



REVIEW Report

Practice change, Education and Extension in Reef Catchments Project

June 2017

Coutts J&R



ACKNOWLEDGEMENTS

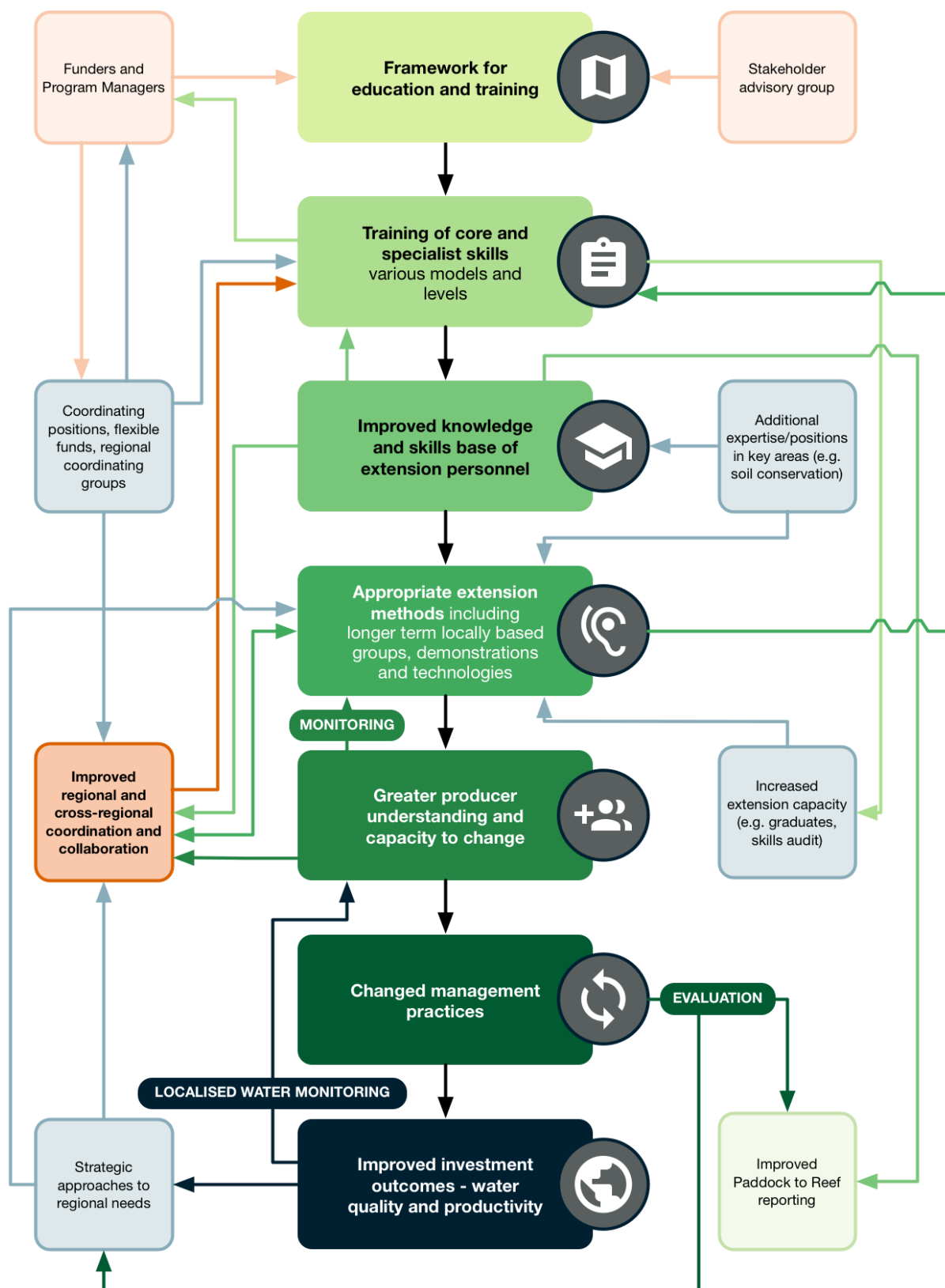
The authors would like to acknowledge the willingness of the stakeholders in agriculture in the reef regions to share their experiences and provide their feedback on emerging findings and recommendations. This enthusiasm and commitment to on-going improvement is a very positive sign for building the capacity needed into the future. Department of Agriculture and Fisheries and Department of Environment and Heritage Protection staff provided excellent support during this process.

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PROGRAM LOGIC OF PROPOSED APPROACH



SUMMARY

This report is an independent assessment of the extension and education activity aligned to the Great Barrier Reef catchments in Queensland. It informs an Implementation Strategy that the Queensland Government can use to guide the delivery of funding aligned to the Great Barrier Reef (GBR) Water Quality Taskforce *Recommendation 3: Extension and Education*¹ and under the Queensland Reef Water Quality Program.

The report makes recommendations on how best to develop extension capacity and provide access to services for farmers to enable accelerated practice change and strengthen long term capacity while reviewing existing education and extension systems.

These draft recommendations are also intended to encourage collaboration across reef stakeholders and investment programs, recognising that many issues will require wider action and support to achieve sustainable change with the extension platform.

Key Messages

1. Improve the targeting, collaboration, coordination and evaluation of reef funded extension and education programs across state and commonwealth funded programs using extension best practice in their design and implementation.
2. Ensure funded programs reward collaboration and provide the mix of longer term extension approaches that deal with building trust, peer support and build producer understanding and commitment to long term improvements.
3. Ensure that there are consistent messages across programs and organisations in relation to information and recommendations about farming and grazing practices.
4. Continue to strengthen and support Industry Best Management approaches as a framework for benchmarking, continuous improvement, identifying changes needed, measuring and reporting change over time and meeting regulatory requirements.
5. Resource an effective platform for regional collaboration in extension delivery and permit flexibility to strategically commit funds to add value to current activities and address gaps at the regional and sub-regional levels.
6. Provide funds/resources to support producer groups to enable facilitated peer-to-peer learning and testing of recommended approaches and new and innovative technologies on-farm.
7. Strengthen the extension and technical understanding and skills of extension and advisory staff to more effectively engage with the producer community and assist them in achieving the desired outcomes – and establish a framework and institutional support for on-going capacity building.
8. Develop and promote a system of professional certification for extension/advisory personnel who demonstrate and meet recognised standards in Nutrient Management, Sediment Management and other similar areas of expertise.
9. Provide stronger peer-to-peer learning and support for extension/advisory staff across sectors through mentoring and networking approaches and strengthen opportunities for career pathways in the reef regions.

¹ DAF16050 Contract Details GBRT Recommendation

10. Introduce new graduates into extension/advisory roles in the region and so develop a ready resource to move into positions and programs to best support producers.
11. Provide extension technical specialists in the existing gaps in expertise such as soils, water quality, farm business management, mixed cropping and communication to support programs and provide training in their areas of expertise.

Recommendations

The draft recommendations of the review are included below. The related findings relevant to these recommendations are included in the body of the report – as are more details surrounding the implementation of these recommendations.

R1. Overseeing the Review Implementation

- R1.1** A Reference Group comprising of government and stakeholder representatives and chaired by an independent person should be established to review the implementation of the recommendations after the first six months and thereafter on an annual basis. This group would provide feedback on the process and suggest ways to address barriers and issues emerging.
- R1.2** A bi-annual extension/delivery organisation survey should be undertaken as a key tool to assess gains in extension capacity and functioning and effectiveness and the appropriateness or otherwise of measures in place.

R2. Coordination and Collaboration

Program design

- R2.1** Hold a two-day, independently facilitated, workshop to review current state and commonwealth extension and education programs/projects directed towards behaviour change and farm management practice change in the reef regions to develop a commitment and mechanism for greater coordination across programs. Work with those delivering reef programs (natural resource management groups [NRMs], industry bodies and DAF) to ensure all relevant program investment managers are involved.
- R2.2** Ensure that steps are taken through funded programs to minimise competition within projects (e.g. competing for the same group of growers to achieve targets) and to require evidence of, and reward cross-program collaboration. Consider regional outcomes and build in collaborative mechanisms to funded programs. This needs to be balanced with going to the market in some situations and investing in targeted on-ground practice change.

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- R2.3** An annual meeting should be held in a reef region with a focus on regional extension coordination groups providing feedback to state and commonwealth program managers on what is working in current programs and barriers and opportunities to improve effectiveness. Program managers would be asked to report back on steps taken to react to earlier feedback on ways to streamline and coordinate at that level. There would be an opportunity to coincide with a 'current situation analysis' from the Paddock to Reef programs in the relevant areas.

Regional Extension Coordination

- R2.4** Appoint/reappoint/continue with a **Regional Extension and Education Coordinator** (REEC) in each reef region to the most appropriate organisation.

- R2.5** An effective **Regional Extension Coordination Group** (RECG), facilitated by the regional extension coordinator, should be continued/developed in each region for sugar and across regions for grazing, grains and horticulture to allow sharing of information and joint decision making. A **Regional Extension Plan** should be developed and updated annually consistent with current programs and regional water quality priorities, with targeting supported by spatial mapping of the layers of extension effort against priority areas. The RECG would initiate and sponsor an annual information exchange of relevant research and delivery organisations.

- R2.6** Given the different context for Grazing – especially in the northern regions outside of the Fitzroy Basin where there is currently a well-functioning regional coordination group for grazing extension within the Grazing Best Management Practice (BMP) project – it is recommended that rather than having an extra layer of regional coordination, an annual Research Development and Extension (RD&E) grazing update is run with organisations working on grazing areas (e.g. regional NRM organisation, DAF, North Queensland Dry Tropics NRM organisation (NQDT), Resource Consulting Services (RCS), JCU, CSIRO, AgForce) to facilitate information sharing, learning about new advances, networking and potentially leading to collaborative opportunities.

- R2.7** Provide **flexible funds** (within guidelines and regional level decision-making) of \$100,000 per year to the five major reef regions to allow priority cross-program/organisational activities to add value to current delivery programs, build synergies, address challenges and plug gaps.

- R2.8** A **Cross-Reef Region Extension Coordinator** (CRREC) should be appointed within an appropriate organisation which has the capability of engaging across all reef regions. The role of the CRREC would be to provide leadership, support, mentoring and direction to the regional level coordination, provide opportunities for networking and learning from each other and to facilitate the link between regions and state and regional reef extension related programs.

R3. Extension Personnel and Expertise

New positions

Note the recommendations for these positions are based on feedback from stakeholders through the scoping interviews and regional workshops. They are not based on a quantitative or comparative analysis. As such they should be viewed as indicative and requiring further testing.

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- R3.1** Appoint or second at least two soil conservation/health/hydrology staff across the regions (possibly, Fitzroy and Burdekin) in appropriate organisations – and source other expertise from where it may reside and is needed - to provide expert input into existing programs and to train/mentor/advise resource management officers across the regions to get a pool of upskilled professionals in this area.
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- R3.2** Appoint an additional grazing officer in the Mackay Whitsunday region in an appropriate organisation as part of the Grazing BMP program.
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- R3.3** Ensure sufficient dedicated communication personnel to proactively work with reef extension and education programs to promote key activities and communicate consistent key messages (including 'Rules of Thumb'), case studies of success, activities and resources based in reef regions.
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- R3.4** Appoint a farming systems officer with expertise in water quality based in an appropriate organisation - and source other expertise from where it may reside and is needed - in the reef regions to support mixed cropping, horticulture and banana growers through their Hort360/BMP program and to coordinate/support in this area across regions. This position could be best placed in the Wet Tropics with input into other regions
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- R3.5** Appoint a mixed farming extension specialist to provide further support for programs directed at improved water quality outcomes in the mixed cropping areas.
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- R3.6** Appoint a position in the Burnett-Mary working across sectors in support of current programs including BMPs to provide whole farm analysis to support the adoption of profitable practices and recommended reef practice changes.
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Graduate program

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- R3.7** The pilot graduate program is already being implemented and its evaluation will provide the basis for its continuation or otherwise and changes that may be needed. Do all possible, including providing funding, to provide a pathway to positions in the reef regions and programs following their initial year. This may mean that on-going graduate intakes may need to be tempered to permit this flexibility.
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Existing Contract Positions²

- R3.8** Extension program planning should be undertaken on a rolling 5-10 year basis showing the expected transition between follow on programs and focus. The terms of contracted extension positions should be modified where there is an expectation of programs continuing beyond the initial short term period to provide more continuity and certainty.
- R3.9** There should also be a website that tracks and links extension staff, positions held, their skills, training and experience – and which also provides alerts for new projects, programs and positions as they are rolled out.

On-going extension roles

- R3.10** The public sector, industry, regional NRM organisations and Landcare have a key role in driving the process and training of on-farm trials and demonstrations in relation to practices benefiting water quality and in demonstrating the application of new technologies to support learning and decision-making – such as the use of drones, nutrient monitoring close to source, visualisation technology and other emerging technologies supporting precision farming. An important role into the future is in training of staff from other organisations in effectively applying these processes and technologies.
- R3.11** More needs to be done to increase the role of the private sector in providing an environment for one-one service and support for producers/growers to better apply and adapt their management practices to those recommended. This has been highlighted through the current *Research and Development for Profit Project – Stimulating Private Sector Extension in Australian Agriculture to Increase Returns from R&D* and its associated forums and surveys. It is also important to ensure that there is individual on-going support for growers and producers who are influenced by 'subsidised programs' to make on-going change. The approach used by Farmacist in nutrient management provides a real opportunity for private delivery of nutrient management support post the subsidised period
- R3.12** The delivery of industry Best Management Practice programs (linked directly to the Water Quality Risk Framework) remains the key to benchmarking, whole farm analysis, identifying management gaps and areas to improve and to capture improvements over time. BMP standards need to continually improve to reflect the latest science and advances in industry best practice and as a consequence support the upward shift in industry performance to achieve reef water quality outcomes. BMP will also play an increasingly important role in providing improved returns for producers through the marketing of sustainable farming and in meeting regulatory requirements. Trained and experienced personnel are needed to continue to effectively drive and coordinate this process.

² Defined as temporary funded positions

R3.13 The public sector and deliverers of industry BMP programs also have a key role in working closely with the introduction of changing regulations and legislative requirements in terms of building producer awareness of the regulations, the implications, benefits of joining BMP programs and assistance with meeting the standards required.

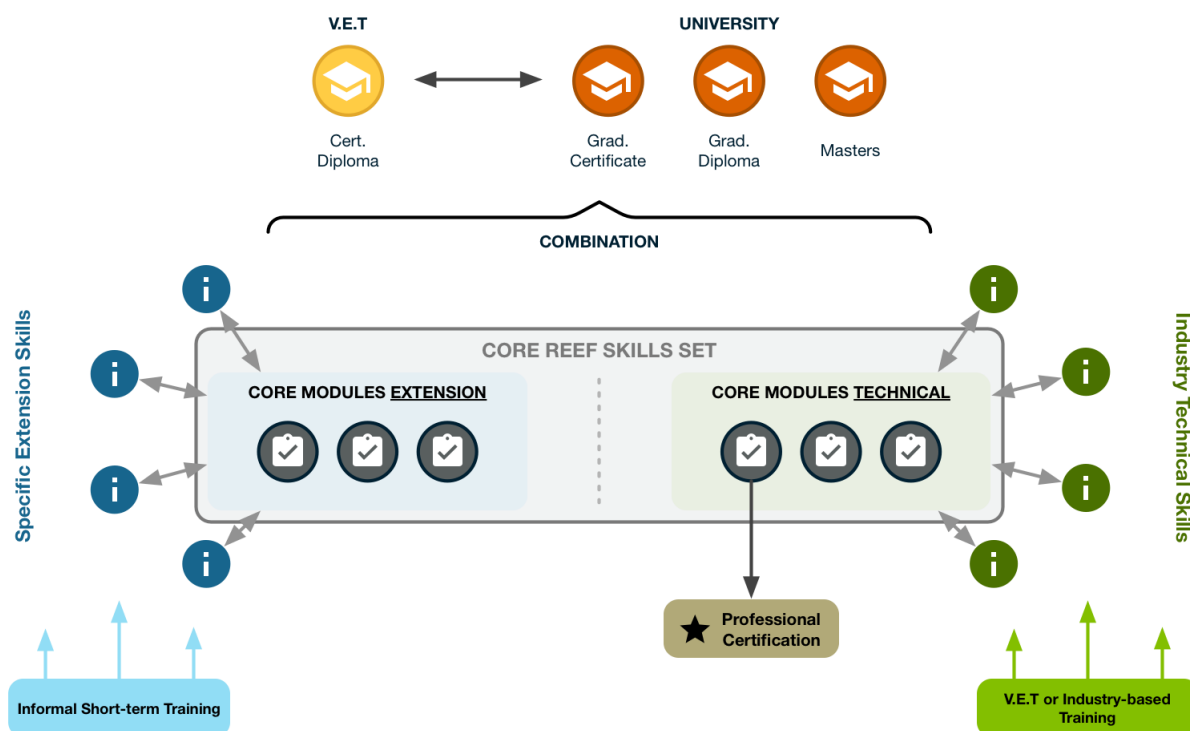
R3.14 The extension gap in nutrient management/water quality practices in relation to (mixed) farming systems/crop rotations (in the context of a farming system) extension needs to be addressed – through developing a BMP approach to mixed farming and directly funding programs targeting this sector.

R3.15 Business management and the economics around recommended practices remains a key area to underpin the efforts towards encouraging management practice change. This is an area where personnel need to be retained and extension personnel have the skills and tools available to be proactive in analysing and extending the financial implications of recommended practice change.

R3.16 Research and Development (R&D) Corporations will need to continue to lead, provide staff and coordinate with research and extension delivery organisations to develop and apply practical production-based technologies while ensuring that water quality considerations are a primary consideration in their application and use.

R4. Training and Capacity Building

Framework for On-going Education and Training for Reef Extension/Advisory Personnel



Oversight/management

- R4.1** Appoint a **Senior Training Development Officer** for three years in an appropriate neutral organisation to develop and implement the process and framework for upskilling the extension delivery staff across sectors in the reef regions – with an advisory committee comprising those with the appropriate knowledge and technical expertise.
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- R4.2** Promote, use and further develop the ‘extension best practice framework’ as a basis for benchmarking individual and collective expertise in the reef region determining extension training needs and providing supporting resources. Link this to a bi-annual survey of extension delivery staff.
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- R4.3** Develop a framework incorporating skill areas, delivery methods and sources of training. This would include a mix of formal and informal courses which may or may not lead to a qualification and could be delivered with a mix of on-line and face to face approaches. This could sit within a Vocational Education and Training (VET) Certificate and/or Graduate Certificate level.
-
- R4.4** Ensure that training is provided by experienced people with practical and theoretical skills to ensure interest and direct relevance to participants.

Core skills

- R4.5** Define and source/develop training material around a set of agreed ‘**Core Reef Extension**’ skills targeting both extension and overarching technical skills. Indicative core extension skills are *Planning effective extension projects and activities*; *Client and collaborator engagement and social marketing and behaviour change*; *Extension delivery*; and *Evaluation and reporting*. Indicative core ‘technical skills are: *Farming in a reef ecosystem*; and *Nutrient/sediment management*; Farm Business Management and whole farm assessment and farm business management.
-
- R4.6** Gain commitment from delivery organisations to upskill their staff in these core areas and provide a web-based platform where extension staff can register their experience and training in these core areas – and register for/seek training/mentoring opportunities. Professional certificates should be provided to staff who meet/have reached the core criteria.
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- R4.7** Provide some degree of subsidy – but also require funding from participants and/or the organisations to avoid a dependence on subsidies.
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- R4.8** Provide professional development for program managers and funders at State and commonwealth level to better understand the farming systems, farm management, extension and behaviour change context and principles.
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- R4.9** Provide funds within programs and recognition for extension staff to run workshops for supplier staff (e.g. fertiliser, irrigation and farm machinery).

Specialist and Technical skills

- R4.10** Define and source/develop specialist courses in extension (e.g. social media; you tube videos; webinars; trial/demonstration design) and technical areas (e.g. advanced nutrient/sediment management; system repair; business management; **specific technical areas relevant to industry**) with relevant training and education organisations and individuals and make them available to extension staff and other stakeholders. These could contribute to a post-graduate qualification or a Certificate or Diploma.
- R4.11** Have a system for professional certification in key skill areas (e.g. nutrient management planning; sediment management planning; soil conservation/health; BMPs). These are intended to provide career pathways, competence and confidence and assist producers in meeting increasing regulatory frameworks.

Mentoring

- R4.12** Develop a mentoring framework (including examining the existing Australasia-Pacific Extension Network [APEN] mentoring program) which enables newer/less skilled extension staff to link with and learn from more experienced and successful staff.
- R4.13** Ensure this is structured and there are 'rewards' and recognition built in for both mentors and mentees with minimum disruption.
- R4.14** The cross-regional extension coordinator could oversee this process with support from regional extension coordinators.

Reef Extension and Education Network

- R4.15** Establish a formalised network of Reef Extension deliverers. This could utilise the platform established by the Rural Industries Research and Development Corporation (RIRDC), managed by APEN, link in with the mentoring program and involve 6 monthly network meetings.
- R4.16** The proposed workshop attached to the APEN conference in Townsville in September could launch this process.

Career development

- R4.17** The increased opportunity for training and/or certification should assist in providing career advancement for extension staff.
- R4.18** Opportunities should also be provided for extension staff to access professional development opportunities (e.g. Nuffield Scholarship) and study visits to other regions and areas.

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- R4.19** In the first years of the program, 2-3 PhD opportunities should be provided whereby candidates continue to work for their institutions and in-situ working on extension related topics to better understand the factors impacting on change and adoption to maximise the value of investments in this area.

R5. Extension Approaches and Methods

Overall considerations

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- R5.1** As important as 'smart' goals are valuable (e.g. X number of growers with a Nutrient Management Plan), goals relating to gains in understanding, attitudes, capacity, motivation and continuous improvement should also be highlighted as project goals. This is about achieving the longer term cultural and attitude change and fostering a generational change.
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- R5.2** BMP (or equivalent – e.g. Hort 360) should continue to be promoted as an effective and holistic framework to take a whole of farm/property perspective and highlighting where changes can benefit productivity, profitability and water quality outcomes.
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- R5.3** Landcare groups with the capacity to work directly with growers/producers should be encouraged to apply for funding for extension projects in their areas.
-
- R5.4** Recognition should be given to growers/producers who successfully achieve audited BMP (or equivalent) accreditation – especially for the water quality related modules.

Methods

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- R5.5** An increased focus should be on funding longer term, *Peer-to-Peer* facilitated group learning – such as 'Focus Farms'; 'Whole-farm Review Groups'; 'Producer Demonstration sites'; and/or 'Producer Learning Groups' – and exposed to new approaches and technologies. Funding should be available directly to producer groups who select their own facilitator or be accessed by delivery organisations who then work to establish groups for this purpose. Those producers less engaged in other approaches should be encouraged to participate in these groups.
-
- R5.6** Greater use should be made of extension technologies such as: local water monitoring (direct feedback to growers); phone apps; precision-farming tools; drones; farm robotics; visualisation technologies and other aids to facilitate learning and understanding and trialling of improved approaches.
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- R5.7** Sugar shed meetings are important with 50% of growers attending (many who may not attend other forums). These should receive an on-going level of support with the proviso of including water quality awareness and management practice recommendations in the mix of information provided and discussions held.

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- R5.8** Nutrient Management/Sediment Plan objectives should include gains in skills in applying the plans in a tactical and practical way (e.g. calibrating machinery; and ensuring weed and irrigation management is in synch with nutrient application) – not just ‘numbers of plans done’.
-
- R5.9** Extension approaches should encourage the development of private sector delivery services – as seen in the approach to Nutrient Management Planning in RP161 *Complete nutrient management planning for cane farming*; and through having private sector deliverers working with growers in peer-to-peer learning projects and developing opportunities for individual services.
-
- R5.10** Greater use should be made of distance engagement technologies for grazing, sugar, grains and the horticultural industries to maximise access to peers, information and expertise which complement face-to-face and group extension methods. These include webinars (short and practical); You-tube videos (farmer/producer centred); on-line moderated forums (e.g. RIRDC/Grains Research and Development Corporation [GRDC] platforms based on US models). These will require training for effective use. The FutureBeef website provides a very good example of how a single website presents all RD&E information relevant to the beef industry.

Communication

- R5.11** Ensure there are sufficient cross-program resources (Department of Agriculture and Fisheries [DAF] and NRM groups) to proactively provide positive and consistent communication messages across regions and industries and advise of resources, training opportunities and progress.
-
- R5.12** ‘Rules of Thumbs’ should be discussed and developed within Regional Extension Coordination Groups and promoted as consistent messages across programs and organisations (e.g. “don’t use flood irrigation within at least 2 days of applying herbicides in cane”) through the communication activities. Some will be industry and regionally specific – and others will be cross-regional.
-
- R5.13** Annual updates should be provided to extension personnel in the region by researchers and government departments developing new understanding, technologies and monitoring approaches.

R6. Monitoring and Evaluation

Overall

- R6.1** RP150 (Reef monitoring, evaluation, reporting and improvement [MERI] Framework 2016) should be adopted as the ‘higher-level’ guide for reef extension and education (E&E). Each industry should develop a suite of data collection instruments to gather consistent data against this framework.

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- R6.2** Efforts should be made to comprehensively and accurately benchmark the practice levels related to the Water Quality Risk Framework (WQRF) in priority areas within each region.
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- R6.3** The Regional Extension Coordinator should provide leadership and support in relation to monitoring and evaluation methodology in partnership with Paddock to Reef.
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- R6.4** Greater use should be made of narratives and other qualitative methods to show the 'theory of change' associated with the different programs and the role and part they play in influencing management practice change.
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- R6.5** A Synergy Matrix approach should be used to demonstrate where each (new) program value adds to the mix and hence provide a basis for their evaluation.
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- R6.6** A Client Management System (CMS) for Grazing BMP/FutureBeef should be explored to assist with planning follow-up, monitoring, evaluation and reporting.
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Reporting

- R6.7** All Reef E&E programs should stipulate (and provide a funding allocation for) reporting against this framework with very clear expectations around demographics, enterprise type, size and location, capacity gains, practice changes and area/polygon affected. This includes BMP programs with public funding – with due consideration for individual privacy protection. Use of a common reporting platform would maximise effectiveness.

Summary of Indicative Allocation

Note: this table refers to the indicative allocation of **new funding** in relation to all draft recommendations and does not include existing or on-going extension personnel, resources or programs. The aim is to **supplement** existing approaches to boost and then maintain extension capacity and approaches into the future to support reef programs and management practice changes which improve profitability and water quality outcomes.

Allocation Area	Cost over 3 years	Percentage of total
New extension initiatives (Recommendations 2.7, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12.5.13)	\$4,160,000	25.3%
Education and training development and undertaking (Recommendations 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10)	\$3,920,000	23.8%
Coordination (Recommendations 2.1, 2.2, 2.3, 2.4, 2.5, 2.8, 2.6)	\$3,200,000	19.5%
New positions/expertise access (Recommendations 3.1, 3.2, 3.3, 3.4, 3.5, 3.6)	\$3,060,000	18.6%
Graduates and career support (Recommendations 3.7, 3.8, 3.9, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.18)	\$1,800,000	10.9%
Monitoring and Evaluation (Recommendations 6.1, 6.2, 6.3, 6.4, 6.5)	\$200,000	1.2%
Implementation of new initiatives	\$105,000	0.6%
Total	\$16,445,000	100%

CONTENTS

Acknowledgements	2
Program logic of proposed approach	3
Summary	4
Key Messages	4
Recommendations	5
<i>Overseeing the implementation of this review</i>	5
R2. Coordination and Collaboration	5
R3. Extension Personnel and Expertise	7
R4. Training and Capacity Building	9
R5. Extension Approaches and Methods	12
R6. Monitoring and Evaluation	13
Summary of Indicative Allocation	15
Contents	16
1. Introduction	19
1.1 About	19
1.2 Scope	20
1.3 Context	20
1.3.1 ReefPlan Extension and Education Strategy	21
1.3.2 Parallel initiatives	22
1.3.3 Pilot programs initiated through this review phase	23
1.3.4 On-going programs targeting management practice and improved water quality	23
1.3.5 Regulations and Extension	26
1.4 Review process	27
1.4.1 Consulting	27
1.4.2 Website and online survey	27
1.4.3 Expert panel	27
1.4.4 Workshops	28
1.4.5 Secondary Sources	28
2. Findings and Recommendations	29
Structure	29
2.1 Overarching Findings	29
2.1.1 Current extension situation	29

2.1.2 Regional, industry and sub-regional factors	36
2.2 Overseeing the Review implementation	40
2.2.1 Oversight	40
2.2.2 Recommendations.....	40
2.2.3 Indicative Budget.....	40
2.3 Coordination and Collaboration	41
2.3.1 Findings from the review	41
2.3.2 Recommendations arising.....	44
2.3.3 Indicative Budget.....	47
2.3.4 Implementation.....	48
2.3.5 Risks.....	48
2.3.6 Monitoring.....	49
2.4 Extension Personnel and Expertise.....	50
2.4.1 Findings from the review	50
2.4.2 Recommendations arising.....	52
2.4.3 Indicative Budget.....	54
2.4.4 Implementation.....	55
2.4.5 Risks.....	55
2.4.6 Monitoring.....	56
2.5 Training and Capacity Building.....	57
2.5.1 Findings from the review	57
2.5.2 Recommendations arising.....	59
2.5.3 Indicative Budget.....	63
2.5.4 Implementation	64
2.5.5 Risks.....	64
2.5.6 Monitoring.....	65
2.6 Extension Approaches and Methods.....	66
2.6.1 Findings from the review	66
2.6.2 Recommendations arising.....	70
2.6.3 Indicative Budget.....	71
2.6.4 Implementation	73
2.6.5 Risks.....	73
2.6.6 Monitoring.....	73
2.7 Monitoring and Evaluation	74

2.7.1 Findings from the Review	74
2.7.2 Recommendations arising.....	75
2.7.3 Indicative Budget.....	75
2.7.4 Implementation	76
2.7.5 Risks.....	76
2.7.6 Monitoring.....	76
2.8 Overall Indicative Budget.....	77
3. Appendices	82
Appendix 1: Industry Best Management Practices (BMP)	82
<i>Focus</i>	82
<i>Industry Sectors</i>	82
<i>BMPs</i>	82
<i>Summary of the sector BMPs</i>	84
Appendix 2: Extension Approaches and Methods	88
<i>Focus</i>	88
<i>Extension Definition</i>	88
<i>Extension Approaches</i>	88
<i>Facilitated groups – Peer-to-Peer Learning</i>	89
<i>Technology Development</i>	89
<i>Training and group presentations</i>	89
<i>Information provision and access</i>	90
<i>One-on-one individual farm advisory</i>	90
<i>Best Management Practice Frameworks</i>	90
<i>E-extension</i>	91
<i>Co-innovation</i>	91
<i>Social Marketing</i>	91
Appendix 3: Extension Best Practice	92

1. INTRODUCTION

1.1 About

This report is an independent assessment of the extension and education activity aligned to the Great Barrier Reef catchments in Queensland. It informs an Implementation Strategy that the Queensland Government can use to guide the delivery of funding aligned to the Great Barrier Reef (GBR) Water Quality Taskforce *Recommendation 3: Extension and Education*³ and under the Queensland Reef Water Quality Program.

Conclusion 3: Agricultural extension, particularly when aligned with other mechanisms such as incentives, is fundamental for improved long term land management.

Recommendation 3: Extension 3. Invest in more effective, targeted and coordinated extension to support large scale land management practice change.

3.1. Restore the long term government commitment to both resource and rebuild capacity in extension services across the Reef across all relevant industry sectors.

3.2. Formalise extension networks and define leadership and roles and responsibilities across local delivery organisations (government, private and farmer-to-farmer), for a whole-of-farm business approach which incorporates Reef health outcomes.

3.3. Support ongoing training programs and career development for accredited extension advisors.

3.4. Make greater use of smarter and more innovative extension approaches including facilitated peer-to-peer learning, demonstration projects and new technologies (for example phone apps).

3.5. Partner with the agricultural industry to develop a large-scale behaviour change program (already underway with the cane industry) to encourage farmers to adopt specific actions, by better understanding their motivations and the associated benefits.

The report makes recommendations on how best to provide access to services for farmers to enable accelerated practice change and strengthen long term capacity while reviewing existing education and extension systems. *This may result in a change in the way that information is provided to farmers, or it may strengthen current approaches that are working well.*⁴

Additionally, it responds to the diverse agricultural industries, local communities and geography present within the Great Barrier Reef catchments including cattle grazing (including beef and dairy production), cropping (including cane and grain farming), and horticulture (including banana growing).

³ DAF16050 Contract Details GBRT Recommendation

⁴ Queensland Reef Water Quality Program fact sheet (<https://reefextension.couttsjr.com.au/FINAL%20EHP-DAF%20brief%20Factsheet.pdf>)

1.2 Scope

The scope of this review was to:

1. Review current public and private sector extension capacity, career development and processes, gaps and opportunities in service delivery and information packages, and identify innovations in extension delivery, advisory services and staff development to achieve large scale practice change and improvement. This should take into account the contemporary requirements of Reef 2050 Long Term Sustainability Plan, the Great Barrier Reef Water Science Taskforce Recommendation 3: Extension and Education, the existing Reef Plan 2013 Extension and Education Strategy and wider cross-sector initiatives.
2. Develop an Implementation Strategy, detailing local level recommendation appendices, that include a focus on innovative concepts in Extension and Education delivery at an industry and sub-regional level, reflecting the feedback provided by both providers and users of Extension and Education services, to ensure that extension delivery is tailored to the needs of each industry and area at an appropriate scale, and can be prioritised on the basis of an audit of current extension providers (both public and private sectors), current and possible future services, and extension capacity needs.
3. Provide a final report detailing outcomes of the analysis, consultation and review processes and make recommendations to the Queensland Government on what activities should be undertaken to meet the investment objectives set by the Taskforce Recommendation 3: Extension and Education.

1.3 Context

The Great Barrier Reef Water Science Taskforce (2016) from which this review is based, described the extension and education context in the following way (p51):

Currently farmers are getting information, advice and signals from multiple sources which can be conflicting. This includes advice from the Department of Agriculture and Fisheries, NRM bodies, productivity boards, sugar mills, industry bodies such as Sugar Research Australia, fertiliser sellers, BMP advisors and others.

The report refers to: the (perceived) lack of access to effective extension services, the need for more extension tools – for example including behavioural economics and alternative delivery pathways to complement more traditional approaches; the need for a Whole of Farm approach; and having a strategy to deal with the problem of short term extension positions. Strengthening extension networks, mentoring support and training was also raised – as well as a need for access to specialist extension advice.

This work follows on from the development of the *Reef Plan Extension and Education Strategy* in 2010 and then the update in 2014 - *ReefPlan Water Quality Protection Plan Extension and Education Strategy Update and Implementation Guide*. Key recommendations from this update are provided below – as are those from the related *Reef Plan Best Management Program Monitoring and Evaluation Review and Practice Change Monitoring, Evaluation, Reporting And Improvement Framework*.

1.3.1 ReefPlan Extension and Education Strategy

The *ReefPlan Water Quality Protection Plan Extension and Education Strategy Update and Implementation Guide 2014* described the core underpinning principles and goals as:

- Maximising the effective integration of extension and education, Best Management Practice and grants programs through regional and state level coordination.
- Improving water quality outcomes in the context of a holistic approach to farm management, which involves maximising water quality outcomes while ensuring productive and profitable agricultural enterprises.
- Prioritising and targeting extension and education effort where the most progress towards regional water quality targets can be achieved.
- Facilitating management practice change requires a mix of extension and education activities.
- Monitoring, evaluating and reporting capacity gains and practice changes resulting from extension and education activity in a consistent format for Reef Plan reporting and to prioritise and plan future delivery.

New or enhanced roles and processes identified in the Extension and Education Strategy Update included:

- Reef Plan Extension and Education Regional Coordinator (Regional coordinator) role to facilitate collaboration and information sharing between Reef Plan programs in priority areas.
- Information/analytical support role to capture the outcomes of extension and education activity in Paddock to Reef program reporting and feedback practice adoption information to stakeholders for decision making purposes.
- Group extension, on-farm development and technical roles/methods need to be strengthened in the mix of extension and education activities.
- Capacity building in relevant extension and technical skills for extension and education deliverers.
- Monitoring, evaluation and reporting framework based around capturing gains in capacity and practice change in farm management.

This review provided an opportunity to understand if and how these mechanisms have been implemented in practice, what has been learned from the implementation (or lack of it) and what else was needed to fully develop the extension and education capacity.

It is noted that DAF implemented the roles of Regional Extension Coordinators with funding to June 2017.

The recommendation in relation to the Monitoring and Evaluation Framework was undertaken and completed in 2016⁵. While this was accepted, it is pending a government response and implementation. The proposed framework was described in the report as seeking to:

Strengthen the current approaches to monitoring and evaluating practice change programs by providing a stronger focus on lead indicators. Lead indicators are 'in-process' measures that are predictive in nature rather than results oriented. For example, pre-adoption measures of

⁵ Stockwell B, Eberhard R, Bycroft P & Coutts J (2016) Reef Plan Best Management Program Monitoring and Evaluation Review and Practice Change Monitoring, Evaluation, Reporting and Improvement Framework, Watershed Australia and Queensland Government.

progressive gains in the capability of producers to adopt recommended practice changes are proposed. The gradual improvement in the positivity of attitudes and aspirations and associated increase in level of knowledge and skills of producers is predictive of how successful the program is likely to generate improved levels of adoption of recommended management practices. In addition, the MERI framework proposes a stronger economic evaluation component that will allow a greater understanding of how change in practices contributes to productivity and profitability outcomes at a range of scales (and a mix of lead and lagged indicators).

Key elements of its recommendations for monitoring included:

1. Adopting a set of common data standards and quality assurance protocols that are aligned to the Paddock to Reef program
2. Establish a common, spatial MERI database/s across investors and delivery agents.
3. Collect finer scale, spatial data which accurately reflects the extent of practice change to support better modelling of outcomes.
4. Incorporate additional indicators of capacity (farmers and delivery agents) to allow measurement of intermediate outcomes and timely program improvements
5. Incorporate additional economic indicators to understand productivity benefits
6. Collate basic programmatic data to track total effort
7. Periodically validate practice change results with other data sources (spatial imagery etc.).

This review revisits the need for effective monitoring and evaluation of extension and education programs for continuous improvement and reporting purposes and the implementation process.

1.3.2 Parallel initiatives

Funding under Recommendation 3 is also being directing towards other projects targeting behaviour and management practice change. These are outlined below.

Major Integrated Projects (MIPs)

The MIPs projects are parallel initiatives to this review – proactively using (and testing) a collaborative, localised and flexible approach to tackling the key water quality concerns. The fact sheet⁶ explains that *the Queensland Government has committed to implement two major integrated projects (MIPs) to: reduce nutrient and pesticide losses into waterways in the Wet Tropics region; and to reduce sediment and particulate nutrient losses into waterways in the Burdekin region. The MIPs will concentrate interventions and management efforts at a catchment scale and fully evaluate their effectiveness in improving water quality. This approach will be trialled in two regions from December 2016 until June 2020 to test whether it is effective and suitable for broader application. The projects will use a suite of complementary interventions and tools tailored to improve water quality outcomes and optimise uptake by landholders in each region. Landholders, local stakeholders and their communities will be actively involved in the design of projects.* Terrain is managing the Wet Tropics focus on nutrient management and North Queensland Dry Tropics is managing the sediment-based project in the Burdekin region. These projects were in the design phase during this review process

⁶ <http://www.ehp.qld.gov.au/assets/documents/agriculture/sustainable-farming/reef/major-integrated-projects-fact-sheet.pdf>

during which maximum effort has been made to involve landholders and other stakeholders in the process.

Cane Changer Project

The Cane Changer project is described as *an initiative designed to recognise Queensland's sugar cane farmers for their positive farming practices and their contribution to protecting the Great Barrier Reef*. It is noted that the project is *funded by the Queensland Government Department of Environment and Heritage Protection, the project is driven by the CANEGROWERS organisation, in partnership with human behaviour experts, Behaviour Innovation*⁷. The project is based on the premise that *growers have a long history of changing their practices...and...are open to the idea of making further changes if there are better ways of doing things*. The initial pilot phase has been completed and the project is now underway in the Wet Tropics.

1.3.3 Pilot programs initiated through this review phase

Pilot Graduate Program

A pilot initiative designed to strengthen the extension resources is the graduate program (or Agricultural Extension Work Placement Program) – being managed by QFF. They describe the purpose of the program as *delivering a pilot internship style program for up to six early career extension officers (trainees), who are recent graduates (holding at least a Certificate IV in a related field) and with no more than one year of experience as extension officers*. The intention is to have trainees *placed for a year in organisations, preferably across the six Great Barrier Reef catchments, to be supported by an appropriate mentor(s) who can provide them with on-ground experience in key extension techniques. The capacity of the organisation to provide the necessary support and mentoring will be a factor in the host selection*. They note that the aim is to have a placement in each catchment if possible, or at least exposure to extension activities in other catchments. Hosts are encouraged to partner with other local, relevant organisations to strengthen their application and provide an enhanced learning experience for the trainee. The project will be evaluated after the first year as a model for mentoring/graduate programs in relation to agricultural extension.

Pilot Extension Training Program

DAF undertook a survey of extension/advisory service providers (public, NRM body, agribusiness and private) in 2016 to determine training needs to strengthen their skills and effectiveness. As well as being an input into this project, the survey has provided the basis of a series of workshops being rolled out across the reef regions linked to Vocational and Educational Training qualifications. This is also a pilot program which will be evaluated for effectiveness and inform the on-going training and capacity building program.

1.3.4 On-going programs targeting management practice and improved water quality

There are many on-going initiatives from a range of organisations and funding sources targeting land management practices in the reef regions to improve water quality flowing into the Great Barrier Reef waters. A recent initiative has been a cross organisational working group, coordinated by the Office

⁷ <http://www.behaviourinnovation.com/canechanger/>

of the Great Barrier Reef, making efforts to pull together and link across many of the current initiatives addressing the 'human dimensions' impacting on behaviours and practices and aligning them with the relevant themes in the Reef 2050 Long Term Sustainability Plan. The Department of Environment and Heritage Protection's (DEHP) working document describes Human Dimensions with respect to reef water quality as encompassing *factors that influence people's practices, behaviours and/or attitudes, relationships and governance; all of which can be linked to either a direct or indirect impact on water quality outcomes entering the Great Barrier Reef*⁸.

Best Management Practice programs

Industry BMPs have their genesis in Environmental Management Systems (EMS) which were designed to be completed by landholders regardless of their commodity and region. The background and process for EMSs is documented in a national framework⁹. EMS provides a management framework based on a simple 'plan, do, check, act' cycle that achieves continual improvement. Historically EMSs had a very low uptake by landholders as there is little in the way of policy drivers or market incentives for agricultural commodity EMS certification. In contrast BMPs are founded on specific industry practices.

In the main, industry and Government policy agendas have been the stimulus for the development of industry BMPs. From this, resourcing has flowed to design and deliver BMPs. For example, the driver for the first industry BMP, that of the cotton sector, was driven by significant community and government concerns about spray drift from pesticide applications. The industry response was the development of *myBMP* which commenced in 1997. The regional NRM group Fitzroy Basin Association (FBA) initiated the development of a grains and grazing BMP commencing 2007 and 2009 respectively and in each case they partnered with AgForce and DAF.

From 2012 onwards the Queensland Government took a policy decision to directly invest in industry BMPs in reef catchments as a voluntary instrument and shift away from land holder regulations. The initial focus was a grazing and cane industry BMP with the grazing BMP partly developed and some modules delivered in pilot workshops whilst the development of the cane BMP commenced following an agreement with Canegrowers. This direct investment in the development and delivery of BMPs clearly had the focus of encouraging and supporting voluntary improvement of land management practices to achieve enhanced water quality outcomes.

More recently investment has been made in developing Banana and Horticulture BMPs. To add to the geographic spread, grazing and horticulture BMP delivery is now supported in South-East Catchments as a means of improving water quality in Moreton Bay. To cover the two other major sectors in the reef catchments, dry land cropping has available the grains BMP and dairy farming relies on the national program DairySAT.

Additionally, the Australian Government directly and indirectly supports industry BMPs and follow-up training and extension support through the National Landcare Program and more recently Reef Trust investment.

National Landcare Programme

National Landcare Programme – The Australian Government also invests in Reef-related projects through the National Landcare Programme. In reef catchments, it funds projects aimed at delivering education programs to improve land manager understanding of soil health and management.

⁸ Draft working document 'Human Dimensions in the Reef Water Quality Space' OGBR (2017)

⁹ Australia's National Framework for Environmental Management Systems in Agriculture Natural Resource Management Ministerial Council Oct 2002

Reef Trust National Landcare Programme

Reef Trust is described as an Australian Government program established to provide innovative, targeted investment to the Great Barrier Reef region, focused on improving water quality, restoring coastal ecosystem health and enhancing species protection. The Government has committed \$210 million to the Reef Trust. It is described as one of the key mechanisms assisting in the delivery of the Reef 2050 Plan, and focuses on known critical areas for investment – improving water quality and coastal habitat along the Great Barrier Reef, controlling the current outbreak of crown-of-thorns starfish, and protecting threatened and migratory species, particularly dugong and turtles. This has included the funding of incentive funding (use of market based instruments) to encourage the uptake of new practices and technologies to improve water quality outcomes on farms and properties. Regional NRM Bodies, Queensland Farmers Federation, RCS, Greening Australia and WWF have been involved in rolling out the funding for the program. Currently most of the NRM Bodies and industries are collaborating through the *Reef Alliance Program: Growing a Great Barrier Reef (RAP)*¹⁰ to deliver and report on Phase III of the program. This phase has a stronger emphasis on extension and education and innovation than previous programs. The use of incentives is a relatively small component of the RAP program, and is highly targeted.

Queensland Government Reef Water Quality Science Program

The Queensland Government funds a number of projects under their *Reef Water Quality Science Program*¹¹ (2012-2019) aimed at capacity building and improving farming practice. The current projects are listed as:

1. RP20C Burdekin Nitrogen Project
2. RP129C Alternative pesticides – water quality guideline development (for selected high priority pesticides discharged to the Great Barrier Reef)
3. RP132G Accelerating the use of FORAGE and other complementary tools to support sustainable grazing land practices
4. RP140B Economic assessment of Banana Best Management Practice (BMP)
5. RP143C Qualifying residual soil nitrogen in sugarcane beds in the Burdekin
6. RP151C Wilmar demonstration trials assessing cane productivity and water quality impacts of mill by-products
7. RP152P Griffith University cost-effective restoration of wetlands that protect GBR
8. RP161C Complete nutrient management planning for cane farming
9. RP167C Sandy Creek – on-farm change for water quality improvement
10. RP169C Connecting cane farmers to local wetlands
11. RP172G Burdekin Dry Tropics gully prioritisation
12. RP173G Cost-effective management to improve land condition

The Queensland Government also invests in reef related projects through its NRM Program¹² which is managed by the Department of Natural Resources and Mines. Queensland has allocated \$80 million to the regional natural resource management investment program over five years from 2013 to 2018, including \$30 million to protect the Great Barrier Reef. The majority of the funding is being provided to support strategic projects delivered through Queensland's regional natural resource management (NRM) organisations. These organisations provide an important link between governments and communities. They also work collaboratively with volunteer and grass-roots organisations (e.g. Landcare), rural industry groups and landholders.

¹⁰ <http://www.gff.org.au/projects/reef-alliance/growing-great-barrier-reef/>

¹¹ <https://www.qld.gov.au/environment/agriculture/sustainable-farming/reef-projects-current/#RP20C>

¹² <https://www.qld.gov.au/environment/agriculture/sustainable-farming/nrm-investment-program/>

Other Programs

Other reef programs include projects such as Project Catalyst – which aims to support farmer led innovation in the cane industry. It includes a substantial element of extension/agronomic/economic support. Project Catalyst is a pioneering partnership between more than 70 Queensland cane growers and major program partners – Reef Catchments, Terrain Natural Resource Management, NQ Dry Tropics, the Australian Government, WWF and The Coca-Cola Foundation.

There is a current initiative to develop a framework around *Human Dimensions* projects. The term is defined as *human factors that exist at all social scales (from the individual through to societal-wide scales) that play a role in shaping social, economic and environmental outcomes associated with the Great Barrier Reef.*¹³ It is noted that, with respect to Reef water quality, *the human dimension encompasses factors that influence people's practices, behaviours and/or attitudes, relationships and governance; all of which can be linked to either a direct or indirect impact on water quality outcomes entering the Great Barrier Reef.* A Human Dimensions work program is being developed to tie in with the themes in the Reef 2050 Long Term Sustainability Plan. Extension and education will have a direct role in progressing these themes.

1.3.5 Regulations and extension

The GBR Water Science Taskforce Final Report identified a need for '*a staged regulatory pathway supported by extension, incentives, compliance, modelling and monitoring is needed to meet reef outcomes*' (page 62). A recent discussion paper¹⁴ entitled *Enhancing regulations to ensure clean water for a healthy Great Barrier Reef and a prosperous Queensland* by the Queensland Department of Environment and Heritage (March 2017) foreshadows a broadening and enhancing of *its existing reef protection regulations to eradicate the most polluting practices from a range of rural and urban industries in the Great Barrier Reef catchment, and transitioning these industries to improved management practices.* Key policy measures being considered included:

- Set or improve minimum practice standards targeting nutrient and sediment pollution for all key industries in all reef catchments
- Set pollution load limits for each reef catchment to target responses for managing risks to water quality
- Provide a framework for water quality offsets to be used to counter residual nutrient or sediment pollution from new agricultural, urban and other intensive land uses.

In terms of implications for farm management practices, it was stated *that minimum practice regulatory standards will be established for commercial banana, horticulture and grain production and that the minimum regulatory standards that apply for commercial sugarcane and grazing production will be improved.* The practices targeted for regulation included: *fertiliser application, maintaining ground cover, irrigation management and keeping records* with minimum practice standards applying to producers in the 35 catchments that drain into the reef.

Significantly, the discussion paper noted that the government *will recognise and reward the efforts of producers to become accredited against industry Best Management Practice programs by providing the ability for these programs to be legally recognised as an alternative pathway for producers to meet minimum practice regulatory standards.* Producers accredited against a recognised Best

¹³ Working papers, DEHP

¹⁴ <https://www.qld.gov.au/environment/agriculture/sustainable-farming/reef-regulations/>

Management Practice program (or equivalent program) will be deemed as demonstrating compliance with the minimum practice regulatory standards.

1.4 Review Process

1.4.1 Consulting

Consulting stakeholders has been an important aspect of the review with mechanisms in place to ensure opportunities for input from people delivering extension, particularly on-ground practitioners. *The consultancy team sought input from as many people as possible in regional areas through phone calls, visits and small workshops between December 2016 and April 2017¹⁵.* It was found that people were generally happy to be interviewed, attend meetings and/or respond to the web survey (see below). Consulting methods included:

- Direct contact from the consultant
- Completing a web based survey
- Contacting the consultants (if not contacted by any team member).

1.4.2 Website and online survey

A website (<https://reefextension.couttsjr.com.au>) was created to provide a place for stakeholders to provide input into the project via a website. It also included background documents, papers and links to related websites. A blog updated the project progress on a monthly basis from December 2016.

A total of **46 stakeholders** responded to the web survey, with 48% from the sugar industry, 26% from the beef/dairy industry, and 26% from across industries/other. The majority of respondents (76%) serviced a single region, with 9% servicing multiple regions and a further 9% servicing all regions. The Wet Tropics region was most represented with 41% of the total respondents, followed by Burdekin (30%) and Fitzroy (both 28%). The most common roles were extension/advisor/consultant (54%) and Natural Resource Management (30%) – other roles included government (4%), industry organisation (2%), and other (9% - e.g. economist, GIS and information management).

1.4.3 Expert panel

An Expert Panel was established to contribute their experience and expertise in the process and content of developing the steps needed and recommendations and act as a sounding board. They helped to ensure that experience from elsewhere and innovative solutions were considered – and to challenge to avoid 'business as usual' and to ensure a balanced and rigorous outcome. Given that effective capacity building, extension and behaviour change is central to the aim of the review, social science/extension as well as industry experience is essential.

The Expert Panel was comprised of:

- **Associate Professor Ruth Nettle**, University of Melbourne. Ruth Nettle is Director of the Rural Innovation Research Group at the University of Melbourne. Ruth has a strong background in extension, capacity building and the social sciences has worked closely with industry and the Rural Development Corporations in this arena. She is the author of many

¹⁵ Queensland Reef Water Quality Program fact sheet (<https://reefextension.couttsjr.com.au/FINAL%20EHP-DAF%20brief%20Factsheet.pdf>)

papers and reports relevant to extension and innovation. Her unit is developing extension training modules for the Research and Development for Profit Private Sector Project.

- **Dr Neels Botha**, Senior researcher with AgResearch New Zealand. Neels was teaching and researching extension at a university in Pretoria in South Africa before going to NZ to work for AgResearch. He is one of the leaders of the Primary Innovation Project which is implementing a co-innovation approach to stimulating innovation across agricultural industry in New Zealand. Neels was one of the social researchers in the Cultural Imprint Study undertaken in the sugar industry in the Herbert region.
- **Shaun Coffey**, an experienced Professional Director, Chairman and Chief Executive with over 30 years of highly successful experience in the technology, manufacturing, energy, environment, agricultural, health, and services sectors.

1.4.4 Workshops

A workshop was held in Brisbane on 23 February 2017 with good representation across organisations and industries. *The aim was to present feedback from consultations to date and gain responses and further input into developing recommendations*¹⁶. Discussion centred around:

- Governance;
- Capacity building;
- Extension approaches;
- Better integrating science into extension; and
- Monitoring and evaluation.

Initial regional meetings were held in January/February to canvass views and regional workshops were run towards the end of March 2017 to report initial findings and emerging recommendations back to stakeholders for feedback. A second Brisbane workshop was run where stakeholders were invited to indicate what resonated with them about the report and recommendations and what they would add or change to improve it.

The draft report was put on-line and stakeholders provided the link and invited to comment using a tailored web survey format. Some provided detailed feedback via e-mail. All feedback was captured in a table and responses to each point documented. Many changes were made in the report as a result of this feedback loop.

1.4.5 Secondary sources

There were a number of key secondary sources that informed this review.

- Skills and Training Need Survey by DAF in 2016
- National Farmer Survey in Extension Services (Quantum Market Research) undertaken for the extension focused Research and Development for Profit Projects (RIRDC/DA/UoM)
- Background documents relevant to the review

¹⁶ March 2017 blog update, <https://reefextension.couttsjr.com.au>

2. FINDINGS AND RECOMMENDATIONS

Review current public and private sector extension capacity, career development and processes, gaps and opportunities in service delivery and information packages, and identify innovations in extension delivery, advisory services and staff development to achieve large scale practice change and improvement. This should take into account the contemporary requirements of Reef 2050, the Great Barrier Reef Water Science Taskforce Recommendation 3: Extension and Education, the existing Reef Plan 2013 Extension and Education Strategy and wider cross-sector initiatives.

Structure

Following presentation of overarching findings, this section will be structured around the key areas of:

- Coordination and Collaboration
- Extension Positions/expertise
- Training and Capacity Building
- Approaches and Methods
- Monitoring and Evaluation

In each section, the topic will be covered in the following way:

- Findings from the review
- Recommendations arising
- Indicative Budget and Implementation
- Risks
- Monitoring

2.1 Overarching Findings

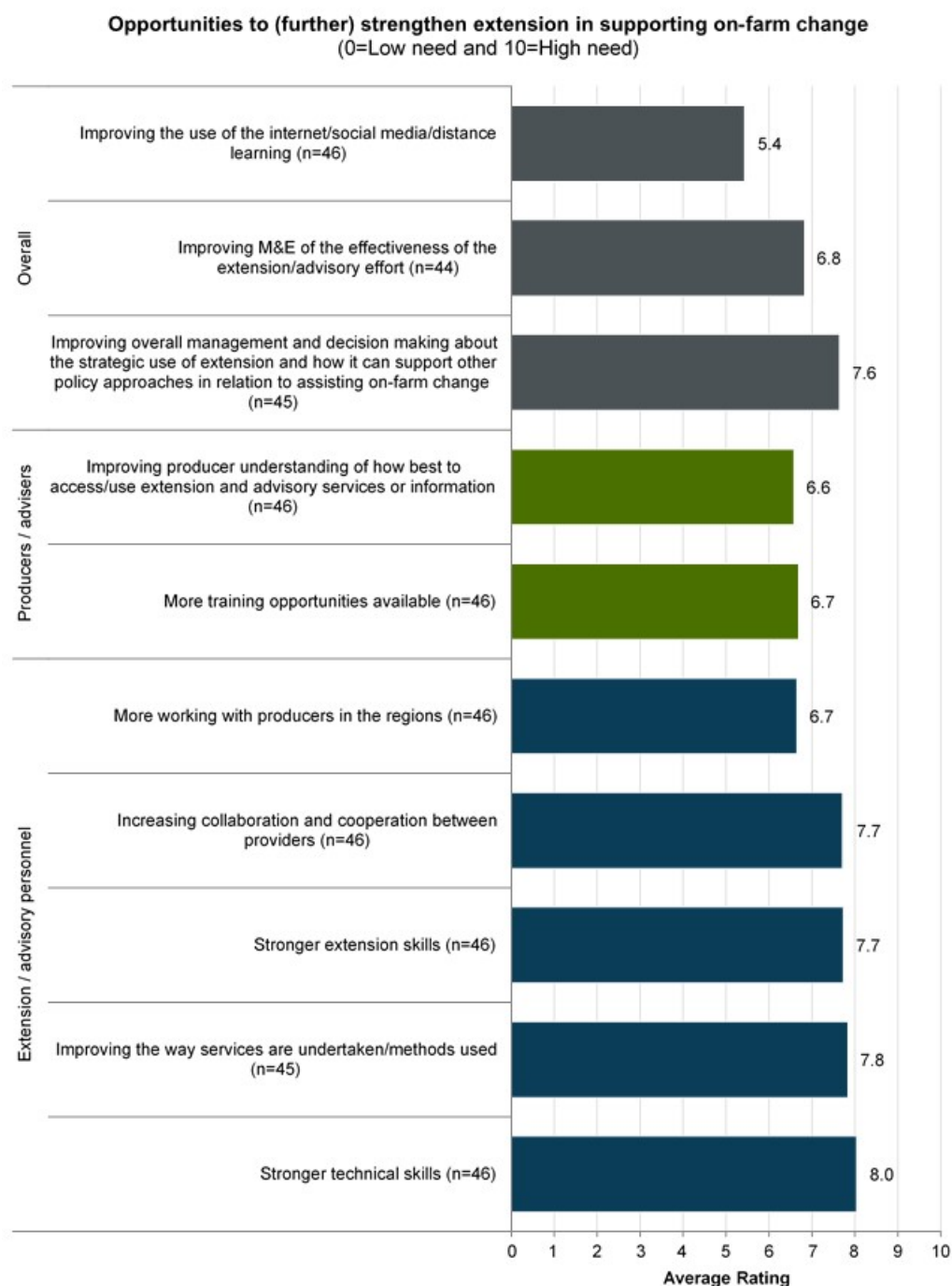
2.1.1 Current extension situation

General

Feedback from stakeholders about the current state of extension in the reef regions reflected those findings presented by the GBR Water Science Taskforce – providing a picture of a fragmented extension system, with high turn-over in government funded programs and lacking some expertise and capacity in key areas. Respondents to the stakeholder survey rated the current extension system as only midway effective in supporting water quality outcomes in the reef regions – providing an overall average rating of 5.4 (on a 0-10 scale, n=46) – similar across sectors.

When asked to rate potential opportunities to strengthen extension in supporting on-farm change, survey respondents had the highest average ratings for: the *strategic management of extension*; *increasing collaboration and cooperation between providers*; *stronger technical and extension skills*; and *improving the extension methods used*. The full responses are shown in the graph below:

Chart 1: Opportunities to strengthen extension (Stakeholder web survey 2017)



These ratings strongly reflected the general feedback from interviews, discussions and workshops with stakeholders. A common and strong theme coming from the regions was a frustration with the

way programs were developed and implemented and the resulting overlap, competition and lack of opportunity (milestone driven) to collaborate effectively with other programs. A number of extension respondents to the survey referred to a perceived lack of management and direction from funding bodies and the limited *on-ground understanding* of the factors that *drive real change*.

Using a whole farm approach was also strongly suggested with one respondent commenting: *we all agree that N rate is not the be all and end all of water quality and productivity. It's a whole of farm approach and identifying the limiting factor on that particular block is the first step in the puzzle.* Another noted: *a program focused on maintaining ecosystem process would be highly beneficial, especially when considered in the context of 'whole of property' management... improvement to production systems is one focus - but improvement and maintenance of natural systems/process is also significant and needs to be included into the decision making.*

The *National Farmer Survey on Extension Services* (2016) asked a range of questions to producers across Australia about their agreement that they currently had the 'knowledge and skills required to effectively manage the property/farm' and whether they 'always knew where to get their information and advice that they needed'. The responses varied across industries. Sugar respondents were most confident about the sufficiency of their current level of skills and knowledge (75% agreement) and knowing where to get information or advice (58% agreement). The responses from other industries relevant to the reef regions included: Cotton (63/54); Horticulture (57/47); Cropping (grains) (56/38); Mixed cropping and grazing (56/46); and Beef (47/32). When asked about satisfaction with the way the current system worked for their farm, Cotton (41%) and Sugar (25%) were the most satisfied. Other industries' satisfaction were: Horticulture (19%); Cropping (grains) (17%); Mixed cropping and grazing (15%); and Beef (13%). These figures need to be kept into perspective in that they were a national sample and voluntary (web survey) responses, but they did reflect the findings of the Great Barrier Reef Water Quality Taskforce findings of a perceived lack of ready extension/advisory services for producers.

Cane

The extension landscape for the cane industry changed with closure of *BSES* and *Sugar Research and Development Corporation* replaced by Sugar Research Australia (SRA). SRA has maintained a regional field presence (much less than in the BSES period) – initially targeted at 'train the trainer' but currently going through a review process to see where they can most add value to growers. Mill Productivity Services have increased in some regions comprising of two groups of farm staff – the technical group which visits the farms supplying the mills to provide support for varieties and pest and disease identification and management and the extension team that take a more project approach and also undertake projects funded by reef programs. In cane regions regional NRM organisations: support cane growers to better plan for the sustainable management of land and water resources; manage and deliver programs that help protect, maintain and restore land and water resources; enhance the capacity of the community to manage for sustainability; and share knowledge and promoting learning and support continuous improvement and best practice. DAF continues to have presence in the development and extension arena through its ReefPlan team with about 10 dedicated FTEs. Staff undertake on-farm trials, provide training on technologies such as the Dual Herbicide sprayer, collaboratively run workshops and provide other communication and extension activities. As well as agribusiness agronomists and product sales staff there are some smaller private companies and consultants who work in funded projects or directly with farmer clients – although this sector is relatively small compared to industries such as cotton.

Adoption surveys of cane producers undertaken by Coutts J&R over recent years have included questions on the preferred way of receiving information/extension support. As the table below shows, there has been a shift over the last three years although with on-farm trials and demonstrations and

workshops remaining high preferences. The changes in choosing one-one extension perhaps mirrors the acceptance that there is less of this available to them.

Table 1: Preferred methods of receiving information/support 2014-16 (cane adoption surveys)

	2014	2015	2016
1	One-on-one extension (82%)	Workshops/Training (52%)	Workshops/Training (42%)
2	Field days/farm walks (64%)	One-on-one extensions (e.g. farm trials/demos) (47%)	On-farm trials/demos (32%)
3	Grower groups (56%)	Field days/farm walks (40%)	One-on-one extension through farm visits (farmer initiated) (31%)
4	Workshops (51%)	Grower groups (32%)	Fact sheets, information, case studies with economic cost-benefit assessments (26%)
5	Grower videos, fact sheets or information on the internet (34%)	Grower videos, fact sheets or information (16%)	Field days/farm walks (19%)
6	Economic cost-benefit assessments of different management options (29%)	Other (websites and email most commonly described) (13%)	Grower groups (18%)
7	Other (2%)	Economic cost-benefit assessments of different management options (3%)	Other growers (neighbours) (15%)
8			Other (email/internet, magazines/newspapers, mail, agronomists, extension officers, shed meeting)(14%)
9			Grower videos (2%)

Financial reasons were given as the main reason producers were prompted to make (or planned to make) changes in both 2015 (59%) and 2016 (38%), followed by Reef Rescue or other funding (44% and 29%), and the biggest barrier to change has consistently been a lack of funds over the three years (60%, 60% and 58%, respectively). From 2015 lack of time has also been an issue, replacing seasonal issues/weather in 2014.

Grazing

A major issue identified with respect to grazing was the distances that need to be covered. Although there has been some success with the use of webinars through the FutureBeef Program (a partnership of Meat & Livestock Australia (MLA), Department of Agriculture and Fisheries (DAF), Northern Territory Department of Primary Industries and Fisheries (DPIF) and the Department of Agriculture and Food Western Australia (DAFWA)), poor internet connection is still currently an issue in some parts. There is a significant Queensland Government investment in Grazing BMP. Grazing BMP is managed through a partnership of FBA, AgForce and DAF and the project is currently delivered in partnership the three additional partners of NQDT, Burnett-Mary and SEQ Catchments. It is delivered in the three largest reef catchments of the Burdekin, Fitzroy and Burnett-Mary. The Grazing BMP program is a voluntary process which helps graziers to identify improved practices including improving long term profitability. Grazing BMP has an externally audited accreditation process available.

MLA EDGE training courses are delivered by private consultants and DAF to help graziers gain knowledge and develop necessary skills to improve their livestock enterprises. Edge courses include Grazing Land Management, Nutrition and Business. These are delivered on a fee for services basis.

There are a number of other private consultants servicing the grazing sector in GBR Catchments with a focus of financial management and succession planning. RCS is the largest consultant delivering grazing sector training in reef catchments. *Grazing for Profit* is the entry level course. Higher level courses, one on one, business benchmarking and succession planning are also available. RCS is currently delivering Project Pioneer through Reef Trust III funding. The three-year project is targeting 50 businesses for a whole of business approach. There is a comparatively low usage rate of private consultants by grazing businesses throughout Queensland.

DAF extension staff (based in the Burdekin, Wet Tropics and Fitzroy catchments) are heavily involved in Grazing BMP delivery and provide additional support to graziers to improve the profitability and productivity of their grazing systems while reducing sediment and nutrient runoff. Specific extension support includes: herd performance, grazing land/sediment management, business and economic evaluation, property planning, record keeping and marketing.

The Australian Government Reef Trust program is delivering support to the grazing sector through regional NRM organisations. The Reef Alliance is coordinating delivery of *Growing a Great Barrier Reef* and is funded through Reef Trust III and partners with the Burnett-Mary Resource Group, FBA, NQ Dry Tropics and Terrain. The Reef Alliance Program does not involve all partners of the Reef Alliance. *Growing a Great Barrier Reef* aims to improve grazing land management through education and awareness and targeted on-ground support amongst other industries. As well, the regional NRM organisations delivered Reef Trust I & II project to grow the management capacity of graziers and cane growers and erosion mitigation projects.

Horticulture general

Most horticultural growers utilise the services of supplier companies such as Elders and Landmark for nutrient and pesticide advice and information. There are some DAF staff who provide development and extension support (e.g. precision-ag) – but these have reduced in recent years. Horticulture Innovation provides Development Officer support in some crops (e.g. Pineapples; Strawberries; Macadamia; Bananas; Mangoes). Growcom has reduced regional staff following the reduction of the Water Use Efficiency project – with no-one north of Townsville.

Growcom delivers the Hort360 BMP program to horticulture growers. The Hort360 program is aligned to the Horticulture Water Quality Risk Framework developed in conjunction with Paddock to Reef. The horticulture program focusing on productivity with water quality benefits – with a real need to be able to demonstrate economic benefits.

There is Reef Trust funding for horticulture - \$2.4M (Bananas received approximately 60% of the funds and the remainder going to other Horticulture). It was noted that the lack of funds for incentive payments was a barrier to roll out – and efforts are being made to address this. Another barrier is the lack of records needed to be in the program.

There is no direct water quality support for crops on the Atherton Tableland (e.g. peanuts; mangoes; maize) as these crops were not seen to be a priority for this purpose, however Terrain have \$300k to support these growers and have engaged Barron Catchment Care. They are using the common *Water Quality Risk Framework* as Growcom assists in reporting and collation of project data.

Growcom delivers the Hort360 BMP program – funded from Reef Trust (Bananas received approximately 60% of the funds and the remainder going to the rest of Horticulture). It was noted that the lack of funds for incentive payments was barrier to roll out – and efforts are being made to address this. Another barrier is the lack of records needed to be in the program. The Hort360 program is aligned to the Water Quality Risk Framework developed in conjunction with Paddock to Reef. It focuses on productivity with water quality benefits – with a real need to be able to demonstrate economic benefits.

Bananas

Banana growers are supported by DAF with extension staff based at the Centre for Wet Tropics Agriculture in South Johnstone and more recently with the Australian Banana Growers' Council who have three staff located with DAF in South Johnstone. Two of the ABGC staff work on reef projects and one on BMP. BMP is delivered by ABGC with support from the Queensland government and Horticulture Innovation Australia. BMP for bananas was launched at Banana Industry Congress in 2013 and is a single point where growers can get information about suggested farming practices, reflects the structure of Freshcare's Environmental Code and provides a checklist, management plan (priorities for change) and resources to help. DAF's role in reef issue is minor at the moment since ABGC has become involved and have 1½ staff. There some private consultants involved also with the banana industry.

Grains and Mixed cropping

Best practice cropping production technologies have advanced significantly in the past two decades with the wide spread uptake of zero till, controlled traffic and opportunity cropping. Growers in the Australian northern grains region has been at the forefront of the application of these technologies. The introduction of pulses into crop rotations have the added benefit of reducing requirements for nitrogen fertilizer and advantages in weed, disease and pest control. However, herbicide resistant weeds have emerged in recent years which has challenged these low till systems. In general, the majority of dry land cropping best practice sees improvements in profitability and water quality through a reduction of tillage, improved residual ground cover and matching fertilizer rates to yield potential.

DAF in partnership with GRDC deliver the Northern Grower Solutions project. The Northern Grower Solutions project has the function of managing short term activities, in a development and extension capacity to address the issues raised locally and deliver results that can be adopted straight away by growers. The project has three nodes in reef catchments: Burnett, Fitzroy and Burdekin (coastal). The *Strategic Cropping Land Mitigation Fund* project that is being administered through DAF and delivered by FBA and Precision Agriculture aims to facilitate the establishment of private precision agricultural technical advisers in CQ.

Grains BMP was initiated by FBA and DAF with the support of AgForce in 2008. Grains BMP program is an industry led process which helps broad acre grain growers to identify improved practices which can help improve the long term profitability of their business. It also helps identify the steps needed to be taken to incorporate best management practices into an enterprise. Participation in Grains BMP is highest in the Fitzroy where it has been a prerequisite to those receiving reef program incentive payments.

In surveys of grain producers involved in Grains BMP by Coutts J&R between 2013 to 2015, the importance placed on incentive funding in prompting changes decreased from most important in 2013 to third-most important in 2015, with training undertaken and the influence of other growers being the most important influences in prompting changes in 2015.

Table 2: Top three enablers of changes 2013/15 (grains adoption surveys)

	2013 (n=75; importance of program components on changes made)	2015 (n= 63; importance of specific influences in prompting changes)
1	Incentive funding (8.2 avg.)	Training undertaken (7.6 avg.)
2	Training workshops (7.9 avg.)	Other growers (7.6 avg.)
3	Self-assessment workshops (7.3 avg.)	Incentive funding (7.4 avg.)

Lack of finances/funding has consistently been the biggest barrier of change throughout 2013 (53%) and 2015 (72%), and further reasons continue to follow a similar pattern across both years, with lack of time (13%) and weather (13%) being cited in 2013, and lack of practicality (e.g. drought) (25%) and other reasons (22%) including floods/weather, labour shortage and lack of time mentioned in 2015.

Reef Trust Phase III funding for the grains sector will be delivered through FBA and Terrain. FBA has a lead in grain grower support in the Burdekin, Fitzroy and Burnett. Support is provided to grain growers across reef catchments to enable growers to continue transitioning towards best management practice.

There is a range of utilisation rates of private consultants by grain growers. Where grower numbers are concentrated consultants are available and many employed on an annual crop area service fee and for specific services (e.g. bug checking). Many resellers (fertilizers, chemicals and seeds) provide a range of agronomic advice and some have links with more independent consultants.

Dairy

The Queensland dairy sector is serviced by extension agencies that, by and large, collaborate in their delivery to provide cohesion, leverage and impact regarding key extension messages. This coordinated approach has been achieved by a history of deliberate focus on cooperative effort to avoid duplication. To this end, key dairy extension personnel regularly come together to plan and coordinate extension activities.

In the past 20 years DAF has reduced its dairy extension personal. In response to declining government services, the private sector in the Queensland dairy industry responded with all the major milk processing companies employing field officers. In Queensland, Parmalat employs four personnel in Farm Services, Lion Dairy and Drinks has two while both Dairy Farmers Milk Cooperative and Norco employ one field officer each. In addition, Subtropical Dairy in partnership with the Queensland Dairyfarmers' Organisation, has a specialist NRM program known as Dairying Better 'n Better (DBnB). Since 2003, one of the key aims of DBnB has been to integrate the activities of a number of partners, stakeholders, programs and plans to provide a coordinated and highly effective NRM support program for Queensland dairy farmers.

One of the biggest extension challenges for the industry is to generate a value proposition amongst the industry to improve their business management skills, particularly in terms of business analysis and linking this to profit drivers. Improved skills in this area flows on to running profitable businesses that have the discretion to invest in NRM outcomes.

2.1.2 Regional, industry and sub-regional factors

Cape York

The Cape York NRM¹⁷ reports that its region of 137,000 square kilometres *extends north from the Mitchell river catchment to “The Tip” of Cape York Peninsula with diverse landscapes including 16 complete river basins*. It includes farming in the highly productive Lakeland district. It reports that 14.3% is national park, 23.2% Aboriginal Shire Lease, Deed of Grant in Trust (DOGIT) or Land Trust with 52.9% leasehold (with 33.9% pastoral lease).

The key sub-regions identified through regional workshops are as follows:

- **Cape:** Grazing - 4 catchments & 18 producers serviced by: Cape York NRM; Southern Cape York Catchments; DAF; AgForce. Also, some mixed cropping – private consultants.
- **Lakeland:** Mixed crops with irrigated horticulture and dryland farming with the main crops being: peanuts, maize, sorghum, bananas, and other tropical fruits.- about 7 larger growers, most of whom have place in coastal areas such as Tully/Innisfail; no local services.

Wet Tropics

Terrain¹⁸ is the NRM body based in the Wet Tropics – an area of 2.2 million hectares extending from Bloomfield in the north, south to Ingham and west to Mount Garnet and includes the Atherton Tablelands. It is noted that there are nine river catchments and the key primary industries are: cane; bananas; dairy; grazing; horticulture; forestry; and fishing and aquaculture. It is also noted that the region is *home to a rich and enduring Aboriginal cultural heritage, with at least 17 Traditional Owner groups made up of more than 20,000 Rainforest Aboriginal people*.

This is a diverse region split between the coastal plain which is mainly under sugar production and the tablelands which is has more grazing, some dairy and mixed cropping. With respect to mixed-cropping, the issue is that many annual crops are used in rotation (peanuts, grass hay, maize, oats) plus there are tree crops, perennial horticultural crops such as coffee; blueberries, bananas, sugar.

A key regional delivery platform for coordination and funding support is provided by WTSIP¹⁹ which is a cross-organisational platform that has employed a network of 10 Extension Officers to work with growers across the region. *Terrain is responsible for delivering the Reef Alliance's cane targets to transition 399 cane growers beyond best management practice and fast track the implementation of innovative practices and also has oversight of the Australian Government's Reef Trust IV Repeated Tenders program and is playing a major role in the Major Integrated Project (MIP) in the Tully and Johnstone catchments*.

The key sub-regions identified through regional workshops are as follows:

- **Herbert:** Wilmar Sugar & two mills crushing approximately 4.5 million tonnes of cane from 580 growers with extension related services provided by a range of organisations (WTSIP; CANEGROWERS; HCPSL; SRA; DAF).
- **Tully:** Tully Sugar and one mill crushing approximately 3 million tonnes of cane from 220 growers with extension related services provided by: WTSIP; TCPSL; Tully mill; SRA; Tully

¹⁷ <https://www.capeyorknrm.com.au>

¹⁸ <http://www.terrain.org.au>

¹⁹ <http://wettropicswaterways.org.au/uncategorised/wtsip/>

Cane Services; DAF; TRAP Consulting); Approximately 6000 hectares of bananas serviced by private consultants; DAF and Total Grower Services.

- **Innisfail:** MSF Sugar: South Johnstone Mill crushing approximately 2 million tonnes of cane from 200 growers with extension related services provided by WTSIP; Innisfail CANEGROWERS; DAF. Approximately 5000 hectares of bananas & limited other horticulture crops including Pawpaws serviced by private consulting, DAF and Total Grower Services.
- **Mulgrave and Babinda:** MSF Mulgrave mill crushing approximately 1.1 million tonnes of cane from 200 growers with extension related services provided by WTSIP; MSF Sugar Agricultural Group; DAF; Cairns CANEGROWERS and SRA.
- **Cairns:** A small number of growers to the north supplying Mulgrave MSF mill and serviced by similar organisations.
- **Mossman:** Mackay Sugar: Mossman Mill crushing approximately 500,000 tonnes, without the Tablelands (possibly 300 km from Tablelands) and 50 growers in Mossman (30 significant). With extension related services provided by: WTSIP; Mossman Agricultural Services: Sugar Productivity services; CRT supplies & services; DAF and Mossman CANEGROWERS.
- **Upper Herbert:** Grazing
- **North Johnstone/Russell upper catchments:** Dairy – serviced from DAF South Queensland; Young dairy Network; Sub-tropical Dairy Program; Grazing – serviced by DAF.
- **Barron:** Mixed cropping, horticulture, grazing and sugar - MSF Tableland mill: crushing approximately 500,000 tonnes from 85 growers (plus Mossman Mill growers) serviced by Terrain through WTSIP and earlier programs; DAF; some private consultants (e.g. Regen agriculture) and Total Grower Services.

Burdekin

NQ Dry Tropics (NQDT)²⁰ is the NRM body operating in this region. Their website describes this region as: *Located in North-Eastern Queensland, our region covers eight per cent of the State. It spans a great variety of landscapes, with a land area of approximately 134,000km² and 12,000km² of sea country (figure 1). The Burdekin River catchment is the second biggest in Queensland covering an area approximately the size of Tasmania. It defines much of our region, along with the adjoining smaller coastal catchments of the Don River, Haughton River, Ross River and Crystal Creek at the most northern extent. The site notes that agriculture dominates the landscape, with beef cattle grazing covering over 96 per cent of the region's land area. While less than nine per cent of the population is involved in grazing, it is by far the most important employer in rural and remote areas. The Burdekin Shire contains Northern Australia's largest irrigation area, with approximately 1,100 km² under irrigation, using both groundwater and surface water. Dryland cropping is widespread in the Belyando-Suttor sub-catchment. The local tourism industry is also highly-focused on showcasing our region's natural assets.*

Sugar sub-regions: Sugar has four distinct mills owned by Wilmar: Pioneer (approx. 2.2million tonnes); Kalamia (approx.1.9million tonnes); Invicta (approx. 3.7million tonnes); and Inkerman (approx. 2.1million tonnes). There are five cane collective organisations representing the interests of growers in the region, however, they aren't tied to specific mills. The five collectives are: Australian Cane Farmers Association, Burdekin Canegrowers, Pioneer Cane Growers Organisation, Kalamia Cane Growers Organisation and Invicta Cane Growers Organisation. The Burdekin cane industry is serviced by extension and education providers, including: DAF, Burdekin Productivity Services, NQ Dry Tropics, SRA, private companies (e.g. Farmacist, Sugar Fix and Agritech Solutions),

²⁰ <http://www.nqdrytropics.com.au/>

Horticulture: In a submission to the Regulation of Australian Agricultural inquiry by the Productivity Commission in 2016²¹, the then mayor reported that *about 3400 hectares of the Burdekin is dedicated to horticultural use such as achachas, mangoes, melons, pumpkins, zucchinis, rice, soybeans, mung beans, sweet corn, beans, maize and cassava. Emerging industries include agave and sorghum.* The Bowen-Gumlu Growers association (BGGA) supports the industry and notes that *Bowen is the largest winter vegetable growing region in Australia sending fruit and vegetables to domestic markets and exporting to international markets.* There are a number of private consultant businesses that provide services to this sector²².

Grazing sub-regions: As noted above, 96% of the region is under grazing. Distances are an issue for the grazing industry which is serviced by DAF (mainly based in Charters Towers). Other extension support services to the industry include NQDT, RCS and Landcare. NQDT is leading the Major Integrated Project (MIP)²³ and working with a consortium of 17 organisations to deliver the project focused on the Bowen Broken Bogie (BBB) catchment in the Burdekin region. This involves significant producer input and will test approaches to improved land management/sediment reduction that will have wider implications for grazing extension.

Mackay Whitsunday

Reef Catchments²⁴ is the NRM body in this catchment. Their regional plan²⁵ notes that the region *extends from the western boundary of the Clarke Connors Range, shrouded in high altitude rainforests, across the expansive cane fields and grazing lands of the coastal lowlands, intersected with rivers and wetlands including the Proserpine, O'Connell and Pioneer Rivers, then flows out to the Coral Sea, continental islands and the Great Barrier Reef.* It adds that *the region has significant agricultural production including the largest area of sugar cane production in Australia, as well as cattle grazing and horticulture.*

Sugar sub regions: Sugar has five district mill areas with three owned by Mackay Sugar and two owned by Wilmar. Mackay Sugar's three mills - Farleigh Mill (maximum production of 1.7m tonnes of sugarcane), Marian Mill (maximum production of 2.6m tonnes of sugarcane) and Racecourse Mill (maximum production of 1.7m tonnes of sugarcane). At Proserpine:

Wilmar Proserpine Mill (production of approximately 2.2m tonnes of sugarcane) and Sarina:

Wilmar: Plane Creek Mill (production of approximately 1.8m tonnes of sugarcane). Cane growers in the Mackay Whitsunday region are serviced by mill Productivity Services, Farmacist and DAF.

Grazing: DAF provide some support to the grazing sector in the region and Reef Catchments NRM have 0.5 FTE managing grazing projects. Grazing is the largest single land-use in the Mackay Whitsunday region which includes the Pioneer, O'Connell and Proserpine River systems. Grazing occupies 44% of the of the total land area of 390,000 hectares. The cane and cattle industries are closely linked with more than 50% of the region's cattle managed by integrated cane and cattle enterprises. Whilst there are over 600 grazing businesses the majority manage less than 50 head.

Horticulture: Horticulture represents approximately 1% of the region's landuse (or 1,200 hectares) in the Mackay Whitsunday region. There are no extension officers servicing the horticultural sector based in the region and Growcom have a Bowen based officer providing limited service.

²¹ http://www.pc.gov.au/data/assets/pdf_file/0005/195881/sub035-agriculture.pdf

²² <http://www.bowengumlugrowers.com.au/>

²³ <https://www.qld.gov.au/environment/agriculture/sustainable-farming/burdekin-project/>

²⁴ <http://reefcatchments.com.au/about-reef-catchments/>

²⁵ http://reefcatchments.com.au/files/2015/02/MWI_NRM_Plan_2014_2021.pdf

Forestry: Forestry represents approximately 10% or 94,900 hectares of land use in the Mackay Whitsunday region.

Fitzroy

FBA²⁶, the lead NRM regional organisation, notes that the *region is over 156,000 square kilometres in size – it has significant agricultural and mining industries, as well as being the largest river basin flowing into the iconic Great Barrier Reef lagoon*. They report that 3700 agricultural businesses operate in the Fitzroy region with most of these producing beef cattle – with around 20% of Queensland's 12 million head of cattle grazed in the Fitzroy Basin. There are an estimated 2.5 million head of cattle within 250 kilometres of Rockhampton. Grazing cattle is the largest form of land-use in the Fitzroy (78%) occupying in excess of 12 million hectares. The largest concentration of cattle is in the Central Highlands.

DAF have a Grazing BMP extension team based in Fitzroy and together with Land Management Officers at FBA and Field Officers in the three sub region organisations they provide extension support to the region's grazing businesses.

There are approximately 600 dryland grain growers in the Fitzroy farming up to 500,000 hectares depending on seasonal conditions. A Grains BMP program is gaining good support and funded through FBA and delivered by DAF. A *Strategic Cropping Land Mitigation Fund* project is being administered through DAF and delivered by FBA and Precision Agriculture and aims to facilitate the establishment of private precision agricultural technical advisers in CQ.

Cropping is undertaken on the catchment's better soils with growers producing both winter and summer crops (wheat, chick peas and sorghum the largest). Cropping is concentrated in the Central Highlands, Dawson Callide valleys and Duaringa and Mackenzie Big Bend districts.

Horticulture in the Fitzroy involves a range of crops with citrus, macadamia nuts and melon production in the Emerald irrigation area, herb production in the Callide and tropical fruits and sweet potatoes along the Capricorn coast. Irrigated cotton production involving up to 100 growers is concentrated in the Emerald irrigation area, along the Dawson valley and a small number along the Mackenzie River.

Burnett-Mary

The Burnett-Mary Regional Group (BMRG)²⁷ describe the region as *comprising the Burnett and Mary river catchments and the associated sub catchment areas of the Kolan, Elliott, Gregory, Baffle, Burrum and Isis rivers*.

There are approximately 3,600 graziers in the Burnett-Mary who manage 3.6 million hectares. DAF has a drought officer but no extension staff based in the region (serviced from Darling Downs). R&D staff are based at the Kingaroy research station. Growcom and Bundaberg Fruit and Vegetables share an extension officer who provides extension services across the sectors and delivers the Hort360 program. Cane Mill service staff are based at Bundaberg and Maryborough and Childers (Isis). The main source of extension is associated with sales of farming inputs through the agribusiness franchises such as CRT and Landmark. A large player is BGA AgriServices based in Kingaroy with branches throughout the region. The subregions are based around different soil conditions and the crops grown.

- Around Bundaberg on the coast, there is cane and horticulture with substantial pulse rotations in the cane (e.g. macadamia nuts, tomatoes, sweet potatoes, capsicums, soy bean peanuts)

²⁶ <http://www.fba.org.au>

²⁷ <http://www.bmrq.org.au/>

and mung beans). Over 23,500 ha is devoted to horticulture with 900 growers across the region. There is also horticulture in the southern part of the coastal area (around the Mary River) There are smaller lifestyle blocks along the coast to the north.

- There is some dairying, fodder crops and piggeries around Monto to the central north, The central Burnett (Mundubbera and Gayndah) has significant horticulture and tree crops with citrus, table grapes, Mangoes and a very large new venture with Blue Berries.
- Cropping is undertaken round Kingaroy, Murgon and Coulsten Lakes (red earths and black clays)– grains, peanuts, other pulse crops mung beans etc., irrigated cotton, fodder crops with some small but significant areas of wine grapes and horticulture. The tree crop Dubosia which provides leaf extract chemicals for the Pharmaceutical industry is also grown in the South Burnett and is the centre for that industry for Queensland and Australia.
- The rest of the region is mainly grazing including smaller lifestyle blocks to the north of Bundaberg.

2.2 Overseeing the Review Implementation

2.2.1 Oversight

An important element of these recommendations is for there to be a process of overseeing the implementation of agreed recommendations and monitoring the progress against intentions. This would include providing an assessment of the appropriateness of the way that the recommendations were interpreted and implemented, issues and barriers around implementation that might require adjustments, changes or termination of elements of the suite of measures.

2.2.2 Recommendations

- R1.1** A Reference Group comprising of government and stakeholder representatives and chaired by an independent person should be established to review the implementation of the recommendations after the first six months and thereafter on an annual basis. This group would provide feedback on the process and suggest ways to address barriers and issues emerging.
- R1.2** An annual extension/delivery organisation survey should be undertaken as a key tool to assess gains in extension capacity and functioning and effectiveness and the appropriateness or otherwise of measures in place.

2.2.3 Indicative Budget

Table 3: Monitoring and evaluation indicative budget

Item	Cost over 3 years	Percentage of total
R7.1 Coordination costs - meetings	\$60,000	0.4%
R7.2 Annual extension/deliverer survey	\$45,000	0.3%

2.3 Coordination and Collaboration

2.3.1 Findings from the review

Extent of problem

1. A constant theme from the regions was the fragmentation of the extension effort (also highlighted in the Water Science Taskforce findings) and the need for better integration and planning of funded programs prior to them being rolled out in the regions. The most mentioned suggestion from the stakeholder survey to increase capacity and effectiveness of extension was the need for a more structured and coordinated approach. Ratings for this as a priority need were among the highest in the survey. This is illustrated by comments such as *more coordination, consensus and consistency of extension programs is needed*, and *effort is required, over time, to get the right people engaged and support a more persuasive, structured and subtle approach*. It was also noted that having a highly-distributed extension network is not, in itself a bad thing.
2. The problem is accentuated in sugar because of the range of organisations with different approaches and mandates and the range of programs and projects and the delivery agents funded to impact on water quality.
3. Examples were given where the funding approaches appeared to work against collaboration because of competition for grower involvement. This worked against collaboration to achieve regional targets.
4. A major limitation to existing *regional* coordination/collaboration efforts is the organisation and program delivery demands on deliverers and the lack of significant financial resources to provide incentive and capacity to support collaborative efforts and fill identified gaps. The MIPs programs are leading the way in providing the means for flexible targeted approaches to deliver outcomes based on local knowledge and needs. It would be worthy to consider lessons learnt through the MIPs process when reviewing wider regional extension delivery to enhance strategic collaboration in addressing regional priorities.
5. There are cross-sectoral needs and opportunities for collaboration - for example, in mixed farming contexts and in grain and grazing situations. These tend to fall in the gaps as they have been lower priority for funding compared to grazing and cane industries in the GBR catchments.
6. There is a need for leadership and increased coordination between land-based programs the Great Barrier Reef Marine Park Authority (GBRMPA) and program such as Reef Trust, BMP and other extension and education based programs. Likewise, Regional Councils and Landcare/ Catchment Groups also need to be included more in regional planning and delivery.

Current Regional Coordination Mechanisms

Designated regional extension coordinators

Currently there are 5 people allocated to E&E coordination supported by DAF (total of 3.5 FTEs) in:

- Fitzroy – 0.66FTE – currently funded until 30 June 2017

- Mackay Whitsunday – 1FTE – currently funded until 30 June 2017 (DAF employee embedded in Reef Catchments)
- Burdekin – <1FTE – currently funded under a Memorandum of Understanding (MoU) until 30 June 2019
- Wet Tropics/Canegrowers – 0.5 FTE – currently funded until 30 June 2017

Feedback from some coordinators were reflected in: *The biggest issue we face is that fact that all members are limited by their organisations resources and work arrangements, other than the NRM group and governmental staff who can be involved in pretty much anything, anytime.... Organisations are in competition for funding and so are reluctant to collaborate outside their usual partnerships to develop meaningful projects. Also because of the funding structure, organisations are applying for funds outside their 'core' business...This contributes to a distrustful atmosphere, limited sharing of information and mis-information/mixed messages getting to farmers. If there was some mechanism/charter so everyone knew what their roles are would be good, but no idea on how to get that to happen.*

Wet Tropics

The Wet Tropics Sugar Industry Partnership (WTSIP)²⁸ is described as *a unique partnership between all cane industry and NRM organisations across the Wet Tropics region with a goal to work together to deliver water quality, productivity and profitability outcomes* which covers the nine Wet Tropics catchments. It is noted that WTSIP currently has oversight of the delivery of Reef Trust Phases III and IV (Repeated Tenders) and is one of the consortium of 30 members coordinated by Terrain in the Queensland Government's Major Integrated Project in the Johnstone and Tully catchments. It is also explained that they *have established governance and staffing arrangements so that we can adapt and expand to cater for additional water quality projects as they come along*. Projects are delivered by the WTSIP extension team who are hosted by WTSIP partners. The current regional extension coordinator is also working with WTSIP and is taking steps to develop a central website to link the extension personnel, activities and resources. There is a gap in addressing enterprises other than sugar and in mixed farming systems.

Cape York

Coordination is organised by the Cape York NRM with South Cape York Catchment Council and DAF through projects for beef and agriculture. They have had to 'buy-in' expertise from DAF.

Dry Tropics

The Burdekin Cane Extension Group (BCEG) facilitated by the extension coordinator has been recognised as an effective platform for bringing together those involved in cane extension. The structure of the industry, funding models and demands on individual members has limited the capacity of the group in terms of collaboration as opposed to information sharing. The group appointed a sub-committee to develop a Terms of Reference (ToR) for reinvigorating the extension coordination, project alignment and communication function of the Group (it was noted that this was a capacity building activity in its own right) with a mission of: *Building capacity and collaboration of Burdekin extension activities through the up-skilling and mentoring of staff and sharing of collective skills and knowledge with an annual action plan*. It was noted that *activities within the ToR had to be practical, given the resource constraints of not-for-profit and private organisations in providing staff for BCEG activities*. Core members of the group are: Burdekin Bowen Integrated Floodplain Management Advisory Committee (BBIFMAC); Burdekin Productivity Services (BPS) Canegrowers organisations (Canegrowers Burdekin Ltd, Burdekin District Cane Growers, ACFA, Sugarfix*); Department of

²⁸ <http://wtsip.org.au>

Agriculture Fisheries and Forestry (DAF); NQ Dry Tropics - sugar related programs (NQDT); Private extension providers: Farmacist, Agritech Solutions, Sugarfix; SmartCane BMP; Sugar Research Australia; and Wilmar Sugar.

The Regional Extension Coordinator also undertakes activities such as maintaining a joint extension activity and planning calendar.

The Mayor of the Burdekin Regional Council also facilitates a *Burdekin Water Futures* Group to share information and assist in coordinating projects from a range of organisations/projects working on water related research and development in the Burdekin. These overlap with organisations also providing extension services, however they are not directly extension focused. They are interested in closer links with extension and potentially undertaking joint activities such as field days.

Grazing extension coordination currently takes place chiefly between the Grazing BMP team.

Horticulture in Bowen/Gumlu/Whitsunday regions

Growcom have an officer based at Bowen who delivers the program Hort360. DAF has RD&E officers based at the Bowen Research Station servicing the horticulture sector. DAF estimated the value of production was \$440 million in 2016 based the production of winter vegetables (eg tomatoes, capsicums, corn, beans) and tropical fruits (eg mangoes, lychees) with over 10,000ha under horticulture across the three regions.

Mackay/Whitsunday

There is currently a large Cane Regional Working Group including: CANEGROWERS, Reef Catchments Ltd, SRA, Farmacist, Mackay Sugar, Wilmar, DAF, Mackay Area Productivity Services (MAPS), Plane Creek Productivity Services Limited (PCPSL) and Sugar Services Proserpine (SPP). It notes that it lacks resellers and some private deliverers. There is a smaller Technical Working Group under this main group to deal with specific issues with relation to water quality, farm management extension etc. This working group would appear to be a good platform for extension coordination.

The Grazing Regional Working Group is the main reference group for NRM for the regions grazing lands and members include local graziers, local AgForce representatives, Reef Catchments Limited and DAF. Regional Working Groups are also in place for Horticulture (consisting of local horticulturalists, Reef Catchments Ltd, DAF) and Forestry (consisting of local Farm Foresters, Reef Catchments Limited, DAF and Pioneer Catchment and Landcare Group).

Fitzroy

There is a currently a Fitzroy Grazing BMP coordinating meeting that meets quarterly which includes DAF and FBA. There is potential and interest to build on this group to form the basis of a cross-sectoral coordinating group by inviting and including representatives of organisations that deliver extension/BMP programs to grains (e.g. Grains BMP), Cotton (e.g. Cotton BMP) and horticulture (e.g. Hort 360) to special meetings (for example immediately following the grazing BMP meeting) for this purpose. This group could share information and priorities and look for collaborative opportunities – especially where there is mixed farming and grazing operating. The current regional extension coordinator participates in the Grazing BMP meetings and could lead the cross-sectoral meeting.

Burnett-Mary

While the BMRG involves stakeholders in developing the regional NRM plan, there does not appear to be a regional coordinating delivery platform in the Burnett-Mary. There are also coordinating

challenges across commodities and between the separate Burnett and the Mary catchments and DAF.

2.3.2 Recommendations arising

Program design

- R2.1** Hold a two-day, independently facilitated, workshop to review current state and commonwealth extension and education programs/projects directed towards behaviour change and farm management practice change in the reef regions to develop a commitment and mechanism for greater coordination across programs. Work with those delivering reef programs (NRMs, industry bodies and DAF) to ensure all relevant program investment managers are involved. The workshop objectives would be to:
- Document the programs and projects based on purpose, funding, target group, geographical focus, time frame, approach and evaluation.
 - Explore overlaps, conflicting/competing activities and potential for synergy.
 - Share what has worked well – and the evidence for this.
 - Develop a joint mechanism/framework to better align projects and maximise synergies and outcomes.
 - Establish a working group to progress the mechanism and report back to stakeholders on progress made.
- R2.2** Ensure that steps are taken through funded programs to minimise competition within projects and to require evidence of, and reward, cross-program collaboration. Consider regional outcomes and build in collaborative mechanisms to funded programs. This needs to be balanced with going to the market in some situations and investing in targeted on-ground practice change.
- R2.3** An annual meeting should be held in a reef region with a focus on regional extension coordination groups providing feedback to state and commonwealth program managers on what is working in current programs and barriers and opportunities to improve effectiveness. Program managers would be asked to report back on steps taken to react to earlier feedback on ways to streamline and coordinate at that level. There would be an opportunity to coincide with a 'current situation analysis' for Paddock to Reef programs in the relevant areas.

Regional Extension Coordination

- R2.4** Gain agreement across extension delivery organisations in regions to regional coordination and the lead organisation for it in that region. Appoint/reappoint/continue with a **Regional Extension and Education Coordinator (REEC)** in each reef region to the most appropriate organisation. The person in this role needs to have a strong background in extension, have a good understanding of regional relationships and issues associated

with reef water quality and have strong interpersonal skills to be able to interact and negotiate with organisational managers and extension deliverers. Their role would be to:

- Facilitate and lead the Regional Extension Coordination Group (as below).
- Co-develop a regional extension plan in line with existing program requirements and regional priorities (as below).
- Liaise with Paddock to Reef and regional organisations to help ensure that monitoring and evaluation activities and reporting capture and provide required information and data.
- Facilitate the decision-making around the use of flexible regional extension funds (as below) to maximise collaborative opportunities, add value to activities being run and address gaps not covered by funded programs.
- Maintain a calendar of extension activities and events across the region.
- Organise regional networking events for extension/advisory staff and work with the training coordinator (as below) to identify capacity building needs and encourage/facilitate extension/advisory staff to develop needed skills.
- Provide targeted mentoring support – and link new staff with appropriate mentors.
- Liaise with the Cross-Reef Region Extension Coordinator (as below) to link with other regions, share approaches and learnings and organise cross- regional activities.

R2.5 An effective **Regional Extension Coordination Group** (RECG), facilitated by the regional extension coordinator, should be continued/developed in each region for sugar and across regions for grazing, grains and horticulture to allow sharing of information and joint decision making (cross sector sharing would occur through extension network meetings outlined later in this document). Representatives from all relevant public, industry and private organisations (including Landcare and catchment groups and GRMPA where appropriate) involved in the planning and/or delivery of extension should be included. Efforts should be made to ensure updated information to allow a strategic view based on priorities, previous and current programs, needs and gaps. A **Regional Extension Plan** should be developed and updated annually consistent with current programs and regional water quality priorities, with targeting supported by spatial mapping of the layers of extension effort against priority areas. The RECG would initiate and sponsor an annual information exchange of relevant research and delivery organisations.

- A technical/extension sub-group of WTSIP would provide the best platform for sugar in the Wet Tropics. Ideally, this technical sub-group would be expanded to include the other commodities in the Wet Tropics – however, if this is seen as too much out of scope of WTSIP, a separate regional coordination group should be established to cover the non-sugar commodities.
- The Burdekin Cane Extension Group would provide the best platform for sugar in the Burdekin.
- The Technical Working Group of the Cane Regional Working Group would be the best platform for sugar extension coordination in the Mackay Whitsundays. As with the other sugar regions, steps should be taken to address non-sugar commodities.

- A Regional Extension Coordination Group would best 'piggy-back' onto the current Grazing BMP coordination group in Fitzroy – to include Grains, Cotton and Horticulture.
- A technical/extension sub-group is needed for grazing that combines Cape York, Wet Tropics and Dry Tropics.
- A technical/development sub-group is needed within and across regions for mixed cropping.

R2.6 Given the different context for Grazing – especially in the northern regions outside of the Fitzroy Basin (where there is currently a well-functioning regional coordination group for grazing extension within the Grazing BMP project) – it is recommended that rather than having an extra layer of regional coordination, an annual RD&E grazing update is run with organisations working on grazing areas (e.g. regional NRM organisations, DAF, NQDT, RCS, JCU, CSIRO & AgForce) to facilitate information sharing, learning about new advances, networking and potentially leading to collaborative opportunities.

R2.7 Provide **flexible funds** (within guidelines and regional level decision-making) of \$100,000 per year to the five major reef regions to allow priority cross-program/organisational activities to add value to current programs, build synergies, provide training, address challenges and plug gaps. **Regional Extension Coordination Groups** would make the decisions on the use of these funds to further water quality outcomes with the Cross-Reef Region Extension Coordinator (position described below) signing off on planned spending. Guidelines for this spending would be that the funded project/activity:

- Addresses a regional priority
- (Also) has water quality outcomes
- Supports cross-program/organisational collaboration and/or adds value to planned activities and/or addresses a gap in extension delivery
- Supports the use of innovative learning approaches and/or new tools and technologies to support on-farm learning.

R2.8 A **Cross-Reef Region Extension Coordinator** (CRREC) should be appointed within an appropriate organisation which has the capability of functioning in all reef regions. The role of the CRREC would be to provide leadership, support, mentoring and direction to the regional level coordination, provide opportunities for networking and learning from each other and to facilitate the link between regions and state and regional reef extension related programs. **It is critical that this position is experienced in extension delivery, located within the reef regions and works closely with the regional coordinators.** This role would be to:

- Work closely with the REECs to provide them with the support and input needed to help them effectively carry out their task – including providing opportunities for them to develop their capacity and understanding of policies and issues affecting the reef regions.
- Provide strategic advice to GBR Investment programs to guide the design and implementation of future activities for improved water quality outcomes for the GBR.

- Oversee and facilitate the reef extension and education network and mentoring programs (as in a later recommendation) and support organisation and promotion of training programs and educational opportunities for extension/advisory staff.
- Sign off on the allocation of the flexible regional extension funding decisions made by the Regional Extension Coordinating Groups.
- Provide an evaluation and reporting of the added value of the regional coordination efforts – where efficiencies were achieved and gains made as a result.
- Facilitate the annual survey of extension/advisory staff to track changes in personal and delivery capacity and effectiveness and fine tune support and training provided.

2.3.3 Indicative Budget

Table 4: Coordination and collaboration indicative budget

Item	Cost over 3 years	Percentage of total
R2.1 State/Commonwealth Program Design 2-day workshop plus cost for follow up working group.	\$50,000	0.3%
R2.2 Build in collaboration	-	-
R2.3 Annual cross-program meeting in reef region	\$60,000	0.4%
R2.4; R2.5; R2.8 Cross-regional extension coordinator; Regional Extension Coordinators support and operating costs	\$3,000,000	18.2%
R2.6 Annual Grazing Forum/update	\$90,000	0.5%
R2.7 Within region flexible funding for strategic and collaborative actions (at \$100,000/yr/region)	\$1,500,000	9.1%

Improved coordination and collaboration will contribute significantly to improved water quality outcomes by improved strategic and efficient use of extension resources and effort, identifying and addressing gaps and adding value to existing projects.

Post 2020/21 (post-this funding initiative)

- It is expected that the value of the coordination effort will be evident and that government will continue to see this as a central function to ensure that future program funding is delivered effectively – with funds continuing to be allocated to these positions in future years.
- Efforts should be made to build a business case for the value of the Regional Extension Coordinating Groups to be made to industry bodies to invest in the platform to maximise the return on grower and federal funding into their industries.

- The decisions made through the program design workshop, working group and program alignment mechanism should be supported by allocation of future funding to reef extension and education programs at state and commonwealth levels.

2.3.4 Implementation

- Queensland Government to provide funding to put/retain extension coordination positions in place within the most logical organisation/s in each region in line with the role specifications as detailed in section 2.2.2 (Regional Extension and Education Coordinator). The CRREC position should also be established as soon as possible to provide the oversight of these positions.
- The CRREC would then work with the regional extension coordinators to work with stakeholders to further develop the Regional Extension Coordinating Groups in their region. The MoU being developed by the Burdekin Regional Cane Group is a good model to start with.
- The criteria for the use of flexible funds would be developed within the guidelines provided including: supporting or initiating collaborative extension activities which build synergies between organisations and/programs and add value to extension efforts aimed at improving water quality outcomes.
- The Regional Extension Coordinating Groups would develop their own MoUs, be provided with the flexible allocation and guidelines and would make the decisions about allocation. The funds would be with the organisation hosting the regional extension coordinator and signed off by the Regional Extension Coordinator with agreement from the CRREC.
- A process would be put into place to provide feedback on strategic initiative and effectiveness of investment programs.

2.3.5 Risks

Lack of support/mandate: there is a risk if there is a lack of support/mandate from the regional and Reef Plan strategy levels or not seeing the importance for regional outcomes and activities and providing strategic feedback into investment programs.

- This could be overcome by clear guidelines and support for the roles with recognised champions from the local regional areas as well as support from the CRREC.

Competing demands: there is a risk that despite coordination efforts and extra flexible funding, individual organisational constraints, program delivery demands, commercial competition and lack of time may limit collaborative efforts.

- This could be overcome in part by including collaboration as a performance indicator and reportable milestone in reef funded projects.

Short term funding: high turnover of staff in short term projects and/or short term contracts can limit the cohesion and commitment of such a coordinating group and their understanding of the needs and opportunities.

- This is difficult to overcome given the current funding environment. Ideally, longer term programs and hence positions are the best solution. Otherwise, the aim is to have the coordination group process robust, with a clear plan of operation, priorities and strategies so it is clear to new members what it has done and where it is heading.

Insufficient flexible funding: If the amount of flexible funding is token rather than meaningful, this will reduce the capacity of the regional extension coordinating groups to make a real difference.

- Ensure this amount is set at a minimum level and is a priority.

Cross-regional coordinator position lacks impact: If the cross-regional extension coordinator lacks experience in the region or in the application of excellent extension approaches at a strategic and practical level, or is based in an organisation that is seen to be a competitor for funding, they will fail to provide the leadership and mentoring for the regional coordination positions.

- Ensure the coordinator has the experience and capacity in extension delivery at a practice and strategic level and is located within the reef regions.

2.3.6 Monitoring

Monitoring of this initiative should be based on how well the structure and process is implemented and working, and the benefits accruing from the initiative.

Table 5: Coordination and collaboration monitoring

Element	Performance indicators	Evaluation Methods
Positions and group structures	<ul style="list-style-type: none"> • Positions and groups in place • Flexible funding is in place and its level • The extent to which all relevant organisations are included and committed • Establishment of strategic/working plan for each group • Occurrence of Annual reef regional extension feedback meeting to program managers and funders 	<ul style="list-style-type: none"> • DAF reporting on establishing coordination initiative and details of locations, organisations and budgets
Coordination position and group function and process	<ul style="list-style-type: none"> • Number of meetings and attendance • Other activities around coordination (e.g. calendars; shared resources) • Decisions made and actions taken to value add with collaboration • Budgets spent in line with purpose • Satisfaction of participants with the process 	<ul style="list-style-type: none"> • Activity and budget reporting by regional extension coordinators to DAF • Short feedback sheet at each meeting – satisfaction with process, decisions made and input • Annual member reflection • Annual survey of extension delivery organisations in reef regions
Benefits of coordination and collaboration	<ul style="list-style-type: none"> • Extent, type, focus and participation of joint/collaborative activities and outputs resulting from the coordination undertaken • Value of activity to growers/producers and its impact on their understanding, skills and follow-up actions • Assessment of effectiveness of pooling effort and resources by representatives. • Impact of annual regional feedback sessions on state and regional program managers and funders 	<ul style="list-style-type: none"> • Activity reporting by regional extension coordinators to DAF • Feedback sheets from participants in activities • Follow up surveys of samples of participants in terms of actions taken and how activity assisted • Narratives • Annual survey of extension delivery staff and organisations in reef regions

2.4 Extension Personnel and Expertise

2.4.1 Findings from the review

1. Despite the findings from the Great Barrier Reef Water Science Taskforce (2016) about the lack of access to effective extension services, the general consensus in this review was that there were sufficient actual extension positions in the reef regions – particularly in the sugar industry. The problem was more around the focus of the extension service, access, short term nature and lack of some speciality areas. This included the lack of staff working closely with producers in a holistic farming systems approach.
2. There were some concerns about the lack of personnel for extension/advisory support in the grazing sector – although the efforts of the Grazing BMP extension team and the workshops and advisory services provided by RCS²⁹ were acknowledged. Feedback from producers highlighted a need for consistent promotion of rotational or cell grazing and understanding about pasture management.
3. Commenting on the current effectiveness of extension (average rating of 5.4 on a 0-10 scale, n=46), a number of stakeholder survey respondents commented on the slow rate of practice change with reasons provided including: growers not being effectively reached; a lack of resources; issues with extension provider knowledge/training; conflicting priorities (e.g. sales productivity/focused); high staff turnover; and the lack of long term follow-up. There were few comments on the actual lack of numbers per se.
4. The issue of short term contracts was raised by the taskforce and was a recurring theme through this review. Extension projects and programs and associated positions being funded for 1-3 years was a significant limitation to attracting and retaining staff and maximising the value of the experience and trust that was built up during the contract project period. It was noted a number of times that short term positions were a problem in obtaining bank loans for houses which was another significant disincentive for experienced people to take on this work. The change process in the area of implementing the best management practices for water quality outcomes is a long term and generational shift and requires long term approaches with extension.
5. There was concern about the impending loss of experienced extension personnel and the lack of being able to readily obtain replacements and fill new positions with people with the background and experience needed to deal with issues facing producers in the regions. This was accentuated by the loss of DAF as a 'training ground' for extension personnel, short term contracts, isolation and lack of mentoring availability.
6. An area where there was strong agreement across regions, industries and organisations was the need for more skilled people in the area of soil management (conservation; hydrology; health). This was seen as a significant gap and limitation for programs. There was also a lack of extension for mixed farming/rotational crops in the Wet Tropics in particular. In the Burnett-Mary, there was particular concern about the lack of farm business management/economic extension support.

²⁹ <http://www.rcsaustralia.com.au/the-rcs-story/our-people/>

7. There was also some lack of understanding and clarity about the roles of the different extension delivery organisations in general and the water quality arena. It was also noted that in some cases organisations were moving to take advantage of reef funding and so expand their business/role opportunities. SRA is currently reviewing its role in sugar extension and development. DAF continues to review its role as a public agency in terms of market failure and input as a government service. The mill productivity services groups have two groupings of staff – the technical team who focus on varieties, pests and diseases and visit every grower supplier at least once a year, and the extension team who often work on funded projects – including reef/water quality directed projects. These are premised on the basis of receiving external funding for the water quality work.
8. Regional NRM organisations play a significant role in providing extension, education and engagement across their respective agricultural sectors. They access both Commonwealth and Queensland Government funding to deliver reef programs.
9. Landcare and Catchment groups also have some capacity in programs related to farm management practice changes in reef regions. However, in some regions and districts, Landcare groups have low membership and limited capacity and in these districts they contribute little to government funded reef programs.
10. One area that does seem to be lacking is that of communications. DAF communication positions have reduced and there appears to be a lack of consistent resources for proactive communication to provide the backdrop for extension engagement. There also appears to be lack of consistency in messages across programs and organisations which can inhibit the change process.
Examples (only) of the type of key messages could be:
 - *If you do not get enough grass growing rain by the end of February, then a decision will be made on whether to sell some stock.*³⁰
 - *Use the recommended fertiliser levels – they save money and protect water quality.*
11. There is a gap in extension support in the mixed cropping areas and the use of alternative crops in rotation with sugar. A related gap is in extension personnel with skills in the effective use of on-farm trials and demonstrations to develop trust and experience with recommended practices. This also includes having awareness, skills and resources to effectively access and use new tools that can improve the learning experience and management practice. This will be exacerbated with the retirement of experienced current DAF extension staff.
12. Although there is use made of agronomists and resellers associated with product sales, there is not a very strong (independent) private sector advisory service in the industries in the reef regions. There are individual examples of success, but many privatised services rely on funded programs to survive. This appears to be due to the culture of free advisory services in the past and the expectation that levy funds will provide this type of support. There is a need to find ways to strengthen the role and take-up of private independent advisory services.

³⁰ <https://futurebeef.com.au/wp-content/uploads/2017/02/BeefTalk-Issue-48-2017opt.pdf>

2.4.2 Recommendations arising

New positions and expertise

Note the recommendations for these positions are based on feedback from stakeholders through the scoping interviews and regional workshops. They are not based on a quantitative or comparative analysis. As such they should be viewed as indicative and requiring further testing.

- R3.1** Appoint or second at least two soil conservation/health/hydrology staff across the regions (possibly, Fitzroy and Burdekin) in appropriate organisations – and source other expertise from where it may reside and is needed – to provide expert input into existing programs and to train/mentor/advise resource management officers across the regions to get a pool of upskilled professionals in this area.
- R3.2** Appoint an additional grazing officer in the Mackay Whitsunday region in an appropriate organisation as part of the Grazing BMP program.
- R3.3** Ensure sufficient dedicated communication personnel to proactively work with reef extension and education programs to promote key activities and communicate key messages (including 'Rules of Thumb'), case studies of success, activities and resources based in reef regions. These positions would work with other extension delivery organisations and programs to determine consistent over-riding themes/key messages/rules of thumb to ensure that producers are receiving the same messages from all sources.
- R3.4** Appoint a farming systems officer based in an appropriate organisation – and source other expertise from where it may reside and is needed – in the reef regions to support mixed cropping, horticulture and banana growers through their Hort360/BMP program and to coordinate/support in this area across regions. This position could be best placed in the Wet Tropics with input into other regions.
- R3.5** Appoint a mixed farming extension specialist to provide further support for programs directed at improved water quality outcomes in the mixed cropping areas.
- R3.6** Appoint a position in the Burnett-Mary working across sectors in support of current programs including BMPs to provide farm analysis to support the adoption of profitable practices and recommended reef practice changes.

Graduate program

- R3.7** The pilot graduate program is already being implemented and its evaluation will provide the basis for its continuation or otherwise and changes that may be needed. A strong learning and experiential framework has been developed and there is a measured expectation on current staff and programs to support and mentor the graduates. Do all possible, including providing funding, to provide a pathway to positions in the region and programs following their initial year. It is important that, having provided this introduction and skilling, the graduates are not left without opportunities to continue to work and

contribute in this area. This may mean that on-going graduate intakes may need to be tempered to permit this flexibility.

Existing Contract Positions

- R3.8** Extension program planning should be undertaken on a rolling 5-10 year basis showing the expected transitioning between follow on programs and focus. The terms of contracted extension positions should be modified where there is an expectation of programs continuing beyond the initial short term period to provide more continuity and certainty.
- R3.9** There should also be a website that tracks and links extension staff, positions held, their skills, training and experience – and which also provides alerts for new projects, programs and positions as they are rolled out.

On-going extension roles

- R3.10** The public sector, industry, regional NRM organisations and Landcare has a key role in driving the process and training of on-farm trials and demonstrations in relation to practices benefiting water quality and in demonstrating the application of new technologies to support learning and decision-making – such as the use of drones, nutrient monitoring close to source, visualisation technology and other emerging technologies supporting precision farming. An important role into the future is in training of staff from other organisations in effectively applying these processes and technologies.
- R3.11** More needs to be done to increase the role of the private sector in providing an environment for one-one service and support for producers/growers to better apply and adapt their management practices to those recommended. This has been highlighted through the current *Research and Development for Profit Project – Stimulating Private Sector Extension in Australian Agriculture to Increase Returns from R&D* and its associated forums and surveys. It is also important to ensure that there is individual on-going support for growers and producers who are influenced by ‘subsidised programs’ to make on-going change. The approach used by Farmacist in nutrient management provides a real opportunity for private delivery of nutrient management support post the subsidised period.
- R3.12** The delivery of industry Best Management Practice (BMP) programs (linked directly to the Water Quality Risk Framework) remains the key to benchmarking, whole farm analysis, identifying management gaps and areas to improve and to capture improvements over time. BMP standards need to continually improve to reflect the latest science and advances in industry best practice and as a consequence support the upward shift in industry performance to achieve reef water quality outcomes. BMP will also play an increasingly important role in providing improved returns for producers through marketing sustainable farming and in meeting regulatory requirements. Trained and experienced personnel are needed to continue to effectively drive and coordinate this process.

- R3.13** The public sector and deliverers of industry BMP programs also have a key role in working closely with the introduction of changing regulations and legislative requirements in terms of building producer awareness of the regulations, the implications, benefits of joining BMP programs and assistance with meeting the standards required.
- R3.14** The extension gap in nutrient management/water quality practices in relation to (mixed) farming systems/crop rotations (in the context of a farming system) needs to be addressed – through developing a BMP approach to mixed farming and directly funding programs targeting this sector.
- R3.15** Business management and the economics around recommended practices remains a key area to underpin the efforts towards encouraging management practice change. This is an area where personnel need to be retained and extension personnel have the skills and tools available to be proactive in analysing and extending the financial implications of recommended practice change.
- R3.16** R&D Corporations will need to continue to lead, provide staff and coordinate with research and extension delivery organisations to develop and apply practical production technologies while ensuring that water quality considerations are a primary consideration in their application and use.

2.4.3 Indicative Budget

Table 6: Extension personnel indicative budget

Item	Cost over 3 years	Percentage of total
R3.1 2 FTE soil conservation/health/hydrology staff	\$900,000	5.5%
R3.2 Additional Grazing BMP officer in Mackay/Sarina	\$450,000	2.7%
R3.3 Extra FTE Communications Officer Reef Plan extension	\$360,000	2.2%
R3.4 1 FTE Farming Systems officer to support Hort360	\$450,000	2.7%
R3.5 1 FTE Mixed cropping specialist extension water quality person in Wet Tropics	\$450,000	2.7%
R3.6 1 FTE Business Development Officer in Burnett-Mary	\$450,000	2.7%
R3.7 Pilot graduate program	\$1,000,000	6.1%
R3.8 Addressing short term contracts	-	-
R3.9 Website support for extension staff – tracking training, opportunities	\$150,000	0.9%
R3.10 Demonstration of new technology	-	-
R3.11 Encourage private sector roles	-	-
R3.12 Ongoing BMP	-	-

R3.14 Address mixed farming – develop BMP	\$100,000	0.6%
R3.15 On-going efforts with Farm Business management	-	-
R3.16 Industry extension role	-	-

The value of new positions and expertise lies in the capacity to fill gaps in such expertise in programs and projects in areas that can make a significant difference in promoting producer learning and understanding of management changes needed and the likely productivity, profitability and water quality outcomes from such changes. As such these are seen to be addressing barriers to adoption.

Post 2020/21 (post-this funding initiative)

- At the end of the 3 years, the on-going need for the specialist positions will need to be reevaluated – and if needed, funding incorporated as part of the core funding allocated to appropriate organisations or included in major program funding.
- Likewise, the need and value of the graduate program will also need to be reassessed on the basis of need and available funding. The legacy of the program, however, is expected to be felt through the on-going contribution of a number of participants who take up needed positions in the regions.

2.4.4 Implementation

- Negotiate locations and host organisations for soil conservation/health/hydrology positions (potentially Rockhampton and Burdekin based); Grazing BMP officer (DAF, Mackay); Communications Officer (DAF, Townsville); the Water quality specialist (Growcom, appropriate location); and the Mixed cropping specialist position – develop roles specifications and advertise. This may include secondments and/or sourcing expertise from organisations able to provide this service.
- The graduate program pilot plan is already in place – build on pilot and learn from it.

2.4.5 Risks

Demands on soil conservation/health/hydrology officers: This appears to be a very high demand area, and even the appointment of two more officers for a period may be insufficient and very demanding.

- A key role of the soil officers would be to undertake training of others in the region as well as providing input into projects and programs.
- Efforts should be made to increase this number over time.
- Look to bringing in the private expertise and skills. Provide a system of governance that supports on-going learning and information exchange.

Graduates left 'hanging' after 12 months – unable to find a job: There is a risk that if new graduates are put on each year, there may not be the infrastructure to fully support them in the range of experiences and mentoring they need and then, just as they get going, their position loses funding.

- For this reason, this review recommends following through on graduates after the initial year until they gain a funded position in the extension system. New graduates can then be advertised to take advantage of the gap left.

Short term contract extension staff: Political and funding realities have appeared to have limited project funding and projects to short terms. Despite the disruption, stress and lack of continuity that this causes, there may be little that can be done to change this limitation.

- The suggested mentoring, networking, capacity building and linking to up-coming positions may help address this issue for individuals involved.

2.4.6 Monitoring

Table 7: Extension personnel monitoring

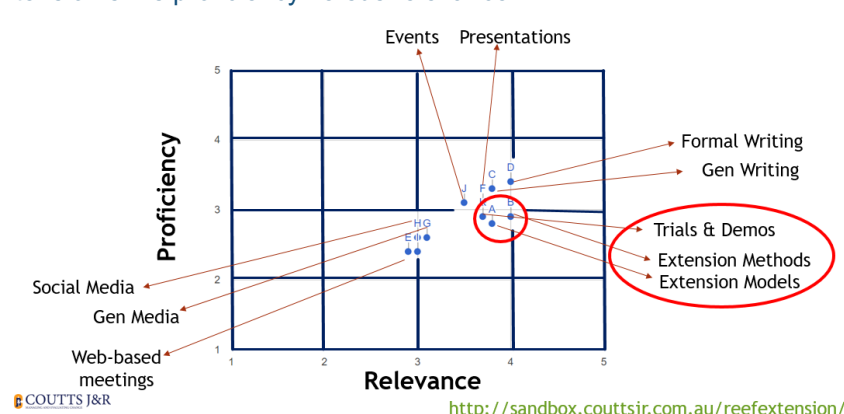
Element	Performance indicators	Evaluation Methods
New Positions	<ul style="list-style-type: none"> • Positions get ratified, described, advertised and filled with qualified people in suitable locations and organisations • Positions are supported and resourced to permit their effectiveness • Positions deliver on purpose and add value to existing programs 	<ul style="list-style-type: none"> • Program reporting to overseeing program/committee • Interviews with staff and program managers 6 months and 12 months into appointment • Project reporting by host organisation
Graduate program	<ul style="list-style-type: none"> • Positions get advertised (initial round also started) and positions filled with appropriate host organisations and program • Positions gain targeted experience and skills 	<ul style="list-style-type: none"> • Reporting by those managing program • Reporting by host organisations • Interviews with graduates and host organisations 6 months and 12 months after appointment
Existing contract positions	<ul style="list-style-type: none"> • Contract lengths are expanded • Those in short term contracts find a pathway forward into other programs and/or organisations • Those in the positions receive training, develop capacity and able to compete for other positions • There is optimism in terms of the future 	<ul style="list-style-type: none"> • Reporting by those managing programs – analysis of contract frameworks • Annual survey of extension staff and delivery organisations
Organisational roles and contribution	<ul style="list-style-type: none"> • Extent to which different organisations complement each other and effectively undertake their roles 	<ul style="list-style-type: none"> • Annual survey of extension staff and delivery organisations

2.5 Training and Capacity Building

2.5.1 Findings from the review

1. There was a strong agreement across all reef catchments and organisations that there was a need for greater training, capacity building and support for those undertaking extension related roles in the reef regions. There appeared to be a wide variance in the levels of experience, understanding, skills and confidence in different methods amongst this group.
2. A (draft) 'Best Management Practice' framework was put together by a group of extension personnel in the reef regions (included in the appendices) reflecting the benchmarking and improvement process used with growers and producers in industry BMP programs. The areas to date include:
 - Planning extension project and activities
 - Client and collaborator engagement
 - Extension delivery
 - Evaluation and reporting
 - Developing your skills and knowledge
 Each of these are described in terms of the ABCD framework and forms a good basis to consider skill sets for those engaged in reef extension.
3. The web survey of personnel in these roles by DAF in 2016 was based on this BMP framework and yielded some good insights and has formed the basis of the planned roll out of extension related training in the first half of 2017. The results are summarised³¹ on the figure below:

Chart 2: Extension skills proficiency versus relevance



The above diagram shows how different skills were rated in terms of proficiency versus relevance across the respondents. There were differences found across the different delivery organisations, however they have a similar trend to the overall picture above. The survey also included needs around specific technical skills relevant to the different industries. It is noted that 'people don't know what they don't know' – meaning that there may be skills that people do not recognise that are needed or they rate their proficiency higher than it actually is in key skill areas.

4. The stakeholder survey for this review had the majority of Extension Practitioner respondents with a medium to high interest in undertaking training in both extension related topics (84%) and technical related topics (88%). Short courses (76%) and mentoring opportunities (48%) were seen

³¹ Full details of survey results reside in DAF

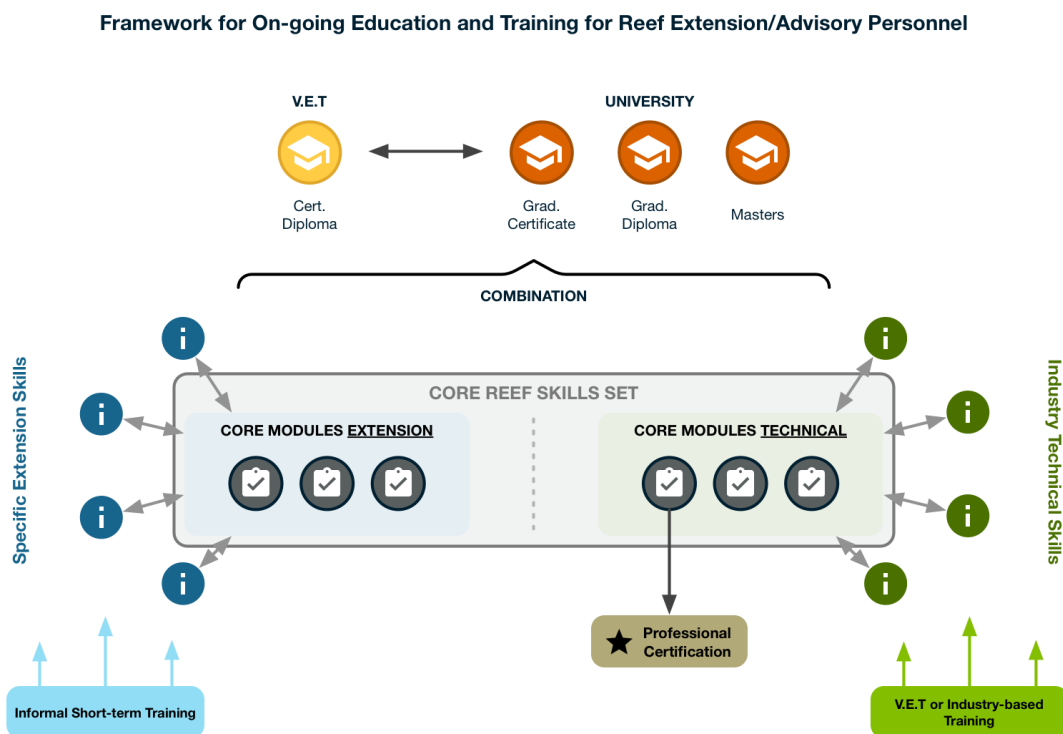
as the most effective methods of delivering training, with face-to-face (44%) and a combination of face-to-face and internet/webinar (48%) the preferred delivery methods.

5. There was only moderate confidence in extension as a career pathway from this stakeholder group with an overall average rating of 5.2 out of 10 (where 0=not at all confident and 10=very confident). Comments noted the issue with short term contracts and a lack of long term pathways given the *project to project* and *supply driven* nature of extension. The need for motivated and highly skilled extension officers was reiterated, as was the need to *build growers capacity to use commercial extension services and realise the value in extension delivery*.
6. There are a range of options in terms of the type and level of training, education/training providers, modes of delivery.
 - JCU is very keen to work with the government to provide education and training at required levels. They refer to the concept of “micro-credentialing” where modules relevant to a professional need can be sourced from a range of its courses and levels. They are open to bundling these modules fit for purpose, flexible delivery and use of ‘practical’ deliverers. They are also open to develop, and have these contribute to, a (post) Graduate Certificate and or diploma.
 - CQ University is another university located in the reef regions which could collaboratively provide this type of service and this needs to be followed up further.
 - The University of Melbourne is currently involved in a federally funded R&D for Profit program which has included the development of extension training modules aimed at the private sector – but with application across all sectors. The two modules currently being finalised and piloted are ‘Extension Design and Evaluation’ and ‘Being an Innovation Broker’. Both of these would be delivered by distance (including videos), are set at graduate levels, involve a cost (once piloting is completed) and can be used towards qualifications.
 - There is also interest in linking training to VET qualifications – Diploma level or higher – which would provide a competency framework and could attract on-going funding support for training. Extension staff are generally less interested in gaining extra qualifications at lower levels to what they already have – although the Certificate IV training in delivery is accepted as necessary for BMP delivery in some programs.
 - Some skill areas require more informal/one off training. This could be around such skills as facilitation, use of social media, videos etc. This type of training will also be important in the mix.
 - In New Zealand, there has been a strong move in the Dairy Industry to address environmental including water quality issues by developing *professional certification* for consultants and others working with producers in areas such as: whole farm assessment, nutrient management and effluent management. This approach has been seen as proactively addressing environmental issues in industry, developing capacity to address needs and increasing regulations, providing confidence and competence in certified providers and developing a private sector market in these areas. This has relevance to the reef regions.
7. Many technical pests and disease staff in the productivity services currently do not have degree level qualifications and may benefit from gaining higher level qualifications – although there is an issue around their ability to give time commitment to training.
8. As well as core extension type skills, there is a need to provide upskilling in a number of technical areas. These are at two levels – higher level understanding related to farming systems and impacts on reef water quality, nutrient management and/or sediment management; and specific skills directly related to technical understanding and needs in their respective industries.
9. A value in common training opportunities across industries, regions and organisations is that it provides an opportunity for networking and learning between participants.

10. There are a number of producers/growers – especially younger growers who are often graduates – who would also be interested in building their skills – both in the technical and extension type areas. This would assist in building networks with extension deliverers, build capacity and provide a greater pool for training and education providers.
11. A major reason why there has been inadequate training for extension staff in the regions to date is because of the lack of a process and framework for this to occur. This will mean a concerted effort to engage and involve organisations that undertake extension delivery and institutions/organisations and individuals that provide relevant training.
12. In developing capacity and leadership and a more rigorous understanding of the most effective extension and education approaches, and providing a career pathway, supporting experienced extension staff to undertake in-situ Masters/PhD research studies directly in this context, would be a positive addition all round.
13. As well as formalised training and education, there is a need for mentoring programs and greater interaction and networking between extension deliverers to assist in professional support, exposure to new ideas and approaches, and a sense of belonging.
14. There is a perceived need in the regions to ensure that program managers and funders have a good understanding of the issues around extension, behaviour change, barriers, practice change and on-going commitment to provide them with a context for planning, monitoring and reviewing programs.

2.5.2 Recommendations arising

Chart 3: Education and training framework



Oversight/management

R4.1 Appoint a **Senior Training Development Officer** for three years in an appropriate organisation to develop and implement the process and framework for upskilling the extension delivery staff across sectors in the reef regions – with an advisory committee comprising those with the appropriate knowledge and skills. It would be beneficial if this position was co-located with JCU, which has campuses in Townsville and Cairns. The core role of this position will be:

- Liaise closely with the DAF Manager (Skills and Education) the CRREC and REECs in the development and provision of capacity training.
- Develop a robust and practical framework to provide on-going training in core extension and technical skills (as below).
- Liaise with extension delivery organisations and producer bodies to determine staff training needs and opportunities.
- Liaise and negotiate with education and training providers to provide the required training in the appropriate modes at the appropriate levels and geared towards the professional and practical needs of extension and advisory deliverers and their clients. This would include cross-accreditation between universities and VET training providers and the ability of completed training to be accredited towards appropriate qualification levels.
- Explore the potential of working with one or more universities to develop modules that could work towards a post-graduate qualification in Reef Agricultural Knowledge Systems – or equivalent.
- Develop and maintain a website/page to provide information in training and education opportunities relevant to the core skills and other relevant areas.
- Promote, advertise and encourage delivery organisations extension/advisory staff and interested producers to participate in training opportunities.
- Develop a mechanism to provide certificates to those extension/advisory staff and producers who meet the core skills.
- Promote networking and peer-to-peer learning opportunities to share new methods, approaches and technologies.

R4.2 Promote, use and further develop the ‘extension best practice framework’ as a basis for benchmarking individual and collective expertise in the reef regions, determining extension training needs and providing supporting resources. Link this to a bi-annual survey of extension delivery staff.

R4.3 Develop a framework incorporating skill areas, delivery methods and sources of training. This would include a mix of formal and informal courses which may or may not lead to a qualification and could be delivered with a mix of on-line and face to face approaches. This could sit within a VET Certificate and/or Graduate Certificate level.

R4.4 Ensure that training is provided by experienced people with practical and theoretical skills to ensure interest and direct relevance to participants.

Core skills

R4.5 Define and source/develop training material around a set of agreed '**Core Reef Extension**' skills targeting both extension and overarching technical skills. Indicative core extension skills are (consistent with the Best Practice Extension Framework in the Appendices):

- **Planning effective extension projects and activities:** understanding different approaches; participative development; which approaches to use in different situations; and how to plan and implement them for impact.
- **Client and collaborator engagement:** understanding how to work best with the roles, needs and goals of different groups and individuals; negotiation skills; social marketing and behaviour change; innovation brokering; and team management.
- **Extension delivery:** understanding how to apply adult and experiential learning; effective mentoring; facilitating meetings and peer-to-peer learning groups; planning and undertaking on-farm/group trials; use of new technologies and tools to assist learning.
- **Evaluation and reporting:** Developing evaluation plans and tools; benchmarking; capturing and analysing evaluation data; and how to make decisions and report on data collected.

Indicative core technical skills underpinning reef water quality are:

- **Farming in a reef ecosystem:** Understanding how different components of farm or property management impact on productivity/profitability; understanding how farming and property practices impact on water quality and what can affect that; basic understanding of the reef ecosystem.
- **Nutrient/sediment management (base level):** Understanding factors affecting nutrient and sediment movement, how it happens and what can be influenced; understanding reef regulations as they affect agriculture and grazing; skills in how to develop an effective nutrient/sediment management plan.
- **Farm business management and whole farm management:** Understanding the economics of farming/grazing and the factors that impact on profitability as well as productivity; ability to put new or recommended practices into an economic context.

R4.6 Gain commitment from delivery organisations to upskill their staff in these core areas and provide a web-based platform where extension staff can register their experience and training in these core areas – and register for/seek training/mentoring opportunities. Professional certificates should be provided to staff who meet/have reached the core criteria.

R4.7 Provide some degree of subsidy – but also require funding from participants and/or the organisations to avoid a dependence on subsidies.

R4.8 Provide professional development for program managers and funders at State and Commonwealth levels to better understand the farming systems, farm management, extension and behaviour change context and principles.

- R4.9** Provide funds within programs and recognition for extension staff to run workshops for supplier staff (e.g. fertiliser, irrigation and farm machinery).

Specialist and industry technical skills

- R4.10** Define and source/develop specialist courses in extension (e.g. social media; You tube videos; webinars; trial/demonstration design) and technical areas (e.g. advanced nutrient/sediment management; system repair; business management; **specific technical areas relevant to industry**) with relevant training and education organisations and individuals and make them available to extension staff and other stakeholders. These could contribute to a post-graduate qualification or a Certificate or Diploma.
- R4.11** Have a system for professional certification in key skill areas (e.g. nutrient management planning; sediment management planning; soil conservation/health; BMPs). These are intended to provide career pathways, competence and confidence and assist producers in meeting increasing regulatory frameworks.
- Professional certification should be the basis for being able to audit farm practices to meet BMP water quality module accreditation – and hence meet regulatory requirements.
 - Consultants with professional certification should be promoted as having the recognised expertise in the certified area to be able to provide a high level of advice and planning.

Mentoring

- R4.12** Develop a mentoring framework (including examining the existing APEN mentoring program) which enables newer/less skilled extension staff to link with and learn from more experienced and successful staff.
- R4.13** Ensure this is structured and there are ‘rewards’ and recognition built in for both mentors and mentees with minimum disruption.
- R4.14** The CRREC could oversee this process with support from REECs.

Reef Extension and Education Network

- R4.15** Establish a formalised network of Reef Extension deliverers. This could utilise the platform established by RIRDC, managed by APEN, link in with the mentoring program and involve six-monthly network meetings.
- R4.16** The proposed workshop attached to the APEN conference in Townsville in September could launch this process.

Career development

- R4.17** The increased opportunity for training and/or certification should assist in providing career advancement for extension staff.
- R4.18** Opportunities should also be provided for extension staff to access professional development opportunities (e.g. Nuffield Scholarship) and study visits to other regions and areas.
- R4.19** In the first years of the program, 2-3 PhD opportunities should be provided, whereby candidates continue to work for their institutions and in-situ work on extension related topics to better understand the factors impacting on change and adoption, to maximise the value of investments in this area.

2.5.3 Indicative Budget

Table 8: Training and capacity building indicative budget

Item	Cost over 3 years	Percentage of total
R4.1 Appointment of senior training developer and support and advisory group	\$600,000	3.6%
R4.2 Develop and use Extension Best Practice Framework	-	-
R4.3 Develop framework for training – different levels, different modes, different topics, different institutions	-	-
R4.4 Training provided by experienced, practical trainers	-	-
R4.5; R4.10 Develop/modify/contract core training material, module and courses	\$1,000,000	6.1%
R4.6 Gain commitment from organisations	-	-
R4.7 Subsidies towards training in core modules - assume 800 places over 3 years with \$400 per training space plus extra costs	\$1,000,000	6.1%
R4.8 Professional Development for funders and program managers in extension	\$20,000	0.1%
R4.9 Provide funds for training to supplier staff	\$500,000	3.0%
R4.11 Professional certification system	\$500,000	3.0%
R4.12; R4.13; R4.14 Mentoring framework and management	\$150,000	0.9%
R4.15; R4.16 Reef Extension Network – establishment and management	-	-
R4.17 Encourage career development	-	-

R4.18 Opportunities for access to professional development opportunities apart from training	\$500,000	3.0%
R4.19 PhD support – for 3 places	\$300,000	1.8%

The value of training and capacity building of those engaged in the extension, advisory and technical areas is that it maximises the effectiveness of the extension resource by ensuring they have the base level of understanding and skills to effectively engage and work with producers to facilitate learning and practice change. It also provides career pathways for staff and incentive to build on their experience and earlier work in the regions.

Post 2020/21 (post-this funding initiative)

- It is expected that the framework and process for upskilling extension/advisory staff will be completed at the end of three years with the courses and process embedded in cooperating educational and training organisations for on-going delivery.
- It is recommended that 8% of future funding for programs related to reef extension and education initiatives be allocated for capacity building/training of staff involved in the program.
- It is expected that the professional/commercial gains from professional certification and/or gaining higher qualifications will drive the sustainability of these programs.
- The on-going support for mentoring and facilitating the reef extension and education network would be funded by voluntary contributions of individuals and organisations involved if the value of the network is evident by the end of the three years.

2.5.4 Implementation

- Develop the role of the senior training development officer and locate in an appropriate organisation within the reef regions (Townsville).
- Establish a training and development advisory group comprising of a core group of representatives from delivery organisations, regional and cross-regional E&E coordinators and training delivery organisations.
- The role of the extension coordinator is to work with the advisory group and relevant deliverers to develop the core modules and certification programs and the delivery process.
- Promote the value and processes for training and certification.
- Negotiate with relevant universities regarding a PhD program for students – criteria being relevant, in-situ extension research in the reef regions, and advertise for candidates.

2.5.5 Risks

A critical mass of extension personnel will not avail themselves to training: Due to time constraints, perceived relevance, financial or practical constraints, insufficient personnel may not take up opportunities.

- Ensure an active stakeholder advisory group that develops interest and commitment in developing their own staff capacity.

- Include staff development in the core skills as a funded requirement and time allowance in new reef education programs.
- Promote the training continually through the communication officers in DAF and other organisations.
- Promote the value of professional certification to extension deliverers, their organisations, government, industry and producers as being recognised for their skill and being capable to provide advice at a high level in keeping with farm/property needs and regulatory requirements.

Development and training costs may blow out if delivered by universities and some training organisations. It is difficult to judge what may be a reasonable cost for this approach – especially if related to formal university or VET extension modules. There may be insufficient funds in this pool to fully fund the full suite of training.

- The use of existing (and pilot training courses) modules and training programs should be sourced and assessed (note APEN's database and University of Melbourne course on these) for purpose.
- Develop a culture of paying by individuals' organisations from the start.

Mentoring can be an onerous load on individuals – especially if there is no funding support for that time. It also requires strong oversight and support. This could be an issue – especially as the graduate program has paid mentoring (although this level of mentoring is much less time consuming – perhaps 2-3 hours per month).

- The focus should be on joint benefits from the mentoring process and have a realistic expectation of commitment on a voluntary basis. This should be linked to the Community of Practice.

The Reef Extension Network concept may not be embraced and/or fully supported by the extension community and their organisations. As with the other measures, extension deliverers are fully committed time-wise and may not be interested or able to give extra time to link in with a wider network.

- There is already an extension 'hub' developed by RIRDC through their extension Research and Development for Profit project. This has resources on it and a capacity for a web platform to link people to share information, ask questions and provide answers/ideas. This could be utilised by this Community of Practice – but will need moderation, which is where APEN would come into it.

2.5.6 Monitoring

Table 9: Training and capacity building monitoring

Element	Performance indicators	Evaluation Methods
Senior extension training developer and core extension skills program and certification program	<ul style="list-style-type: none"> • Suitable person appointed • Advisor group in place 	<ul style="list-style-type: none"> • Reporting from program and extension developer

	<ul style="list-style-type: none"> • Traction being gained with stakeholders • Framework developed to suit need – in terms of levels, topics and delivery mechanisms • Electronic 'passport' in place and being used by trainees • Take-up and co-payment of training opportunities and core extension skills • Feedback and changes in effectiveness by those undertaking training 	<ul style="list-style-type: none"> • Expert review of courses, content and process • Feedback from participants • Questions in annual extension deliverer survey • Feedback from Advisory Group on program and effectiveness
Mentoring Program and Community of Practice	<ul style="list-style-type: none"> • Support for reef extension workshop at APEN conference • Numbers and type of extension deliverers committed to mentoring process and/or being part of the Community of Practice • Level of value felt from improved support, networking and linkage by extension deliverers • Improvement in effectiveness of extension delivery as a result of the extra support and networking 	<ul style="list-style-type: none"> • Workshop evaluation • Report from workshop organisers • Traffic on on-line Community of Practice hub • Questions in annual extension survey

2.6 Extension Approaches and Methods

2.6.1 Findings from the review

1. Factors that were identified by survey respondents as key to successful extension approaches included: evidence-based locally/personally relevant practical information; demonstrated results; skilled, knowledgeable and motivated extension officers; collaborative learning experiences that have greater buy-in; innovative partnerships between NRM regions and industry; minimising financial risks involved in early adoption; and working with the right landholders who are receptive and motivated to learn and adopt changes. It is also noted that non-traditional methods may be needed to engage those who are more isolated and those who have not engaged with existing approaches.
2. There is a danger of encouraging a 'tick and flick' approach to the development of Nutrient Management Plans (for example) without fully addressing the understanding and implementation in a whole of farm systems approach. Numbers of Nutrient Management Plans do not in themselves necessarily lead to improved practice change. An impressive approach to developing Nutrient Management Plans with individual cane farmers is that being used in the RP161 *Complete nutrient management planning for cane farming* project in the Burdekin. This follows on from the grower-lead RP20C *Burdekin Nitrogen Project* which used on-farm trials to verify the '6 easy steps' approach including recommended nitrogen levels. The RP161 project was developed in collaboration with DEHP, Farmacist, a local grower and SRA. The program is delivered by Farmacist³² using the following approach:

³² <http://www.farmacist.com.au/>

RP161 – Complete Nutrient Management

- Benchmark farm block by block and understand what their current nutrient management program is – provide a baseline to be able to measure change
- Collect and spatially allocate all relevant soil test data they have on hand to allow site block specific fertiliser requirements to be determined
- Conduct a full farm nutrient plan taking into account varieties, crop classes, soil types, soil chemical data, limitations and previous block history
- Provide a block by block plan in-line with the *6 easy steps* providing what blend to use at what rate, when to apply and where to place it
- Go on-farm and calibrate the fertiliser box with the grower and make sure he/she understands the process to enable correct calibrations in the future
- Test strip one block – apply with grower and ensure correct consignments at harvest
- Make 2 farm visits to ensure all other factors that lead to efficient nitrogen use are under control (irrigation, weeds etc.)
- Provide full phone support
- Collect actual application data, link to harvest data, and record changes in practice.

The initial support is subsidised (\$5000 in value) for the first year with growers providing \$500. The initial follow-on benefits include the take-up of on-going commercial arrangements to continue some or all of these services (developing the private sector's role) and has also resulted in growers getting together in groups to discuss what they are learning. Where individual approaches need to be funded to gain the momentum for change, these types of approaches offer more sustained gains than having Nutrient Management Plans alone.

3. Many other examples of extension approaches that were seen as successful were provided through interviews and the web survey. Examples included:
 - **Women in Grazing Bus Tour:** providing a supportive learning environment, establishing a peer support network and mentoring and resulting in changes such as a move to rotational grazing, monitoring of pastures and gully remediation.
 - **Resilience in Grazing project** (Collinsville): based on grazer-led field days and demonstration sites, provided 200 land managers with increased awareness and understanding of outcomes and demonstrated improved practices covering 5000 hectares.
 - **Project Nemo** (Herbert cane): On-farm, grower focused demonstration plots and targeted group and individual extension focusing on improved application technique and changes to enhanced efficiency fertilisers for improved water quality outcomes.
 - **Real-time water quality monitoring** (Baratta Creek sub-catchments, Burdekin): provided real time water quality results that linked directly with farm practices used, which provided local, measured information to growers on impact of practices on water quality from trusted agencies/advisors.
4. Many respondents to the stakeholder survey highlighted 'relationship building' as key to assisting on-farm practice change, including the need to build trust and a rapport with the growers and spending the time to understand their needs...*personal relationships* (are critical) *with customers*

and becoming the trusted adviser so that we can deal with the subtler issues and there is a need for empathy, and a willingness to understand the other demands in a grower's life and business. The delivery of more practical and tailored one-on-one advice was also seen as an effective method with comments noting the value of discussion based on regional/local need and hands-on assistance with detailed problems on-farm. Highly trained and knowledgeable extension officers with experience and technical competence were also seen as important, as was the need for financial incentives.

5. The emphasis on 'behaviour change' and the understanding and science behind it is very much being discussed at the moment. This is evident in the recently implemented 'Cane Changers' project in the Wet Tropics. A literature review of factors impacting on behaviour change reinforced much of what has been recognised in extension and extension research over recent decades: change is complex; it is affected by grower/producer contexts and goals; trust is very important – in those making recommendations and in the technologies/practices themselves; peer-to-peer learning is important; adaptation of research at farm/property level is often necessary; and there is a need to be able to trial change before full adoption.
6. There is a range of extension models and approaches that provide different contributions to the change process. These include: facilitated groups (experiential learning and peer-to-peer learning); technology development (on farm trials, demonstrations, adaptation); training and group presentations (workshops, shed meetings, field days); information provision and access (information packages, internet sites, social media); one-one advisory; e-extension (including webinars, videos); BMP and benchmarking approaches; co-innovation (stakeholder forums for developing new approaches); and social marketing (using marketing principles in addressing problem). Each needs specialist skills and the knowledge of when to use different approaches with different issues and demographics.
7. It is important to understand the distinction between a 'group meeting' where the technical experts present information, observations, recommendations and answer questions (which still has an important place in extension delivery) to groups based on facilitating *peer-to-peer learning*. Facilitated groups have the following characteristics:
 - The group chooses to come together with peers and a facilitator who they trust and with whom they feel comfortable to share farm information.
 - There is a skilled facilitator (who ideally has some technical understanding of the farming context but does not dominate discussion using this expertise).
 - The group chooses what it is they wish to explore and learn about (however, if there is group funding related to water quality, for example, a boundary would be that the group activity has some connection with water quality outcomes).
 - The group makes decisions about activities and their purpose and are involved in the planning and undertaking of those activities.
 - The group benchmarks what they are currently doing/achieving on-farm so that changes can be measured/documented.
 - The group considers what has been learned from the activities and from their own related experience and decide further actions to take, whether to change topics or whether to disband the group.
8. There are a range of approaches using these principles to support peer-to-peer learning that can be used in different contexts. These include:
 - a. **Focus farms:** A 'typical' farm or property is chosen in an accessible location with a facilitated advisory group made up of extension, advisory and producer representatives who overview the total farm situation with the focus group producer and suggest changes that could be made to improve outcomes. Other producers are invited to 'open days' on

- the farm to hear about and discuss recommendations, rationale, changes made and resulting impacts. The focus farm would run for 2-3 years.
- b. **Whole farm/property review groups:** A facilitated group of producers agree to take turns at meeting on each other's farms where the host farmer for that meeting takes them around the farm or property and then describes the different management approaches used, issues they have and opportunities. The other producers discuss and provide suggestions resulting in the host farmer developing an action plan to make changes to improve farm outcomes. This action plan is revisited when it is the turn of that producer to be a host again and learnings discussed.
 - c. **Producer demonstration sites:** These are where groups of producers get together – with the technical and extension support they require – to test recommended practices in a farm trial/demonstration setting to gain understanding about the practice in terms of their implementation and implications for their own farm/property.
 - d. **Producer learning group:** This is where producers meet regularly in a facilitated setting to share information and bring in expertise to learn more about topics, tools and technologies related to their farming or property needs. This can be face to face or through a web-based system where technology allows it.
9. There are different demographics in all industries which require different approaches used in extension to facilitate change. There is an expectation that the younger farmers/property owners will be more at ease with some of the new communication and information sourcing technologies.
 10. The extension skills survey undertaken by DAF indicated a high level of interest in being skilled in extension models and methods beyond what was already being undertaken. There was less relevance and interest in the use of social media and other internet platforms. However, given the increasing number of younger growers and producers more at ease with these approaches, they should also be considered.
 11. There was much discussion about the different technologies and internet aids that have been developed to assist growers and producers in understanding their farms and properties and undertaking better planning and precision approaches. These include such technologies as water monitoring, drones, visualisation techniques, spatial maps and precision technologies. There appears a lack of a use of these extension and learning aids in the current extension programs – but a lot of potential to use them in the change process.
 12. BMP approaches are now in use across the key industries and are providing a 'whole of farm/property' benchmarking process – including covering those practices that impact on water quality. This is a significant tool that should be valued and developed and promoted further – with most now linked firmly to their respective *Water Quality Risk Frameworks* (WQRF) for reporting to *Paddock to Reef*. Different industries have had different levels of success in the rate of grower engagement around BMP and the extent of auditing. The critical element is that it is used as a basis for benchmarking, identifying change needed, gaining the necessary skills and making the practice changes.
 13. A key issue is the heavy weighting in current reef programs on short term numbers and outputs (e.g. numbers of growers with Nutrient Management Plans) and funding focused on one-one approaches in achieving this. There are less funds for longer term, trust building methods that foster producer to producer learning and trialling, testing and adopting long term change. There is a need to balance the short term targets with dealing with the cultural shift that needs to occur over time.

14. The MIPS offer the flexibility to employ the best extension approaches given the context that is being addressed. Early indications are that the full range of extension approaches are being considered to be used where they will be most effective for the issue and/or producers involved.
15. The need for more resources for communication purposes and ensuring a constant and consistent message was raised by a number of stakeholders. It has been advised that the Reef 2050 Communications Network (which is made up of representatives from a number of government agencies and NRM groups) recently met and agreed to work together to develop key messages that can be used across the sectors.

2.6.2 Recommendations arising

Overall considerations

- R5.1** As important as 'smart' goals are valuable (e.g. X number of growers with a Nutrient Management Plan), goals relating to gains in understanding, attitudes, capacity, motivation and continuous improvement should also be highlighted as project goals. This is about achieving the longer term cultural and attitude change and fostering a generational change.
- R5.2** BMP (or equivalent – e.g. Hort 360) should continue to be promoted as an effective and holistic framework to take a whole of farm/property perspective and highlight where changes can benefit productivity, profitability and water quality outcomes.
- R5.3** Landcare groups with the capacity to work directly with growers/producers should be encouraged to apply for funding for extension projects in their areas and be represented in the Regional Extension Coordination Groups.
- R5.4** Recognition should be given to growers/producers who successfully achieve audited BMP (or equivalent) accreditation – especially for the water quality related modules.

Methods

- R5.5** An increased focus should be on funding longer term, *Peer-to-peer* facilitated group learning – such as 'Focus Farms'; 'Whole-farm Review Groups'; 'Producer Demonstration sites'; and/or 'Producer Learning Groups' – and exposed to new approaches and technologies. Funding should directly be available to producer groups who select their own facilitator or accessed by delivery organisations who then work to establish groups this purpose. Those producers less engaged in other approaches should be encouraged to participate in these groups.
- R5.6** Greater use should be made of extension technologies such as: local water monitoring (direct feedback to growers); phone apps; precision-farming tools; drones; farm robotics; visualisation technologies; and other aids to facilitate learning and understanding and trialling of improved approaches.

- R5.7** Sugar shed meetings are important with 50% of growers attending (many who may not attend other forums). These should receive an on-going level of support with the proviso of including water quality awareness and management practice recommendations in the mix of information provided and discussions held.
- R5.8** Nutrient Management/Sediment Plan objectives should be implemented in a whole of farm context and include gains in skills in applying the plans in a tactical and practical way (e.g. calibrating machinery; and ensuring weed and irrigation management is in synch with nutrient application) – not just ‘numbers of plans done’.
- R5.9** Extension approaches should encourage the development of private sector delivery services – as seen in the approach to Nutrient Management Planning in RP161 *Complete nutrient management planning for cane farming*; and through having private sector deliverers working with growers in peer-to-peer learning projects and developing opportunities for individual consulting.
- R5.10** Greater use should be made of distance engagement technologies for grazing, sugar, grains and the horticultural industries to maximise access to peers, information and expertise which complement face-to-face and group extension methods. These include webinars (short and practical); You-tube videos (farmer/producer centred); on-line moderated forums (e.g. RIRDC/GRDC platforms based on United States models). These will require training for effective use. Shed meetings in sugar should continue to be part of the approaches used in the funding mix. The FutureBeef website provides a very good example of how a single website presents all RD&E information relevant to the beef industry.

Communication

- R5.11** Ensure there are sufficient cross-program resources (DAF and NRM groups) to proactively provide positive and consistent communication messages across regions and industries and advise of resources, training opportunities and progress.
- R5.12** ‘Rules of thumb’ should be discussed and developed within Regional Extension Coordination Groups and promoted as consistent messages across programs and organisations (e.g. “don’t use flood irrigation within at least 2 days of applying herbicides in cane”) through the communication activities. Some will be industry and regionally specific, and others will be cross-regional.
- R5.13** Annual updates should be provided to extension personnel in the region by researchers and government departments developing new understanding, technologies and monitoring approaches.

2.6.3 Indicative Budget

This area is more about redirecting and being more flexible in extension approaches funded as part of on-going and new programs directed at water quality outcomes. This also relates to the training

recommendations in areas such as extension methods training, distance approaches and use of trials and technologies to assist learning.

Table 10: Extension approaches and methods indicative budget

Item	Cost over 3 years	Percentage of total
R5.1 Including goals relating to producer capacity gains	-	-
R5.2 BMP continues as key framework for whole of farm benchmarking and change	-	-
R5.3 Landcare groups encouraged to apply for funding for projects	-	-
R5.4 Recognition to producers who compete BMP accreditation	-	-
R5.5 Increased focus on funding facilitated peer-to-peer approaches to learning – three testing and development phase	\$2,000,000	12.2%
R5.6 Greater use of new on-site technologies to support learning	-	-
R5.7 Sugar shed meetings should continue to be supported	\$200,000	1.2%
R5.8 Nutrient/Sediment Management Plans undertaken in a whole farm and producer skilling approach	-	-
R5.9 Approaches should provide scope for further development of private sector/commercial services	-	-
R5.10 Greater use of distance engagement technologies	\$300,000	1.8%
R5.11 Strengthen communication programs with consistent messages	-	-
R5.12 'Rules of thumb' should be developed and promoted	-	-
R5.13 Annual updates to extension personnel by researchers	\$60,000	0.4%

All the evidence about behaviour change shows how important it is to build trust and facilitate peer-to-peer learning amongst the mix of extension approaches. This is a gap in the reef areas and needs to be recharged as it will help deliver capacity, attitude and motivation to change. There is also the need to ensure that new technologies are utilised to their fullest extent to bridge distance and demonstrate the need for, and benefits of, recommended changes in practice.

Post 2020/21 (post-this funding initiative)

- Use of the appropriate technologies should be included as a budget line in new program proposals to enhance delivery and achievement of outcomes.
- The seed funding of peer-to-peer groups is expected to demonstrate significant benefits and drive project funding through levy-funded activities and future reef relevant funding. On-going informal and/or self-funding groups linked to consultants are expected to be motivated following this seed funding.

2.6.4 Implementation

- Implementation would occur through training and increased flexibility in extension delivery and overt funding for alternative extension approaches.
- There is already a commitment to continue funding the BMP programs.
- DAF would be provided with resources around the new technologies and lead the way in adapting them for use in grower group contexts and providing training to other deliverers in their use.

2.6.5 Risks

Bias against longer term/group extension methods: There is a risk that given the emphasis on outputs such as Nutrient Management Plans, water quality related practice change in 'polygons' and wanting results in short time frames, there will be a reluctance to fund projects that emphasise longer term producer capacity building and approaches to cultural change.

- Funding for extension projects should also have capacity building targets and evidence of increased understanding, changed attitudes, improved skills and motivation to contribute to improving reef water quality.

BMP continues to have slow uptake in some industries: BMP is a good framework but it relies on incentive to undertake it and skills in the deliverer to move beyond initial engagement to impact on capacity, planning and management practice change with the associated auditing.

- With regulation will come an increased 'incentive' for meeting base level requirements. BMP auditing in the water quality modules would ensure that producers meet this minimum standard.
- Some incentive programs already require producers receiving grants to join the relevant BMP program. This should be encouraged.
- Cane Changers are encouraging record keeping which is essential for BMP accreditation in the sugar industry.

2.6.6 Monitoring

Table 11: Extension approaches and methods monitoring

Element	Performance indicators	Evaluation Methods
Greater use of mix of extension approaches including longer term locality and group based approaches in high priority areas	<ul style="list-style-type: none">• Number of initiatives effectively funded and using learning group processes• Extent of use of new technologies, trials, water monitoring• Extent of impact on capacity and practice change from participants	<ul style="list-style-type: none">• Program and project reporting• Annual extension deliverers survey• Report from group work including gains in capacity and practice change influenced by the approach

BMP program	<ul style="list-style-type: none"> • Extent of participation • Changes in capacity • Changes in management practices – GIS and area based • Contribution to practice change knowledge 	<ul style="list-style-type: none"> • BMP program records • Paddock to Reef Records
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2.7 Monitoring and Evaluation

2.7.1 Findings from the Review

1. A monitoring and evaluation (M&E) framework (referred to as RP150) was developed for reef extension and education in 2016³³ (referred to in the introduction to this report). This is yet to be fully released but does provide the overriding framework for effective monitoring and evaluation. There is some feedback that this needs to convert to standardised feedback sheets and survey forms at paddock level to ensure the right data is captured in the right way.
2. Reef Alliance is using a common spatial database across participating NRM groups to capture practice change in Reef Trust 3. This is uploaded to the Paddock to Reef spatial database (different, but a similar approach which allows for such transfer).
3. There is a problem capturing data for extension related change in the same way that 'works' are captured. DAF extension are using iPads to be able to directly provide data on the Paddock to Reef spatial database, which should improve this situation.
4. There was a lot of concern expressed about how to demonstrate attribution of impact given the number of programs working in the management practice change area. This can be dealt with by a combination of: asking growers about relative and type of influence of different programs; capturing narratives that trace the theory of change; and/or using a 'Synergy Matrix' to show what different programs value add to the mix and then evaluate them on how well they fulfil that defined function and link to other complementary programs.
5. Key issues around practice change reporting has been the doubling up of data and the inaccuracy around reporting of changes (e.g. from D to C) on farms conflicting data. Software is being introduced to better deal with these issues – but it requires the capacity of staff monitoring change to have the knowledge and skills required for accurate assessment and reporting.
6. The calibration of industry BMP programs to the respective WQRF has been a big step forward. The agreement by some BMP programs to provide spatial data to Paddock to Reef has also been a big gain. This should be a condition of government funding to support industry BMP plans.
7. The current spatial database does not capture capacity gains – which are a key indicator of movement towards practice change and on-going change and which is recommended in overarching M&E framework. There is also a lack of clarity about how this would be captured and reported in a consistent and meaningful metric.

³³ Stockwell B, Eberhard R, Bycroft P & Coutts J (2016) Reef Plan Best Management Program Monitoring And Evaluation Review and Practice Change Monitoring, Evaluation, Reporting And Improvement Framework, Watershed Australia and Queensland Government.

8. The need for a CMS for Grazing BMP/FutureBeef was raised as a mechanism which would assist the capture of practice change and be used for M&E reporting.

2.7.2 Recommendations arising

Overall

- R6.1** RP150 (Reef MERI Framework 2016) should be adopted as the 'higher-level' guide for reef E&E. Each industry should develop a suite of data collection instruments to gather consistent data against this framework.
- R6.2** Efforts should be made to comprehensively and accurately benchmark the practice levels related to the WQRF in priority areas within each region.
- R6.3** The Regional Extension Coordinator should provide leadership and support in relation to monitoring and evaluation methodology in partnership with Paddock to Reef.
- R6.4** Greater use should be made of narratives and other qualitative methods to show the 'theory of change' associated with the different programs and the role and part they play in influencing management practice change.
- R6.5** A Synergy Matrix approach should be used to demonstrate where each (new) program value adds to the mix and hence provide a basis for their evaluation.
- R6.5** A Client Management System (CMS) for Grazing BMP/FutureBeef should be explored to assist with planning follow-up, monitoring, evaluation and reporting.

Reporting

- R6.7** All Reef E&E programs should stipulate (and provide a funding allocation for) reporting against this framework with very clear expectations around demographics, enterprise type, size and location, capacity gains, practice changes and area/polygon affected. This includes BMP programs with public funding – with due consideration for individual privacy protection. Use of a common reporting platform would maximise effectiveness.

2.7.3 Indicative Budget

There are no direct new costs associated with these recommendations. It is a policy issue around spatial reporting to Paddock to Reef and within programs to ensure they have the appropriate tools to capture data necessary for reporting and in the evaluation and reporting requirements of programs and projects.

2.7.4 Implementation

- Endorse and implement RP150 – the M&E framework for reef extension and education. Provide sample data collection instruments to be adapted at program and project levels.
- Require publicly funded reef extension, education and BMP programs to contribute data to Paddock to Reef in the format required at a spatial level with due privacy protection.
- Build in stronger M&E requirements for programs to better capture capacity building information and request narrative as part of the reporting and evidence base.
- Work towards the inclusion of information about producer involvement in BMP and training programs in the Paddock to Reef spatial database.

2.7.5 Risks

Delay in endorsing and implementing RP150: This M&E framework was completed in 2016 and lacks effective exposure in its completed form and inclusion in reef E&E programs.

- Roll out the framework without delay with full endorsement and link reporting against it as a requirement for funded reef programs.

Lack of willingness or agreed protocols for all programs to report spatially around management practice to Paddock to Reef: There remain issues around privacy and maintaining guarantees to producers about the protection of their data which could slow down this process.

- Continue serious negotiations with all parties around protocols and need for information sharing including asking producers to formally agree to sharing this level data in this way.
- Build it in as an on-going requirement for public funding.

2.7.6 Monitoring

Table 12: Monitoring and evaluation monitoring

Item	Cost over 3 years	Percentage of total
R6.1 Reef MERI framework as higher level guide – suite of tools developed for each industry	\$200,000	1.2%
R6.2 Efforts should continue in regional benchmarking of practice levels and change over time	-	-
R6.3 Regional Extension Coordinator to also provide leadership in regional monitoring and evaluation	-	-
R6.4 Greater use of narratives, case studies and other qualitative methods to test and demonstrate theory of change in action	-	-

R6.5 A Synergy Matrix approach should be used to demonstrate where each new program adds value to the mix and hence the basis for its evaluation.	-	-
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Without effective benchmarking and evaluation, we have no idea of progress that has been made, gaps remaining, benefits achieved and lack the capacity to accurately report to funders and for report card purposes. This can drive more targeted investment and increase returns on investment.

2.8 Overall Indicative Budget

No special budget allocation	Moderate Priority	High Priority	Very High <i>Initial</i> Priority
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Recommendation	Cost over 3 years	Percentage of total	Notes/Post 3 years
Oversight of implementation			
R7.1 Coordination costs - meetings	\$60,000	0.4%	Need reassessed and met with new funding if needed
R7.2 Annual extension/deliverer survey	\$45,000	0.3%	
R2. Coordination and Collaboration			
R2.1 State/Commonwealth Program Design 2-day workshop plus cost for follow up working group.	\$50,000	0.3%	If the value is seen it will be funded from internal/administrative sources
R2.2 Build in collaboration	-	-	
R2.3 Annual cross-program meeting in reef region	\$60,000	0.4%	
R2.4; R2.5; R2.8 Cross-regional extension coordinator; Regional Extension Coordinators support and operating costs	\$3,000,000	18.2%	Reassessed and continued if value evident and new funds available
R2.6 Annual Grazing Forum/update	\$90,000	0.5%	
R2.7 Within region flexible funding for strategic and collaborative actions (at \$100,000/year/region)	\$1,500,000	9.1%	
R3. Extension Personnel and Expertise			
R3.1 2 FTE soil conservation/health/ hydrology staff	\$900,000	5.5%	Reassessed and continued if value evident and funds available, commercial opportunities
R3.2 Additional Grazing BMP officer in Mackay/Sarina	\$450,000	2.7%	

R3.3 Extra FTE Communications Officer Reef Plan extension	\$360,000	2.2%	developed and/or delivery organisations appoint as core staff members
R3.4 1 FTE Water quality specialist to support Hort360	\$450,000	2.7%	
R3.5 1 FTE Mixed cropping specialist extension water quality person in Wet Tropics	\$450,000	2.7%	
R3.6 1 FTE Business Development Officer in Burnett-Mary	\$450,000	2.7%	
R3.7 Pilot graduate program	\$1,000,000	6.1%	Continuation based on evaluation of pilot program
R3.8 Addressing short term contracts	-	-	On-going policy and funding situation
R3.9 Website support for extension staff – tracking training, opportunities	\$150,000	0.9%	Need reassessed and met with new funding if needed
R3.10 Demonstration of new technology	-	-	
R3.11 Encourage private sector roles	-	-	On-going policy and funding situation
R3.12 Ongoing BMP	-	-	[Core BMP funding not covered in this review]
R3.14 Address mixed farming – develop BMP	\$100,000	0.6%	One-off cost
R3.15 On-going efforts with Farm Business management	-	-	Referring to existing positions and recommended new position R3.6
R3.16 Industry extension role	-	-	A statement rather than funded action
R4. Training and Capacity Building			
R4.1 Appointment of senior training developer and support and advisory group	\$600,000	3.6%	Framework, courses, process in place - may not need extension of this position - Education/training institutions responsibility
R4.2 Develop and use Extension Best Practice Framework	-	-	Part of Training Development Role
R4.3 Develop framework for training – different levels, different modes, different topics, different institutions	-	-	Part of Training Development Role R4.1
R4.4 Training provided by experienced, practical trainers	-	-	Part of R4.7
R4.5; R4.10 Develop/modify/contract core training material, module and courses	\$1,000,000	6.1%	Framework, courses, process in place -

			education and training institutions responsible for update
R4.6 Gain commitment from organisations	-	-	
R4.7 Subsidies towards training in core modules - assume 800 places over 3 years with \$400 per training space plus extra costs	\$1,000,000	6.1%	Percentage of future funding for programs allocated for capacity building/training
R4.8 Professional development for funders and program managers in extension	\$20,000	0.1%	Should just become another option for staff PD
R4.9 Provide funds for training to supplier staff	\$500,000	3.0%	Should be embedded into future programs
R4.11 Professional certification system	\$500,000	3.0%	Should be self-funding - as a requirement to be able to accredit
R4.12; R4.13; R4.14 Mentoring framework and management	\$150,000	0.9%	Potential to continue to this as part of fees to professional organisation
R4.15; R4.16 Reef Extension Network – establishment and management	-	-	Role of coordinators - continued if positions continue
R4.17 Encourage career development	-	-	On-going policy and funding situation
R4.18 Opportunities for access to professional development opportunities apart from training	\$500,000	3.0%	Percentage of future funding for programs allocated for capacity building/training
R4.19 PhD support – for 3 places	\$300,000	1.8%	Potential for Universities to offer scholarships; Government VET subsidies
R5. Extension Approaches and Methods			
R5.1 Including goals relating to producer capacity gains	-	-	On-going as part of regular programs and funding
R5.2 BMP continue as key framework for whole of farm benchmarking and change	-	-	On-going policy and funding situation
R5.3 Landcare groups encouraged to apply for funding for projects	-	-	On-going policy and funding situation
R5.4 Recognition to producers who complete BMP accreditation	-	-	Embedded in BMP programs
R5.5 Increased focus on funding facilitated peer-to-peer approaches to learning – three testing and development phase	\$2,000,000	12.2%	It is expected that these approaches will demonstrate such good returns on investment that

			they will be continued as part of future program funding
R5.6 Greater use of new on-site technologies to support learning	-	-	On-going policy and funding situation
R5.7 Sugar shed meetings should continue to be supported	\$200,000	1.2%	Expected that industry will continue this after this boost
R5.8 Nutrient/Sediment Management Plans undertaken in a whole farm and producer skilling approach	-	-	It is expected that these approaches will demonstrate such good returns on investment that they will be continued as part of future program funding
R5.9 Approaches should provide scope for further development of private sector/commercial services	-	-	On-going policy and funding situation
R5.10 Greater use of distance engagement technologies	\$300,000	1.8%	It is expected that these approaches will demonstrate such good returns on investment that they will be continued as part of future program funding
R5.11 Strengthen communication programs with consistent messages	-	-	Should be embedded into current and future programs
R5.12 'Rules of thumb' should be developed and promoted	-	-	Should be embedded into current and future programs
R5.13 Annual updates to extension personnel by researchers	\$60,000	0.4%	Funding should be included for this purpose as part of research and development funding
R6. Monitoring and Evaluation			
R6.1 Reef MERI framework as higher level guide – suite of tools developed for each industry	\$200,000	1.2%	On-going modification as part of programs
R6.2 Efforts should continue in regional benchmarking of practice levels and change over time	-	-	On-going policy and funding situation
R6.3 Regional Extension Coordinator to also provide leadership in regional monitoring and evaluation	-	-	Depends on future of coordination position post-3 years
R6.4 Greater use of narratives, case studies and other qualitative methods to test and demonstrate theory of change in action	-	-	Should be embedded into current and future programs

R6.5 A Synergy Matrix approach should be used to demonstrate where each new program adds value to the mix and hence the basis for its evaluation	-	-	Depends on future of coordination position post-3 years
Total	\$16,445,000	100%	

3. APPENDICES

Appendix 1: Industry Best Management Practices (BMP)

Peter Long; Jeff Coutts; Roy Murray-Prior; January 2017. [<https://www.couttsjr.com.au>]

Focus

This paper summaries industry BMPs relevant to reef catchments and considers how they support adoption of targeted practices. In the context of this review, the particular focus is on encouraging and supporting practice change. The aim is to provide a background paper for the Review of Extension and Education as part of addressing "Recommendation 3: Extension and Education of the Great Barrier Reef Water Science Taskforce". [<http://www.gbr.qld.gov.au/documents/gbrwst-finalreport-2016.pdf>]

Industry Sectors

The two largest sectors in reef catchments by landholders are beef cattle grazing (9,083 businesses^[1]) and sugar cane growing (3,316 businesses). Other agricultural sectors within reef catchments are: irrigated and dryland grain, pulse and cotton cropping, a wide range of horticulture including bananas as well as dairy farming.

BMPs

Rationale

Industry BMPs have their genesis in Environmental Management Systems (EMS) which were designed to be completed by landholders regardless of their commodity and region. The background and process for EMS is documented in a national framework^[2]. EMS provides a management framework based on a simple 'plan, do, check, act' cycle that achieves continual improvement. Historically EMS had a very low uptake by landholders as there is little in the way of policy drivers or market incentives for agricultural commodity EMS certification. In contrast BMPs are founded on specific industry practices.

In the main industry and Government policy agendas have been the stimulus for the development of industry BMPs. From this, resourcing has flowed to design and deliver BMPs. To illustrate, the driver for the first industry BMP, that of the cotton sector, was driven by significant community and government concerns about spray drift from pesticide applications. The industry response was the development of *myBMP* which commenced in 1997. The regional NRM group Fitzroy Basin Association (FBA) initiated the development of a grains and grazing BMP commencing 2007 and 2009 respectively in each case they partnered with AgForce and Department of Agriculture and Fisheries (DAF).

From 2012 onwards the Queensland Government took a policy decision to directly invest in industry BMPs in reef catchments as a voluntary instrument and shift away from land holder regulations. The initial focus was a grazing and cane industry BMP with the grazing BMP partly developed and some modules delivered in pilot workshops whilst the development of the cane BMP commenced following an agreement with Canegrowers. This direct investment in the development and delivery of BMPs clearly had the focus of encouraging and supporting voluntary improvement of land management practices to achieve enhanced water quality outcomes.

More recently Queensland Government investment has been made in developing grains, banana and horticulture BMPs. To add to the geographic spread, grazing and horticulture BMP delivery is now supported in South-East Catchments as a means of improving water quality in Moreton Bay. To cover the two other major sectors in the reef catchments, dry land cropping has available the grains BMP (now funded to develop an accreditation system through the Queensland Government) and dairy farming relies on the national program DairySAT.

Additionally, the Australian Government directly and indirectly supports industry BMPs and follow-up training and extension support through the National Landcare Program and more recently Reef Trust investment.

BMP process

All BMPs are available on-line and can be completed independently. However, the majority are completed with industry facilitator support in a workshop or one on one environment to work through the self-assessment process. The availability of project resources dictate the level of support for module completion. In the main, the content (standards) are grouped into modules and have a below, at and above industry levels. The documented industry standards have been developed by industry and research experts based on the best available science and best industry practice. Whilst some BMPs have endeavoured to cover all aspects of the business others are not as comprehensive, for example excluding people and business management. Further there is a need to for additional work to demonstrate the wider, non-water quality benefits of BMPs including: enhanced business management, decision making and ultimately farm profitability.

BMPs are self-assessment tools and in general are only as effective as the understanding/knowledge and integrity of a participant's assessment. In parallel with EMS they are based on a simple 'plan, do, check, act' cycle where participants can identify where there are opportunities for change (improvement) in their practices. Where a participant identifies a practice change, the BMP process allows an action plan to be produced. In some cases, the action may be acquiring additional information or a new skill prior to effecting the practice change.

The provision of information and training may be integrated into BMP events with a twofold purpose of raising awareness and providing an opportunity for skill development (e.g. soil health, farm safety). However, this is not universal. This process has a twofold purpose, of stimulating a more critical and informed participation self-assessment as well as the provision of relevant information. All BMPs encourage participants to repeat their self-assessment on a routine basis, for example grains suggesting annual reassessment.

Data gathering

BMPs are a very data rich environment and in the majority of cases the data is held by the relevant industry organisation. However, given Government funding, periodic reports are required with aggregated summaries of industry practices across specific geographic areas. Given the background of potential reef regulations all BMPs provide assurances that individual participant results will remain anonymous and only aggregated data reported.

Initially the level of participation and balance of below, at and above industry standard was of interest. However, with the completion of reassessed modules there is greater interest in the number of participants that have reassessed and improved their practice. However, one interesting experience is that of grains BMP where there was a reduction in the average level of standards for some practices upon reassessment. The explanation suggested was that growers were now better informed and are making more 'critical' self-assessments due to their improved knowledge and understanding of the self-assessment process.

The other and critical use of the results for extension is the opportunity to identify where additional skill development may be required. Two approaches are taken to identify the extension needs, firstly where data is reviewed on a district basis to identify where practices are low for specific standards and secondly, where some BMPs request participants to complete a training expression of interest form to identify training and extension support they are interested in. Both data sets can bring an efficiency to the content selection and geographic targeting of follow-up extension delivery as well as improved coordination across providers. The on-going challenge for those involved in extension/advice delivery is, whether project resources are available and whether there is flexibility in existing project commitments to address the identified needs. The other opportunity for this data is to better inform current and future industry research and development investment. There is also scope for the private sector and input suppliers to link in with identified gaps and needs with improved servicing/advice in a win/win arrangement with clients – for example, precision agriculture.

Accreditation

The two primary BMPs (grazing and cane) funded by the Queensland Government require that a percentage of those completing a BMP be audited by a third party to assure credibility and integrity in the self-assessment results. For grazing BMP those successfully completing an audit achieve the status of an Accredited Producer which is valid for three years. However, there are currently no market signals that reward accredited producers and hence a weak value proposition for producers. There could potentially be scope to increase 'social recognition' and hence peer encouragement. Cane growers need to have completed three modules to be eligible for accreditation prior to nominating for an audit. For the cane BMP, independent third party industry audits are used as part of the BMPs monitoring, evaluation and performance review. To support this objective, a random sample of growers will be audited anytime within a five-year period. Cotton growers may elect to have an audit completed of their self-assessment to achieve *myBMP* accreditation, which will be current for five years. As noted above, The Queensland Government has now also funded an accreditation system for grains.

In New Zealand, auditing (compulsory and user-pay) of Nutrient Management Plans is currently being phased in (pers. com. N Botha)

Summary of the sector BMPs

Banana sector

The Australian Banana Growers' Council with support from the Queensland Government deliver Banana BMP. The program is also supported by Horticulture Innovation Australia. The BMP was launched at Banana Industry Congress in 2013. Banana BMP is a single point (app was developed, funded by Queensland Government) where growers can get information about suggested farming practices, reflects the structure of Freshcare's Environmental Code and provides a checklist, management plan (priorities for change) and resources to help. Modules include:

- Land and soil

- Biosecurity
- Pesticides
- Integrated pest and disease management
- Fertilizer and soil additives
- Water
- Waste
- Energy
- Fuel

Dairy sector

The Dairy Self-Assessment Tool (DairySAT) is a voluntary national environmental self-assessment and action planning tool for Australian dairy farmers and is funded by industry levies. DairySAT is an environmental self-assessment and action planning tool for Australian dairy farmers. It covers 10 key topic areas: Soils, Fertilisers, Effluent Management, Irrigation, Greenhouse Gas Emissions, Biodiversity, Energy and Water in the Dairy, Pests and Weeds, Chemicals, and Farm Waste. DairySAT enables farmers and the broader dairy industry to:

- Understand the environmental issues facing dairy farming
- Benchmark on-farm environmental management practices with industry best practice
- Identify the most critical environmental management practices on their farm
- Develop action plans to address the identified practices
- Access further information to understand environmental issues and improve practices on farm

Cotton sector

MyBMP is a voluntary farm and environmental management system which provides self-assessment mechanisms, practical tools and auditing processes to ensure that Australian cotton is produced according to best practice. The original BMP program began in 1997 and was reviewed and redeveloped in 2006-7 with the new online 'myBMP' system re-launched in 2010. MyBMP is hosted and managed by Cotton Australia with funds from the National Landcare Program and Cotton Research and Development Corporation. MyBMP provides the opportunity for participants to benchmark their practices (across all the business) and identify where they sit against industry standards. MyBMP advisors are available to support growers complete the program and resources available include the latest research findings and legislation, on-farm tools and templates for workplace health and safety matters.

myBMP modules include:

- Biosecurity
- Energy
- Fibre quality
- Integrated Pest Management
- Pesticide Management
- Petrochemical storage and handling
- Farm safety
- Water management
- Natural assets
- Healthy soils and accountability

Grains sector

The Grains BMP program is a voluntary, industry led process which helps broad acre grain growers to identify improved practices which can help improve the long term profitability of their business. It also helps identify the steps needed to be taken to incorporate best management practices into an enterprise. Grains BMP was initiated by FBA with the support of AgForce and the DAF in 2008.

Action plans associated with these modules are developed by individual growers to help identify and prioritize improved practices for their own farm. Grain growers can complete the modules independently, with assistance from an advisor or in groups. The Grains BMP modules are:

- Soil fertility management
- Property design and layout
- Pesticide application
- Making best use of rainfall
- Integrated pest management
- Managing climate risk

Grazing sector

The Grazing BMP program is a voluntary, industry led process which helps graziers to identify improved practices which can help improve the long term profitability of their business. It also helps identify the steps needed to be taken to incorporate best management practices into an enterprise. Grazing BMP was initiated by FBA with the support of AgForce and the DAF in 2010. Grazing BMP is now delivered by partner organisations across three reef regions and South East Queensland with funding support from the Queensland Government. Within the three reef regions there have been 1247 grazing businesses complete BMP modules to date. Grazing BMP comprises of 157 standards and divided into the following modules:

- Soil Health
- Animal Health and Welfare
- Animal Production
- People and Business
- Grazing Land Management

Grazing BMP has an accreditation system in conjunction with ISO19011 which enables producers to independently audit their businesses through a third party, against a set of core criteria within the program. This also ensures credibility and integrity in the data.

Horticultural sector

Hort360 is a computer based, risk assessment tool, which is designed to give an overview of farm business operations. It is a whole of farm business approach. The program is voluntary, managed by Growcom with funding support from the Queensland Government. Based on risk and opportunities established via Hort360 Growcom provides on farm technical support, training and funding avenues to support practice change adoption. Hort360 currently consists of the following modules:

- Sediment
- Water Quality
- Irrigation
- Energy
- Workplace Safety

- Industrial Relations
- Air
- Biodiversity
- Waste

Hort360 is currently going through a restructure to improve its usability and reporting functionalities to align with Freshcare Environmental and Ethical Employment accreditations and will contain several new modules Better Business, Sediment and Water Quality will be restructured to form Pesticide, Soil, Nutrient, Runoff and Growcom is currently scoping a Biosecurity and Climate module.

Sugarcane sector

The Smartcane BMP is led by Canegrowers with Queensland Government support and is a voluntary best practice system for cane growing across Queensland, aiming to support business productivity, profitability and stewardship. Smartcane is delivered by partner organisations across all growing districts. The BMP facilitators work with growers to develop an action plan to assist them to meet the required standard. Action plans are designed to suit each individual farmer and their business and support is provided to assist in the implementation of the actions. Seven BMP modules are included and are aimed at addressing whole of farm operations:

- Drainage and irrigation management*
- Pest, disease and weed management*
- Soil health and plant nutrition management*
- Crop production and harvest management
- Natural systems management
- Workplace health and safety management
- Farm business management
- Managing people and the environment

*Core modules to be completed for a grower to achieve accreditation.

The Smartcane BMP modules have been modified to align with the on-farm criteria used by Bonsucro which provides international standards for sustainable sugar. Bonsucro is designed to establish global market access across a wide range of production systems.

[1] ABS (2013); [2] Australia's National Framework for Environmental Management Systems in Agriculture Natural Resource Management Ministerial Council Oct 2002

Appendix 2: Extension Approaches and Methods

Jeff Coutts; Peter Long; Roy Murray-Prior; January 2017. <https://www.couttsjr.com.au>

Focus

This paper outlines the range of extension methods and approaches that have relevance in the reef regions. The aim is to provide a background paper for the Review of Extension and Education as part of addressing "Recommendation 3: Extension and Education of the Great Barrier Reef Water Science Taskforce". [<http://www.gbr.qld.gov.au/documents/gbrwst-finalreport-2016.pdf>]

Extension Definition

For the purpose of this issues paper, extension is defined as 'the process of encouraging and supporting voluntary change on farm to improve production, profitability, environmental and/or social outcomes'. This includes increasing awareness, understanding, skills, motivation and pathways to change.

In the context of this review, the focus is on encouraging and supporting practice change that directly or indirectly leads to improved water quality outcomes to benefit the Great Barrier Reef.

Extension is part of a suite of approaches to encourage and support change. Other approaches include: grants/incentive funding (partial payment of equipment or on-ground works); legislation and regulation; price incentives (in terms of sales of equipment and other inputs); and industry policies and guidelines. It is rarely the case that only one approach is sufficient – e.g. understanding and skills are often required to most effectively use incentives, new equipment/inputs or to respond to regulations or follow guidelines. It has also been noted that on some occasions, policy can be 'perverse' – working against rather than promoting positive change on farm.

Extension then encompasses a wide range of agencies and individuals who work with producers including those in such roles as: government extension staff; NRM body staff; local government; mill productivity services staff; Sugar Research Australia regional staff; Horticultural Industry Development Officers; company staff supporting input suppliers (equipment, fertilizer, seed, chemicals, etc.); private consultants and NGOs (Non-Government Organisations). Other organisations, including Research and Development Corporations (including Meat and Livestock Australia and Dairy Australia), fund development and extension projects and programs in the reef regions.

Extension Approaches

Extension can be viewed on a continuum from "Top Down" (or *persuasive*) extension where the underlying approach is to gain adoption of a predetermined innovation/farm practice across a farming population to "Bottom-up" (or *facilitative*) extension where the underlying approach is to assist members of the farming community in determining what they need to better fulfil their farm and personal goals. Each of these extremes may be suited for different contexts (e.g. a new improved crop variety developed by researchers may just require good communication and promotion), however, in many cases extension works where the extremes meet – bringing together different parties who can contribute and support the most effective change.

In reviewing extension approaches to determine "What Works and Why?" as part of a suite of projects funded by the Cooperative Venture in Human Capacity Building, five 'models' (or approaches) were identified – each with their own underlying rationale and mostly complementing rather than replacing other approaches. These are discussed briefly below as well as some extra approaches that have been identified. Note the names of the approaches have been modified to better reflect the intent of the model.

Facilitated groups – Peer-to-Peer Learning

Facilitated groups is a long term strategy based on developing relationships, trust and respect for the skills and experience each person brings to the group. The extension person is usually the facilitator and it is helpful if they have some technical understanding of the farming context of the producers involved. Participation in individual groups is by invitation or application rather than open access. Although most groups meet face-to-face because of the local links, it may be that phone or web links might be used when distance is an issue. The aim of the group is to share information, raise issues being faced and opportunities that are presented and together decide how best to address these. These could be addressed by inviting in 'experts', undertaking on-farm trials, holding training workshops, accessing information or available tools and/or going on farm walks or tours. A key element is to be able to share some of the outcomes from these groups to inform/encourage other producers (not in groups) with the successes. In the cane industry, there are groups/shed meetings that work in this fashion - others tend to be more open forums with technical updates/questions and answers. Each have their place, but it is important to make the distinction.

Technology Development

Technology development is mainly about testing/adapting research and practices that are used elsewhere into a local context or developing new technological solutions in a local, on-farm context that is visible and easily accessed. It generally involves on-farm trials or demonstrations and may link to one or more of the facilitated groups. Involvement of producers, advisers with some research input increases the value of the process so that there is both ownership and rigour involved. Holding field days or farm walks on the sites allows interest and understanding to develop and confidence in the demonstrated results and their implications. This approach has been used extensively across agriculture and would be an important part in developing confidence in reduced nitrogen rates in the sugar industry and appropriate changes in other industries. Once again, the on-ground relevance of the outputs from this approach can improve the quality of messages delivered through other extension approaches.

Training and group presentations

Training events, workshops or courses are based on deliverers having confidence in a set of knowledge and skills which are applicable to the producer/consultant group that is either being targeted or who have requested the training. This includes one-off group meetings to provide information about new technologies, approaches or products which are open to whoever wishes to attend. Training can be part of a formal or informal program but in either case will be most effective if: the participants have seen the need for the training; their own related experience and knowledge is shared during the process; adult and experiential learning is used; local examples that participants can relate to are included; they have the opportunity to directly relate it to their own situation; different learning styles are catered for; there are agreed actions; and there is planned follow-up post the

training. The planned follow-up will often involve one-one-on visits by farm advisers to adapt, reinforce and support the behaviour change for a farmer's context.

Information provision and access

Having ready access to practical and relevant information is often critical to the change process. Information being proactively sent out through (e-)newsletters, social media, mass media helps to maintain an awareness of issues, opportunities and solutions in a general sense. Being able to easily access more specific technical information, manuals, tools and remote expertise at the time when the producer is ready for it in their decision-making process is essential. Opportunities to allow testing ideas with the information or tools available helps with the decision-making process. Linking technologies/approaches to risk and economics adds to the value of the information. Producers engaged in other processes are often provided with or alerted to such information and tools – or they seek it through their contacts or internet searches. Case studies/videos of other producers making changes have been shown to be very useful and influential in giving producers confidence and 'tips' in adoption. Model outputs, videos and other information material have also been shown to be useful in generating discussion in producer events or groups. This works best if the information has been developed through Technology Development and/Facilitated Group processes.

One-on-one individual farm advisory

A major factor in supporting on-farm change is having a trusted adviser who can help work through the relevance, implications and practical implementation of new technologies or approaches on an individual farm. Often individuals can be quite convinced of the value of adopting a new technology or practice, however the translation to their own situation is often not clear. Such individual support is best done by someone with the necessary technical expertise and an intimate knowledge of the specific farming system – and also experience on other farms using that particular technology or approach. A coach or mentor approach has been shown to be more effective than the 'expert' making the decision for the producer. Producers need to prepare as best as they can for such discussions and spend time working through the implications with their adviser.

It has been suggested that a specific extension approach that has developed in this category is that of encouraging or assisting producers to put in a proposal for a grant and/or to assist producers in completing requirements/desirable actions such as 'completing Nutrient Management Plans' or similar tasks. A key issue is the need for the relevant extension and technical knowledge and skills to provide the most effective support here.

Best Management Practice Frameworks

Best Management Practice frameworks and alternatives (for example, Water Quality Risk Framework) provide a mechanism for a producer to consider the range of different management practices undertaken on the farm and where they are placed in terms of recognised 'best industry practice'. This can be undertaken individually or as part of a group and administered online or with assistance. This then provides the basis for seeking assistance or training to enable improvements to be made where they are most needed – and a benchmark to show progress over time. A separate paper in this series describes more about this approach in the reef regions.

E-extension

E-extension refers to 'electronic' extension – the use of technology to provide information and extension support from a distance. This could be through avenues such as: websites; online tools; wikis; Facebook; Twitter; e-newsletters; web surveys; webinars; or other forms of distance communication and sharing. In terms of 'extension' (rather than one-way information provision), the emphasis should be on enabling interaction and information sharing between those involved. Depending on how these technologies are used, they can provide a distance application of other approaches: *Information Provision and Access* – if the focus is on information supply side; *Facilitated Groups* – if the focus is on engaging people in peer interaction and discussion; *Training* – if the focus is on distance education or webinar presentations; and even *One-on-one* if the focus is on mentoring from a distance.

Co-innovation

There is a lot of interest in the co-innovation approach in the extension context. Co-innovation is about effective engagement of stakeholders to equally share their understanding of issues or opportunities, gain ownership and to jointly seek solutions using their expertise and resources to best aid the process. It is most relevant when the situation is complex, science findings are contested and there is no clear/easy way forward. Relevant stakeholders can include producers, extension/advisory staff, researchers, input providers, marketers, sellers etc. Extension's main role is in using its expertise and networks to link people and facilitate the process and ensure everyone has a voice – and to enable on-going planning and reflection as the process unfolds. Co-innovation helps to consider what mix of extension approaches might best be used together with other initiatives to address the situation – and also inform what further research may be needed. It can provide a strategic umbrella to better inform, guide and make adjustments over time.

Social Marketing

Like Co-innovation, 'Social marketing' is about better understanding and engaging people to be able to work with them towards specific behaviour changes. It is based on marketing principles around a framework of actions to most effectively use the best marketing strategies for the target group and practices. A literature review by Lester Pahl (DAF, 2016) identified a framework of 11 actions with the following benchmarking criteria:

1. Challenge statement
2. Customer orientation
3. Clear focus on behaviour
4. Informed by behavioural theory
5. Audience insight
6. Exchange
7. Competition
8. Segmentation
9. Mix of methods
10. Piloting
11. Broad-scale implementation and evaluation

There are variations on these steps and also different approaches to applying these to a particular context.

Appendix 3: Extension Best Practice

Planning requirement				
Usefulness / Confidence				
Skills required				
Professional Standard	Ordinary	Workable, room for improvement	Best Practice	Innovative
Management Issue	D	C	B	A
Planning extension project and activities	<p>No planning undertaken, only responses to limited client demand.</p> <p>Activities based on what has been previously done.</p>	<p>Identifies industry needs and uses this in planning project and activities.</p> <p>Develops project plan and plans activities to suit the program/funding and target audience.</p>	<p>Uses project evaluation and industry data linked to the program/funding and to inform project planning and activities.</p> <p>Detailed project plan developed with evidence of planning and targeting delivery to achieve program/funding outcomes.</p>	<p>As for B, Plus: Uses formative evaluation to design projects.</p>

Client and collaborator engagement	<p>Has limited and static group of clients that are usually engaged through phone and visits.</p> <p>Has limited network. Does not work regularly with other collaborators.</p>	Maintains network including innovative clients, other extension providers and researchers.	<p>As for C, plus: Understands and engages with industry supply chain and policy and funders.</p> <p>Meets regularly with other extension providers, industry, NRM etc. to ensure across project and program coordination.</p>	As for B, plus: Maintains national/global networks of industry knowledge and extension practice.
Extension delivery	<p>At best based on transfer of technology and programmed learning (workshops). Uses limited engagement approaches.</p>	As for D, plus: uses additional extension models of technological development and consultant mentor.	<p>As for C, plus: delivery built of group facilitation and empowerment model.</p> <p>Extension is producer driven and supports producer's networks to have a wide range of sources and professional advice. Integrates Web and social media.</p>	<p>As for B, plus: has knowledge and experience of all extension models and delivery media. Works with producers to support business benchmarking to measure change.</p> <p>Regularly trials and evaluates new techniques.</p>
Evaluation and reporting	No evaluation incorporated only activities and interaction reported. May use event feedback sheets.	<p>As for D, plus:</p> <p>Representative surveying to detect changes in KASA (knowledge, aspiration, skills, attitude) amongst some clients.</p>	<p>As for C, plus: Designs processes to identify before and after changes in management practices.</p> <p>Management practice profile established and documented for each client.</p>	<p>As for B, plus:</p> <p>Incorporate other lines of evidence of impact into M&E design.</p> <p>E.g. remote sensing, production and price data</p>

				and changes in product sales.
Developing your skills and knowledge	Rarely attends technical or professional development.	Attends technical development opportunities and occasional professional development workshops.	Regularly attends workshops and conferences and undertakes professional development to keep knowledge and skills updated.	As for B, plus: Learns and applies new skills and seeks knowledge from other sectors and disciplines. Has a wide network and uses mentor/s.