Managing waterway health in the Goulburn Broken Catchment, Victoria, Australia

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Abstract
Historically within most catchments, resource management programs have been planned and implemented in isolation of one another. This was once the case in the Goulburn Broken Catchment, a major catchment of the Murray Darling Basin, Australia. Although only 2% of the Murray Darling Basin’s land area, the catchment generates 11% of the basin’s water resources.

Learning from the past, a cooperative and collaborative approach to natural resource programs has developed. This approach is the envy of many other catchment communities and agencies. Through a combination of “Partnership Programs”, “Operational Initiatives” and community involvement, significant programs have been implemented within the catchment, which will benefit not only the local community but communities further afield. The outcomes of the waterway health program highlight the benefits provided through the establishment of cooperative and partnership resource improvement programs. These programs were founded on the ability of the community to recognise the need for integration, base management decisions on best available science and an ability to work together. Their effective delivery has been provided through the resources provided, to the local community, by the Natural Heritage Trust with matching and State and local allocations.

While programs have shown success, challenges still face the community. These challenges include verification and implementation of environmental flows, storage of the catchment’s vital water resources, and maintaining community involvement and participation in on-going works programs. The Goulburn Broken Catchment community, with the support of Federal, State and Local Governments, is looking at opportunities for continued improvements in waterway health.

Keywords: Goulburn Broken Catchment Management Authority; waterway health; catchment management; aquatic ecosystems; water quality; integration of programs; and monitoring

The catchment
The name Goulburn Broken is derived from the two major river systems within the catchment, the Goulburn River and the Broken River. The catchment covers 17% of central and northern Victoria (2.4 million hectares), and houses in excess of 200,000 people. The region stretches from close to the outskirts of Melbourne in the south to the Murray River in the north, and supports major agricultural (dryland and irrigated), food processing, forestry and tourism industries. The catchment is shown in Figure 1.

From the irrigated Goulburn and Murray Valleys to the dryland grazing and cropping regions and high country valued for its tourism and recreational uses, the Goulburn Broken catchment is a foundation of the Victorian and Murray Darling Basin water resources and economic wealth. Although only 2% of the Murray Darling Basin’s land area, the catchment generates 11% of the basin’s water resources. The catchment generates 26% of the rural export earnings for the State of Victoria. Downstream users of water resources rely heavily on the water exported from the catchment.

History of catchment management
Waterway management
Waterway management in the catchment commenced in the late 1800s, with a range of activities far different from those of today. Early desnagging, channelisation, banking and construction of on-stream storages significantly altered the condition of the natural stream...
systems. In addition changing landuse in the catchment and along the floodplain altered natural processes – hydrological, geomorphic and ecological.

Formalisation of waterway management began with the establishment of River Improvement Trusts. In the Goulburn Broken Catchment the earliest established trust was the Broken River Improvement Trust which formed in 1960. In the 1960s Shire-based River Improvement Trusts were established throughout parts of the catchment.

During the 1980–90s major changes occurred to these and River Management Boards were established. With them, came major changes with strategic catchment-based waterway programs, rather than just local problems, and a focus on “river health”. The establishment of the Goulburn Broken Catchment Management Authority (see below) enabled waterway management to be undertaken on an integrated catchment basis.

Catchment management

Broad community concern throughout Victoria for natural resources (salinity in particular) in the early 1980s resulted in a parliamentary enquiry into salinity. Because of the high level of community action within the Goulburn Broken Catchment with the commencement of Landcare, it was selected as the pilot region for a community-driven program to develop a catchment-wide salinity plan.

The Salinity Pilot Program Advisory Committee was constituted in 1986 to combat the rising groundwater in both the dryland and irrigation areas of the Goulburn Broken Catchment. By 1990 community input into decision making and policy development had proven so successful in the implementation of the action orientated management plans that the model was extended throughout Victoria and the Salinity Pilot Program Advisory Committee became the Salinity Program Advisory Committee (SPAC).

The introduction of the new Catchment and Land Protection Legislation in 1994 saw the role of SPAC being replaced by the Goulburn Broken Catchment and Land Protection Board. Under this new legislation the Board became the lead body responsible for setting policy and direction, coordinating implementation and monitoring achievements in natural resource management. This move to whole of catchment management was an opportunity to incorporate other environmental degradation issues with salinity and address these issues with a more holistic approach.

In 1998 the Goulburn Broken Catchment Management Authority (GBCMA) was constituted by the Victorian State Government to be responsible for land and water resource management for the Region. The Lower Goulburn Waterways Authority, Mid Goulburn...
Broken Waterways Authority and Upper Goulburn Waterways Authority ceased to exist and became direct operational arms of the GBCMA as Goulburn Broken Waterways and Upper Goulburn Waterways.

The establishment of a peak natural resource management organisation for the catchment

When first formed the Goulburn Broken Catchment Management Authority (GBCMA) liaised extensively with all sectors of the catchment community to produce management plans for both the dryland and the irrigation regions. Because the concept of landuse needed to be changed, an intensive community education program was undertaken by GBCMA to inform, educate and change the perceptions of current land use and the problems that they were causing.

Working with its' partners, including Goulburn-Murray Water (a rural water authority), Goulburn Valley Water (urban water authority), local government and the Department of Natural Resources and Environment, GBCMA has now developed detailed strategies to address land and water degradation. The mission and vision statements of GBCMA are given in Figure 2.

Membership

Members of the Authority board are drawn from within the region and collectively have a wide range of experience and knowledge of primary industry, land protection, water resource management, waterway and floodplain management, environmental conservation, Local Government, food processing and business and financial management.

To ensure GBCMA’s activities reflect community views, the Board has set up three community-based Implementation Committees. These are the:

- Shepparton Irrigation Implementation Committee, the
- Mid-Goulburn Broken Implementation Committee and the
- Upper Goulburn Implementation Committee.

These committees, along with the operational committees, have the responsibility of developing and putting in place on-ground works under the Authority’s broad strategies as well as acting as a link between the GBCMA Board and the community.

Coordinating Committees ensure a consistent approach to catchment problems, such as river management, salinity, nutrients, soil acidity. The GBCMA is working to ensure land and water resources are protected and enhanced as well as improving the region’s social wellbeing, environmental quality and productive capacity in a sustainable manner.

Our vital water resources

Stream health in the region is of vital importance. Not only for the local region but also for communities over 500 km downstream. The Goulburn Broken Catchment Management Strategy notes that the catchment rivers and streams have undergone major changes since settlement. These changes, together with increased use of the streams and adjacent floodplains have resulted in many problems including:

Mission Statement

As a peak natural resource management organisation, the GBCMA will lead the cost-effective protection and enhancement of the catchment's land and water resources to improve social well being, environmental quality and the sustainable productive capacity of the catchment

Vision Statement

To work with the community to achieve integrated Catchment Management through the implementation of the Regional Catchment Strategy

Figure 2 Mission and vision statements of GBCMA
• increased stream and gully erosion;
• increased rate and incidence of bank erosion;
• threats to public and private assets by stream damage;
• decline in the quality of water;
• loss of riparian vegetation and decline in stream frontage condition;
• decline in the condition of aquatic and terrestrial habitat.

The Goulburn Broken Catchment Strategy (1996) notes that the catchment has been identified as a major contributor of nutrients to the Murray River (300 tonnes of phosphorus and 3,000 tonnes of nitrogen annually), and that blue-green algal blooms resulting from excessive nutrients in waterways are occurring with increasing frequency. They pose unacceptable risks to public health and the Region’s billion dollar food processing and export industries.

State of the streams in the catchment
Streams within the region are highly valued for a range of reasons: potable water supply, stock and domestic water supply, recreation (both passive and active), the presence of threatened and vulnerable fish species, aesthetic beauty, biodiversity values for example. Their condition varies significantly throughout the region. Mitchell presented the condition of the region’s streams in a report in 1990. This is summarised in Table 1.

Targets for stream health
The principles for natural resource programs are contained within the Goulburn Broken Regional Catchment Strategy. This document was prepared in a collaborative approach between the community and agencies. Priority goals for waterway health contained within the Strategy are:
• 65% reduction in nutrient loads leaving the Goulburn Broken Catchment;
• reduce stream salinity; and
• improve the health of 3,000 km of streams to good or excellent over 30 years while maintaining the condition of streams currently rated as good, very good and excellent (restoration of riparian zones, protection of remnant native vegetation and aquatic ecosystems, and provide for fish migration).

Programs and priorities
The key river management objectives and priority activities in the catchment are as follow.

Objectives
• Protection and enhancement of the environmental, economic, recreational and aesthetic values of rivers and waterways (stream health).
• Protection of public and private assets from stream related impacts.

Priority activities
Control of channel instabilities impacting on waterway objectives; protect and enhance values of native vegetation; enhance fish migration/instream diversity; undertake activities which enhance/protect water quality; control exotic vegetation within riverine zones;

Table 1 The condition of streams within the Goulburn Broken Catchment (Mitchell, 1990)

<table>
<thead>
<tr>
<th>Basin</th>
<th>Length of stream in each environmental rating category (km)</th>
<th>Total stream length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Basin 4 - Broken</td>
<td>409</td>
<td>30</td>
</tr>
<tr>
<td>Basin 5 - Goulburn</td>
<td>4,711</td>
<td>279</td>
</tr>
</tbody>
</table>
establish benchmarks and monitor performance of activities; encourage appropriate research; encourage community participation; support catchment; other CMA programs where riverine objectives are achieved.

Catchment-based issues – impacts on stream health
Streams are a reflection of the management of our catchment, both past and present. A range of natural resource issues are present in the catchment; many influence the well-being of our streams. These include the following:

Water quality/nutrients
Excessive quantities of the nutrients, phosphorus and nitrogen, can lead to excess growth of aquatic algae, including blue-green algae. Algal blooms occur frequently in and downstream of the catchment. Nutrients are generated from numerous sources in the catchment, some natural, many human-induced. The major sources of nutrients in the catchment include irrigation drainage, sewage treatment plants, sediment mobilisation, urban stormwater and intensive animal industries (fish farms).

The catchment was nominated as Victoria’s highest priority for nutrient reduction in the Murray Darling Basin Commission Algal Management Strategy (1994). To address this issue a Water Quality Strategy has been prepared for the catchment. This is expected to achieve a 65% reduction in the loads of phosphorus reaching waterways and leaving the catchment. The Strategy targets all major sources of nutrients, especially near and along streams and waterways.

Salinity
Inappropriate clearing, replacing deep-rooted vegetation with annual pasture, and irrigation have dramatically increased groundwater recharge. The rise in groundwater level will have a major impact on rivers and streams, with increased saltloads and the destabilisation of banks through saline seepage.

The dryland catchment currently contains about 4,500 ha of saline discharge. This area is growing at 5% per year, and will ultimately increase to 38,000 ha in 50 years if nothing is done. The dryland catchment exports an average of 260,000 tonnes of salt to either the irrigation region or the River Murray (approx. 45%). This will double in 50 years if remedial action is not taken.

In the irrigation area the natural underground drainage system of aquifers has not coped with the introduction of intensive irrigation. Now 43% of the Shepparton Irrigation Region (SIR) is underlain by watertable within 2 metres of the surface. If nothing is done, some 65% of the SIR will have a high watertable by 2020, severe land salinisation will occur and most major wetlands will have suffered irreversible degradation.

This issue is addressed by the implementation of endorsed 30 year Land and Water Management Plans, now in their 10th year of implementation.

Biodiversity management
A Native Vegetation Strategy has been produced as the first part of a more comprehensive Biodiversity Strategy for the catchment. The actions listed set the direction for the community and funding bodies of the critical opportunities to protect and enhance the vegetation resources of the catchment.

The GBCMA, in partnership with CSIRO and the Myer Foundation, has recently commenced an innovative project entitled “Heartlands”. This project will increase our understanding of the benefits we receive from natural ecosystems and help us to incorporate the protection of these ecosystems into catchment works.
Pest plants and animals
Action Plans are in place for the control and eradication (where possible) of the most critical pests.

Achievements
Achievement within the catchment has been founded on the integration of individual programs and close relationships with the community.

On-ground works
The Goulburn Broken Catchment community has produced successful program integration, provided a tool for the attainment and adoption of new science and created a framework for programs to be integrated at strategic, planning and implementation levels. The CMA together with the catchment community, State and Federal Government (NHT), and other key stakeholders work together to develop and implement a range of programs to improve stream health. Annually, there are over 500 individual on-ground management projects throughout the catchment.

Pre-work benchmarking is established to monitor the performance of programs and individual projects. Examples include the application of the Index Stream Condition (ISC) monitoring the impact on vegetation, water quality, channel stability and the increase in aquatic life. The monitoring is noted before and after on-ground works, looks at both short and long term changes and is evaluated against program activities.

The control of channel instabilities impacting on waterways has resulted in 150 km of stream being protected. More than 320 km of riverine frontage has been fenced off and 230 hectares protected from stock to protect and enhance values of native riparian and frontage vegetation. The habitats of endangered and vulnerable species have been targeted in this work. These include the squirrel glider, brolga, stone bush curlew, superb parrot, grey-crowned babbler and the regent honeyeater. Exotic woody weeds were controlled along 250 km of frontage. e.g. willows, desert ash, blackberry.

To enhance fish migration 22 fishways have been constructed to assist in-stream diversity. This innovation has opened up 200 km of streams for migration to endangered fish species. Recent monitoring by the Marine and Freshwater Resources Institute of these fishways, confirmed their effectiveness.

Activities undertaken which enhance/protect water quality include enhanced treatment of sewage and effluent from towns and industry. Sewage treatment plants have reduced phosphorus loads from an estimated 50 t/yr in 1993/94 to approximately 30 t in 1997/98. Work currently underway at Shepparton will see this fall to 10 t/yr. Shepparton has an effluent load equivalent to 200,000 people. Two major milk processing plants have reduced phosphorus discharges by over 6 tonnes per year. Fish farming industries have modified their feeding methods and reduced their phosphorus output from 29 t/yr to 18 t/yr by improved management practices.

In the dryland areas in-stream and near-stream phosphorus loads and sediment sources are being controlled. The reduction of phosphorus from irrigation drainage into our river systems due to works has been masked by a run of three dry years. However diversion of water from irrigation drains has increased substantially and drain diversion plans are being implemented. Landholders have made major investments (over $35 million per year) in improving land and water management in the catchment. Works such as farm reuse and improved irrigation systems contribute to improvement in water use efficiency with major benefits to our waterways.

Community involvement
The GBCMA is a regional community initiated and designed structure. It emphasises the community responsibility in deciding the direction in natural resource management.
The structure has a very high component of empowered community representatives who take on the responsibility for all natural resource activities in the catchment (water, land, air, and biodiversity). The GBCMA has a close relationship with authorities, groups and individuals. Landcare groups take on much of the responsibility for riparian fencing and revegetation.

Goulburn Valley Water is the major sponsor for Waterwatch, a water quality monitoring program that has involved over 100 school groups and over 40 Landcare groups. Goulburn Murray Water, GBCMA and the National Landcare Program also support Waterwatch. Goulburn Valley Environmental Employment Program was established twelve months ago to involve voluntary unemployed youth in natural resource rehabilitation.

The GBCMA relationship with Local Government has resulted in joint projects such as bike paths, walking trails, control of exotic weeds and erosion in the riparian zone, litter interceptors on storm-water outfalls, and construction of fishways.

State Government supplies funding for waterway works and control of crown land frontages to rivers and streams. Negotiations with EPA have set the distance of septic tanks from rivers and streams. Federal Government supplies Natural Heritage Trust funding for riparian vegetation for natural resource management.

Goulburn Valley Water and Goulburn Murray are committed to the Water Quality Strategy in supplying high quality water to the food processing industry in the region. These food processing industries are committed to treating wastewater to be re-used for sustainable land based irrigation; e.g. Bonlac received the Banskia Award for their innovative approach.

Monitoring – tracking our progress
To gauge our progress, a range of monitoring programs have been established. The programs vary according to the funding available, the goals of the programs and the range of values to be protected or enhanced. Two key methodologies are employed: snapshot indicators (indicators of condition); and targeted monitoring (monitoring against stated goals). It is essential that “performance monitoring” be linked to the goals of the program. Monitoring generally starts before the development of a strategy, design and implementation of works and activities to enable the establishment of benchmarks. In other instances control sites are established.

Examples of monitoring programs
The Catchment Management Authority employed the Index of Stream Condition (ISC) to benchmark the condition of streams in the catchment. The Index of Stream Condition has been utilised by all Catchment Management Authorities in Victoria to assist in assessing the effectiveness of programs and to aid regional priority setting. The Index is a measure of a stream’s change from natural or ideal conditions; it presents an indication of the extent of change in respect of five key “stream health” indices: Hydrology; Physical Form; Streamside Zone; Water Quality; and Aquatic Life. Benchmark conditions have been established for more than 120 sites within the catchment. ISC sites will be reassessed in 2005.

In addition to the catchment scale initiative, project related monitoring has been employed using the Physical Form and Streamside Zone sub-indices. To date we have seen the ratings of some stream reaches improve within a two to five year time frame. Table 2 presents details of some of the targeted monitoring programs being implemented within the catchment.

Challenges
Many challenges still face the community with respect to natural resource management. The way in which rivers are treated, valued and managed has changed dramatically over the
past twenty years, even more so in the past five. This has come about through experience and the information provided by researchers and practitioners. Further information will come to light and it will change the way we manage waterways from a stream health perspective.

Emerging issues
Emerging issues, which require consideration and further investigation to enable us to better manage our waterway, include:
• Decreased flow in unregulated streams – increasing diversion demand.
• Decreased environmental water due to increasing demand for irrigation extraction.
• Increasing incidence of algal blooms in streams.
• Stormwater – gross pollutants.
• Sedimentation of rivers (sources and transportation rates).
• Other pollutants (unidentified / potential impacts yet unknown).
• Recreational use of rivers.
• Grazing regimes in riparian areas.
• Restoration of floodplain ecosystems for biodiversity and water quality purposes.
• Fragmentation of riparian biolinks by inappropriate development.
• Timber harvesting, particularly the removal of woody debris from floodplain.

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References