of the protected properties, discounted to a present value (6% discount rate), is \$1.3M.

5.4.2 Infrastructure Benefits

By aiming to maintain the RBZ, there are a number of infrastructure assets in Ulmarra which will not need replacement or relocation in the long term. The replacement value of these assets has been estimated by PBP (1998) as follows. The discounted present value of these benefits is shown.

		Estimated Discounted Present Value
• protection of threatened public roads	\$0.3M	\$0.2M
• protection of threatened mains services (ie. power, telephone, town water)	\$1.0M	\$0.5M
• protection of vacant residential allotments	\$1.5M (1.08)	\$0.5M
• protection of threatened commercial properties	\$1.9M (2.1)	\$0.5M
• protection of flood mitigation levee <i>rural</i>	<u>\$1.4M</u>	<u>\$1.0M</u>
	(0.06)	
Total	\$6.1M	\$2.7M

Why are these the same?
 Why is 1.9 higher than 1.4??

5.4.3 Benefit/Cost Ratio

The cost of implementing the Plan is discounted to a present value (6% discount rate) of \$5.4M (Section 5.1).

The benefits associated with reduced long term voluntary purchases (Section 5.4.1) and avoiding infrastructure replacement costs (Section 5.4.2) provide an estimated total benefit of \$4.5M, after discounting to present value.

Hence the benefit cost ratio of the Plan is estimated to be 0.74. $\frac{4.0}{5.4} = 0.74$

6 REFERENCES

CRCC (1993)

Ulmarra Bank Erosion Investigation

Prepared by Patterson Britton & Partners, November 1993

CRCC (1994)

Ulmarra Bank Erosion Further Investigations

Prepared by Patterson Britton & Partners, April 1994

CRCC (1997a)

Ulmarra Bank Erosion

Completion of Riverbank Stability Investigations

Prepared by Patterson Britton & Partners, January 1997 (Issue No 5)

CRCC (1997b)

Ulmarra Riverbank Management Interim Policy

Prepared by Patterson Britton & Partners, January 1997 (Issue No 2)

CRCC (1998)

Ulmarra Riverbank Management Options Report - Draft

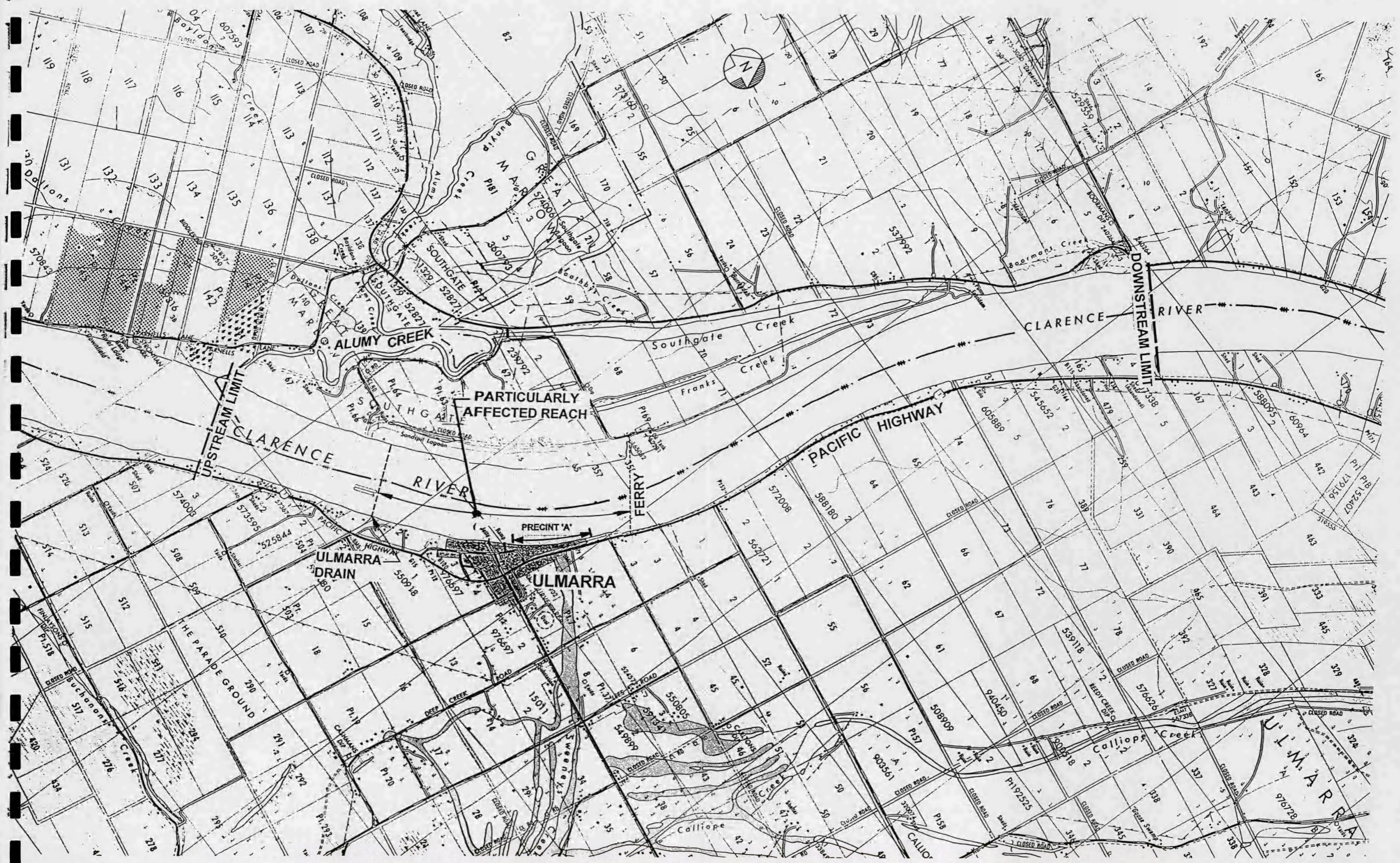
Prepared by Patterson Britton & Partners, August 1998

Public Works (1992)

Clarence River Photogrammetric Analysis - Draft

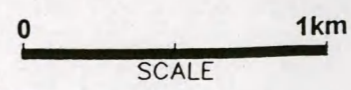
March 1992

FIGURES



SOURCE: 1:25 000 TOPOGRAPHIC MAPS (TINDALE, TUCUBIA, COPMANHURST, & GRAFTON)

J2332/R2137



EXTENT OF ULMARRA RIVERBANK MANAGEMENT PLAN

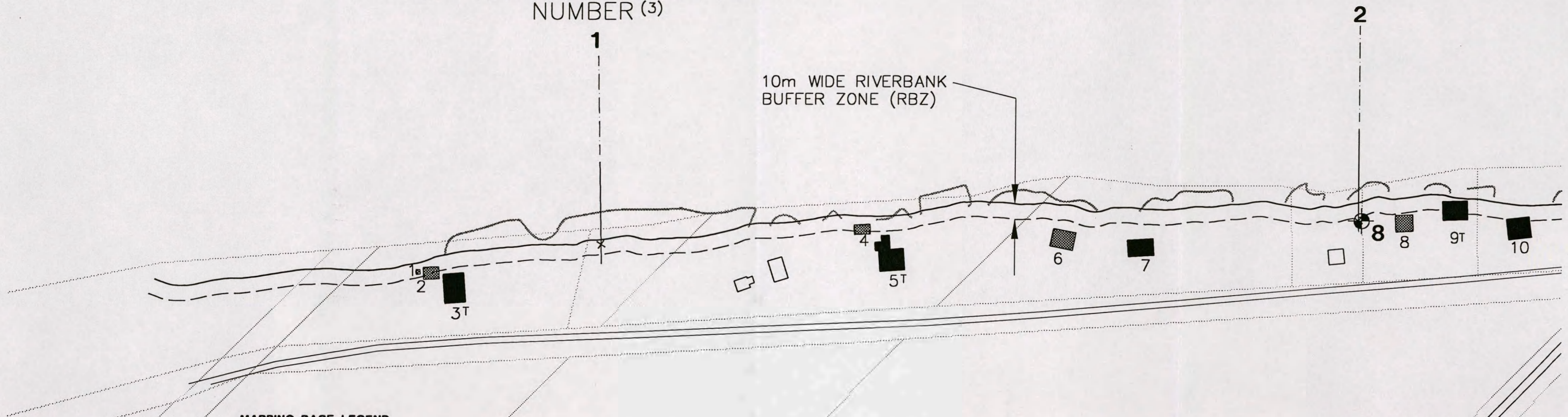


CLARENCE RIVER

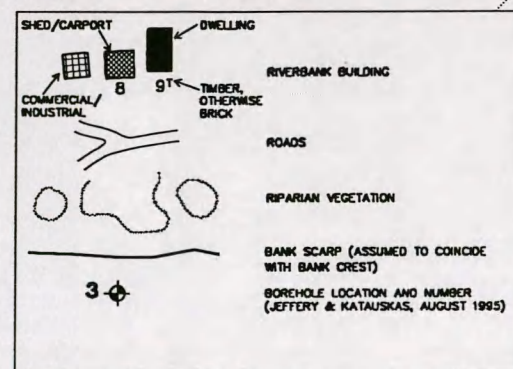
DOWNSTREAM →

1993 BANK CROSS-SECTION
NUMBER (3)

10m WIDE RIVERBANK
BUFFER ZONE (RBZ)

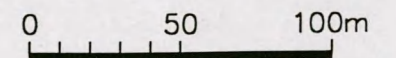


MAPPING BASE LEGEND



NOTES

1. MAPPING BASE FROM PUBLIC WORKS CLARENCE RIVER PHOTOGRAMMETRIC ANALYSIS - AERIAL PHOTOGRAPHY MARCH 1991 ESTIMATED PLANNIMETRIC ACCURACY ON CADD FILE +/-1mm IN 100m (PUBLIC WORKS, 1992)
2. CADASTRAL OVERLAY FROM LAND INFORMATION CENTRE (1997) HAS NOT BEEN INVESTIGATED AND IS INDICATIVE ONLY.
3. BANK CROSS-SECTIONS SURVEYED FOR ULMARRA BANK EROSION INVESTIGATION IN JULY/AUGUST 1993. CROSS-SECTIONS SHOWN ON THIS PLAN AS A SOLID LINE DEPICT THE EXTENT OF THE SURVEY. 'X' SHOWS CH.O SURVEY MARKS.
4. IN PRECINCT A (REFER MAP 4 OF 8) ROCK WILL BE PLACED FROM THE UNDERWATER TOE OF THE BANK UP TO MHWM.
5. OUTSIDE OF PRECINCT A, ROCK WILL BE PLACED FROM THE UNDERWATER TOE OF THE BANK UP TO MHWM AFTER A BANK FAILURE HAS OCCURED AND WHERE THERE ARE IRREGULARITIES IN THE ALIGNMENT OF THE BANK
6. OUTSIDE OF PRECINCT, ULMARRA SHIRE COUNCIL WILL GIVE CONSIDERATION TO REDUCING THE WIDTH OF THE RBZ FROM 10 METRES TO 5 METRES FOR INDIVIDUAL PROPERTIES, SUBJECT TO ACCEPTABLE BANK SLOPE (REFER APPENDIX B).



**ULMARRA RIVERBANK
MANAGEMENT PLAN
MAP 1 OF 8**

CLARENCE RIVER

DOWNSTREAM →

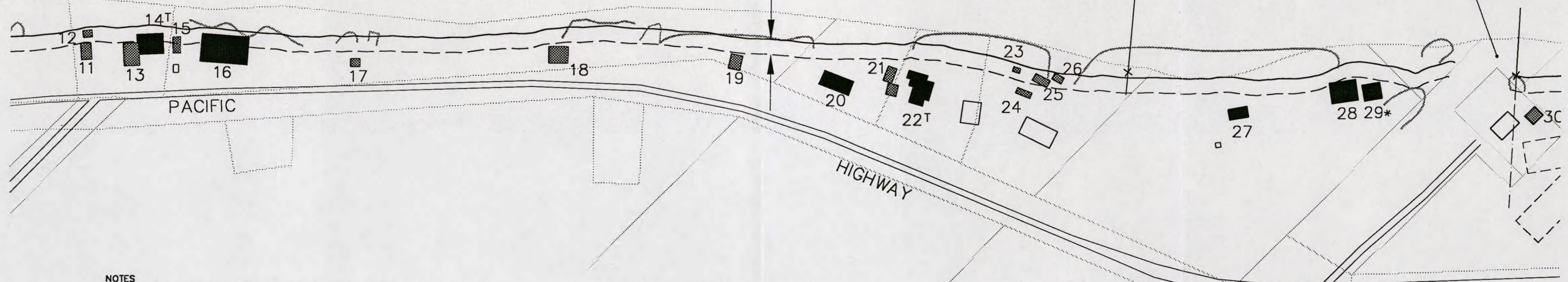


ISG GRID POINT
FROM PUBLIC WORKS
(MARCH 1992) - LANDFORM
DETAIL SHEET 4

1993 BANK CROSS-SECTION
NUMBER (3)

10m WIDE RIVERBANK
BUFFER ZONE (RBZ)

ULMARRA
DRAIN



NOTES

1. MAPPING BASE FROM PUBLIC WORKS CLARENCE RIVER PHOTOGRAMMETRIC ANALYSIS - AERIAL PHOTOGRAPHY MARCH 1991 ESTIMATED PLANNIMETRIC ACCURACY ON CADD FILE +/-1mm IN 100m (PUBLIC WORKS, 1992)
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MAPPING BASE LEGEND

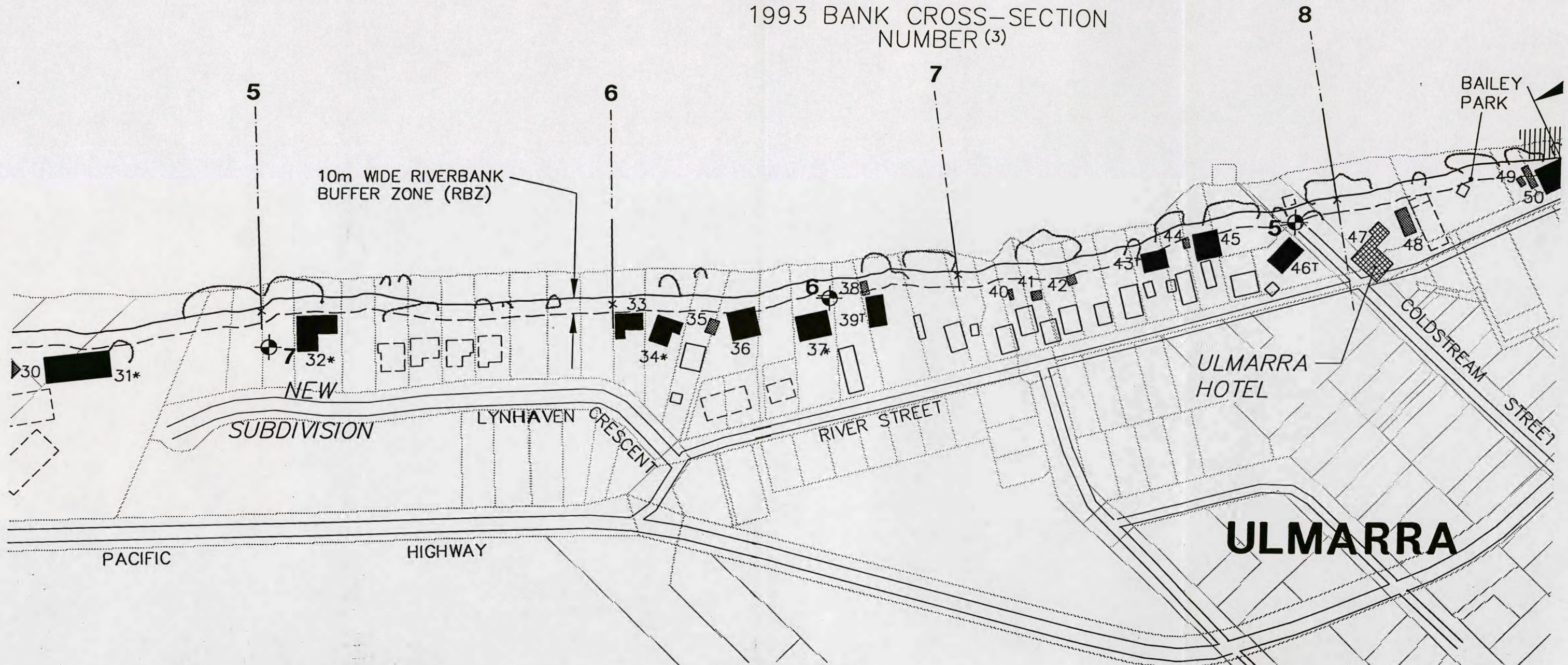
0 50 100m

CLARENCE RIVER



DOWNSTREAM →

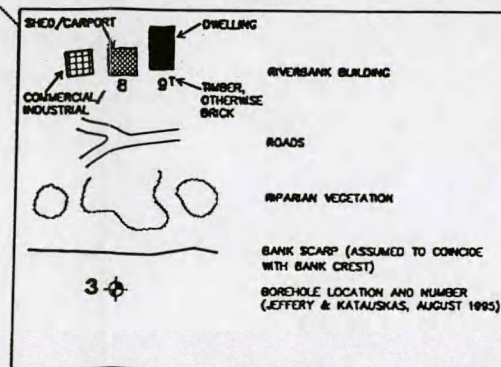
1993 BANK CROSS-SECTION NUMBER (3)



NOTES

1. MAPPING BASE FROM PUBLIC WORKS CLARENCE RIVER PHOTOGRAMMETRIC ANALYSIS - AERIAL PHOTOGRAPHY MARCH 1991 ESTIMATED PLANIMETRIC ACCURACY ON CADD FILE +/-1mm IN 100m (PUBLIC WORKS, 1992)
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MAPPING BASE LEGEND





CLARENCE RIVER
DOWNSTREAM

10m WIDE RIVERBANK BUFFER ZONE (RBZ)

FERRY CROSSING

WATKINS LANE

PRECINCT 'A'

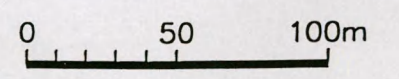
BUTTER FACTORY

NOTES

1. MAPPING BASE FROM PUBLIC WORKS CLARENCE RIVER PHOTOGRAMMETRIC ANALYSIS - AERIAL PHOTOGRAPHY MARCH 1991 ESTIMATED PLANIMETRIC ACCURACY ON CADD FILE +/-1mm IN 100m (PUBLIC WORKS, 1992)
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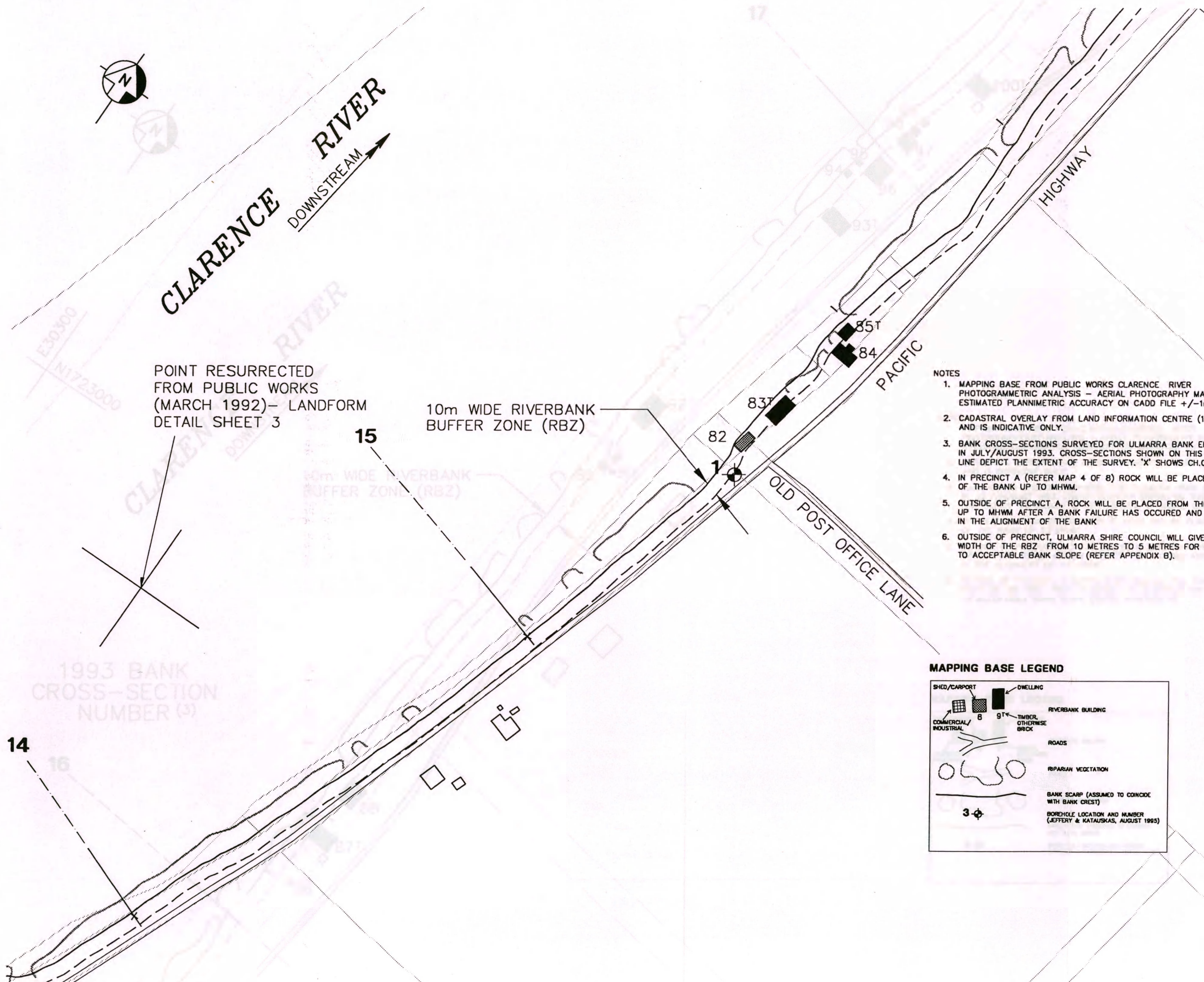
MAPPING BASE LEGEND

	SHED/CARPORT		DWELLING
	COMMERCIAL/INDUSTRIAL		RIVERBANK BUILDING
	TIMBER/OTHERWISE BRICK		ROADS
	RIPIARIAN VEGETATION		BANK SCARP (ASSUMED TO COINCIDE WITH BANK CREST)
	BOREHOLE LOCATION AND NUMBER (JEFFERY & KATAUSKAS, AUGUST 1985)		



ULMARRA RIVERBANK MANAGEMENT PLAN
MAP 4 OF 8

E 303000
N172100



POINT RESURRECTED FROM PUBLIC WORKS (MARCH 1992) - LANDFORM DETAIL SHEET 3

10m WIDE RIVERBANK BUFFER ZONE (RBZ)

15

10m WIDE RIVERBANK BUFFER ZONE (RBZ)

1993 BANK CROSS-SECTION NUMBER (3)

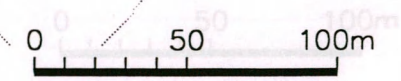
14

16

NOTES

1. MAPPING BASE FROM PUBLIC WORKS CLARENCE RIVER PHOTOGRAMMETRIC ANALYSIS - AERIAL PHOTOGRAPHY MARCH 1991 ESTIMATED PLANNIMETRIC ACCURACY ON CADD FILE +/-1mm IN 100m (PUBLIC WORKS, 1992)
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MAPPING BASE LEGEND



**PLACEMENT CONCEPT FOR
TOE ROCK PROTECTION**

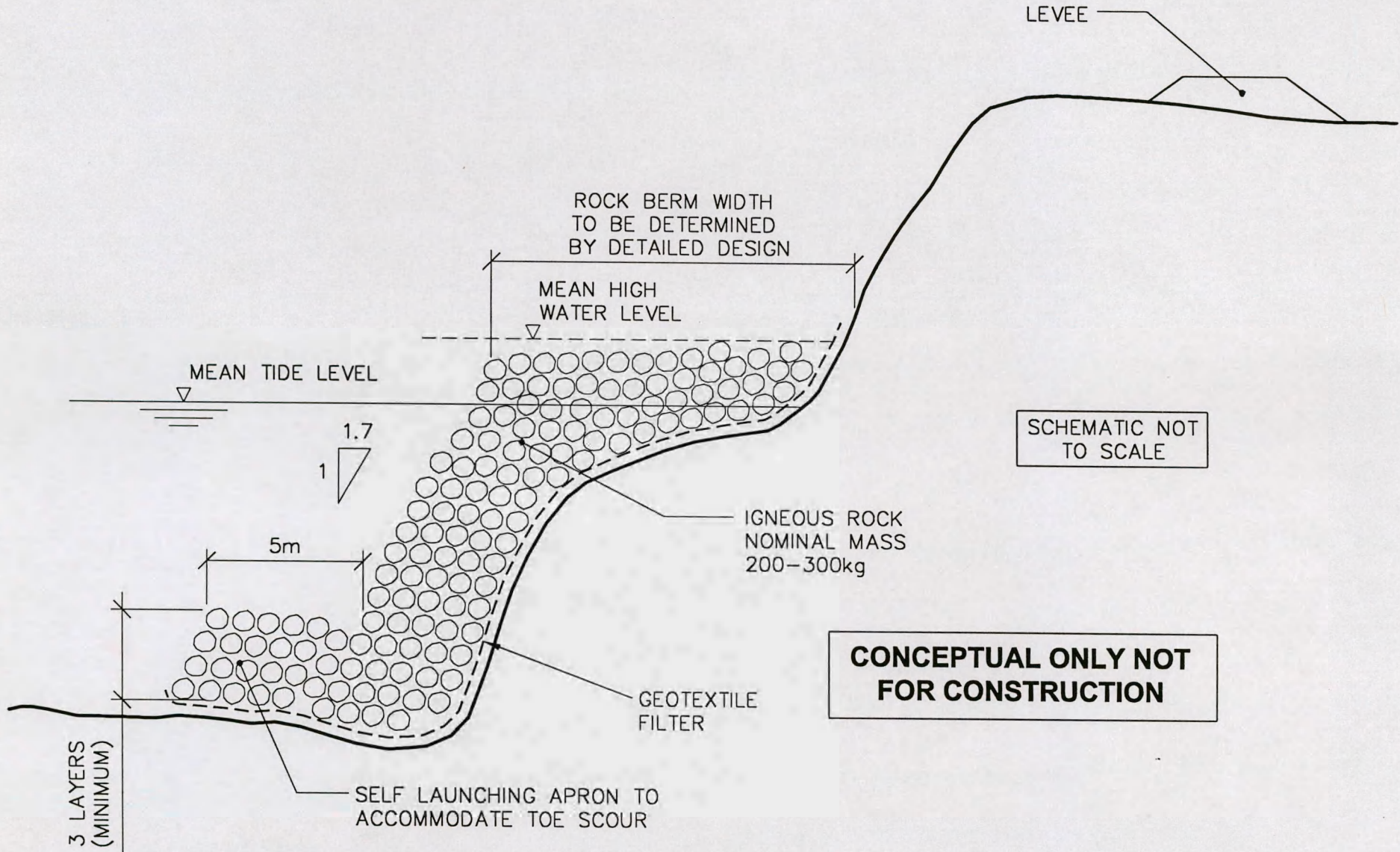


FIGURE 10

APPENDIX A

**SCHEDULE OF PERMISSIBLE "MINOR ADDITIONS"
TO RESIDENTIAL AND COMMERCIAL/INDUSTRIAL PROPERTIES**

APPENDIX A - SCHEDULE OF PERMISSIBLE "MINOR ADDITIONS" TO RESIDENTIAL AND COMMERCIAL/INDUSTRIAL PROPERTIES

A1. Development of residential property under the Ulmarra Riverbank Management Plan shall be considered by Ulmarra Shire Council to constitute a "minor addition" where it comprises one or more of the following

- (i) swimming pool
- (ii) carport (to accommodate up to a maximum of two standard motor cars)
- (iii) domestic garage (up to 30 m² floor area)
- (iv) storage shed (up to 30 m² floor area)
- (v) fencing
- (vi) open storage area
- (vii) gazebo (up to 20 m² floor area)

A.2 Development of commercial and industrial property under the Ulmarra Riverbank Management Plan shall be considered by Ulmarra Shire Council to constitute a "minor addition" where it comprises one or more of the following:

- (i) carport (to accommodate up to maximum of two standard motor cars)
- (ii) storage shed (up to 30 m² floor area)
- (iii) fencing
- (iv) open storage area

APPENDIX B

PROCEDURE TO ESTABLISH WHETHER A 5 METRE
WIDE RBZ COULD APPLY TO INDIVIDUAL
PROPERTIES OUTSIDE OF PRECINCT A

APPENDIX B.1 – PROCEDURE TO ESTABLISH WHETHER A 5 METRE WIDE RBZ COULD APPLY TO INDIVIDUAL PROPERTIES OUTSIDE OF PRECINCT A

Outside of Precinct A, where a relatively gentle riverbank slope is encountered, a local reduction in the width of the Riverbank Buffer Zone (RBZ) from 10 metres to 5 metres would be considered for individual properties. The procedure to establish whether or not a 5 metre wide RBZ could apply to an individual property is detailed below.

- (i) Establish current riverbank profile(s) at right angles to the local alignment of the waterline for individual property. Profile surveys to comprise a minimum of fifteen (15) survey points, with chainages extending from a minimum of 10 metres landward of the bank crest, to a minimum of 20 metres beyond the underwater bank toe. The bank profile between the crest and the underwater toe shall be defined by a minimum of ten (10) survey points. All surveys are to be carried out by a Registered Surveyor.
- (ii) Surveys used for RBZ assessment shall have been undertaken within two years of that assessment.
- (iii) At least two (2) riverbank profiles shall be surveyed for an individual property, each co-inciding with the junction of the riverside property boundary and the respective side property boundary.
- (iv) Riverbank profiles surveyed for an individual property shall be equally spaced and no more than 20 metres apart, ie. if the length of the riverside boundary to an individual property is between 20 and 39 metres, a minimum of three riverbank profiles would need to be established, one each at the riverside boundary corners, and one in the middle.
- (v) The average slope of the riverbank, above and below the Mean Low Water Mark, shall be determined for each of the surveyed riverbank profiles by a practicing Civil Engineer experienced in the area of riverbank stability.
- (vi) For each riverbank profile, the average slopes determined in (v) shall be used with **Table B.1**, to assess whether a 5 metre RBZ could apply.
- (vii) The maximum RBZ width assessed for the riverbank profiles within a particular property shall be taken to apply throughout that property.

Table B.1 (tentative*)

Conditions under which the RBZ could be reduced to 5 metres

- ✓ **Conditions under which RBZ of 5 metres could be considered**
- x **Conditions under which RBZ of 5 metres would not be considered**

For example, if the representative slope of the bank above MLWM is adopted as 1(v):2.5(h), and below MLWM is adopted as 1(v):3.5(h), then a 5 metre wide RBZ could apply, refer shaded cell in table.

		Representative Slope of Bank above MLWM (v:h)					
		1:1.5	1:2	1:2.5	1:3	1:3.5	1:4
Representative Slope of Bank below MLWM (v:h)	1:1.5	X	X	X	✓	✓	✓
	1:2	X	X	X	✓	✓	✓
	1:2.5	X	X	X	✓	✓	✓
	1:3	X	X	✓	✓	✓	✓
	1:3.5	X	X	✓	✓	✓	✓
	1:4	X	X	✓	✓	✓	✓

* The above table needs to be confirmed by additional slip circle analysis.

APPENDIX B.2 – ULMARRA RIVERBANK MANAGEMENT PLAN: INDIVIDUAL LOT RIVERBANK SURVEY: SURVEY BRIEF

Property Description: Lot & DP No.
(to be inserted) Street address

Purpose of Survey

The purpose of the survey is to closely define the above water and below water riverbank profile in front of the nominated property. The profile is required as base information for an assessment of riverbank stability by a practicing Civil Engineer experienced in the area of riverbank stability.

Riverbank profile(s) are to be provided in paper and digital formats, tied into Integrated Survey Grid (*ISG*) and Australian Height Datum (*AHD*) so that they can be incorporated into Council's riverbank monitoring database.

Qualifications

All surveys must be carried out by a Registered Surveyor with experience in hydrographic surveys.

Scope of Survey

- (i) Establish riverbank profile(s) at right angles to the local alignment of the waterline at the nominated property. Each profile must comprise a minimum of fifteen (15) survey points, with chainages extending from a minimum of 10 metres landward of the bank crest, to a minimum of 20 metres beyond the toe of the underwater bank ie. sufficient to confirm the bed of the river. The bank profile between the crest and the underwater toe shall be defined by a minimum of ten (10) survey points.
- (ii) At least two (2) riverbank profiles are required for the nominated property, each co-inciding with the junction of the riverside property boundary and the respective side property boundary.
- (iii) Riverbank profiles for the nominated property shall be equally spaced and no more than 20 metres apart, ie. if the length of the riverside boundary to the nominated property is between 20 and 39 metres, a minimum of three riverbank profiles would be required; one each at the riverside boundary corners, and one in the middle.
- (iv) Water level at the time of survey is to be shown on the profiles.

- (v) ISG co-ordinates of the zero offset of each riverbank profile and the bearing of each profile is to be provided. All levels are to be reduced to Australian Height Datum.
- (vi) Profiles are to be presented with no vertical exaggeration at a scale of approximately 1 in 200..
- (vii) The profile is to show a reference line of .75 m below AHD and labelled “adopted MLWM” (*ie. adopted mean low water mark*).
- (viii) A site plan to suitable scale is required showing location of properties, ISG co-ordinates of zero offsets and bearings of profiles, two front corners of building(s) and assessed top of bank on each profile line, with appropriate symbols and descriptions.
- (ix) Digital copies of all surveys plan shall be provided in DXF format.

APPENDIX C

FUNDING APPRAISAL IN RESPECT OF
FLOOD MITIGATION MEASURES

APPENDIX C – FUNDING APPRAISAL IN RESPECT OF FLOOD MITIGATION MEASURES

Flood mitigation measures are eligible for funding through State and Commonwealth Governments. Allocation of funds however depends upon priorities across all government programs as well as within the flood mitigation program. Two financial assistance schemes are used as shown in **Table C.1**.

Table C.1 FINANCIAL ASSISTANCE SCHEMES FOR FLOOD MITIGATION

Scheme	Commonwealth Contribution	State Contribution	Council Contribution
Commonwealth Assisted	40%	40%	20%
State-Only	Nil	66.7%	33.3%

Financial assistance from the Commonwealth is provided in the form of grants on a 2:2:1 basis (*Commonwealth:State:Council*), administered by the Department of Resources and Energy. Within budgetary constraints, grants are provided for programs which are generally consistent with Commonwealth priorities.

The State-Only scheme does not involve Commonwealth funding. Funds are provided on a 2:1 basis (*State:Council*). Funds are provided to Councils for projects which fail to attract Commonwealth assistance and for comprehensive flood and floodplain management studies.

Council's contribution for implementation of the Ulmarra Riverbank Management Plan would be funded through CRCC, sourced from either general rates or special rates. Special rates are only considered appropriate where a project benefits a specific group or zone within the Local Government Area. For most measures Council's contribution would normally be provided from general rates.

CRCC derives its funding from contributions from its constituent Councils of Grafton City, Maclean, Nymboida, Copmanhurst and Ulmarra Shires. CRCC calculates its assessment for each Shire based on population, ratable land value and value of completed flood protection works. CRCC has made allowances in its forward program for capital works contributions at Ulmarra in 1998/99 under 2:1 and 2:2:1 schemes.

Total funds under these schemes are limited each year and the highest priority and most worthy projects on a state-wide basis will be placed on a Commonwealth Assisted scheme and receive Commonwealth funds. The other projects will compete for funds under the State-Only scheme.

APPENDIX D

CURRENT LISTING OF PROPERTY OWNERS
AFFECTED BY THE ULMARRA RIVERBANK
MANAGEMENT PLAN

Owner	Title	Initials	PBP			Description	Area (m ²)	No	Property Address			Service Address			
			d	s	c				St	Town	Postal Code	Number	Street	Town 1	Code
Buchanan		J&IF	3	1	2	Lot 507 DP 751390			PO Box 262	Ulmarra	2462	983	Pacific Highway	Ulmarra	2462
Toms		RE	5		4	Lot 1 DP 198425			C/- Post Office	Corindi Beach	2456	1009	Pacific Highway	Ulmarra	2462
Want		TK&GM	7	6		Lot 3 DP 574003		1027	Pacific Highway	Ulmarra	2462	1027	Pacific Highway	Ulmarra	2462
Jabour		CR&EP	9	8		Lot 1 DP 512246		1045	Pacific Highway	Ulmarra	2462	1045	Pacific Highway	Ulmarra	2462
Eggins		RJ&YJ	10			Lot 2 DP 574003		1051	Pacific Highway	Ulmarra	2467	1051	Pacific Highway	Ulmarra	2462
Booth		RC	14	11, 12	13	Lot 1 DP 574003		1061	Pacific Highway	Ulmarra	2462	1061	Pacific Highway	Ulmarra	2462
Avery		WD&MJ	16	15, 18, 19	17	Lot 4 DP 619781			PO Box 228	Ulmarra	2462	1063	Pacific Highway	Ulmarra	2462
Miller		GA	20	21		Lot 21 DP 864357		1103	Pacific Highway	Ulmarra	2462	1103	Pacific Highway	Ulmarra	2462
Miller		GA	22	23, 24, 25, 26		Lot 22 DP 864357		1109	Pacific Highway	Ulmarra	2462	1109	Pacific Highway	Ulmarra	2462
Sherriff		FR&HA	27, 28, 29			Lot 11 DP 789459			"Corndale", Pacific Highway	Ulmarra	2462	1117	Pacific Highway	Ulmarra	2462
United Protestant Ass.				30		Lot 3 DP 617490		339	Pacific Highway	Wahroonga	2076	1141	Pacific Highway	Ulmarra	2462
United Protestant Ass.			31			Lot 15 DP 789573			PO Box 614	Grafton	2460	30	Lynhaven Crescent	Ulmarra	2462
Dowsett	Mr & Mrs	NF	32			Lots 17-22 DP 843331	19440	Lots 17-22 DP 843331	Pacific Highway	Ulmarra	2462		Lynhaven Crescent	Ulmarra	2462
Smith	Mr & Mrs	RA		v		Lot 19 DP	1809	56	Larkkari	Coutts	2460		Lynhaven	Ulmarra	2462

Owner	Title	Initials	PBP			Description	Area (m ²)	No	Property Address			Service Address			
			d	s	c				St	Town	Postal Code	Number	Street	Town 1	Code
						843331			Street	Crossing			Crescent		
Wilks	Mr & Mrs	EC		v		Lot 20 DP 843331	1416	31	Perth Street	Toowoomba	4350		Lynhaven Crescent	Ulmarra	2462
Fitzsimmons	Mr & Mrs	KD		v		Lot 23 DP 809457	1556	79	Blairs Lane	Kempsey	2440	21	Lynhaven Crescent	Ulmarra	2462
Peebles	Mr & Mrs	S		o		Lot 24 DP 809457	1533	19	Lynhaven Crescent	Ulmarra	2462	19	Lynhaven Crescent	Ulmarra	2462
Pawley	Mr & Mrs	AJ		o		Lot 25 DP 809457	1491	17	Lynhaven Crescent	Ulmarra	2462	17	Lynhaven Crescent	Ulmarra	2462
Mawhinney	Mr & Mrs	PD		o		Lot 26 DP 809457	1444		PO Box 453	Maclean	2463	15	Lynhaven Crescent	Ulmarra	2462
Eastwood	Ms	BM		o		Lot 27 DP 809457	1444	Lot 27	Lynhaven Crescent	Ulmarra	2462	13	Lynhaven Crescent	Ulmarra	2462
Roughley	Mr & Mrs	KR		v		Lot 6 DP 778006	1453	RMB 4	Pacific Highway	Ulmarra	2462	11	Lynhaven Crescent	Ulmarra	2462
Russell	Mr	MF		v		Lot 7 DP 778006	1444		PO Box 5102	East Lismore	2480	9	Lynhaven Crescent	Ulmarra	2462
Petravicius	Mr	DJ		v		Lot 8 DP 778006	1466	85	Maroubra Road	Maroubra	2035	7	Lynhaven Crescent	Ulmarra	2462
Stevens	Mr & Mrs	RJ	33			Lot 9 DP 778006	1665	5	Lynhaven Crescent	Ulmarra	2462	5	Lynhaven Crescent	Ulmarra	2462
Fairweather	Mr & Mrs	TS	34			Lot 10 DP 778006	2265		PO Box 70	Grafton	2460	3	Lynhaven Crescent	Ulmarra	2462
Avery	Mr & Mrs	MD		35		Lot 11 DP 778006	1827		King Street	Ulmarra	2462	1	Lynhaven Crescent	Ulmarra	2462
Raymond/ Mrs B J Pierucci	Mr	EM	36			Lot 5 DP 705951	1895	49	River Street	Ulmarra	2462	51	River Street	Ulmarra	1462
Kell	Mr & Mrs	EC		v		Lot 4 DP 253610	1409	45	River Street	Ulmarra	2462	45	River Street	Ulmarra	2462
Dickson	Mr & Mrs	D	37			Lot 1 DP 794856	2706		PO Box 168	South Grafton	2460	41	River Street	Ulmarra	2462
Mitchell	Ms	AR		o		Lot 1 DP 781995	1796	39	River Street	Ulmarra	2462	39	River Street	Ulmarra	2462
Northam	Mr & Mrs	DR	39	38		Lot 1 DP 784036	2555	37	River Street	Ulmarra	2462	37	River Street	Ulmarra	2462

Owner	Title	Initials	PBP			Description	Area (m ²)	No	Property Address			Service Address			
			d	s	c				St	Town	Postal Code	Number	Street	Town 1	Code
Grady	Ms	JE		o		Lot 2 DP 853177	1136	1	Bacon Street	Grafton	2460	33A	River Street	Ulmarra	2462
Ivett	Mr	RJ		o		Lot 1 DP 853177 LI 0020/278 0	1187	33	River Street	Ulmarra	2462	33	River Street	Ulmarra	2462
Van Gend	Dr	CM		40		Lot 1 DP 197040	980.1		PO Box 88	Grafton	2460	31	River Street	Ulmarra	2462
Finlayson	Mr & Mrs	RA			41	Lot 1 DP 998849		29	River Street	Ulmarra	2462	29	River Street	Ulmarra	2462
Piper	Mr & Mrs	RH		o		Lot 1 DP 6000056	1278	27	River Street	Ulmarra	2462	27	River Street	Ulmarra	2462
Hughes/Ms TA Wilson	Mr	PO		42		Lot 1 DP 794808	1146	25	River Street	Ulmarra	2462	25	River Street	Ulmarra	2462
Carlton	Mr & Mrs	D	43			Lot 1 DP 996684 Book 2086 No 327		21	River Street	Ulmarra	2462	21	River Street	Ulmarra	2462
Priest	Mr & Mrs	BE		o		Lot 1 DP 196829	910.4		PO Box 448	Grafton	2460	19	River Street	Ulmarra	2462
Smith-White	Mr & Mrs	SJ	45	44		Lot 1 DP 800248	1382	Sandra Noonan Property Manager	L J Hooker Prince Street	Grafton	2460	17	River Street	Ulmarra	2462
Pitt	Miss	JE		o		Lot 1 DP 782160	1351	23	River Street	Ulmarra	2462	23	River Street	Ulmarra	2462
Bultitude	Mr	HB	46			Lots, 4, 5, 6 & 7		1	Coldstream Street	Ulmarra	2462	1	Coldstream Street	Ulmarra	2462
Rogers Pty		RJ	47			Lot 1 DP		2	Colstream	Ulmarra	2462	2	Coldstream	Ulmarra	2462

Owner	Title	Initials	PBP			Description	Area (m ²)	No	Property Address			Service Address			
			d	s	c				St	Town	Postal Code	Number	Street	Town 1	Code
Ltd - Commercial Hotel			*			847075			Street				Street		
Ulmarra Shire Council	The Manager			48		Part Lot 7 DP 751390			PO Box 13	Ulmarra	2462		River Street	Ulmarra	2462
Tuckey	Mr & Mrs	HS	51	49-50		Lots 1-3 DP 782589	1581	11	River Street	Ulmarra	2462	9-13	River Street	Ulmarra	2462
Brown	Mr	SD	52	54		Lot 1 DP 158898	1220	7	River Street	Ulmarra	2462	7	River Street	Ulmarra	2462
Whitford	Mr & Mrs	CF	53			Lot 2 Book 2231 No 897	379.4	5	River Street	Ulmarra	2462	5	River Street	Ulmarra	2462
Van Haeren	Mr & Mrs	RW	56	55		Lot 1 DP 995561 LIC 0020/475 7	1391	43	Pacific Highway	Ulmarra	2462	43	Pacific Highway	Ulmarra	2462
Jago	Mrs	GC	57			Lot 1 DP 196108	4378	41	Pacific Highway	Ulmarra	2462	41	Pacific Highway	Ulmarra	2462
Egginis	Mr	RT		0		Part Lot 3 Book 1205 No 510		39	Pacific Highway	Ulmarra	2462	39	Pacific Highway	Ulmarra	2462
McPhee	Mr	FA		58		Part Lot 3 Book 1818 No 415		17	McPherson Crescent	Grafton	2460	37	Pacific Highway	Ulmarra	2462
Lloyd	Mr	KS	60		59	Part Lot 2 Book 1205 No 512	885.3	35	Pacific Highway	Ulmarra	2462	35	Pacific Highway	Ulmarra	2462
Egginis	Mrs	CW	61	62		Lot 2 Book	550.1	33	Pacific Highway	Ulmarra	2462	33	Pacific Highway	Ulmarra	2462

Owner	Title	Initials	PBP			Description	Area (m ²)	No	Property Address			Service Address			
			d	s	c				St	Town	Postal Code	Number	Street	Town 1	Code
						1903 No 973									
Eggin		RT	63 *			Pt 7 DP 751390		33	Pacific Highway	Ulmarra	2462	33	Pacific Highway	Ulmarra	2462
Norce			65 *			Lot 102 DP 816691			PO Box 486	Ulmarra	2462	Lot 102	Pacific Highway	Ulmarra	2462
Avery		WD & MJ	66 *			Lot 101 Dp 816691			PO Box 228	Ulmarra	2462	Lot 101	Pacific Highway	Ulmarra	2462
Norco			67 *, 68 *			Lot 104 DP 826322		21	Pacific Highway	Ulmarra	2462	21	Pacific Highway	Ulmarra	2462
Chard	Mrs	VJ	69			Lot 103 DP 836322	1039	19	Pacific Highway	Ulmarra	2462	19	Pacific Highway	Ulmarra	2462
Bultitude	Mr & Mrs	DP	70	71		Lot 1 DP 196255	683.1	17	Pacific Highway	Ulmarra	2462	17	Pacific Highway	Ulmarra	2462
Blanch	Mr	RL	73	72		Lot 5 Part Lot 6		15	Pacific Highway	Ulmarra	2462	15	Pacific Highway	Ulmarra	2462
Jordan	Mr & Mrs	PC	75	74		Lot 1 DP 797211	935.8	13	Pacific Highway	Ulmarra	2462	13	Pacific Highway	Ulmarra	2462
Lowcock	Mr & Mrs	GJ	76		77	Lot 1 DP 782281 Lot 1 DP 799012	1404	11	Pacific Highway	Ulmarra	2462	9-11	Pacific Highway	Ulmarra	2462
Watkins	Ms	ME	78		79	Lot 1 DP 622894	1060	7	Pacific Highway	Ulmarra	2462	7	Pacific Highway	Ulmarra	2462
Watkins	Mr & Mrs	KS	80			Lot 2 DP 622894	1044	3	Pacific Highway	Ulmarra	2462	3	Pacific Highway	Ulmarra	2462
Eggin	Mr	RT	81			Lots 1 & 2 DP 781234	1341		Pacific Highway	Ulmarra	2462	1-3	Pacific Highway	Ulmarra	2462
Power		DM&	83	82		Lot 12 DP		1419	Pacific	Ulmarra	2462	1419	Pacific	Ulmarra	2462

Owner	Title	Initials	PBP			Description	Area (m ²)	No	Property Address			Service Address			
			d	s	c				St	Town	Postal Code	Number	Street	Town 1	Code
		KL				115166			Highway				Highway		
Cross		D&B	84, 85			Lot 12 & 13 DP 201023			PO Box 236	Ulmarra	2462	1431	Pacific Highway	Ulmarra	2462
Felsch		GR		V		Lot 1 DP 996403			PO Box 1237	Grafton	2460	1441	Pacific Highway	Ulmarra	2462
Soan		MA&EI	87	86, 88		Lot 1 DP 572008		45	Ilurrawong Avenue	Hawkes Nest	2324	1469	Pacific Highway	Ulmarra	2462
Hay		H&VR	92	89, 90, 91		Lot 1 DP 588180		106	Pacific Highway	Ulmarra	2462	1509	Pacific Highway	Ulmarra	2462
Blanch		BC	93			Lot 11&12 DP 837968		RMB 107	Pacific Highway	Ulmarra	2462	1543	Pacific Highway	Ulmarra	2462
Blanch		BC	100	94 - 99		Lot 11&12 DP 837968		RMB 107	Pacific Highway	Ulmarra	2462	1545	Pacific Highway	Ulmarra	2462
Vickers		RW&VM	101	102-107		Lot 1 DP 817372		RMB 11, 1567	Pacific Highway	Ulmarra	2462	1567	Pacific Highway	Ulmarra	2462
Sullivan		RD&JE		V		Lot 6 DP 773043		RMB 115	Pacific Highway	Ulmarra	2462	1619	Pacific Highway	Ulmarra	2462
Bingham		G&JS		V		Lot 5 DP 773043		54	Mahogany Drive	Marcus Beach	4573	1641	Pacific Highway	Ulmarra	2462

* commercial properties

V = vacant residential properties

O = residential properties with buildings located sufficiently far from the river such as not to be affected by riverbank hazard within 50 years.

d = dwelling

s = shed

c = carport

APPENDIX E
COSTING OF PLAN

APPENDIX E – COSTING OF PLAN

E.1 COST ELEMENTS

The Ulmarra Riverbank Management Plan comprises the following principal elements:

- Rock Placement;
- Riverbank Buffer Zone;
- Voluntary Purchase;
- Monitoring and Review.

E.2 ROCK PLACEMENT

E.2.1 Toe Rock in precinct A

The Plan allows for the placement of rock from the toe of the bank to MHWL plus a self launching rock apron to accommodate toe scour (**Section 3.1**).

Precinct A involves the area between buildings numbers 51 and 81, a length of 600 m. Based on detailed costings carried out in PBP (1998), the cost of toe rock plus toe apron in Precinct A is estimated to be:

- \$2.22M, including a contingency of 25%;
- maintenance \$33,000 pa.

E.2.2 Supplementary Toe Rock

The Plan allows for the placement of supplementary rock from the toe of the bank up to MHWL plus a self launching rock apron, after a bank failure has occurred and where there are irregularities in the alignment of the bank (**Section 3.1**).

It is not possible to predict where, when and the size of future bank failures. A failure is likely to be triggered by a combination of protracted rainfall and the occurrence of flood; particularly one which recedes rapidly. For the purpose of estimating a cash flow over a 50 year period, the following assumptions were made:

- Precinct A - after initial capital works, costs would be limited to life cycle costs ie. annual maintenance costs;
- Areas Outside of Precinct A - approximately 30% of the riverbank will receive toe rock over the 50 years in 10 off 5 yearly indicative, construction episodes. Life cycle costs would extend annually after each construction episode.

Based on these assumptions and toe rock cost estimates for areas outside of Precinct A (*PBP, 1998*), supplementary toe rock costings are estimated to be:

- \$500,000 every five (5) years;
- maintenance of \$10,000 pa per \$500,000 capital works.

E.2.3 Riverbank Buffer Zone (RBZ)

Initially the width of the RBZ will be set at 10 metres. However, outside of Precinct A, the width of RBZ will be reviewed on a lot by lot basis in accordance with the procedure outlined in **Appendix B**. This procedure will involve bank surveys by a Registered Surveyor and a width review by a practicing Civil Engineer.

Survey costs will vary depending upon whether a single allotment survey is carried out or whether several allotments could be surveyed concurrently viz:

- cost of individual bank survey in accordance with **Appendix B.2** - \$1,500
- cost per allotment for batch surveys - \$600 per allotment

It is assumed that the surveys will be carried out in batch mode.

Similarly, it is assumed that the engineering review will be carried out as a consolidated assessment.

The engineering review includes further detailed geotechnical assessment to firm up **Table B.1**.

There are a total of 32 built structures/dwellings located in the RBZ and outside of Precinct A. The cost of initial reevaluation of the RBZ is therefore estimated as:

- survey cost - \$20,000
- Engineering review of **Table B.1** and RBZ widths - \$20,000

It is assumed that the cost of any future reviews of the RBZ would be incorporated with the Monitoring and Review activities (*see below*).

E.2.4 Voluntary Purchase (VP)

The Plan allows for the VP of residential properties affected by the RBZ (**Section 3.3**).

There are a total of 43 building structures located within a 10 m RBZ. Nineteen (19) are dwellings. The market value of these properties is estimated to be \$4.6 million (*PBP, 1998*).

The cost of the VP component of the Plan will depend upon the success of the Plan in containing long term bank recession. It will also depend upon the uptake rate which will reflect landowner interest in VP.

It is likely that with the Plan in place, VP may be the best way for landowners to realise the true value of their property when they choose to sell. Hence it would be reasonable to assume that the

majority of properties affected by the RBZ will be bought through VP over the next 50 years. As little interest in VP has been expressed by the general public, it is assumed that the uptake rate will be slow initially and increase towards the end of the 50 year period. Hence, for the purpose of estimating a VP cash flow, it is assumed that VP will commence at year five (5) and continue in two yearly allocations with up to 75% of the properties in the RBZ acquired voluntarily by the end of 50 years. Costs are therefore estimated as follows:

- \$3.5M spread over 50 years, commencing year 5;
- ie. approximately \$160,000 in years 5 and 9 and \$160,000 every two years after that (*ie. 22 lots of \$160,000 = approx \$3.5M*).

E.2.5 Monitoring and Review

The monitoring and review program is set out in **Table 3.1**. It comprises both annual and periodic tasks which are costed as follows:

- | | |
|---|-------------------------------------|
| • Annual inspection and report | \$5,000 pa |
| • Regular surveys of permanent riverbank cross-sections | \$10,000 every 5 years |
| • Post major flood survey | 4 off @ \$10,000 each over 50 years |
| • Aerial photography and photogrammetry | \$25,000 every 10 years |
| • Engineering review | \$20,000 every 10 years |

E.2.6 Present Value of Plan

The total of the Plan, taking into account the time distribution of capital works and cash flows described above, is \$5.4M when discounted to a present value (*6% discount rate*).