Management Plan for the Upper Condamine River and Tributaries

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ABSTRACT:

The Warwick and Clifton Shire River Improvement Trusts, with the support of the Department of Primary Industries and the Commonwealth National Landcare Program, funded the preparation of a River Management Plan which provides the framework for addressing key management issues impacting upon the Upper Condamine River, its tributaries and associated riparian zones within the Shires of Warwick and Clifton, Southern Queensland. The process used in preparing this plan involved field assessment, community participation and co-operation from various agencies. The Study was the first of its kind for a river system in inland Queensland.

The Upper Condamine River, within the Shires of Warwick and Clifton has a catchment area of over 5300 km^2. The combined length of the Condamine River and its main tributaries in the Study Area is approximately 1050 km. Land uses comprise intensive agriculture, grazing, forestry, intensive livestock, meat and dairy processing, other industries, National Parks and Urban Centres. Furthermore, recreation and the environment are important values for the area.

The Study process involved the assessment of the physical and environmental condition of the river system and riparian zones, the description of the processes impacting on that condition and the identification of stakeholders and beneficiaries and their relationships with the river system.

Key management issues identified included the management of riparian vegetation, stream siltation, erosion, flood break-outs, water quality, accelerated rates of runoff, perceived threats to riparian lands and water rights, inadequate public awareness on stream management issues and the lack of funding for river management.

1. INTRODUCTION

The Condamine River forms part of the upper-most headwaters of the Murray-Darling River System.

The Study Area comprised the upper part of the Condamine River Catchment, within the Darling Downs Shires of Warwick and Clifton (refer Fig. 1)

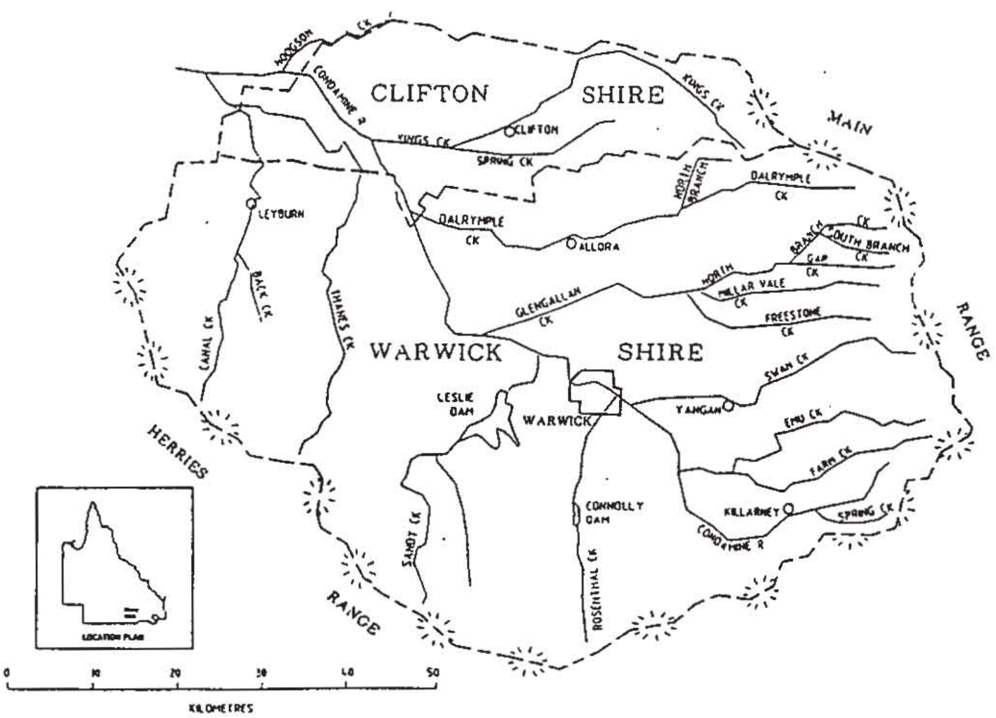

Figure 1: Locality Plan: Upper Condamine River Catchment

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2. HISTORY AND DEVELOPMENT

2.1. Discovery and Settlement

The area was 'discovered' by explorer and botanist, Alan Cunningham, on an expedition from the Hunter Valley, in 1827. Cunningham, even then realised the importance of his discovery, writing in glowing terms of the area's rich soils and the luxuriance of the pastures. Though only some 100km from the coastal settlements around Brisbane, the area was initially inaccessible from the coast due to the rugged nature of the Great Dividing Range.

Cunningham returned to the Downs in 1828, trekking west from Brisbane and travelling via a 'Gap' in the Dividing Range, which he had recorded during his first journey.

Twelve years later, a trail was blazed through Cunningham's Gap and the first settlers arrived with their large flocks of sheep. By 1847, the entire area had been taken up by squatters (Power, 1993).

The area was more closely developed in the period from 1860 to 1870, with the larger pastoral holdings being sub-divided into smaller parcels for agricultural use. By the late 1800's, some 20,000ha in the Warwick District was under cultivation.

2.2. Agriculture

The Darling Downs area is renowned as being one of the best agricultural areas in the nation. Approximately 124,000ha of land is cultivated within the Study Area (Carberry, 1995), producing a variety of crops including sorghum, sunflowers, barley, maize, wheat, lucerne and fodder crops.

The area also supports significant numbers of beef and dairy cattle, sheep and pigs.

2.3. Urban Development

The major urban area within the Study Area is the City of Warwick, with a population of 10,000. Including surrounding rural areas and other smaller centres, the total population of Warwick Shire is 19,000 and 5,800 for Clifton (Carberry, 1995).

2.4. Water Resources

As is typical for most inland river systems, stream flows are extremely variable. Flow gauging records for the period from 1961-1991 show annual runoff rates ranging from 0.9 to 261ML/km^2, with an average of 43.5ML/km^2.

Associated with the intensive agricultural development is a high demand for irrigation supplies. Groundwater sources supply the bulk of this demand due to the relative unreliability of surface flows. Department of Primary Industries' estimates indicate that annual water consumption from groundwater sources is 30000ML with 7000ML per annum being drawn from 'unregulated' surface water sources.

Major water conservation works are limited to a 107,000 ML Storage on Sandy Creek (Leslie Dam) and a smaller storage on Rosenthal Creek (Connolly Dam). Leslie Dam provides both irrigation water supplies (80% of yield) and urban supplies. Connolly Dam is utilised entirely for urban water supply purposes.

Sandy and Rosenthal Creeks are minor tributaries of the Condamine River, that drain catchments principally of granitic origin.

In the lower parts of the Condamine River system, below the Study Area, there is also a substantial amount of private development involving the 'harvesting' of flood flows. Within the Study Area, there is only limited waterharvesting.

2.5. History of River Management

River Improvement Trusts have operated in the Upper Condamine Area since 1956.

The catalyst for the formation of the area's River Improvement Trusts was the heavy infestation of the Condamine River and many of its tributaries by Weeping Willows.

In 1950, a major flood event resulted in massive break-outs at a number of locations along the Condamine River and some of its major tributaries. These break-outs caused severe soil erosion and waterlogging of cropping land.

At the time, there was a prevailing view that such break-outs were simply the result of a flood event of exceptional magnitude.

In subsequent years, however, further break-outs were reported. In many areas, it was feared that these break-outs would ultimately result in major stream course changes. It was then recognised, that the prolific growth of Weeping Willow trees within and adjacent to these streams had significantly reduced the flow capacity of the streams.

It was concluded that the Willow trees needed to be removed to alleviate this flooding problem. This culminated in the 1956 formation of the Condamine Trust, which covered part of the current Study Area.

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In the following years, River Trusts, in various forms, were eventually created and expanded to cover the entire Study Area.

The 'principles' under which the Condamine and other Trusts operated were simply:

- To clear Willow trees selectively.
- To undertake an experimental program of poisoning Willow trees.
- To clear the river and creeks of flow obstructions.
- To attempt to prevent flood break-outs (through the construction of levee banks).

By the mid 1970's, the majority of the Willows and major snags had been successfully removed in each of the Trust areas. From this time, the Trusts devoted most of their resources towards paying-off past debts. Only limited works involving regrowth control and the removal of major snags, caused by fallen gum trees and the like, were performed.

To date, the focus of the Trusts has remained on regrowth control and clearing debris obstructing stream flows. Various works have also been performed in order to prevent potential avulsions and protect eroding stream banks.

3. BACKGROUND TO STUDY

The study was borne out of a recognition by the Warwick and Clifton Shire Trusts and the Department of Primary Industries that a strategic approach to river management was required.

This recognition corresponded to community and Government expectations for river managers to broaden their focus beyond just physical stream attributes to include also biological and social values associated with stream systems.

Furthermore, it was clear management strategies needed to be based on a firm understanding of stream processes. Prior to this Study, very little was understood about either physical or ecological stream processes, and particularly how these processes have been affected by catchment development and past stream management practices.

4. GEOMORPHOLOGY OF THE UPPER CONDAMINE RIVER SYSTEM

The Condamine's tributaries are characterised, to a large degree, by the nature of the soil and geological units they drain. A number of tributaries drain westwards across thick alluvial deposits of volcanic origin overlying Tertiary volcanic and Jurassic sandstone and other sedimentary material. These are referred to as the **Alluvial Streams**.

Those streams to the west of the Condamine and draining eastwards are referred to as the **Western Streams**. These drain across Jurassic and older Carboniferous sediments, granites and other intrusive rocks. Alluvium is much thinner in the western streams. The western streams are, therefore, better controlled by resistant bedrock outcropping.

4.1. Alluvial Streams

The alluvial streams include Hodgson, King, Spring, Dalrymple, Glengallan, Freestone, Swan, Emu and Farm Creeks.

Most of these streams are severely incised for much of their course. Incision is evident from perched gullies, trenching or terracing of the channel bed and banks, and active bank erosion (triggered by deepening). Upland sediment storage zones were also observed and severe gullying on some streams. Active incision in the form of upstream-progressing nick-points were also observed.

4.2. Western Streams

The Western streams include Rosenthal, Sandy, Greymare, Rodgers, Thanes, Canal and Back Creeks.

The western streams are in better physical condition than the alluvial streams. This is largely because their form is controlled by frequent bedrock outcrops, unlike the alluvial streams where the streams erode easily through the unconsolidated alluvial and colluvial material. Sandy Creek carries a high sand load as it drains from granitic material. Large sand deposits were observed in a tributary of Sandy Creek upstream of Leslie Dam. Downstream sites show no signs of degradation although re-working of bed material is likely during higher flows.

Many reaches of the Western streams are characterised by snags and vegetation in the channel.

4.3. The Condamine River

The Condamine River rises east of Killarney and flows west across Tertiary volcanics through Killarney and across older sedimentary material, before turning north-west at the Elbow Valley Fault. It continues, thereafter, through Warwick in a north-westerly direction before branching downstream of the Hodgson Creek confluence and flowing out of the Study Area.

Below Warwick, the Condamine's alluvial deposits are more extensive, forming vast plains that have been intensively developed for agriculture. Oxbow lakes are visible around the Dalrymple and Kings Creek confluences. Numerous break-out channel

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paths are also evident throughout these alluvial plains.

Inspection of the long-profile of the river shows a classic concave-upwards shape. Generally, concavity increases as the degree of resistance or outcrop control decreases as would be expected.

Unlike many of its alluvial tributaries, the main river is in good physical condition. This is mainly because it is controlled, throughout much of its length, by bedrock outcrops. The numerous relic channels and floodplain channels, however, potentially could capture the main channel.

5. A MODEL FOR AUSTRALIAN RIVER CHANNEL CHANGE

Erskine, (in Ian Drummond and Associates, 1993) developed a 4-stage model to account for changes before and since European settlement in the Goulburn River catchment which has been adopted as a general model for the Condamine River. The model is described, briefly, below. The four stages are as follows:

- Pre-European;
- Depositional;
- Incising;
- Present.

5.1. Pre-European

The pre-European conditions of the rivers was one of dynamic equilibrium, over a time-scale of, say, 1000 years. In general, sediment supply was equal to sediment delivery while processes such as meander development and slope changes continued as a result of natural processes.

5.2. Depositional Phase

With the arrival of Europeans, large-scale clearing of floodplain and other catchment areas released huge quantities of sediment to the river systems. This is referred to as Post-Settlement Alluvium (PSA). This PSA is delivered towards the river and deposited over much of the inner floodplain to a thickness of around 1m, but particularly around confluences with main stream stems as deltas or alluvial fans.

5.3. Incising Phase

Following delivery and deposition of the immediately-available new sediment, supply rates slowed as upstream sediment supplies became exhausted and increased runoff increased the streams' sediment transport capacities. Streams began to incise back through the PSA deposits. Increased runoff resulted from better drainage and clearing which increased overland and shallow subsurface flow. In recent times, improved soil conservation and farming practices helped reduce the supply of sediment to the streams.

However, rapid incision and deepening caused further channel instabilities which, in turn, caused widening and terracing through width adjustment and bank erosion. Freshly-worked deposits became transported and deposited further downstream.

5.4. Present Phase

The present phase in many stream systems is characterised by relative stability. Sediment loads have reduced and streams have adjusted their form to suit. Some floodplain vegetation has been re-established and banks stabilised.

6. EFFECTS OF EUROPEAN SETTLEMENT IN THE CONDAMINE CATCHMENT

The following section documents the history of land-use change in the Condamine catchment and develops a specific application of the model described above.

6.1. Pre-settlement conditions on the Condamine River

From historical accounts, It is clear that the tributaries, particularly the alluvial streams, were less-well developed than they are today. Cunningham refers to Glengallan Creek as "a chain of deep ponds" from observations on 5th June 1827. The relevant quotation from his diary is as below:

"Deep ponds, supported by streams from the highlands, immediately to the eastward, extend along their central lower flats; and these, when united in a wet season, become an auxiliary to the Condamine's River, a stream which winds its course along their south-western margin."

6.2. Effects of European Development

It can, reasonably be assumed that gully development commenced in the Condamine catchment soon after European settlement, particularly given the poor resistance of the alluvial soils found there. Early pioneers allowed the fertile flood plains to be heavily grazed (Carberry, 1995). Intensive agricultural development also occurred rapidly following settlement.

6.3. Hydrological Response

Clearing of native vegetation for agricultural development, similar to that which occurred immediately after European settlement, is known to have major impacts on the drainage network and sediment transport. These include:

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- Changes to the hydrological balance (decreased evapotranspiration and increased overland flow);
- Loss of floodplain storage area for floodwaters;
- More frequent higher flows and less frequent lower flows;
- Reduced resistance to erosion of both the river bank and floodplain; and
- Salinity and high water tables.

The sediments released from the catchment by the different methods of erosion were either re-deposited on the floodplain during overland flow events or delivered to the tributaries. In the early years, sediment volumes may have been very large; the streams conveying a slurry of water and sediment during floods, particularly downstream of gully confluences.

6.4. Incision and re-working of sediments

Following the dramatic sediment releases immediately following European settlement, coinciding with a period of decades of above-average rainfall, it is likely that sediment loads declined. This was, to some extent, due to the realisation of the problems, improved practices and the spread of Willows in the streams and riparian zones.

There then followed a period of incision in the streams and reworking of sediment. Incision probably worked upstream from the base of the tributaries, and back from the banks of the tributaries as headcuts or gullies. This occurred because as the upstream supply of sediment declined, the streams were able to transport material that had been recently deposited on the beds.

However, the spread of Willows eventually began choking the streams and encouraging deposition. Following removal of the Willows in the 1960's, a second phase of incision has occurred. Material deposited in alluvial fans along the Condamine is gradually being eroded and transported downstream. The rate of sediment yield thereafter decreased rapidly from this second peak through time. Most of the post-Willow incision may have happened within a few years. It is reasonable to assume, therefore, that the second incision phase is nearing completion. Bank erosion, however, is ongoing in most of the alluvial streams.

6.5. Bank Erosion in the Alluvial Streams (Present Day)

The second phase of incision following the removal of Willow trees has been accompanied by channel widening and meander migrations on most of the alluvial tributaries as the streams adjust to increased discharge, decreased boundary resistance (removal of vegetation), and, to a lesser extent, a change in long-term flood frequency.

Bank erosion is manifest through meander migration and channel widening. Meander migration is caused by different hydraulic processes but achieved through bank erosion. Meander migration may be ongoing and, is a more complex channel response, incorporating longitudinal instabilities.

7. COMMUNITY INVOLVEMENT

The success of any stream management strategy will depend, ultimately, on the level of community ownership and support. With this in mind, the Study involved a significant community consultation program. This involved stakeholder participation in both formal workshops and in on-site field discussions.

Out of this process, the following key issue areas were identified:

- Riparian Zone Vegetation Management;
- Stream Capacity and Stability;
- Water Management;
- Landholder Rights, Resources and Support Systems;
- Land Management; and
- Water Quality.

The specific concerns relating to each of these categories are detailed in the following table.

Table 1: <u>Summary of Key Management Issues</u>

Management Issue	Key Areas of Concern
1. Riparian Zone Vegetation Management	• Spread of the weed Lippia. • Growth of exotic vegetation. • Loss of native vegetation. • Grazing within the riparian zones. • The possibility of restrictions on land-use • Growth of water weeds.
2. Physical Capacity and Stability of Streams.	• Channel obstructions. • Stream siltation. • Bank erosion. • River course changes. • Flooding.

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3. Water Management.	• Lack of groundwater recharge. • Over use of groundwater reserves. • Lack of water storages. • Inadequate regulation of water consumption.
4. Landholder Rights, Resources and Support Systems.	• Threats to existing water and land rights. • Lack of guidelines defining best practice. • Lack of finance for stream management. • Lack of community awareness and education programs.
5. Land Management.	• Inadequate on-farm moisture retention. • Deficiencies in runoff control. • Soil erosion.
6. Water Quality.	• Poor water quality.

8. FUTURE MANAGEMENT APPROACH.

The project Steering Committee recognised that the Trusts should take-on a lead agency role for the first two issue categories identified above. The other, issues, though in themselves important, were considered to be outside of the Trusts' core activity area. Indeed, many of these areas were already covered by agencies or groups with well-established and recognised lead agency roles. The Trusts' roles relating to these non-core issues will focus largely on improving inter-agency co-ordination on stream management. This process will be facilitated through a community-based, Catchment Co-ordinating Committee that has formed for the Condamine River Catchment in recent years.

The roles that will be adopted by the Trusts relate closely to the traditional Trust roles. However, there is also recognition of the need to manage for a much broader suite of stream values. Apart from the Trusts, there is no alternative agency with lead-agency status in managing the physical integrity of the streams or the riparian vegetation.

8.1. Elements of Management Strategy.

Pro-active and thoughtful management will be necessary for the rehabilitation of the physical and biological condition of the Upper Condamine River System.

This will require a combination of in-channel stabilisation works and changes to land management practices. To fulfil the required role, the Trusts will need significantly increased resourcing. They will also need a broadened expertise base amongst Trust membership and technical and operational staff. However, of probably more importance is raising community awareness of the processes that have resulted in stream degradation and then encouraging the adoption of land management practices that are sensitive to stream values.

This Study has been an important first step in raising community awareness of the problems that exist and in encouraging community participation in addressing such problems. On-going community involvement in strategy implementation will be an integral part of the Trusts' future management approach.

Key elements of the management strategy therefore include:

- an emphasis on community education programs;
- increased community involvement in Trust planning and strategy implementation;
- involvement with other agencies in the preparation of guidelines defining best-practice in land and riparian zone management;
- interaction with other agencies on issues affecting the physical or ecological values of the area's watercourses;
- actively pursuing increased funding for river management;
- support for and participation in research projects relevant to stream management;
- actively supporting and participating in soil conservation and gully-erosion control projects.
- managing flooding problems through both works implementation and involvement in land management planning;
- performing stabilisation works on those streams where erosion is of concern;
- undertaking riparian zone revegetation works;
- ensuring the protection of riparian vegetation by encouraging the adoption of appropriate management practices or by statutory means where necessary;
- actively participating in the control of problem exotic weed species; and
- managing snags to provide a balance between preserving habitat values and maintaining the physical integrity of the stream.

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