

Adaptive Management Strategy

Background

The Burnett-Baffle WQIP covers more than 30,000 km² of the catchments that contain the Burnett, Kolan, and Elliott Rivers and Baffle Creek and more than half of the land area of the Burnett Mary NRM region.

Nutrients (specifically dissolved inorganic nitrogen), sediment and pesticides are identified as the priority water quality issues. The main industries that are the focus of the WQIP are grazing, sugarcane, horticulture as well as urban areas. The catchments covered by the WQIP are variable in size and rainfall but generally have intensive cropping and urban centres concentrated in coastal areas and grazing occupying a large percentage of the inland areas. Rainfall is variable and annual averages vary from less than 800mm inland up to 1500 mm at the coast. Flow variability is very high and rivers can be characterised by several years with no major events. The Kolan and Burnett Basins are also heavily regulated.

This adaptive management strategy follows the principles and steps outlined in Eberhard et al. 2008. The double loop model of adaptive management (Eberhard et al 2008) reflecting the inner loop (managing implementation) and the outer loop (planning cycle ie the five year period until the WQIP is revised) could be used to represent the process for the Burnett-Baffle WQIP but in a way a middle loop is required in which some minor adjustment of the load reductions in RCTs and associated MATs might be required. This is due to the high uncertainty in the current and required loads used to set the water quality targets or the reduction in loads required. For example, if a smaller load reduction in DIN was required, less landholders would need to change practices to achieve the outcome or if a larger load reduction in sediment was required, greater effort in practice change would be required. In both these example situations, would not lead to additional MATs but the adjustment to targets is not as large a task as a review and revision of the entire WQIP.

Conceptual models

Nutrients (DIN), sediment and pesticides have been identified as high priority water quality issues in the Burnett-Baffle WQIP. The basic conceptual models are summarised below.

Figure 1 Conceptual framework of the Burnett-Baffle WQIP

	Management Action	Management Action Targets (MATs)	Resource Condition Target (RCT)	Aspirational Target	Aspirational Target
Nutrients (particularly DIN)	Actions such as awareness, education, extension, incentives as outlined in WQIP	Growers to complete Farm Management Systems, attend workshops, adopt nutrient and irrigation/drainage management practices	Reduce (annual estimated) DIN loads at end of catchment by 80% over 50 years	chlorophyll a concentrations in receiving waters to meet WQ guidelines	Increased ecosystem health and resilience of receiving waters
Sediment	Actions such as awareness, education, extension, incentives as outlined in WQIP	Graziers to complete Property Management Planning, attend workshops, adopt management practices to prevent erosion.	Reduce (annual modelled) sediment loads at end of catchment by 38% over 50 years	Suspended sediment concentrations in receiving waters to meet WQ guidelines	Increased ecosystem health and resilience of receiving waters
Pesticides	Actions such as awareness, education, extension, incentives as outlined in WQIP	Growers applying pesticides to complete Farm Management Systems, attend course, adopt pesticide and irrigation/drainage management practices	Reduce pesticide concentrations by 25%	Pesticide concentrations in receiving waters to meet WQ guidelines	Increased ecosystem health and resilience of receiving waters

Management practices (particularly fertiliser management) in the intensive agricultural industries (sugarcane and horticulture) result in the export of excess nitrate from paddocks to the receiving waters (via surface and groundwaters) in the coastal catchments of the Burnett-Baffle WQIP. Nitrate is taken up by phytoplankton which impacts on ecological health of coral reefs and other GBR ecosystems (via various mechanisms such as turbidity and smothering etc). Note that the WQIP focused on the management actions that address the potential impacts to the receiving waters.

Management practices (particularly management of groundcover and riparian areas) in the grazing industry result in the increase of erosion and export of sediment and particulate nutrients from paddocks to the waterways of the WQIP catchments. Over time, sediments are transported to the receiving waters of the WQIP.

Sediment impacts on coral reefs/seagrass etc. These receiving water impacts were the focus of the WQIP, however, changed management practices will also lead to reduced sediment loads of freshwater systems.

The Burnett-Baffle WQIP adopts the GBRMPA guidelines as a trigger for action for both chlorophyll a (linked to nitrate concentrations) and sediment. The relationship between nitrate, chlorophyll a and coral health is well established but modelled relationships are not developed for the Burnett Baffle WQIP area.

Improved nitrate management including the reduced application of excess fertiliser, taking account of fertiliser from other sources and adopting better application methods are expected to reduce loads in runoff. DIN from grazing lands is not well understood so there are currently no specific management actions to address this source.

Pesticide runoff enters waterways and at times, concentrations have been detected above guidelines. Pesticide application management practices will assist to improve the precision in the application of pesticides and irrigation and drainage management practices will reduce the risk of pesticides in runoff that leaves farms.

Uncertainty

Nutrients (DIN)

Annex doesn't estimate DIN particularly well from sugarcane or horticulture and the catchment models don't account for the small coastal areas that drain directly to the sea like Moore Park Creek and the creeks near Bargara. The DIN loads have been calculated from estimates of the landuse of sugarcane/horticulture, fertiliser application rates and surface runoff/drainage to groundwater. No local studies have quantified the amount of DIN likely to reach groundwater or estimated loads likely to reach the receiving waters.

Sediment

The most recent sednet model uses 50% groundcover with a suite of other factors to predict erosion and therefore the load of sediment entering waterways. Recent estimates of groundcover developed by NRW seem high for the Burnett catchment at around 80% cover for most of the WQIP area. This spatial information has not been used to rerun the models and update estimates of sediment loads from each subcatchment. Also the estimation of the sediment trapping of impoundments is uncertain and greatly affects the model's estimate of loads reaching the end of the Burnett catchment. The proportion of the total sediment load from hillslope, gully and bank erosion is uncertain and the mapping of gullies has not been completed and included in the modelling. It is estimated that increased groundcover and improved riparian vegetation will reduce the erosion from hillslopes and banks respectively. Available data does not indicate that

there is more likely to be erosion where riparian vegetation is reduced or less erosion where riparian vegetation is intact.

Pesticides

Dry conditions and limited capacity for pesticide monitoring in marine waters during events has meant that limited data is available to identify the extent of the area in receiving waters where pesticides may exceed guidelines. Several sampling programs have detected concentrations of some pesticides (mainly herbicides) in water and sediments in both freshwaters and estuaries and in some instances these are above available water quality guidelines. This warrants further investigation and a need for MATs/MAs to lower concentrations in these environments.

It may be that during wetter years with more runoff, higher concentrations of other pesticide are detected which may exceed guidelines. Conversely, much wetter conditions may dilute the pesticide concentrations so they no longer exceed guidelines.

There is also uncertainty about how concentrations of similar chemicals (herbicides) present at the same time may impact on ecosystem health of the receiving waters.

Learning objectives

The Burnett-Baffle WQIP Monitoring and Modelling strategy includes monitoring and modelling requirements to address key uncertainties identified during development for the WQIP.

Further refinement of modelling or more monitoring especially during event conditions will provide information to enable refinement of the current loads and required loads thought to protect aquatic ecosystems and therefore also the load reduction targets. Also refinement of the pollutants from a range of sources ie sugarcane/horticulture for nutrients and types of erosion for sediment together with more information on the effectiveness of practices in making water quality improvements will produce better estimates of cost effectiveness of practice change in meeting targets for different industries/management actions. A receiving waters model is required to link end of catchment nutrient loads to nutrients and chlorophyll a concentrations in receiving waters. Improved modelling at the plot scale to predict end of catchment load changes in nutrient export from adoption of management practices will enable refinement of the ability of MATs to change end of catchment loads. Plume monitoring and mapping is essential to refine the impact of catchment on receiving waters including the GBR and local fringing reefs.

Benchmarking of current practices together with research on the effectiveness of practices will enable refinement of the level of uptake required to enable targets to be met.

An assessment of the effectiveness of supporting actions (including incentives) and partnerships in accelerating adoption of practices is required to assess the progress towards achieving these targets.

The ability to undertake these activities is influenced not only by available funding but also capacity of organisations and effective partnerships that are needed to carry out the activities and conditions such as whether effective rainfall is received to cause runoff for some activities.

Performance trajectories

For the RCT to reduce nitrate by 80% over 50 years, this is expected to be linear
Reduction of 40% over 25 years and x reduction in 5 years

For the RCT to reduce sediment loads to receiving waters by 38% over 50 years or 17% over 25 years, this is also assumed to be linear and relies on modelled annual loads. It is not expected that reductions of sediment loads would be able to be monitored due to variability in flows and time

lags for sediment to be transported through the catchment (ie sediment already delivered to waterways will take decades to be transported through the system).

The RCT to reduce pesticide concentrations is also expected to be linear.

Feedback loops

MATs – the feedback loop for the adoption of management practices as outlined in the MATs will be through industry based surveys with data from BMRG when reporting to funding providers through six monthly progress reports to accompany this. Comparisons of achieved rate of uptake and the expected rates of uptake can be made.

RCTs – the assessment of reduced loads will be made using improved/revised modelling or estimates due to the variation in the system, time lags for sediment, and the associated problems with monitoring end of catchment load reductions to track performance against targets.

Event based monitoring to be undertaken to revise/refine catchment models

Effectiveness of management practices needs to be determined to improve the estimated benefits of changing practices.

Scenarios/responses

There are a range of scenarios outlined and the appropriate responses.

Scenario - improved modelling revises current or target loads to enable an updated calculation of the required load reduction. Response – targets revised, also revise MATs to match change in RCTs and the achieved adoption of management actions can be compared to required actions to revise progress in meeting revised targets.

Scenario - reduced rate of uptake of practices due to limited funds/wet weather/other circumstances. Response – increase uptake during drier times to increase average rate of uptake over the 5 years (or the required timeframe for funding).

Scenario – reduce rate of uptake of practices due to current economic conditions. Increase the support or improve the program delivery methods or make it more attractive to adopt actions such as increase the rate of incentive payments

Scenario - Better estimates of the effectiveness of management practices under local conditions. Response – changes to the number of landholders or the size of the change in management practice required to reduce runoff to meet load reduction targets. This scenario could also enable better prioritisation of actions to achieve most cost effective reductions of pollutants.

Scenario - Reduced resourcing will mean that the MATs and the MAs outlined in the WQIP will not all be able to be achieved. In some cases the funding source will indicate which of the activities can be funded, otherwise the most cost effective actions would be a priority for funding. Response – reduce expected outcomes and explore other funding opportunities.

Scenario – actions not achieving expected outcomes ie reductions in pollutants to receiving waters. Response – the effectiveness of practices should be examined or other potentially increasing sources of pollutants which could be offsetting actions should be examined.

Scenario – some management practices more popular than others such as sediment vs nutrients and pesticides. Additional benefits may improve the attractiveness of some actions in relation to others. Response – adjust the incentives to enable priority actions to become more attractive.

Scenario - Significant emerging issues such as new pollutants of concern, new or expanding land uses, or interacting effects such as impacts of climate change, change the importance of the current pollutants of concern and priority of management actions to address these in a cost effective manner. Response – these situations would trigger a revision of the plan to accommodate the new or increased risks to water quality.