

The Management of Stream Erosion and Sedimentation - An Interactive Community Driven Process

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ABSTRACT: "RIVERCARE" is an initiative of the Manning Catchment Management Committee and the Department of Land and Water Conservation (DLWC formerly DWR). It was devised as an interactive process with landowners as part of the LANDCARE program to address the Manning Valley's number one areas of concern; bank erosion, floodplain stripping, sedimentation and stream/riparian vegetation management.

Through a series of overlays placed on enlarged aerial photographs the necessary information is collected by landowners and their perceived management options are listed. This information is melded with Departmental technical input, an on-site inspection, consultation with other authorities to form a FINAL PLAN which forms the basis of management of the river for about five years.

The concept won the Australian Water and Wastewater Association's Federal "WATER ENVIRONMENT MERIT AWARD" for 1995.

1. ABOUT THIS PAPER

This paper describes in a general way the development and implementation of the RIVERCARE planning process as part of the LANDCARE program on the mid-North Coast of New South Wales. I have deliberately not set down quantities of technical process and data in this paper because this is readily available elsewhere in such publications as Newbury and Gaboury (1993), Raine and Gardiner (1995).

2. THE REQUIREMENTS OF THE MANNING CATCHMENT COMMITTEE

From its inception the Manning Catchment Committee designated its number one area of concern to be streambank erosion, floodplain stripping of the mid-river area, sedimentation in the estuary areas, and vegetation management.

It was generally accepted by the Committee that the sediment deposits in the lower section of the Manning River came from upstream during flood

events, and they were the result of bank erosion and floodplain stripping. Some contribution, particularly to the wash load, came from gully erosion. Problems with lack of growth of vegetation on the river channel banks or overgrowth in the channels indicated an overall plan was needed to set management strategies.

3. HOW THE DLWC MET THE COMMITTEE'S REQUIREMENTS

The Logic behind the assessment process.

After a deal of soul searching a system of rating the Manning River was devised for the non-tidal areas. Two parameters were used to highlight the most highly degraded areas.

Firstly the geomorphic state of the river was divided into three categories indicating, high, medium or low (*red, yellow, green*) levels of degradation. A number of gradations had been bandied about but it became apparent that a three cell subdivision was sufficiently accurate for the purpose at hand.

When this was combined with a three category state of vegetation rating a nine cell matrix was formed which gave nine management ratings. These are set out in *Figure 1*.

The geomorphic rating was devised to tell us about the river's stability and is related to the dominant, bankfull or characteristic flow - the 1 in 18 month flood flow.

The vegetative rating was used because vegetation is the second most important factor in controlling a channel's stability, width, etc. Hey and Thorne (1983) give seven variables which define the hydraulic geometry of rivers, and note "*Discharge has a major effect on channel width, through the continuity equation, while bank vegetation appears to dominate the process of bank erosion*". This is confirmed in Hey and Thorne (1986).

Experience in the Manning Catchment has shown that bank erosion can largely be controlled by vegetative means with minimal structural input if the channel is close to being in a regime state.

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STATE OF BANK VEGETATION

		DEGRADED (RED)		POOR (YELLOW)		GOOD (GREEN)	
		RATING	MANAGEMENT	RATING	MANAGEMENT	RATING	MANAGEMENT
D E G R A D E D O F D E G R A D E D O F R I V E R	D E G R A D E D R E D	•River channel is in an advanced stage of disintegration	•There is a need for extensive general repair of the channel and its vegetation and to apply the RIVERCARE planning method, with follow up design plans. Check to see if this plan needs to be part of a TOTAL CATCHMENT PLAN	•River channel is in an advanced stage of disintegration.	•There is a need for extensive general repair of the channel with extensive replanting of its vegetation. Apply the RIVERCARE planning method. Detail design plans needed in some area. Check to see if this needs to be part of the TOTAL CATCHMENT PLAN.	•River channel is in an advanced stage of disintegration.	•Although there is good bank cover an unstable channel points to a wider catchment problem which may need an TOTAL CATCHMENT MANAGEMENT PLAN.
		•River channel starts to enter a state of decline and physical instability.	•Prepare a RIVERCARE plan. Later probably also a design plan for riparian works. Check to see if this plan needs to be part of the TOTAL CATCHMENT PLAN.	•River channel starts to enter a state of decline and physical instability.	•Prepare a RIVERCARE plan for the river channel and its vegetation and implement that plan.	•River channel starts to enter a state of decline and physical instability.	•Undertake a RIVERCARE plan for the channel and retain existing vegetation management style. Check for wider catchment degradation.
		•Vegetation on the banks is either missing, banks are bare or are falling into the channel.		•Vegetation on the banks is either sparse, or the wrong kind or has excessive growth within the river channel.		•Vegetation on the banks is generally sound with a good species diversity.	
O F D E G R A D E D O F R I V E R	P O O R Y E L L O W	•River channel is stable from erosion.	•Inspect after flood events and rectify any minor instability	•River channel is stable from erosion/.	•Inspect after flood events and rectify any minor instability.	•River channel is in a good stable state.	•Seek extension advice on maintaining existing condition.
		•Vegetation condition is degraded, maybe contains exotics, or noxious weeds for example.	•Get advice on bank and channel vegetation, planning and management.	•Vegetation on the banks is sparse, or the wrong kind or has excessive growth within the river channel.	•Get advice on bank and channel vegetation, planning and management.	•Vegetation on the banks in good condition with a good diversity of Australian native species.	•Keep up the good work!

Figure 1. River stability and vegetation rating with management options.

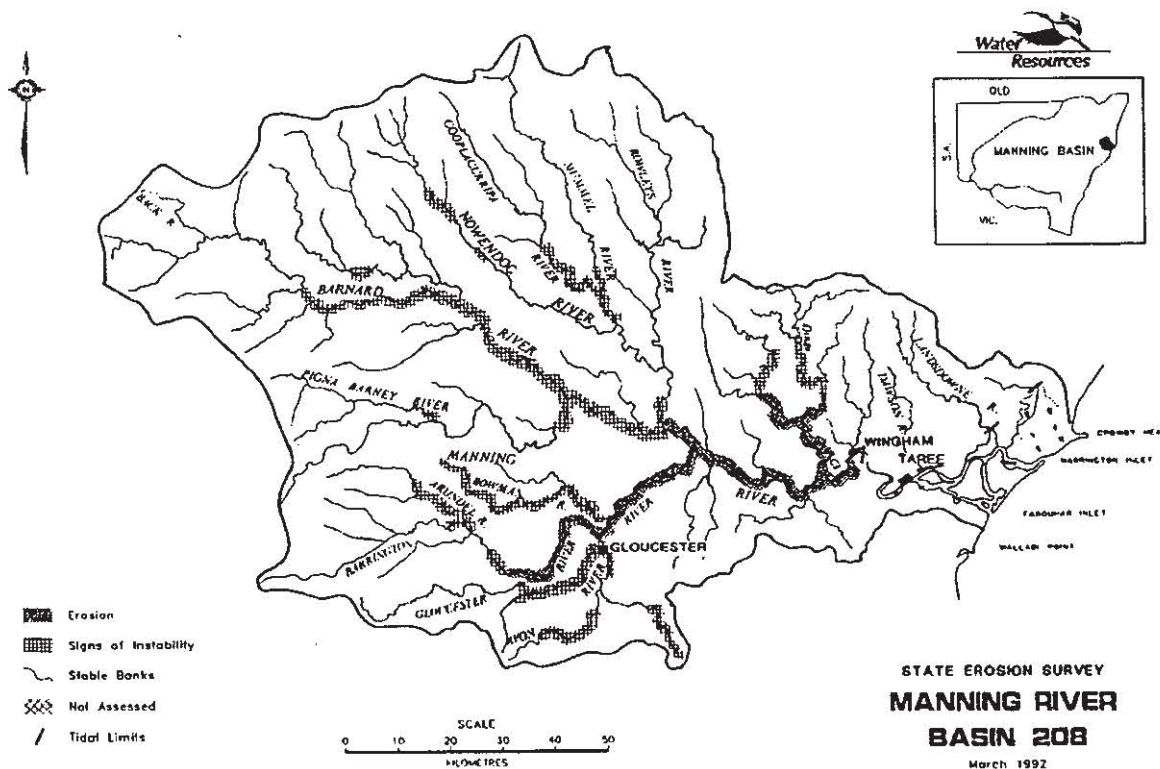


Figure 2. Channel Stability Map used in the initial assessment of the Manning Valley 1992.

4. THE PROCESS DEVISED

Initially the catchment was assessed according to the categories described above to determine the areas of greatest importance and as set out in Raine and Gardiner (1992). These largely coincided with the areas where people were asking for assistance - see the generalised map at *Figure 2*.

It became apparent that we were going to need a large amount of data about the rivers if we were to manage them effectively. Resources to have departmental people go along the rivers and collect this data were not available. After discussion with the Committee it was decided to adopt an approach similar to that being used in property planning. Enlarged aerial photographs were obtained to form the base and acetate overlays to form the data layers. The size adopted was A1. A type of manual GIS, if you like.

This system was put in place with explanatory notes. It has been undergoing constant modification since that time, mainly in format, but in essence the procedure has remained the same. The layers are shown at *Figure 3* which sets out the layer arrangement used in the most recent plans we have been undertaking, - The Nambucca River Valley. This plan focuses on problems associated with extensive gravel extraction and bank erosion. The geomorphic layer is designed to pick up this information.

An abridged step-by-step process and the approximate time required for a five layer five sheet RIVERCARE plan is set out in a box at the end of this paper.

5. THE INITIAL TRIALS

The very first plan was evolved on the Gloucester River at Gloucester NSW. This River had been subject to river management in the late 1960s and early 70s. The works put in place then were designed to correct a River that was in a highly degraded state. The work, which consisted at that time of mesh/rock training walls and willows planted behind, was seriously in need of maintenance. Many of the original works were damaged, washed out or just plain ineffective. The plan sets down action which needs to be taken to consolidate these old works and bring them into line with current methods and practices.

Further problems were arising from the growth of river oaks and bottle brush consolidating the point bars and islands in the river. Alignment widths

were set to provide a guide to Landowners on how to manage this pioneer vegetation before it blocked the main channel.

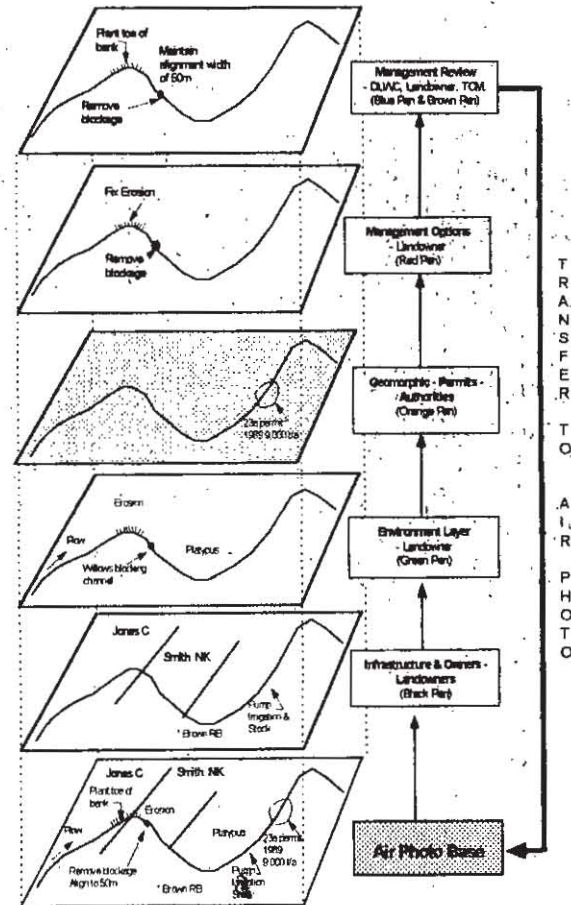


Figure 3. Graphical representation of the RIVERCARE planning process, for a five layer plan.



Photograph 1. BARRINGTON RIVER, GLOUCESTER, NSW, showing a section of River looking d/s from a point-bar cleared, of brush and oak to relieve flow concentration on a downstream eroding bank. This is part of the Barrington RIVERCARE plan.

6. LANDOWNER INPUT

By the use of an overlay process similar to that in *Figure 3* the landowners put down details about their ownership, their property boundaries, environmental features, problem areas and proposed management schemes.

This is then consolidated during a "walk-through" phase with Departmental Officers, who walk along the river and discuss the information on the plan layer with the relevant landowner.

A management proposal is drawn up from this.

7. TECHNICAL INPUT

The Department's input consists of:

- a) Initial liaison - advice on setting up a RIVERCARE plan.
- b) Assistance in applying for National Landcare Program grants to access funds for the project.
- c) Ordering of aerial enlargements.
- d) Setting up the photos and acetate overlays on backing boards, providing pens, rubbers etc.
- e) Producing the Landowner Activity Guide.
- f) Working out channel dimensions.
- g) Putting together the management strategy for the river.
- h) Liaising with other Government Departments such as Fisheries, National Parks & Wildlife, etc.
- i) Arranging for the finalised plans to be vetted and signed off by the Group, Catchment Committee, the Department etc.
- j) The issuing of permits to the Group at the end of the process.
- k) Follow on/up activities into the future.

8. THE ON GROUND ASSESSMENT

This is part of the walk through process, whereby the information on the overlays is assessed in relation to the on ground conditions existing at the time of inspection.

The width of the channel is measured to see how it lines up with the calculated widths as set out in Raine and Gardiner (1994). This provides a clue to the extent of channel degradation or widening. Other factors such as vegetation type, style and density are considered along with environmental factors.

Agreement is sought from the individual landowners and the Landcare Group to the proposed management style.

9. ACCEPTANCE OF PLANS

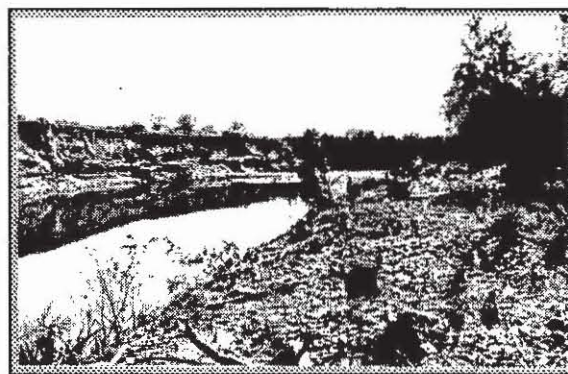
Once the plans reach the final stage they are signed off by the Landcare Group, and the Catchment Committee after approval has been obtained from such bodies as the Department of Fisheries and the National Parks and Wildlife Service and the Department of Land and Water Conservation.

Permits for works are issued on a whole plan basis to the responsible Landcare ("RIVERCARE") Group.

10. ON GROUND WORKS

The RIVERCARE plans enable a planned works program to be put in place. As the plans are accurately scaled it is possible to quantify the amount of work that needs to be done to achieve the objectives set down as part of the implementation process.

In some areas desirable results can be obtained by simply controlling channel vegetation growth as below.

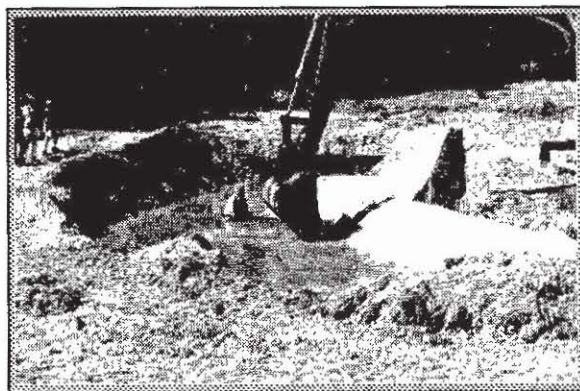


Photograph 2. Bottle brush cleared to alignment opposite eroding bank which is to be planted along the toe. BARRINGTON River, NSW, looking downstream.

In other instances structural works of various types may be needed. The degree and nature of these depend on the extent of degradation being addressed. Photographs 3, 4 and 5, for instance, depict the construction of log sills in the Nambucca River, New South Wales, as part of a restoration program to stabilise erosion, re-establish the pool-riffle system of the River as well as the health and habitat of the River.



Photograph 3. NAMBUCCA RIVER, NSW. The construction of a log sill to recreate the pool/riffle sequence in a highly degraded sandbed river. NAMBUCCA River Stabilisation Task Force.



Photograph 4. Placing a geotextile membrane upstream of the log sill to reduce undersill seepage and raise the water table level in the river channel.



Photograph 5. Securing log sill timbers to vertical piles with friction pins. Banks of the stream are subsequently planted out with trees.

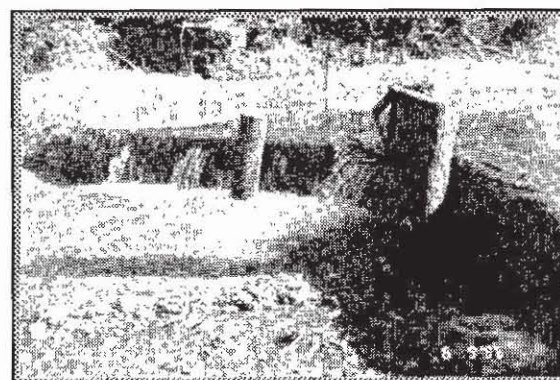
11. EXPECTED OUTCOMES

By undertaking a RIVERCARE plan Landcare members become part of a cohesive interactive group with a common purpose, namely restoring and maintaining the common river channel adjacent to their properties.

To date, there have been some very positive outcomes. The extent of works undertaken by RIVERCARE groups has been beyond expectation, particularly where they have been initiated with seed funding from the NSW RIVERCARE 2000 program.



Photograph 6. Gravel build up reclaiming a degraded area in the MANNING River at TIRI resulting from "manipulation" of the channel vegetation - Mt George RIVERCARE plan.



Photograph 7. A recently placed log sill in the NAMBUCCA River, starting to re-develop the pool/riffle sequence of the River. Sills are placed to parameters set by the NSW Department of Fisheries to promote fish passage. Surplus sand and gravel are initially removed from the pool upstream of the sill and the downstream plunge pool. This material is sold to pay for the cost of the works.

12. REFERENCES

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PROCEDURE FOR UNDERTAKING A RIVERCARE PLAN

Below is an abridged list of steps currently being used (Feb 1994). They are constantly under review as is the time involved in producing the Rivercare Plans. The assumption here is that five (5) aerial enlargements with five (5) overlays are used for the plan. At a scale of 1:5000 it will cover 25 to 30 km of river

	ITEM	APPROX DLWC TIME PLUS TRAVEL
STAGE 1	INITIAL DISCUSSION	
	DLWC talks to Landcare group about procedures, extent, commitment, costs, funding options.	20 hours
STAGE 2	FUNDING APPLICATION, SETTING UP BASE PLAN	
	Apply for funding (NLP). When obtained order aerial photograph enlargements, maps, look at catchment parameters, catchment areas, flow hydrographs, work out river widths, set up photographs on backing sheets with overlays, set up package for handover to Landcare group.	60 hours
STAGE 3	INITIAL HANDING OVER OF PLANS, COLLATION OF INFORMATION	
	Arrange meeting, present "Activity Guide," set direction, landowners collect information, return plans to DLWC for assessment.	23 hours
STAGE 4	SITE DISCUSSION, FINALISE INFORMATION, PERMITS	
	LANDCARE GROUP arranges program for site discussion with DLWC Officers. Assessment and agreement on management transferred to aerial photo base. Organise approvals for clearing vegetation, moving sand and gravel, for example.	180 hours
STAGE 5	FINAL ACCEPTANCE OF PLAN	
	Landcare group views and comments on final plan. Final comments from Fisheries National Parks and Catchment Committee sought. Make changes, have Landcare group, Catchment Committee, DLWC sign-off plan - laminate.	35 hours
STAGE 6	HANDOVER COMPLETED PLAN	
	Present plans, approvals and associated material to LANDCARE group.	7 hours
	START IMPLEMENTATION PHASE	
		TOTAL 325 hours