Performance Story Report

Evaluation of Investment in the Reef Catchments Reef Rescue Project August 2010

Dr. Jon Graftdyk & Phillip Trendell

This project is supported by Reef Catchments, through funding from the Australian Government's Caring for our Country

Contents

Executive Summary

The delivery of the Reef Catchments Reef Rescue project has been successful. The outcomes achieved in the project have exceeded the original expectations.

From the development of the Mackay Whitsunday Water Quality Improvement Plan, a range of specific improved land management practices (A & B class) for intensive agricultural land uses was identified. These practices were based on the best available science and information with regards to improving on-farm economic and environmental sustainability. The Reef Catchments Reef Rescue Plan delivery process is focused on the increased adoption of these improved land management practices across agricultural commodities in the region.

The Reef Catchments Reef Rescue MERI Plan was submitted at the end of September, 2009. Through consultation with coasts and aquatics staff from the Australian Government Land and Coasts Division, the MERI plan was modified and finally approved in January 2010 and has a timeline till June 2012.

The foundation activities were initially started during the Sustainable Landscapes Program (completed June 2008). These were then further developed and improved upon in Year 1 and 2 of Reef Rescue. Reef Catchments has then been able to continue to progress through the Reef Rescue program logic as anticipated in the MERI plan.

To date, Reef Catchments has developed and submitted the regions' Reef Rescue Plan through to 2013 and implemented the first 2 years of partnership projects and water quality grants for both individual and industry wide projects. The partnerships developed in Year 1 with regional industry service providers have continued into Year 2 and have been a key factor in helping to achieve the immediate outcomes.

The successful development of these foundation processes and early achievement of some immediate outcomes has seen an increase in the investment in incentives for water quality improvement, resulting in increased support for land managers to uptake A & B class practices and for planning and farm management. These water quality grants being provided to landholders and industry have helped to progress and achieve some of the intermediate outcomes identified in the Reef Rescue program logic.

Section 1: Background

The delivery of the Reef Rescue Water Quality Grants in Mackay Whitsunday Region focuses on the efficient processes and continued development and maintenance of strong stakeholder partnerships developed in 2008/2009 to achieve the common goal of improved reef water quality. These partnerships include the establishment and support of industry working groups and precision planning consultants to work with landholders to ensure delivery of intended Caring for our Country targets and outcomes.

The Reef Rescue Water Quality Grants focused on a range of specific improved management practices (A & B class) for intensive agricultural land uses. The increased adoption of these practices will improve the water quality of the Great Barrier Reef lagoon by reducing nutrient, pesticide and sediment load. Estimated load reductions in the Mackay Whitsunday region based on the anticipated uptake of A and B class management practices could be up to:

- 25% for dissolved inorganic nitrogen
- 20% for residual herbicides (ametryn, atrazine, diuron and hexazinone)
- 20% for particulate nitrogen and phosphorus
- 30% for filterable reactive phosphorus
- 5% for suspended sediment

To date Reef Rescue has received $12,588,125 in funding from Caring for our Country. With a minimum of 50% funding to be matched by land mangers a total in excess of $31,906,000 has been invested by agriculture in the Reef Catchments region to adopt improved land management practices.

Key outcomes from the delivery of Reef Rescue project water quality grants/incentives in the Mackay Whitsunday region have been:

- Adoption by farmers and pastoralists of improved soil, nutrient and pesticide management practices
- The development of farm input and practice recording and reporting systems that can outline industry practice trends
- Practice improvement
- A flexible streamlined delivery of incentive funds via a process that links funding levels to water quality improvement outcomes to maintain a high return on investment and a clearly defined public benefit.

The Reef Catchments Reef Rescue program commenced in 2008 and is currently in its second year.

The Performance Story Report

A Performance Story Report is an evaluation approach which provides a statement of the progress that has been achieved in maintaining or improving NRM goals or targets. The Performance Story is supported by evidence at each level of outcome developed in the program logic. This is a participative process which matches quantitative evidence from a data trawl and through science panels with qualitative evidence of the adoption of improved management practices (A & B class) for intensive agricultural land uses. This Performance Story Report will:

- identify the intended outcomes
- report on the achievements against these expectations
- discuss what was learned and what will be changed
- describe the steps taken to ensure the quality of the data presented.

The Performance Story Report process provides a structured approach to outcomes and evaluation and consists of a five part participatory process, and a five part report structure. The process steps used to develop this report are as follows:

- Step 1: Planning workshop.
- Step 2: Data Trawl
- Step 3: Social inquiry process
- Step 4: Science panel
- Step 5: Evaluation summit

To ensure that the key Caring for our Country outcomes are being achieved, monitoring, evaluation, reporting and improvement (MERI) activities have been undertaken. This information has been used to inform all stakeholders involved in the project of its progress and success.

In the Mackay Whitsunday region emphasis has beens placed on the Australian Government's MERI framework and through the use of an established database for monitoring and reporting the adoption rate data for cane and other industries across the region has been achieved.

The MERI framework was used in an adaptive approach to evaluate progress. Program logic, planning and collaboration was undertaken with the:

- key commodity working groups
- industry working groups
- reef and catchment science and implementation groups

These groups performed the function of a collaborative advisory panel which culminated in the Reef Catchments Reef Rescue Performance Summit, consistent with the MERI framework. Reporting activities were consistent with the MERI framework. Participants were invited to synthesise key evaluation findings and identify areas of most significant change and develop recommendations for future activities and investment.

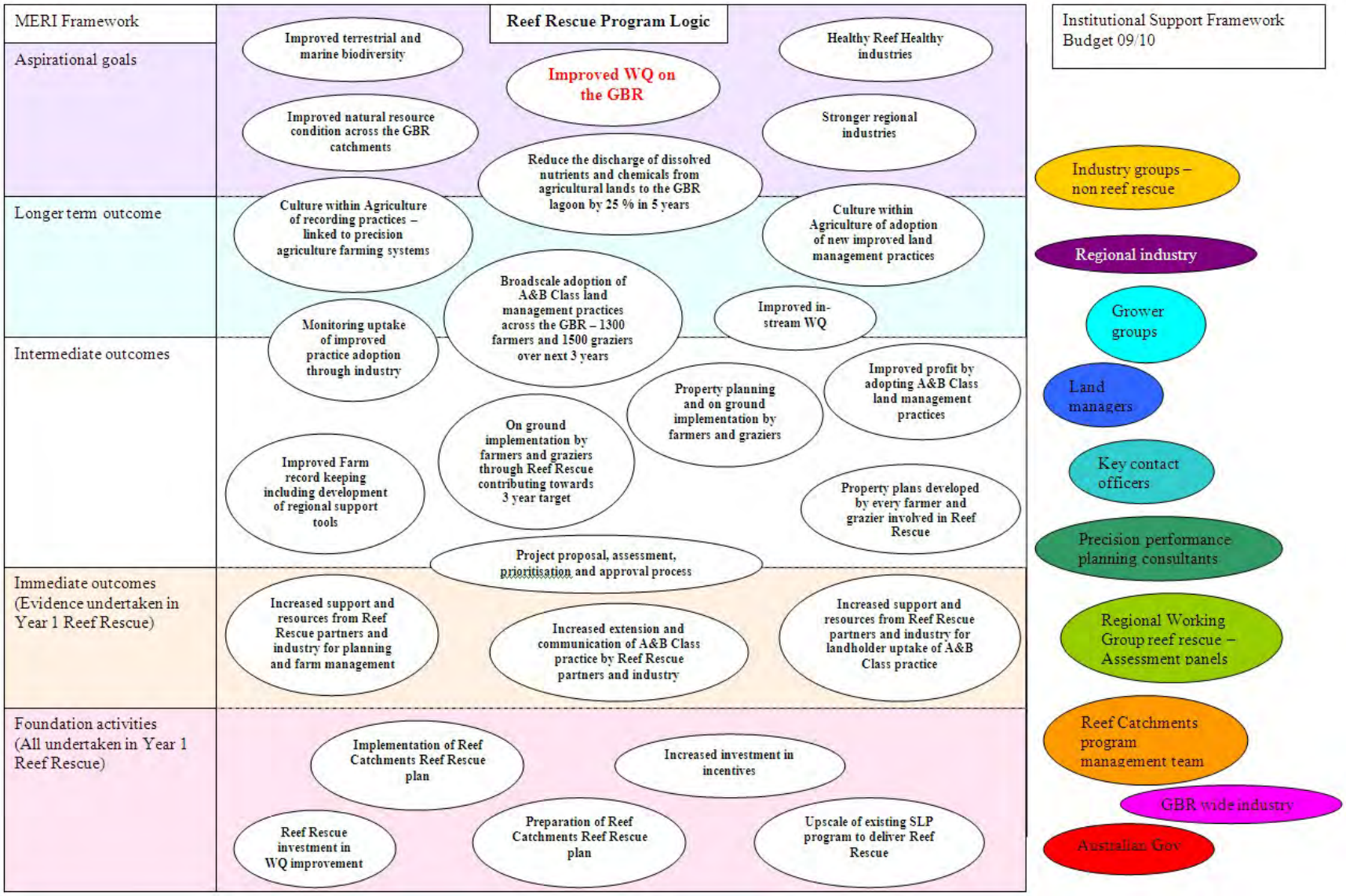
Step 1: Planning workshop

Planning workshops were conducted at the commencement of the project to articulate, test and approve the underlying assumptions and methodologies used in the project. The planning workshop was run with the Reef Rescue management team along with input from the different Industry Regional Working Groups (Plate 1).

During the planning workshop the program logic model was created. This is the rationale behind the program and diagrammatically represents the hierarchy of the water quality grants activities, outputs and immediate, intermediate and longer term outcomes and the links between them. The program logic model created for the Reef Rescue Water Quality Grants in Mackay Whitsunday Region is shown in **Figure 1** and formed the basis from which the evaluation questions were developed and for the framework on which evidence is presented in the results chart section of the report.

Plate 1 Participants at MERI Training and Planning Workshop in year 1 of Reef Rescue

Figure 1 Program logic for Reef Rescue Water Quality Grants in Mackay Whitsunday Region



Key Evaluation Questions

The key evaluation questions were developed to determine how well the project is proceeding in line with its original design and identify the sources of information (lines of evidence) that will answer these questions. In the case of the Reef Rescue Water Quality Grants the key evaluation questions needed to answer the Caring for our Country targets which are:

- To increase the number of farmers who have adopted land management practices that will improve the quality of water reaching the reef lagoon by a further 1300 over three years.
- To increase the number of pastoralists who have improved ground cover monitoring and management in areas where run-off from grazing is contributing significantly to sediment loads and a decline in the quality of water reaching the reef lagoon by a further 650 over an area of 3.8 million hectares over three years

The key evaluation questions identified in the planning workshop used to guide this study were then aggregated into the following four categories:

1. **Impact**
   - In what ways and to what extent has Reef Rescue delivery in the Mackay Whitsunday region had on adoption of improved land management practices that improve water quality entering the GBR lagoon?
   - What, if any, unanticipated positive or negative changes have resulted from delivery of Reef Rescue in the Mackay Whitsunday region?

2. **Effectiveness**
   - In what ways and to what extent has the Reef Rescue project in the Mackay Whitsunday region contributed to the Caring for our Country "Protecting the Reef" targets?
   - What other activities/strategies might be more effective in the Mackay Whitsunday region for achieving the Caring for our Country "Protecting the Reef" targets?

3. **Appropriateness**
   - To what extent have delivery process, technical advice and training been appropriate in engaging land managers to adopt land management practices that achieve water quality improvement outcomes?
   - Who adopted what, in what situations and why?

4. **Efficiency**

- To what extent has the Mackay Whitsunday Reef Rescue delivery process and program attained the highest value out of available resources?
- What other ways could we invest or improve our Reef Rescue delivery process for greater return?

Step 2: Data Trawl

The data trawl focused on obtaining and collecting the existing relevant scientific data on the outcomes identified through the program logic exercise.

The data trawl was conducted by the Reef Rescue management, who examined all existing previous reports, documents and the database associated with the previous Sustainable Landscapes program and the first year of Reef Rescue. Existing relevant scientific data on water quality and land management practice change was obtained, collated and synthesized. Wider sources were reviewed such as other NRM regions resources that might provide evidence for the achievement of outcomes and a literature review was undertaken to develop an understanding on the critical components of Performance Story Reports. Moving forward one of the key outcomes identified is to highlight the long term outcomes of Reef Rescue.

Step 3: Social Inquiry Process

As identified in the MERI plan, there are a range of monitoring activities that have been established and will be continued through the duration of the project.

Reef Rescue Participant Interviews

Based on the key evaluation questions developed in the planning workshop, a participatory interview process with land managers from cane, beef and horticulture, Reef Rescue delivery staff and Industry Working Group members was undertaken using a communications consultant. 50 participant interviews were conducted by phone by a local communication consultant, PROSE PR. These interviews were transcribed and presented at the performance summit workshop for analysis. In Year 3, another 70 interviews will be completed following the same evaluation questions but asked in a slightly different format.

The Land Manager interviews included:

- 35 cane interviews
- 13 grazing interviews

- 2 horticulture interviews
- Collation of responses, transcription and presentation of interviews

Land Manager Field Day Survey
A survey conducted at the field day each year asking landholders about Reef Rescue. Questions include: Have you heard about Reef Rescue? How did you hear about it? Did you get involved? If no, what was the reason? In 2009 did 67 and in 2010 did 63 (Appendix 1).

Case Studies
11 case studies; 5 cane, 4 grazing and 2 horticulture. The Case studies included asking some of the same questions asked during the participant interviews. Year 3 will see another 12 case studies completed (Appendix 2).

Economic Analysis
An economic analysis of landholders adopting A and B class management practices for water quality improvements for both grazing and cane has been initiated and some initial results have been developed (Appendix 3). It is intended to continue these in Year 3 and to get 'real life' scenarios analysed, these will be included in future Performance Story Reports

MERI Performance Summit
The MERI Performance Summit will be an annual event and will allow all invited participants (interviews, case studies, Reef Rescue industry service providers and regional working group members) to look at the evidence collected and review comments to date. Participants will be able to provide comments or add more feedback to the evidence collected.

Regional Working Group Reviews
Each year the grazing and sugar regional industry working groups will review the MERI performance story and evidence collected and provide feedback linked to our program logic.

Step 4: MERI Performance Summit Workshop

The Reef Catchments Reef Rescue MERI Performance Summit Workshop held on the 3rd of June 2010 and drew together land managers who were Reef Rescue incentive recipients, Reef Rescue delivery staff, Industry Working Group members, Reef Rescue participant interviewees and selected individuals form associated industry partners. Following a brief introductory session, which provided a synopsis of the Reef Rescue delivery process and the outcomes delivered for each industry in years one and two of Reef Rescue in Mackay Whitsunday, a presentation was made of findings including an

overview of the Reef Rescue Program Logic Results Chart. Participants were invited to analyse the Reef Rescue Program Logic Results Chart and provide review comments on where improvements could be made and to help identify gaps in the delivery process. Following this, the participants were divided into five groups and given ten of the participant interviews to review. Each of the five groups were asked to choose the two 'best' interviews. The two chosen interviews from each of the five groups were then shared with whole group. From the ten interviews which were presented, a further selection process was undertaken where by all five groups were asked to select the two 'best' interviews out of these ten. These two interviews became the two interviews included in the Performance Report Story.

The remainder of the workshop was spent identifying what participants saw as being the key issues that had been raised during the workshop. Feedback was then sought from the participants about what they thought had worked well during workshop and what had been learned.

The Reef Catchments Reef Rescue MERI Performance Summit Workshop actively engaged both Reef Rescue delivery staff, grant recipients and industry in the actual analysis of the data. As a result of the participants actively being involved in developing the recommendations there is ownership of the results and a much greater potential of the recommendations being implemented (Plate 2).

Section 2: Results chart

The results chart shows how investment in Reef Rescue has contributed to a range of NRM outcomes in the Reef Catchments.

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
Foundation Activities	Increased investment in incentives Upscale of existing SLP program to deliver Reef Rescue	5 Year Reef Rescue program funded by Australian Government through Caring for our Country with $146 million of the $200 million going to water quality grants. Adaption of SLP process for Reef Rescue – milestones, activity information, property planning. Includes major upgrade to the SLP database to include the automated processing and input of Expressions of Interest and project proposals recording of milestones, issuing of payments and outputting of reports to cope with the greater volume of projects in Reef Rescue. SLP paperwork has been modified and converted into .pdf forms to enable quick processing into the Reef Rescue Database. Development of regional Industry partnerships to deliver on-ground support	Successful upgrade to the SLP process to deliver Reef Rescue. Process working well.	Delivery good More reef wide collaboration needed Lost a year in transition from SLP to Reef Rescue Foundation activities are good KISS principals – frameworks, structures, transparent Big link to existing services – both getting support Spin-off benefit to existing staff – something to sell, have a carrot

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
	Preparation of Reef Catchments Reef Rescue plan Reef Rescue investment in WQ improvement Implementation of Reef Catchments Reef Rescue plan	08/09 and 09/10 Reef Catchments Reef Rescue Regional Delivery plans developed 08/09 Reef Catchments Reef Rescue Budget $5,808,125 09/10 Reef Catchments Reef Rescue Budget $5,580,000 +$1,200,000 = Total $12,588,125 Extra $1,200,000 of funding provided late in 09/10 Successful completion of Year 1 and 2 Reef Rescue Indicative Budget of around $7 million for 10/11 and some of the funds secured for 11/12 and 12/13.	Successfully completed 08/09 Reef Rescue and is currently delivering on planned outputs and outcomes for 09/10 Reef Rescue. Investment set to continue till 2013.	Good delivery in regions, but statewide partnerships are dysfunctional for sugar NRM groups competing against each other Need more $
Immediate Outcomes	Increased extension and communication of A&B Class practice by Reef Rescue partners and industry	ABCD frameworks for Cane, Grazing and Horticulture developed showing the different management practice classes. Focus of Reef Rescue is the adoption of B class management practices. Cane has had a review in late 2009 and updated its ABCD in early 2010. Development of eligible activity list and information for Cane, Grazing and Horticulture for the Mackay Whitsunday region GBR wide industry projects (Canegrowers, AgForce, Growcom, QFF, RGC) – newsletters, fact sheets, case studies, state-wide newsletter articles Regional Industry Working Groups – direct communication with all of the main industry service providers in the region and their participation in development of regional ABCD frameworks	Well organised showcase for when Minister Tony Bourke visited the region to see Reef Rescue on the ground. Case studies and participant interviews feedback demonstrates that the industry partners have been effective at communicating and providing extension for A&B class management practices There has been regular Reef Rescue publicity in local newspaper, radio and television	More Reef rescue cane and grazing information signage on properties Grower (& industry) resistance to ABCD Framework. Don't like being labeled More water quality testing of grazing and urban waterways to determine their contribution compared to cane

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
		Key Contact Officers (Canegrowers, AgForce, Growcom) – regional newsletter articles, landholder letters, field days. 650 Cane EOI's, 160 Grazing EOI's and 23 Horticulture EOI's Reef Catchments – newsletters, case studies, website, field days, participant interviews, banners, posters, landholder signs, radio and television interviews	Still EOI's coming in so interest is still out there.	Education of urban households on impacts of chemical runoff Sharing of information reef wide (ABCD) More opportunities for cross regional sharing of information EOI will continue as we have a culture of looking over the fence Framework not the right tool as there is confusion of 'A' & 'B' and BMP Grower resistance to boxes Link A & B practices together for cane Need to compare hand weed v residuals v control with rate and product More information on $ return

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
				Grazing – only people in the know involved. Grazing doesn't have as developed communication pathways, staff or resources. Alternate grazing industries such as goats No cohesion within grazing – no organisation to unite graziers. Grazing affected by land prices affects adoption of improved practices. Grazing affected by rural- residential development Cane – more involvement and interest Horticulture – mixed cropping. Should consider promotion through cane and grazing. Does Growcom have non-member details?

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
				Details of approved projects available to be accessed by round 3 farmers Reef Regulation needs accountability of blocks under 2000ha for grazing Industry is reluctant to promote adoption of 'A' practices as these are innovative, beyond BMP and not yet proven. 'A' practices should be trailed first. 'A' practices are determined from a NRM perspective, not necessarily from a sustainable, profitable, productivity perspective. Event WQ sampling downstream of properties to demonstrate WQ benefits of management practices

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
	Increased support and resources from Reef Rescue partners and industry for landholder uptake of A&B Class practice	5 Precision Planning Consultants (Plane Creek Productivity Services, Agriserv (Mackay Area Productivity Services and BSES), Canegrowers Proserpine, DEEDI, Growcom) – support for Stage 1 and 2 project development and milestone completion 3 Key Contact Officers (Canegrowers, AgForce, Growcom) – EOI coordination, phone calls and queries, support Stage 2 applicants Regional Industry Working Groups – development and approval of Industry wide projects to support growers, graziers and producers adopt A and B class management practices. Examples are Community GPS Base Stations and CQ Beef.	There have been more resources and support provided for landholder uptake of A and B class management, but in some areas is limited by the amount of Reef Rescue funding able to be provided. The Precision Planning Consultants and Key Contact Officer roles have been a key to the successful delivery of Reef Rescue in the region. Inclusion of Key Contact Officer role has helped to filter out invalid projects and optimise the time of the planning consultants. Industry wide projects show commitment by industry to provide resources and support for the adoption of A and B class management practices	Property plan quality for cane is low. Too much pressure on PPC to get numbers KCO have been a good first filter Provision for assistance from consultants to formulate and submit property plans
	Increased support and resources from Reef Rescue partners and industry for	Precision Planning Consultants (Plane Creek Productivity Services, Agriserv (Mackay Area Productivity Services and BSES), Canegrowers Proserpine, DEEDI, Growcom) – support for the development of a property plan and annual input (nutrient, chemical etc) plans.	Industry (DEEDI, Agriserv, BSES) has supported the planning and farm management process by developing the current practice book and action	No resources outside of Reef Rescue for planning in cane or horticulture

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
	planning and farm management	Development of Current Practice Benchmarking process (report, action plan) for Cane and Grazing (developed by DEEDI) and utilisation of Growcom WQ FMS module to assist in property planning Regional Industry Working Groups – development and approval of Industry wide projects to support growers, graziers and producers in property planning and farm management. Example is AgDat remote.	plan Good support for Reef Rescue participants, but there is less resources available for non-participants or costs involved.	Grazing – Plenty of interest on ground amongst those 'in the know' – seem too many who are unaware (people with goats). Grazing industry as a whole is not as organised as cane, can't think of a possible solution Unclear on the structure for horticulture
	Project proposal, assessment, prioritisation and approval process	Regional Industry Working Groups – participation in the development and approval of the prioritisation process for water quality grant projects. Cost/benefit analysis included in prioritisation process following a review by Jon Rolf (CQU) on SLP. High Priority 50%, Moderate 40%, Low 30% and Very Low 20%. Maximum Funding amounts placed on certain Irrigation, Stormwater and Riparian Management (fencing and off-stream watering points) activities. Participation in the approval of individual and industry wide projects. Reef Catchments – development of all relevant documents including EOI, Project Proposal Form, Milestones and Schedule of Operations for all activities. Reef Rescue Incentives Database has been upgraded to use electronic .pdf project proposal form and can develop all contracts and manage all milestone payments.	The project proposal, assessment, prioritisation and approval process has been streamlined and simplified by the development of the electronic .pdf forms and the further development of the Reef Rescue database with upgrades such as conducting the prioritisation of projects based on approved criteria. 50% of respondents to the 50 MERI participant interviews indicated that they would have still undertaken activities if	Irrigation prioritisation Irrigation should have the same prioritisation as other projects Incentive levels for pasture management should be higher to encourage users to trial Equality and transparency should be the objective Mechanical control and maintenance of

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
		Training was provided to all Key Contact Officers and Precision Planning Consultants in using the new electronic forms and information provided on the prioritisation process. Reef Catchments – participant interviews, case studies. Review of budget for grazing projects changed how fencing costs were determined and pasture/Stocktake monitoring was funded	funded at 20% Greater leverage was achieved by making the fencing activities in grazing more competitive by enabling land managers to develop their own budgets per km of fence rather than having a default $/km The budget allocated to pasture/stocktake monitoring was reduced by 40% enabling a greater number of land managers to be funded	erosion, not just fencing off of gullies Map of where $ have been spent Potential change should impact priority and there may be a need to change priorities in the future. This could be farm size and area related Need a way to deal with smaller land areas For GPS projects ha should be separate from priority as GPS completes a holistic farm management system Have a different priority for smaller cane growers with GPS Review sediment detention basins, send project after land management change. Review irrigation

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
				projects Have picked up more of the big growers, the smaller growers and fence sitters will take more work 20% funding statement may not be true for the next lot of participants Objectivity and equity v flexibility. May need new priorities and a new focus Long waiting lists for cane, need to resolve this Reef rescue process is running smoothly and is 'spot on' for industry contracts and Reef Catchments Some of the timelines for outcomes may have to be shifted
Intermediate Outcomes	Property plans developed by every farmer and	To be involved in Reef Rescue, every grower, grazier and producer must complete a current practice benchmark report/action plan (or FMS module) and a	The development of the current practice book has helped growers and graziers	Phil Trendell looks much more presentable with short

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
	grazier involved in Reef Rescue	property plan. If a grower is involved in a nutrient, chemical or irrigation project, than they must complete a relevant management plan for that activity.	benchmark their current practice and allow the precision planning consultants to develop recommendations with them. The action plan book has helped them to prioritise on ground activities and develop an implementation plan. Good process in having the development of property plans by every farmer and grazier included as a component of the Reef Rescue contract signed by them.	hair and clean shoes, is this due to Reef Rescue? Is this sustainable and can we make it transferable? Proposals v planning, the bench marking must be done first
	On ground implementation by farmers and graziers through Reef Rescue contributing towards 3 year target	Reef Rescue database is designed to track the number of projects/landholders/activities undertaken and demonstrate progress towards achieving the 3 year targets 08/09 Sugar 119 Projects involving 170 growers Grazing 50 Projects involving 50 graziers Horticulture 7 Projects involving 7 producers 09/10 Sugar 195 Projects involving 242 growers Grazing 53 Projects involving 53 graziers Horticulture 6 Projects involving 6 producers All of the projects combined are impacting on around 86000 ha	Reef Rescue meeting objectives in terms of land managers involvement and ha of land under practice improvement	

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
	Improved Farm record keeping including development of regional support tools	Reef Regulations has now made growers and graziers to keep and maintain records on nutrient and chemical applications. Regional Industry Working Groups – development and approval of Industry wide projects to support growers, graziers and producers in property planning and farm management. Example is AgDat (web based and remote) for cane and grazing. Grazing current practice benchmark report/action plan identifies areas for improvement in record keeping	Reef Regulations has made growers and graziers keep records to a legislative standard. For adoption of A and B class management practices, a higher level of record keeping is required. Resources and support will still be needed into the future to achieve this higher standard and continue to support the implementation of tools such as AgDat.	
	Property planning and on ground implementation by farmers and graziers	There have been many farmers who have adopted A and B class management practices without receiving Reef Rescue funding. Early estimates are around 15% of growers and graziers will do this. Will need to closely monitor the uptake after Reef Rescue has finished.	While on-ground changes are happening without Reef Rescue funding, the level of property planning is very minimal. Development of Current Practice Benchmarking process (report, action plan) for Cane and Grazing might help in getting increased participation by landholders.	More planning for PPC or possibly grower Need a planning forum Need a simplified farm plan for multiple uses (chemical, nutrient) Planning needs to be marketed more effectively. Undertaken prior to project proposal Define purpose of property planning (to run a viable profitable business or document

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
				NRM outcomes as prescribed by NRM Group)
	Improved profit by adopting A&B Class land management practices	Regional Industry Working Groups - funding support provided for Grazing and Cane Economic Analysis of the implications in adopting A and B class management practices for water quality improvement. Initial findings will be presented by July 2010 for Cane (Cane economic evaluation delivered by DEEDI for Mackay Whitsunday Region) and October 2010 for grazing and projects will hopefully continue in 10/11 to get more information. GBR wide industry projects (Canegrowers, AgForce, Growcom, QFF, RGC) – case studies, state-wide newsletter articles Reef Catchments – case studies, participant interviews	Too early to show we have achieved this through our Program Logic. There is some evidence to show there is improved profit through the adoption of A and B class management practices. Anecdotal evidence suggests that participants believe they will be economically better off in the long term. Economic analysis studies by DEEDI will be able to provide some more evidence for this.	Profit – wouldn't do it if they would not get a benefit. More profitable at 'B' therefore better business management Target high risk catchments and position in the landscape Emphasis on improved profit which goes hand in hand with improved sustainable practices
	Monitoring uptake of improved practice adoption through industry	The development of AgDat (web based or remote) by Agtrix for Mackay Sugar and Plane Creek Mills for data recording, management, analysis and reporting. Includes funding support through Reef Rescue. Growcom has completed a WQ FMS module with 23 producers in the region and will redo them at later dates to see practice change over time. The development of AgDat for the grazing industry. Land condition assessment and Remote Sensing imagery. GBR wide industry projects (Canegrowers, AgForce, Growcom, QFF, RGC) – baseline projects	Systems in place but need some refinement. Now need to get growers using it, particularly outside Reef Rescue	Invested in AgDat but now we need a support role, possibly a 2010-11 industry project

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
		Completion of Current Practice Benchmarking reports for Cane and Grazing. Industry service providers – such as Productivity and Extension Services in sugar		
Longer term Outcomes	Broadscale adoption of A&B Class land management practices across the GBR – 1300 farmers and 650 graziers over next 3 years	Feedback from Australian Government based on Year 1 and 2 figures and projected participation levels is that these targets will be reached within the time frame. Aggregated data will be presented at Reef Rescue symposium on June 8 & 9, 2010 for Years 1 and 2 and will be included.	Well on the way to achieving this Longer Term outcome across the GBR catchments. Aggregated data for all of the Reef Regions for 2008-2010; Cane – 928 land managers Grazing – 487 land managers Horticulture - 219 land managers Dairy – 13 land managers	
	Culture within Agriculture of adoption of new improved land management practices	Too early to have collected any credible evidence to show we have achieved these Longer Term Outcomes through our Program Logic. There is some evidence to suggest that there is a better culture today within Agriculture of adopting new improved land management practices, technologies and activities like recording practices if there is a clear benefit for them or support like incentives provided.	Too early to show we have achieved this Longer Term Outcomes through our Program Logic.	
	Culture within Agriculture of recording practices – linked to precision agriculture farming systems			

MERI Framework	Reef Rescue Program Logic Components	Evidence Collected	Reef Catchments Taskforce Review Comments	Regional Working Group/Performance Summit Review Comments
	Improved in-stream WQ	Too early to have collected any credible evidence to show we have achieved these Longer Term Outcomes through our Program Logic. Paddock to Reef Monitoring and Modelling program (DERM, CSIRO, DEEDI, Reef NRM's) combined with the Marine Monitoring program (GBRMPA) will provide reports on improvements in the future.	Too early to show we have achieved these Longer Term Outcomes through our Program Logic.	
	Reduce the discharge of dissolved nutrients and chemicals from agricultural lands to the GBR lagoon by 25 % in 5 years			
Aspirational Goals	Improved natural resource condition across the GBR catchments	Too early to have collected any credible evidence to show we have achieved our Aspirational Goals through our Program Logic. There is information on current conditions (2007 – 2009) across the GBR catchments on a variety of topics (water quality, industry outputs, current practices etc) through a range of reports - State of the Region reporting, Industry annual reports, Water Quality Improvement Plans, ABS Surveys etc and this will be used as baseline from when Reef Rescue started to show improvements.	Too early to show we have achieved these Aspirational Goals through our Program Logic.	
	Improved terrestrial and marine biodiversity			
	Stronger regional industries			
	Healthy Reef Healthy industries			
	Improved WQ on the GBR			

Section 3: Implications

Reef Catchments has a proven track record in incentive delivery, with over $3 million allocated to the adoption of improved land management practices from 2005 to 2008 through Sustainable Landscapes. The Reef Rescue program was therefore able to build on the solid foundations developed in the delivery of Sustainable Landscapes.

Reef Rescue has clearly achieved the Caring for our Country targets which are:

- To increase the number of farmers who have adopted land management practices that will improve the quality of water reaching the reef lagoon by a further 1300 over three years.
- To increase the number of pastoralists who have improved ground cover monitoring and management in areas where run-off from grazing is contributing significantly to sediment loads and a decline in the quality of water reaching the reef lagoon by a further 650 over an area of 3.8 million hectares over three years.

In achieving these targets Reef Rescue has met all contractual and reporting requirements according to agreed milestones and schedules. There has been widespread adoption of practice change by land managers in the Reef Catchments region.

In year 1 of Reef Rescue 119 sugar projects involving 170 growers, 97 grazing sub-projects involving 52 graziers, 7 horticulture projects involving 7 producers.

Year two of Reef Rescue delivered 195 sugar projects involving 242 growers 132 grazing sub-projects involving 45 graziers 6 horticulture projects involving 10 producers.

All of the projects combined are impacting on around 86000 ha

3.1 Addressing the Evaluation Questions

Progress towards achieving immediate and intermediate outcomes

Increased support and resources from Reef Rescue partners and industry for planning and farm management

Reef Rescue has funded the placement of 5 Precision Planning Consultants within local industry service providers to work directly with farmers and graziers involved in Reef Rescue. This support includes the development of a current practice booklet for both grazing and cane to help with the development of property plans and an action plan for adopting A and B class management practices.

Local sugar industry service providers have increased their efforts to support farmers with property planning and collection of current practice activities for growers not involved in Reef Rescue to date.

Reef Catchments has been successful in implementing a commercial project looking at the planning support required for implementation of A class cane practices

Precision Planning Consultants (Plane Creek Productivity Services, Agriserv (Mackay Area Productivity Services and BSES), Canegrowers Proserpine, DEEDI, Growcom) – support the development of a property plan and annual input (nutrient, chemical etc) plans. The development of the Current Practice Benchmarking process (report, action plan) for Cane and Grazing (developed by DEEDI) and utilisation of Growcom WQ FMS module has assisted in property planning. The Regional Industry Working Groups have developed and approved industry wide projects which support growers, graziers and producers in property planning and farm management. Example is AgDat remote.

Increased extension and communication of A&B Class practice by Reef Rescue partners and industry

Reef Rescue has funded the placement of 3 Key Contact Officers within local industry service providers to coordinate extension and communication activities and manage Expressions of Interest from local farmers and graziers. Part of the role of the 3 Key Contact Officers includes providing regular updates and information in regional and statewide newsletters.

The Grazing Key Contact officer role has seen the establishment of a formal partnership with the grazing industry representative, AgForce, to host the Grazing Key Contact Officer position based within the Mackay Whitsunday Region.

There has been industry endorsement of the A & B class management practices for the region. The A & B class management practices were reviewed during Year 2 Reef Rescue and the updated version has been printed up as a document for distribution.

ABCD frameworks have been developed and reviewed for Cane, Grazing and Horticulture showing the different management practice classes. The focus of Reef Rescue is the adoption of B class management practices. Cane has had a review in late 2009 and updated its ABCD in early 2010 and grazing was reviewed in early 2010.

There has been the development of eligible activity list and information for Cane, Grazing and Horticulture for the Mackay Whitsunday region. The promotion of GBR wide industry projects (Canegrowers, AgForce, Growcom, QFF, RGC) in newsletters, fact sheets, case studies and state-wide newsletter articles. Regional Industry Working Groups have direct communication with all of the main industry service providers in the region and their participation in development of regional ABCD frameworks. Key Contact Officers (Canegrowers, AgForce, Growcom) have produced regional newsletter articles, landholder letters and have attended field days. To date 650 Cane EOI's, 160 Grazing EOI's and 23 Horticulture EOI's have been received demonstrating that extension and communication of A&B Class practice is being successful in Reef Catchments. Reef Catchments has

produced newsletters, case studies, website, field days, participant interviews, banners, posters, landholder signs, radio and television interviews to continue to communicate of A&B Class practice (Plate 2).

Plate 2 Cane field day at Reef Rescue participant property

Increased support and resources from Reef Rescue partners and industry for landholder uptake of A&B Class practice

Reef Rescue funding support has been provided to industry wide projects aimed at supporting growers wanting to adopt A & B class management practices. Projects include supporting the establishment of community GPS base stations and the installation of yield monitors in all harvesters so that yield maps can be developed for all cane farmers (Plate 3).

Reef Rescue funding also established the first Central Queensland BEEF (Better Economic and Environmental Futures) Group in the Mackay Whitsunday region. This project encouraged cattle graziers to explore and adopt new technologies that enhanced the long term profitability of their enterprise while protecting their environmental future.

Five Precision Planning Consultants have been employed to develop Reef Rescue projects (Plane Creek Productivity Services, Agriserv (Mackay Area Productivity Services and BSES), Canegrowers Proserpine, DEEDI, Growcom) and provide support for Stage 1 and 2 project development and milestone completion. Three Key Contact Officers

(Canegrowers, AgForce, Growcom) have been employed to help in EOI coordination, phone calls and queries and to support Stage 2 applicants

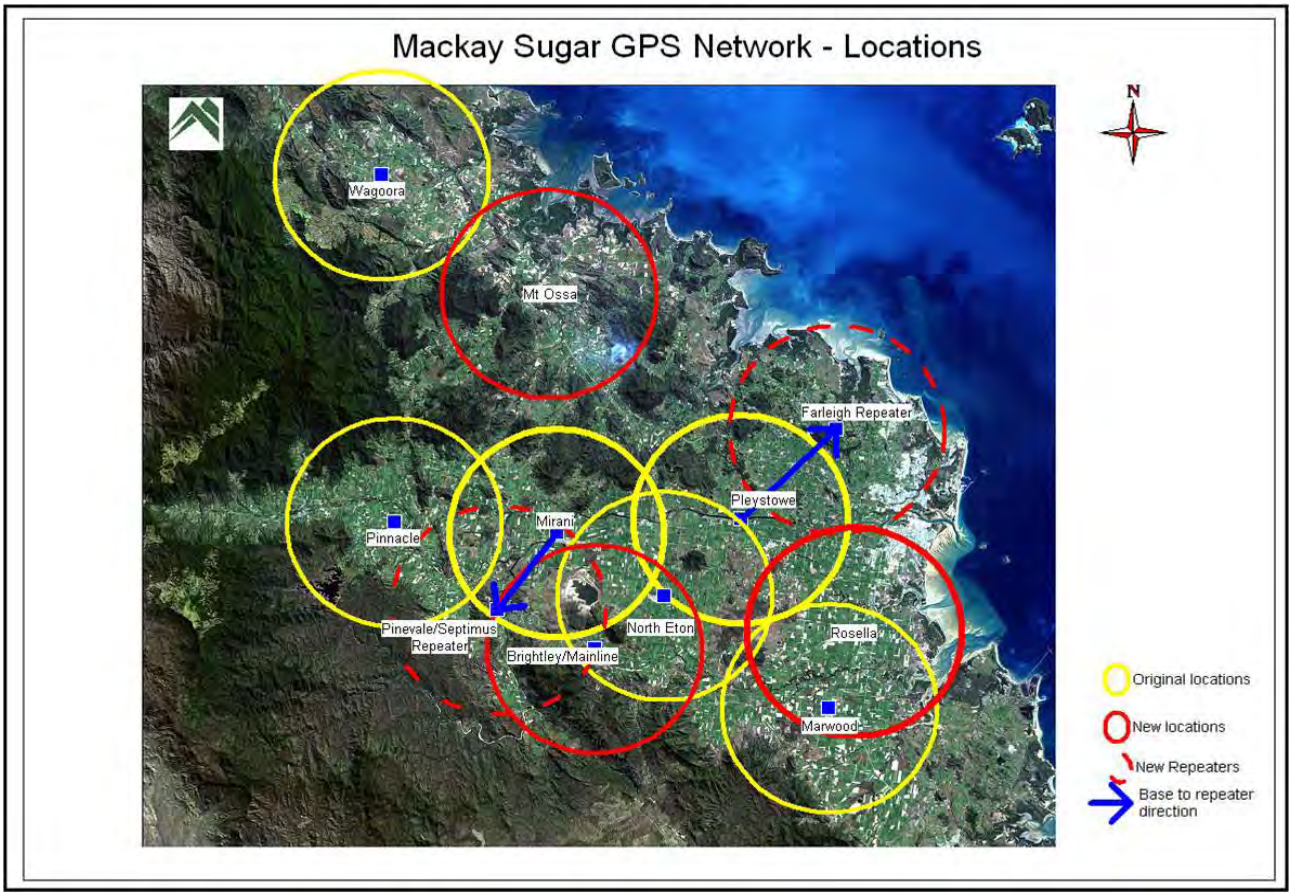


Plate 3 Establishment of community GPS base stations in the Mackay Sugar milling area

Regional Industry Working Groups have assisted in the development and approval of Industry wide projects to support growers, graziers and producers adopt A and B class management practices. Examples are Community GPS Base Stations and CQ Beef.

Project proposal, assessment, prioritisation and approval process

The development of the Regional Industry Working Group, which is supported by all major local industry service providers, helps in the coordination of the Reef Rescue process, development of eligible activities and the delivery of the water quality grants.

The Regional Industry Working Groups participate in the development and approval of the prioritisation process for Reef Rescue water quality grant projects. A cost/benefit analysis including prioritisation process was included following a review by Jon Rolf (CQU) on SLP. High Priority 50%, Moderate 40%, Low 30% and Very Low 20%. Maximum Funding amounts were placed on certain Irrigation, Stormwater and Riparian Management (fencing and off-stream watering points) activities.

The Reef Rescue delivery methodology used was based on the previous Sustainable Landscapes Program incentive schemes delivered in the region. The project proposal and site assessment procedures were updated and new project prioritisation was developed

which included getting industry support and endorsement through the Reef Rescue Regional Industry Working Groups for the prioritisation process. Reef Catchments developed all relevant documents including EOI, Project Proposal Form, Milestones and Schedule of Operations for all activities. Reef Rescue Incentives Database has been upgraded to use electronic .pdf project proposal form and can develop all contracts and manage all milestone payments.

Training has been provided to all Key Contact Officers and Precision Planning Consultants in using the new electronic forms and information provided on the prioritisation process.

Reef Catchments has conducted participant interviews and case studies. A review of the budget for grazing projects changed how fencing costs were determined and pasture/Stocktake monitoring was funded.

Reef Operatives meetings has allowed discussions with the other NRM groups delivering Reef Rescue on the proposal and assessment processes they have used and Reef Catchments has used this information to change and improve our delivery method.

Improved Farm record keeping including development of regional support tools
The introduction of the new state government Reef Regulations in 2010 has meant that every cane farmer and some graziers must now keep basic records of all nutrient and chemical inputs. While having an impact of delivering Reef Rescue, Reef Regulations has helped achieve this outcome much quicker than would have been expected without them.

Development of AgDat with Mackay Sugar and Plane Creek (Sucrogen) to have a web-based or in tractor unit record keeping system that can allow analysis of inputs to productivity etc. The intention is to promote AgDat to Proserpine Mill, other regions and even other industries (Plate 4).

In 2010, the development of AgDat for grazing was started through product designer Agtrix who have partnered with another private company, Taggle Pty Ltd to link real time spatial mapping of cattle on a property the same as AgDat remote would map where a tractor/equipment has been applying fertilizer and chemicals (Plate 5).

Grazing current practice benchmark report/action plan identifies areas for improvement in record keeping.

Plate 4 AgDat remote unit installed in a tractor

Plate 5 Taggle radio tracking ear tag in cattle

On ground implementation by farmers and graziers through Reef Rescue contributing towards 3 year target

The provision of incentives has accelerated the adoption of the on-ground implementation of A & B class management practices by many farmers and graziers. Through the interviews and case studies, many participants have stated that they wouldn't have been able to do this for another 5 years without the support or may never have done it at all.

With the implementation of on ground works by farmers in year I & 2, many other farmers are becoming comfortable utilising the same or similar equipment or have become interested in doing something similar through Reef Rescue.

Reef Rescue database is designed to track the number of projects/landholders/activities undertaken and demonstrate progress towards achieving the 3 year targets. The delivery of Reef Rescue is well on track with 119 sugar projects in 08/09 involving 170 growers, 52 grazing projects involving 52 graziers and 7 horticulture projects involving 7 producers. In 09/10 195 Sugar projects involving 242 growers, 45 grazing projects involving 45 graziers and 6 horticulture projects involving 10 producers. All of the projects combined are impacting on around 86000 ha. Reef Rescue is meeting objectives in terms of land managers involvement and ha of land under practice improvement.

Property plans developed by every farmer and grazier involved in Reef Rescue

To receive Reef Rescue funding property plans must be completed by all participants with the support of the relevant industry based Precision Planning Consultants. This includes identifying current practice, a farm risk assessment and development of an action plan for adopting A and B class management practices on farm for soil, nutrient, chemical and water (irrigation/stormwater).

For cane, all farmers who are doing a nutrient, chemical or irrigation management activity must also complete an annual input management plan. For example, a grower receiving funding for a shielded sprayer unit to apply knockdowns must also produce a chemical management plan showing weed pressure, target weeds, product being used and rate, water rates, application method and timing.

The Grazing Precision Planning Consultant position is based with industry partner DEEDI, the role includes supporting graziers in property planning through farm risk assessment, action planning and information sharing. The development of the Concepts for Sustainable, Profitable and Productive Grazing Workshop in Mackay has seen an increase in the support for the development of property plans.

The development of the current practice book has helped growers and graziers benchmark their current practice and allow the precision planning consultants to develop recommendations with them. The action plan book has helped them to prioritise on ground activities and develop an implementation plan. The development of property plans by every farmer and grazier is included as a component of the Reef Rescue contract signed by them.

Property planning and on ground implementation by farmers and graziers
With the new State Government Reef Regulations, it is possible in the near future that cane farms over 70 ha in the Mackay Whitsunday region will have to complete an annual Environmental Risk Management Plan focusing on nutrient and chemical input risks. These Environmental Risk Management Plans are currently only needed in Terrains' NRM region.

There have been many farmers who have adopted A and B class management practices without receiving Reef Rescue funding. Early estimates are around 15% of growers and graziers will do this. There will be a need to closely monitor the uptake after Reef Rescue has finished.

While on-ground changes are happening without Reef Rescue funding, the level of property planning is very minimal. The development of Current Practice Benchmarking process (report, action plan) for Cane and Grazing has helped in getting increased participation by landholders.

Monitoring uptake of improved practice adoption through industry
An increase in the monitoring of the uptake of practices has been achieved through the development of a Cane and Grazing Current Practice Booklets. The Current Practice Booklets have been produced to assist farmers and graziers in the development of property plans and outlines their current best practices and future action plans in an easy to follow ABCD framework. Local industry service providers are looking to utilise this process in the future to collect data from non Reef Rescue participants.

Local industry service providers such as Productivity Boards already collect a large amount of grower information annually that can be linked to the ABCD framework. This information includes row spacing, tillage operations, legume fallows etc.

Mackay Sugar has developed AgDat as a record keeping tool but it can also be used to collect aggregated data sets for adoption of A & B practices within the WQIP sub-catchments.

AgDat is currently also being developed for the grazing industry as a record keeping tool which can also be used to collect aggregated data sets for adoption of A & B practices within the WQIP sub-catchments.

More work is being done on this through Industry based projects (Canegrowers Baseline study), Australian Government (Reef Rescue Baseline survey) and the Paddock to Reef project.

Improved profit by adopting A&B Class land management practices
Regional Industry Working Groups approved funding support for Grazing and Cane Economic Analysis of the implications in adopting A and B class management practices for water quality improvement. Initial findings will be presented by July 2010 for Cane and October 2010 for grazing and projects will hopefully continue in 10/11 to get more information.

As identified in the MERI plan is the need to complete case studies of growers who have implemented works and will include looking at the economic benefits for the growers and graziers.

Through the industry wide grants, DEEDI are also completing economic reviews and profit probes with a number of cane and grazing land managers to also provide evidence of improved sustainability through adoption of the A and B class land management practices for improved water quality.

Improved in-stream WQ

Work has only just started on the Paddock to Reef monitoring project and this will inform us of the WQ improvements from the activities being implemented at a Paddock, Sub-catchment and Catchment level. Some of the results released to date from the paddock scale trials have shown A and B class management practices do provide water quality improvements over C and D class management practices (Plates 6, 7 & 8).

Plate 6 Sandy Creek cane catchment

Plate 7 St Helens Creek horticulture catchment

Plate 8 Flaggy Rock Creek grazing catchment

Broadscale adoption of A&B Class land management practices across the GBR – 1300 farmers and 650 pastoralists over an area of 3.8 million hectares over next 3 years

This target is for growers and graziers receiving funding or training through Reef Rescue. In the Mackay Whitsunday Region for Years 1 and 2, the numbers are:

1. 279 new projects involving 366 farmers
2. 60 repeat projects involving 69 farmers
3. 91 new projects involving 91 graziers
4. 6 repeat projects involving 6 graziers

Once aggregated data is supplied from other regions we will be able to combine to show the overall outputs and outcomes from Reef Rescue at a GBR wide level.

Feedback from Australian Government based on Year 1 and 2 figures and projected participation levels is that these targets will be reached within the time frame.

Increased investment in incentives

Significant investment has been directed from the Federal Government for Reef Rescue as the flagship initiative for the increased adoption of improved land management practices that improve water quality of the Great Barrier Reef lagoon by reducing nutrient, pesticide and sediment load while helping improve farm productivity and profitability across agricultural commodities. To date Reef Rescue has received $12,588,125 funding from Caring for our Country. With a minimum of 50% funding to be matched by land mangers a total in excess of $25,176,250 has been invested by agriculture in the Reef Catchments region to adopt improved land management practices.

Upscale of existing SLP program to deliver Reef Rescue

The existing SLP delivery process was adapted and upgraded to deliver the Reef Rescue funding. Milestones, activity information, property planning paperwork has been modified and a major upgrade to the SLP database has been undertaken to include the automated processing and input of Expressions of Interest and project proposals recording of milestones, issuing of payments and outputting of reports to cope with the greater volume of projects in Reef Rescue. SLP paperwork has been modified and converted into .pdf forms to enable quick processing into the Reef Rescue Database.

3.2 Lessons learned

Information about evaluations undertaken, lessons learned and unanticipated outcomes.

One of the key components of a MERI plan is collating the recommendations and discussions from evaluations and reviews of the program to identify outcomes and any lessons learned. The MERI plan for this region has attempted to allow all the different levels (grant participants, delivery agents, industry service providers, regional body etc) of Reef Rescue stakeholders to be involved in this process. This has provided a good

coverage of feedback and comments on the program from all of the different pathways of involvement and participation.

The MERI Performance Summit has been the major evaluation undertaken for Reef Rescue in our region. Most of the comments and feedback from this workshop and lessons learned have helped to develop our MERI performance story. A summary of the principal lessons learnt from the MERI Performance Summit are as follows:

1. All participants agreed that the water quality grants/incentives are a key to reaching intermediate outcomes as quickly as possible. Without them it would have been impossible to achieve what we have in the same time period. The interest level by farmers and graziers is still high and more incentives could get even more outcomes quickly.

2. There were suggestions on new activities that could possibly attract funding to get even more people involved and more investigation is required into the water quality benefit of them. This includes a strong push for more eligible activities with irrigation management in cane.

3. There were mixed comments about if repeat projects should be accepted and funded when there were still new farmers and graziers waiting to get involved. The repeat projects do help to get more hectares of land implementing A and B class management practices.

4. It was very important to get industry involvement and support from the very start of the project, including the development stage. This is because they are key partners in completing the immediate outcomes and moving ahead to achieve longer term outcomes.

5. The planning component of Reef Rescue needs to be completed before the completion of any water quality grants project. This is because the focus and interest from the farmer or grazier does go down or change once they complete their on-ground works. The planning component is one of the key outcomes wanting to be achieved through Reef Rescue.

6. Participant interviews, some comments included sending out the questions first so that they could be a bit more prepared for the interview. Some responses to this included the issue that this might mean prepared responses that tell what we want to hear, not how they actually felt.

7. BSES field day survey, some comments included doing this at other local field days or events such as the Pioneer Valley Show or Sarina Stockyard Sales.

8. Case studies, some comments included putting in more economic and productivity results to match what was done on-ground. Also once there are some results from Paddock to Reef, could the estimated load reductions be put on the case study as well?

The Reef Rescue Regional Sugar and Grazing Industry Working Groups conducted reviews of the Reef Rescue Program Logic and the evidence collected to show how the program is achieving it. The comments and feedback from these reviews have helped to develop our MERI performance story. Some of the principal lessons learnt from them are as follows:

1. There were plenty of comments and examples by the participating industry service providers about the extra support and resources that is now being provided farmers and graziers, not only through Reef Rescue, but being incorporated into existing networks and extension support services. Wanted to highlight that this is happening and shouldn't be underestimated

2. The reviews also highlighted how appreciative industry was of involving them from the development stage of Reef Rescue for our region and the ownership that they feel over the program. This includes accepting that they are key partners in completing the immediate outcomes and moving ahead to achieve longer term outcomes identified in the program logic.

3. Reef Rescue program logic, some comments included putting in figures such as "40% of industry adopting A and B class practices", rather than just saying "industry adopting A and B class practices".

3.3 Improvement

Information about improvements or changes as a result of lesson learned from monitoring and evaluation and how these are reflected in the MERI plan / program logic.

Reef Rescue has been a very successful program over the first 2 years of delivery in the Mackay Whitsunday region. Even with this success, implementing the MERI plan has highlighted areas that need to be maintained, reinforced or improved to help make the program more efficient and effective.

From the above mentioned list in section 3.2, the following improvements and changes have been or are continuing to be discussed and the MERI plan and program logic changed or updated if required.

From MERI Performance Summit:

1. For the remaining time of Reef Rescue, a key target is to maintain the highest possible percentage of Reef Rescue allocated funds to water quality grants. In Year 3, over 90% of the funding is allocated to individual water quality grant projects (farmers and graziers), industry wide projects (more resources available for farmers and graziers) and partnership projects (support for farmers and graziers wanting to be involved).

2. There will be discussions at the Regional Industry Working Group level into further investigation into some of the new activities mentioned. This will include looking at the water quality benefits and other aspects such as private v public benefit. If necessary, the list of eligible activities will be updated and the new activities able to be funded.

3. The majority of water quality grants (around 80 to 85%) are targeted at new farmers and graziers but there are still excellent water quality outcomes from funding repeat participants and so this will continue.

4. The regional industry working groups need to be coordinated to still meet regularly and continually updated with what is happening with Reef Rescue so they continue to have that ownership.

5. In consultation with the Key Contact Officers and Precision Planning Consultants, no project proposal can be accepted until confirmation that the first stage of the planning component has been completed. This first stage involves completing the current practice report and then the next stage is the development of a 5 year action plan for adopting A and B class management practices.

6. There is still discussion going on whether it is better to send out the interview questions first or have them answer without any prior planning. These will not be conducted again until 2011 and a decision will be made closer to the date.

7. It has been agreed to utilise the Key Contact Officers and Precision Planning Consultants to conduct the survey at other local field days and events. Has been included in their new 10/11 contracts.

8. Discussions will continue on how to best present the economic or productivity information on the case studies. Problem is that the cane productivity info will not come out until 6-8 months after their project has been completed. May have to do case studies on participants who completed their project the previous year so we can get productivity information. Once results come in from Paddock to Reef we will be able to put up estimated load reductions based on activities being implemented, soil type and ha's impacted on.

From Regional Industry Working Group reviews:

1. Through the working group reviews and involvement in the MERI performance summit, Industry encouraged to always provide information on the extra resources and support provided outside of any Reef Rescue funding.

2. The continuation of the Regional Industry Working Groups is a key activity for the remaining 3 years of Reef Rescue and the support for this group will remain one of the partnership projects.

3. There will be a review of the Reef Rescue Program Logic based on the feedback and comments received and updated or changed if seen as an improvement. If this happens, will notify the coasts and aquatics staff from the Australian Government Land and Coasts Division.

Section 4: Instances of Significant Change

The following 2 vignettes were chosen out of the 50 interviews conducted by the participants of the Reef Rescue MERI Performance Summit workshop as representing the most changes occurring as a result of the investment in Reef Rescue.

What is a vignette?

Vignettes are used to elicit responses, interpretations and judgments about a particular set of circumstances or context within a research setting. When used in qualitative social sciences, vignettes offer a method for simulating complex events, outcomes and/or problems and use these to explore people's perceptions, opinions, beliefs and attitudes. For Reef Rescue, the vignettes were extracted directly from the participant's interviews.

Vignette #1 Reef Rescue accelerating practice change

This participant is a sugarcane farmer who applied for Reef Rescue funding for projects in soy bean planting, nutrient management, chemical management, fertiliser application and matching row width and run off issues. Some of the projects were already planned, however Reef Rescue funding enabled this farmer to adopt change quicker. He would not have made the changes at the same rate without Reef Rescue funding.

The farmer felt that there was a great deal of openness and an ease application process to access the funding. The only negative he felt was that the funding pool had not been big enough to get to enough growers quickly. He believes there has not been enough funding to go around with the overwhelming take up of the program.

He had heard about Reef Rescue through his local Canegrowers and fellow growers. His motivation for getting involved was to receive the funding assistance and to get fast tracked to take up newer farming technologies. These would have both environmental and financial long term benefits.

He found that the local industry based staff were very helpful and supportive, without whom, he would not have received funding.

The farmer felt that the activities he had adopted would have the environmental and economic outcomes he was trying to achieve. He could not say for sure, however, as he had not completed the entire program thus far. He felt that it has not had a major impact to date, but it definitely had some positive outcomes so far. His intention is to undertake more projects to compliment his system and he will see more beneficial results.

The benefits the farmer is hoping to achieve include using less nitrogen fertiliser. He believes he has already achieved this by growing alternate crops such as soy beans and matching row spacings to a controlled traffic in a 1.8 system. He thinks that he has reduced his run off and that he is not losing topsoil or chemical fertilisers into the waterways. This translates into economic benefit as he does not have to purchase more amounts of chemical fertilisers if he is retaining his topsoil and nutrients, then there is less input to make in the longer term.

He believes there are further steps to take with his projects and will hopefully be going to full control traffic and zonal tillage system over time. The farmer said that he would have adopted the changes if he had received only 20% funding, but that he wouldn't have been able to do it as quickly without Reef Rescue funding.

He suggested that future changes to the funding program should require growers to have a staged five year plan. He feels this would ensure longer term projects do not run out of funding before they are completed.

He is very grateful for Reef Rescue as it has helped him accelerate his projects. Without funding, this would have taken him 5 years, but with funding it took him only 2 years.

This vignette was considered significant by the participants at the MERI performance summit workshop for the following reasons:

- It provides a real farmer perspective
- It illustrates the importance of Reef Rescue incentive funding and how it has helped to accelerate land management practice change
- It demonstrates the enthusiasm of the Sugar industry to be involved in Reef Rescue and how interest in participating in the program exceeds the funding available

- It highlights that Reef Rescue is achieving both environmental and financial long term benefits
- It shows the importance of the partnership between Reef Catchments and the local industry based staff in the delivery of Reef Rescue
- It records the importance of working with repeat land holders in continuing to achieve land management practice change
- It demonstrates how the activities promoted by Reef Catchments through Reef Rescue are achieving genuine on-ground change in reducing the amounts of chemical fertilisers applied
- It demonstrates that if the % of Reef Rescue funding was reduced the rate of practice adoption would decline
- It illustrates the change in land manger perception to the importance of land management planning brought about by Reef Rescue

Vignette #2 Reef Rescue recognises farmer's efforts

Employed as a Precision Planning Consultant by Reef Catchments, this farmer believes a significant number of the farmers that he had visited as part of his job had already made changes. A lot of farmers incurred significant expense off their own back and he was able to refund them a little bit for what they had already done. Nearly everyone that he had spoken to was aware change was needed and that the incentive helped them to make the changes.

He is not sure if the farmers would of made the changes at the same rate without Reef Rescue funding as some were convinced that these changes are the right way to go and that they were going to go ahead with or without the funding. Then there were the ones that were sitting on the fence who needed a prod from Reef Rescue to get them going.

He seems to think the reason why the Reef Rescue process had been successful was because the farmers were getting a lot of negative press. They felt like everybody in the world was picking on them. Reef Rescue was now showing recognition of the farmers and the improvements that they are doing. The growers have been very happy with it.

He doesn't think the publicity and what activities were funded was good enough. He was a farmer himself for most of his life and he knows unfortunately when you get a big envelope in the post with a big thick brochure full of papers, farmers are not going to read it properly.

The papers were sent at the end of the year when farmers are busy and coming up to a holiday period. It was put away in the "let's look at it next year" category and then never followed it up.

The other activities which he believes should be promoted is the irrigation equipment. Because of the limited pool of money that is available the farmers are doing the best that they can. If there was more money, the irrigation equipment could be improved because you can put the fertiliser and chemicals into the soil without having to wait for rain to wash it in and if you can do that with irrigation. That would be a significant benefit as funds are limited and irrigation equipment is expensive.

It has been useful having industry based staff available, who are all working together for a common objective. He receives a lot of information from the local BSES office. He feels that they would have had the same uptake without Reef Rescue. The whole thing was an ongoing part of their job so when Reef Rescue came along, it was just reinforcing what they had already been taught and shown.

Cash incentives provided by Reef Rescue is usually a good way to get the fence sitters going. They are the people who are not really sure and are prepared to be little bit slow in making the changes voluntarily. The cash is also good because it rewards those that have made the effort and had decided to go ahead. It is really like saying 'thank you'.

He feels that the balance is right between the paperwork, input from him, input from the farmers and input from the industry. One of the problems that he thinks in the cane industry overall is that the average age of the farmers and the majority of farmers are well into their 50s and 60s and at that sort of age, change is not easy.

This vignette was considered significant by the participants at the MERI performance summit workshop for the following reasons:

- It provides the perspective from an industry partner and a member of the Reef Rescue delivery team

- It shows that the cane industry is aware of the need for practice change and that incentives helped them
- It demonstrates that Reef Rescue has helped in the recognition of the farmers and the improvements that they are doing
- It demonstrates the need to improve and develop alternatives the way Reef Rescue activities and funding are promoted
- It provides suggestions of the need for new activities that could attract more people to get involved in Reef Rescue
- It illustrates that if Reef Rescue had more funding greater and faster land management change could be achieved
- It reinforces the importance of the partnership of Reef Rescue with industry
- It highlights the importance of providing a cash incentive
- It indicates the challenges involved in bringing about change in the cane industry

Section 5: Final Impact Statement

The delivery of the Reef Catchments Reef Rescue project has been successful. The outcomes achieved in the project have exceeded the original expectations. 29% of the growers in the sugar industry have adopted land management practices that will improve the quality of water reaching the reef lagoon, representing 61% of the industry land area in the Mackay Whitsunday region. 4% of the graziers have improved ground cover monitoring and management in areas where run-off from grazing is contributing significantly to sediment loads and a decline in the quality of water reaching the reef lagoon, representing 25% of the grazing land in the Mackay Whitsunday Region. 28% of the horticultural producers in the region have adopted land management practices that will improve the quality of water reaching the reef lagoon, representing 46% of the industry land area in the Mackay Whitsunday region. Combined all of the projects are impacting on around 86,000 ha.

Cane

The Reef Rescue sugar water quality grants have been very successful at encouraging growers and industry to adopt A & B class soil, nutrient, pesticide and irrigation management practices. In year one 300 expressions of interest were received to be involved in Reef Rescue. Out of the 300 funding was available to work with 170 growers, representing 14% of the cane industry in Mackay on 119 Individual projects and 3 innovation projects (8 growers) which impacted on 46,220 hectares in year 1 representing 24% of the cane land. These projects included 69 soil (machinery modifications for controlled traffic, zonal tillage units, GPS guidance), 28 chemical (shielded sprayer units for applying knockdowns), 29 nutrient (nutrient management plans, improved application such as sub-surface compost application, variable rate technology) and 6 irrigation (tail-water recycling) subprojects. The total project costs for year one was $6,224,187 with Reef Rescue contributing 33% to the total cost (Table 1). Twelve Industry projects were undertaken in year one (involving CSR, Mackay Sugar, MAPS and DERM) impacting on the entire central region sugar production area (over 120 000 hectares). These projects included GPS base station coverage, GPS tracking and yield monitors on all harvesters and GPS tracking and variable rate applicators on all CSR liquid fertiliser contractors. Total project costs were $4,595,431 with Reef Rescue contributing 43% to the total project cost (Plate 9 & Table 1).

In the second year of Reef Rescue 445 expressions of interest were received for cane projects. Reef Rescue worked with 183 new growers and 65 repeat growers, representing 15% of the cane industry in Mackay on 45 Individual projects resulted in improved practices being implemented on around 44,090 hectares representing 37% of the cane land. These projects included 139 soil projects (machinery modifications for controlled traffic, zonal tillage units, GPS guidance), 87 chemical projects (shielded sprayer units for applying knockdowns), 88 nutrient projects (nutrient management plans, improved application such as sub-surface application, variable rate technology) and 43 irrigation/stormwater projects (tail-water recycling, improved application, sediment/detention basins). Total project costs were $6,646,596 with Reef Rescue

contributing 33% to the total project cost (Table 1). Eleven industry projects (involving Mackay Canegrowers, Mackay Sugar, Agriserv, MAPS, QPI&F and Agtrix) were supported in year two. These projects supported the development of a mapping component for AgDat remote and support for training (web based and remote) in AgDat, supporting a Break Crop Management Extension Role, Economic Analysis of the adoption of A & B practices for water quality improvement, Mill Mud Commercial Scale Truck Applicator and establishment of Demonstration Farms. All the industry projects impacted on the entire central region sugar production area (over 100 000 hectares).

The continuation of 3 sugar precision planning consultants based with Mackay Area Productivity Services, Plane Creek Productivity Services and Canegrowers Proserpine are included in the tally of industry projects. Between the three positions, in year two they visited 160 new individual growers and supported 41 Stage 2 growers including the development and updating of their property plans and support with their project proposals.

Plate 9 Example of one of cane the cane projects funded through Reef Rescue is a sub surface fertiliser box with a variable rate controller combined with a GPS and a controlled traffic system

Table 1 Reef Rescue Cane Total Outputs Year 1 & 2

Sugar	Year 1	Year 2	Total
EOI	300	445	745
Projects	119 new	145 new and 56 repeat	264 new and 56 repeat
Landholders	170 new	183 new and 65 repeat	353 (65 are now repeat)
New Landholders % of Industry (1200)	14%	15%	29%
Impacted Area Ha	29005 Ha	44090 Ha	73095 Ha
Impacted Area % of Industry Area	24%	37%	61%
Total Project Costs	$6,224,871	$10,381,311	$16,606,182
Total Reef Rescue Contribution $	$2,077,939	$3,405,511	$5,483,450
Total Reef Rescue Contribution %	33%	33%	33%
Soil – Number	69	139	208
Soil – Hectares	24152 Ha	43429 Ha	67581 Ha
Soil - % of Industry Area	20%	36%	56%
Total Soil Project Costs	$5,044,400	$6,646,596	$11,690,996
Total Reef Rescue Soil Contribution $	$1,544,958	$2,345,862	$3,890,820
Total Reef Rescue Soil Contribution %	31%	35%	33%
Nutrient – Number	29	88	117
Nutrient – Training			62
Nutrient – Hectares	9867 Ha	19630 Ha	29497 Ha
Nutrient - % of Industry Area	8%	16%	24%
Total Nutrient Project Costs	$384,354	$1,203,340	$1,587,694
Total Reef Rescue Nutrient Contribution $	$140,494	$471,216	$611,710
Total Reef Rescue Nutrient Contribution %	37%	39%	39%
Chemical – Number	28	87	115
Chemical – Training			51
Chemical – Hectares	8438 Ha	21065 Ha	29503 Ha
Chemical - % of Industry Area	7%	18%	25%
Total Chemical Project Costs	$507,480	$1,577,931	$2,085,411
Total Reef Rescue Chemical Contribution $	$199,914	$588,662	$788,576
Total Reef Rescue Chemical Contribution %	39%	37%	38%
Irrigation/Stormwater – Number	6	43	49
Irrigation/Stormwater – Hectares	774 Ha	3524 Ha	4298 Ha
Irrigation/Stormwater - % of Industry Area	1%	3%	4%
Total Irrigation/Stormwater Project Costs	$172,605	$2,437,077	$2,609,682
Total Reef Rescue Irrigation/Stormwater Contribution $	$34,558	$477,529	$512,087
Total Reef Rescue Irrigation/Stormwater Contribution %	20%	20%	20%
Industry Projects	12	11	23
Impacted Area Ha	120 000 Ha	60 000 Ha	120 000 Ha
Impacted Area % of Industry Area	100%	50%	100%
Total Industry Project Costs	$4,595,431	$2,996,435	$7,591,866
Total Reef Rescue Industry Project Contribution $	$1,965,482	$887,983	$2,853,465
Total Reef Rescue Industry Project Contribution %	43%	30%	38%

Grazing

The Reef Rescue Grazing water quality grants provided incentives to support graziers and industry to adopt A & B class pasture, nutrient, and riparian management practices. In year one Reef Rescue received 110 expressions of interest to be involved in grazing projects. In year one Reef Rescue funded 52 graziers(2% of the industry) involving 97 Individual projects and 2 industry projects which resulted in 6,264 hectares of land under improved practice in the Mackay Whitsunday Region, representing 8% of the grazing land. These projects involved 51 pasture management projects (12 land type fencing projects consisting of 11.4km, 38 nutrient management projects, 19 riparian fencing projects which fenced along 33.6km of riparian land protecting 67ha and the construction of 50 off-stream watering points (Plate 10 & Table 2).

A Current Practice Booklet was developed to monitor the adoption of A & B practice change that is consistent with the Reef wide protocols established through the RGC and

QFF for Reef Rescue. The Current Practice Booklet was developed in conjunction with DPI & F by the Precision Planning Consultant, separate to the two industry projects.

Plate 10 An example of one of the grazing projects funded through Reef Rescue is riparian fencing dividing the riparian zone from the alluvial floodplain enabling improved management of the riparian zone and reduced bank erosion.

A number of industry projects were developed through involvement with DPI&F. In the first reporting period a grazing evaluation project was undertaken which investigated typical cattle properties in the region and then used this information to analyse the potential implications into adopting A & B land management practices to achieve improved water quality. This analysis helped to determine the likely implications for a grazier seeking to move from D and C class activities to B and A class management activities for grazing properties in the Mackay Whitsunday region. Reef Rescue funding also established the first Central Queensland BEEF (Better Economic and Environmental Futures) Group in the Mackay Whitsunday region in the first reporting period. Continuing support has led to the formation of a second group in the January-June period. Members of the CQ BEEF Groups have been drawn from a variety of locations and backgrounds in the area and are all motivated to increasing the sustainability of their business. The groups provide an opportunity for local graziers to work together to evaluate their business, and to identify and implement practices that improve sustainability and achieve improved water quality. This project is focused on encouraging cattle graziers to explore and adopt new

technologies that will enhance the long term sustainability of their enterprise while improving water quality.

During year two of Reef Rescue funded 45 graziers (2% of the industry) to undertake 132 individual projects impacting on 12,494 hectares representing 17% of the grazing land. The projects included 90 pasture management projects (land type fencing and pasture monitoring sites), 70 nutrient management projects (soil testing), 13 riparian fencing projects (46.5 km of fencing and 125ha of riparian habitat) and the construction of 39 off-stream watering points. A further 3.5km of stream bank, and 7ha of native riparian vegetation was enhanced to stabilise eroding stream bank areas (Table 2).

In year two AgDat grazing project was developed as an industry project to extend the concepts of the AgDat database used extensively in the local cane industry to include specific requirements relevant to the grazing industry. This project has provided high quality tools in information management and dissemination to meet the growing community expectations being placed upon the grazing industry of the Mackay Whitsunday region. The project has also investigated the use of new cattle tag technology to demonstrate the capabilities of spatial tracking technologies in the grazing industry. The primary purpose of the project is to support the sustainability of the grazing industry through the collection and provision of relevant and current information relating to on and off farm activities. AgDat has the facility to gather, collate and analyse this operational data and to generate appropriate performance indicators that will promote wider adoption of Best Management Practices.

This project will incorporate a world's first pilot trial of new cattle tag technology that allows graziers to practically track where their cattle are in real time. The potential of cattle tracking has long been recognised for its potential applications in the monitoring and management of stock in sensitive areas such as riparian zones and gullies, grazing pressure analysis and virtual fencing. Until now there has not been a practical technology available to enable these applications. This project will trial a low cost, lightweight, battery powered cattle tag developed by an Australian company, Taggle Pty Ltd, to provide an initial demonstration of the capabilities of advanced spatial mapping applications to the grazing industry.

Table 2 Reef Rescue Grazing Total Outputs Year 1 & 2

Grazing	Year 1	Year 2	Total
EOI	110	115	225
Projects	52 new	39 new and 6 repeat	91 new and 6 repeat
Landholders	52 new	39 new and 6 repeat	91 new (6 are now repeat)
Landholders % of Industry	2%	2%	4%
Impacted Area Ha	6264 Ha	12494 Ha	18758
Impacted Area % of Industry Area	8%	17%	25%
Total Project Costs	$741,447	$930,825	$1,672,272
Total Reef Rescue Contribution $	$348,449	$442,625	$791,074
Total Reef Rescue Contribution %	47%	47%	47%
Groundcover – Training			52
Groundcover – Hectares	5929 Ha	12361 Ha	18290 Ha
Land type Fencing	11.4 km	52 km	63.4 km
Pasture and Stock Monitoring Sites	51	90	141
Nutrient Monitoring Sites	38	70	108
Riparian Hectares	67 ha	125 ha	192 Ha
Riparian Fencing Km	33.6 km	46.5 km	80.1 km
Off-stream Watering Points	50	39	89
Industry Projects	5	6	11
Total Industry Project Costs	$642,000	$1,684,880	$2,326,880
Total Reef Rescue Industry Project Contribution $	$281,416	$392,440	$673,856
Total Reef Rescue Industry Project Contribution %	44%	23%	29%

Horticulture

The Reef Rescue horticulture water quality grants have been very successful at encouraging producers and industry to adopt A & B class soil, nutrient, pesticide and irrigation management practices. In year one 12 expressions of interest were received to be involved in Reef Rescue. Reef Rescue funded 7 (15% of the industry) Individual producer projects impacting on 270 hectares representing 20% of the horticulture land area. The funded projects included 4 soil (inter-row management), 2 chemical (hooded sprayer units for applying knockdowns), 2 nutrient (nutrient management plans & fertigation) and 2 irrigation (improved application) subprojects (Plate 11 & Table 3). One industry project was developed involving Growcom completing current practice benchmark survey across Mackay Whitsunday horticulture producers through their FMS process.

Plate 11 An example of a Reef Rescue funded horticulture funded project is a under canopy micro sprinkler irrigation system incorporating fertigation

In year two, Reef Rescue received expressions of interest from 13 producers and funded 10 Individual producer (13% of industry) projects impacting on around 350 hectares, representing 26% of the horticulture land in the region. These projects include 4 soil project (cover crop during wet season), 3 nutrient (nutrient management plans & fertigation), 3 chemical project (hooded sprayer units for applying knockdowns) and 5 irrigation projects (improved application and links to fertigation in the future) (Table 3).

The successful continuation of the Horticulture key contact officer/precision planning consultant based with Growcom. The position worked with 1 new producer and 4 stage 2 producers to complete or update their FMS risk assessments and property plans and had 5 active projects.

Table 3 Reef Rescue Horticulture Total Outputs Year 1 & 2

Horticulture	Year 1	Year 2	Total
EOI	12	13	25
Projects	7 new	6 new and 4 repeat	13 new and 4 repeat
Landholders	7	6 new and 4 repeat	13 new (4 now repeat)
Landholders % of Industry (45)	15%	13%	28%
Impacted Area Ha	270 Ha	350 Ha	620 Ha
Impacted Area % of Industry Area (1350)	20%	26%	46%
Total Project Costs	$104,910	$226,133	$331,043
Total Reef Rescue Contribution $	$52,455	$91,193	$143,648
Total Reef Rescue Contribution %	50%	40%	43%
Soil – Number	4	4	8
Soil – Hectares	157 Ha	161 Ha	318 Ha
Soil - % of Industry Area	12%	12%	24%
Total Soil Project Costs	$52,361	$44,580	$96,941
Total Reef Rescue Soil Contribution $	$26,181	$22,290	$48,471
Total Reef Rescue Soil Contribution %	50%	50%	50%
Nutrient – Number	2	3	5
Nutrient – Hectares	30 Ha	31 Ha	61 Ha
Nutrient - % of Industry Area	2%	2%	4%
Total Nutrient Project Costs	$5,122	$2000	$7,122
Total Reef Rescue Nutrient Contribution $	$2,561	$1000	$3,561
Total Reef Rescue Nutrient Contribution %	50%	50%	50%
Chemical – Number	2	3	5
Chemical – Hectares	55 Ha	140 Ha	195 Ha
Chemical - % of Industry Area	4%	10%	14%
Total Chemical Project Costs	$3,018	$31,900	$34,918
Total Reef Rescue Chemical Contribution $	$1,509	$6,380	$7,889
Total Reef Rescue Chemical Contribution %	50%	20%	23%
Irrigation/Stormwater – Number	2	5	7
Irrigation/Stormwater – Hectares	28 Ha	139 Ha	167 Ha
Irrigation/Stormwater - % of Industry Area	2%	10%	12%
Total Irrigation/Stormwater Project Costs	$44,408	$147,153	$191,561
Total Reef Rescue Irrigation/Stormwater Contribution $	$22,204	$61,523	$83,727
Total Reef Rescue Irrigation/Stormwater Contribution %	50%	42%	44%
Industry Projects	1		1
Total Industry Project Costs	$100,000		$100,000
Total Reef Rescue Industry Project Contribution $	$50,000		$50,000
Total Reef Rescue Industry Project Contribution %	50%		50%

Estimated Load Reductions

The focus of the Reef Rescue Water Quality Grants is to promote a range of specific improved management practices (A & B class) for intensive agricultural land uses that will improve the water quality of the Great Barrier Reef lagoon. The increased adoption of these practices will improve water quality by reducing nutrient, pesticide and sediment load running off the landscape and entering the Great Barrier Reef lagoon.

Based on the expected uptake of A and B class management practices the load reduction targets for Reef Rescue in the Mackay Whitsunday region are:

25% for dissolved inorganic nitrogen

20% for residual herbicides (ametryn, atrazine, diuron and hexazinone)

20% for particulate nitrogen and phosphorus

30% for filterable reactive phosphorus

5% for suspended sediment

To date based on the activities which have been funded in year 1 and year 2 in Reef Rescue the estimated load reductions are presented in Table 4. It must be noted that the load reductions presented in Table 4 are estimates that are based on Reef Catchments models linked to the Reef Catchments WQIP, which have yet to be verified by the Paddock to Reef Monitoring and Modelling Program and may be subjected to change at a later date (Plate 12).

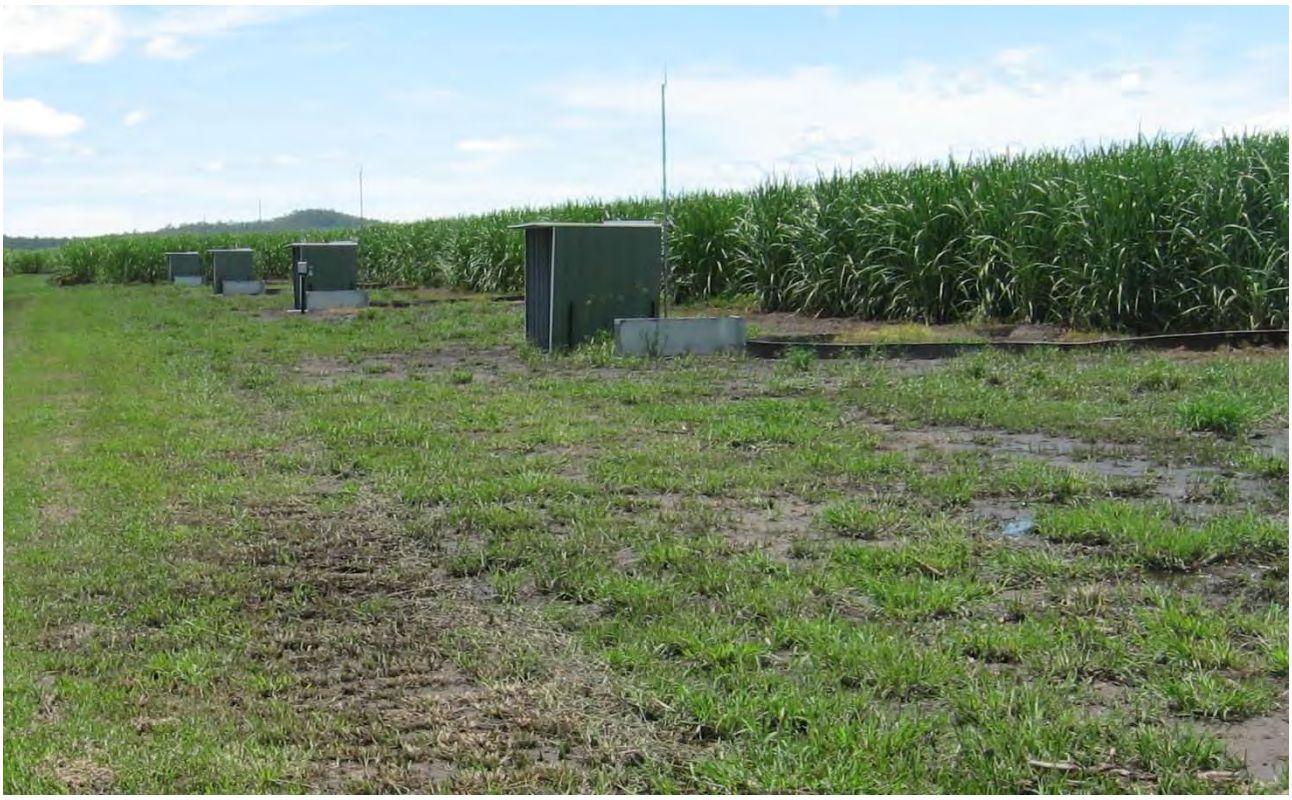


Plate 12 Paddock to Reef Monitoring and Modelling Program cane monitoring site in the Mackay Whitsunday Region

Table 4 Estimated Load Reductions

2008 - 2010 Reef Rescue Total Estimated Load Reductions from Current Individual Water Quality Grants	*Mackay Whitsunday WQIP 2014 target Mackay Whitsunday WQIP 2014 target*
Suspended sediment load reduction by approximately **75 500 t/yr**	**8000 t/yr**
Particulate nitrogen load reduced by approximately **271 t/yr**	**360 t/yr**
Particulate phosphorus load reduced by approximately **117 t/yr**	**150 t/yr**
DIN (Dissolved inorganic nitrogen) load reduced by approximately **102t/yr**	**550 t/yr**
FRP (Filterable reactive phosphorus) load reduced by approximately **14 t/yr**	**100 t/yr**
Total pesticide loads reduced by approximately **838 kg/yr**	**1910 kg/yr**

Section 6: Appendix

Appendix 1: Land Manager Field Day Survey

2010 Reef Rescue Survey

BSES Field Day May 20th and 21st

What is the major land use on your property?

Cane ☐
Grazing ☐
Horticulture ☐
Other _____

Have you heard about the Reef Rescue Program and the associated grants for adopting improved management practices?

Yes ☐
No ☐

How did you hear about it?

Word of Mouth ☐
Industry Staff ☐
Industry Newsletters ☐
Canegrowers Reef Rescue Pack ☐
Meetings/Workshops ☐
Other _____

Where you interested enough to get involved?

Have a current project ☐
Have put in an EOI ☐
Still thinking about it ☐
Not interested ☐
Other _____

If still thinking about it or not interested, was there a specific reason?

Financial reasons ☐
No benefit from practice change ☐
Waiting to see results ☐
Other _____

If you have a current project, how did you find the process?

Demanding and time consuming ☐
Manageable ☐
Easy and not time consuming ☐
Other _____

If there was one thing you could suggest to improve the process, what would it be?

_____

Appendix 2: Case Studies

Please note that at the time of preparation all case studies (Grazing, Cane and Horticulture) were in a draft version.

Grazing

Case Study 1

REEF RESCUE

2010

RIPARIAN MANAGEMENT

Reef Rescue helped Geoff Bosel to construct 7.8km of riparian fencing and install four watering points on his grazing property.

With the help of Reef Rescue funding, Mt Challenger grazier Geoff Bosel was able to carry out changes that have made a big difference in the way he is able to manage his property, particularly in keeping his cattle out of the creeks.

Geoff constructed 7.8 km of riparian fencing and installed four watering points throughout the property.

"(The funding) has made it easier to handle the country. Mustering used to be very ad hoc and the shortage of people to help work the land has always been a problem," he says.

Now, Geoff is able to hold planned musters and utilise the resources that he does have.

The work done through Reef Rescue means that it will be easier for Geoff to continue to develop the property himself.

"Where we have built the fences along the riparian zone, they will not get washed away, which is a big plus. This will stop all of the cattle wandering off after floods. (The activities) have improved the creek by reducing cattle tracks," he says.

The newly constructed riparian fencing and watering points will help to improve water quality by creating bank stabilisation, reducing sediment input into the waterways, improving native riparian vegetation, increasing ground cover and preventing cattle from disturbing sediments on the bank.

Geoff initially became involved in Reef Rescue because he was looking for some assistance in the Queensland Country Life newspaper.

"We saw the advertisements for Reef Rescue, and Reef Catchments was the only (organisation) helping out graziers," Geoff says.

He had already established a few kilometres of riparian fencing on the property and without the Reef

About the farm...

Geoff Bosel has owned his Mt Challenger property since 1997. The 7,540 hectare property is located at the headwaters of Eden Lassie Creek. Previously, the property has consistently run 800-900 breeders/heifers and their progeny to two years. Mt Challenger now runs 1,000 breeders and Geoff sells his weaners at 6-9 months at the Sarina and Rockhampton cattle sales. His vision was to run cattle on agistment and upgrade the breeding herd to become a profitable cattle property.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Rescue funding, would have continued slowly, but progressively.

"We couldn't afford to continue to do a large amount of riparian fencing because of the financial investment. It doesn't matter what your best intentions are - if you have no income, you can't act upon any of those plans. Reef Rescue assisted in constructing this fencing at a faster rate."

Geoff was impressed with the support he received throughout the project and from Department of Employment, Economic Development and Innovation precision planning consultant Jim Fletcher.

"It doesn't matter what your best intentions are. If you have no income, you can't act upon any of those plans."

"Getting involved in the planning workshop was great. It was good to hear what other people were doing, and to hear what they think you should be doing," he says.

"There were no problems with Jim. He is a good man for the bush and he went through the processes clearly and made the application process easy."

Geoff's vision for the future of his property includes eliminating a lot more of the weeds and to establish smaller paddocks to enable cell grazing.

Geoff has previously undertaken large-scale weed control for snake weed on his property, and now, he is trying to manage weed impact on the pasture and increase the stocking rate.

OUTCOMES

bank stabilisation

reduced sediment disturbance and cattle tracks near waterways

improved riparian native vegetation

improved ground cover

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 2

REEF RESCUE
2010

River Run Grazing

RIPARIAN & PASTURE MANAGEMENT

Reef Rescue helped Stephen and Leanne Fogarty and Darren and Melanie Hamblin make big changes on their grazing property. They were able to attend a pasture stocktake workshop, construct 4.5 km of riparian fencing and a number of watering points throughout the property, conduct soil tests and take control of Lantana weed in the riparian zone.

Since taking over River Run in 2006, Stephen and Leanne Fogarty and Darren and Melanie Hamblin have developed the infrastructure of fences and lane-ways and planted improved pastures such as Callide Rhodes and Creeping Blue, Signal and Pangola grasses on the property. Seca Stylo, Lablab, Cowpea and Butterfly Pea legumes have also been planted into the pastures.

Stephen, the property manager, has intensively managed the pastures with Urea, DAP, foliar and mill mud sprays being applied along with trial plantings of fodder crops. Spreading the mobs out during the wet season meant better pasture utilisation and less Buffalo Fly - which ultimately has resulted in content cattle. Stephen does supplemental feeding to add protein in dry conditions and to maintain weight-gain during the wet season.

Stephen says the hardest part about having cattle on the coast, is managing the wet season with them, but with Reef Rescue funding, further improvements on the property were able to be made to address the issue.

He participated in a stocktake workshop, which gave him the opportunity to brush-up his skills and provide direction in estimating pasture yields and developing forage budgets. Stephen has since begun the process of taking photos of pastures and adjusting stocking rates.

The Fogartys and Hamblins also used the funding to successfully construct 4.5 km of riparian fencing on River Run.

"It worked out really well. Getting the river fenced off was a really big thing. We are now able to manage the movement of cattle more effectively and maintain higher ground cover," Stephen says.

"We would not have this scale of fencing without the Reef Rescue funding. There would still be large sections of the Pioneer River to which we would not be able to control the access of cattle. Having a good body of grass on the ground has helped to eradicate erosion and having the riparian zone fenced has also been a benefit in the wet conditions."

About the farm...

The Fogarty and Hamblin families own a 220 hectare grazing property called River Run, which is an ex-sugarcane farm. The property has 300 dry heifers and steers with 20 Bazadias breeders - when crossed with the Brahman they are called Bazaman. The enterprise is run as a fattening block, and the stock are dressed to 240 kg to 290 kg for Kuttabul, Marian, Walkerston and Slade Point butcher shops. River Run is also a proud supplier to Bushman's Bazaman pies and Romeo and Juliet's Restaurant in Mackay.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Stephen does not feel that they have lost access to too much of the riparian area, as it is still a managed zone.

The provision of a number of watering points throughout the property helped to reduce cattle tracks down to the river and pads around existing dams.

Stephen also used the Reef Rescue funding to conduct soil tests, which was particularly helpful for the front paddock. He discovered that the previous year's DAP application had provided little benefit, indicating a problem.

Finally, Stephen was able to control Lantana weed along the riparian zone to relieve pressure on existing native vegetation.

Stephen found out about the Reef Rescue initiative from the newspaper and ABC radio. From there, he says paperwork and access to the funding was a simple process.

The Reef Rescue funding encouraged Stephen to implement the changes on River Run at a faster rate.

"Getting the river fenced off was a really big thing. We are now able to manage the movement of cattle more effectively."

"I had always wanted to do a bit more in the data-recording aspect of the property management and access to the stocktake workshop provided a good first step in that direction. The soil testing will also be beneficial," Stephen says.

Overall, changes which may have taken five years to implement, instead took just one year. "We probably would not have conducted the same scale of work without the 50 per cent level of funding. We would have stretched the work out over a longer period of time," Stephen says.

Department of Employment, Economic Development and Innovation precision planning consultant Jim Fletcher provided great support to Stephen throughout the duration of the project.

"Access to Jim was great. He was down to earth, very knowledgeable and shared that knowledge freely. We probably would not have become involved (with Reef Rescue) as easily, without Jim," Stephen says.

OUTCOMES

content cattle and improved knowledge in property management.

effective management of cattle movement and reduced cattle tracks and pads around river and dams.

better nutrient management, erosion eradication and increased ground cover.

weed control and better control of stock during wet season.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 3

REEF RESCUE
2010

RIPARIAN & PASTURE MANAGEMENT

Reef Rescue helped Karen Scanlan construct 5.4 km of riparian fencing and install five off-stream watering points on her Flaggy Rock grazing property.

Karen Scanlan's vision for her Flaggy Rock grazing property is for it to be weed free and to run as a viable property with approximately 200 head of cattle. She believes that farming has a bright future in the Mackay region and is interested in the potential of value adding for good land management practice.

Karen first heard about Reef Rescue through her involvement with Sarina Landcare, and after joining the initiative, was able to use the funding to continue to improve her property. She constructed 5.4 km of fencing along the riparian zones of Weybush and Flaggy Rock creeks.

In conjunction with the riparian fencing work, she also installed five off-stream watering points. A contractor was used to assist with both projects.

The improvements to Karen's farm, along with the knowledge in pasture management that she gained throughout the Reef Rescue work, has resulted in the stabilisation of the banks along the property's waterways and the reduction of sediment input into the waterway caused by cattle tracks. She was also able to improve the native riparian vegetation and increase ground cover on the property.

Karen says without the Reef Rescue funding, she would not have been able to implement the changes as easily due to competing priorities on the property.

"There was so much work that needed doing on the property. The partnership worked really well because we would not have been able to afford to give the work the priority that we did," she says.

"We had a list of priorities for the property which included the activities funded by Reef Rescue as well as other jobs like house improvements and pump repair. The incentives provided by Reef Rescue enabled priority to be given to some of the more environmental orientated projects, such as fencing along the riparian zone, which may not have been done for five, perhaps, ten years. There are still other activities with Reef Rescue that we are interested in doing in the future."

About the farm...
Karen Scanlan has been operating her 500 ha grazing property at Flaggy Rock for two years. She runs 140 adults and calves with 17 bulls, and has the intention of increasing the stocking rate to 200 as she improves the pasture. The breeding property runs Drought Master bulls and heifers. The cattle are sold at the Rockhampton Drought Master sales, in Nebo and at the Mackay Elders market.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

The initiative also gave Karen access to information from the project's precision planning consultant, who helped increase Karen's knowledge about pastures, how to better manage them and identify pasture species and weeds. "(The consultant) was very helpful. Because of the involvement of the industry staff, we understood the process clearly and felt comfortable with the contract that we had to sign and the paperwork that was required to receive payments," Karen says.

Karen also believes that the cash incentive scheme offered by Reef Rescue is the most appropriate way of getting farmers involved in best practice.

"I think that it is much better than the punitive approach. I doubt that farming could afford to implement these activities without incentives. The running of workshops would be very useful and informative, but at the end of the day they wouldn't enable the changes to occur. Education is great, but farming doesn't pay that well - there is rarely surplus money around to undertake environmental work. The practicality is that most people just don't have the money to spend on these activities."

Karen is confident that the activities promoted by Reef Rescue will bring about desired environmental and economic outcomes in grazing.

"From the point of the (Great Barrier Reef), the more people that become involved, the better. More people mean that bigger steps can be taken to improve the reef. We are very happy and have achieved everything that we were hoping to achieve. We have spoken to neighbours about Reef Rescue and encouraged them to get involved." she says.

In addition to the potential of value adding for good land management practice, Karen is also interested in stewardship payments for graziers who care for areas of native revegetation.

"For us, the main goals we have for the future is to improve our pastures and conduct some vegetation along the creeks. It would be useful to continue to receive assistance to achieve these goals," she says.

"The partnership worked really well because we would not have been able to afford to give the work the priority that we did."

The property's pastures include Signal Grass Pangola, Setaria and Legumes. Karen has plans to plant eight hectares of Cow Pea and Butterfly Pea for the bulls to direct graze.

Weed control is primarily done by slashing, as Karen is trying to reduce the use of chemicals. Chemical control is used only as a last resort. Between 150 and 200 ha of the property is fenced off from grazing at all times, to protect the native vegetation.

OUTCOMES

increased ground cover

improved riparian buffer and native vegetation

bank stabilisation

reduced cattle tracks and sediment run-off into waterways

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 4

REEF RESCUE
2010

PASTURE MANAGEMENT

Reef Rescue helped David Wright and his family improve the pasture management on their Constant Creek and Mt Spencer grazing properties. They were able to construct 1.55 km of land type fencing at Constant Creek and 3.55 km at Mt Spencer.

David Wright and his family had already begun making improvements to their Constant Creek grazing property, when they found out about the Reef Rescue initiative.

The project funding allowed the family partnership to speed up the work and complete 1.5 km of land type fencing at Constant Creek and 3.55 km at the second property at Mt Spencer.

The Constant Creek project fenced off a hard ridge from flatter, more productive land.

The family had also installed a watering point at this property.

The land type fencing constructed at Constant Creek helped to improve and maintain ground cover through more efficient use of available forage.

The family was comfortable building land type fencing which met the Reef Catchments standards for the funding offered. They implemented a wildlife-friendly top plain wire fence.

The funding advanced the rate at which the family was able to initiate and complete the works. "We wouldn't have done (the Constant Creek work) so quickly, if we didn't get the funding. We would have left it for another year or so," David says.

David said the family was planning on completing the Mt Spencer fencing within the next five years, however the Reef Rescue funding brought this forward. In fact, there is parts of the Mt Spencer property that they would never have fenced, if not for the funding.

"The 50 per cent funding is very generous and makes it very attractive to do fencing activities."

David is already seeing the environmental and economic outcomes that his family set out to achieve.

"We have already been able to undertake re-seeding with Signal Grass and the land type fencing has enabled us to lock the cattle

About the farm...

David Wright and his family has three grazing properties in the Mackay region. The main breeder property is at Mt Spencer, between Eton and Nebo, and runs 4,500 head of cattle over 80,000 acres. The Constant Creek property is 1700 acres and runs 500 head of cattle, however David's vision is to increase this to 1000 head. All steers are sent to the Dabin Property, near Nebo, to grow and finish while the cull heifers are sent to Constant Creek to trade weight. Most of the cattle go to the meat works.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

out of that land type while the pasture is established. Without the fence, we would not have been able to stop the cattle getting into the newly re-seeded pasture," David says.

He hopes that they will now be able to manage the ground cover more effectively and as a result, increase the stocking rate.

David is also confident that the family will experience economic benefits in the long run.

"The 50 per cent funding is very generous and makes it very attractive to do fencing activities."

In terms of improving water quality, David and his family's work means improved ground cover, which will reduce sediment input into the waterways.

David initially read about the Reef Rescue initiative in the media, but didn't realise that it applied to grazing.

After speaking to Department of Employment, Economic Development and Innovation precision planning consultant Jim Fletcher, he discovered that he could get involved.

"Jim was very good to work with. He obviously has a good background in the (grazing) industry and is a very practical bloke. The mapping and planning component was excellent and pointed out directions for the future," David says.

"With these two projects, I signed off on them and it was within a fortnight that I had received the (funding). It was like return mail. The big advantage of the way the Reef Rescue budgets were developed, was that I didn't have to race around town getting quotes from all and sundry. You just put your own figures in and they were accepted, or not."

Due to the size of the job, David would not have carried out the work without 40 per cent funding or more.

"Anything less does not justify advancing the priority of the works. The 50 per cent is what made the project attractive," he says.

"In comparison to anything else that I have tried to do in the past, Reef Rescue does not compare. The project was so simple and easy - that's the reason why I would line up to have another chop at it. I can't criticise the process at all. I hope that the funding continues for years to come. Particularly with larger properties, it is difficult to get all of the work done in 12 months. There are a lot of benefits that could come from Reef Rescue."

OUTCOMES

improved ground cover and pasture utilisation

reduced cattle tracks near waterways

reduced sediment input into waterways

improvement in ground cover

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Cane Case Studies

Case Study 1

REEF RESCUE
2010

FALLOW CROP & CONTROLLED TRAFFIC SYSTEM

Reef Rescue helped Frank Clayton convert his sugarcane farm to a 1.83 metre Controlled Traffic System and implement rotational legume fallow crops. With the funding, Frank was able to modify his equipment to match the new row-spacing and purchase a legume planter.

In 2009, Frank Clayton applied for Reef Rescue funding to help convert his sugarcane farm to a 1.88m Controlled Traffic System and the incorporation of rotational legume fallow crops. Frank was successful, and received funding to help modify his equipment to match the new row spacing and the purchase of a legume planter.

"The weather and conditions might not allow for a legume fallow crop each year, but I will try my best, because of how good a ground cover it provides over the wet season, how good the plant cane looks after and the fact that we don't need to add any nitrogen," Frank says.

Along with improving his soil management, Frank has been looking at ways of improving his nutrient and chemical management on-farm. He also received funding to put new discs on this three-row sub-surface stool splitter, to improve application through the trash. Frank says he also does soil testing and uses the BSES Six Easy Steps to determine nutrient requirements across the farm. "We have also modified the stool splitter with an extra tank to put on our cane grub control at the same time."

To improve his chemical management, Frank also applied for and was successful in receiving funding to help purchase a High Clearance Spray Rig and five shields. He still uses residual chemicals in plant cane for weed control, because some problems existed when he bought the farm.

In ratoons, he will use the High Clearance Spray Rig to apply knockdowns over the stool and the shields will allow for knockdowns in the inter-row at the same time. The rig allows this to be done up to out-of-hand stage, which is very useful for vine control.

Along with all of these improvements in the paddock, Frank has been busy improving his

About the farm...
Frank Clayton and his family own two sugarcane farms near Bloomsbury, 95km north-west of Mackay. The Claytons had been battling the drought in Armidale as sheep and cattle farmers and in 2007, headed north to try cane farming. Frank now has 300 hectares with 250 hectares under cane production. The O'Connell River passes between the two farms.

REEF CATCHMENTS | CARING FOR OUR COUNTRY

stormwater management across both of the farms.

"On one farm we have 85 per cent of run-off going through two dams. On the other, we received some funding through Reef Rescue to help with the construction of three sediment/detention basins that take around 80 per cent of the farm's run-off. We are looking to build two more small ones ourselves, to take it up to 50 percent."

"On one farm we have 85 per cent of run-off going through two dams."

Frank says that Reef Rescue helped him to make changes on the farms sooner, rather than over a five or 10 year timeframe.

"We would have definitely delayed the work on our fertiliser box and most likely would have only done one of our activities we had funded by now." Other activities, such as GPS, would also have been a long way down the track.

The benefits of the work Frank is doing for water quality through Reef Rescue include reducing the risk of sediment and particulate nutrient losses with the Controlled Traffic Minimum Tillage System and rotational legume fallows increasing ground cover, reducing run-off and improving soil structure.

There is also a reduced risk from dissolved nutrient losses with accurate targeted sub-surface granular nutrient applications based on crop requirements. Frank is also minimising the risk from residual chemical losses with accurate targeted applications based on weed pressure and replacement of residuals with knockdowns where practical. Finally there is a reduced risk of sediment, particulate and dissolved nutrients and dissolved chemical losses off-farm with improved stormwater management including dams and a series of sediment/ detention basins.

OUTCOMES

improved soil, nutrient and chemical management

improved stormwater management

increased ground cover, reducing run-off and improving soil structure.

reduced risk of sediment particulate, dissolved nutrients and dissolved chemical losses off-farm

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 2

REEF RESCUE
2010

John and Phil Deguara

IMPROVED FARMING SYSTEM

Reef Rescue helped John and Phil Deguara to finish modifying their equipment for a Controlled Traffic System. The Deguaras also purchased and installed a Viper Pro Variable Rate Control unit to improve the efficiency and accuracy of nutrient and chemical applications across the farm.

John and Phil Deguara began converting their sugarcane farms to a Controlled Traffic System in 2003.

After measuring their harvester, haul-out and tractor wheel spacings, they decided that a 1.9 metre single wide row system would be most suitable.

In seven years, the pair have modified their tractors and planters to match the new row spacing and have installed a GPS autosteer unit and base station.

After this year's planting, the Deguaras will have about 20 hectares left until the farm is entirely converted to the Controlled Traffic System.

Phil says they have experienced significant timesaving of labour whilst managing the new system.

"We are looking forward to even more saving when coming into establishing the second crop cycle. Maybe even some extra ratoons in a crop cycle with the reduced compaction."

Reef Rescue helped John and Phil to finish modifying their equipment to match their row spacing, which including a zonal tillage unit, mounding boards and their ripper and grubber which is also now three-row.

They also have a bean planter, so that they can plant legume crops such as soybean during the fallow period. This helps to provide a cover crop during the wet season and helps put organic matter and nitrogen back into the soil, which can be utilised by the following cane crop.

Along with improving their soil management, John and Phil have been looking at ways to improve their nutrient and chemical management on-farm.

Through Reef Rescue, they received funding to purchase and install a Viper Pro Variable Rate Control unit. This is used for both nutrient and chemical applications and has improved the efficiency and accuracy of operations across the farm.

This was combined with Reef Rescue funding to modify their three-row Stool Splitter Fertiliser Box to match their

About the farm...
John and Phil Deguara are third and fourth generation sugarcane farmers. They have two farms in the Mackay sugar district - one at Beaconsfield (70 hectares) and the home farm at Brightly (252 hectares)where the family has been farming since 1983. The southern branch of Sandy Creek flows next to their Brightley property, not far from where both branches meet near Eton.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

row spacing and the fitting of double discs for improved sub-surface application.

Phil says that he uses EM mapping, soil testing and the BSES Six Easy Steps recommendations to determine the nutrient and fertiliser blend requirements across the farm.

"This might mean four or five different blends for a year, which usually would be difficult to apply and maintain accuracy, such as correct calibration, for the different blends."

The Viper Pro Unit controls this well, allowing for specific targeting of nutrient requirements. It is also mapped on a kilogram output which is good for record keeping.

The new double discs and press wheel set up has been a major improvement to the Deguara's fertiliser application. They go through wet trash or thick trash (better window of opportunity for applications) and help with no moisture loss which can cause stress on ratoons."

To improve their chemical applications, the pair received funding to purchase a four-row shield sprayer unit and to modify and widen out their High Clearance Spray Rig.

"The shielded spray unit has been very useful in the soybean fallow and plant cane in replacing residuals in the inter-row, but time may only allow for targeted applications in ratoons due to weather conditions and weed pressure," Phil says.

The High Clearance Spray Rig is used to apply knockdowns at out-of-hand stage and will be useful in controlling areas with vine problems.

The Viper Pro unit is used to control the boom sprayer, so that there is auto-calibration, no overlap and mapped applications of knockdowns in fallow and residuals in the cane cycle.

"Reef Rescue really helped speed up what we were trying to achieve on our farms from probably over a five to ten year period, perhaps to a two to three year period. We would most certainly have done something like the zonal tillage unit, but would not have done something like the Viper Pro Unit and most of the chemical activities in such a short time frame," Phil says.

The work that John and Phil are doing through Reef Rescue benefit water quality by reducing the risk of sediment and particulate nutrient losses as the Controlled Traffic minimum tillage system reduces run-off and improves soil structure. There is also a reduced risk from dissolved nutrient losses, with accurate targeted sub-surface granular applications based on crop requirements. There is also a reduced risk from residual chemical losses, with accurate targeted applications based on weed pressure and replacement of residuals with knockdowns.

OUTCOMES

improving efficiency and accuracy of operations across the farm

improved soil management and fertiliser application

improved chemical management

improved water quality through reduction of sediment, particulate nutrient and residual chemical losses

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 3

REEF RESCUE
2010

IMPROVED FARMING WITH CONTROLLED TRAFFIC

Reef Rescue assisted Don Myers in converting his sugarcane farm to a Controlled Traffic Minimum Tillage System. Don received funding to modify his equipment to match the new row spacing, purchase a legume planter and install GPS guidance.

Don Myers first began making changes to the original design of his sugarcane farm in 2006. He constructed a 80 megalitre ring tank, to hold irrigation water and applied for funding through the Sustainable Landscapes program to build two sediment/detention basins.

In late 2008, Don decided to move to a 1.83 metre Controlled Traffic Minimum Tillage System and incorporate rotational legume fallow crops. He applied for support through Reef Rescue and was successful, receiving funding to assist in modifying his equipment to match the new row spacing, purchase a legume planter and install GPS guidance. 2010 will be his second year of planting on the new system.

Along with improving his soil management, Don has also been looking at ways of improving his nutrient and chemical management on farm. He uses EM mapping, soil testing and BSES Six Easy Steps to determine nutrient requirements across the farm.

After a legume crop, Don adds no nitrogen to the following plant cane crop. To improve his chemical management, Don also applied and was successful in receiving funding to help purchase a four-row Shielded Sprayer unit and to modify a four-wheeler motorbike into a high clearance spray rig.

Don says that his overall aim is to reduce his use of residual herbicides.

"This will be through applying only banded applications on top of the stool and the replacement of them with knockdowns where practical, such as in the inter-row."

Along with all of these improvements in the paddock, Don was also interested in doing some more stormwater management work and in 2009, applied to construct some more sediment/detention basins. After some negotiations, one of these structures was actually turned into a constructed

About the farm...
In 2005, Don Myers decided he was tired of doing shift work and wanted the opportunity to work for himself. So, he and his family purchased a 127 hectare sugarcane farm near Homebush, around 25km south-west of Mackay. They currently have 107 hectares under cane production. Sandy Creek borders Don's farm along the southern edge, with some big trees left amongst the riparian vegetation.

REEF CATCHMENTS | CARING FOR OUR COUNTRY

wetland and designed through the Queensland Wetlands Program being run through DPI&F (now DEEDI) at the time. Through this program, it was identified that for a constructed wetland to be able to provide water quality improvements, its surface area must be a minimum of 10% of the catchment area. In this case, Don's catchment area was 36 hectares - which means that normally, it would have had to be 3.6 hectares in size. But with Don's improved land management activities reducing losses, the structure could be made smaller to fit in the site available and still provide water quality improvements. Despite at first being skeptical about the changes and whether they would work, Don says he is glad he went through with it and is proud of the structure.

The design of the constructed wetland is completely aimed at water quality improvements. There are two deeper holes at the entry and exit points for the refuge of animals, such as fish, during the dry. However, about 80 per cent of the wetland is shallow (60 to 120 cm) to allow native water plants to grow in the water body and along the edge. Don says he was shown how the plants grow the biofilms that help breakdown nutrients and chemicals.

In November 2009, the structure was planted up with local native species around the edge and middle of the wetland.

Most survived.

"The wet season in early 2010 meant that the structure was very full for nearly four months and the water plants put in the middle will need to be replaced."

"Now, between 80 and 85 per cent of all run-off from the farm goes through a stormwater management structure."

Don says Reef Rescue helped him significantly in achieving his vision for the farm, in a shorter time frame.

"We would not have been able to do the Shielded Sprayer and the constructed wetland, and it would have taken another two to three years to get the GPS and see the full benefits of the farming system that we are trying to implement. Now, between 80 and 85 per cent of all run-off from the farm goes through a stormwater management structure."

For water quality, the benefits of the work that Don is doing through Reef Rescue includes reduced risk of sediment and particulate nutrient losses, reduced run-off and improved soil structure and reduced risk from residual chemical losses.

OUTCOMES

improved soil structure through use controlled traffic

reduced use of residual herbicides

improved stormwater management

reduced risk of sediment and particulate nutrient losses, reduced risk from residual chemical losses.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 4

REEF RESCUE
2010

CONTROLLED TRAFFIC IMPROVED FARMING SYSTEM

Reef Rescue helped Brian and John Stevens to implement a Controlled Traffic System by providing funding support for a GPS tractor kit and autosteer unit, a six-row bean planter and three-row wavy disc cultivator.

Brian and John Stevens first began converting to a Controlled Traffic System at their Ilbilbie and West Hill sugarcane properties in 1996.
They decided on a 1.85 metre system and currently plant dual rows 500 millimetres apart with a double disc opener planter.
In this time, the Stevens' have modified all of their tractors and most of their equipment for managing cane.

Brian says they only have around 16 hectares left to convert to the wider rows.
"Then we will finally have both farms entirely on the new system. Once we are all on the wider rows, our aim after last ratoon is to direct-drill a legume crop and spray out the cane. We will then spray out the legume crop, go through once with a ripper, which is a three-row zonal that can go through trash, once with a three-row wavy disc cultivator and then plant."

All of the Stevens' work will be done with a GPS.
This will help save time and money and maintain the most amount of ground cover during the fallow and replanting period.

Reef Rescue assisted the Stevens' in implementing this Controlled Traffic System by providing funding support for a GPS tractor kit and autosteer unit, a six-row bean planter and the three-row wavy disc cultivator.

Their harvesting group was also successful in receiving funding to fit a GPS on their harvesting gear, so that all the operations would now be on guidance.
"We also changed the coulters on the bean planter to double discs, or moisture seekers, and this has helped greatly to plant directly through trash and the old stool to maintain our minimum till system," John says.

On-farm trials showed the benefits of maintaining the trash,

A family business...
Brian and John Stevens are third and fourth generation sugarcane farmers.
The pair have two farms in the Plane Creek district at Ilbilbie and West Hill.
The family began farming in 1948 and have since cultivated a total cane production area of about 710 hectares.
Marion Creek flows through their Ilbilbie property and West Hill Creek through the other.

REEF CATCHMENTS
CARING FOR OUR COUNTRY

compared to cultivation for establishing legumes.

One of the biggest benefits that the Stevens' found from using GPS guidance was the reduction in driver fatigue during operations.

Driver fatigue was seen to be responsible for causing inefficient and inaccurate operations, such as harvesting, that had flow-on effects such as increased compaction in ratoons or billet losses.

Another benefit is the reduced tillage, minimising soil disturbance, helping to reduce weed pressure and the need to control them.

Along with improving their soil management, the Stevens' have been looking at ways to improve their nutrient, chemical and stormwater management on-farm too.

They utilise a three-row Stool Splitter Fertiliser Box and are currently fitting double-discs for improved sub-surface application.

"We use EM mapping, soil testing and the BSES Six Easy Steps recommendations to determine our nutrient requirements across the farm," Brian says.

For chemical management, the pair have been successfully using a new residual, called Flame, on their plant cane and this has helped reduce the need for control in ratoons.

The Stevens' have also constructed some sediment/detention basins to help with stormwater for irrigation purposes.

This leaves the sediment/detention basins empty for the next rainfall.

The work that the Stevens' are doing through Reef Rescue to improve water quality includes reducing the risk of sediment and particulate nutrient losses with a GPS-based Controlled Traffic Minimum Tillage System maintaining ground cover, reducing run-off and improving soil structure.

"Reef Rescue has really helped us to fast-track our vision for our farm from maybe a 10-year goal, to earlier than five years. We would have definitely had to prioritise activities and possibly would not have done some of it at all, without the support," Brian says.

"Reef Rescue has really helped us to fast-track our vision for our farm from maybe a 10-year goal, to earlier than five years."

OUTCOMES

save time and money and maintain the most amount of ground cover during the fallow and replanting period

reduction in driver fatigue during operations

reduced tillage, minimising soil disturbance, reducing weed pressure and the need to control them

improving water quality by reducing the risk of sediment and particulate nutrient losses, reducing run-off and improving soil structure.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 5

REEF RESCUE
2010

CONTROLLED TRAFFIC SYSTEM

Reef Rescue helped Rex Stroppiana purchase and install a GPS and make modifications to his existing three-row zonal tillage unit, planter, harvester and other equipment, so that he could convert his sugarcane farm to a 1.85 metre Controlled Traffic System.

Rex Stroppiana first worked with Reef Catchments in 2006, when he constructed a sediment/detention basin through the Sustainable Landscapes program.

When Reef Rescue was established in late 2008 and water quality grants became available for the adoption of improved management practices, Rex made the big decision to convert to a 1.85 metre Controlled Traffic System with GPS guidance and reduced tillage.

Rex received funding from Reef Rescue to help with the purchase and installation of the GPS and the necessary modifications to his existing three-row zonal tillage unit, planter, harvester (elevator extension) and other equipment to suit his new row spacing.

Rex says he also added double-disc openers in front of his wide shute single row planter, to suit his reduced tillage system.

"After all the time in the shed, I finally planted my first cane at 1.85 metres in 2009."

During the conversion phase from 1.5 metres to 1.85 metres, it was still necessary to cultivate the ground to get rid of the old stool and compaction areas.

Currently, Rex still needs to offset and rip the ground to prepare it for planting. This is done on GPS, so there is no overlap.

Rex then uses his zonal tillage unit to work only the ground where he is going to plant. Once fully converted over, Rex hopes to mainly use his zonal tillage unit to renovate and prepare the ground for planting.

Rex says that with the GPS and zonal tillage unit, he saves about half of the costs he used to have with conventional cultivation.

"I have gone from using around 200 litres per hectare of diesel to about 100 litres per hectare and hope to improve on this into the future."

Along with improving his soil management, Rex has also been improving his chemical and irrigation management on farm.

About the farm...
Rex Stroppiana is a third generation farmer who owns and manages a sugaroane property at Devereux Creek, 35km west of Mackay. The property size is 301 hectares, with 250 hectares under sugaroane production and five hectares of forestry. The property is bordered by Devereux Creek and the Pioneer River. The property has water allocation from the river, which is transferred to on-farm storages to be used for irrigation.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Through Reef Rescue, he also received a small amount of funding to purchase and install computerised controls and new guns on two hard hose irrigators.

"I have a lateral overhead low-pressure irrigator on my flat country, but need the high-pressure on my broken sloped country. With the control, I can now put out exactly what I want, reducing the risk of run-off. By using WaterSense for scheduling, it will go on at the right time," Rex says.

To improve his chemical applications, Rex received funding for a high clearance spray rig. He is keen to make the rig as flexible as possible with spraying different chemicals at different times on varying row spaces. The rig consists of a seven-row boom, legs and droppers with air-induced nozzles, two tanks, two pumps and two controllers. It can be set up to spray any row spacing from 1.5 metres to 1.85 metres and can be used across the farm while Rex is converting to the wider rows, or by other growers. The boom can be used to spray out fallows, but will mainly be used for applying knockdowns for vine control at the out-of-hand stage.

At the same time, the legs have been set up to be used to spray knockdowns in the inter-row. For his plant cane, the droppers will be used for a banded application of residual herbicide directly over the bed.

Rex says this will automatically cut out half of the residual he applies on-farm. Because the spray rig allows Rex the ability to do weed control at the out-of-hand stage, he has more opportunity to utilise knockdowns over residual chemicals where practical.

Reef Rescue was the catalyst for Rex to make these big changes on his farm.

Without the water quality grants, Rex says he was always keen to use GPS and zonal tillage, but would not have made the decision to go out to the wider rows and modify all of his equipment.

"The chemical and irrigation management improvements allowed us to complete jobs in one year, that might have taken over three years, allowing us to look at what can be done next," Rex says.

He is also keen to look at improving his nutrient management through the use of a spreader for organic-based fertilisers or the possibility of split applications of Liquid N.

The water quality benefits of the work Rex is doing through Reef Rescue include reducing the risk of sediment and particulate nutrient losses with a Controlled Traffic minimum tillage system on GPS guidance decreasing soil exposure over a crop cycle, reducing run-off and improving soil structure.

Rex is also reducing risk from residual chemical losses with accurate targeted applications based on weed pressure reducing the amount of residual applied and the replacement of residuals with knockdowns where practical throughout a crop cycle.

OUTCOMES

saving costs by almost 30 per cent

improving soil, chemical and irrigation management

reducing the risk of sediment and particulate nutrient loss, decreasing soil exposure, reducing run-off and improving soil structure

reducing the risk of weed pressure

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Horticulture Case Studies

Case Study 1

REEF RESCUE
2010

UNDER-CANOPY IRRIGATION SYSTEM

Reef Rescue has helped David Hunter implement big changes on his organic banana farm. With the Reef Rescue funding, David was able to put a stop to run-off caused by irrigation, by implementing an under-canopy micro sprinkler irrigation system with fertigation capabilities.

In 2000, David Hunter became interested in becoming a certified organic farmer and so began the first steps towards changing his farm.

In 2006, David became certified A-grade organic. Since then, he has been busy doing significant revegetation of native species across his farm.

This has included major efforts in planting up bare hill slopes and putting in wind-breaks for crop protection.

To be certified organic means that David is not allowed to use chemicals to control pests such as weeds, rats and insects on his farm. Dave says all of the weed control is currently done mechanically, by slashing and brush cutting.

He has also tried to encourage biological control of rats, by placing owl boxes throughout his farm.

During his fallow, David also utilises brassica crops that can help provide a natural control for soil pests such as nematodes.

For nutrients, David says he is only allowed to use certified organic fertilisers.

"We make our own compost on-site from a range of organic sources such as chook manure, and this is spread out under the bananas."

David also uses a legume crop called Pinto Peanuts in his crop and inter-row to help provide some nitrogen and ground-cover leaving no soil exposed.

One area of the farm that Dave was keen to improve, was his irrigation system.

He currently uses a high pressure overhead sprinkler system and was noticing some issues.

"In the Mackay region, we need to have a lower planting density than up north, to let sun into the crop during our colder winter."

About the farm...
David Hunter owns and manages an organic banana farm at Cameron's Pooket, near Calen, 55km north west of Mackay. The beautiful St Helens Creek an Eungella National Park border the 50 hectare property, which has nine hectares under banana production. When David moved to the property in 1989, banana crops were already established. The photo above, taken in March 2010, shows damage the property sustained during Tropical Cyclone Ului.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Also, with the decreased canopy cover, some run-off was caused by irrigation.

Dave was keen to prevent this run-off, and was successful in getting Reef Rescue funding to implement an under-canopy micro-sprinkler irrigation system with fertigation capabilities.

This means he will change the entire set-up of his farm to suit the new system and obtain the most benefits.

"We will be going into a double row of bananas so as to maximise the three metre diameter of the micro-sprinklers and get the best root growth from the crop," David says.

There will be reduced losses from evaporation, and David can use this as a fertigation system for applying fertilisers like fish emulsion and trace elements such as Boron and Zinc.

"We make our own compost on-site from a range of organic sources such as chook manure, and this is spread out under the bananas."

"This means we can apply the right amount at the right time and have confidence in the equipment we are using."

Reef Rescue has helped David start to implement the big changes on his farm. He was always keen to look at adopting an improved irrigation/fertigation system, but the cost was going to make it a long-term project.

David says he can now speed up the process and complete it within just a couple of years, rather than five to 10 years.

The work David is doing through Reef Rescue towards improving water quality include reducing the risk of sediment and particulate nutrient losses from maintaining a good inter-row ground cover and implementation of an irrigation system that will not cause any run-off.

David is also reducing the risk of dissolved nutrient losses with accurate-targeted nutrient applications through a fertigation system and nutrient rate based on crop requirements.


Biological control of rats with owl boxes


Before and after revegetation

OUTCOMES


preventing run-off caused by irrigation


reduced losses from evaporation and best root growth possible


protecting riparian areas


increasing water quality by reduced risk of sediment and particulate nutrient losses from good inter-row ground cover. reduced risk from dissolved nutrient losses

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Case Study 2

REEF RESCUE
2010

WET SEASON COVER CROP

Reef Rescue helped Tony Soden to implement a cover crop in his fallow to maintain ground cover during the wet season. The funding will also assist Tony in putting organic matter back into his soil and out-compete weed species during production of his eggplant, pumpkin and melon crops.

Out of the 200 hectares used for horticulture crop production on Tony Soden's Longford Creek property, half is spelled and the other half is planted up, so that around 100 hectares is utilised each year.

From this, around 80 hectares produces eggplant and the other 20 is used for pumpkins or melons to provide crop rotation throughout the farm.

Tony was successful in receiving Reef Rescue funding to help him implement a cover crop in his fallow to maintain ground cover during the wet season, put organic matter back into the soil and to out-compete weed species so they don't seed and generate during crop production.

After the 100 hectares has been spelled for 12 months, he does some ground preparation so that he can plant a cover crop, such as sorghum, during the wet season from December to April.

The cover crop is then incorporated and the ground bedded-up, ready for planting eggplant (5ft 4" rows) or pumpkins and melons (10ft 8" rows).

Plastic is placed on top of the beds, with trickle tape beneath it.

Tony says that he also has three filtration and fertigation units, so that 100 per cent of the farm is covered.

"We plant with a set-planting fertiliser mix and then utilise our fertigation system to apply the right amount of nutrients at the right time, based on crop stage and any nutrient deficiencies. The aim is for a maximum of three to four fertigation applications during a crop cycle."

About the farm...
Tony Soden is a seoond generation farmer who owns and manages a property at Longford Creek, 40km north of Proserpine. His family bought the property in 1978. Half of the 400 hectares is used for cattle, while Tony grows eggplant, pumpkin and melon on the other. Eden Lassie Creek and other small oreeks flow through the property, providing water for stook and irrigation purposes by transferring to on-farm storages during the summer wet season.

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Despite the plastic providing weed control amongst the crop, there are still issues of weeds in the inter-row.

Depending on rainfall, Tony needs to do maybe a maximum of two knockdown chemical applications during a crop cycle to control the weeds.

The eggplants are then handpicked and brought back to the packing shed before being placed in cold storage ready to be trucked away.

Tony aims to establish 10,000 eggplants per hectare and half a case per plant - that's 5000 cases per hectare.

During the busiest time of the season, Tony employs a number of pickers and packers to help get his entire crop off the paddock.

He has been making great changes on his farm to maximise production, while minimising impacts to natural resource condition, such as water quality, leaving his farm.

Reef Rescue has helped Tony to implement his cover crop during the wet season, when economic reasons meant that it may not have been able to be done each year.

For water quality, the benefits from the work that Tony is doing through Reef Rescue includes reducing the risk of sediment and particulate nutrient losses by using a cover crop to maintain good ground cover during the wet season.

Tony is also reducing risk from dissolved chemical losses with reduced herbicide usage during the crop stage.

OUTCOMES

maximising production while minimising impact on natural resource condition

putting organic matter back into the soil

out-competing weed species and reducing weed pressure

reducing risk of sediment and particulate nutrient loss by maintaining good ground cover

REEF CATCHMENTS

CARING FOR OUR COUNTRY

Appendix 3: Economic Analysis

3.1 Grazing Economic Review

Estimating the economic implications for grazing properties in the Mackay Whitsunday catchments of practice changes to more sustainable landscapes

Miriam East

Agricultural Economist

Primary Industries and Fisheries, Mackay

June 2009

Introduction

This report has been prepared for Reef Catchments to determine the costs and benefits of changes to management practices for grazing properties in the Mackay Whitsunday region.

Analysis of the costs and benefits associated with adoption of intensive grazing best management practices is required to determine the effect on the profitability and economic sustainability of grazing enterprises, and the economic viability of capital investment to achieve best management.

Reef Catchments is the natural resource management organisation for the Mackay Whitsunday region. Reef Catchments work in a variety of ways to improve catchments in the region that flow to the reef. Recent substantial funding from the Australian Government's Reef Rescue initiative has seen an allocation of funds to graziers, horticulturalists and sugarcane producers to improve their land management practices, thus assisting to protect the reef from climate change and improving water quality.

Reef Catchments have identified that while there is good understanding of the management process required for each of the respective classification levels, there is poor understanding of the likely economic implications for a grazier seeking to move from D or C level classification to B or A. In addition, while there is a significant amount of understanding of the impact of best management practices adoption on farm enterprise economic viability for extensive grazing operations, little information exists for the intensive coastal grazing systems. These intensive grazing systems heavily utilise soil, nutrient and chemical management practices and are the dominant grazing based operations within the Mackay Whitsunday (MW) region as well as much of the Terrain and Mary Burnett NRM regions within coastal environments.

Project Methodology

Reef Catchments has categorised grazing management practices into four classification levels (A, B, C and D). D class represents a lack of grazing management practices moving to A class which describes cutting edge management (see Table 1 for descriptions). The management practices carried out on individual grazing properties lies somewhere within these descriptive parameters. In reality, an individual property may use management practices that fit into different categories, for example, some watercourses may have been fenced (Class B practice) but may run cattle at a continuous set stocking rate (Class C practice). To simplify this analysis, the management practices of the representative farms are considered to fit neatly

into each classification level. The A, B, C, D classification framework for management practices is detailed in the Mackay Whitsunday Water Quality Improvement Plan (Drewry, Higham & Mitchell 2008). The grazing management practices are shown in Table 1.

Table 1: Soil management practices for grazing classified in the ABCD framework.

D Class Grazing Soil Management	C Class Grazing Soil Management
Description: No pasture management 1. High stocking rates 2. Minimal infrastructure 3. Pasture utilisation exceeds sustainable thresholds 4. Emergency feeding or de-stocking required every year 5. No weed management	Description: Basic pasture management 1. Continuous set stocking rate 2. Minimal infrastructure 3. Pasture utilisation regularly exceeds sustainable thresholds in dry season 4. Emergency feeding or de-stocking required one in three years 5. Records kept in daily diary
Resource condition indicators (one or more indicators): 1. General lack of any perennial grasses 2. Increasing areas of bare ground. Erosion problems in fragile soils 3. Thickets of woody plant growth 4. Riparian areas very degraded	Resource condition indicators (one or more indicators): 1. General decline in perennial, palatable and productive (3P) grasses 2. Increase in less desirable pastures 3. Susceptible to erosion 4. Some increase in areas of bare ground 5. Increase of weeds 6. Riparian areas degraded
Planning and record keeping: 1. None	Planning and record keeping: 1. Basic pasture management 2. Keep daily diary
Capital: 1. Basic boundary fence 2. Basic internal fencing and watering	Capital: 1. Same as Class D
B Class Grazing Soil Management	**A Class Grazing Soil Management**
Description: 1. Six monthly pasture monitoring used to adjust stocking rates annually 2. Some soil testing & nutrient deficiency remediated 3. Some grazing to land types 4. Some drainage lines and watercourses separated by internal fences 5. Pasture utilisation exceeds sustainable thresholds 3 in 10	Description: 1. Monthly pasture monitoring used to adjust stocking rates as required 2. Soil testing & soil nutrient deficiencies remediated 3. All grazing to land types 4. All major drainage lines and watercourses separated by internal fences 5. Pasture utilisation exceeds sustainable thresholds rarely.

years 6. Pasture spelling incorporated into management 7. Emergency feed core breeders 8. Records kept in Paddock Journal	Pasture utilisation never exceeds sustainable thresholds for drainage lines and watercourses 6 – 8. Same as Class B
Resource condition indicators (one or more indicators): 1. Some decline in 3P grasses 2. Some minor weeds 3. Some decline in soil condition 4. Some thickening of woody plants 5. Some decline in riparian condition	Resource condition indicators (all indicators at this level): 1. Good cover of 3P grasses 2. No significant weeds 3. No erosion and good soil surface condition 4. No sign of woodland thickening 5. Riparian areas in good condition
Planning and record keeping: 1. Identify grazing land types and pasture types for each paddock using existing farm maps 2. Develop and implement Grazing Land Management Plan, including plan for water infrastructure 3. Keep records in Paddock Journal 4. Record pasture condition and cattle production 5. Adjust Grazing Land Management Plan the following year if required	Planning and record keeping: 1 – 5. Same as Class B – but with more formal documentation and accurate record keeping
Capital: 1. Some fencing to separate grazing land types drainage lines and watercourses 2. Some off-stream watering points	Capital: 1. Stock fences to separate grazing land types & all major drainage lines and watercourses 2. All off-stream watering points

Herd gross margins were calculated using Breedcow Plus in the Breedcow and Dynama Herd Budgeting Software (Holmes 2009).

A benefit cost analysis (or discounted cash flow analysis) is presented to evaluate the investment potential where capital investment is required to implement the proposed grazing management changes. The benefit cost analysis estimates the net present value (NPV) of the incremental net cash flow stream over 20 years following a capital investment. The net present value is the estimation of the difference in annual cash flow for the farm, with and without the proposed investment. This analysis is presented to determine the viability of investments in land regeneration, fencing and watering points for the grazing enterprise to operate in a higher class of management actions. The increase in land value (if any) of the capital investment has not been included in the analysis. If it is expected that the capital investment in improved grazing management practices will increase the land value, then the reader can consider the increase in value together with the net present value of the investment.

The benefit cost analysis over 20 years has been calculated for four scenarios:

Scenario 1: 200 hectare north MW property - grazier transition from D class to A class management practices through the 20 years.

Scenario 2: 200 hectare north MW property - grazier transition from C class to A class management practices through the 20 years.

Scenario 3: 1000 hectare south MW property - grazier transition from D class to A class management practices through the 20 years.

Scenario 4: 1000 hectare south MW property - grazier transition from C class to A class management practices through the 20 years.

Representative or "typical" farms have been used for the analysis based on the majority of properties within the Mackay Whitsunday region. This allows graziers to compare their own property with the results that most closely match their own situation.

The smaller representative modelled farm is 200 hectares of grazing land located in the northern section of the Mackay Whitsunday region. It is assumed that the property is comprised of 42% eucalypt hills and ranges (85ha), 34% poplar gum woodlands (67 ha), 14% coastal tea tree plains (28 ha) and 10% alluvial flats and plains (19 ha). See Appendix 1 for details of each land type.

The larger representative modelled farm is 1000 hectares of grazing land located in the southern section of the Mackay Whitsunday region. It is assumed that the property is comprised of 26% eucalypt hills and ranges (258ha), 24% poplar gum woodlands (241 ha), 33% coastal tea tree plains (330 ha), 8% alluvial flats and plains (76 ha) and 10% coastal wetlands (95 ha). See Appendix 1 for details of each land type.

Farm Model Assumptions

Most assumptions are consistent for both representative property sizes, however, the larger property is expected to have more purchasing power which results in some lower costs. The assumptions consistent for both property sized are:

- The properties are assumed to run a breeding cattle herd turning off store weaners which are sold at the Sarina saleyards. All older heifer, cow and bull sales are direct to Borthwicks meat processors.
- An owner operator wage and other fixed costs have not been included in the analysis as the analysis focuses on the grazing enterprise rather than whole farm profit. In addition, it is expected that for most smaller grazing properties in the Mackay Whitsunday region the owner operator wage is supplied by either a cane enterprise or off-farm income.
- It is assumed that land on which D class management actions are practiced will be in D land condition, land with C class management will be in C condition, and so on. In reality this may not always be the case, however, if land is in good condition but D class management actions are consistently practiced, the land will revert to D condition over time.
- When operating with C and D class management practices, it is assumed that over-stocking is occurring. Therefore, the analysis assumes that when practicing C and D class management, the land is stocked to the B condition stocking rate (emergency feeding keeps the stocking rate above what the pasture can carry). When operating with B or A class management, it is assumed that sufficient skill has been acquired in pasture monitoring so that the stocking rate is correct for the B or A condition land, respectively.

- Emergency feeding is assumed to be required in all classes of grazing soil management. However, the frequency decreases as a landholder moves towards A class management. In D class feeding is required for six months 8 in 10 years. In C class feeding is required for six months 3 in 10 years. In B class feeding is required for six months 2 in 10 years. In A class feeding is required for three months 2 in 10 years.
- Pasture re-establishment is required to move from D condition land to C condition land or better. Pastures in D condition are assumed to be fully weed infested and require spraying and cultivation in preparation for re-seeding with improved pasture species. Cultivation should only be undertaken on slopes with lower gradient. In this analysis, the relatively flat land received two cultivations in preparation for sowing, land with a slight slope received one cultivation and land with higher slopes unsuitable for cultivation were burned then aerial seeded. Pastures are assumed to be re-sown with improved grass species suitable for each land type and the specific enterprise feed requirements. For this analysis, the representative properties have been re-sown with a mixture of Callide Rhodes grass with a legume component, Signal grass, Pangola grass, and Creeping Bluegrass with a legume component.
- Fertiliser is assumed to be required to bring all soil types from D condition to C condition, and then fertiliser is required to maintain pasture productivity and reduce weed competition. Fertiliser applications should be tailored to meet the specific mineral requirements of the land type, pasture species and cattle enterprise through regular soil tests. The fertiliser is best applied towards the end of the wet season (April/May) to minimise leaching and to allow the grass to "bulk up" prior to the onset of cooler temperatures in autumn/winter that slow grass growth (Bishop, n.d.). For this analysis, it is assumed that 100kg/ha fertiliser (Di-Ammonium Phospate - DAP) is required at re-sowing of all grasses (Bishop, n.d.) and periodically through the 20 years to maintain the soil phosphorus level at around 15 parts per million.
- Fencing is assumed to be required to assist the land regeneration from D and C condition to B and A condition. It is assumed that 1km per 100ha would need to be constructed to move from D class management to C class management, reflecting some fencing of riparian areas and land types. A further 1km per 100ha would need to be constructed to move from C class management to B class management, reflecting the fencing of all riparian areas and land types. Cost of fencing is assumed to be $7,000 per kilometre, which is a contractor cost for fence construction and includes the cost of fence materials and labour. Annual fence maintenance costs have also been included at 5% of the value of the fences constructed.
- It has been assumed that pasture monitoring will be undertaken by graziers who have been using D class practices in preparation for pasture re-establishment. This is in association with education through attending a Grazing Land Management course and the Stocktake course. The pasture monitoring in advance of the pasture re-establishment is a learning phase so that the pasture re-establishment will be successful and the correct stock pressure applied at all times of the year. So in D class it is assumed that 1 site per land type will be monitored twice per year, and the same for C class management. For B class and A class management it is assumed that 2 sites per land type will be monitored twice per year. Although there are no direct costs of pasture monitoring, a cost of $40 per site per monitor is included to cover the labour cost of completing the pasture monitoring.

Due to the large difference in property size of the two representative grazing properties, there are economies of scale involved that enable the large property to purchase some inputs at a lower per unit cost than the small property, such as fence materials, fertiliser and cattle drench. These input costs are 3% lower for the large property in the analysis. In addition, some of the capital costs required to transition a property from D class management to A class management do not increase at the same rate as the increase in hectares. The following assumptions have been used with the small property assumptions in the left column and the large property assumptions in the right column.

- Watering points are assumed to be required for stock watering as riparian fencing is constructed to limit watering at natural water sources. Cost of watering point materials (poly pipe, tank & pump) and installation is estimated at $8,000 per water point. See Table 2 for number of water points. A labour cost for checking the new watering points has been included at 2 hours per water point per month at $25 per hour.
- Soil tests are assumed to be required to provide analysis of soil mineral and nutrient deficiencies. The soil tests advise the fertiliser applications to improved pastures. See Table 2 for number of soil tests. Cost of soil test is assumed to be $140 each.

Table 2: Assumptions that vary for small vs. large properties

200 hectare property	1000 hectare property
Watering points	
It is assumed that 1 new watering point per 100ha will be required in the transition from D class management to C class management. A further 1 new watering point per 100ha will be required in the transition from C class management to B class management.	It is assumed that 1 new watering point per 200ha will be required in the transition from D class management to C class management. A further 1 new watering point per 200ha will be required in the transition from C class management to B class management.
Soil testing	
It is assumed that 1 soil test be conducted to inform the pasture re-establishment required in the transition from D class management to C class management. Once in C class management, it is assumed that there is an annual soil test. In B class management 2 soil tests are assumed annually. In A class management, 4 soil tests are assumed annually (one per land type) which inform fertiliser applications.	It is assumed that 2 soil tests be conducted to inform the pasture re-establishment required in the transition from D class to C class management. Once in C class, it is assumed that there is 2 soil tests annually. In B class management 4 soil tests are assumed annually (one per land type, excluding the coastal wetland). In A class management, 8 soil tests are assumed annually (two per land type, excluding the coastal wetland) which inform fertiliser applications.

- Animal husbandry costs, gross cattle prices, freight costs and selling costs per head are detailed in Appendices 2 - 4.
- The modelled examples have been tested with a Reef Catchments Cattle Working Group to verify the assumptions and farming systems modelled.

Results

The base case management **level D** describes a lack of grazing management where overgrazing pressure has caused a significant decrease in productive, perennial and palatable (3P) grasses with a corresponding increase in weeds. In this base case most stock watering points are natural watercourses. Changes to

grazing management to move from **level D to level C** are relatively large and require significant capital investment. It is expected that graziers would take part in both the Stocktake and the Grazing Land Management workshops. These workshops result in a much greater understanding of pasture growth, stock feed requirements and safe pasture utilisation levels for each land type. In addition, through the workshops graziers develop a Grazing Land Management Plan and install new fencing and watering points to protect fragile riparian areas. After these works are completed, Level D land is expected to require a complete destock for a minimum of 12 months. During this time, remedial works such as construction of contour banks and trash cropping may be required, as well as resowing of 3P pasture grass species and weed control. To maintain newly re-established pastures in C, B or A condition, appropriate care must be taken by practicing management actions contained in B and A class.

To move from **level C to level B** requires further capital investment as well as education. Soil tests and additional pasture monitoring per land type every six months allow for nutrient deficiencies to be corrected and stocking rates to be adjusted annually. Pasture spelling every few years assists in maintaining pastures in good condition. Further fencing and water points are installed to separate all land types, drainage lines and watercourses, with all watering points now off-stream.

As a grazier undertakes a move from **level B to level A**, the changes in grazing management are smaller and build upon changes made to reach level B. Additional soil testing to remediate soil nutrient deficiencies is carried out so that each land type is tested individually. This allows fertiliser application to be very accurate, thus only applying the correct volume of fertiliser and minimising loss of nutrients through poor timing or unnecessary application. Pasture monitoring becomes more frequent as required, with stocking rates adjusted when necessary, and a regular planned pasture spell during the wet season is incorporated into pasture planning.

The three main benefits of these cumulative grazing management changes are:

1. Higher conception rates for 2 year old heifers (first mating) and cows (subsequent matings). This results in higher weaning percentages as the grazier moves towards level A.
2. The quality (weight and general appearance) of weaners, and culled heifers/cows is better when they are turned off, resulting in a higher price.
3. The greater volume of pasture available per head results in a reduction in the number of years emergency feeding is required to sustain livestock – lower costs.

The gross margins for both properties operating with each set of management practices are shown below in Table 3. The gross margin for an operation within a stable herd structure is equivalent to the gross income received less the variable costs incurred. Variable costs are those directly attributable to an animal which vary in proportion to the size of the operation, such as animal husbandry and marketing expenses. A gross margin is not a measure of farm profit as it does not take into account the fixed costs of the enterprise. These fixed costs include: rates, operators labour, insurance, depreciation, administration, and so forth.

The modelled gross margins when operating with B, C and D management practices assume that the 200ha property is carrying 85 adult equivalents (AE's), which is over-stocked when the land is in C and D condition but the correct stocking rate when the land is in B condition. Likewise, the stocking rate of 562 AE's for the 1000ha property is over-stocked in C and D condition but correct for the B condition land. For both properties, the A condition stocking rate is the correct stocking rate for the pasture. Therefore, as a grazier moves from D class management practices through to B class management practices, the stocking rate for the property does not increase, rather the stock already running on the property are assumed to have better liveweight, condition and weaning rates, and the amount of emergency feeding reduces. As a

grazier moves from B class management to A class management, the stocking rate increases for the property in accordance with the improved pasture condition. The gross margin per AE is calculated based on the husbandry costs, gross cattle prices, freight and selling costs, weaning rates and stock weights as detailed in Appendices 2 – 4. The gross margin figures do not include the emergency feeding costs or any capital costs involved with changing from D and C class management to B and A class management. These costs are included in the net present value analysis.

Table 3: Gross Margins

	A	B	C	D
200ha north MW representative property				
Herd gross margin	$16,823	$8,901	$5,394	$3,119
Gross margin per AE	$148.88	$104.72	$63.46	$36.69
AE's run	113	85	85	85
1000ha south MW representative property				
Herd gross margin	$112,182	$59,627	$35,764	$20,525
Gross margin per AE	$150.58	$106.10	$63.64	$36.52
AE's run	745	562	562	562

The gross margins shown above in Table 3 are the gross margins for the whole cattle herd under each scenario and land condition. Note that the gross margin does not include the owner operator's labour to manage the herd. The herd gross margins for the 200ha property are low, indicating that the majority of graziers with a herd around 100 AE's would operate with some additional income external to the cattle enterprise, potentially external to the farm.

Net present values are calculated from the discounted cash flow for capital investments over a 20 year time period using a 5% discount rate. Benefit cost ratios are also provided to assist in determining the viability of the capital investment. The benefit cost ratio is the ratio of the sum of the discounted costs of the investment to the sum of the discounted benefits over the 20 year investment period. The benefit cost ratio tells the return over a 20 year period for every dollar spent in present dollar value. For an investment to be viable, the benefit cost ratio needs to be equal or greater than 1. Discounting is used to bring all costs and benefits over the 20 years to present values so that comparisons can be made between investment options.

Table 4: Discounted cash flow analysis

	D-A	C-A
200ha north MW representative property		

Net present value	**-$94,970**	**-$71,177**
Benefit cost ratio	0.60	0.63

1000ha south MW representative property		
Net present value	**$87,299**	**$103,754**
Benefit cost ratio	1.07	1.12

The net present value of undertaking the capital investment required to move a typical 200 hectare property located in the north Mackay Whitsunday region and using D class management practices to a position where all A class practices are used is -$94,970. If the property is initially using C class management practices and moves to A class practices, the net present value is -$71,177.

The net present value of undertaking the capital investment required to move a typical 1000 hectare property located in the south Mackay Whitsunday region and using D class management practices to a position where all A class practices are used is $87,299. If the property is initially using C class management practices and moves to A class practices, the net present value is $103,754.

The negative NPVs for the 200ha property indicate that the increases in cattle production and the gross margin are insufficient to cover the large capital investment required, while the larger operation of the 1000ha property makes a positive return. Despite the smaller capital costs when moving from C class to A class as pasture re-establishment is not required, the NPV is larger but still negative for the 200ha property, as the change in gross margin is also smaller. The benefit cost ratios less than 1 indicate that a grazier from a 200ha size property is better off to not invest in moving from D or C class management practices to A class practices under the scenarios analysed. So, for most typical smaller properties using D class or C class management practices, it is likely that financial incentives will be required to help offset some of the capital costs and assist the grazier move towards A class practices.

On the other hand, the positive net present value and benefit cost ratio greater than 1 indicate that investment into management practice improvement is profitable for the larger 1000ha properties. Therefore, education alone may encourage some of these larger graziers to improve their management practices, however, due to the riskiness of many of the transition activities and the relatively low return on investment, financial incentives may still be required for larger graziers.

The costs of management practice improvement are likely to vary greatly between individual properties. Characteristics such as the number and extent of land types on the property, the extent of riparian areas, the existing fences, etc. will all influence the costs of undertaking management practice improvement. Therefore, individual property assessment is required to determine the costs relevant to the specific property before embarking on the transition process, and also when determining any incentive payments applicable.

The net present values shown in Table 4 are based upon the various assumptions detailed earlier. As noted above, many of the costs used in the analysis are variable depending on the individual farm circumstances and also on factors external to the farm. Also, there are many risks in the process of improving the grazing

management practices of a grazier, such as partial or full failure of re-establishing pasture species, which may result in costs higher than those used in this analysis, thus further increasing the unattractiveness of the project. To account for some of the variability in costs, sensitivity analysis has been carried out below.

Sensitivity Analysis

Sensitivity analysis has been undertaken to show the volatility of the modelled results to changes in cattle prices and changes to fertiliser application rates. Cattle prices are highly variable both between and within seasons. The prices used in the analysis are considered reasonable for the Mackay region, however, every grazier knows that prices fluctuate widely based on rainfall, feed availability, the Australian dollar, and local and export demand. The fertiliser application rates are constant in this analysis, however, as a grazier improves management practices towards A class, the fertiliser application rate is closely tied to the soil tests. As fertiliser is such a large expenditure to maintain pasture condition in the more productive levels, sensitivity analysis has been undertaken to show the volatility of the modelled results to changes in the quantity of fertiliser applied.

Table 5 shows the volatility of the modelled results to changes in cattle prices. For the 200ha property, changes in cattle prices bring a reasonably proportionate increase (decrease) in the NPV when changing from D class or C class to A class. For example, a 25% increase (decrease) in cattle prices results in a 31% increase (decrease) in the NPV for a change from D class to A class, while it results in a 47% increase (decrease) in the NPV when changing from C class to A class.

Table 5: Sensitivity analysis on cattle prices

	D-A	% change	C-A	% change
200ha north MW representative property				
NPV with 25% higher cattle prices	-$65,901	31%	-$37,382	47%
NPV with 10% higher cattle prices	-$83,337	12%	-$57,660	19%
Base NPV	**-$94,970**	**0%**	**-$71,177**	**0%**
NPV with 10% lower cattle prices	-$106,593	-12%	-$84,694	-19%
NPV with 25% lower cattle prices	-$124,039	-31%	-$104,972	-47%
1000ha south MW representative property				
NPV with 25% higher cattle prices	$264,964	204%	$325,365	214%
NPV with 10% higher cattle prices	$158,364	81%	$192,392	85%
Base NPV	**$87,299**	**0%**	**$103,754**	**0%**
NPV with 10% lower cattle prices	$16,236	-81%	$15,106	-85%
NPV with 25% lower cattle prices	-$90,363	-204%	-$117,865	-214%

On the other hand, the results of the 1000 ha property are very highly sensitive to the cattle price used for the analysis. Table 5 shows that for the large property changing from D class to A class, a 10% increase (decrease) in cattle prices leads to a 81% increase (decrease) in the NPV, or a 204% increase (decrease) with a 25% increase (decrease) in cattle prices. Likewise, a change from C class to A class is also very sensitive to the cattle prices used, with a 25% increase (decrease) in cattle prices increasing the NPV by greater than 3 times or 214%. The greater sensitivity of the results for the 1000 ha property are explained by the significantly greater number of cattle sold each year and the lower capital costs relative to the number of cattle.

Table 6 shows the volatility of the modelled results to changes in the amount of fertiliser applied. In recent years fertiliser prices have continued to increase and therefore, the rate of fertiliser application has become more of an issue. This analysis has sought to apply the amount of fertiliser required to maintain healthy pastures for cattle production with around 15 parts per million (ppm) phosphorus. However, the actual fertiliser required on individual properties may be higher or lower than the base rate of 100kg/ha used in this analysis. Table 6 shows for the 200 ha property moving from D class management to A class management, if only 75kg/ha fertiliser is applied, the NPV increases by 19% to -$77,021 for the 20 year investment, while if 150kg/ha fertiliser is applied, the NPV decreases by 38% to -$130,868.

Table 6: Sensitivity analysis on fertiliser application rates

	D-A	% change	C-A	% change
200ha north MW representative property				
NPV with 75kg/ha fertiliser	-$77,021	19%	-$50,447	29%
Base NPV (100kg/ha fertiliser)	**-$94,970**	**0%**	**-$71,177**	**0%**
NPV with 125kg/ha fertiliser	-$112,919	-19%	-$91,907	-29%
NPV with 150kg/ha fertiliser	-$130,868	-38%	-$112,636	-58%
1000ha south MW representative property				
NPV with 75kg/ha fertiliser	$182,188	109%	$213,292	106%
Base NPV (100kg/ha fertiliser)	**$87,299**	**0%**	**$103,754**	**0%**
NPV with 125kg/ha fertiliser	-$7,590	-109%	-$5,785	-106%
NPV with 150kg/ha fertiliser	-$102,479	-217%	-$115,323	-211%

The NPV for the 1000 ha property is quite sensitive to the fertiliser application rate. Table 6 shows that when moving from D class management to A class management, if only 75kg/ha fertiliser is applied, the NPV increases by 109% to $182,188, while if 150kg/ha fertiliser is applied, the NPV decreases by 217% to -$102,479. The high sensitivity to the fertiliser application rate is due to the larger area of pastures to be fertilised and the lower capital costs relative to the size of the property.

Conclusion

The analysis has shown that based on the assumptions used, it is likely that few small graziers will voluntarily move from D class and C class management practices to A class practices due to the negative economic returns from the capital investment required to make the transition. Larger graziers may just require education to be willing to voluntarily move towards A class management as the economic return from the capital investment is positive over 20 years. However, the costs of change will vary significantly between properties due to property specific characteristics, and so individual property assessment is essential to inform the change process for the graziers involved.

The analysis shows that financial incentives are likely to be required to encourage smaller graziers to invest in changing their management practices towards A class. Financial incentives may also be required by larger graziers to encourage practice change due to the riskiness of the capital investment.

Higher cattle prices than the ones used in the analysis are likely to improve the economic potential of investments into management practice improvement, although even with higher cattle prices, incentives are still likely to be required to offset the large capital costs and cattle prices are volatile. If individual grazing properties require less (more) fertiliser than used in this analysis to maintain their high animal productivity when using B class and A class management, then the economic return from the capital investment will be higher (lower).

The resulting conclusion from this analysis is that the capital costs of regenerating poor condition land are large, so if land is in good condition… prevent it declining. While there are additional annual costs to the grazing enterprise when operating with B and A class management, in most years the gross margin associated with the higher productivity cattle herd would cover the additional operating costs.

References

Bishop, H. n.d., Pastures: Mackay Whitsunday region: A guide for developing productive and sustainable pasture-fed grazing systems, Department of Primary Industries & Fisheries and Mackay Whitsunday Natural Resource Management Group.

Drewry, J., Higham, W., and Mitchell, C. 2008, Water Quality Improvement Plan: Final report for Mackay Whitsunday region, Mackay Whitsunday Natural Resource Management Group.

Holmes 2009, Breedcow and Dynama Herd Budgeting Software, Queensland Primary Industries and Fisheries.

Appendix 4. ABCD Management Frameworks

4.1 Grazing ABCD Management Framework

Mackay Whitsunday Region Grazing management Practices

ABCD Management Frameworks

A ‘path for improvement’ for graziers and the extension staff who support them

2010-2011

The *Mackay Whitsunday grazing management practices: ABCD management frameworks* document has been designed to support the identification and validation of grazing management practices that can improve both freshwater and marine water quality and ecosystem health as identified in the Water Quality Improvement Plan (WQIP), (Drewry, J., Higham, W., Mitchell, C. 2008). A pivotal stage in the WQIP process was the development of the ABCD framework. The ABCD framework was designed to highlight and facilitate communication about the different levels or standards of management practice (as opposed to resource condition) within the grazing industry for different water quality parameters (i.e. sediment, nutrients and chemicals). The classification provides a definition and a scale of improvement from dated to current best practice through to future aspirational or 'cutting edge' practices.

Over time, changes in knowledge, technology, costs and market conditions may validate cutting-edge Aspirational practices so they eventually become Best management practices. If these practices are widely adopted and become the new industry standard, they may become Conventional practices within an ABCD framework. Considerable effort was undertaken to consult with grazing industry partners when developing the ABCD framework. However it must be noted that producers have identified there may be a need to adopt practices across several classification levels to successfully manage and operate their farming enterprise on a year to year basis.

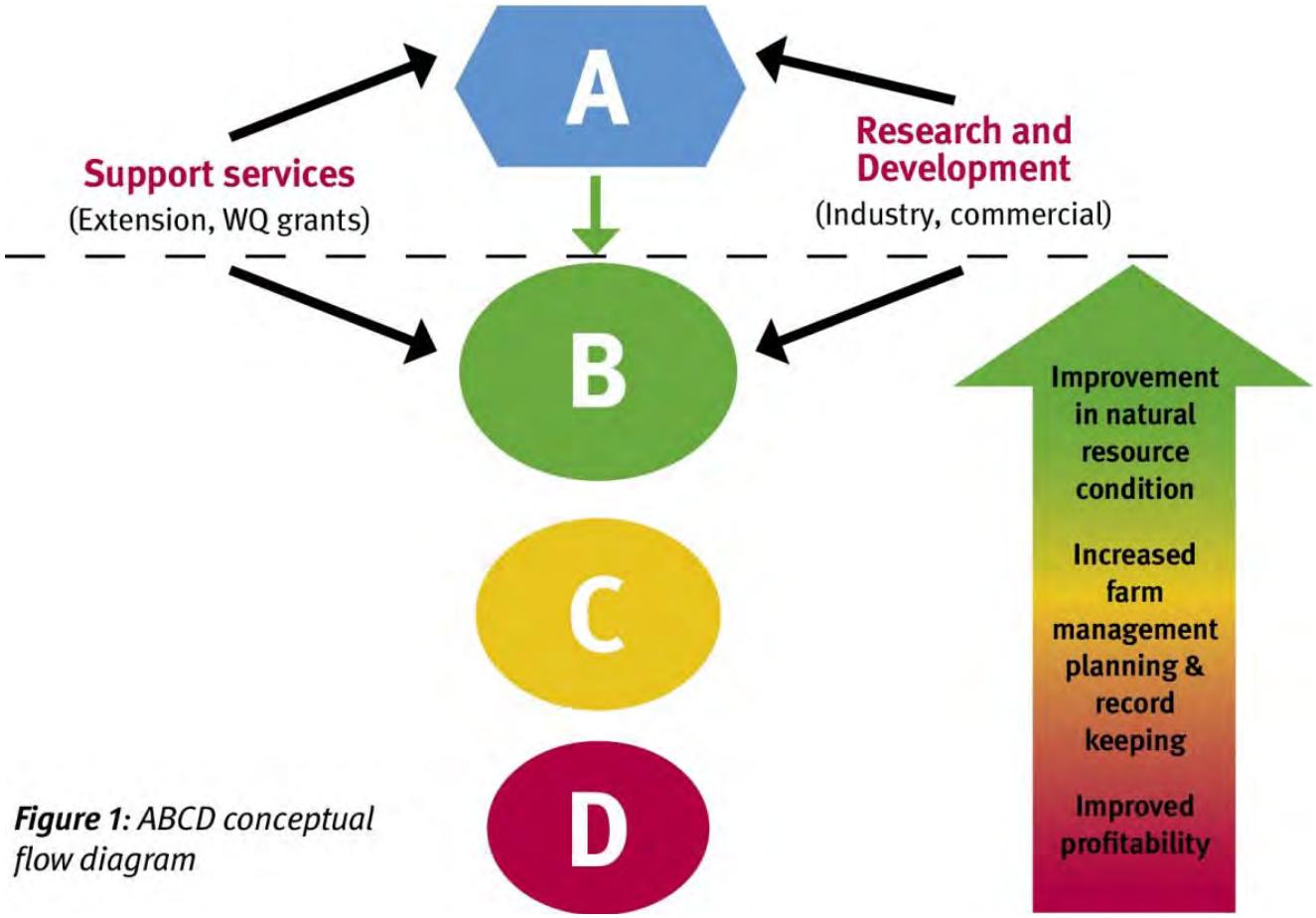


Figure 1: *ABCD conceptual flow diagram*

While the focus of the outcomes associated with practices outlined in this document is toward the enhancement of end of catchment water quality and marine ecosystem health. The practices indentified must also be quantified in terms of their economic and social benefits to the individual land managers and the broader community prior to being adopted as the most suitable practice solutions.

Table 1 Classes and definition of ABCD Framework for grazing management practices

Class	Description of practice	Effect on resource condition
Aspirational	• New and innovative practices adopted by growers that require further validation to determine industry wide environmental, social and economic costs/benefits. • Validation requires R&D and if appropriate, some validated practices will become recommended BMP. • Development of Farm Management Plans and utilisation of new and innovative technology.	• Validated practices likely to achieve medium to long term target resource condition goals if widely adopted. • Some practices may have good environmental outcomes which may not be universally endorsed as feasible by industry and community.
Best practices	• Currently promoted practices referred to as 'Best Management Practices'. • Widely promoted by industry to achieve current and future industry expectations and community standards. • Development of Farm Management Pans and utilisation of common technology	• Practice likely to achieve short to medium target resource condition goals if widely adopted.
Conventional	• Common practices widely adopted by industry but meet only basic current industry expectations and community standards.	• Practice unlikely to achieve short term target resource condition goals if widely adopted.
Dated	• Practices superseded or unacceptable by current industry expectations and community standards.	• Practice likely to degrade resource condition if widely adopted.

For the ABCD framework it is important to specify the current resource condition, resource condition targets, and timeframes, as well as the year of reference for the level of classification. This provides a common reference point and allows the framework to be used to communicate to water quality researchers, social scientists, economists, industry research and extension organisations, and land managers information on:

- The level of water quality improvement that can be achieved through improved management practices;
- The social and economic costs and benefits of adopting improved management practices;
- The level of adoption of management practices required to achieve the Water Quality Targets;
- The emphasises on the importance of detailed farm management planning and

record keeping to achieving improved resource management, rather than a single technology or individual practice.
- The type and scope of action such as Market Based Incentives (MBIs) required to achieve Water Quality Targets

The ABCD framework classification descriptions for grazing are reviewed and updated to ensure:

- the wording of the classification descriptions match current industry terminology;
- resource condition indicators have been defined;
- the link between the resource condition indicators and the level of practice validated and
- actions required to move from one level of management to another level of management further defined.

Pasture management practices for grazing are summarised below. Current practice is likely to be a mix of all practices in the table

Dated Grazing Pasture Management Practices that are superseded or unacceptable	Conventional Grazing Pasture Management Farming practices that meet minimum expectations
Stocking rate exceeds pasture availability **Description:** **1.** No pasture monitoring. **2.** Ground cover targets exceeded for most grazing land types in most years. **3.** No wet season spelling. **4.** No rotation grazing. **5.** Regular survival supplementary feeding **6.** No weed control. **7.** Lack of infrastructure to deal with stocking rate **8.** No stock management / husbandry.	Property specific – no differentiation between grazing land types **Description:** **1.** Pasture management strategy based on the major grazing land type. **2.** Pasture monitoring conducted for the major grazing land type. **3.** Carrying capacity based on seasonal visual assessment or set stocking rate (not recorded). **4.** Occasional survival feeding
Planning and record keeping: **1.** Records kept in head.	**Planning and record keeping:** **1.** Basic record keeping.
Resource Condition (one or more indicators): **1.** Badly degraded **2.** Absence of 3P grasses **3.** Increasing areas of erodible bare ground **4.** Increasing proportion of weeds	**Resource condition indicators (one or more indicators):** **1.** General decline in perennial, palatable and productive (3P) grasses **2.** Increase in less desirable pasture species **3.** Susceptible to erosion **4.** Some increase in areas of bare ground **5.** Increased weed presence
Best Practice Grazing Pasture Management Currently promoted Best Management Practices	**Aspirational Grazing Pasture Management** Innovative practices that require further validation
Property specific – independent management of less resilient grazing land types **Description:** **1.** Biannual pasture monitoring at critical times and stocking rates adjusted accordingly and appropriate nutrition action strategies implemented **2.** Soil testing of land types and following recommended analysis / fertiliser regimes where appropriate **3.** Fencing to land types. **4.** New watering points where cattle are excluded from existing watering sources by fencing to land type. **5.** Rotational / seasonal spelling	**Description:** **1.** Pasture management strategy based on all grazing land types. **2.** Carrying capacity based on consideration of longer term climatic data for all grazing land types. **3.** Stocking rates adjusted for all grazing land type to achieve ground cover targets. **4.** Geo-referenced soil testing and monitoring sites for each land type and deficiencies remedied. **5.** All grazing land types fenced where practical and appropriate. **6.** Pasture utilisation seldom exceeds sustainable thresholds. **7.** Monitoring grass : legume ratios
Planning and record keeping: **1.** Paper/electronic records kept (photos), technology for spatially identifying problem areas. **2.** Records kept in Paddock / Farm journal.	**Planning and record keeping:** **1.** High quality records kept **2.** Records kept in computer database
Resource Condition (one or more indicators): **1.** Stability in 3P grasses **2.** Managed weed presence (woody or otherwise) **3.** Maintain or improve soil condition	**Resource condition indicators (all indicators at this level):** **1.** Good cover of 3P grasses **2.** Identified weed control program **3.** Minimal erosion, with management strategy in place **4.** Minimal woodland thickening, with management strategy in place

Pasture spelling practices for grazing are summarised below. Current practice is likely to be a mix of all practices in the table.

Dated Grazing Pasture Spelling Management Practices that are superseded or unacceptable	Conventional Grazing Pasture Spelling Management Farming practices that meet minimum expectations
No pasture spelling **Description:** **1.** Pasture spelling not used in the management of any grazing land types. **2.** Lack of internal fencing	Pasture spelling for some grazing land types **Description:** **1.** One-off spell (wet season) – opportunity, not planned. **2.** Inadequate fencing and infrastructure. **3.** De-stocking as a consequence of above…
Planning and record keeping: **1.** No records kept	**Planning and record keeping:** **1.** Records kept in head.
Resource Condition: **1.** Badly degraded **2.** Absence of 3P grasses **3.** Increasing areas of erodible bare ground **4.** Increasing proportion of weeds	**Resource condition indicators (one or more indicators):** **1.** General decline in perennial, palatable and productive (3P) grasses **2.** Increase in less desirable pasture species **3.** Susceptible to erosion **4.** Some increase in areas of bare ground **5.** Increased weed presence
Best Practice Grazing Pasture Spelling Management Currently promoted Best Management Practices	**Aspirational Grazing Pasture Spelling Management** Innovative practices that require further validation
Pasture spelling for less resilient grazing land types **Description:** **1.** Pasture monitoring used to determine spelling (such as wet season spelling) used periodically in the management of less resilient grazing land types. **2.** Planned annual regime so as to better utilise country. **3.** Rotation based on seasonal conditions and pasture monitoring results. **4.** Land types assessed and vulnerable types given more consideration.	Pasture spelling for all grazing land types **Description:** **1.** Pasture spelling (such as wet season spelling) used periodically in the management of all grazing land types to maximise soil seed bank. **2.** All land types taken into consideration and planning appropriately for each land type. **3.** Pasture allowed to re-seed at appropriate intervals. **4.** Grazing strategies implemented during the growing season.
Planning and record keeping: **1.** Paper/electronic records kept (photos) Technology for spatially identifying problem areas. **2.** Records kept in Paddock / Farm journal.	**Planning and record keeping:** **1.** High quality records **2.** Records kept in computer database
Resource Condition (one or more indicators): **1.** Stability in 3P grasses **2.** Managed weed presence (woody or otherwise) **3.** Maintain or improve soil condition	**Resource Condition (all indicators at this level):** **1.** Good cover of 3P grasses **2.** Identified weed control program **3.** Minimal erosion, with management strategy in place **4.** Minimal woodland thickening, with management strategy in place, according to regional ecosystem zone requirements

Riparian management practices for grazing are summarised below. Current practice is likely to be a mix of all practices in the table.

Dated Grazing Riparian Management Practices that are superseded or unacceptable	Conventional Grazing Riparian Management Farming practices that meet minimum expectations
No independent management of riparian / frontage grazing land types **Description:** **1.** Riparian grazing land types are not managed independently of other grazing land types. **2.** Unrestricted access all year. **3.** Extended periods of excessive stocking rates	**Description:** **1.** Riparian grazing land types are not managed independently of other grazing land types **2.** Riparian zone not fenced. **3.** Off stream watering points used to encourage stock away from riparian area.
Planning and record keeping: **1.** No records kept	**Planning and record keeping:** **1.** Records kept in head.
Resource Condition: **1.** Bank erosion and slumping, eroding cattle tracks, minimal grass or vegetation cover, high weed component	**Resource Condition:** **1.** Bank erosion and slumping, eroding cattle tracks, acceptable grass or vegetation cover, high weed component
Best Practice Grazing Riparian Management Currently promoted Best Management Practices	**Aspirational Grazing Riparian Management** Innovative practices that require further validation
Independent management of riparian / frontage grazing land types **Description:** **1.** Riparian grazing land types are managed independently of other grazing land types where practical. **2.** Riparian areas fenced using permanent robust fencing that is a minimum of 20m from the top of the bank, where appropriate on defined watercourses **3.** Carrying capacity based on pasture monitoring in spring and autumn conducted for riparian grazing land types. **4.** Stocking rates adjusted independently of other grazing land types in response to pasture monitoring to maintain higher ground cover for riparian grazing land types. **5.** Preference for dry season grazing – regular, short interval grazing period/s with wet season spelling to maintain ground cover and minimise stock loss **6.** Off-stream watering points provided.	**Regeneration or revegetation of native vegetation within riparian / frontage grazing land types** **Description:** **1.** Independent grazing management is applied to encourage natural regeneration (weed control) or revegetation of a native riparian vegetation buffer (at least 10m wide) from the top of the bank **2.** Riparian areas fenced using permanent robust fencing that is located above the seasonal flood zone (if practical) a minimum of 20+m from the top of the top of the bank. **3.** Exclusion of stock is conducted while native riparian vegetation buffer is established up to 5m tall. The native riparian vegetation buffer consists of local native trees & shrubs constant with the original regional ecosystem **4.** Selective grazing consistent with B practice can be implemented to manage pasture grass adjacent to the native riparian vegetation buffer, once the native riparian vegetation buffer is established.
Planning and record keeping: **1.** Records kept in Paddock / Farm journal.	**Planning and record keeping:** **1.** High quality records kept **2.** Records kept in computer database
Resource Condition: **1.** Reduced riparian bank slumpage with adequate grass and vegetation cover	**Resource Condition:** **1.** Stable riparian banks with well established or regenerating native riparian vegetation buffer at least 10m wide from the top of the bank

Gully management practices for grazing are summarised below. Current practice is likely to be a mix of all practices in the table

Dated Gully Management Practices that are superseded or unacceptable	Conventional Gully Management Farming practices that meet minimum expectations
No gully management **Description:** **1.** Gully management not used for any grazing land types.	**Gully management for identified risk areas** **Description:** **1.** Identification of risk areas with appropriate action taken. **2.** No rehabilitation of identified eroding gullies.
Planning and record keeping: **1.** Records kept in head.	**Planning and record keeping:** **1.** Records kept in head.
Resource Condition: **1.** Actively eroding gullies, with moving sediment	**Resource Condition:** **1.** Actively eroding gullies, with moving sediment
Best Practice Gully Management Currently promoted Best Management Practices	**Aspirational Gully Management** Innovative practices that require further validation
Gully management for vulnerable grazing land types **Description:** **1.** Prevent establishment of new gullies and contain expansion of established gullies in susceptible or vulnerable grazing land types. **2.** Monitoring susceptible areas and implementation of restoration activities – appropriate and site specific… **3.** Fencing of rehabilitated area and manage independently. **4.** Carrying capacity based on pasture monitoring in spring and autumn conducted for vulnerable grazing land types. **5.** Stocking rates adjusted independently of other grazing land types in response to pasture monitoring to maintain higher ground cover within the active gully catchment. **6.** Planning for infrastructure takes into account minimisation of risk to gully erosion.	**Gully management for all grazing land types** **Description:** **1.** Prevent establishment of new gullies and contain expansion of established gullies in all grazing land types. **2.** Fencing of rehabilitated area and manage independently. **3.** All grazing land types in the active gully catchment are managed independently of other grazing land types. **4.** Carrying capacity based on consideration of longer term inter-annual variability and monitoring in spring and autumn conducted for grazing land types in the active gully catchment. **5.** Stocking rates adjusted independently of other grazing land types in response to pasture monitoring to maintain higher ground cover within the active gully catchment. **6.** Annual or biannual wet season spelling or complete exclusion is conducted for grazing land types within the active gully catchment. **7.** Planning for infrastructure takes into account minimisation of risk to gully erosion. **8.** Active stabilisation of gullies using restoration or mechanical intervention
Planning and record keeping: **1.** Records kept in Paddock / Farm journal.	**Planning and record keeping:** **1.** High quality records kept **2.** Records kept in computer database
Resource Condition: **1.** Reduction in the expansion of gully erosion or movement of sediment out of gully areas	**Resource Condition:** **1.** Stable gullies, no expanding gully erosion or movement of sediment out of gully areas. Increasing vegetation cover in erosion prone gullies.

Nutrient management practices are summarised below. As grazing nutrient management progresses to B and A class there is increasing precision in management of nutrient inputs to optimise the supply of nutrients to the pasture. The use of equipment as defined in this table can be owned individually, share-owned, or contracted.

Dated Grazing Nutrient Management Practices that are superseded or unacceptable	Conventional Grazing Nutrient Management Farming practices that meet minimum expectations
Description: **1.** No nutrient program or opportunistic (price-based) unregulated application	**Description:** **1.** Applying fertiliser based on visual assessment, and historic application **2.** Limited soil testing **3.** Uneven application of fertiliser with limited calibration **4.** Set rate application to all land types
Planning and record keeping: **1.** No records kept	**Planning and record keeping:** **1.** Records kept in head.
Machinery: **1**. Broadcast applicator	**Machinery:** **1**. Broadcast applicator
Best Practice Grazing Nutrient Management Currently promoted Best Management Practices	**Aspirational Grazing Nutrient Management** Innovative practices that require further validation
Description: **1.** Conduct soil tests per representative soil type and fertilizer application does not exceed recommended rates – related to pasture composition **2.** Legumes introduced for increased pasture protein and nitrogen soil levels **3.** Timing nutrient applications with respect to seasonal conditions and rainfall probabilities **4.** Apply fertiliser to appropriate ground cover density (nitrogen-end of wet season / phosphorous-pre wet season where practical) **5.** Strategic pasture renovation to reduce compaction issues **6.** Even application of fertiliser **7.** Strategic high nitrogen paddocks (grazing or fodder)	**Description:** **1.** Geo-referenced soil sampling in identified, specific zones in paddocks each year, which includes more comprehensive sampling **2.** GPS guidance (light bar or auto steer) in fertiliser application **3.** Apply variable fertiliser rates between paddocks based on representative soil type **4.** Soil ameliorants to achieve desirable ph **5.** Timing nutrient applications with respect to seasonal conditions and rainfall probabilities **6.** Apply fertiliser to appropriate ground cover density (nitrogen-end of wet season / phosphorous-pre wet season where practical) **7.** Planned pasture renovation based on analysis of soil resistivity measurements **8.** Even application of fertiliser **9.** Strategic high nitrogen paddocks (grazing or fodder)
Planning and record keeping: **1.** Records kept in Paddock / Farm journal.	**Planning and record keeping:** **1.** High quality records kept **2.** Records kept in computer database
Machinery: **1.** Ability to adjust rate for granular or liquid applicators	**Machinery:** **1.** Application of granular or liquid fertiliser with GPS guidance

Chemical management practices are summarised below. The term chemical is used in this section is a general classification including herbicides, fungicides, rodenticides and insecticides for which similar management principals apply. The equipment as defined in this table does not have to be owned individually (e.g. can be share-owned, contracted or other).

Dated Grazing Chemical Management Practices that are superseded or unacceptable	Conventional Grazing Chemical Management Farming practices that meet minimum expectations
Description: **1.** Zero weed control **2.** Inappropriate and reactive application and use of chemicals **3.** One herbicide strategy for the whole farm based on historic application rates or rules of thumb **4.** Often the maximum lable rate of residual and knockdown products used irrespective of weed pressure **5.** No drift control **6.** No calibration knowledge **7.** Poorly maintained machinery **8.** Inappropriate nozzles used	**Description:** **1.** Reactive weed control **2.** Alternate strategies not considered **3.** Infrequent calibration of spray equipment to be conducted **4.** Poor nozzle maintenance **5.** Poor chemical selection **6.** Poor knowledge of appropriate chemicals and application rates **7.** Inappropriate Personal Protection Equipment (PPE)
Planning and record keeping: **1.** No records kept	**Planning and record keeping:** **1.** Basic record keeping.
Machinery: **1.** Standard spray rig, with conventional nozzles	**Machinery:** **1.** Standard spray rig, with a suitable range of nozzles for various application tasks
Best Practice Grazing Chemical Management Currently promoted Best Management Practices	Aspirational Grazing Chemical Management Innovative practices that require further validation
Description: **1.** Implementation of new application technology for, improved placement, timing and drift reduction **2.** Choice of herbicides and application rates based on weed spectrum and growth stage **3.** Knockdown herbicides replace residual herbicides where practical (residual herbicides only used where weed species and pressure demands it). **4.** Timing chemical applications with respect to weed stage, irrigation and rainfall probabilities **5.** Alternative strategies to chemical control for woody weeds **6.** Integrated weed control approach to weed management including chemical, mechanical biological and nutrition **7.** Selection of chemicals which minimize impact on legumes **8.** Spatial recording of major weed species with GPS **9.** Completed accreditation and competency requirements for chemical usage **10.** Meet legislative requirements for chemical storage, application and disposal **11.** Methods used to prevent weed seed spread and property hygiene	**Description:** **1. - 11.** Same as 'B' class **11.** Targeted herbicide strategies within paddocks **12.** GPS guidance (light bar or auto steer) in chemical application **13.** NIR detection and control of weeds **14.** Low rates of nitrogen used to strategically outcompete low level weed infestations
Planning and record keeping: **1.** Records kept in Paddock / Farm journal.	**Planning and record keeping:** **1.** High quality records kept **2.** Records kept in computer database
Machinery: **1.** Boom/less jets, low drift nozzles (matched to job), splatter guns, wick wipers with manual rate control **2.** Pressure sprayers, knapsack sprayers, stem injection/cut stump and slashers	**Machinery:** **1.** Boom jets, low drift nozzles (matched to job), splatter guns, wick wipers with manual rate control **2.** NIR detectors **3.** GPS guidance **4.** Low impact machinery

Appendix One

Group Members:

Grazing Industry Working Group (past & present)

- Rod McFadzen (Land Manager)- Chair
- David George (Land Manager)
- Graham Townsend (Industry/Land Manager)
- Ron Earle (AgForce/Land Manager)
- Neil Cliffe (DEEDI)
- Harry Bishop (Local Regional Expert)
- Brigid Nelson (DEEDI)
- Jon Graftdyk (Reef Catchments)
- Will Higham (Reef Catchments)
- Reg Andison (DEEDI)
- Bob Bennett (AgForce/Land Manager)
- Carrie Mayne (AgForce)
- Jean Borg (Land Manger)
- Marie Vitelli (AgForce)
- Jim Fletcher (DEEDI)
- Raylene Hansen (DEEDI)
- Miriam East (DEEDI)
- Ross Dodt (DEEDI)
- Krista Cavallaro (DEEDI)

ABCD Framework Technical Working Group

- Rod McFadzen (Land Manager)- Chair
- Raylene Hansen (DEEDI)
- Jim Fletcher (DEEDI)
- Jon Graftdyk (Reef Catchments)
- Bob Bennett (AgForce/Land Manger)
- Bill Davies (AgForce/Land Manger)
- Carrie Mayne (AgForce)
- Ross Dodt (DEEDI)
- John Hughes (DEEDI)
- Miriam East (DEEDI)

- Bill Camm (Land Manager)

Bibliography:

Drewry, J.; Higham, W.; Mitchell, C. (2008). Water quality improvement plan. Final report. Mackay Whitsunday Natural Resource Management Group.

4.2 Cane ABCD Management Framework


Department of Employment, Economic Development and Innovation
SECOND EDITION
Central Region sugarcane management practices
ABCD Management Frameworks
A 'path for improvement' for growers and the extension staff who support them
2010–2011
REEF CATCHMENTS
Mackay Sugar
CSR SUGAR
CANEGROWERS
AgriServ
Queensland Government

SECOND EDITION

Central Region sugarcane management practices

ABCD Management Frameworks

A 'path for improvement' for growers
and the extension staff who support them
2010–2011

Introduction

The *Central Region sugarcane management practices: ABCD management frameworks* document has been designed to support the identification and validation of cane management practices that can improve both end of catchment water quality and marine ecosystem health as identified in the Water Quality Improvement Plan (WQIP), (Drewry, J., Higham, W., Mitchell, C. 2008). A pivotal stage in the WQIP process was the development of the ABCD framework. The ABCD framework was designed to highlight and facilitate communication about the different levels or standards of management practice (as opposed to resource condition) within the cane industry for different water quality parameters (i.e. sediment, nutrients and chemicals). The classification provides a definition and a scale of improvement from dated to current best practice through to future aspirational or new and innovative practices. Although soil, nutrient and pesticide management practices are the focus of the WQIP, this document has included irrigation, financial/business, WHS and harvest management practices.

Over time, changes in knowledge, technology, costs and market conditions may validate new and innovative Aspirational practices so they eventually become best management practices.

If these practices are widely adopted and become the new industry standard, they may become Conventional practices within an ABCD framework. Considerable effort was undertaken to consult with cane industry partners when developing the ABCD framework (Appendix one). However it must be noted that there may be a need to adopt practices across several classification levels to successfully manage and operate farming enterprises on a year to year basis.

While the focus of the outcomes associated with practices outlined in this document is toward the enhancement of end of catchment water quality and marine ecosystem health, the practices indentified must also be quantified in terms of their economic and social benefits to the individual land managers and the broader community prior to being adopted as the most suitable practice solutions.

The WQIP specifies the current resource condition, resource condition targets, and timeframes, as well as the year of reference for the level of classification. This provides a common reference point and allows the framework to be used to communicate to water quality researchers, social scientists, economists, industry research and extension organisations, and land managers information on:

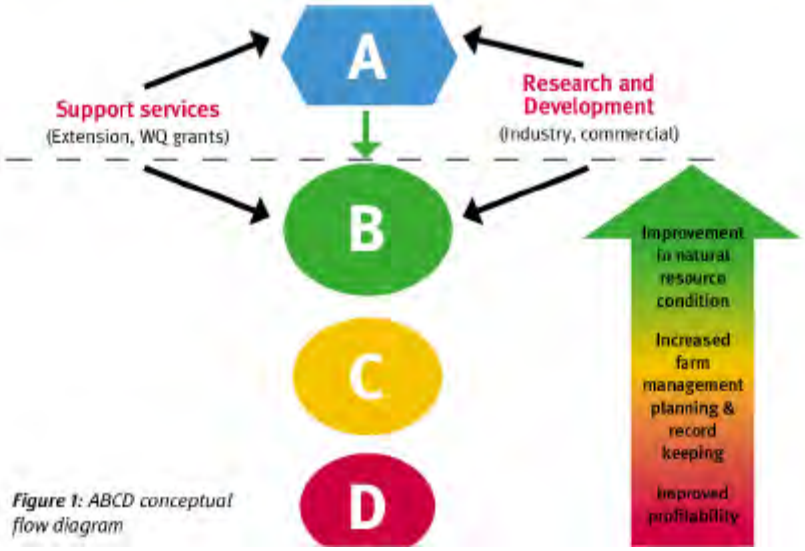


Figure 1: ABCD conceptual flow diagram

- The level of water quality improvement that can be achieved through improved management practices;
- The social and economic costs and benefits of adopting improved management practices;
- The level of adoption of management practices required to achieve the Water Quality Targets;
- The emphasises on the importance of detailed farm management planning and record keeping to achieving improved resource management, rather than a single technology or individual practice.
- The type and scope of action such as Market Based Incentives (MBIs) required to achieve Water Quality Targets

The WQIP and this booklet is regularly reviewed and updated to ensure:

- the wording of the classification descriptions match current industry terminology;
- resource condition indicators have been defined;
- the link between the resource condition indicators and the level of practice validated and
- action required to move from one level of management to another level of management further defined.

Table 1 Management classes and definition for ABCD framework for management practices

Class	Description of practice	Effect on resource condition
Aspirational	• New and innovative practices adopted by growers that require further validation to determine industry wide environmental, social and economic costs/benefits. • Validation requires R&D and if appropriate, some validated practices will become recommended BMP. • Development of Farm Management Plans and utilisation of new and innovative technology.	• Validated practices likely to achieve medium to long term target resource condition goals if widely adopted. • Some practices may have good environmental outcomes which may not be universally endorsed as feasible by industry and community.
Best practices	• Currently promoted practices referred to as 'Best Management Practices'. • Widely promoted by industry to achieve current and future industry expectations and community standards. • Development of Farm Management Pans and utilisation of common technology	• Practice likely to achieve short to medium target resource condition goals if widely adopted.
Conventional	• Common practices widely adopted by industry but meet only basic current industry expectations and community standards.	• Practice unlikely to achieve short term target resource condition goals if widely adopted.
Dated	• Practices superseded or unacceptable by current industry expectations and community standards.	• Practice likely to degrade resource condition if widely adopted.

Soil management practices for cane are summarised in table 2. Current practice is likely to be a mix of all the practices in the table, although the green cane trash blanket practice is likely to be adopted by about 80% of farmers in this region.

As cane soil management progresses to B and A class there is increasing precision in management of cultivation and controlled traffic to minimise impacts of compaction and erosion. Controlled traffic, for example, is nonexistent in D and C class management, while B class includes controlled traffic, and A class includes controlled traffic with GPS guidance of all operations. D and C class includes cultivated plant cane while B and A class includes strategic or zonal tillage for plant cane.

Table 2 Soil management practices for cane classified in the ABCD framework

Dated cane soil management
Practices that are superseded or unacceptable

Description:
1. Cultivated bare fallow
2. Fully cultivated plant cane
3. Cultivated ratoons

Planning and record keeping:
1. Records kept in head

Machinery:
1. Standard equipment
2. Machinery and equipment does not match crop row spacing

Conventional cane soil management
Farming practices that meet minimum expectations

Description:
1. Minimum till bare fallow with chemical weed control
2. Rotational crops may be grown
3. Reduced cultivation of plant cane replaced by strategic chemical weed control

Planning and record keeping:
1. Written records kept

Machinery:
1. Standard equipment
2. Machinery and equipment does not match crop row spacing

Best practices cane soil management
BMP currently promoted by the industry

Description:
1. Controlled traffic permanent wheel tracks matched to harvesting machinery wheel centres
2. Initial row establishment formed with Global Positioning System (GPS) guidance as a minimum
3. Rotational crops grown on all fallow where practicable
4. Strategic or zonal tillage of fallow crops and plant cane
5. Strategic ripping of wheel tracks in ratoons, only when necessary
6. Headlands, drains and waterways managed as filter strips

Planning and record keeping:
1. Identify soil types and productivity zones using existing maps, digitised mill data and other technology
2. Technology for spatially identifying problem areas
3. Develop computer skills enabling access to digital mill data and Geographic Information System (GIS) software
4. Develop basic 'Soil Management Plan' utilising soil mapping (slope, soil type, flooding, specific soil problems)
5. Records kept in paddock journal and/or electronic data capture

Machinery:
1. Matched wheel spacing for planting equipment based on harvesting machinery wheel centre measurements
2. GPS guidance on row establishment equipment
3. Zonal tillage equipment
4. Rotational crop establishment equipment

Aspirational cane soil management
Innovative practices that require further validation

Description:
1. Everything as for Class B plus the following
2. Controlled traffic permanent wheel tracks with GPS guidance of planting, zonal tillage, harvesting and haul out machinery
3. Site specific application of ameliorants
4. Reduction in harvesting impacts

Planning and record keeping:
1. Spatially identified soil types and management zones across blocks and farms utilising remote sensing and Electro Magnetic (EM) soil mapping technology
2. Integrate a spatial based Soil Management Plan, addressing Land and Water Management Plan (LWMP), or current environmental risk management criteria
3. Geo-referenced spatial data captured in GIS software systems
4. Records kept in electronic data capture
5. Production of harvester yield maps

Machinery:
1. Matched wheel spacing on all equipment based on harvester centres
2. GPS auto guidance systems on bed-formers, planting equipment and harvesting machinery including haulouts
3. Automated base cutter height fitted to harvester
4. Yield monitors fitted to harvester

The use of equipment as defined in this table can be owned individually, share-owned, or contracted.

Nutrient management practices are summarised in table 3. As cane nutrient management progresses to B and A class there is increasing precision in management of nutrient inputs to optimise the supply of nutrients to the plant. For example, with D and C class there are only one or two nutrient rates for the farm, while for B class management nutrient rates may vary between blocks. In A class nutrient rates may vary within blocks.

Table 3 Nutrient management practices for cane classified in the ABCD framework

Dated cane nutrient management **Practices that are superseded or unacceptable**	**Conventional cane nutrient management** **Farming practices that meet minimum expectations**
Description: 1. Current application rates based on historic application rates or rules of thumb **Planning and record keeping:** 1. Records kept in head **Machinery:** 1. Surface fertiliser box	**Description:** 1. Sample representative soil types prior to planting 2. Application rates based on soil test analysis and current industry recommendations (e.g. 6 Easy Steps nutrition guide) 3. If surface applied, irrigated / cultivated into soil where possible **Planning and record keeping** 1. Conduct soil tests 2. Develop basic nutrition managment plan 3. Written records kept **Machinery:** 1. Surface or sub-surface fertiliser box (granular)
Best practices cane nutrient management **BMP currently promoted by the Industry**	**Aspirational cane nutrient management** **Innovative practices that require further validation**
Description: 1. Geo-referenced soil sampling in key soil types in blocks prior to planting each year, which may include more comprehensive sampling eg. A and B horizon at the same site 2. Application rates based on latest industry recommendations taking mill by-products, compost, other organic nutrient sources and block history into account 3. Application of mill mud/mud ash should not exceed crop cycle nutrient requirements 4. Timing nutrient applications with respect to crop stage, and rainfall probabilities 5. Incorporation of surface applied fertiliser, and as soon as practicable, within seven days, using overhead irrigation that does not result in runoff **Planning and record keeping:** 1. Identify soil types/productivity zones for each block 2. Develop Nutrient Management Plan using varieties, yield, soil mapping and latest industry recommendations 3. Change fertiliser rates between blocks where identified 4. Conduct leaf analysis if required 5. As a minimum, calibration of fertiliser applicator should occur with change of product or application rate 6. Records kept in Paddock Journal and/or electronic data capture **Machinery:** 1. Ability to adjust rate for granular or liquid applicators 2. Granular applicators must have capacity for sub-surface application	**Description:** 1. Geo-referenced soil sampling in identified, specific zones in blocks each year, which includes more comprehensive sampling eg. A and B horizon at the same site 2. Apply variable fertiliser rates within blocks where identified 3. Application rates based on specialist interpretation including individual block yield potential, of the latest industry recommendations 4. Timing nutrient applications with respect to crop stage, irrigation and rainfall 5. Records kept in computer database 6. Banded application of mill mud accounting for crop cycle phosphorous requirement and soil properties **Planning and record keeping:** 1. Identify soil types/productivity zones within each block using GPS yield and soil mapping 2. Develop spatial-based crop cycle Nutrient Management Plan using varieties, yield, soil mapping and specialist interpretation of latest industry recommendations 3. Knowledge of latest nutrient management issues and recommendations 4. Conduct soil tests (and leaf analysis if required) 5. Records kept in electronic data capture 6. Some basic/periodic water quality monitoring 7. Near-Infrared (NIR) data used to adjust nutrient rates **Machinery:** 1. Variable rate applicator for granular sub-surface or liquid surface with remote/automatic controlled rate and GPS guidance 2. Banded on-row applicator for mill by-products or other organic ameliorants 3. The majority of nutrients sub-surface applied where practical

Agricultural chemical management practices for cane are summarised in table 4. The term chemical is used in this section as it is a general classification including herbicides, fungicides, rodenticides, and insecticides for which similar management principles apply.

As cane chemical management progresses to B and A class there is increasing precision in their management.

Table 4 Chemical management practices for cane classified in the ABCD framework

Dated cane chemical management
Practices that are superseded or unacceptable

Description:
1. One herbicide strategy for the whole farm based on historic application rates or rules of thumb
2. Often uses maximum label rate residual and knockdown products, irrespective of weed pressure.

Planning and record keeping:
1. Records kept in head

Machinery:
1. Standard spray rig, with conventional nozzles

Conventional cane chemical management
Farming practices that meet minimum expectations

Description:
1. One or two herbicide strategies for the whole farm
2. Uses residual and /or knockdowns at rates appropriate to weed pressure.
3. Calibration of spray equipment to be conducted regularly
4. Meet minimum accreditation and competency requirements for chemical usage
5. Meet legislative requirements for chemical storage, application and disposal

Planning and record keeping:
1. Develop basic Herbicide Management Plan
2. Keep material safety data sheets (MSDS)
3. Written records kept

Machinery:
1. Standard spray rig, with a suitable range of nozzles for various application tasks

Best practices cane chemical management
BMP currently promoted by the industry

Description:
1. Implementation of new application technology for improved placement and timing
2. Knockdown herbicides replace residual herbicides where practical (residual herbicides only used where weed species and pressure demands it).
3. Efficient use of pre-emergents to reduce overall chemical application.
4. Timing chemical applications with respect to crop stage, irrigation and rainfall probabilities
5. A focus on good weed control in fallow and plant cane to ensure minimal herbicide in ratoon stages

Planning and record keeping:
1. Identify – weed types/pressure, soil types and productivity zones for each block
2. Develop herbicide management plan using weed pressure, soil types, crop stage and yield mapping. Formulate best practice pre-emergent management plan using only approved chemicals
3. Change herbicide strategy between blocks where identified
4. Maintain knowledge of latest chemical management issues, recommendations and regulations
5. Monitor weed pressure
6. Meet minimum accreditation and competency requirements for chemical usage
7. Meet legislative requirements for chemical storage, application and disposal
8. Adjust herbicide strategy for next year if required
9. Records kept in Paddock Journal and or electronic data capture

Machinery:
1. Shielded sprayers, low drift nozzles (matched to job) and high clearance spray equipment with manual rate control

Aspirational cane chemical management
Innovative practices that require further validation

Description:
1–5. Same as B class
6. Targeted herbicide strategies within blocks e.g. weed pressure on row ends; patches of weeds/vines; turning on/off

Planning and record keeping:
1. Identify – weed types/pressure, pests and diseases, soil types and productivity zones within each block using GPS yield and soil mapping. Weed survey of blocks
2. Develop spatial based Herbicide Management Plan using weed pressure, soil types, crop stage, yield mapping and IWM principles
3. Change herbicide strategies within blocks where identified
4. Maintain knowledge of latest chemical management issues, recommendations and regulations
5. Monitor weed pressure
6. Automated record keeping (e.g. Variable Rate Screen)
7. Adjust herbicide strategy for whole of crop cycle

Machinery:
1. Shielded sprayers, low drift nozzles (matched to job) and high clearance spray equipment with remote / automatic variable rate control and GPS guidance
2. Automated boom height control,
3. Weed scanner / sensing equipment
4. Multiple tank set ups for chemical injection

The equipment as defined in this table does not have to be owned individually (e.g. can be share-owned, contracted or other).

In March 2008, SYDJV and the FutureCane team identified harvesting as one of two major impediments to the adoption of the 'improved' farming system. Harvesting contractors must be able to directly access incentive money to facilitate adoption of technical equipment, machinery modifications and operating practices which are necessary to enable growers to change practices and extract the full benefits of the 'improved farming system.'

Harvesting management practices for cane are summarised in table 5. As cane harvesting management progresses to B and A class there is increasing precision in management of harvesting practices.

Table 5 *Harvesting management practices for cane classified in the ABCD framework*

Dated cane harvesting management **Practices that are superseded or unacceptable**	**Conventional cane harvesting management** **Farming practices that meet minimum expectations**
Description: 1. Inefficient farm layout: short rows, narrow and rough headlands common & no ability to harvest through blocks **Planning and record keeping:** 1. Records kept in head 2. Minimal communication between grower and contractor 3. No reference to mill cane quality reports by grower **Machinery, capital works actions:** 1. Standard harvester with no means of adjustment to meet harvesting best practice	**Description:** 1. Some consideration given to improving efficiency of farm layout for harvesting & harvesting through blocks is practiced **Planning and record keeping:** 1. Some written recording 2. Verbal harvest plan agreement between grower & contractor pre-crushing 3. Some reference to mill cane quality reports by grower **Machinery, capital works actions:** 1. Some improved modifications to harvester
Best practices cane harvesting management **BMP currently promoted by the industry**	**Aspirational cane harvesting management** **Innovative practices that require further validation**
Description: 1. Farm layout suitable for efficient harvesting **Planning and record keeping:** 1. Development of harvest management plan between farmer and contractor (includes written contract and price agreement) 2. Records kept in Paddock Journal and/or electronic data capture 3. Access to harvester performance reports at a block level **Capital works/landscape actions:** 1. Installation of GPS tracking devices onto harvesters 2. Harvester front modifications and elevator extensions, to match row spacing 3. Roller train optimisation and correct matching to choppers 4. Accurate consignment of bins to match harvester position	**Description:** 1. Farm layout optimised for efficient harvesting **Planning and record keeping:** 1. As per B 2. Records kept in electronic data capture 3. Access harvester performance reports and yield maps at a block level and use to make better farm layout and harvesting decisions. **Capital works/landscape actions:** 1. Harvester and haul out utilising GPS guidance equipment plus harvester yield monitor 2. Automatic base cutter height control 3. Roller train optimisation and correct matching to choppers 4. Automatic primary extractor fan speed control linked to harvester pour rate 5. Electronic consignment of bins

The use of equipment as defined in this table can be owned individually, share-owned, or contracted.

Water management practices for cane are summarised in table 6. As cane water management progresses to B and A class there is increasing precision in management of water inputs.

Table 6 Water management practices for cane classified in the ABCD framework

Dated cane water management **Practices that are superseded or unacceptable**	**Conventional cane water management** **Farming practices that meet minimum expectations**
Description: 1. No scheduling tools utilized 2. Irrigations based on gut feel 3. Basic drainage considered in original farm layout **Irrigation application:** 1. Application amount unknown 2. No consideration of matching nozzles to pump **Planning and record keeping:** 1. No recording or planning	**Description:** 1. Visual checks – experience 2. How long it takes to get around 3. Prioritise crop cycle, e.g. plant cane, 1st ratoon over 5th ratoon 4. Water availability 5. Costs – energy (e.g. weekend tariffs) 6. General knowledge of local rainfall history 7. Existing farm layout and infrastructure considers drainage – laser levelling **Irrigation application:** 1. Based on experience 2. Amount often unknown, loosely determined by pump meter reading/time/ha 3. No efficiency checks conducted on equipment 4. May change nozzles to match pump size and pressure 5. Some consideration due to soil type – mainly textural 6. Consideration to land formation and slope 7. Water quality tests conducted **Planning and record keeping:** 1. Records, including water meter readings kept in farm diary 2. Basic understanding of soil moisture characteristics – based on texture rather than scientifically determined PAWC 3. Planning based on verification of meter readings, not measured system outputs 4. Planning based on productivity potential
Best practices cane water management **BMP currently promoted by the industry**	**Aspirational cane water management** **Innovative practices that require further validation**
Description: 1. Scheduling tools used manually on main soil type or limiting soil type 2. Weather forecasting models used 3. Irrigation scheduling plan for each crop year 4. Storm water storages / sediment traps 5. Water testing incorporated, mainly for on-farm reuse 6. Irrigation systems match soil and topography **Irrigation application:** 1. System efficiency checks conducted annually 2. Application amount matched to soil plant available water capacity (PAWC), infiltration rate and crop stage 3. Water quality tests conducted regularly when using bores **Planning and record keeping:** 1. Block based water management plan encompassing: soils; scheduling; efficiency – system check; allocation; farm layout and infrastructure; economics 2. Records kept in Paddock Journal and/or electronic data capture	**Description:** 1. Scheduling tools utilized with some level of automation 2. Scheduling based on block or management units 3. Scheduling based on specific soil types 4. Weather forecasting models used 5. Comprehensive drainage plan considering all farm drainage points 6. Storm water storages / sediment traps 7. Water testing incorporated, mainly for on-farm reuse 8. Use of low pressure overhead and trickle irrigation systems **Irrigation application:** 1. System efficiency checks conducted annually 2. Application amount matched to soil plant available water capacity (PAWC), infiltration rate and crop stage 3. Water quality tests conducted regularly when using bores 4. Software scheduling tools used **Planning and record keeping:** 1. Soil type based water management system encompassing: soils; scheduling; efficiency – system check; allocation; farm layout and infrastructure; economics 2. Records kept in electronic data capture

The use of equipment as defined in this table can be owned individually, share-owned, or contracted.

Workplace Health, Safety and Environmental management practices for cane are summarised in table 7. As cane workplace health, safety and environmental management progresses to B and A class there is increasing precision in management of workplace health, safety and environmental processes.

Table 7 Workplace health and safety management practices for cane classified in the ABCD framework

Dated cane WHS management **Practices that are superseded or unacceptable**	**Conventional cane WHS management** **Farming practices that meet minimum expectations**
Planning and record keeping: 1. Little or no training provided 2. No policies 3. Minimal inductions 4. Minimum understanding of WH&S 5. No record keeping 6. Little or no hazard identification and risk management 7. Lack of personal protective equipment (PPE)	**Planning and record keeping:** 1. Basic understanding of WH&S 2. Conducts mental risk assessments 3. Provides verbal warning and instructions 4. Provides basic inductions 5. No formal records kept 6. Basic PPE 7. Basic emergency procedures
Best practices cane WHS management **BMP currently promoted by the industry**	**Aspirational cane WHS management** **Innovative practices that require further validation**
Planning and record keeping: 1. Generic WH&S Policies 2. Written risk management procedures 3. Basic written warnings and policies 4. Provides relevant safe equipment 5. Basic record keeping 6. Basic review of policies and procedures 7. Basic written inductions 8. Feed back 9. Emergency procedures (First Aid) 10. Sign off on induction, etc. by employee/s	**Planning and record keeping:** 1. Formal Inductions 2. Training in risk management/assessment 3. Hazard identification 4. Formal policies/procedures 5. Follow up and review of policies and procedures 6. Detailed record keeping 7. Detailed knowledge of WH&S Policies 8. Detailed emergency procedures 9. As for point 10 'B' class

Business/finance management practices for cane are summarised in Table 8. As cane Business/finance management progresses to B and A class there is increasing precision in management of Business/finance processes.

Table 8 *Business/financial management practices for cane classified in the ABCD framework*

Dated cane business/financial management Practices that are superseded or unacceptable	Conventional cane business/financial management Farming practices that meet minimum expectations
Description: 1. Ensure all financial information is provided to an Accountant for compilation 2. No formal Budgets are written 3. No formal Business Plans are written 4. Marketing is left to the Mill and Queensland Sugar Limited (QSL) **Financial records:** 1. Invoices and Receipts kept together 2. Fuel dockets kept separately 3. Wages documented 4. Basic financial analysis from Bank Statements 5. Discuss with Bank Manager when necessary **Budgets:** 1. Basic unwritten 2. Basic opportunity analysis 3. Basic GM cost analysis **Business plans:** 1. Basic planning 2. No succession planning 3. No benchmarking **Marketing:** 1. No marketing strategy – left to the mill and/or QSL	**Description:** 1. BAS completed quarterly on computer system then (maybe) checked by an accountant 2. Budgets and economic analysis completed 3. Skills training identified and hand written paddock journals 4. Awareness of mill pricing system **Financial records:** 1. Recording payments/receipts in a computerised cashbook 2. Books of prime entry 3. Quarterly entry of data (BAS; fuel rebate) 4. Financial analysis completed & discuss with accountant **Budgets:** 1. Annual operational and capital budgets developed 2. Year on year comparison 3. Economic analysis of whole farm gross margin 4. Annual farm budget compared to actuals 5. Basic machinery costs analysed 6. Opportunity cost analysis when necessary **Business plans:** 1. No formal annual strategic plan 2. No succession planning 3. Basic benchmarking - accountant developed using their client base 4. Skills training identified 5. Written paddock journals completed **Marketing:** 1. No formal marketing strategy 2. Aware of mill pricing system, minimal usage
Best practices cane business/financial management BMP currently promoted by the industry	**Aspirational cane business/financial management** Innovative practices that require further validation
Description: 1. BAS completed quarterly on computer system 2. Budgets and cost centre analysis completed monthly 3. Strategic business planning undertaken and computerised 4. Formal marketing strategy **Financial records:** 1. Detailed monthly entries into computerised recording system using basic cost centres (MYOB etc) 2. Monthly reporting and financial analysis 3. Update machinery and other asset values plus liabilities to develop actual statement of position annually 4. As C class	**Description:** 1. Record changes to asset values annually 2. Detailed ratio analysis 3. Management plans updated regularly 4. Economic analysis of spatial/paddock gross margins 5. Marketing own product **Financial records:** 1. Detailed entry using comprehensive cost centres to assist in depth analysis 2. Monthly computerised entry and reports 3. Development and analysis of changes in statement of position at least annually 4. Financial and performance analysis discussed with competent business advisor/consultant (this maybe your accountant)

Budgets:
1. All budgets computerised living documents personally developed and reviewed monthly
2. Cost centre specific budgeting
4. Detailed machinery costing computerised and analysed at least annually
5. As C class

Business plans:
1. Strategic business plan developed
2. Succession plan written
3. Benchmarking
4. Skills training plan
5. Land and water management plan completed (with water quality information continuously updated)
6. Economic analysis
7. Paddock journals computerised and added into Nutrient; soil and chemical management plans

Marketing:
1. Formal marketing strategy
2. Utilisation of mill (or other) pricing system

Workshops:
1. FEAT workshop
2. Succession planning workshop
3. Land and water management plan workshop
4. Farm productivity improvement plan (FPIP)
5. Business planning workshop

Budgets:
1. Detailed ratio analysis (e.g. use of FEAT or similar tool
2. Benchmarking/accountants group and proactive farmer group
3. Cost centre analysis
4. Monthly budget comparison to cost centres. Various partial budgets for economic analysis
5. As B class

Business plans:
1. Detailed succession plan regularly updated and implemented
2. Strategic plan and risk analysis updated annually
3. Land & water management plan updated quarterly
4. Skills training regularly for management and staff
5. Economic analysis of spatial/paddock gross margins
6. Sensitivity analysis (risk)
7. As B class

Marketing:
1. Controlling marketing of own product
2. Futures / hedging

Appendix one

Group members:

Regional working group

- Burn Ashburner (AgriServ)
- Raylene Hansen (DEEDI)
- Will Higham (Reef Catchments NRM)
- Kerry Latter (CANEGROWERS) - Chair
- John Markley (Mackay Sugar)
- Ian McBean (Proserpine Sugar Ltd)
- Michael Porter (CANEGROWERS)
- Phil Ross (AgriServ)
- Rob Sluggett (PCPSL)
- Peter Sutherland (Sugar Services Proserpine)
- John Tait (CSR)
- Phil Trendell (Reef Catchments NRM)

Technical working group

- Burn Ashburner (AgriServ)
- John Eden (CANEGROWERS)
- Raylene Hansen (DEEDI)
- John Markley (Mackay Sugar) - Chair
- Rob Sluggett (PCPSL)
- Peter Sutherland (Sugar Services Proserpine)
- Phillip Trendell (Reef Catchments NRM)

Industry participants

- Sergio Berardi (Farmer)
- Chris Blackburn (Farmer/contractor)
- Lee Blackburn (Farmer/contractor)
- Kevin Borg (Farmer/contractor)
- Lawrence Bugeja (Farmer)
- Tony Bugeja (Farmer)
- Andrew Cappello (Farmer)
- Glenn Clark (Farmer)
- Neil Cliffe (DEEDI)
- Rob Cocco (Reef Catchments NRM)
- Tony Crowley (Contractor)
- Gerry Deguara (Farmer)
- Steve Dinsdale (Contractor)
- Frank Frazer (Dept of Industrial Relations)
- Jon Graftdyk (Reef Catchments NRM)
- Alan Graham (Canegrowers)
- Ron Gurnett (Farmer)
- Andrew Guy (Farmer)
- Joy Guy (Farmer)
- Alison Hambleton (NRW)
- Tony Hinschen (Farmer)
- John Hughes (DEEDI)
- Brad Hussey (AgriServ)
- Tony Jeppesen (Farmer)
- Lisa Keating (Farmer)
- Rob Keating (Farmer)
- Rodney Lamb (Farmer)
- Richard Lewis (DEEDI)
- Joe Muscat (Farmer/harvester opr)
- John Pastega (Farmer)
- Frank Perna (Farmer)
- Greg Plath (Farmer)
- Lou Raiteri (Farmer)
- Jackie Richters (PCPSL)
- Phil Ross (AgriServ)
- Sue Rowlinson (PCPSL)
- Allan Royal (AgriServ)
- Barry Salter (AgriServ)
- John Simpson (Farmer)
- Wayne Simpson (Farmer)
- Malcolm Warren (Proserpine Sugar Mill)
- Warren Watts (Farmer)
- Eddie Westcott (Farmer)
- Trevor Wilcox (BSES Ltd)
- Lindsay Williams (Farmer)
- Ross Williams (Farmer)
- Steve Young (Farmer/contractor)

Bibliography

Azzopardi, M. (2001) COMPASS: A self-assessment workbook. BSES Indooroopilly: Australia.

Drewry, J.; Higham, W.; Mitchell, C. (2008). Water quality improvement plan. Final report. Mackay Whitsunday Natural Resource Management Group. Mackay: Australia.