

5. Conclusions and Recommendations

5.1 Conclusions

Evaluation of the Method

The method was very successfully and achieved its objectives by :

- Providing a comprehensive and objective 'snap-shot' view and analysis of the physical and ecological condition of the Maroochy River.

- Providing a solid database and method for integrated catchment management with links to other sources of data (hydrology and land use and other information about the catchment.

- **Highlighting the seriousness of the river degradation in the catchment on a site by site basis, showing where the problems are occurring and providing an indication of the processes causing the problems.**

- **Establishing a baseline against which the trends and future rate of change in condition can be assessed by follow-up surveys at the carefully defined site locations (including the photographs).**

- **Providing an assessment of the Maroochy River which can contribute towards a state-wide assessment of the State of the Rivers in Queensland using the same objective methodology.**

- **Stimulating and directing action through integrated catchment management to find permanent solutions to the problems identified and to preserve, rehabilitate and re-establish the riverine condition throughout the catchment so that the potential values of streams and rivers can be realised.**

Condition Assessment

In terms of the overall condition rating, about one third of the major stream length in good condition, another third in moderate to poor condition, and a further third in degraded to highly graded condition. These overall condition ratings were produced from the combination of the individual ratings shown in the table opposite.

- Only 14% of the total length of streams

in the entire catchment was rated as being in *very good condition*, with virtually all ratings above 80%.

- 19% of the total length of streams in the entire catchment was rated as being in *good condition*, that is with moderate to poor environmental condition ratings but stable bed and banks.

- 32% of the total length of streams in the entire catchment was rated as being in *moderate to poor condition*, that is with poor to very poor environmental condition ratings but stable bed and banks.

- 29% of the total length of streams in the entire catchment was rated as being in *very poor or degraded condition*, that is with very poor environmental condition ratings but unstable bed and bars, and partially unstable banks.

- 4% of the total length of streams in the entire catchment was rated as being in *highly degraded condition*, that is with very poor environmental condition ratings and both the bed and banks being unstable.

Each of the major sub-catchments had sections classified in each of the overall condition categories. Most of these sections in better condition occurred in the State Forest areas in the headwaters of the catchment, which have been protected from the clearing for grazing, crops, orchards and sugar cane that characterises most of the catchment. Isolated sections of streams in good condition occurred in the wetland areas in the lower parts of Coolum, Doonan and Eudlo Creeks. Much of the estuarine areas were also given good condition ratings. Extensive mangrove and salt marsh flats have been retained along much of the estuary banks. The condition of the bed, and aquatic vegetation (e.g. sea-grasses, and bed stability) in these estuary sections were not considered in deriving the condition ratings for the estuary.

Most of the sections rated in highly degraded condition occurred in the upland areas of Petrie, Eudlo, Brown and Paynter Creeks and North Maroochy River. The lowland areas adjoining the extensively modified streams and drains in the sugar cane fields were also rated poorly.

The other major findings from the study in relation to the major components were :-

Reach Environs - 50% of the length of major streams in the catchment was classified as being

in poor or very poor condition, with 70-75% of Paynter and Petrie Creeks being poorly rated. Only 16% of the length of the major streams were classified as being in very good condition. These poor ratings reflect the extent of clearing along the stream verges for sugar cane, grazing, orchards, crops and for residential developments.

Riparian Vegetation -Most of the riparian vegetation in the catchment was rated as in *poor to very poor* condition (83% of the major stream length). Only 8% of the stream length was rated as being in *very good* condition. This was mostly attributed to clearing of the riparian area.

Mean riparian zone widths were only 14m (after setting the maximum for any zone at 50m), and 80% of the stream length were less than 20m wide, 40% less than 10 m wide and 30% less than 5 m wide. Lower ratings were also produced because much of the remnant riparian vegetation is dominated by exotic species (Camphor laurel, exotic pines, para grass chinese elm, willows and other exotic grasses).

Aquatic Vegetation- There is very little aquatic vegetation in the catchment. 88% of the length of the major streams were rated as *having very poor* aquatic vegetation cover. Unlike the other components the poor aquatic habitat ratings does not necessarily imply that the condition of the aquatic vegetation has deteriorated from a pristine state where aquatic vegetation covers were higher in the undisturbed streams. The natural attributes of the streams would have meant that aquatic vegetation cover would have been naturally low. These attributes include the narrow width and steep banks of the streams, rocky substrates and closed canopy cover over the stream by rainforest and *Eucalyptus* forest over most of the rivers and streams.

Bank Stability -Over 80% of the bank length in the entire catchment was rated as being *stable* (81 - 100% stable) or *quite stable* (61-80% stable).

Only 6% of the bank length was rated as *unstable* or *very unstable* (0-40% stable). Most of the instability in the bank appeared to be related to flow wave action, stock damage and clearing of the bank vegetation. The dominant process was erosion (95%) rather than aggradation (5%). Most of the erosion and aggradation occurred irregularly or was found along almost the entire length of the bank. Significant bank erosion was also found on bends (linked to a meandering process) and associated with obstacles along the banks.

Bed and Bar Stability - 60% of the length of the streams in the catchment was rated as *stable or quite stable* (rating >61%). Only 17% of the bed length was rated as *unstable or very unstable* (rating < 40%). Most of the bed was rated as eroding (59%), but the dominant process for the unstable sites was aggradation. Subjectively, 54% of the sites were rated as *stable*, 16% as *eroding* and 30% of sites as *aggrading*.

Aquatic Habitat - 17% of the length of streams in the non-estuarine parts of the catchment were rated as being in *very poor* condition; with a further 19% in poor condition. The majority (35%) of the stream length was in *moderate* condition. Only 5% was rated as *very good* and about 24% as *in good* condition.

Recreational Values - There was a broad range of recreational opportunities throughout the catchment :-

- o 11% of the sites rated as pristine natural (remote sites with restricted access and isolation from human impact and contact).
- o 73% were rated as undeveloped rural - that is with natural, but highly modified settings, with good road access and moderate human contact.
- o 7% of the sites occurred at highly modified urban settings, but with no recorded resort developments along the streams.

There is therefore a wide range of recreational opportunities to cater for all tastes. The recreational potential of the streams and rivers was also subjectively recorded for a wide variety of activities, from passive nature appreciation and walking to active types such as picnicking to fishing, water skiing and canoeing. Clearly riverine areas are the focus for much of the recreation in the catchment, much of it related to the natural attributes and settings of these areas. This increases the value of the remnant areas and increases the need for conservation and rehabilitation.

Most of the more remote and natural settings occurred in the State Forest areas in the upper catchment. In a landscape that has been extensively cleared the stream verges provide readily accessible semi-natural areas for walking and nature appreciation. The value of these areas is difficult to assess because it is a matter of a sub-conscious appreciation of the presence of these

areas and their availability even though the actual use of these areas may be small.

Scenic Values - Once again these were subjectively assessed with the recorder asked to rank the scenic value of the site from 1-10 and to list the various features which contributed to this value assessment. At most of the sites the scenic value was linked to inherent natural beauty, scenic rural settings and artistic values. About 60% of the sites were ranked poorly from 1-3, reflecting the rural setting and clearing of most of the catchment. About 15% of the sites ranked from 8-10. These higher ranking sites were located in the upland areas, in the State Forest and at the sites of falls, rapids and cascades. Scenic values could be improved by re-establishing riparian vegetation.

Conservation Values - The conservation values were again determined subjectively at each site by the recorder. The distribution of known rare or endangered species in the catchment was not taken into account although the methodology does allow for this. The conservation ratings therefore refer to the broad scale assessment based on the ranking of the sites as remnant and representative habitat for aquatic and riparian plants or animal species, and the value of the stream verges as wildlife corridors. The majority of sites (>50%) were given a very poor rating (rank <3). Mostly these sections occurred in the degraded areas associated with sugar cane, and in the cleared upper reaches of Petrie and Paynter Creeks, North Maroochy River. 19% of the stream length was rated as having good to very good condition. These sections occurred in the uncleared headwaters of the South Maroochy River, Brown & York Creeks, and in the estuary and scattered throughout the rest of the catchment. The conservation value ratings were strongly linked with the condition of the riparian vegetation and aquatic habitat.

Prognosis

The prognosis is therefore that the streams and rivers are mostly in *poor to moderate* condition with a major loss of environmental values but without major bank or bed stability problems that would have produced a far worse report. Fortunately serious problems with gully erosion or with severe bank erosion appear to be isolated to the lowland reaches of Petrie, Paynter, Eudlo Creeks. In some respects the prognosis was not as bad as would have been expected given the extent of clearing in the lowland areas of the catchment and the population size. Several natural

attributes of the streams have so far acted to reduce the extent of degradation that may have otherwise occurred. These attributes include the retention of a narrow riparian fringe of vegetation along the steep bank faces beside most streams. Also many of the streams have rocky beds and rock outcrops along the banks which act as controls resisting the erosion that may otherwise have occurred. Also, there is relatively little severe bank or gully erosion in the catchment. These aspects are discussed further in the following section, however their occurrence has provided a unique opportunity to act now before the streams deteriorate any further. Much can be achieved now using 'natural remedies' because of this situation. Once the streams have severely degraded much more serious action will be required to restore their values, ('major surgery'), and to overcome the problems they cause in terms of uncontrolled erosion and altered channel and flow patterns.

The message is therefore to take up the challenge and to seize this fortunate opportunity to prevent further deterioration in the rivers and streams and to re-habilitate them. The projected population growth, which will see the Maroochy Shire double its population size in the 20 years from 1980 to the year 2000, will put immense pressure on the streams and rivers in the near future.

Natural Stream Attributes which have Prevented More Serious Deterioration in River Condition

Despite the moderate to poor condition rating assigned to most of the streams and rivers in catchment many sections retain some values and the condition is perhaps better than expected because of several fortuitous natural attributes. These are:-

- **Remnant riparian vegetation on steep bank slopes**

Despite the extensive clearing of the catchment and the loss of much of the riparian vegetation, with 83% of the stream length in poor to very poor condition, a narrow but very vital strip of trees and shrubs remains along most of the banks. In many areas this strip may only be 2-10m wide and is confined to the slope of the banks, but these remnants remain along most of the banks.

Very few banks were completely bare. It is true that much of this remnant vegetation dominated by Camphor laurel and other exotic species, but there were some trees, shrubs, herbs and grasses present. There were also pockets of remnant rainforest and other native trees and shrubs along

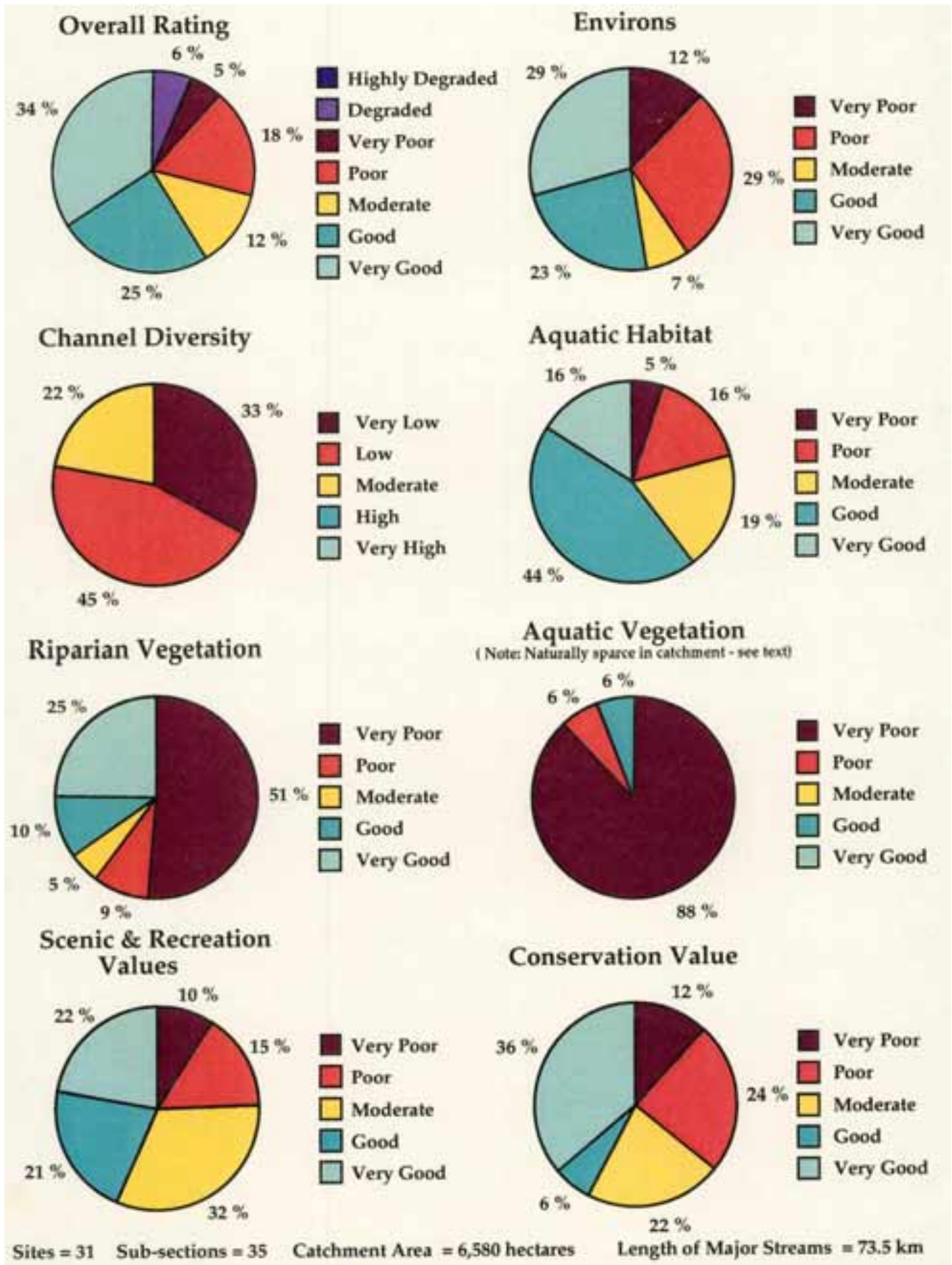


Upstream Site Highly Degraded by loss of Riparian Vegetation - Site 11 Petrie Creek, Menarys Rd.

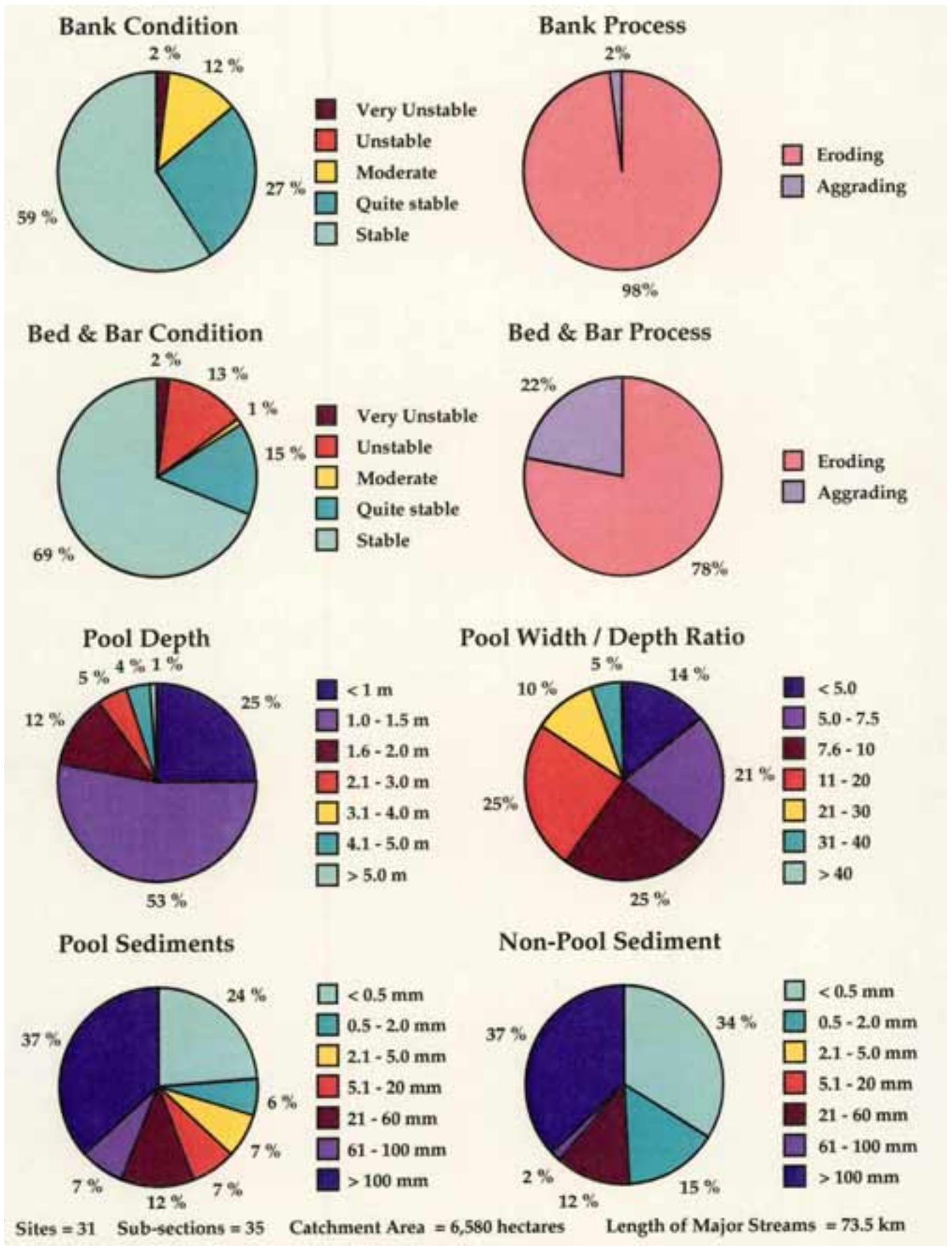


Downstream Site protected from bank erosion by retention of Riparian Vegetation
- Site 27 Petrie Creek, about 2 km downstream of Site 11

South Maroochy River



South Maroochy River



river sections despite the extensive clearing of the floodplain and valley flat areas.

Probably these vegetation remnants have been left, not because of a conscious decision to protect the streams, but simply because the banks were too steep and too difficult to clear. Or the vegetation on the banks has re-generated or been invaded by exotic species after originally being cleared.

Whatever their origin, the retention of these narrow, but highly valuable strips of shrubs and trees has protected the stream from the severe bank erosion and bed instability which would otherwise have occurred if this vegetation had been **cleared**. **There are** many dramatic demonstrations of this throughout the catchment. When moving downstream through the boundary of an area with a narrow riparian vegetation to a cleared area there are often dramatic changes in the stream. The stable banks and stable bed of the area with riparian vegetation quickly changes to steep, slumping and eroding banks, and to beds almost completely infilled with sediments. These changes are accompanied by an almost complete loss of ecological values, and the creation of stream problems that require on-going and often expensive and ineffective management, rather than streams which essentially 'look after themselves'.

◦ **High incidence of boulder and rock substrates provides controls restricting bed and bank erosion**

The boulder and rock substrates along much of the streams, particularly in the South Maroochy have also provided another de-facto control measure which has prevented the deterioration in stream condition which would have otherwise occurred.

Given the extent of clearing of vegetation in the catchments, and along the stream banks, many more areas would have eroded but for this natural protection. Once again the ecological values of these sections of stream may be very low but they can be restored by re-establishing riparian vegetation and other measures. The presence of these natural erosion controls can be used for advantage in accomplishing this restoration.

Severe headward gullying erosion and other processes de-stabilising the bed and banks are not prevalent in the catchment.

Fortunately channel avulsion (where a "perched"

stream assumes a new course on the floodplain), and headward gully erosion (where the bed erodes and deepens and this progresses upstream) are not prevalent in the catchment. Similarly severe erosion in the catchment leading to excessive sediment dumping into the stream is also not prevalent, though soil erosion associated with horticulture is a concern. These processes can irrevocably damage streams.

Remnant patches of streams and rivers sections in good condition are scattered throughout the catchment in both upland and lowland areas.

The 14% of stream length in *very good* condition, and the further 19% in *good* condition are scattered throughout the catchment. Each of the major sub-catchments has a range of sections in various conditions including the very good and good categories. The streams in good condition occur in the State Forest areas in the headwaters, but there are also remnant patches on private land in the slopes and in the lowland areas including freshwater wetland and mangrove /salt marsh swamps. These remnants act as buffer strips enhancing the value of the surrounding areas and also provide the 'seeds' or foci for restoration initiatives. They also provide dramatic examples of what the all the streams once looked like, and 'working models' of how streams in good condition operate. They also provide goals and models of the direction and objectives for restoration of different areas.

Major Initiatives and Objectives for Improving the State of the Maroochy River Catchment

The overall classification and condition assessment clearly establishes that riparian vegetation management and re-establishment should be the major priority in the Maroochy catchment. The loss of the riparian vegetation is not only the reason for the poor rating of many of the stream sections, but is also a fundamental cause of the more serious problems with bank erosion and loss of ecological values. Despite the poor rating of the riparian vegetation condition (83% in *poor to very poor* condition), what remains is highly valuable and is saving the banks from erosion and preventing further degradation of the condition.

◦ **Protect Existing Riparian Vegetation**

The existing riparian vegetation should be

protected. This applies not only in the State Forest and other public land areas but also on private lands.

Increase the Value of Existing Degraded Riparian Vegetation by Increasing its Width and Structural Diversity

The value and effectiveness of riparian vegetation is related to its many roles in :-

- stabilising banks,
- intercepting sediments and nutrients in runoff from the catchment,
- providing a corridor for terrestrial and amphibian wildlife (birds, mammals, frogs, reptiles and invertebrates), and
- providing shelter, shade, organic debris which feed and support the instream communities in many ways.

These roles depend on the width, structural diversity and species composition of the riparian vegetation zone. Enhancement programmes should therefore be directed at these objectives in staged exercises with practical and realistic aims. Ideally riparian vegetation strips of 25-50m are desired, but clearly this may be an unrealistic objective. The value to width relationship is probably not linear but increases rapidly at first and then tapers off. The first objective should be focused on the banks themselves, and then further out along a strip of the floodplain bordering the stream.

The structure of the riparian vegetation is also important. A diversity of structural types is required that is a mixture of tall trees, low trees, shrubs and other understorey species, herbs and grasses. Closing the canopy over the smaller streams is also important if the streams are to regain their original nature.

- **Replace Exotic Species with Endemic Native Species**

Strategies for replacing exotic species such as Camphor laurel and preventing their regeneration in the restoration areas should be investigated. The emphasis should be on effective replacement not simple removal which may leave the banks temporarily prone to erosion.

- Restore Lost Riparian Vegetation

Restoration of riparian vegetation in areas where it has been removed would provide the most effective means of improving the condition of the

streams and rivers. This should be seen as a general programme and as an integral part of efforts to stabilise and overcome areas of severe bed and bank erosion and other forms of instability.

This is not an easy task as there are many problems and it involves the cooperation and assistance of many land holders and community groups. There are problems with financing, weed control, fire management, stock watering issues, fencing maintenance and all the difficulties inherent in undertaking works in areas where the beneficiaries may be remote from where the action need to be directed. However, there are case histories where rainforest has been successfully restored along streams in a cooperative ventures involving landowners, residents in nearby towns and various government agencies. Such activities are at the foundation of what integrated catchment management is really about. Such schemes also have the advantage that they can be initiated as pilot schemes building on the initial enthusiasm of local groups. If successful such pilot schemes will act as catalysts for future expansions of the programmes involving whole communities through schools and other community groups.

Turnbull and Olsen (1992) recognised the unique conservation values of the remnant riparian vegetation communities (rainforest, *Eucalyptus*, and exotic species dominated) and the merits of re-establishing this vegetation. Most areas would be fertile enough to allow for rainforest regeneration. They also recommended the replacement of the exotic species with natives.

5.2 Recommendations

The major recommendations from the study are:-

1. Re-establish and Protect Riparian Vegetation

The major focus for action should be directed at re-establishing riparian vegetation:-

a) Protect existing remnant pockets of riparian vegetation in State Forest areas, other remnants on public and private land, remnant freshwater wetland and mangrove/ saltmarsh areas.

b) Enhance existing riparian vegetation by increasing its width and encouraging the fencing of stream verges and the establishment of defined

hardened stock watering points to reduce stock damage. Efforts should also be made to increase the structural diversity of remnant zones and the replacement of exotic species.

c) Restore lost riparian vegetation through appropriate integrated programmes.

2. Establish *the Need for Temporary Bed and Bank Stabilisation Measures in Highly Degraded Areas and Investigate Long-term Solutions through Integrated Catchment Management.*

The stream sections in degraded and high-degraded condition with severe bank erosion and/or bed erosion or excessive build-up of instream sediments may require urgent rehabilitation measures. This may involve well designed artificial bank protection techniques as interim, temporary measures. Further more detailed study of these areas, including the resourcing, would be required to identify the cause of the problem and the appropriate long term solution using an integrated catchment approach. Such bed and bank stabilisation measures should be seen only as stop-gaps to arrest the degradation until the long term cause can be identified and solved permanently.

3. *Follow-up Survey in 3-5 years to establish trends and rates of degradation in condition and the effectiveness of rehabilitation and protection measures.*

It is suggested that this condition assessment be repeated in 3-5 years dependent on the availability of the required resources and the perceived need for such a follow-up. Repeat surveys are required to determine the trends in the changes in condition in different parts of the catchments. The projected increase in population in the catchment will put extra pressure on the streams and rivers. Establishing the trends and the time-frame for degradation are important for setting priorities and establishing the seriousness of the problem. Follow-up surveys would also be very useful for establishing the effectiveness of re-habitation or riparian vegetation and various other management initiatives stimulated by this report. The methodology has been designed to allow for this replication as the survey sites have been carefully described and located.

6. References

- Anderson, J.R. (1993a) *State of the Rivers Project. Report 1. Development and Validation of the Methodology.* Report to the Department of Primary Industries, Queensland.
- Anderson, J.R. (1993b) *State of the Rivers Project. Report 2. Implementation Manual.* Report to the Department of Primary Industries, Queensland.
- Arthington, A. H. (1992) *Annotated Bibliography of Literature on the Condition of Queensland Streams and Rivers.* Report to the Water Resource Commission, Brisbane, Queensland.
- Capelin, M. A. (1987) *Horticulture Land Suitability Study - Sunshine Coast, Southeast Queensland.* Land Resources Bulletin No. QV87001. Department of Primary Industries, Queensland.
- Gregory, H. *Making Maroochy - A History of the land, the people and the Shire.* Boolarong Publications & the Maroochy Shire Council.
- MSC (1982) *Maroochy River Floodplain Development Control Plan Part B: Supporting Information.* (Unpublished Report) Prepared by Environment Science and Services for Maroochy Shire Council, Queensland.
- Turnbull, M. H. and Olsen M.F. (1992) *Vegetation Survey and Assessment of Landscapes within the Boundaries of the Maroochy Shire.* Maroochy Shire Council, Queensland.