



Burdekin Water Quality Adaptive Management Framework

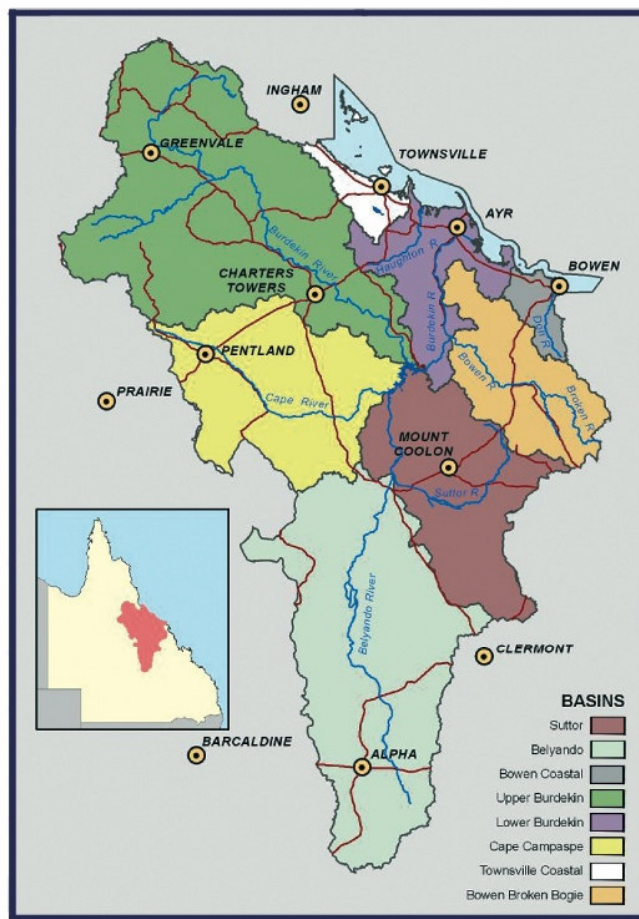
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2007

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Australian Government



Queensland
Government



ARC Centre of Excellence
Coral Reef Studies



Contents

| | |
|----------------------------------|----|
| 1. Executive Summary | 3 |
| 2. Background | 4 |
| 3. The development process | 5 |
| 4. Workshop report | 7 |
| 5. Adaptive management framework | 11 |
| 6. Conclusions | 17 |
| 7. Glossary of acronyms | 18 |
| 8. Appendixes | 19 |
| 9. References | 26 |

List of Figures and Tables

| | | |
|----------|--|----|
| Figure 1 | Map of the WQIP development process showing the contribution of an Adaptive Management Framework (Strategy). | 4 |
| Figure 2 | Agreed steps in scoping and delivering the AMF | 5 |
| Figure 3 | Draft composite model of Burdekin water quality improvement based on interview data. | 7 |
| Figure 4 | The Burdekin water quality adaptive management cycle | 11 |
| Figure 5 | Land management change | 13 |
| Figure 6 | Institutional participation | 14 |
| Table 1 | Summary of feedback on conceptual model for WQ improvement | 8 |
| Table 2 | Adapting the plan to address system changes | 9 |
| Table 3 | Integration of WQIP activities with other resource management initiatives | 15 |

1. Executive Summary

Water quality improvement is a seemingly straightforward business: study the way water moves through a catchment; identify water quality threats; and implement management actions to address them. However, there are also many complexities and much uncertainty involved in water quality improvement and this is why an adaptive approach is fundamental.

Complex and interactive river and ground water systems, multiple issues of concern, many and diverse stakeholders, time lags between management actions and anticipated improvement, and uncertainties about the contribution of specific land management practices, are some of the complexities and uncertainties identified by research and stakeholders in the Burdekin region.

Two key drivers of adaptive management were identified during the development of the adaptive management framework:

1. participation of key stakeholders and the wider catchment community;
2. monitoring (and modelling) water quality, land use change and other system phenomena to provide feedback into the management system.

These two processes are fundamental to every stage of the adaptive management cycle. There are specific participation and monitoring requirements for each stage. The framework also describes the institutional arrangements and the land use change mechanisms that will support water quality improvement.

A participative approach to the development of the framework also delivered benefits for Water Quality Improvement. Feedback suggests that this project contributed to the development of a shared understanding of water quality issues, change mechanisms and planning direction. The framework now provides a basis for BDT staff to work together with stakeholders to improve water quality.

2. Background

The Adaptive Management Framework presented in this document is a key component of the Burdekin Dry Tropics Region Water Quality Improvement Plan (WQIP). The document guiding the Commonwealth Government Coastal Catchments Initiative (CCI) *The Framework for Marine and Estuarine Water Quality Protection* (Environment Australia 2002) describes the minimum requirements for a water quality improvement plan. Among the many other components of the plan, the WQIP should 'identify strategies for adaptive environmental management, recognising the implications to environmental monitoring programs of management interventions over time' p5.

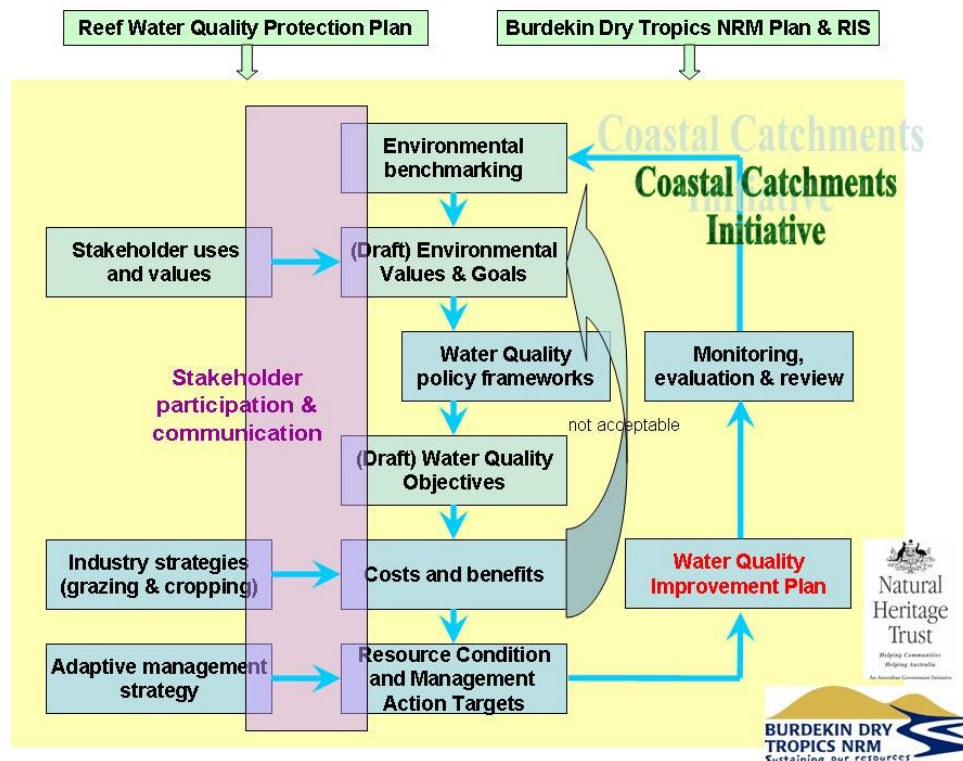


Figure 1 Map of the WQIP development process showing the contribution of an Adaptive Management Framework (Strategy).

The adaptive management framework indicates how the WQIP will be implemented and how implementation of the WQIP is related to other NRM, water management, and productivity related initiatives. An adaptive approach explicitly acknowledges complexity and uncertainty and describes how these elements will be addressed in implementation of the WQIP and in subsequent adaptive cycles. The Burdekin Dry Tropics NRM recognised the opportunity provided by the development of an adaptive management framework to coordinate many of the other activities and requirements of the plan, as well as the NRM targets they have already carefully described in the NRM strategy (Burdekin Dry Tropics Board 2005a) and other important planning documents in the region.

The Burdekin Dry Tropics NRM also identified the need for a participative approach to the development of an adaptive management framework.

3. The development process

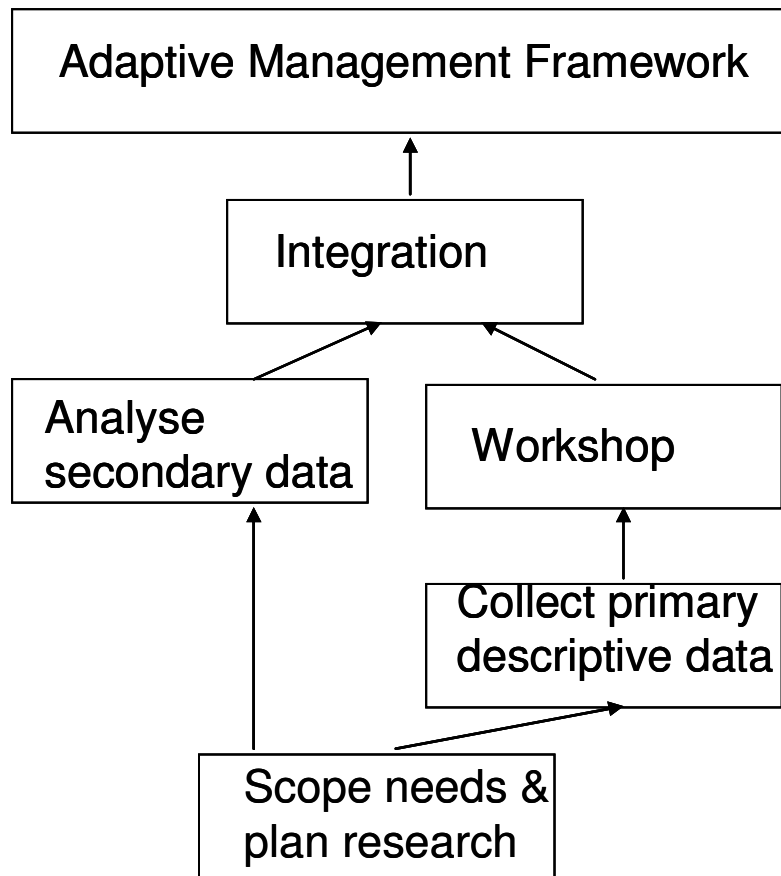


Figure 2 Agreed steps in scoping and developing the AMF

The project was developed in consultation with BDT and with approval of the BDT WQ Steering Committee. This report tables the process and outcomes of this research project. The project was designed to achieve the following outcomes:

1. Engagement of key stakeholders in WQ Planning.
2. A shared understanding of planning direction enabling BDT staff to work together with stakeholders to improve water quality.
3. Assumptions about water quality management and the nature of the BDT region will be made explicit.

The project involved six steps described below:

1. Collect descriptive and predictive data;
2. 21 interviews were conducted between 13 February, 2007 and 23 March, 2007;
3. Analyse data and report (see 'Summary of Stakeholder Perceptions Report');
4. Workshop 26 April, 2007 (see 'Workshop Report');

5. Integrate with existing water and NRM management plans; and
6. Develop an agreed adaptive management framework.

Details of Stakeholder perception and the workshop have been previously reported as (Broderick 2007a, 2007b). These can be found on the BDT CCI web site <http://www.bdtmrm.org.au/cci/news/>.

The project sought to deliver the agreed outcomes through the project process, interim reports, and this final report.

Project Outputs

1. Clear adaptive management framework for water quality improvement (See Section 5 this report).
2. A report summarising the framework development process (this report).

Project summary

Though focused on developing an adaptive management framework as a component of the BDT WQIP, this project also helped to engage stakeholders more rigorously in the WQIP development process. The process involved clarifying system understandings firstly through interview and model drawing and secondly through workshopping a draft model. This enabled participants to clarify their own understandings of the system and to become aware of the variety of views of other stakeholders.

During the interview and workshop phase of the project, consolidated stakeholder views were reported to BDT NRM as formative feedback for WQIP development. Three of the most commonly expressed views involved concerns about research and development for land management change, institutional arrangements, and many were keen to know how they would be involved in target setting (developing environmental goals).

The process provided the opportunity to address differences in understanding of the catchment system and its water quality inputs to the GBR. A model of the biophysical catchment system showing water quality issues, attributing them to causes, and identifying monitoring requirements was developed alongside this project. Developing a conceptual model of the WQ system proved both a learning experience and a great challenge as it is on this shared understanding of the system that the WQIP is based. This model will be reviewed as part of the adaptive management process as more becomes known about the system or elements of the system change with time, other events, or management success. There were a variety of views expressed on the nature of the biophysical system and water quality issues but an even greater variety on the proposed management approaches and institutional arrangements. The AMF process identified gaps in understanding and need for greater clarity surrounding planning management actions and institutional arrangements.

4. Workshop Report

This section presents a summary and analysis of the data collected at the AMF workshop, held at Ayr on 26th April 2007. Details of the workshop organisation, information presented, and workshop evaluation has previously been reported (Broderick 2007b). The workshop was divided into two main participatory sections, one aimed at refining a conceptual model of the system, and the second at exploring ideas about system changes and adaptive management. These activities served several purposes: to elicit expert and important local knowledge; to provide opportunities for interaction and sharing ideas between stakeholders to promote increased understanding. There was much involvement and some lively discussion in the groups.

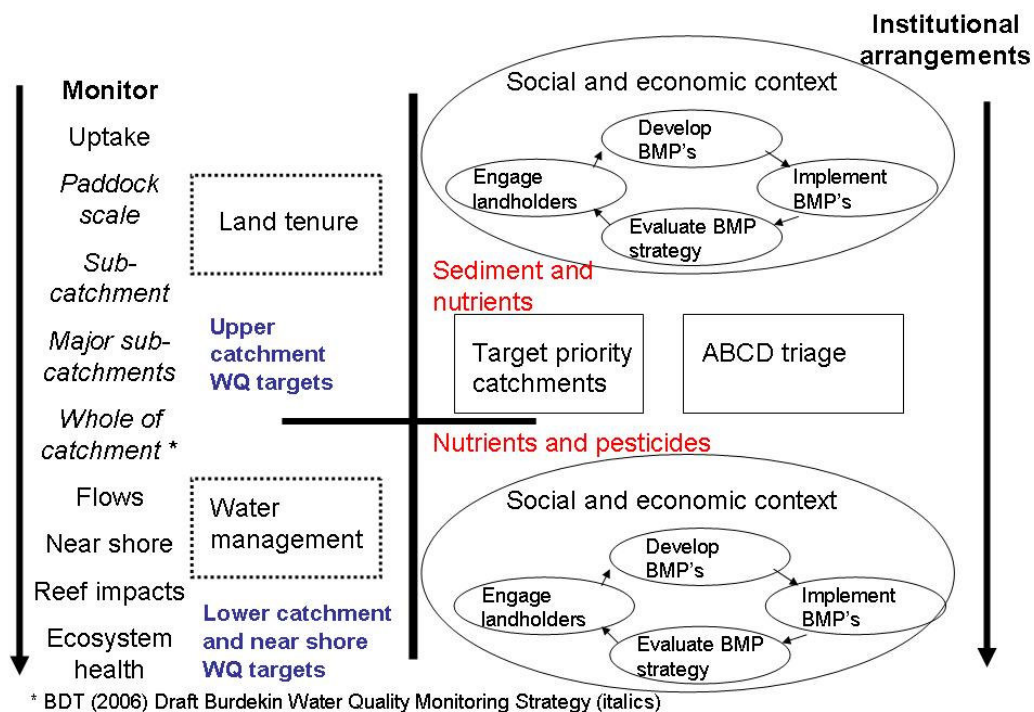


Figure 3 Draft composite model of Burdekin water quality improvement based on interview data. This model was presented at the workshop for comment and discussion.

Refining a conceptual model of the system

Participants were asked to examine the conceptual model, note any disagreement or agreement with it, and suggest how it could be improved. They were also asked to consider participant views on change and improvement. Differences of opinion were expressed in the group discussions. The notes from group discussion contributed to the development of the AMF version in this report. The full notes from this session were extensive and included many diagrams (see Appendix A for a collation of all the notes from this activity).

Information collated from this activity was highly varied and included views on additional information, redundant information, and presentation methods (including interpretation of arrows, boxes etc...). Feedback also suggested that this activity helped to clarify some participants' understanding of the system and of the views of other stakeholders. A summary of content feedback can be seen in Table 1.

Table 1 Summary of feedback on conceptual model for WQ improvement

| WQIP sub-system | WQIP considerations |
|-----------------------------|--|
| The biophysical system | <ul style="list-style-type: none"> • Spatial and temporal variation needs to be considered. • Acknowledge uncertainty about frequency of events and likely WQ impacts • Integrate with other water management activity e.g. groundwater and WR plan |
| Issues of concern | <ul style="list-style-type: none"> • Ambient WQ conditions also require monitoring to ensure that 'new' problems are identified. |
| Monitoring and modelling | <ul style="list-style-type: none"> • Biophysical monitoring and modelling should be considered separately from the social and economic monitoring and management performance monitoring. • Adaptive process for refining and improving models? |
| Setting targets/objectives | <ul style="list-style-type: none"> • Develop rigorous process to establish, review and evaluate? • Are they only for the GBR or are there also freshwater targets? |
| 'Best' management practices | <ul style="list-style-type: none"> • Develop management practices that contribute to WQ improvement. • Don't call them 'best' (alternate suggestion offered eg Management practices for WQ improvement 2007) • Involve, inform and support landholders in making changes to improve WQ. • These should also be considered at different scales: catchment, enterprise, and paddock. • Practices are related to specific land uses but the processes for developing them and implementing are common to most land uses. • Implementation including use of incentives must consider cost of the practice change, WQ benefit and socio-economic conditions of the landholder/ industry. • Need to specify what will be monitored, and when, and how these activities will be evaluated. |
| Other management approaches | <ul style="list-style-type: none"> • Consider other management actions for land use/management change |
| Community engagement | <ul style="list-style-type: none"> • Need to communicate with and involve wider community and stakeholders. |
| Institutions | <ul style="list-style-type: none"> • Map institutional arrangements/ responsibilities. |

An adaptive approach to water quality improvement

Participants were provided with background information on adaptive management prior to the workshop. At the workshop they were presented with a brief overview of adaptive management and an opportunity to determine which aspects of water quality improvement could be managed in an adaptive way. In the group discussion activity that followed (see activity instructions below) one group was assigned to each of the discussion topics and participants chose which group they would work in.

Group Discussion Activity: Adaptive management

How would the plan need to change if there was a change in?

1. *Biophysical, social or economic conditions*
2. *Water quality Environmental Values*
3. *Best Management Practices and uptake conditions*
4. *Institutional arrangements or Industry involvement*
5. *Increased development*

Discuss and note:

- *Gaps in current understanding*
- *Likely changes in this area*
- *Impacts of changes on other areas of the model*
- *Be prepared to report back to the large group!*

Participants engaged well with this activity and there was some lively discussion in the groups. Notes from this activity are detailed and extensive (see appendix). A summary table of these notes is presented below.

Table 2 Adapting the plan to address system changes

| System aspect | Gaps in understanding | Likely changes... | Impacts on other areas of the model. |
|---|--|--|---|
| Biophysical, social and economic conditions | How changes in one system eg water price affect a change in others eg land use | Crop varieties, Increased technology, water price, decision-making processes, increased weeds and pests, market conditions, farm ownership, coastal development. | BMP's, new landowners, New issues of concern, Institutional arrangements, monitoring other than WQ, monitor markets and socio-economic change. |
| Water quality environmental values | Current WQ values? Process for eliciting and reporting on and using in planning. | Refinement and improvement of methods to work with values, increased community awareness, Climate change, | Shifting baselines and targets? Greater expectations for participation and justice in process, more realistic expectations about what can be achieved and costs etc..., need to account for climate |

| | | | |
|---|---|---|--|
| | | | change in objectives/ review process. |
| Best management practices and uptake conditions | Connections between particular management practices, land condition and WQ. Other benefits for BMP's? Costs? | Increased understanding, increased knowledge of practices and WQ and practices and 'uptake' conditions. | May require other tools to change WQ, BMPs for different and variable conditions (increased R&D), timelines for uptake and anticipated WQ improvement may need to be adjusted. |
| Institutional arrangements and industry involvement | Need to communicate institutional arrangements, data sharing and communicating between projects, Collaborations between other projects e.g. L&W management plans, nutrient zones. | These will continue to evolve and will continue to need to be communicated. | Can enable or disable WQIP implementation, consider representation of stakeholders' views. |
| Increasing development | How much development will be permitted, what WQ impacts this will have. | Trends in development have already been forecasted for different areas. | Need to model changed land use scenarios to determine new issues of concern. |

Based on the feedback from this activity, it was considered sensible to create an explanatory diagram showing the overarching adaptive management process and two separate diagrams for three main WQ management considerations: land use/management change; and institutional arrangements. There was also a need to develop a model of the dynamic biophysical system, including land uses, issues of concern, and monitoring and modelling. The conceptual model was later developed as part of the 'Issues Report' which provides a full description of the biophysical system (Mitchell 2007).

5. The Adaptive Management Framework

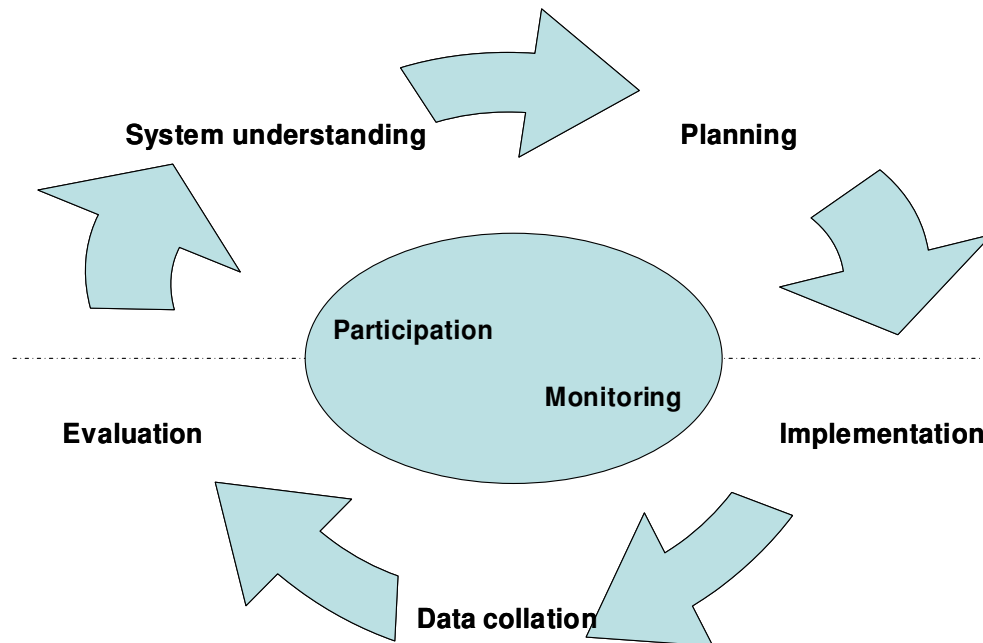


Figure 4 The Burdekin water quality adaptive management cycle

The Adaptive Management Framework is an overarching framework designed to guide implementation of the WQIP. The Burdekin water quality adaptive management framework consists of three diagrams, a table, and supporting information.

The adaptive cycle is represented in Figure 1. The important components and process elements of the adaptive cycle are identified. The key components are: planning; implementation; data collation; evaluation; and system understanding. The central process elements are participation and monitoring. Each of these components and process elements are described in relation to the Burdekin Water Quality Improvement Plan below.

It is anticipated that this current WQIP will be implemented and water quality management would proceed around this cycle. Not all activities will proceed in the order they are described data collation and its representation and communication, for example, is an ongoing activity and reporting will be at regular intervals. Adjustments will be made to the plan at agreed times based on monitoring data and evaluation. There will also be a review period when data are collated, the plan evaluated, and new understandings will be articulated and the first cycle completed.

Components

System understanding- Current understanding of the system is described, highlighting uncertainties and gaps in knowledge. This component also establishes the logic of the adaptive approach. Stakeholders' knowledge is elicited and is integrated with other information from regional documents and previous WQIP evaluation. A vision for the next cycle is developed. The institutional arrangements are clarified, adjusted, or reinforced at this stage. Changes in understanding of the system are identified. Progression around the cycle is examined and the next planning process is established.

Planning- Water quality values and problems are identified; goals and objectives are set, and management actions are developed, and monitoring and modelling are planned. The development of management actions also requires an adaptive approach and this is described as a sub-component of planning. Plan implementation is costed in the planning phase of the cycle and a budget for plan implementation developed. The result is the WQIP in the first instance, and revised plans after completing the adaptive cycle.

Implementation- In this stage the management actions are prioritised and implemented and the monitoring program is firmly established. Data from the monitoring program is used to 'tweak' management actions as needed. Ongoing monitoring program continues regardless.

Data collation - All monitoring and modelling data including changes in water quality, evidence of management action implementation, and any other feedbacks received are collated, represented and communicated in relation to the WQ objectives and management targets of the WQIP.

Evaluation- Judgements are made about the overall effectiveness of the plan and its particular components. This process should involve all stakeholders and be communicated to the interested public.

Processes

Participation - The whole adaptive management approach is underpinned by clear communication with stakeholders and the public. Communication and involvement is important at each stage of the AMF and in communicating the overall process and outcomes. Participation is particularly important in determining environmental values and developing management actions. Voluntary land management change requires willing participation of landholders in the development and implementation of management actions. These activities are underpinned by a clearly articulated participatory approach that includes relevant industry groups.

Monitoring - Collecting data is important in each phase of the AMF. It is also important to provide the baseline data and register any change as a result of the WQIP. Monitoring and modelling is essential to increase understanding of how the water quality system functions. The *Draft Burdekin Water Quality Monitoring Strategy* (Brodie et al. 2006b) and *Draft*

Burdekin Water Quality Modelling Strategy (Brodie et al. 2006a) will guide the biophysical monitoring and modelling. An overall WQIP monitoring and evaluation plan will provide integration between the WQIP components. In addition to the biophysical monitoring and modelling, the WQIP monitoring and evaluation plan is expected to describe how management actions, environmental values, participation, and institutional arrangements will be monitored and evaluated. It will identify points for review of this information and plans for the use of formative evaluation of WQIP implementation progress in the adaptive cycle.

Land management change

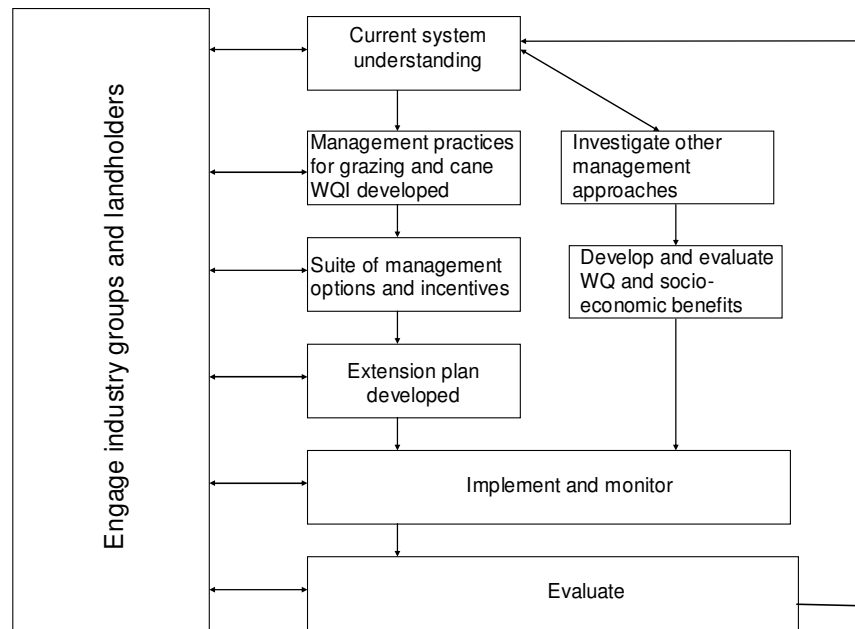


Figure 5 Land management change

Land management change is the principal management action to be undertaken in improving water quality in the Burdekin. Changing land management in the Burdekin WQIP means working with landholders to bring about voluntary change. This development and implementation process, is both participatory and adaptive and this requires consideration of socio-economic conditions (Vanclay 1992). In the Burdekin region, this process has been undertaken by working with industry groups in grazing and cropping industries, and landholders, to develop management practices to improve water quality. A suite of management practices and incentives (as appropriate) are offered to landholders and their uptake is monitored. In subsequent planning cycles new management actions will be developed.

In order to demonstrate water quality improvement, clear links must be made between land management practices, water quality issues of concern

and water quality management actions. Gaps in data demonstrating land management change and WQ improvement will be filled in subsequent adaptive cycles. In the interim, it is important that land management change is monitored and evaluated as an important component program of the WQIP.

Institutional arrangements

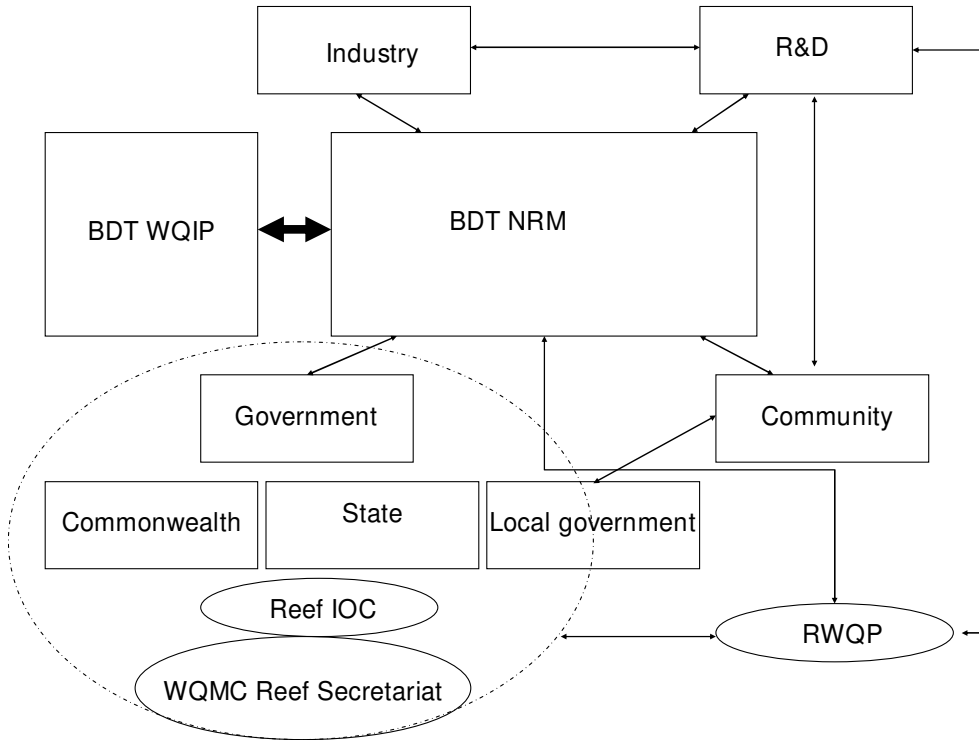


Figure 6 Institutional participation in Burdekin water quality improvement

Institutional participation in Burdekin water quality improvement is essential if the plan is to be successfully implemented. Many stakeholders participated in the development of the plan and its success depends upon the commitment to the responsibilities allocated to organisations in the planning process. There are many shared responsibilities for water quality improvement, at various scales, which are not described here in detail but which are articulated in the plan. For example, the community have a role in consulting on the plan development and more specifically; landholders have a key role in implementation of management actions. Industry stakeholders have had a key role in developing management practices to improve water quality. This diagram shows the central role of the Burdekin Dry Tropics NRM group for carriage of the plan with the support of other institutions identified.

Integration with other initiatives

A key intention of the WQIP is to further focus NRM efforts on achieving measurable improvement in water quality. In this case, the Burdekin CCI project is aimed at improving downstream water quality to maintain GBR water quality values. In doing so, the WQIP builds on other plans and existing NRM activities in the region. A participative approach to involving the key stakeholders and staff in the development of this AMF also helped to identify opportunities for integration during WQIP development and implementation.

Much integration has already occurred in the development of the WQIP including, for example, coordinating with the Event Monitoring Program- a collaborative activity that is coordinated by ACTFR and involves a host of other organisations and community volunteers (Burdekin Dry Tropics Board 2005b). There is also evidence of integration of events and participation in plan development. For example, project officers have worked closely with industry (grazing and cropping) to develop management practices for water quality improvement and consult on them. Table 3 describes some key areas of WQ integration identified for the development and implementation of the WQIP.

Table 3 Integration of WQIP activities with other resource management initiatives

| WQIP area of activity | Resource management initiative | Integration |
|------------------------------|--|---|
| System understanding | (Queensland Government 2006) (Burdekin Dry Tropics Board 2005a) (The State of Queensland and Commonwealth of Australia 2003) | The WQIP builds on system modelling and participatory plan development that have occurred in relation to other planning activities. System understanding also comes from the input of social, biophysical scientists, extension officers, and landholders, involved in plan development. |
| Planning | (Reef Water Quality Partnership 2007) (Burdekin Dry Tropics Board 2005a) | Burdekin WQIP activities contribute to a whole of GBR approach to managing water quality. They provide opportunity to coordinate existing NRM activities and to plan for additional management actions that specifically target water quality outcomes (see appendix 7 of the NRM plan). At a local level, it may be possible to develop and implement management actions that also help to achieve other NRM RCT's. |
| Implementation | (State of Queensland and Commonwealth of Australia 2003) (Burdekin Dry Tropics Board 2005a) | BDT NRM has the responsibility to implement the WQIP along with BDT NRM projects so it is in their interests to identify as much integration as is possible. The Burdekin WQIP will also benefit from and contribute to other 'Reef Plan' initiatives for improving water quality such as Nutrient Management Zones, and the Reef Extension Program. |

| | | |
|----------------------|--|---|
| Data collation | (Mitchell 2007; Reef Water Quality Partnership 2007) | The WQIP brings together data from all relevant sources in a cohesive plan. Coordinating and reporting data is a fundamental part of the plan. Reporting should be compatible with agreed Reef Partnership format. |
| Evaluation | (Queensland Government 2006) (The State of Queensland and Commonwealth of Australia 2003) | Evaluation of the WQIP will provide valuable feedback to further planning cycles. It will also provide feedback to the Reef Plan on progress in improving water quality in the GBR region, and the WR plan, in particular the purposes: 'b. to provide a framework for sustainably managing water and the taking of water. e. to provide a framework for reversing, where practicable, degradation that has occurred in natural systems.' p6 |
| <i>Participation</i> | (Burdekin Dry Tropics Board 2005a) (The State of Queensland and Commonwealth of Australia 2003) Industry participation eg BSES Local government participation | One of the major benefits of the WQIP is that it builds on participation activities undertaken in NRM management. It also provides rigour to partnership approaches to developing and implementing management actions. |
| <i>Monitoring</i> | (Reef Water Quality Partnership 2007) (Queensland Government 2006) | The WQIP provides the opportunity to coordinate monitoring and modelling activities to prioritise sub-catchments and identify key pollutants of the region and to 'measure' changes in water quality as a result of implementation of the WQIP. This information can also be used to inform the WR Plan. Specific monitoring of implementation of management actions is required to allow comparisons between management action implementation and WQ data. At a broader level it is also necessary to monitor system pressures such as development and market fluctuation may affect plan evaluation and furthering system understanding in subsequent adaptive cycles. |

6. Conclusions

The adaptive management framework presented in this report was developed to best meet the needs of the Burdekin Water Quality Improvement Plan. The framework described in Section 5 of this report describes the preferred adaptive approach to management with specific consideration of land use change mechanisms and institutional arrangements. Participation and monitoring were identified as central to an adaptive approach and they are described in relation to the phases of the adaptive cycle.

The framework was developed with input from key stakeholders and BDT staff. Participation in the development was a key tool in the development of the framework. A participatory approach to the development of an adaptive management framework has proven to deliver multiple outcomes. Stakeholder involvement in WQ plan development increased during this project. Feedback from stakeholders indicated appreciation of the opportunity to provide input to the planning process and many suggested that they had increased their appreciation of the variety of views on water quality problems and how they can best be addressed.

Finally this project has contributed to a shared understanding of planning direction. Assumptions about water quality management and the nature of the BDT region were made explicit and participants were provided with the opportunity to share ideas leading to some changed views. This process has developed a framework that will enable BDT staff to work together with stakeholders to improve water quality.

To ensure that the WQIP supports adaptive management of water quality, important processes (identified in this project as participation and monitoring) must be incorporated in all aspects of the plan. Further work is required to describe and document these processes in relation to the components of the adaptive cycle: planning; implementation; data collation; evaluation, and system understanding. However planning should not prevent the commencement of these essential processes. As this project attests, the benefits of participation and a more comprehensive system understanding are revealed through doing and monitoring and evaluating.

6. Glossary of Acronyms

| | |
|--------|--|
| ACTFR | Australian Centre for Tropical Freshwater Research |
| AIMS | Australian Institute of Marine Studies |
| AMF | Adaptive management framework |
| BDT | Burdekin Dry Tropics (NRM region- also called BDTNRM) |
| BMP | Best management practice |
| CCI | Coastal catchments initiative |
| CRC | Cooperative Research Centre |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| GBRMPA | Great Barrier Reef Marine Park Authority |
| MAT | Management action target (Burdekin Dry Tropics Board 2005a) |
| NMZ | Nutrient management zones |
| NRM | Natural resource management |
| RCT | Resource condition target (Burdekin Dry Tropics Board 2005a) |
| WQIP | Water quality improvement plan |

7. Appendixes

A Workshop notes conceptual model

B Workshop notes adaptive management

Appendix A
 Workshop notes- conceptual model
 Notes from workshop activity 1

| WQIP concern | System components/relationships based on diagram |
|-----------------------------|---|
| The biophysical system | <p>Not much of this detail was shown on the model because understanding of the biophysical system was remarkably consistent.</p> <p>Spatial and temporal variation needs to be considered.</p> <p>Acknowledge uncertainty about frequency of events and likely WQ impacts.</p> <p>Split catchment between grazing (upper) and cropping (lower) country.</p> <p>Need interaction of this with the monitoring and modelling.</p> <p>Consider water use (extraction) and modifications to water management system eg irrigation in the model.</p> <p>Need to consider groundwater in the cropping area particularly.</p> <p>Consider other water 'fates' eg tailings into wetland areas?</p> |
| Issues of concern | <p>Most agreed that the issues of concern were correct. That is sediment and nutrients from the grazing lands and nutrients and pesticides from the cropping lands.</p> <p>Ambient WQ conditions also require monitoring to ensure that 'new' problems are identified.</p> |
| Monitoring and modelling | <p>The detail of the monitoring and modelling approaches was generally believed to be expressed inadequately in the diagram. Participants felt that the biophysical monitoring program be clearly specified i.e. what is being monitored and when? At what scale?</p> <p>Need to specify GBR when referring to reefs.</p> <p>It was felt that socio-economic and project evaluation monitoring activities should be described separately.</p> <p>There was a suggestion that socio-economic monitoring also include 'sustainable production' and 'sustainable communities'.</p> <p>Adaptive process for improving and refining models?</p> |
| Setting targets/objectives | <p>The role of targets and objectives in the adaptive process must be spelt out. How are they established, reviewed and evaluated? Are they only for the GBR or are there also freshwater targets?</p> |
| Community engagement | <p>It is necessary to consider other pressures on communities in the catchment, communicate WQIP development more widely and engage community support for MATs.</p> |
| Institutions | <p>Detail of the institutional arrangements and relationship with industry was not shown on the diagram. All participants said it would be helpful if this was mapped out and the connections between these arrangements and relationships and the plan activities made clear.</p> <p>Clarification of what can be said with 'one voice'.</p> |
| Other management approaches | <p>The relationship with the BMP's and other land and water use/management approaches should be considered. This may involve specific targeting of priority catchments (based on land condition and catchment load contribution in the grazing area), targeting priority areas (soil type/topography/farm scale) in cropping lands, overhauling institutional arrangements for water management in the cropping area, consider role of water efficiency LWMPS in the cropping area, and consideration of</p> |

| | |
|-----------------------------|--|
| | land tenure and property rights for implementing WQ improvements. |
| WQIP concern | System components/relationships based on diagram |
| 'Best' management practices | <p>There was some concern about the term 'BMP's', suggest using more specific term. One suggestion was: '2007 recommended practices for improving WQ'.</p> <p>There are differences in the way improved management practices and the processes of land management changes are expressed by different groups. Agricultural extension practitioners use terminology related to productivity benefits, WQ extension practitioners use specific terminology related to WQ benefits, and WQ managers use project management terminology.</p> <p>These should also be considered at different scales: catchment, enterprise, and paddock.</p> <p>Underlying principle: inform and support landholders in making changes to improve WQ.</p> <p>Practices are related to specific land uses but the processes for developing them and implementing are common to most land uses.</p> <p>Implementation including use of incentives must consider cost of the practice change, WQ benefit and socio-economic conditions of the landholder/ industry.</p> <p>Need to consider other ways of managing change e.g regulation</p> <p>This activity must be better connected to monitoring activities and investigated from a 'risk' (environmental, social and economic risk) perspective.</p> <p>Scale is also an issue- what land management practices can be managed at which scale?</p> <p>Specific considerations for different issues of concern especially in the cropping sector.</p> <p>Need to specify what will be monitored, and when, and how these activities will be evaluated.</p> <p>Two phase approach: develop the logic of the BMP program and actual BMP's consistent with this, trial, monitor and evaluate; develop logic for implementation (including incentive payments and technical support) trial, monitor and evaluate.</p> |

Appendix B

Workshop notes- adaptive management

Notes from workshop activity 2

Workshop participants were involved in discussions to consider the **adaptive qualities** of the Water Quality Improvement Plan. In groups they discussed their chosen topic and identified:

1. gaps in current understandings
2. likely changes in this area
3. impacts of these changes on other areas of the WQ improvement model.

Adaptive management can address uncertainty that stems from gaps in knowledge and can also address uncertainty that arises from the interactions of different management actions in a complex system and 'surprising' events. The idea is not to remove uncertainty completely but to plan for ways in which it can be identified and accommodated in the WQIP.

Increased development

There is likely to be increased development in urban housing, industrial, rural, peri-urban and coastal (eg marinas). Within each of these categories there are also specific trends that should be identified e.g. in rural areas there is a move toward more intensive development.

There is also likely to be change in climate which will affect all of these, particularly the coastal.

Water quality objectives. We need to look at individual parameters such as particular nutrients, heavy metals and the individual management practices that apply. Changes in land use will also affect the plan possibly leading to competition for water.

How should this be addressed? Using modeling scenarios? The implications may require voluntary uptake, or maybe this should be regulatory-based, according to the sector.

Monitoring will need to change to cover the social, economic and biophysical aspects of the changes or proposed changes. The robustness of the information needs to be considered.

Implications for local governments, planning, etc.

Large scale developments may require offsets eg. market based incentives, tax incentives, etc.

Institutional arrangements and industry involvement

Gaps include:

- Overview arrangements must be communicated eg institutional arrangements should be mapped.
- Data sharing and talking between project (within the WQIP portfolio and between regions).
- Communication across projects and programs. For example who currently monitors what?

- L&W management plans, CCI and NRW and Nutrient Zones. These things should be better coordinated. This should be a priority. It would be preferable to break the catchment into smaller local groups for local coordination. Suggest through a catchment coordinating committee for each catchment.
- There will be a need for integration of WQ plans with the Nutrient Management Practice. Part of the problem is removal of extension staff, centralized representation, changes in land use, EMS and Q.A. will impact on landholders.
- Industry engagement is okay at the local level. At the higher level there is a lack of feedback. It is hard to talk to “industry” as sometimes “industry” does not represent the farmers and the information often does not filter through.

Need to change:

- Regulatory mechanisms to move industry ‘lagers’. Increased MP uptake through regulatory mechanisms not necessarily a good thing as it may become a ‘tick box’ process.
- Movement toward EMS and Q&A.
- Change of land use due to urban or industrial encroachment will have impacts on agricultural practices.
- Need true representation on water management groups (eg 2 water boards and other system for groundwater).

Management Practice Improvement

The workshop participants generally agreed that the term ‘Best Management Practices’ was misleading.

Gaps include lack of research into what is really “best” practice.

Is there really an impact on the reef from grazing? Require monitoring and modeling to better make that connection.

Management practices need to be trialed. Results from trials need to be fed back and integrated into new practices (a monitoring and evaluation process for the actual management practice and for its implementation).

Trialing should measure WQ benefits of particular management approaches as well as contribution to sustainable production and farm business outcomes (costs and benefits).

Possible changes in this area which will affect need for and viability of changed management practices include:

- Market forces may influence behaviour (e.g. changes in consumer patterns, Mad Cow, etc.). Also increasing agribusiness involvement, economies of scale etc..
- Climate variation can impact on market forces and therefore influence on the uptake of MPs. Also water availability and water allocation.
- Affect of ‘big (rainfall) events’ and the need for different MP’s for different conditions.
- Timelines can influence the implementation of the plan. eg. if there is a decrease in GBR WQ, the time line could be pushed forward. Land use will be a main driver of change.
- Generational changes can influence uptake of MPs. Landholder demographics.

Need to incorporate the following changes in the model:

- 'Principles' of WQI need to be incorporated into relevant legislation (eg leasehold land, water management act, reef plan etc...)
- Climate variation must be recognized in the plan including direct impacts on the biophysical system as well as impacts on markets, economic drivers, socio-economic conditions of producer.
- Differing timelines depending on changed conditions eg decline in GBR at a greater rate than anticipated.

Water quality environmental values

Continue to manage for ecosystem health even if this is modified; the objectives of the plan won't necessarily change but the actions will. An effort should be made to obtain the triple bottom line.

Gaps: What are the current of WQ values? Do we have enough information to properly understand these values? Is the public sufficiently able to articulate these?

Change: This includes climate change, increased development, increased community expectations, and increased education levels.

Water quality objectives and targets: these would depend on the speed of change. This may need to be redefined. The concept of environmental resilience should be introduced i.e. how will the environment tolerate new development? – don't try to modify water to adapt to new development.

Some values are unrealistic i.e. returning to pre-European levels. We need to have an educated public to be able to understand realistic values, however if the public is too educated expectations would become greater. The question is what can we realistically achieve? We also need to investigate the role regulation could play in protecting environmental values.

Biophysical, social or economic conditions

Gaps in understanding:

How will the price of water change in the face of continuing SEQ and Murray Darling shortages? This may be accompanied by changes of crop varieties, GM, increased agricultural technology.

Decision making on water in the future may be different. Rapid decisions may need to be made. They may be based on desperate political need rather than carefully tested science/policy approaches.

Weeds, pests and soil degradation will affect water quality and impact of management measures. What is the role of monitoring in this?

Market conditions e.g. the sugar price versus the fertilizer price e.g. if sugar drops and fertiliser remains at price, could lead to crop changes. Only profitable farmers can afford to be green (unless incentives offered).

We will need to adapt plan in future to address other pollutants and other industries, and different management practices.

Changes in farm ownership. Farm succession is an important issue. Younger generations may not take over properties. Perhaps farms will be bought out and amalgamated. Larger farms have a different management approach.

Regulatory approaches may be needed if BMP process is unsuccessful.

Development of tourism and coastal development will require larger water allocation in the future. This will change the WQ objectives also?

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