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Landholders driving change: Exploring new incentives

Scoping and trialling incentives and institutional arrangements

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Landholders Driving Change Major Investment Project

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Contents

Figures

Tables

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Executive summary

The Landholders Driving Change (LDC) project is working closely with graziers in the Bowen, Broken, Bogie (BBB) catchments from 2018 through to 2021 to tackle erosion and improve land management, productivity and water quality in this important Reef region. The LDC project is one of two Major Integrated Projects (MIPs) funded by the Queensland Government. The MIPs have been designed to work collaboratively with landholders to pilot a range of innovative methods to improve water quality entering the Reef lagoon.

This report has been commissioned by the NQ Dry Tropics to support the trial and evaluation of new incentive approaches as part of the LDC project in the BBB. The project has:

- Reviewed relevant land management practices with a focus on grazing and gully remediation and analysed the public and private benefits of practice change;
- Collated and assessed potential incentives to facilitate adoption of desirable land management practices;
- Reviewed and summarised learnings from previous incentive programs; and
- Summarised incentive programs currently available to BBB landholders.

The BBB contributes 25% of the fine sediment discharged to the Great Barrier Reef, primarily from grazing lands. Four types of erosion generate sediment; hillslope erosion, streambank erosion, hillslope gullies and alluvial gullies. Gully erosion is the dominant source of sediment in the BBB. Practices to reduce sediment loss have been identified, and include managing stocking rates and ground cover, fencing to land type and the provision of watering points, the management of linear features such as roads, gully remediation through erosion stabilisation, revegetation and/or earth works, bank and bed stabilisation.

There are 63 grazing enterprises in the BBB. From the literature and workshops held with graziers in the design phase of the LDC project, factors that influence adoption of new practices were identified to include motivations (intrinsic, lifestyle, financial etc.), attitudes to risk, farm debt and others. Operational and financial constraints can also be a significant influence. Importantly, graziers and grazing enterprises are diverse, with different landholders holding different motivations and facing different barriers, using different practices and engaging with different practice change programs. Some of the most significant water quality gains might be realised by working with the “least engaged” graziers with limited adoption of improved practices. However, this is likely to be challenging to achieve. Innovation and peer-peer learning are led by highly engaged graziers with a high level of adoption of improved practices. Ideally, the LDC project will:

- Engage graziers not previously engaged in extension or water quality programs;
- Accelerate adoption of good practices across the full spectrum of graziers (motivations, practice levels etc.); and
- Develop and test new practices (innovation) by working with graziers who are already using good practices.

Consequently, a flexible suite of incentives is required to support practice change across these different cohorts of graziers. Different incentives work for different groups of graziers, so layering complementary incentives is likely to achieve outcomes across the grazing community. Incentives include financial, non-financial and regulatory mechanisms to encourage adoption. Non-financial incentives include the provision of information and support through extension and training services, as well as recognising and rewarding high performers. Financial incentives reward particular behaviours and include market-based instruments, grants and subsidies. Regulation is used by governments to proscribe or limit undesirable behaviour (and is not considered as part of this report). Incentives can be used to address market and institutional failures and knowledge constraints that are contributing to the continuation of practices that accelerate erosion.

A public and private benefits analysis has been used to derive a set of guiding principles about the appropriateness of non-regulatory incentives for different practices in the BBB. Other factors, however, also need to be considered when deciding on an incentive-based approach and the best mix of incentives. These other factors include engagement objectives, implementation costs, institutional fit and so forth. Overall, we stress that a mix of incentives should be used to facilitate engagement and adoption across different cohorts of landholders. We also find some forms of incentives cannot be implemented in the LDC Project (due to the project's short time-frame, scale and authority). As a collaborative project though, the LDC has the potential to influence the development and trial of incentives and supporting institutional arrangements in the longer-term.

Six substantive recommendations (and a number of sub-recommendations) to support and trial incentives within the LDC project and to support longer-term practice change are presented for consideration by the LDC Project Panel. Recommendations relate to the current LDC project and timeframes and to the LDC's ability to influence longer- term outcomes.

RECOMMENDATIONS FOR THE CURRENT LDC PROJECT

RECOMMENDATION 1: DEVELOP A GULLY CALCULATOR

As more major gully restoration projects are implemented and evaluated, incentives for gully remediation should become more discriminating, based upon the potential public benefits. Development of a transparent metric to estimate sediment load reduction for individual projects through development of a 'gully calculator' would provide a more robust way to target funding to projects based on an assessment of benefits and cost. Given that the LDC project is already characterising gullies in the BBB and trialling remediation methods, the development of a tool that allows site-based estimates of sediment benefits is feasible and would be a significant legacy of this project. This should build on existing work in this area.

RECOMMENDATION 2: COLLECT/IMPROVE DATA ABOUT LAND AND LANDHOLDERS

There is great heterogeneity of landholder types, motivations, capacity to change and history of engagement, as well as land condition, management practices and presence of gullies (that may be a legacy of previous land condition and practices). A greater understanding of the BBB landscape and enterprises, including social and economic characteristics, would enable LDC to better target incentives and evaluate the fit between incentives and different groups of graziers.

RECOMMENDATION 3: IMPLEMENT A SUITE OF COMPLEMENTARY INCENTIVES TO SUPPORT GRAZIERS IN ONGOING LAND MANAGEMENT FOR WATER QUALITY BENEFITS

It is recommended that the LDC project should provide a **complementary mix of incentives** including:

- Working with existing and proposed regulations;
- Providing ongoing access to information (such as property management planning, financial planning etc);
- Providing ongoing assistance to engage with and/or achieve BMP accreditation;
- Providing grants tailored with payments associated with achieving key inputs or outcomes; and
- Supporting recognition and reward of high performers or those that have made large changes in land management.

RECOMMENDATION 3A: LDC SUPPORT BBB LANDHOLDERS TO UNDERSTAND THEIR CURRENT REGULATORY OBLIGATIONS

We recommend that LDC should, through the Policy Engagement program area, ensure that BBB landholders fully understand their regulatory obligations, and facilitate landholder input to regulatory reviews or proposed regulatory amendments (including recent changes to the reef protection regulations and Vegetation Management Act). This could include brokering more effective State approaches to the co-design of local implementation arrangements for regulation.

RECOMMENDATION 3B: LDC PROVIDE ONGOING ASSISTANCE FOR LANDHOLDERS TO ACCESS INFORMATION, EXTENSION SERVICES AND SUBSIDISED TRAINING

Provide multiple and variable pathways for graziers to engage with training and support services. Information, extension and training should align with and complement existing industry BMP, DAF extension and property management planning processes including:

- Property mapping and planning;
- Erosion and other land management planning;
- Financial services including succession planning; and
- Grazing management training e.g. DAF or commercial services.

RECOMMENDATION 3C: LDC REFINE THE CURRENT GRANTS SCHEME TO REWARD ON-GROUND CHANGE AND IMPROVED MAINTENANCE OF BENEFITS OVER TIME

It is recommended that the LDC refine the current grant scheme (applied only when landholders are considered to be operating at a level at or above 'duty of care') process to:

- Incorporate longer term management agreements (ideally attached to title, although landholders suggested this would not be well received);
- Include staged payments (some up front and some on the achievement of an input or output) focussed upon the achievement of key input or outcomes milestones (landholders suggested that this is reasonable and acceptable);
- Include follow up monitoring (acceptable to landholders); and
- Require that grant selection be based on return on investment (public benefit/public cost).

It is recommended that the LDC trial the use of a tailored grants approach with these characteristics, and in the longer-term (beyond current LDC funding) trial targeted stewardship payments as an extension of this approach.

RECOMMENDATION 3D: LDC TO PROVIDE SOCIAL RECOGNITION AND SUPPORT INNOVATION WITH LEADING LANDHOLDERS

It is recommended that the LDC:

- Develop a social recognition program/event for high performing landholders. This could be something like a gala dinner or an invitation-only field trip/training activity, potentially incorporating links to the new 'Reef champions' awards and visits to leading graziers in other parts of the GBR; and
- Consider how social recognition can more explicitly be incorporated into the LDC Demonstration and Cluster group activities.

RECOMMENDATION 4: RIGOROUSLY EVALUATE ALL INCENTIVES USED WITHIN THE LDC AND ADVOCATE FOR BETTER USE AND ACCESS TO EVALUATION REPORTS

LDC should rigorously evaluate the uptake of incentives offered. The level of investment and scale of the LDC Project provides a unique opportunity to evaluate how graziers respond to the mix of incentives on offer. As well as assessing outcomes (levels of engagement, levels of adoption and the effectiveness of gully remediation trials) evaluation should focus on learning more about 'what works for who, and why' i.e. for the different cohorts of land managers in the BBB.

This project has revealed the lack of systematic approaches to incentive and program evaluation and access to previous evaluation reports across GBR water quality programs. This constrains opportunities for learning and improvement. Relevant research reports provide some information, but generalise findings, are slow to produce and difficult to access. LDC should encourage Queensland and Australian Governments to facilitate better access to evaluation reports prepared for water quality programs.

<u>RECOMMENDATIONS TO INFLUENCE LONGER-TERM OUTCOMES</u>

The level of investment and the integrated delivery approach of the LDC project provides a unique opportunity to broker longer-term arrangements to support improved and ongoing incentives to improve water quality from grazing lands.

RECOMMENDATION 5: INSTITUTIONALISE LONG TERM APPROACHES TO CATCHMENT REPAIR

Working collaboratively with the State Government, it is recommended that the LDC Project explore options for the codesign and establishment of **a governance mechanism to** support the long-term planning, financing, delivery and management of significant gully erosion prevention and rehabilitation efforts. To support this, the LDC should collaboratively explore the potential to establish an enduring mechanism (e.g. such as a purpose-built Trust of some kind) to buffer the impact of short-term project funding and to allow a more systematic approach to remediation of major gully systems (including managing risk and longer-term monitoring).

RECOMMENDATION 6: INVESTIGATE COLLABORATIVE APPROACHES TO SUPPORTING BEST PRACTICE GRAZING LAND MANAGEMENT

The LDC project should seek to influence the development of a stable and continuously improving system of catchment scale support for extension, training, farm planning support and regulatory compliance management for rangeland grazing in the GBR. Specifically, the LDC should:

- Engage with emerging opportunities for additional incentives such as Reef Credits;
- Identify and support complementary incentives that could be adopted by government agencies (tax concessions, rate rebates);
- Ensure local voices contribute to policy development;
- Co-design and negotiate the best long -term regional system for grazier support for practice improvement and pathways for graziers to engage with catchment repair; and
- Engage with government to understand and manage regulatory barriers to improved practices.

1 Introduction

The Department of Environment and Science, through its Queensland Reef Water Quality Program, has contracted NQ Dry Tropics to work with industry, landholders and communities to design and implement one of two Major Integrated Projects (MIPs). The objective of the Landholders Driving Change (LDC) MIP project is to work closely with landholders in the Bowen, Broken, Bogie (BBB) catchments through 2018-2021 to tackle erosion and improve land management, productivity and Reef water quality in this region.

This "Exploring New Incentives – Scoping and Trialling Incentives and institutional arrangements" activity is one of five activity areas[1] within the LDC project. The "Exploring New Incentives" activity has four objectives, three[2] of which are included in the scope of works and this report:

1. Build on previous work to establish a comprehensive understanding of financial drivers, opportunities and constraints to adoption of improved practices for water quality and landscape remediation and understand landholder perceptions of these issues in the Bowen Broken Bogie (BBB). Identify incentive options (financial and non-financial to be pursued through the LDC project.
2. Consider potential institutional arrangements that are realistic in the short term to support ongoing improved practice adoption and landscape remediation over the medium to long term.
3. Scope the range of existing services and incentives available through other initiatives that could provide additional opportunities for landholders in the BBB to access support for the adoption of improved management practices.

To address the three objectives in scope for this study, the project has:

- Reviewed relevant land management practices (grazing and gully remediation) and analysed the public and private benefits of practice change;
- Collated and assessed potential incentives to facilitate adoption of desirable land management practices;
- Reviewed and summarised learnings from previous incentive programs; and
- Summarised incentive programs currently available to BBB landholders.

This has been primarily a desk-based analysis, with findings and emerging recommendations tested with science experts, BBB landholders and the LDC project panel through a series of

[1] The other four activity areas are: 1) BBB grazier support; 2) landscape remediation; 3) influencing other land managers; and 5) policy engagement

[2] The fourth, which is not included in the scope of this study, is to canvas and trial the most promising incentive options and supporting institutional arrangements that can be applied in the BBB to support accelerated adoption of management practices with water quality outcomes, support long term arrangements for maintenance of on ground works and promote improved operational flexibility and viability within the BBB grazing community.

workshops. With a focus on providing practical insight into financial and non-financial incentives that could be trialled as part of and within the life of the LDC, this report makes a series of recommendations for consideration by the LDC Project Panel. Given the constraints of the LDC project timeframe and scale, recommendations are provided for both actions that can be incorporated into the LDC project, and those that will help to provide a strong foundation for longer-term incentives for good grazing management. Additional detail is provided in a number of appendices that address specific elements of the project brief. Figure 1 below illustrates how the report sits together and how the appendices support the findings in the main report.

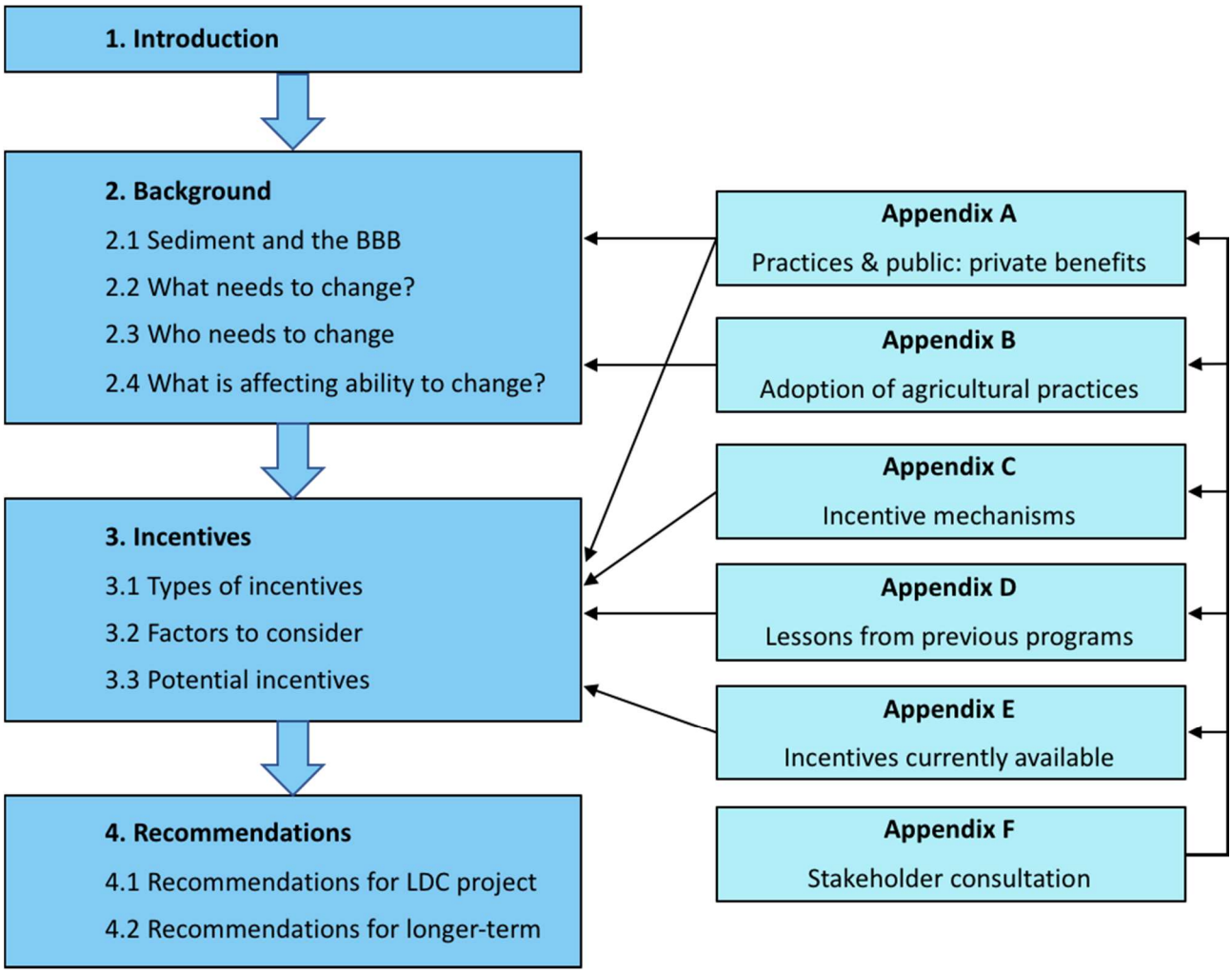

Figure 1 Format of this report including appendices

2 Background

2.1 Sediment and the Bowen Broken Bogie Catchment

The Bowen Broken Bogie (BBB) Catchment produces 25% of the total fine sediment load discharged to the Great Barrier Reef (GBR)[3] and represents some of the highest sediment concentrations and loads in the GBR. The current annual average sediment loads from the BBB are estimated to be 7.5 times the natural rate (Bartley et al., 2015). Grazing lands are the primary source of total suspended sediment (TSS) loads in the BBB. Gully erosion (hillslope and alluvial) is considered the dominant source of TSS (65%), followed by hillslope (27%) and streambank (8%) erosion. These proportions vary between sub catchments, but gully erosion is the dominant sediment source, except in the Broken River sub catchment where hillslope erosion dominates (65%).

Four types of erosion contribute to the sediment loads. These are:

1. Hillslope gully erosion (Figure 2) is the most prevalent form of gully erosion (the BBB catchment contains around 2,750km of gullies (Waterhouse, Greiner, Bainbridge, & King, 2017)). Hillslope gully erosion has linear or branching features along hillslope drainage lines. In this type of gully the overland or subsurface water flow over the gully headwall causes the headwall to migrate upslope. Wilkinson, Kinsey-Henderson, Hawdon, Ellis, and Nicholas (2013) note that there is extensive literature related to the management of this type of gully;
2. Hill slope erosion includes rilling and sheetwash erosion, and commonly surrounds gully erosion in the BBB (Wilkinson et al., 2013);
3. Streambank erosion contributes about 8% of BBB loads, although riparian tree cover is largely intact in the BBB (Waterhouse et al., 2017). There is some evidence of severe stream bank erosion at a number of existing and abandoned mine sites in the upper sections of the little Bowen sub-catchment; and
4. Alluvial gullies (Figure 3). These occur in deep alluvial soils which result in gullies which are not necessarily aligned with overland flow pathways. Like hillslope gullies, these gullies are probably initiated by localised vegetation disturbance along drainage lines. Once these gullies are established, mass failures at their edges can see them spread independent of surface runoff.

There is considerable evidence that gully erosion became much more widespread in south-east Australian landscapes following the introduction of livestock grazing, and associated degradation of ground vegetation cover (Prosser, Rutherfurd, Olley, Young, & Wallbrink, 2001).

[3] The Bowen sub-catchment delivers 43% of the Burdekin TSS. The Bowen and the Upper Burdekin sub catchments have the highest rates of accelerated erosion relative to pre-European rates at 7.5 and 3.6 times respectively (Bartley, Croke, Bainbridge, Austin, & Kuhnert, 2015).

Figure 2 Hillslope Gully Erosion in the Burdekin River Basin

Photographs by Scott Wilkinson and Rebecca Bartley

NOTE: Figure 2 depicts a small hillslope gully. They can range in size from small to very large.

Figure 3 Alluvial Gully Erosion in the Burdekin River Basin

Photographs by Scott Wilkinson and Rebecca Bartley

2.2 What needs to change?

Reduction of sediment from the BBB requires the management of groundcover and active gullies that are expanding and contributing sediment. Table 1 presents the recommended practices to manage groundcover and gullies for reduced sediment. The first two columns present the farm activity to which the practice focuses and the recommended practice (generally B class practices). The third column provides an indication of current practice level in the BBB. Data for this table were sourced from the NQ Dry Tropics Water Quality Improvement Plan grazing management workshop in 2015 (Park & Dickson, 2015). More accurate data may become available in the near future through the new adoption level benchmarks being assessed by the Paddock to Reef team (DAF) across the GBR. The Reef Water Quality Risk Framework (informally known as the ABCD management practice framework) defines four classes of practice standards; D is below duty of care[4] or what is expected of a landholder as a steward of the land, C is duty of care, B is best practice and A is aspirational. A more in-depth discussion of current practices, minimum acceptable standard and improved practices is provided in **APPENDIX A**.

Table 1 Current and desirable management practices for sediment management (Park and Dickson, 2015)

Farm activity	Recommended practice	Current average practice in the BBB
Grazing	Stocking rates consistent with long-term benchmarks	C [5]
	Fencing to land type and provision of water points to ensure achieve end-of- dry season ground cover targets	Assumed at C class[6]
Hillslope gullies	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	C
	Remediation of active gullies – revegetation and stabilisation (includes fencing and destocking)	D
	Remediation of active gullies – includes and major earth works	Not assessed
Alluvial gullies	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	Not assessed – assumed at D
	Remediation of active gullies - minor works/management actions – no major reshaping	D
	Remediation of active gullies - major works including re-shaping	Not assessed
Streambank erosion	Management of stock on frontage country to achieve end of dry season ground cover targets	C-D[7]
	Regeneration of riparian frontage (large waterways)	Assumed to be D class as most waterways only partially fenced
	Engineering protection	No established practice

[4] Duty of Care is outlined in the Land Act (1994) (Anon., 2017). Duty of care is also termed as 'general environmental duties' under the Environmental Protection Act (1994) https://www.ehp.qld.gov.au/management/planning-guidelines/legislation/general_environmental_duty.html. These minimal acceptable standards can be thought of as the expectations a society has in regard to the stewardship of land that a land manager is responsible for. Basically, it means that landholders should take all reasonable steps to avoid land being degraded.

[5] At the workshop, 45% of land was estimated by experts in C class and 35% in D class

[6] 60% was estimated to be in C class and 20% in D class

[7] 30% was estimated to be in C class and 30% in D class

2.3 Who needs to change?

There are 71 properties in the BBB catchments, and 63 grazing businesses operating under a range of ownership structures. Five are owned by mining companies and two are owned by Government. The remainder are a mix of family managed through to agricultural businesses. Tenure of these properties is dominated by leasehold land (73%) with around 16% owned as freehold land (Waterhouse et al., 2017). There are also National Parks and State Forests as well as several large mining operations in the BBB including four coal mining operations and one operating gold mine. It is estimated that there are also up to 119 abandoned mines. **The focus of this study is incentives for grazing land managers.**

2.4 What factors influence adoption?

There have been a number of studies investigating factors that group graziers into type in the GBR and the BBB (Bohnet, Harding, Haug, & Roberts, 2007; Bohnet, Roberts, Harding, & Haug, 2011) influence adoption of improved land management broadly and for graziers and other land managers in GBR catchments. Key messages from these studies are summarised below. The full discussion of factors that influence adoption of land management practices generally and for the GBR and BBB in particular is provided in **APPENDIX B**. Based on the literature and insights from the LDC design process, key factors that influence adoption of improved land management practices in the GBR and Burdekin can be discussed in the categories of financial and intrinsic motivations, type of change required, attitude to risk and uncertainty and incentive scheme design. Each is discussed in Table 2

Table 2 What does the literature and landholders say influence adoption of practice change?

Motivator	Description and experience from the literature
Finance	Landholders with strong financial and economic drivers stated that they are unlikely to adopt conservation practices unless there are clear financial incentives (Greiner, 2015; Rolfe & Gregg, 2015). Greiner and Lankester (2007) highlights that **farm debt** is an indirect driver of intensification and slow take up of practices to de-intensify. This is because graziers need to generate sufficient income to cover interest and principal repayments through good and bad years. The need for fixed payments can prevent early and adequate de-stocking in drought years and motivates short term maximization of production.
Intrinsic motivations	Whilst finances are important, landholders who are conservation orientated are not completely driven by financial motivations (Greiner, 2015; Rolfe & Gregg, 2015). Conservation motivation for this type of landholder tends to be intrinsic (they enjoy a sense of personal pride from their well-managed land, they enjoy the environmental benefits of good land management, they aim to leave their land in good condition for the next generation etc.).
Fit with current practices	Greiner and Gregg (2011) note that conservation management not fitting with current practices and/or not fitting with goals presented a significant barrier to adoption (conservation and lifestyle motivation results in greater adoption of conservation practices). It has been found that when new practices do not flow naturally from current, financial support becomes a larger driver for motivation. In the context of sediment management, this was found in cases where outcomes required riparian fencing and watering points (Januchowski-Hartley, Moon, Stoeckl, & Gray, 2012).

Attitude to risk and uncertainty	Landholders who saw themselves as risk takers with respect to new grazing practices have a higher rate of adoption of rotational grazing, adjustment of stock to pasture condition and early destocking for drought (Greiner, Patterson, & Miller, 2009). Insufficient labour resources and feelings of risk related to variable climate conditions were significant impediments to conservation practices in general for Burdekin landholders. These plus uncertainty about tenure, uncertainty about the industry, loss of productive capacity on property, lack of broader community support and insufficient information about optimal management practices were impediments to adoption more generally (Herr, Greiner, & Stoeckl, 2004).
Incentive scheme design	In studies broader than the Burdekin or GBR, contract design has been listed as a barrier to conservation practice adoption. Contract features such as the duration of contracts, the influence of a contract on land security and the ability to exit a contract all affect uptake (Greiner, 2015; Whitten, Reeson, Windle, & Rolfe, 2013). Greiner (2015) found that higher payments, shorter contracts, flexibility within contracts and the ability to use external monitoring providers all increased participation. Whitten et al. (2013) also highlight the need for high payments, stating that this may help overcome the barrier imposed by the difficulty to trial many conservation activities. Greiner (2015) also notes that there is great heterogeneity across landholders in terms of their properties, management styles and motivations and a conservation program made for the average will attract very few landholders.

Other components of the LDC design process (see Waterhouse et al., 2017) have allowed graziers to express what they see as barriers to adoption of land management practice change and what is needed to overcome these. These are summarised in Table 3.

Table 3 Graziers perspectives on barriers to land management practice adoption and strategies to overcome these

Grazier perspective of barrier to land management practice change	BBB landholder perspective on ways to overcome adoption barriers
• Complexity of decisions due to the need to consult other family members; • Operational and financial constraints (especially those caused by climate variability and uncertainty surrounding the future); • Lack of science or information, lack of skills on property and lack of local leadership; • Lack of motivation due to landholders being unaware of the decline in land condition, ignorant of better management and comfortable in their current situation; and • Perceived (more cattle = more money) and actual financial barriers (need to service high debts, lack of funds and resources in terms of labour and equipment).	• Education (about the impact of farm management on biodiversity – see Greiner (2015) discussion on this in terms of identifying the richness and uniqueness of biodiversity), training, extension and research including technical and applied management courses, environmental management courses, on property demonstration sites and more research; • Property management planning; • Financial incentives – rate and rent relief, grants, subsidies, stewardship payments, farm management deposits; • Regulatory approaches and cross compliance arrangements; • Catchment groups; • Targeted (1 on 1) extension and mentoring; • Business planning; • Critical thinking skills to help identify priorities; • Case studies and cost benefit analyses; and • Demonstrations.

3 How to motivate change? Investigating incentives for land management change in the BBB

3.1 Types of incentives

Individual landholders respond to a variety of incentives when making decisions about land management (Wills, 1997). Markets are based on private property rights and are the most widely used mechanism for signaling incentives to individuals in western society. Markets signal value through prices. Through the market, landowners are rewarded for land uses that produce marketable outputs (such as cattle production for beef) but not for other socially valued products such as the maintenance or enhancement of public goods (in this case, managing land processes to minimise the runoff of total suspended solids (TSS) onto the GBR). When the market fails to supply a good to the level that is socially desirable, market failure is said to have occurred and government intervention through changing the incentives that landholders face may be justified (Murtough, 2002). Government intervention is only justifiable if it is welfare enhancing and the benefits of the intervention outweigh the costs (see Coggan, Whitten, and Bennett (2010) and Coggan (2012)).

Incentives for intervention can be divided into three distinct categories:

1. Non-financial;
2. Financial; and
3. Regulatory.

Non-financial incentives are measures designed to improve the flow of information and corresponding signals and incentives without providing any direct financial payment to landholders. Non-financial incentives include information provision through extension or one-off training, programs that seek to lubricate an existing market such that it provides a financial incentive (a regional body or other entity operating as a broker in an existing market to reduce the administration costs of engaging in a market and gaining private financial gain) and measures that seek to reward landholders who are doing the right thing already.

Financial incentives: are designed to directly alter the structure of financial pay-offs to land managers and are usually specifically intended to substitute for missing monetary signals that are generated within markets for other goods and services. Depending on the allocation of property rights, financial incentives can be seen as a financial reward/compensation for the provision of the public good (in this case the property rights are considered to be held by the landholder which is referred to a beneficiary pays) or a fine for impacting on property rights held by the public (polluter pays). Financial incentives can be managed through a market-based instrument (MBI) or through a non-competitive process such as flat rate grants.

Regulatory incentives: are non-voluntary measures designed to compel management change using the coercive powers of government. Regulations designed to protect native vegetation are an example of coercive policies.

Table 4 provides a brief description of the types of incentive schemes that fall under each category, some (largely) Australian examples for each incentive type as well as a brief description of the strength and challenges associated with each incentive type. A discussion on which incentives were considered viable for the LDC project is provided in section 3.3. A detailed discussion of different types of incentive schemes and their strength and challenges is provided in **APPENDIX C**. Lessons learnt from previous policy initiatives designed to influence land management in the BBB and broader is summarised in **APPENDIX D** and incentives currently available to landholders in the BBB are summarised in **APPENDX E**.

3.2 Factors to consider when choosing an incentive (or mix)

There are many incentive types and quite often an incentive scheme will use a mix of incentive types to fulfil the land management objectives (e.g. extension and covenant, or covenant and payment). In this section we discuss key factors to assist in deciding on the right mix of incentives for the problem. Key concepts introduced in this section include choosing the incentive action and design with reference to:

- The ongoing public and private benefits;
- The cause of the market failure;
- The existence of additional objectives for an incentive scheme (engagement);
- Can/should the incentive be targeted?
- The risk of crowding out good behaviour and the objective to crowd in good behaviour;
- Focussing on outputs, inputs or outcomes;
- Current and future institutions and governance (including regulation and compliance);
- Nesting, stacking and path dependencies; and
- Maintaining the benefits through time.

Recommendations on what this means for the LDC BBB incentive scheme are introduced at the conclusion of each concept but discussed in more detail in the recommendations section (Section 4).

Table 4 Types of incentives

Type	Name	Description and examples	Strengths	Challenges
Non-financial	Extension/information provision	Provision of information and support to generate change. E.g.: • Agforce BMPs • Qld DAF Future Beef	• Non-invasive • Informative • Low cost to administer Can be used as a stepping off point for engagement and information collection for other more targeted incentive schemes such as grants, subsidies and competitive payments	• Likely to only generate small and slow change unless applied in conjunction with regulation or a financial incentive • Requires landholders to engage voluntarily (so unlikely to attract those that have no history of engagement) • Start/stop nature could create frustration and dis-adoption • Action stops when extension stops so limited application for long term outcomes
	Brokering	A broker that helps an existing market to work better for an environmental outcome. E.g.: • Brokers in water markets. Brokers in biodiversity offset markets (BushBroker, BioBanking, EcoFund - Qld)	• When the markets exist, low cost to implement • When a market exists, facilitates resources flowing to their highest value use and subsequent efficiencies	• Relies on the existence of a market with defined property rights, buyers and sellers and gains from trade. • No markets to broker into as yet • Need to define how they would broker (fee/fee-less) • Need to assess the cost and benefits of brokering in an existing market (or sponsoring a private party to do so)
	Product differentiation	Set a product apart and gain premium prices due to environmental actions or special features associated with the product. E.g.: • Banrock Station wines (wetland conservation) • King Island dairy (regional premium) • Taupo Beef (tick of approval for nitrogen emission reduction)	• Market already exists for beef which could reduce the administration cost • If initiated by growers could be a way to engage with landholders who don't engage with extension • Producers get financial reward from buyers (LDC budget can be used for other initiatives) Linked to BMPs or other initiatives	• Slow to start and see rewards • Requires very good documentation, sound metrics and verification (self-assessment, 2nd or third party depending on the market) to achieve credible results • No evidence that there will be a price premium for BBB beef at this point
	Social recognition	Rewards the intrinsic motivation to do good. E.g.: • Land for Wildlife • Reef Champions awards	• Potential to crowd in good land management • Non-invasive	• Likely to only generate small and slow change unless applied in conjunction with regulation or a financial incentive

Type	Name	Description and examples	Strengths	Challenges
		• CaneChanger (GBR catchments)	• Informative • Low cost to administer • Can be used as a stepping off point for engagement and information collection for other more targeted incentive schemes such as grants, subsidies and competitive payments	• Requires landholders to engage voluntarily (so unlikely to attract those that have no history of engagement)
	Voluntary conservation covenant (can be linked to financial payments)	Binding contract for land management and outcomes. Contract on title so persists into perpetuity. E.g.: • State government conservation covenant • Trust for Nature • Qld Nature Refuge	• Conservation covenant is on title and applies in perpetuity • Contract could be linked to financial payments for the upfront signing and ongoing management of the land under covenant. This would be subject to negotiation. • Could be linked to other organizations such as Trust for Nature to administer the conservation covenant through a revolving fund	• Conservation covenant applied at the state government level (which have geographical restrictions) • Management agreement is not attached to title so not binding on future owners/managers • Needs monitoring and compliance assessment to ensure the benefits are maintained • Voluntary so unlikely to attract all of the target landholders
	Voluntary management agreements (can be linked to financial payments)	Non-binding agreement for land management and outcomes. E.g.: • LDC currently has management agreements	• Introduction to a relationship with LDC / water quality programs • Could lead to an agreement on title • Flexibility	• Management agreement is not attached to title so not binding on future owners/managers • Needs monitoring and compliance assessment to ensure the benefits are maintained • Voluntary so unlikely to attract all of the target landholders
	Industry codes/self-regulation	• Grazing BMP • Smartcane BMP • My BMP (cotton) • ISO 14001	• Reward those at the top end as a form of social recognition • Could engage landholders who have been difficult to engage with before • Can use the grazing BMPs as a stepping off point	• Requires third party verification to hold any weight. • Self-regulation is highly unlikely to achieve adoption at sufficient scale to make a substantive difference
Financial	Grants	Direct once-off financial payment usually towards on ground works. Usually involves cost-sharing and a contract. E.g.: • Over the fence grants (BBB)	• Well known and understood	• Flat rate usually does not reward innovation

Type	Name	Description and examples	Strengths	Challenges
	Subsidies	Indirect, once-off payment linked to an input to production. Can be linked to a contract. E.g.: • Fencing subsidy • Subsidised fees to attend training • Diesel subsidy	• Flexible. Can be used for big and small projects • Recipients usually provide some level of in kind and/or financial contribution to the project	• Does not take advantage of heterogeneity of landscapes and landholders and therefore potential for gains from trade and efficiencies • Very unlikely to engage those that have not engaged before • Usually one off so does not support change over time • Requires extensive information by the NRM body to know the right rate to pay • Often not accompanied by monitoring and compliance so often no accountability or reportability
	Stewardship payments	Ongoing (over the life of the contract) payments for stewardship. These can be paid on actions or outputs or outcomes. These can be determined individually or allocated as a part of a competitive process such as a tender. E.g.: • National environmental stewardship program • Fitzroy tender (competitive allocation)	• If paying for outcomes may pay for more than one action over time ***If conducted as a competitive process:*** • Reveals the cost for landholders to conduct activities • Potential to be a more cost-effective approach to allocating a fixed budget than a fixed price scheme • Informs landholders of the public benefit of land management • The competitive process may be of interest to landholders who have not previously engaged with programs	• Deciding on duty of care over which stewardship is rewarded • Deciding on the correct level of payment • Budget to facilitate payments • As it is fixed price, does not utilize the heterogeneity of the landscape and landholder cost to get the greatest bang for the buck • May not engage with landholders who do not usually engage ***If conducted as a competitive process:*** • Need enough sellers to be competitive (which may not be the case if the tender was only available in BBB) • Need to generate a benefits index to assess offers for value for money • Design and implementation of such a scheme can be complicated which can generate high transaction costs to design, implement and administer • Need to consider if paying over time or one-off payments for one off action

Type	Name	Description and examples	Strengths	Challenges
				• Need to enforce management plan to maintain value (can be linked to payments) and be clear about management responsibility • For gully issues in the BBB time-periods need to be long in some cases to generate benefits
	Credit trading	Permits allocated for emission production (or reduction). Credits purchased (by Government). E.g.: • Carbon farming initiative • Reef credits (under development)	• Provides certainty about emission for all participants • Allows emissions to occur for the highest value output • Facilitates compensation to those who reduce emissions	• Need a clear understanding of actions and sediment transfer outcomes • Need many buyers and sellers to create a market • Requires information to allocate credits, design and enforce rules for trade and monitoring and enforcement (which can be costly to enact and administer)
	Cap and trade	Creates a regulated cap on emission levels and allocates rights to emit to this cap to market participants. Market participants buy and sell emission permits according to their need. The market enables price signalling and financial reward as permits are traded whilst there are gains from trade. E.g.: • Nitrogen Oxide and Sulphur Dioxide emission trading in the United States • Lake Taupo (NZ) nitrogen emissions	• Provides certainty about emission for all participants and caps total emissions • Allows emissions to occur for the highest value output • Facilitates compensation to those who reduce emissions	• Needs an enforced cap • Need a clear understanding of actions and sediment transfer outcomes • Need many buyers and sellers to create a market • Requires information to allocate credits, design and enforce rules for trade and monitoring and enforcement (which can be costly to enact and administer)
	Offsets	Approval for a damaging activity is granted if impacts are at least or more than mitigated elsewhere such that no-net-impact or net gain ensues. E.g.: • Queensland Environmental Offsets (2017) – vegetation, koala habitat, fish habitat.	• Provides an external demand for an environmental activity • Facilitates innovation and flexibility with how environmental outcomes are achieved • Facilitates low cost environmental outcomes • Could engage landholders who have been difficult to engage with before	• Requires an impact to generate the demand for a credit which could result in a net loss • Can be very costly to create a metric that enables no net loss or net gain transactions

Type	Name	Description and examples	Strengths	Challenges
	Land purchase	Purchase and manage land with environmental values. This can include purchase, covenant and resell in a revolving fund. E.g.: • Australian Bush Heritage Fund (Biodiversity that is not represented in the Reserve System	• Secures benefit over time	• Up front cost to purchase • Ongoing cost to manage
	Local government rate rebates	Rate exemption, reduction of differentiation offered as an incentive for positive environmental actions or performance. E.g.: • Brisbane city council rate reductions for properties who meet Land for Wildlife certification	• Could engage landholders who have been difficult to engage with before	• NQDT do not have the authority to conduct a rate rebate scheme directly • Won't be attractive in local government areas with a low rate base • Linking land management to rate rebate and ensuring outcomes over time
	Tax concession	Tax rebate, reduction or exemption offered as an incentive for environmental actions or performance. E.g.: • Properties with a Nature Refuge agreement eligible for a tax concession	• Removes a known barrier to improved land management • Could engage landholders who have been difficult to engage with before	• NQDT do not have the authority to conduct a tax related incentive • How to ensure landholders conduct their on-ground actions
	Low interest loans	Funding at low interest repayments for approved projects. E.g.: • Queensland Rural and Industry Development Authority has low interest loans for a range of projects including sustainability, disaster recovery etc.	• Directly addresses a known barrier to adoption to land management change • Provides a large upfront amount of finances which could be useful for projects requiring large capital investment (such as engineering works) • Already exist (QRIDA)	• Loan repayments still have to be made by the landholder • Interest of banks to engage • Does not fund the ongoing lost income from land taken out of production. There is still a financial cost to landholders
	Debt for conservation	Creditor or third party reduce debt burden in exchange for land management actions. E.g.: • Examples in developing nations	• Removes a known barrier to improved land management • Could engage landholders who have been difficult to engage with before, especially if they are struggling with high debt servicing obligations	• How to ensure landholders conduct their on-ground actions • Potentially high cost and unproven in western countries

Type	Name	Description and examples	Strengths	Challenges
Regulatory		Legislation and regulation. E.g.: • Reef regulations already exist related to record keeping associated with chemical use etc	• Signals minimum acceptable practice • Effective compliance should reduce incidence of regulatory breaches	• Government responsibility • Social and political acceptability • Effective design and implementation for diffuse pollution sources

3.2.1 Net public and private benefit

Pannell (2008) presented some rules that could be applied by decision makers to guide the selection of incentives. This is often referred to as the Public Private Benefit Framework (PPBF). In this framework, policy mechanisms are organised into five categories.

Pannell's (2008) Public Private Benefit Framework (PPBF) incentive categories

- Positive incentives – financial or regulatory instruments to encourage change (financial payments, required standards or codes of conduct);
- Negative incentives – financial or regulatory instruments to inhibit change (taxes, fines, required standards or codes of conduct);
- Extension – technology transfer, education, communication, demonstrations, support for community networks;
- Technology change – development of improved land management options such as strategic research and development (R&D), participatory R&D with landholders, provision of infrastructure to support a new management action; and
- Informed no action.

The choice between the mechanisms depends on the level of private and public net benefits from the proposed land use change.[8] Private net benefit refers to the benefits minus the costs accruing to the private landholder as a result of making the land management change. Public net benefits refer to the benefits minus the costs accruing to everyone other than the land manager as a result of the land management change. Applying the PPBF (Pannell, 2008) present 10 rules for incentive selection:

Applying the PPBF to incentive selection

- Do not use positive incentives for land use change unless public net benefits of change are positive;
- Do not use positive incentives if landholders would adopt land use changes without those incentives;
- Do not use positive incentives if private net costs outweigh public net benefits;
- Do not use extension as the main tool[9] unless the change being advocated would generate enough positive net private benefits such that it is sufficiently attractive to landholders for them to change. That is, the practice is sufficiently adoptable for the adoption to continue if the extension ceases;
- Do not use extension as the main tool where a change would generate negative net public benefits;

[8] It is important to understand that these principles should not be used to rigidly but be used as a guide only and that risk, uncertainty and temporal aspects of practice change need to be considered as well.

[9] It is likely that extension is used as a supporting tool for most other form of incentives. Rules 4 and 5 refer to extension as the main tool.

- If private net benefits are negative, but not too negative, consider a technology development to create improved and environmentally beneficial land management options that can be made adoptable with or without positive incentives;
- If private net benefits outweigh public net costs, the land use changes could be accepted, if they occur, no action is needed. Or they could be penalised at an appropriate level but not prohibited;
- If public net costs outweigh private net benefits, use negative incentives (regulation, taxes etc);
- If public net benefits and private net benefits are both negative, no action is necessary. Adverse practices are unlikely to be adopted; and
- In all cases, action needs to be weighed up against a strategy of no action.

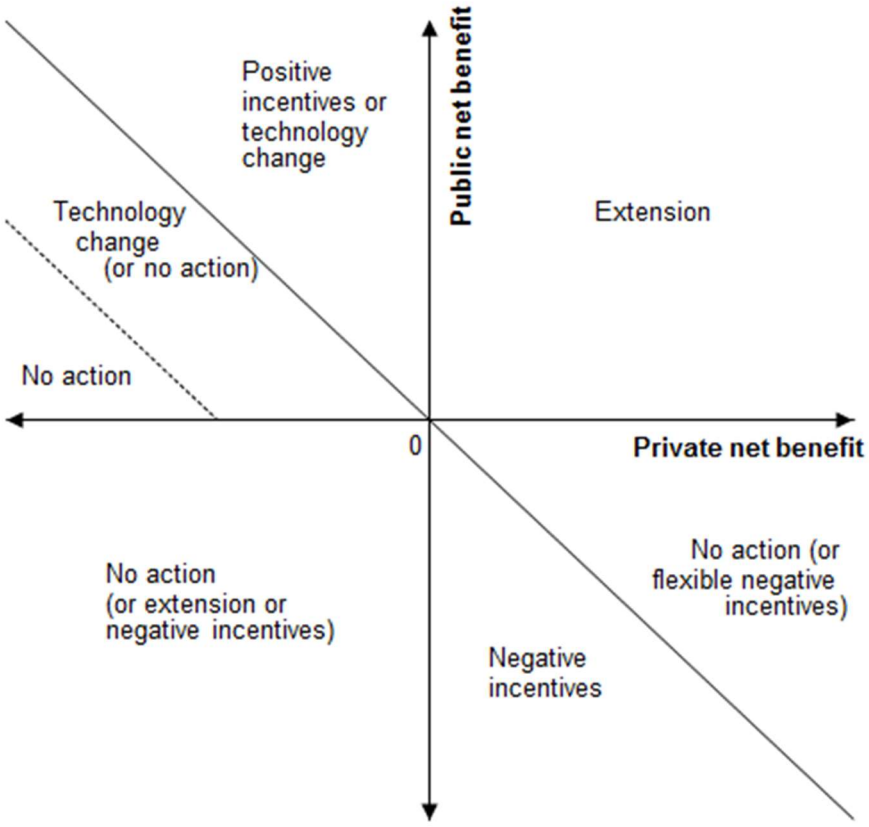

Figure 4 Pannell's public private benefit framework

Source: http://dpannell.fnas.uwa.edu.au

Applying an understanding of public and private benefits to incentive selection in the BBB

Appendix A provides detail on how the PPBF can be applied to assist in decision making surrounding incentives. In summary, decision makers should consider the current average practice, the minimum acceptable standard (as anything below this should not be considered for a financial incentive) but could qualify for other non-financial incentives and what is considered to

be an improved level of practice. Following Pannell (2008) the guiding principles were applied to scope out some first principles when it comes to the use of incentives in BBB (Table 5).

Conclusions of the public: private benefits analysis

- Incentive payments to landholders appear sound to consider for practices that have sufficiently high public benefits, are technically feasible, and have a threshold of estimated sediment load reduction per public cost.
- Other things being equal, practices having small or moderate upfront costs and where landholders can be reasonably expected to maintain the benefits are the practices where direct financial incentives to landholders will work well.
- Where significant levels of incentives are granted, binding responsibilities should extend in time, ideally beyond the current ownership or leasehold arrangements. Landholder obligations should be clearly documented, and compliance monitoring and inspections agreed.
- Where landholders cannot be reasonably expected to maintain benefits after an initial incentive, alternative mechanisms should be considered, including assigning property rights to the investor, or acceptance that the issue cannot be effectively managed.
- Given the large variations in benefits and costs associated with erosion management, a metric that is based on benefits, costs and other relevant factors (time-period, time-lags, landscape factors etc) would improve the effectiveness of public investment.

To improve the understanding of public and private benefits and aid in the future selection of incentives, it is recommended that the LDC:

- collect/consolidate information on land condition, land management, effectiveness of gully remediation activities;
- modify the existing grants scheme; and
- investigate institutional arrangements to support catchment restoration activities such as remediation of major gullies

SEE RECOMMENDATIONS 2, 3C and 5 in Section 4.

Table 5 Considering incentives from first principles

	Practice	Min std for incentive	Current average practice	Best practical practice	Private benefit (H, M, L, 0 or negative)	Public benefit (H, M, L, 0)	Technical feasibility (H, M, L, 0)	Adoptability (H, M, L, 0, negative)	Non-profit related barriers	Upfront cost ($/unit)	On-going maintenance costs needed? ($/unit)	Should incentives to landholders be considered?
Grazing	Stocking rates consistent with long-term benchmarks	C	C	B	L-M	M	H	M	H	0 on farm, only training workshop (Park and Dickson, 2015)	Only 3 days ($720) labour/year	No
	Fencing to land type and provision of water points to ensure achieve end-of- dry season ground cover targets	C	C	B	L	M	M-H	M	L	$200-500,000/farm (Park and Dickson, 2015) – suspected to be over-estimates as RCS suggest electric fencing is effective and much cheaper.	No assume landholder maintains or consider small payment for maintenance. Could build in as part of compliance assessment	Yes
Hillslope gullies	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	C	C	B	Not covered in grazing workshop – assume 0	M (30% effectiveness, Wilkinson et al.2015)	H	Zero to L	L	Hard to assess on a farm basis as one-off figure. $9,200/km (Skull *et al.*, 2016). $5,000/km (Wilkinson *et al.*, 2015). $2,000/km, lower cost option for B has promise but is untested in wide application (Park and Dickson, 2015)	As for grazing fencing	Yes
	Remediation of active gullies – reveg and stabilisation	D	D	B	Zero to negative	M-H (50% effectiveness, Wilkinson et al.2015)	M	Zero to negative	L	Andrew Brooks assumption $350,000 /farm	Probably no, if gullies are remediated and stock excluded, otherwise may be required	Maybe

	Practice	Min std for incentive	Current average practice	Best practical practice	Private benefit (H, M, L, 0 or negative)	Public benefit (H, M, L, 0)	Technical feasibility (H, M, L, 0)	Adoptability (H, M, L, 0, negative)	Non-profit related barriers	Upfront cost ($/unit)	On-going maintenance costs needed? ($/unit)	Should incentives to landholders be considered?
	(includes fencing and destocking)									$41,200/km excl rock shute (Skull *et al.*, 2016) $4,500-9,000/km and add $10-30,000/km if hydroseeding is included (Wilkinson *et al.*, 2015)		
	Remediation of active gullies – includes and major earth works	D	D	B	Zero to negative	H (70% effectiveness, Wilkinson et al.2015)	M	Zero to negative	L	Andrew Brooks assumption $700,000 /farm Alternatively assume $66,200/km (Skull *et al.*, 2016) Drop structure: $30,000–50,000 per gully head, reshaping and seeding: $10,000 per gully head (Wilkinson *et al.*, 2015).	Probably yes	Maybe or no. Comments for previous, only harder
Alluvial gullies	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	C	B	B	Negative	M (30% effectiveness, Wilkinson et al.2015)	M	Zero to L	L	As for hillslope gullies	As for grazing fencing	Yes
	Remediation of active gullies - minor works/management actions – no major reshaping	D	D	B	Negative	H (50% effectiveness, Wilkinson et al.2015)	M	Zero to negative	N/A	$6 million ($20,000/ha for 300 ha gullies on an assumed 20,000 ha farm, Brooks, *pers. comm)*	Probably yes	Maybe

	Practice	Min std for incentive	Current average practice	Best practical practice	Private benefit (H, M, L, 0 or negative)	Public benefit (H, M, L, 0)	Technical feasibility (H, M, L, 0)	Adoptability (H, M, L, 0, negative)	Non-profit related barriers	Upfront cost ($/unit)	On-going maintenance costs needed? ($/unit)	Should incentives to landholders be considered?
	Remediation of active gullies - major works including re-shaping	D	B	B	Negative	H (70% effectiveness, Wilkinson et al.2015)	M but less well established than for hillslope gullies	Zero to negative	N/A	$18 million ($60,000/ha and 300 ha gullies on a 20,000 ha farm (Brooks, *pers. comm.*)	Probably yes	Probably no
Streambank erosion	Management of stock on frontage country to achieve end of dry season ground cover targets	C	C-D (Park and Dickson, 2015) C-B (Waterhouse *et al.*, 2017)	B	L	H	M	M	L	$15,980/km for fencing, off-stream water and natural regeneration (Bartley *et al.*, 2015)	No or small – landholders should maintain fences	Yes
	Regeneration of riparian frontage (large waterways)	N/A	D	B	Assume tied to stock management					0	0	No
	Engineered stream bank toe protection or bed protection	Engineering success will be highly dependent on upstream measures – best decided by NQDT or DNRME and not landholders								$143,880/km for battering and up to over $5 million/km if major rock structures are needed (Bartley *et al.*, 2015)	Probably yes	No

3.2.2 Understanding market failures and incentive schemes

Why intervene? A market failure perspective

Individual landholders respond to a variety of incentives when making decisions about land management (Wills, 1997). Markets based on private property rights are the most widely used mechanism for signaling incentives to individuals in western society. At present, landowners are rewarded for land uses that produce marketable outputs (such as cattle production for beef in the BBB) but not for other socially valued products such as the maintenance or enhancement of public goods (in this case managing land processes to minimise the runoff of TSS onto the GBR). As a result, landholders produce products which are paid for by the market (cattle) at the expense of other products which may generate a public good, but which do not earn landholders an income. When the market fails to supply a good to the level that is socially desirable, market failure is said to have occurred and government intervention may be justified (Murtough et al., 2002).[10]

Government intervention may be in the form of regulation, through addressing and rectifying market failures and the establishment and support of a market (Market Based Instruments MBIs), through other means such as coercion or through schemes that combine techniques and also draw on partnerships and social networks (Buitelaar, 2007).

Coupled with an understanding of the public private benefits associated with the application of incentive mechanisms, applying a market failure analysis assists in the process of understanding barriers to the adoption of desirable land management and subsequently begins to help understand types of intervention that may be successful and their design.

Why do markets fail and what does this mean for incentive mechanism selection and design?

The perfect market has a number of characteristics. Namely, unlimited buyers and sellers, complete information, zero cost to trade (transaction costs), completely and costlessly defined and enforced property rights and no entry, exit or capital constraints. Based on this statement, there are a number of design components that are critical to enabling a market to function. These are discussed in this section with the market failures present in the BBB summarised in Table 6.

Property rights are completely defined and enforced

A property right defines who may use an object, who controls the use of the object, who may receive benefits from the object, and who legally has the ability to impose costs on others in relation to the object (Bromley, 1989). To achieve the maximum possible benefit from a right in a private property regime, the right must have the characteristics of excludability, divisibility and transferability. Each is discussed below.

Excludability allows the owner to exclude others from consuming outputs. This feature relies on the practicality of identifying and stopping potential consumers. If potential consumers can be

[10] Government intervention is only justifiable if it is welfare enhancing and the benefits of the intervention outweigh the costs (see Coggan et al. (2010)) and Coggan (2012).

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identified and excluded from free consumption, they can be charged for their consumption and part of their benefit can be extracted to the right owner.

At present, land managers in the GBR cannot identify beneficiaries from improved land management nor can they exclude beneficiaries from the benefits of improved land management until payment has been made for the provision of land management that reduces TSS onto the GBR.[11] If it is too costly to exclude beneficiaries from the supply of a good it is also impossible to extract a charge for the provision of this good resulting in weak financial incentives for potential suppliers to provide the good above the level of private benefit. At the same time, land managers have clearly defined, excludible rights and clear market signals in relation to some goods, such as the value of cattle production, but not others.

Divisibility is the ability to separate the bundle of property rights in space and scope. Divisibility allows property right owners to manage the sub- components of a resource separately or to divide up and sell separate pieces of the resource. If institutions allow the divisibility of a private property right, the value of this right is greatly enhanced. Credit trading, for example, capitalises on the ability to create property rights for different outcomes from the same piece of land which can be traded in different markets.

Transferability is the final property right characteristic essential for exchange in a private property market-based regime. Transferability of rights grant the ability to sell the property right to others (Whitten & Bennett, 2005).

Buyers and sellers have complete information

Efficient and effective markets also require information to function. Buyers of a product need to know who is selling, what they are selling, how they will use it and how much it is worth. Likewise, a seller of a good needs to be able to define what they are selling as well as understand what the cost to them is of selling the good. In some cases, this information exists but is asymmetrically held (meaning one of either the buyer or the seller has more information than the other). In the case of land management to generate a reduction in TSS, investors in land management improvements and sellers of these actions need to know how many units of TSS reduction different land management actions produce, buyers need to know what this is worth to them, and sellers need to know what they would accept in compensation to undertake this land management change.

There is zero cost to exchange

An exchange in a market will only occur if the benefit of the exchange to both parties outweighs the cost of exchange. The cost of exchange is affected by how well property rights are defined and the ease for buyers and sellers to find each other in the market and make the exchange. At present, it is too costly for those that benefit from reduced TSS on the GBR to find and purchase land management changes from graziers who can provide this service. Likewise, it is also too costly for land managers to find and negotiate with individuals who might be willing to purchase changed land management activities from them. Property rights would need to be defined and allocated

[11] The inability to exclude beneficiaries from the supply of a good is also discussed in the literature as a public good.

such that they could be exchanged for any market-based incentive scheme to be successful to bring about land management change. There also needs to be a market place or facilitator through which those that supply a good and those that wish to buy the good can find each other at low cost (or at least at a cost that does not erode all the benefits from the exchange).

Table 6 Market failures and what this means for incentive mechanisms in the BBB

Market failure	Description	What this means for incentive selection and design in the BBB
Property rights are not excludable	Land managers cannot exclude beneficiaries from the positive outcomes from land management change (reduced sediment on the GBR). At the same time, land managers have clearly defined and excludable rights surrounding cattle production. There is no incentive for the provision of good land management beyond the private benefit	Government provision of a financial payment to the supplier of sediment reduction begins to overcome this lack of property right. Property rights would need to be better defined for a trading-based scheme. Investing here could facilitate trading frameworks in the future
Property rights are not divisible	At present, land managers cannot profit from the different types of services generated from land management (sediment reduction, biodiversity, carbon acquisition, etc)	Tools which provide information about environmental benefit exist in different forms for different services. Progressing a tool to calculate the sediment benefit from ground cover and gully remediation could progress divisible property rights which could then facilitate trading into markets for different services (credit trading) and better grant investment in the short term
Transferable property rights	Once property rights for the environmental benefits of land management change are resolved the transaction costs of exchange may be reduced, which can assist with property right transferability	
Information	Potential sellers need to know what they can produce, how to produce it, who is demanding it and what it will cost to produce it. Buyers need to know who can produce what and the value of different land management actions in different parts of the landscape through time. This information is difficult to produce with scientific certainty. Information costs also exist due to the fact that success of management actions can only be measured ex-poste (afterwards) but the cost of management change occurs up-front.	Extension-style incentive schemes can assist in filling initial information gaps (on ground and to policy makers) of what actions generate what sediment reduction benefits. More information is needed on cause and effect of land management and sediment outcomes. This is needed to support financial payments and any trading schemes proposed in the future. Policy makers may also have a role in reducing information costs for market participants to facilitate exchange.

To address the market failure that drives the continuation of land management practices that accelerate erosion, it is recommended that the LDC:

- apply a suite of complimentary incentives to encourage adoption of improved practices;
- Collect data on land condition, land management, landholder characteristics and the effectiveness of actions on-ground; and
- Rigorously evaluate the uptake and impact of incentives.

SEE RECOMMENDATIONS 3A, 2 and 4 in Section 4.

3.2.3 Are there other objectives (such as engagement) of an incentive scheme?

It is understood that landholders in the BBB can be loosely divided into those that regularly and willingly engage in land management improvement activities and landholders who do not have a history of engaging in activities to change land management. If an objective of the incentive program is to engage those who have not previously engaged, the incentive mix will most likely look very different to one selected to generate large land management improvement outcomes at least cost.

For example, an incentive scheme focussed on improving engagement would build on the BMP process, focussing strongly on providing education on land management techniques and demonstrating outcomes, assisting with property management planning, business planning and mentoring in order to reduce the feeling of complexity about land management.

To support an objective of improving engagement, it is recommended that the LDC:

- Collect and consolidate data on BBB enterprises, landholder characteristics, history of engagement etc; and
- Rigorously evaluate the uptake and impact of incentives on different cohorts of graziers.

SEE RECOMMENDATIONS 2 and 4 in section 4.

3.2.4 Can/should the incentive be targeted?

The type of incentive mix to apply can also be guided by the potential relative sediment reduction. Some landscapes will have a high sediment reduction response to a change in land management and/or the remediation of a gully whilst others, less so.

To target the incentive to achieve the greatest land management change, it is recommended that the LDC:

- Collect and consolidate data on BBB enterprises, landholder characteristics, history of engagement etc; and
- Rigorously evaluate the uptake and impact of incentives on different cohorts of graziers

SEE RECOMMENDATIONS 2 and 4 in Section 4.

Engagement and sediment reduction targets could also be combined such as demonstrated in Figure 5. Some landholders will not be able to make significant sediment reductions (bottom left of Figure 5) whilst others will (top left of Figure 5). If engagement is an objective of the incentive approach, then it may be worth engaging with those at the bottom left using incentives that are relatively low cost to administer such as broad extension and access to training (but with limited

subsidies for training) but focussing engagement with those at the top left of the box in Figure 5. Incentives for those in the top left could include heavily (or completely subsidised) training targeted to individual land managers, flexible grants paid over time for improvements beyond the duty of care and social recognition of land management improvements. One objective for landholders in the top left of Figure 5 is to move them across to the top right where they establish a history of engagement and large sediment reduction benefits. If engagement is a key objective of the incentive approach, celebrating new engagers and even small gains in sediment reduction will be critical.

There is also a cohort of landholders who have a long history of engagement in land management change activities. Once again, the relative sediment reduction benefit from these landholders will vary. Incentives should be focussed on those in the top right of Figure 5 where the biggest change can be made from the investment. Incentives for this top right could include training and supporting the trial of new technologies and innovation, competitive stewardship with payments made over time, social recognition and opportunity for these landholders to mentor others. Those at the bottom right may be best supported through science to assess if there is the potential for additional gains in sediment reduction from these properties.

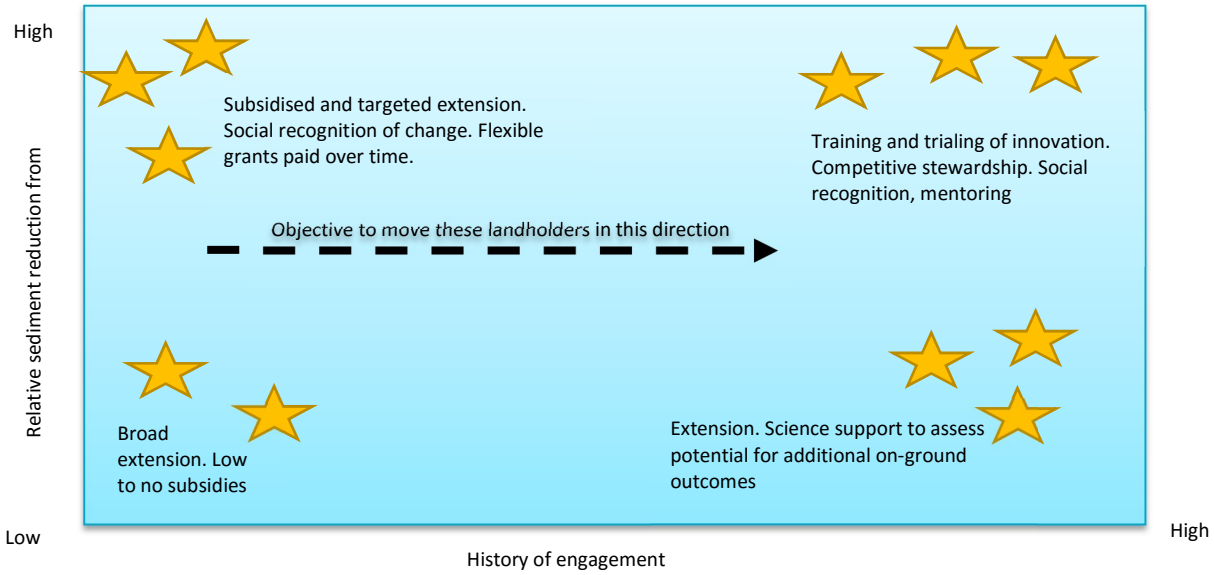

Figure 5 Incentives need to be matched to landholders and sediment reduction benefit

3.2.5 Crowding in and crowding out good land management

The values and behaviours of the landholders also need to be taken into consideration when deciding on incentive mixes. An incentive mix needs to be considered in light of landholder motivations and should be designed such that it supports and motivates (crowds in) good land management rather than crowding it out ('crowding out' occurs when government spending [such as incentives] decreases private investment in the same activity [good grazing practices] because it takes away the 'warm glow' or feeling of moral responsibility associated with conducting the activity and replaces these with economic instruments). At the same time, care needs to be taken

when selecting incentives that an incentive scheme does not send the signal that it is thought that good land management is not profitable.

Incentives that 'crowd in' good behaviour tend to be those focussed on encouraging and motivating early adopters. Incentives used tend to be those that publicly recognise achievements. (Rode, Gómez-Baggethun, & Krause, 2015) note that this is most effective when the recognition is considered to be credible, revered and unexpected. An Australian example of this is the sugarcane industries 'Canechanger' program. The objective of Canechanger is to recognise the hard work that leading canegrowers are putting in to make positive environmental changes, to foster innovation and positive change.

To crowd in good land management, it is recommended that the LDC:

- Investigate the 'best' way to reward those land managers who are leaders in good land management or gully remediation and/or have made the greatest positive changes towards good land management. This may be an awards night (perhaps linked to Reef Champions), access to 'invitation only' special learning activities or field trips or trials.

See RECOMMENDATION 3D in section 4.

3.2.6 Focussing on outputs, inputs or outcomes

The incentive scheme should ultimately be tailored to achieve the targeted ***outcome*** (e.g. number of species, number of bird breeding pairs, units of sediment removed from the watercourse etc.). Purely outcome-focussed schemes tend to be costly to monitor due to the significant time lags that often occur between actions and outcomes. The long time-lags associated with sediment reduction may also mean that a policy purely focussed on outcomes places the risk of action failure on the landholder (works done up front but not paid for straight away), this could be a major deterrent to participation. If it is considered that the cost of a pure outcome focussed policy outweighs the benefits, an incentive scheme targeted towards rewarding inputs to the outcome (such as fencing) or processes (having a covenant in place), or a mix of these, as a surrogate measure for outcome may be more practicable.

Given the time lags that occur between land management change and outcomes, it is recommended that the LDC incentives programs are designed rewarding on a mix of inputs and outcomes (usually outcomes are a proxy for sediment reduction). The level of payment could be gradated based on the potential to generate a positive change. In addition, the timing of the payment could influence adoption. For inputs that have a high up-front cost, payments could be staged to cover some up-front cost and reward for completion of the input. Incentives could target inputs such as:

- Fencing (perhaps paid half up front and half on completion of fencing);
- Beginning the BMP accreditation process;

- Completion of specific training courses in land management and verified implementation of identified components;
- Property management planning (PMP) and verified implementation of key components;
- Conducting financial planning with accredited planner; and
- Implementing approved sediment management activities (stick dams etc).

Outcomes could include:

- Land management categorisation change (such as shifting from C to B – proxy for sediment reduction);
- BMP accreditation; and
- Verified water quality improvements.

See RECOMMENDATIONS 2, 3 and 4 in Section 4

3.2.7 What is possible in current and future institutions and governance frameworks

Incentive programs need to fit the institutional context in which they are applied, that is, the implementing organisation needs to have the capacity to plan for, finance, implement and administer the incentive scheme. The long term nature of targets envisaged under the Reef 2050 Plan makes this extra important. Key institutional factors to consider include:

- The long term program objectives and available budget;
- The spatial and temporal reach of the intended program;
- The skills and capacity (particularly technical) of the implementing organisation; and
- The institutional authority or mandate, including insurances and standard maintenance.

Some incentives, such as cap and trade and offsets, require regulatory power to set a cap or an offset approval condition, so can only be established by state or federal governments (although third parties can play related roles such as market brokering). Rate rebates can only be offered by the rateable authority (local government) and tax concessions by the Australian Taxation Office.

NQ Dry Tropics (and all Queensland Natural Resource Management bodies) are non-statutory, so have no statutory powers or designated responsibilities. The scale and timeframe of the LDC project (BBB catchment, 2018-2021) also constrain the ability to trial and evaluate some types of incentives. As a collaborative project, however, the LDC project has the potential to influence the development and trial of incentives and supporting institutional arrangements that reach beyond the current authority and capacity of NQ Dry Tropics. Pathways to influence the broader context of grazing incentives and disincentives are discussed further in the recommendations.

See RECOMMENDATIONS 5 and 6 in Section 4

3.2.8 Nesting, stacking and path dependencies of current and future incentives

Incentives are never introduced in a policy vacuum. New incentives need to be assessed in terms of how they interact/nest with current and future policies and programs. In the case of the BBB, it is recommended that incentive schemes build on the success of the BMP programs and do not compromise the effectiveness of these existing programs or produce unintended and perverse results. Land management is also underpinned by regulation.

Current policies and programs may rule out the introduction of some incentives and/or make others more attractive (if existing schemes reduce transaction costs of implementing and administering new incentives, for example). Future goals also need to be considered when choosing and implementing new incentives and conducting the groundwork to operationalize incentives (such as setting up systems which enable the measurement of cause and effect). The introduction of some incentives may support the implementation of other incentive approaches in the future (extension may be the best approach to bring in new landholders initially and build support for other incentives, such as a competitively allocated stewardship payment or credit trading markets, in the future). Alternatively, the selection of an incentive mix now may make the implementation of other incentive mixes cost prohibitive in the future. At the same time, it is a good idea to asses if there are any current policies and programs that work against the goals of the new incentive or impede the effectives of the new incentive. This is often referred to as removing perverse incentives.

SEE RECOMMENDATIONS 3, 4 and 5 in Section 4.

3.2.9 Can the benefits be maintained through time?

The environmental benefits derived from incentives need to be maintained through time. This is particularly the case when financial payments are made to landholders. Maintaining benefits through time is typically managed through a land management agreement or contract but the method of maintaining benefits should be matched to the level of investment, as well as the history of landholder engagement.

At the top end of the investment spectrum are financial payments to landholders. If large sums are paid to landholders, then payments should be linked to the initial signing of an agreement/contract and then linked to the achievement of certain milestones through time. As discussed in section 3.2.6, whilst a payment linked to an outcome is the best possible way to ensure benefits are maintained through time, for outcomes with long time lags, such as sediment reduction, payments may be better linked to achievable input milestones so as to not reduce participation. Regardless, establishing land management agreements or contracts that run for a period of time to see benefits is critical to maintaining benefits. LDC will need to think about the need for contracts, length of time for contracts, and the method to ensure compliance to contracts taking risk and uncertainty prolific in the natural environment into consideration.

Placing a covenant on land title is another method to ensure benefits are maintained through time regardless of the ownership of the property. Despite the sediment reduction benefit potential of this, BBB landholders were not comfortable with incentives linked to title, saying that it would be perceived as a constraint to sale of property and therefore a disincentive to participation.

In many cases an incentive may not result in a large sum of cash being paid to a landholder. When this is the case, the process of maintaining benefits and compliance should be much more supportive and facilitative. If compliance is less than required, effort should be made to understand the barriers to compliance with lessons learned on how to improve incentive implementation in the future and/or if the landholder can be supported further to comply with original obligations.

Ongoing monitoring is also critical to the maintenance of benefits. Monitoring can be a way for land managers to showcase the environmental gains they are making and also be a way to highlight any potential red flags with current management such that adjustments can be made to management agreements. This is another reason why long-term institutional arrangements for incentives and associated works planning and delivery are crucial.

SEE RECOMMENDATION 3 and 5 in Section 4

3.3 Potential incentives for the LDC

The potential incentive types were presented in Table 4. Not all incentive types, however, are feasible for implementation as a part of the LDC project. Table 7 provides a justification for which incentives are considered feasible for the LDC and which incentives are not.

Table 7 Potential incentives for the LDC

Incentive type	Feasibility
Extension/information provision	Extension services are already offered by the LDC, as well as by QDAF and Grazing BMP. Extension/information provision provides information and services that support all other incentives. **Enhancing extension services and information provision is recommended as part of the incentive suite for the LDC.**
Social recognition	**Social recognition is recommended** as part of the suite of LDC incentives as a complement to other incentives and to encourage high performance and innovation.
Market brokerage	Market brokerage **is not a realistic option** for the LDC due to the absence of markets for water quality benefits. If markets emerge in the longer term, NQDT may be able to provide brokerage services to facilitate water quality outcomes. **Watching brief for brokerage in carbon credits and future Reef Credits.**
Product differentiation	**Product differentiation is not recommended** for LDC due to the set up time and costs and uncertainty about market premiums. Produce differentiation may be an option for longer-term industry development or niche producers to undertake at their own initiative.
Voluntary conservation covenant	Currently offered by the Queensland Government, and are likely to complement other incentives for graziers motivated by conservation outcomes. **Recommended as a part of the incentive suite for the LDC.**
Voluntary management agreement	Already offered by LDC and other organisations. **Recommended as part of the suite of LDC incentives.**
Industry codes/self-regulation	Industry codes such as BMPs **are recommend**ed as a part of the suite of incentives for LDC.
Grants	Already implemented by the LDC. Grants with improved contracting, staged payments through time varying based on impact on sediment reduction and improved monitoring and compliance are **recommended** as part of the suite of incentives for the LDC. This moves the grants to be closer to stewardship payments.
Subsidies	Already implemented by the LDC. Enhanced and targeted subsidies are **recommended** as a part of the suite of incentives for the LDC.
Stewardship payments	**Recommended** as a part of the suite of incentives for LDC due to the recommended changes to the implementation of grants.
Credit trading	**Not recommended** for the LDC process beyond a watching brief of the development of Reef Credits. **Watching brief for carbon and Reef Credits.**
Cap and trade	**Not recommended** for the LDC due to the regulation required for operationalisation and transaction costs of implementation. **Watching brief for brokerage opportunities.**
Offsets	**Not recommended** for the LDC due to the regulation required for operationalisation and transaction costs of implementation. **Watching brief for brokering opportunities.**
Land purchase	**Not recommended** for the LDC due to the cost of purchase and ongoing management.
Local government rate rebates	**Not recommended** for the LDC. Not within the power of the LDC.
Tax concessions	Tax concessions and low interest loans are available for some relevant activities, and LDC is sharing this information with BBB graziers.
Low interest loans	Provided by QRIDA. LDC **provide information** on these.
Debt for conservation	**Not recommended** due to high cost of purchase and low operational certainty.

4 Recommendations

The BBB hosts a cohort of land managers with a diversity of motivations, property characteristics, practices and engagement experience. Efforts to reduce sediment will focus on improved grazing management practices and restoration of gullies. The LDC should offer a suite of complementary incentives that engage the full spectrum of land managers – engaging the previously unengaged, accelerating adoption of improved practices and supporting the trial and development of new practices such as the remediation of major gully systems. Many of the incentive mechanisms reviewed as part of this report are not able to be implemented as part of the LDC, because of constraints in time, scale and authority. The LDC project also provides an opportunity to support the development of future incentive programs in the medium to longer term.

With this in mind, recommendations are presented in two groups:

1. Actions that can be implemented as part of the LDC project to
    a. Manage for big gullies; and
    b. Facilitate improved ongoing land management.
2. Actions that the LDC project can undertake to influence future incentive opportunities.

The following sections propose, describe and justify a set of recommendations arising from this work.

4.1 Recommendations for the LDC project to manage big gullies

4.1.1 Recommendation 1: Develop a 'gully calculator'

The current grants approach is mostly based on a cost-sharing ratio for eligible practices which assume fixed proportions of public and private net benefits (although gully remediation works may cover full costs up to a cap). In reality, both the benefits and the costs will be highly variable between landholders and properties. As more major gully restoration projects are implemented and evaluated, incentives for gully remediation should become more discriminating, based upon the potential public benefits. Development of a transparent metric to estimate sediment load reduction for individual projects through development of a 'gully calculator' would provide a more robust way to award projects based on assessment of benefits/cost. Given that the LDC project is already characterising gullies in the BBB and trialling remediation methods, the development of a tool that allows site-based estimates of sediment benefits is feasible and would be a significant legacy of this project. Investment in a gully calculator has the potential to improve the impact of investments in gully remediation both within and beyond the LDC project, under current and potential future incentive systems. This should build on existing work in this area.

It is recommended that the gully calculator would incorporate:

- Factors of connectivity, dependencies (if applicable depending upon the site) with grazing management and time-lags between actions and outcomes;

- Expected benefits and overall length of time for expected benefits from gully works;
- Up-front costs, on-going maintenance payments (if required) or other public costs required to maintain benefits; and
- A discount rate if the incentive is staged over time.

Calculators are not a new concept - QDAF is currently developing calculators to estimate the cost: benefit of grant-funded water quality projects in the cane, grains, banana and grazing industries. A similar riparian benefit: cost calculator (simple spreadsheet with user manual) has been developed and used successfully in Victoria). A gully calculator would codify emerging knowledge about the costs and benefits of gully remediation projects, which would improve the effectiveness of grants for gully remediation, and any future incentive systems such as reef credits.

4.2 Recommendations for the LDC project for the management of large gullies and the improvement of ongoing land management

4.2.1 Recommendation 2: Consolidate and improve data about land and landholders

As discussed in previous sections of this report, there is great heterogeneity of landholder types, motivations, capacity to change and history of engagement, as well as land condition, management practices and presence of gullies (that may be a legacy of previous land condition and practices). A greater understanding of the BBB enterprises, including social and economic characteristics, would enable LDC to better target incentives. This more nuanced understanding of how landholders engage with incentives offers a learning opportunity that could have significant legacy value to water quality programs across the GBR grazing lands. It is recommended that the LDC consolidate their understanding of BBB grazing enterprises by collecting, collating and using spatial data and information about:

- Current land condition and land management practices;
- Presence and characterisation of gullies;
- Social and economic characteristics of landholders and enterprises; and
- History of engagement with extension services or water quality programs.

4.2.2 Recommendation 3: Implement a suite of complementary incentives to support landholders in ongoing land management for water quality benefits.

It is recommended that the LDC project should provide a complementary mix of incentives **to engage and support BBB graziers to improve water quality across the spectrum of land management practices as per**

Figure 6. It is recommended that, in addition to existing regulation, the LDC offers a complementary mix of incentives including:

- Working positively with existing and proposed regulations;
- Providing ongoing access to information (such as property management planning, financial planning etc);
- Providing ongoing assistance to engage with and/or achieve BMP accreditation;

- Providing grants tailored with payments associated with achieving key inputs or outcomes; and
- Supporting recognition and reward of high performers or those that have made large changes in land management.

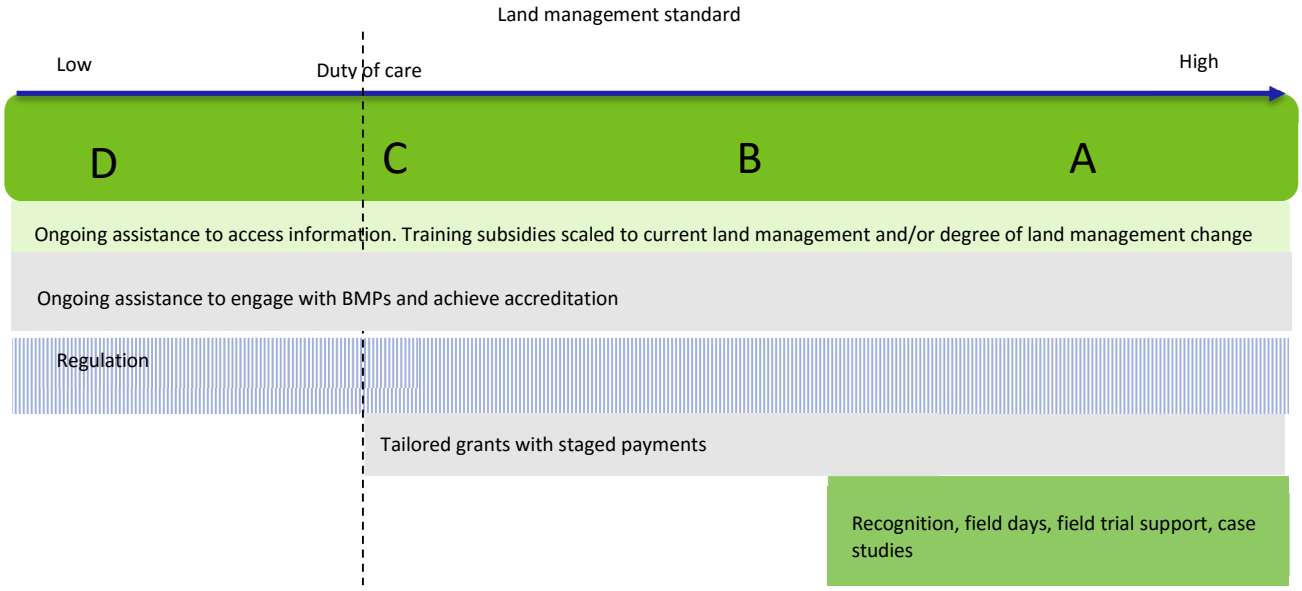

Figure 6 Potential incentive mix supporting the spectrum of landholders to improved practices

Recommendation 3a: LDC support BBB landholders to understand their current regulatory obligations and facilitate landholder input to reviews or proposed amendments to relevant regulations.

Regulation is applied by governments, so sits beyond the remit of NQ Dry Tropics and the LDC project. In

Figure 6, A through to D management classifications indicate levels of land management practices. Regulatory obligations apply to all land managers. C level practice is considered to be 'duty of care', below which regulatory compliance is expected to be the main force to bring land management up to regulated standards (C level). Regulatory obligations can be confusing and water quality regulations have recently changed. Other regulations e.g. vegetation management, may also impact grazing practices, and have been raised by graziers as an impediment to achieving water quality outcomes.

We recommend that LDC should, through the Policy Engagement program area, ensure that BBB landholders fully understand their regulatory obligations, and facilitate landholder input to regulatory reviews or proposed regulatory amendments (including recent changes to the reef protection regulations and Vegetation Management Act). This could include brokering more effective State approaches to the co-design of local implementation arrangements for regulation.

Recommendation 3b: LDC provide ongoing assistance for landholders to access information, extension services and subsidised training

The LDC project should offer **information, extension and subsidised training** opportunities to BBB graziers and provide multiple and variable pathways for graziers to engage with training and support services. Information, extension and training should align with and complement existing industry BMP, DAF extension and property management planning processes including:

- Property mapping and planning;
- Erosion and other land management planning;
- Financial services including succession planning; and
- Grazing management training e.g. DAF or commercial services.

The different engagement pathways (extension, demonstration and cluster groups) offered by LDC as part of the Grazier Support program are appropriate to facilitate wide access to LDC support and resources.

Collecting and interpreting information about BBB enterprises (RECOMMENDATION 2) will allow the LDC team to consider how different pathways and different services are accessed by different cohorts of growers. Evaluating 'what works for who' can help improve the program (targeting of incentives) and identify lessons that may have wider application.

Recommendation 3c: LDC refine current grants scheme to reward on-ground change and improve the maintenance of benefit over time

Grants should be used to facilitate adoption of improved practices, where the public benefit reflects the public cost, but not to meet regulatory 'duty of care' obligations. Improvements to the current grants program are recommended, incorporating tailored (individualised) grants and staged payments. While there isn't sufficient time within the LDC project for NQDT to trial a stewardship payment scheme based on payments for outcomes such as groundcover, shifting the grants program to one where staged payments for outputs occur over time moves towards a stewardship-type scheme, which should be explored as an option in the longer-term.

Landholder agreements for grants need to be strong and binding, with clearly articulated responsibilities among the parties involved, including monitoring for compliance within the agreement and a focus on the follow-up assessment of outcomes achieved. The current grants process has the potential to generate greater outcomes with small changes. It is recommended that the LDC refine the current grant process to:

- Incorporate longer term management agreements (ideally attached to title, although landholders suggested this would not be well received);
- Include staged payments focussed upon the achievement of key input or outcomes milestones (landholders suggested that this is reasonable and acceptable);
- Include follow up monitoring (acceptable to landholders); and
- Require that grant selection be based on the return on investment (public benefit/public cost).

It is also recommended that the LDC trial the use of a tailored grants approach with these characteristics, and in the longer term (beyond current LDC funding) trial targeted stewardship payments as an extension of this approach.

Referring to the public: private benefits framework (section 3.2.1 and APPENDIX A), it is recommended that financial payments only be considered when a landholder is operating above the duty of care (above C in

Figure 6) and relative to the estimated public benefit of potential land management change (sediment reduction) /public cost (based on information collected in RECOMMENDATIONS 1 and 2).

Given the time lags that occur between land management change and outcomes, it is recommended that the LDC incentives programs are designed to reward a mix of inputs and outcomes (usually outcomes are a proxy for sediment reduction). The level of payment could be gradated based on the potential to generate a positive change. In addition, the timing of the payment could influence adoption. For inputs that have a high up-front cost, payments could be staged to cover some up-front cost and reward for completion of the input.

Staged payments could be structured, for example, to balance:

- Up-front fencing and water point costs and staged payments for cattle exclusion or spelling;
- Up-front planning costs and staged grants/subsidies for (verified) implementation;
- Up-front costs for on-ground works and staged payments for stabilisation/revegetation/maintenance.

Outcome-based payments could be linked to agreed ground cover or land condition outcomes, but require careful consideration of measurement and assessment processes and timing.

Recommendation 3d: Social recognition and supporting innovation with leading graziers

It Is recommended that the LDC evaluate and strengthen **social recognition** elements of the LDC program, such as such as public promotion of good practices and outcomes (through events or media, for example), tailored field trips and support for innovation trials (such as the Demonstration and Cluster groups proposed as part of the Grazier Support program).

Quite often, landholders who operate at A and B level practice gain intrinsic private benefit from exceptional land management. When this is the case, incentive programs that recognise and reward achievements and facilitate risk-taking to trial new approaches are recommended. To advance these incentives it is recommended that the LDC:

1. In consultation with landholders, develop a social recognition program/event for high performing landholders. This could be something like a gala dinner or an invitation only field trip/training activity, potentially incorporating links to the new 'Reef champions' awards and visits to leading graziers in other parts of the GBR. This approach has been successfully used in the cane industry by Project Catalyst. The LDC could provide insight into this approach for GBR catchments more broadly by trialling a social recognition program and assessing the benefits of such an approach for graziers; and
2. Consider how social recognition can more explicitly be incorporated into the LDC Demonstration and Cluster group activities. One barrier to the adoption of innovative land management practices and gully remediation techniques is the difficulty to trial techniques at low cost. Higher performing landholders could be rewarded and extended through LDC support of land management trials. Rewards could be extended through field days and the use of high performing sites as case studies.

4.2.3 Recommendation 4: Rigorously evaluate all incentives used within LDC, and advocate for better use and access to evaluation reports.

LDC should rigorously evaluate the uptake of incentives offered. The level of investment and scale of the LDC Project provides a unique opportunity to evaluate how graziers respond to the mix of incentives on offer. As well as assessing outcomes (levels of engagement, levels of adoption, effectiveness of gully remediation trials) evaluation should focus on learning more about 'what works for who, and why' i.e. for the different cohorts of land managers in the BBB (using the information described in RECOMMENDATION 2). These learnings should be fed back into the LDC project implementation, and transferability considered. This work should use the major gully remediation trials to co-design and test incentives for this new area of GBR investment. Findings will help inform the refinement of longer-term institutional arrangements for managing catchment restoration activities in the GBR (RECOMMENDATION 5).

This project has revealed the lack of systematic approaches to incentive and program evaluation and access to previous evaluation reports. This constrains opportunities for learning and improvement. Relevant research papers provide some information, but tend to generalise findings, are slow to publish and may access may difficult to access. LDC should encourage Queensland and Australian Governments to facilitate better access to evaluation reports prepared for water quality programs.

4.3 Recommendations to influence longer-term outcomes

The short time frame of the LDC project is a major constraint to trialing new incentives. Culture and behaviour change programs require sustained incentives over time. However, the level of investment and integrated delivery approach of the LDC project provides a unique opportunity to broker longer-term arrangements to support improved and ongoing incentives to improve water quality from grazing lands.

Recommendation 5: Institutionalise Long Term Approaches to Catchment Repair

Catchment repair activities in the BBB (and wider catchment) require a stable, long-term institutional arrangement to plan, mobilize investment, design, coordinate and negotiate significant effort and to monitor long term compliance and outcomes. Establishing clear institutional responsibilities for catchment repair could:

1. Continue to build catchment erosion prevention and repair capacities within the BBB/Burdekin and across key utilities (e.g. Council, Transport and Main Roads, Mining Companies, etc.);
2. Explore mechanisms to consider catchment repair efforts as insurable assets;
3. Continue to improve design and delivery associated with catchment repair; and
4. Report competently on actual improvements in water quality outcomes relative to costs.

Consultation undertaken as part of this project has generated a specific suggestion for a governance mechanism, such as a trust, to support ongoing investment in gully repair.

Working collaboratively with the State Government, the LDC Project could explore options for the codesign and establishment of **a governance mechanism to** support the long-term planning, financing, delivery and management of significant gully erosion prevention and rehabilitation efforts. To support this, the LDC should collaboratively explore the potential to establish an enduring mechanism (e.g. such as a purpose-built Trust of some kind) to buffer the impact of short-term project funding and to allow a more systematic approach to remediation of major gully systems. This would enable:

1. Longer-term contractual arrangements, staged payments and follow-up monitoring;

2. Disaster management of remediated gully systems (i.e. post cyclonic floods); and

3. Building and extending the capacity to remediate and maintain major gully systems.

The Wet Tropics Major Integrated Project has an equivalent issue with the trial installation of river, riparian, wetland and drainage management and the development to pollution treatment systems.

Information about the potential success of gully remediation techniques is currently in a forming stage. Coupled with on-ground application in a variable climatic environment means that a percentage of gully remediation works will fail. A high chance of failure could act as a deterrent to landholder participation in gully management activities in the future. It is recommended that the LDC investigate how the impacts of the risk of gully failure can be reduced for landholders. One suggestion from the landholder meeting was through some form of purpose-built trust. This trust could operate to provide landholders with financial assistance to restore gully remediation work, if they do everything right (as per their contracts and supported by ongoing and validated monitoring and reporting) and the gully remediation fails due to unforeseen circumstances. Such a mechanism would also enable longer-term contractual arrangements for financial incentives, as per RECOMMENDATION 3C, and follow-up monitoring (recognised as a significant failing in current restoration investments across the GBR).

A purpose-built trust (or other institutional mechanism) could begin with existing available grant monies. More investigation is needed, however, on the governance arrangements required to make this work and the operation of such a scheme. Lessons from the operation of River Improvement Trusts could inform the development of this mechanism, and existing NRM arrangements should also be considered. A purpose-built trust would provide a long-term institutional arrangement for specific catchment rehabilitation and major catchment repair project delivery. It would need to have, or be able to access, whole of catchment prioritisation, technically competent program development, fund management capacity and highly competent delivery skills.

4.3.1 Recommendation 6: Collaborative Approaches to Supporting Best Practice Grazing Land Management

In the longer term, the LDC project should seek to influence the development of a stable and continuously improving system of catchment scale support for extension, training, farm planning support and regulatory compliance management for rangeland grazing in the GBR. This system should be:

a. Catchment based;
b. Involve ongoing R&D;
c. Coordinate extension approaches;
d. Ensure integrated and co-managed approaches to implementation of the new Reef Protection regulations; and
e. Enable effective prioritization of ongoing extension effort and reporting of improved practice uptake.

A focused and collaborative approach to the design of such a system should be considered during the balance of the MIP. In doing so, over the life of the LDC project, the LDC and NQ Dry Tropics should engage with key institutions (industry, government, regional NRM) to collaboratively influence the longer-term arrangements.

Long-term incentive arrangements (from improved grazing practices to major gully remediation) will need long term institutional arrangements to deliver effective outcomes and to achieve the targets envisaged under the Reef 2050 Plan, including systems to support catchment-scale planning and management, property-scale planning and BMP systems and engagement with non-agricultural land managers. These longer-term arrangements should include:

- **Engaging with emerging opportunities** for additional incentives, such as Reef Credits, BMP accredited Beef and NAB 'green accounting' loans;
- **Identifying and supporting complementary incentives** that could be adopted by government agencies e.g. tax concessions for gully fencing (ATO), council rate rebates for good land stewardship (Local Government), and the potentially perverse outcomes from some incentives such as agistment assistance;
- Ensuring that **local voices can contribute to policy** dialogue about long-term institutional arrangements that affect land management and environmental outcomes;
- Seeking to co-design and **negotiate the best long-term regional system of grazier support for practice improvement**, integrating the efforts of industry BMP, implementation of regulations, research coordination and regional NRM programs within the catchment, as well as developing pathways for graziers to engage with catchment repair; and
- Seeking closer **engagement with government** to understand and proactively **manage regulatory barriers to improved practices** (i.e. seeking better ways to integrate activities under the Vegetation Management Act and other legislation to deliver better landscape outcomes and improve profitability and practices).

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Appendix A Practice change and public: private benefits

A.1 Introduction

The Landholder Driving Change (LDC) project is one of two Major Integrated Projects that are working closely with farmers to improve water quality in north Queensland. The LDC project is working with the grazing community in the Bowen-Broken-Bogie catchments of the Burdekin. This component of the LDC will explore incentive options including traditional incentives, market-based mechanisms and non-financial incentives to accelerate adoption of more sustainable grazing practices and the remediation and maintenance of gully systems that are contributing high sediment loads to the Great Barrier Reef (GBR).

This document, prepared by Natural Decisions, contributes to the Exploring New Incentive project being led by James Cook University (JCU). Specifically, this piece of work contributes to the first Objective of the RFQ:

Assess each improved grazing management practice against the following criteria: 1) what is the minimum acceptable standard and current practice; 2) likely degree of public net benefit of the practice; 3) private net benefit to landholders; 4) whether the practice requires significant upfront costs; 5) whether it requires significant on-going maintenance costs; 6) whether there are significant non-financial related barriers to adoption.

Using the results above, assign each practice to the soundest broad policy tool choice. These include financial incentives for practices with sufficiently high public benefits (can include extension/technical advice as well), extension only for those with sufficiently high private benefits and high public benefits, no action for those with low amounts of public and private benefits and potentially regulation if practices are below minimum standards.

Where the costs (upfront and/or maintenance) appear to be excessively high, we have also considered a category termed 'innovative conservation financial mechanism'. This acknowledges that a financing mechanism may be warranted but it is unclear as to what it might be.

IMPORTANT NOTE/CAVEAT: This document has been developed from a 'first principles' perspective regarding whether an incentive mechanism might be warranted on the basis of public and private net benefits. It does not represent the views of landholders in the LDC project or the Project Panel but is presented as a basis for discussion and testing as part of the LDC Exploring New Incentives project. There has also been some scope change following discussion with Andrew Brooks regarding gully classification and the limitations of the Water Quality Risk Framework with respect to gully classification.

A.2 Method and results

Four components were identified initially, with a fifth and sixth added in response to discussion with Andrew Brooks. These are:

- Agree on erosion types;
- Develop a practice list for each erosion type;
- Define the current average practice (what most land managers are doing currently), minimum acceptable standards and improved (B class) practice;
- Assess level and scale of adoption, public net benefits, private net benefits, estimate technical feasibility and costs (upfront, on-going maintenance and non-profit related) for each practice;
- Identify the characteristics of management practices best suited to direct financial incentives, noting that the actual type of financial incentive will be recommended from Appendix B); and
- Recommendations regarding financial incentives given the variability of benefits and costs associated with gully management practices

The approach taken for each component is outlined below.

A.2.1 Types of erosion

In consultation with Andrew Yates, Donna Turner and Jane Waterhouse, four erosion types were agreed; 1) hillslope erosion; 2) hillslope gullies, 3) alluvial gullies[1]; 4) streambank erosion.

A.2.2 Develop practice list for each gully type

A practice list which includes the current average practice, minimum acceptable standard and improved practice was developed. To develop the practice list, the following sources of information were used:

- Reef Plan Paddock to Reef Grazing Water Quality Risk Framework (Anon., no date);
- Reef Trust Phase IV gully and streambank practice toolbox (Wilkinson *et al.*, 2016);
- North Queensland Dry Tropics Sustainable Agriculture Handbook (Anon. 2018);
- Streambank management in the Great Barrier Reef catchments: a handbook (Bartley *et al.*, 2015); and
- Managing gully erosion as an efficient approach to improving water quality in the Great Barrier Reef lagoon (Wilkinson *et al.*, 2015).

Additional discussion with Andrew Brooks regarding the limited suitability of the Reef Grazing Water Quality Risk Framework to be used to assess gully management practices regarding the ABCD framework

After a phone discussion with Andrew Brooks (10th April 2018) and meeting with the project team and Andrew Yates, we understand that that there is another project to develop a systematic gully

classification system http://nesptropical.edu.au/index.php/round-3-projects/project-4-9/. The approaches for assessing and monitoring gullies, particularly the range of alluvial gullies are not yet reflected in the Toolbox. Given this development, it was agreed that the practice list developed for this project should be kept relatively simple and sufficiently flexible to enable more comprehensive gully classification types to be better incorporated in future.

The suggested erosion practice list is shown in Table 1 in column 2.

Define current average practice, minimum acceptable standard and improved practice

Whether a financial incentive mechanism or other approach is warranted to encourage land management practice change depends on the level of public net benefits and private net benefits associated with the change. The logic behind the policy tool options (financial incentives, extension, technology development such as R&D, regulations or informed no action) have been well articulated through the work of (Pannell, 2008) through description of the public: private benefits framework.

An important (often overlooked or not understood by non-economists) element of economic thinking is that to create an incentive for land-use change, landholders could be offered payment out of public funds (beneficiary-pays in the sense that the public benefits from the anticipated environmental improvements), or could potentially be charged a tax for the pollution that they generate as a result of not changing land use (polluter-pays). The choice between beneficiary-pays and polluter-pays depends on who is considered to have the property rights, which is essentially a political decision. In practice, it often seems to be the case in Australia that the beneficiary-pays approach is used to encourage landholders to change their current land management in environmentally beneficial ways.

To assess both public and private net benefits requires an understanding of the current average practice. The benefits of management practice change are assessed relative to those of the current practice; implicit in this thinking is also consideration of what would have happened 'without' the project.

Current average practice

The current average practices have been assumed and data sources are indicated where available. The Reef Water Quality Risk Framework (informally known as the ABCD management practices framework) (Anon., no date) was largely used as the basis of assessing current practices being at A, B, C or D management practice level, with current practices assessed through data mostly previously sourced from the Water Quality Improvement Plan grazing management workshop held in 2015 (Park and Dickson, 2015). In the absence of a sufficiently robust gully classification system and acknowledged inadequacies of the Reef Water Quality Risk Framework for gullies (Andrew Brooks, *personal communication*), the gully practices in particular are acknowledged as an inadequately represented:

Grazing management

- Stocking rates consistent with long-term benchmarks: These are assumed as C class (Park and Dickson, 2015), which is that 'stocking rate estimates tend to be above district benchmarks for some or all land types.'

- Fencing to land type and provision of water points to ensure achieve end-of- dry season ground cover targets: Assumed as C class based on grazing workshop run as part of WQIP (Park and Dickson, 2015).

Hillslope and alluvial gullies (noting that ABCD classification is not very helpful for gullies, Andrew Brooks, *personal communication*):

- Prevention: Most at C class (Park and Dickson, 2015)
- Remediation of gullies: Most gully management is at D class (Park and Dickson, 2015), commonly because of legacy issues. Note also that C class gully practices in the Reef WQ Risk Framework do not involve gully fencing, it is only for B class practices that fencing (where practical) is recommended.

Streambank erosion:

- Management of stock: The WQIP grazing workshop suggested streambanks on major waterways were split between D and C class as defined in the Reef Water Quality Risk Framework (D being unfenced and C being limited fencing and off-stream water) and acknowledged that most smaller streams were unfenced (Park and Dickson, 2015). Results from the MIP Synthesis report suggest practices are at C-B level (Waterhouse *et al.*, 2017) and so the results from these two sources are conflicting. Overall C class practice is assumed.
- Riparian regeneration: Riparian regeneration is tied to stock management. Given that waterways are commonly only partially fenced, there would be limited opportunity for riparian regeneration. Current practice could therefore be assumed as D class because with only partially fenced waterways there is likely to be limited opportunity for riparian regeneration.
- Engineering protection: Engineering success will be highly dependent on upstream measures. Given the cost of engineering it is safe to assume most waterways do not have engineering infrastructure. Remediation of major gullies is a feature of the LDC Project, but there are no established 'average' practices for this in the BBB.

Current average practices assumed are listed in column 4 Table 1.

Minimum acceptable standard

A practice below a minimum acceptable standard should not be considered for financial incentives. The minimum acceptable standard can be thought about as the landholders 'duty of care' (as outlined in the Land Act 1994[2]) (Anon., 2017). Duty of care is also termed as 'general environmental duties' under the Environmental Protection Act (1994) https://www.ehp.qld.gov.au/management/planning-guidelines/legislation/general_environmental_duty.html. These minimal acceptable standards can be thought of as the expectations a society has in regard to the stewardship of land that a land manager is responsible for. Minimal acceptable standards need to be associated with compliance measures if they are to have practical meaning; without effective monitoring and compliance it is hard to make a compelling case that landholders are maintaining a duty of care.

Minimum acceptable standards are currently used as a threshold in Reef Water Quality Risk Framework (Anon., no date). In recent years it has become accepted that financial incentives for grazing land management practices should not be paid unless grazing land has achieved C class management. The minimum acceptable standards for management practices in the LDC incentives project, considering both the intent of the Reef Water Quality Program as well as legacy issues associated with gullies are suggested as:

Grazing management practices: Grazing management practices need to be at least C class for incentives to be considered. D class management is below expectations of maintaining 'duty of care'. Graziers in the BBB catchment who are over-stocked are more likely to carry high levels of farm debt and be reluctant to reduce cattle numbers in time of drought from work conducted by Romy Greiner (Waterhouse *et al.*, 2017); as such these landholders are likely to have greater worries than long-term land management and payment of financial incentives is unlikely to be sufficient to change their overall management in the long term.

Gully management (hillslope and alluvial): Gully activity and scale is largely a function of land and soil type and involves the role of a land-use trigger at some point over the last ~ 100 years. All parts of the landscape are not equally susceptible. Some of the most degraded properties from a grazing management practice point of view do not have gullies and vice versa. Whilst stocking rates need to be considered as part of overall strategy, for the purpose of reducing sediment loads effectively, gully treatment and grazing should be treated largely independently (Andrew Brooks, *personal communication*). The only minimum requirement for gullies to be at least considered for incentives would be that the landholder has to at least maintain a fence around the gully.

Streambank erosion: Many graziers have partially fenced off larger waterways already (Park and Dickson, 2015). Considering provision of incentives at this C class level will reward landholders who have already shown commitment to works (provided there are not issues of significant dis-adoption). The argument is that benefits will be gained through completing waterway fencing.. It is not recommended that incentives should be provided where there is no previous riparian fencing (D class practice). Assumed minimum practice standards are shown in column 3 in Table 1.

Improved practice

It is assumed that the improved practice for which incentives would be considered is indicative B practice (recognising the limitations of ABCD in gully management practice thinking), and where possible (e.g. if innovative remediation practices are found) A class. For gullies where there is confidence that gullies are operating independently of stocking rates this principle may be relaxed.

Public net benefits, private net benefits, estimated technical feasibility, adoptability, non-profit-related barriers and costs

The assumptions around each of the management practices are outlined below. Note that results from the grazing management WQIP workshop (Park and Dickson, 2015) were used for most assumptions unless indicated otherwise. Technical feasibility for grazing management practices were assessed as high (meaning there should be a low risk of failure to realise benefits). Fencing should be high technical feasibility, although because there is the possibility of landholders leaving the gate open which can be a problem it has been reduced to medium-high). For most other

measures medium technical feasibility has been assumed. Adoptability was estimated based on the categories shown in Appendix A (which were adapted and simplified from categories used in the Investment Framework for Environmental Resources, INFFER). Additional information about profitability and costs are outlined below:

Grazing management practices:

- Profitability was assessed as low (for moving from C to B) from grazing workshop, but other information, from the long-term Wambiana grazing trial and RCS Consulting (Terry McCosker, *personal communication.*) suggests that profitability can be moderate. RCS suggest that sustainable stocking rates will vary with land type but are likely to be in the region of 10-14 LSU day/ha/100 mm. A clear view of whether moving from C-B grazing practices is sufficiently profitable to not require incentives is needed for the LDC project. Currently we have assumed that financial incentives are not needed.
- Fencing to land type and provision of water points to ensure achieve end-of- dry season ground cover targets: The grazing workshop suggested profitability was neutral to negative. RCS Consulting figures suggested much lower fencing and off-stream watering costs than using conventional fencing and therefore costs from the grazing workshop are suspected to be over-estimates.

Hillslope gullies[3]

- The grazing workshop results (Park and Dickson, 2015) were used to interpret likely private net benefit, comments on adoption and non-profit related barriers.
- Costs were assumed from discussion with Andrew Brooks as part of a Reef Trust Project 'Agricultural Renewal Investment Fund'[1]. Costs were based on a notional typical 20,000 ha farm assumed to contain hillslope gullies on non-river frontage country – contains patchy linear gullies, typically expect 20-50 ha gullies at range $10,000-30,000/ha.
- Assume average 35 ha x $20,000 = $700,000/farm where major works are required.
- Assume $350,000/farm where minor works are required.

Alluvial gullies:

- WQIP Grazing workshop results were used (same as for hillslope gullies) although the distinction between alluvial and hillslope gullies was not made at the workshop.
- Costs from the discussion with Andrew Brooks[1] were assumed for a notional 20,000 ha farm on river frontage county where one might expect 100-500 ha gullies at rehabilitation costs ranging from $20,000-100,000/ha. Assume average 300 ha x $60,000/ha = $18 million (range $2 million - $50 million).
- $18 million was used for practices requiring major works on 300 ha gullies.
- $2 million was used for minor works farm (100 ha gullies x $20,000/ha).

Streambank erosion:

- Adoption comments were used from the grazing WQIP workshop notes were used (Park and Dickson, 2015).

- Management of stock on frontage country: ≈$16,000/km for fencing, off-stream water and natural regeneration (Bartley *et al.*, 2015).
- There is assumed to be no regeneration of riparian frontage (large waterways) unless the waterway is fully fenced and with stock exclusion for the vast majority of time. Occasional crash grazing for weed and pest control might be considered.
- Engineered stream bank toe protection or bed protection: $143,880/km for battering and up to over $5 million/km if major rock structures are needed (Bartley *et al.*, 2015).

A.2.3 Criteria for considering financial incentives to landholders

Whether financial incentives should be considered was assessed on the basis of practice characteristics (Table 1) and an assessment of the sediment load reduction in relation to public costs.

The practice characteristics and principles used were based on factors considered in the public: private benefits framework (Pannell, 2008):

- Practices that had private net benefits (ranging from small positive to negative) were considered as potential for incentive payments as long as there are sufficiently high public benefits
- Practices had to have at least medium public net benefits (all were deemed to meet this criterion). Note that, in practice, public net benefits need to consider proximity to the stream network – gullies in closer proximity to waterways will have higher sediment delivery ratios than those less well connected.
- High technical feasibility was preferred over medium technical feasibility, but medium technical feasibility was not ruled out.
- Practices needed to have only moderate adoptability (all met this criteria). High adoptability practices would be expected to be adopted without financial incentives.
- Practices with high non-profit related barriers were excluded from consideration for financial incentives because such barriers are often hard to overcome. The only practice that was ruled out on this basis was maintaining stocking rates consistent with long-term benchmarks.
- Practices which had lower upfront costs and or limited/no requirement for on-going maintenance payments should be preferenced for financial incentives above practices which had very high upfront costs and/or significant requirement for ongoing maintenance. However, there is a challenge that arises in the case of gullies. Some of the most cost-effective gully remediation can occur for very active large gully remediation (point sources) (Andrew Brooks, *personal communication*). Technical assessment as to the likely sediment reduction/public cost should drive the decision. Public costs need to include consideration of both upfront and maintenance costs. A threshold level of sediment reduction/public cost should be used to discriminate gullies to be considered for financial incentives. For gullies where this threshold is not met will be more suited to

research and development or a deliberate 'informed no action' strategy in terms of the public: private benefits framework.

Based on the above criteria, Table 2 was developed and includes an explanation for the rationale about whether direct financial incentive payments to landholders might be considered. Note that these have been developed based on first principles and have not yet been discussed or tested with landholders. Doing so will be critical.

There are four major categories:

- Financial Incentives recommended for landholders: Characteristics of significant financial incentives to be recommended for landholders are that the benefits are able to be maintained in the long term. The landholder being prepared to sign a binding agreement which extends beyond their ownership and agree to compliance being undertaken would provide confidence that public benefits will not be lost. Fencing to land type to maintain groundcover, fencing for gully erosion prevention measures and fencing of waterways generally have characteristics that look well-suited to direct financial incentives. Binding agreement would include that landholders maintain the fence and keep the gate closed (there might be exceptions for occasional crash grazing for weed control, but this needs to be stated and subject to agreed compliance assessment) with the responsibility extending to future landholders (e.g. agreement on title or as part of lease agreement). Without such an agreement, there is no guarantee that the benefits from fencing and stock exclusion will be maintained and the public benefits are at high risk of being lost. Monitoring and compliance assessment measures are likely to be needed to ensure fences are maintained and stock are excluded. Gullies to be considered for financial incentives to landholders need to meet a level of sediment load reduction/cost and landholders need to be prepared to sign binding agreements to maintain the remediation measures.
- Financial incentives not recommended for landholders: Where landholders are not prepared to maintain stocking rates consistent with long-term benchmarks, then incentives would not be offered on the basis that non-profit related barriers are unlikely to be overcome. Furthermore, landholders would need to agree to maintain stocking rates at or below long-term benchmarks to be considered for incentives. An exception here might be considered for gullies where it is clear that the erosion processes are operating independent of stocking rate.
- Financial incentives might be recommended for landholders: Financial incentives might be considered for gully remediation practices subject to the sediment load reduction per public cost and where the landholder is likely to be able to manage the on-going maintenance requirements. Overall it would need to be demonstrated that the benefits are large and can be maintained for the financial costs (combined upfront and maintenance if required). As outlined for previously, acceptance of a payment from public funds should be tied to a binding agreement that maintain the remediation measures, with the responsibility extending to future landholders.
- Possible innovative conservation financing mechanism (incentive is worthwhile based on benefits and costs but is beyond the capacity of the landholder): This category has

been added. It recognises that some, possibly many, gully remediation practices are likely to be well beyond what landholders can afford to maintain. These are likely to include some of the larger alluvial and hillslope gullies where major earthworks are required. If it can be foreseen that the responsibility of maintaining benefits is unlikely to occur (e.g. the landholder is unwilling sign a binding agreement to do so) then providing incentives to landholders may not be a sound investment of public money. There are situations where it might have to be accepted that the problem is too difficult (in which case the recommended action is to accept the sediment loss and impacts on the GBR as technically unfeasible and/or cost prohibitive), conduct more research and development to reduce costs sufficiently so that landholder incentives could be considered or consider a different innovative conservation financing mechanism (perhaps funded by private investors, superannuation funds or philanthropic sources. Such a mechanism would need to be agreed to by the landholder and require assigning binding agreements and property rights to the investor).

A.3 Findings

There are very large variations in the benefits (in terms of sediment load reduction) of practice change associated with managing hillslope erosion, hillslope gully erosion, alluvial gully erosion and streambank erosion. Costs are also highly variable and site specific. Given this, improvements to the direct financial incentives approach being offered to landholders by LDC currently (based on set unit rates and public: private cost shares) could be improved. We recommend that financial incentives are offered to landholders based on an assessment of benefits and costs where the following factors can be demonstrated as relevant to any of the four erosion categories:

Benefits:

- A threshold level of public benefits (reduced sediment erosion) needs to be agreed. This threshold could be agreed by technical experts using available knowledge.
- Site assessment (regardless of the erosion type) is essential and the sediment reduction benefits are estimated (for gullies or streambanks through technical expert assessment[4] and for hillslope erosion using Paddock to Reef)
- Benefits need to include consideration of:
    - Time period that the incentive is to be paid (can be variable)
    - Time-lags (some benefits occur more quickly than others)
    - Whether there are dependencies between grazing management and public benefits or not (if dependencies then grazing management needs to be of at least minimum acceptable standard before incentives would be offered)
    - Connectivity (e.g. if gullies are directly connected to waterways of importance from the perspective of GBR impacts)

Costs:

The cost components only need to consider the public costs but do need to include:

- Up-front costs
- On-going maintenance payments (if required) or other public costs requested in the time-period for the benefits to be maintained
- Agreed discount rate to be applied to the time-period under consideration for the incentive
- Whether there is an upper threshold limit for costs to be provided and if so what this is. In theory the upper limit is not important (provided the benefit threshold is met and the project is the best in terms of benefit/cost comparison) but in practice there are often reasons for setting a threshold (e.g. political considerations, perceptions of equity and opportunity for participation, reduced risk).

Landholder obligations

- Minimum practice standards below which an incentive would not be offered
- Binding agreement which extend in time beyond the current landholder ownership or leasehold arrangements to maintain the public benefits in the long term and include clearly documented expectations about the landholder's obligations as a condition of accepting incentive payments. This includes agreement regarding compliance monitoring and inspection.
- Natural Decisions have developed a riparian benefit: cost score calculator which is being used in Victoria to provide a more defensible basis for riparian incentives. Such a calculator could be developed/ adapted to provide a more robust basis for the LDC project to assess erosion projects. The calculator is a spreadsheet tool with a user manual and has been well-tested for practicality and useability.

A.4 Conclusions

Incentive payments to landholders appear sound to consider for practices that have sufficiently high public benefits, are technically feasible to address, and have a threshold of estimated sediment load reduction per public cost (which considers both upfront and maintenance or other costs required to maintain the benefits over the time period of the incentive).

Other things being equal, practices having upfront costs that are small or at least not excessive and where landholders can be reasonably expected to maintain the benefits at little or no cost are the practices where direct financial incentives to landholders will work well.

It is proposed that receiving significant levels of incentives (a threshold would need to be agreed) should also come with binding responsibilities which extend in time beyond the current landholder ownership or leasehold arrangements to maintain the public benefits in the long term. Clearly documented expectations about the landholder's obligations as a condition of accepting incentive payments are also required as part of a binding agreement along with landholder agreement for compliance monitoring and inspections.

Where it is unreasonable to expect landholders to be able to maintain benefits following an initial incentive (from a cost or technical feasibility point of view), direct financial incentives to landholders may not be practical or realistic. In such cases a more innovative conservation

financing mechanism (which includes assigning of property rights to the investor) could be considered. In some cases, if sufficiently cost-effective gully remediation costs are not feasible there may need to be acceptance that the erosion problems cannot be effectively managed.

Given the large variations in the benefits (in terms of sediment load reduction) and costs associated with management of erosion, development of a metric based on benefits/costs and which accounts for other relevant factors (time-period, time-lags, relevant landscape factors, upfront and additional costs, discount rate) is recommended. This would be a short-term improvement on the current approach used by LDC which is based on set unit rates and estimated public: private cost shares.

Apx Table A.1 Erosion management practice changes proposed

	Practice	Min std for incentive	Current average practice	Best practical practice	Private benefit (H, M, L, 0 or negative)	Public benefit (H, M, L, 0)	Technical feasibility (H, M, L, 0)	Adoptability (H, M, L, 0, negative)	Non-profit related barriers	Upfront cost ($/unit)	On-going maintenance costs needed? ($/unit)	Should incentives to landholders be considered?
Grazing	Stocking rates consistent with long-term benchmarks	C	C	B	L-M	M	H	M	H	0 on farm, only training workshop (Park and Dickson, 2015)	Only 3 days ($720) labour/year	No
	Fencing to land type and provision of water points to ensure achieve end-of- dry season ground cover targets	C	C	B	L	M	M-H	M	L	$200-500,000/farm (Park and Dickson, 2015) – suspected to be over-estimates as RCS suggest electric fencing is effective and much cheaper.	No assume landholder maintains or consider small payment for main tenance. Could build in as part of compliance assessment	Yes
Hillslope gullies	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	C	C	B	Not covered in grazing workshop – assume 0	M (30% effectiveness, Wilkinson et al.2015)	H	Zero to L	L	Hard to assess on a farm basis as one-off figure. $9,200/km (Skull *et al.*, 2016). $5,000/km (Wilkinson *et al.*, 2015). $2,000/km, lower cost option for B has promise but is untested in wide application (Park and Dickson, 2015)	As for grazing fencing	Yes

	Remediation of active gullies – reveg and stabilisation (includes fencing and destocking)	D	D	B	Zero to negative	M-H (50% effectiveness, Wilkinson et al.2015)	M	Zero to negative	L	Andrew Brooks assumption $350,000/farm $41,200/km excl rockshute (Skull *et al.*, 2016) $4,500-9,000/km and add $10-30,000/km if hydroseeding is included (Wilkinson *et al.*, 2015)	Probably no	Maybe
	Remediation of active gullies – includes and major earth works	D	D	B	Zero to negative	H (70% effectiveness, Wilkinson et al.2015)	M	Zero to negative	L	Andrew Brooks assumption $700,000/farm Alternatively assume $66,200/km (Skull *et al.*, 2016) Drop structure: $30,000–50,000 per gully head, reshaping and seeding: $10,000 per gully head (Wilkinson *et al.*, 2015).	Probably yes	Maybe or no. Comments for previous, only harder
Alluvial gullies	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	C	B	B	Negative	M (30% effectiveness, Wilkinson et al.2015)	M	Zero to L	L	As for hillslope gullies	As for grazing fencing	Yes
	Remediation of active gullies - minor works/manag	D	D	B	Negative	H (50% effectiveness,	M	Zero to negative	N/A	$6 million ($20,000/ha for 300 ha gullies on an assumed 20,000 ha	Probably yes	Maybe

	ement actions – no major reshaping					Wilkinson et al.2015)				farm, Brooks, *pers. comm)*		
	Remediation of active gullies - major works including re-shaping	D	B	B	Negative	H (70% effectiveness, Wilkinson et al.2015)	M but less well established than for hillslope gullies	Zero to negative	N/A	$18 million ($60,000/ha and 300 ha gullies on a 20,000 ha farm (Brooks, *pers. comm.*)	Probably yes	Probably no
Streambank erosion	Management of stock on frontage country to achieve end of dry season ground cover targets	C	C-D (Park and Dickson, 2015) C-B (Waterhouse *et al.*, 2017)	B	L	H	M	M	L	$15,980/km for fencing, off-stream water and natural regeneration (Bartley *et al.*, 2015)	No or small – landholders should maintain fences	Yes
	Regeneration of riparian frontage (large waterways)	N/A	D	B	Assume tied to stock management					0	0	No
	Engineered stream bank toe protection or bed protection	Engineering success will be highly dependent on upstream measures – best decided by NQDT or DNRME and not landholders								$143,880/km for battering and up to over $5 million/km if major rock structures are needed (Bartley *et al.*, 2015)	Probably yes	No

Apx Table A.2 Comments on whether incentives to landholders seem sensible given the practice characteristics identified in Table 1 (and subject to an assessment of sediment erosion benefits per public cost).

	Practice	Do direct financial incentives to landholders seem appropriate?	Comments
Grazing	Stocking rates consistent with long-term benchmarks	No	No on the basis that the evidence is that running stocking rates consistent with long-term benchmarks is profitable. Subsidies for training workshops could be considered if there is evidence that landholders adopt practices after attending training workshops. Non-profit related barriers appear to be important and if there is no evidence of increased adoption from provision of training workshops then training workshop subsidies would not be recommended.
	Fencing to land type and provision of water points to ensure achieve end-of- dry season ground cover targets	Yes	Yes, but these should only consider if stocking rates are consistent with long-term stocking rates. It is recommended that there would also be a requirement to have a binding agreement in place for farmers to maintain the fence, with consequence if not (compliance and if needed some enforcement measures). The rationale is that without the fence being maintained benefits of public investment will be lost and public money will not be well spent.
Hillslope gullies (note that targeting to gullies more connected to waterways is an important part of prioritising for highest public benefits)	Erosion prevention (fencing to achieve reduced/controlled livestock access and linear features management	Yes, but only provided there is no potential for a perverse outcome[5]	Yes, and the same rationale as for fencing as for grazing also applicable.
	Remediation of active gullies – revegetation and stabilisation (includes fencing and destocking)	Maybe or no	This cannot be answered easily without a site assessment to both assess benefits and costs (which include upfront and maintenance costs) and consideration of whether the landholder can maintain the benefits. Financial incentives to landholders could be recommended if there was confidence regarding high technical feasibility and assessment of sediment reduction benefits in relation to public costs. Maintenance responsibilities also need to be clear and with a binding agreement. For gullies which are intractable from a landholder's perspective, some other type of innovative conservation financing mechanism, acceptance of no action or further R&D to find innovative and lower cost ways of gully remediation are needed. Clear property rights and responsibilities would need to be established for any finance mechanism.
	Remediation of active gullies – includes and major earth works	Maybe or no-comments for previous, only sometimes harder	
Alluvial gullies	Erosion prevention (fencing and reduced/controlled livestock access and linear features management	Yes, but only provided there is no potential for a perverse outcome	Yes – same comments apply as to hillslope gully erosion prevention

	Remediation of active gullies - minor works/management actions – no major reshaping	Maybe or no	The comments as for hillslope gullies. Incentives need to be on the basis of an assessment of benefits and costs and whether the landholder can meet requirements associated with maintaining the benefits (binding agreement extending to future property owners). If these can't be agreed, then another mechanism or no action would be more appropriate.
	Remediation of active gullies - major works including re-shaping	Maybe or no	
Streambank erosion	Management of stock on frontage country to achieve end of dry season ground cover targets	Yes	Yes – if there are high public benefits, low private benefits. Landholders would be expected to maintain fences and would need to agree (binding agreement and accept that compliance measures are an important part of the agreement). Demonstrating that there are sufficient off-stream watering points could be an important part of assessing whether stock management on frontage country will achieve the public benefits benefits, otherwise there is potential for a perverse outcome (more paddocks for grazing management but without stock exclusion from waterways).
	Regeneration of riparian frontage (large waterways)	No	No – the primary means of achieving riparian regeneration is through grazing management.
	Engineered stream bank toe protection or bed protection	No	No, the landholder does not control river management.

A.5 Appendix A References

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Appendix B Adoption of new agricultural practices

B.1 Introduction

Extensive literature about the adoption of technologies in agriculture exist in the international context and in relation to Australia including GBR catchments. In this section the broad influences on adoption are discussed before the discussion is focused on the GBR and the BBB.

B.2 What influences adoption broadly?

Pannell et al. (2011) note that adoption is a learning process and as such is continuous and following the sequence of:

- awareness of a problem or opportunity (including understanding of the relative advantage that adoption may present[12]);
- non-trial evaluation (information collection);
- trial evaluation (if small scale trials are not available, the rate of adoption decreases significantly);
- adoption (if the trial is successful, adoption might be ramped up);
- review and modification; and
- non or dis-adoption.

The learning process is influenced by the characteristics of the landholders such as the families[13] and broader social environment as well as the characteristics of the innovation (Pannell et al., 2011). In their initial discussions, Pannell et al., (2011) refer to agricultural practices. However, it is recognized that the adoption of conservation practices may be less likely to follow these norms because they are relatively more complex then agricultural practices, and/or the benefits are less observable. (Pannell et al., 2011) also suggest that a number of social processes also influence adoption. These are:

- the existence and strength of social networks;
- the physical proximity of other adopters (due to observability and trialability);
- distance of property to an information source;
- history of relationships between landholders and those with the information;

[12] Impact on short term costs, profits in the medium to long term, impacts on other parts of the system within which it is embedded, adjustment costs to facilitate adoption, impact on riskiness, compatibility with existing technologies, beliefs, values and practices, complexity, government policies, impact on family lifestyle, self-image, environmental credibility.

- ethnic and cultural difference; and
- extension, marketing and promotion programs.

Finally, demographic and situational variables are important. These include:

- financial capacity to adopt;
- off farm income (financial and time-based ability to adopt);
- property size;
- age (especially when there are long time lags between investment and payoff);
- education levels; and
- reason for holding land (agricultural production or lifestyle)

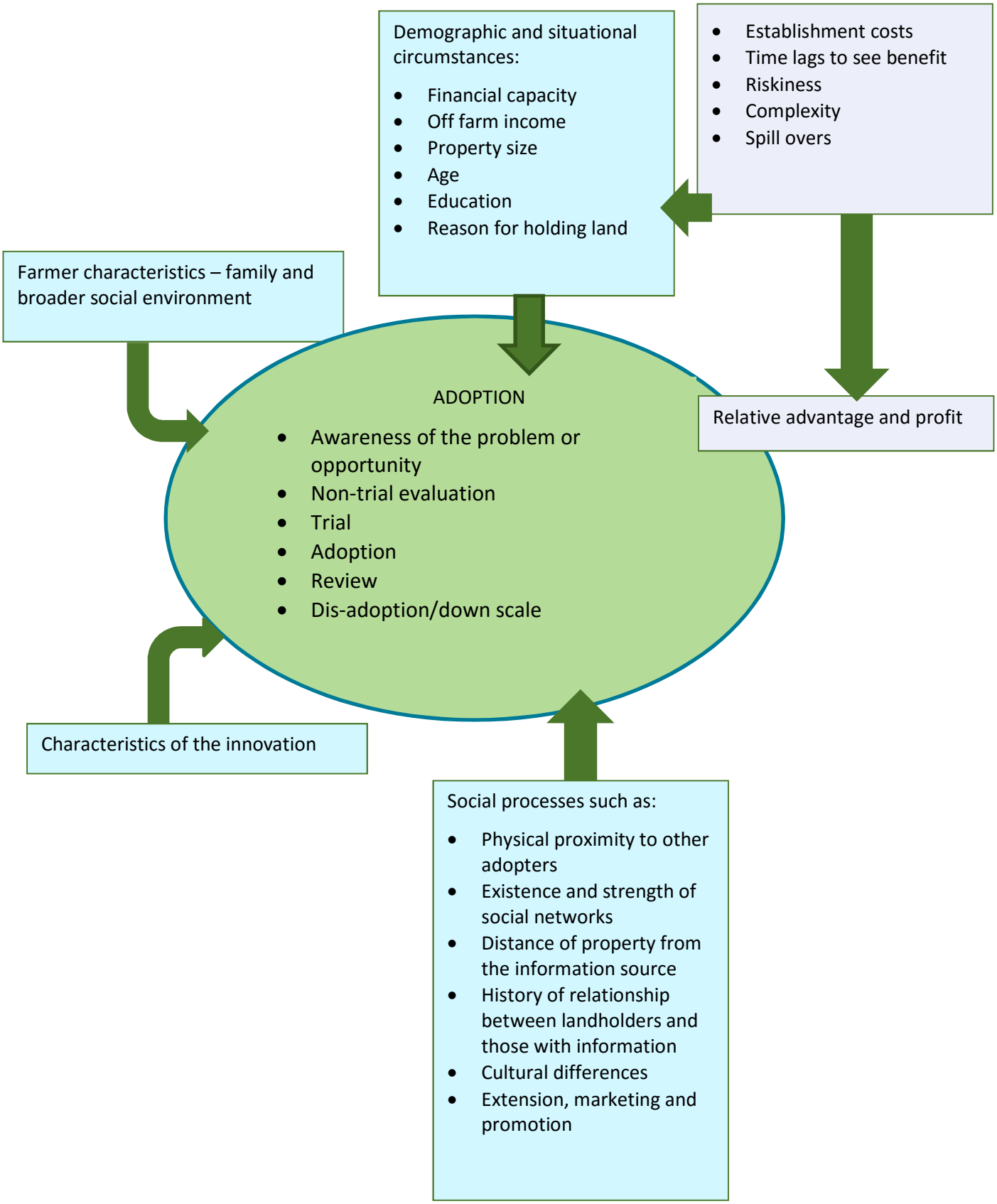
Figure B1 summarises the influences of adoption of conservation practices as per the literature.

Pannell et al. (2011) suggest that relative advantage and profit have strong implications for adoption of conservation practices. The lower the profitability of a conservation practice, the higher the conservation goals of the farmer need to be to adopt the practice. Other factors that impact on the relative advantage of conservation practices include:

- high establishment costs;
- long time scales to see benefit;
- riskiness;
- complexity; and
- spill overs.

Rolfe and Gregg (2015) summarise Pannell et al. (2006) reasons for non-adoption of conservation practices to be due to:

- landholders not having relevant information about the problem or opportunity (which can be solved with extension, research, development and training programs);
- landholders have the relevant information but there is no benefit for them to adopt (which can be resolved using either regulation, grants and competitive tenders for one off change or payments can be made for ongoing change); and
- there is risk and uncertainty associated with making the change (this can be managed with the clarification of property rights, designing programs which allow landholders to trial different practices coupled with extension and incentive mechanisms that address the barriers to adoption).



Apx Figure B.1 The influences of adoption

Source: Adapted from Greiner (2015); Greiner and Gregg (2011); Greiner, Patterson, and Miller (2009); Herr, Greiner, and Stoeckl (2004); Pannell et al. (2011).

B.3 The adoption literature for the GBR

There is an increasing literature discussing the factors that affect adoption of agricultural broadly and conservation practices, specifically in Australia and targeted to understanding in GBR catchments. Key findings of research into adoption of land management and conservation practices in the GBR is provided in Box B.1.

B.3.1 Key factors and findings of land management change adoption in the GBR

Box B. 1 Summary of barriers to adoption of conservation and land management incentives in the GBR region

Greiner (2011) (Northern Australia):

- Found that intrinsic motivations of farmers were more dominant than financial motivations for farmers in Northern Australia when it came to adoption of conservation practices. The exception to this was for works that required large capital costs
- Conservation management not fitting with current practices and/or not fitting with goals presented a significant barrier to adoption
- Lack of trial ability was a barrier to adoption
- Required investment in skill were also significant adoption inhibitors.

Januchowski-Hartley (2012) (Mackay Whitsundays):

- In the Mackay Whitsundays found that program bias towards ecological rather than production outcomes, impractical programs and government mistrust were barriers to adoption for riparian conservation incentives
- Private benefit was a strong driver for engagement. Private benefit was reported as being from “a sense of stewardship” and “improved landscape aesthetics”.

Greiner (2009) (Burdekin)

- Found that conservation and lifestyle goals are the prime motivations for graziers in the Burdekin
- Farmers with high conservation and lifestyle motivations tended to have the greatest adoption of conservation practices
- Those motivated by economic/financial and social goals are looking for external assistance such as government incentives and extension

Herr (2004) (Burdekin)

- Impediments to conservation practice adoption fall into the categories of 1) due to uncertainty; 2) due to information gaps and 3) due to financial constraints
- Landholders preferred financial incentives such as tax concessions and cost sharing arrangements as well as tenure conversion from leasehold to freehold for conservation effort
- Insufficient labour resources and variable climate conditions were significant impediments to conservation practices in general. These plus uncertainty about tenure, uncertainty about the industry, loss of productive capacity on property, lack of broader community support and insufficient information about optimal management practices were impediments to adoption more generally

Greiner (2015) (Burdekin)

- Goals such as making money are usually only tools for achieving higher order aspirations such as securing a family lifestyle. The higher order motivations drive landholder decision making
- Higher payments, shorter contracts and more flexibility significantly increased the chance of participation. Preference for external monitoring.
- Higher monetary incentive is required for longer contracts or for contracts that require cattle to be removed from an area. There is a strong preference for flexibility within contracts. There is great heterogeneity of preference across contract attributes. **Programs tailored to the average will attract very few. Programs need to be well tailored to those that need to be engaged.**

B.3.2 Land management change adoption in the GBR – the detail

Rolfe and Gregg (2015) assess factors that affect adoption of improved management practices for graziers in GBR catchments. They state that intrinsic motivations of farmers were more dominant than financial motivations when it came to adoption of conservation practices (this is widely supported, see also Greiner (2015)). Within this, attitudes to risk, conservation ethic and lifestyle motivations were indicators that landholders were more likely to adopt conservation practices while landholders with strong financial and economic drivers stated that they were unlikely to adopt conservation practices unless there were clear financial incentives. In relation to riverine protection programs, Januchowski-Hartley et al. (2012) state that barriers to adoption in the Mackay Whitsunday catchment included a program bias towards ecological rather than production outcomes, impractical programs and government mistrust. In this study, landholders noted that private benefit was a strong driver for engagement while cash for on ground works, extension and community recognition were the most preferred incentive mechanisms.

Greiner and Gregg (2011) and Greiner et al. (2009) also noted that intrinsic motivation was often greater than financial motivation for conservation practices.[14] The exception to this in Greiner and Gregg (2011) was the adoption of management of frontage country and rotational grazing. It is noted that this is probably due to the capital costs to fence and provide watering points required for these management actions. With respect to riparian vegetation management, Herr et al. (2004) found a negative association between the number of family members working on the farm and the likelihood that riparian vegetation would be fenced off Greiner et al. (2009) highlight that graziers that they surveyed in the Burdekin noted the 5 most highly rated property goals were to: 1) pass on land in good condition; 2) produce high quality food; 3) enjoy farm work; 4) feel independent; and 5) look after the environment. Greiner et al. (2009) note that conservation and lifestyle goals are the prime motivations for graziers in the Burdekin. Similar to Pannell et al. (2011), Greiner and Gregg (2011) note that conservation management not fitting with current practices and/or not fitting with goals presented a significant barrier to adoption. Similarly, complexity, lack of trial ability (also Whitten, Reeson, Windle, and Rolfe (2013)) and the required

[14] (Greiner, 2015) suggests that assessing motivations is useful when studying adoption as the higher order motivations tend to be those that drive landholder decision making.

investment in skill were also significant adoption inhibitors. It is interesting to note that the impact of adopting conservation practices on profits were never identified as barrier to adoption. Despite this, once off payments rather than payments for ecosystem services were suggested to encourage adoption. Greiner et al. (2009) found that graziers with lifestyle and conservation motivations had the greatest adoption of conservation practices whilst those motivated by economic/financial and social goals tended to be looking for external government assistance such as government incentives and extension to assist in the adoption of conservation practices.

Greiner et al. (2009) focused on the impact of risk, defined as measurable and immeasurable uncertainty, on adoption. They noted that landholders who saw themselves as risk takers with respect to new grazing practices had a higher rate of adoption of rotational grazing, adjustment of stock to pasture condition and early destocking for drought. Managing grass cover was seen to be the best option for managing risk. On the theme of risk, Greiner and Gregg (2011) found that landholders wishing to maintain their resource base were more likely to identify interest rates and debt payments as a risk and inhibitor to adoption. Greiner and Lankester (2007) highlight that farm debt is an indirect driver of intensification requiring graziers to generate sufficient income to cover interest payments and principal repayments through good and bad years. The need for fixed payments can prevent early and adequate de-stocking in drought years and motivates short term maximization of production. This raises questions about the use of relationship with banks as a potential in the mix of incentive schemes to consider (see discussion on debt for conservation swap).

A study by Herr et al. (2004) provides some additional insights into Burdekin landholder motivation for conservation adoption. These authors categorise impediments to motivation into 3 categories: 1) uncertainty; 2) information gaps; and 3) financial constraints. Herr et al. (2004) also found that increases in equity in a property had a negative influence on paddock spelling and riparian vegetation management and that landholders were less likely to spell paddocks if they owned rather than managed the property, had a family successor or had leasehold title. Insufficient labour resources and variable climate conditions were significant impediments to conservation practices in general. These plus uncertainty about tenure, uncertainty about the industry, loss of productive capacity on property, lack of broader community support and insufficient information about optimal management practices were impediments to adoption more generally. Landholders surveyed in this study rated financial incentives (especially tax incentives) as the most effective adoption assistance mechanism. Other suggestions for adoption assistance included cost sharing approaches and the conversion of tenure from leasehold to freehold and rate/lease reduction for conservation. More specifically, those who rated variable climate conditions as a strong impediment rated conversion from leasehold to freehold tenure as an effective policy for conservation. Those that rated lack of community support as an impediment rated income tax incentives as an effective policy. It must be noted, however, that income tax incentives only apply in years of high income (they are also not targeted to areas of high conservation value). Accordingly, it is argued that income tax incentives could be more effective if supplemented with other mechanisms such as tradable resource use permits and assurance bonds. Finally, those who did not see lack of community support as a problem rated debt for conservation swaps as highly effective.

Whitten et al. (2013) and Greiner (2015) focus on the impact of contract design on uptake or conservation schemes. In these studies, it is noted that contract features such as the duration of

contracts, the influence of a contract on land security and the ability to exit a contract all affect uptake. Using choice modelling Greiner (2015) found that higher payments, shorter contracts, flexibility within contracts and the ability to use external monitoring providers all increased the chance of participation. Whitten et al. (2013) also highlights the need for high payments stating that this may help overcome the barrier imposed by the difficulty to trial many conservation activities. Greiner (2015) also notes that there is great heterogeneity across landholders in terms of their properties, management styles and motivations and a conservation program made for the average will attract very few landholders. Whitten et al. (2013) also note that there are a number of landholder factors that reduce participation in conservation programs notably organization of the farm and specialist skill that is required.

B.4 BBB landholders and adoption

There are a number of studies that have focused on adoption of BMPs in the Burdekin from which some adoption factors for the BBB have been derived. Key findings from the literature note that:

- On most properties in the Burdekin and the BBB particularly, management decisions are made in consultation with other family members which can make the decision about adoption more complex.
- Respondents in the BBB tended to be younger which should support greater adoption of management practices.
- In the BBB, adjustment of stocking rates and fencing off existing and new riparian buffer zones were regarded as the BMPs with the highest environmental benefits.
- Waterhouse et al. (2017) also reports on a Greiner and Lankester survey (2007) which assessed the impact of farm debt on adoption. This research found that graziers with more debt tended to carry more cattle than they would like due to loan servicing commitments and also tended to be reluctant to reduce stock number in a drought.

BBB respondents noted the following barriers to adoption:

- Operational and financial constraints (especially those caused by climate variability and uncertainty surrounding the future);
- Lack of science or information, lack of skills on property and lack of local leadership;
- Lack of motivation due to landholders being unaware of the decline in land condition, ignorant of better management and comfortable in their current situation;
- Perceived (more cattle = more money) and actual financial barriers (need to service high debts, lack of funds and resources in terms of labour and equipment);
- Lack of time to think, plan, consider and implement new strategies; and
- Lack of peer support and industry leadership (encouragement, mentoring and relevant demonstrations).

BBB landholders suggested mechanisms to overcome current barriers to adoption which included:

- Education (about the impact of farm management on biodiversity – see Greiner (2015) discussion on this in terms of identifying the richness and uniqueness of biodiversity), training, extension and research including technical and applied management courses, environmental management courses, on property demonstration sites and more research;
- Property management planning;
- Financial incentives;
- Regulatory approaches and cross compliance arrangements;
- Rate and rent relief;
- Grants;
- Stewardship payments;
- Interest subsidies;
- Subsidies for the purchase of machinery and herbicides and to attend courses and field days;
- Farm management deposits;
- Catchment groups;
- Targeted (1-on-1) extension and mentoring;
- Business planning;
- Critical thinking skills to help identify priorities;
- Case studies and cost benefit analyses; and
- Demonstrations.

Appendix C Incentive mechanisms

In this Appendix, the incentive mechanisms, as they fall under the categories of non-financial and financial are presented. Regulatory 'incentives' are not discussed as these are considered to be outside the scope of this research.

C.1 Non-financial incentives

C.1.1 Extension/suasion/social recognition

Extension/suasion is an incentive approach aimed at changing an individual or firm's perceptions and priorities about land management through information provision, education programs and social recognition and pressure schemes. This incentive approach has the benefit of better informing people about the implications of their actions and rewarding those that are doing the right thing in a way alternative to the provision of financial reward (social recognition). Information can act as an incentive in two ways. Firstly, private benefits to improved land management may be highlighted. Secondly, some landholders may wish to change their behaviour if negative public impacts are brought to their attention (this type of information is sometimes called "moral suasion"). It is recognised that some landholders are intrinsically motivated to do the right thing. Whilst these landholders gain some form of private benefit (financial and non-financial) from good land management, their motivations can be enhanced through some form of social recognition. This may be in the form of status (Land for Wildlife sign on the gate or being a recognised 'Reef Champion' are examples of this. Other examples include award nights, demonstration sites and case studies) and can also be through activities such as providing access to exclusive training opportunities for high performers.

Suasive instruments are usually low cost to administer, and thus are a good option for a first choice incentive scheme. It is important that information and education campaigns provide practical and clear advice on changing behaviour. Social pressure schemes are more likely to succeed in instances where the scientific evidence for the undesirability of an act is widely accepted (Comerford & Binney, 2004).

Whilst extension/suasion/social recognition programs are an important component in the incentive mix they rarely achieve widespread NRM change when used in isolation. Instead, suasive measures are often used as an accompaniment to other incentive programs – for example a financial payment linked to engagement with an extension officer to produce a property management plan. This form of non-financial incentive can also be inhibited if applied in a start/stop nature as this can lead to frustration and dis-adoption.

Apx Table C.1: Key Strengths and challenges of extension/suasion/social recognition style incentives

Strengths	Challenges
• Non-invasive • Informative • Low cost to administer • Can be used as a stepping off point for engagement and information collection for other more targeted incentive schemes such as grants, subsidies and competitive payments	• Likely to only generate small and slow change unless applied in conjunction with regulation or a financial incentive • Requires landholders to engage voluntarily (so unlikely to attract those that have no history of engagement) • Start/stop nature could create frustration and dis-adoption • Action stops when extension stops so limited application for long term outcomes

C.1.2 Brokering

Brokering is an incentive mechanism that seeks to lubricate/assist a current market operate better for the environmental outcome. A broker operates within an existing market to reduce the transaction costs of exchange and thereby facilitate more/better environmental transactions. Water brokers in Australia and the United States, government operating as a broker in the Pinelands tradeable development right market in the U.S as well as the Australian BushBroker, BioBanking and EcoFund vegetation offset schemes are all examples of where a broker has emerged or been introduced to reduce the transaction costs of using an existing market for an environmental outcome (Coggan, Buitelaar, Whitten, & Bennett, 2013).

Apx Table C.2 Key Strengths and challenges of brokering as an incentive

Strengths	Challenges
• When the markets exist, low cost to implement • When a market exists, facilitates resources flowing to their highest value use and subsequent efficiencies	• Relies on the existence of a market with defined property rights, buyers and sellers and gains from trade. • No markets to broker into as yet • need to define how they would broker (fee/fee-less) • Need to assess the cost and benefits of brokering in an existing market (or sponsoring a private party to do so)

C.1.3 Product differentiation

Another successful approach in this style of incentive has been in product differentiation. Once again, this style of incentive seeks to manipulate a current market such that it operates to send market signals to reflect the public good. A good example of this approach is Banrock Station wine which is marketed based in part on presenting the positive environmental management of Banrock Station wetlands as a consumption attribute of the wine. This is done via including statements about wetland management on wine bottles and donating to local wetland conservation projects worldwide from the purchase of each bottle of Banrock Station wine. Another successful example of market lubrication has occurred in New Zealand through Taupo Beef. In this case, beef producers in the Taupo catchment are regulated to comply with a nitrogen emission cap. In order to meet this cap and remain profitable, producers concentrate on producing a premium beef product which gains a 20-30% premium price over retail high end beef. The premium nature of the beef profit is enhanced by environmental compliance which is

substantiated and verified by local government (Waikato Council). Positive environmental product differentiation also occurs for commodities (timber) and regions (King Island produce).

The Hughes family or Dulacca with their Rangeland Quality Meat were recently BMP accredited with AgForce which is contributing to the sale of premium sirloin to the Regatta Hotel in Brisbane (AgForce, 2017).

Apx Table C.3 Key Strengths and challenges of product differentiation as an incentive

Strengths	Challenges
• Market already exists for beef which could reduce the administration cost • If initiated by growers could be a way to engage with landholders who don't engage with extension • Producers get financial reward from buyers (LDC budget could be used for other initiatives) • Linked to BMPs or other initiatives	• Slow to start and see rewards • Requires very good documentation, sound metrics and verification (self-assessment, 2nd or third party depending on the market) to achieve credible results • No evidence that there will be a price premium for BBB beef at this point

C.1.4 Voluntary conservation covenant

Conservation covenants are legally binding agreements between a statutory authority and a landholder. Typically, the only authorities able to offer conservation covenants are State government agencies and departments, and some local governments and not-for-profit organisations. Covenants can be common law agreements that last for a specified length of time or statutory agreements that are attached to the title of the land and bind future landholders. The covenant will specify certain conservation activities to be undertaken by the landholder, such as leaving remnant vegetation standing and/or actively managing the natural resources on the property through such actions as fencing and revegetation. A financial payment could be linked to the upfront signing of the covenant and ongoing payments for land management could be tied to the conservation covenant for a period of time and subject to meeting agreed outcomes (fencing a gully, for example).

The main benefit to conservation covenants is that they are voluntary and can protect important natural resources on private lands. Additionally, a range of NRM issues can be addressed in the one agreement. This instrument will attract landholders who are concerned about the future management of their properties.

The main disadvantage, however, is that the voluntary nature of the agreements may mean that key properties are not protected, and a coordinated landscape outcome may not occur. This approach is also not likely to engage landholders who have been difficult to engage with in the past.

There are a number of ways by which a conservation covenant can be placed on a property or portion of a property. One way a property may have a conservation covenant placed on all or a portion of it is through a revolving fund. Revolving funds operate through the purchase of a property, conservation covenant placed on all or a portion and the property is sold on with the covenant on title. There are a number of examples of revolving funds operating throughout Australia. Trust for Nature is probably the most well-known. There are already a number of

conservation covenants in the BBB. A conservation covenant could be a good incentive to maintain good gully management over time.

Apx Table C.4 Strengths and challenges for implementation of voluntary conservation schemes

Strengths	Challenges
• Conservation covenant is on title and applies in perpetuity • Contract could be linked to financial payments for the upfront signing and ongoing management of the land under covenant. This would be subject to negotiation. • Could be linked to other organizations such as Trust for Nature to administer the conservation covenant through a revolving fund	• Conservation covenant applied at the state government level (which have geographical restrictions) • Management agreement is not attached to title so not binding on future owners/managers • Needs monitoring and compliance assessment to ensure the benefits are maintained • Voluntary so unlikely to attract all of the target landholders

C.1.5 Voluntary management agreements

These operate in a similar manner to conservation covenants except that they are not attached to the land title in perpetuity. Rather, they are a binding agreement with the current landholder. Although these agreements do not offer permanent protection, they may attract landholders that are worried about the effect of a covenant on their land value.

Apx Table C.5 Strengths and challenges for implementation of voluntary management agreement

Strengths	Challenges
• Introduction to a relationship with LDC / water quality programs • Could lead to an agreement on title • Flexibility and an end	• Management agreement is not attached to title so not binding on future owners/managers • Needs monitoring and compliance assessment to ensure the benefits are maintained • Voluntary so unlikely to attract all of the target landholders

C.1.6 Industry codes/self-regulation

Industry self-regulation is the process where an organization or industry group monitors its own adherence to legal, ethical or safety standards rather than have these enforced by a third party. Industry codes of conduct and self-regulation, which largely occur through self-declaration, are increasing in popularity across a range of industries. Unfortunately, very few programs require any form of third-party verification. However, third-party verification requirements can be enormously complicated and costly to implement. There are some examples of successful third-party verification – ISO14001 for environmental management, ISO 9000 on quality management and SA 8000 on labour management, are examples. It has been found that industry standards with third party verification tend to result in better outcome performance (environmental performance, for example) compared to those who have not adopted (Lagace, 2018).

Strengths	Challenges
• Reward those at the top end as a form of social recognition • Could engage landholders who have been difficult to engage with before • Can use the grazing BMPs as a stepping off point	• Requires third party verification to hold any weight. This is likely to be complicated and costly

C.2 Financial

C.2.1 Grants and subsidies

Grants and subsidies provide a sum of money given to contribute to the financial cost of conducting on-ground work. A grant is a direct and one-off financial payment whilst a subsidy is an indirect payment on an input to production (diesel subsidy, fencing subsidy and discounted training fee). The benefits of subsidies and grants are that they are popular and well understood. They may be flexible and can be used by large or small groups addressing problems at a variety of scales. Grants and subsidies are usually given on the understanding that the recipient contributes resources and/or time in-kind to the project. It is thought that they should be aimed at:

1) Projects that would not otherwise be undertaken due to a lack of resources;

2) To projects that will have clear anticipated outcomes; and

3) To projects that offer clear and positive public benefits (Comerford & Binney, 2004; Pannell, 2008).

It should be possible to estimate the private-public benefit split and provide guidance on the input required from the landholder. Grants and subsidies may be particularly useful in situations where a "trigger" is needed to help landholders overcome initial barriers to change, such as a new type of equipment or infrastructure (Comerford & Binney, 2004; Pannell, 2008). Grants and subsidies are usually one-off payments and as such may not be suitable for encouraging ongoing land management change. This is seen as a challenge for this approach, but this could be overcome by withholding a portion of the money to be used as maintenance payments for ongoing compliance (such as the maintenance of fences). Another limitation is that grants and subsidies often address only one action rather than the many changes that might be needed on a property.

Grants and subsidies are not without their criticisms. The main disadvantage of this approach is that due to asymmetric information it may be difficult for regional NRM bodies to choose the projects that will generate the greatest environmental outcomes for the investment (bang for buck). This might be seen as an inefficient use of public funds. Grants and subsidies can also be administratively complex for applicants, contributing to high administration costs and low take-up of the incentive.

Apx Table C.6 Strengths and challenges for implementation of subsidies and grant style incentives

Strengths	Challenges
• Well known and understood • Flexible. Can be used for big and small projects • Recipients usually provide some level of in kind and/or financial contribution to the project •	• Flat rate usually does not reward innovation • Does not take advantage of heterogeneity of landscapes and landholders and therefore potential for gains from trade and efficiencies • Very unlikely to engage those that have not engaged before • Usually one off so does not support change over time • Requires extensive information by the NRM body to know the right rate to pay • Is not often accompanied by monitoring and compliance so often no accountability or reportability

C.2.2 Stewardship payments

Stewardship payments are payments made to a landholder for carrying out actions that maintain current NRM values or that improve NRM outcomes on their properties. These payments are based on the premise that the landholder would be providing a public service and the level of the fee paid reflects this. The main benefit of a stewardship payment is that they can address more than one problem at a time (for example, address biodiversity and water quality outcomes concurrently) as well as passive management actions (for example, the retention of native vegetation). Stewardship payments are a clear way of acknowledging the public benefits from a private landholder's actions. A challenge of stewardship payments is deciding on the correct level of payment. Determining eligible activities can also be difficult, as payment should only apply to activities that exceed the landholder's "duty of care", a concept that can be hard to define.

One way to overcome these challenges is to use a competitive process such as an auction or a tender to allocate the stewardship payment. Through the competitive process, landholders are asked what work they would be willing to conduct on their property (supported by some form of management plan for this work to be conducted over a number of years) and what price they would be willing to accept to conduct this work. A fixed budget is then allocated out to landholders based on which landholders 'bid' offers the best value for money (ecological outcome and cost). A competitive tender cannot guarantee the extent of change but caps the cost of the incentive. A well designed and implemented competitive tender not only reveals the cost for landholders to change but can achieve greater environmental change for a fixed budget compared to a fixed price scheme. For example, the results of the BushTender trial were compared to a fixed price scheme to reveal that for the same budget, a fixed price scheme would generate 25% less biodiversity compared with the competitive tender approach (Stoneham, Chaudhri, Ha, & Strappazzon, 2003).

There are a number of factors that need to be in place for a competitive tender to realise its potential. This incentive approach is best used when there are many sellers (so there is competition), when there is heterogeneity across properties and bidders (if all sellers are the same then a market will be no more beneficial than a fixed price scheme) and when a benefit index can be developed through which bids are assessed and ranked. Competitive tenders are not costless to

design and administer, therefore it is advised that expert assistance is brought in to review the potential costs and benefits, design and pilot such a scheme.

Apx Table C.7 Strengths and challenges of stewardship payments

Strengths	Challenges
• Pays for outcomes and so pays for more than one action • Can be used to pay for outcomes over time	• Deciding on duty of care over which stewardship is rewarded • Deciding on the correct level of payment • Budget to facilitate payments • As it is fixed price, does not utilize the heterogeneity of the landscape and landholder cost to get the greatest bang for the buck • May not engage with landholders who do not usually engage

Apx Table C.8 Strengths and challenges of a competitive tender

Strengths	Challenges
• Pays for outcomes (so can be used to make payments over time) • Reveals the cost for landholders to conduct activities • Potential to be a more cost-effective approach to allocating a fixed budget than a fixed price scheme • Informs landholders of the public benefit of land management • The competitive process may be of interest to landholders who have not engaged with	• Need many sellers to be competitive (which is not the case if the tender was only available in BBB, would need to be much broader across GBR catchments) • Need to generate a benefits index to assess offers for value for money • Design and implementation of such a scheme can be complicated which can generate high transaction costs to design, implement and administer • Need to consider if paying over time or one-off payments for one off action • Need to enforce management plan to maintain value (can be linked to payments) and be clear about management responsibility • For gully issues in the BBB time-periods need to be long in some cases to generate benefits

C.2.3 Cap and trade

A cap and trade style incentive is a polluter pays financial incentive but enables flexibility and innovation by creating a cap on the total level of an activity that can take place and allocates rights to emit to this cap to market participants. Participants can then buy and sell emission rights according to their needs. This style of incentive is best applied when there is a clear emission target that must be met. A cap and trade scheme requires administration by an agency that has the authority to set and enforce an emission cap and allocate and enforce rights to emit as well as the conditions under which trade can take place and how rights will be monitored and enforced.

Reef credits is a cap and trade style incentive being considered for the BBB. There are many institutional components that are being worked through for this scheme.

Apx Table C.9 Strengths and weaknesses of a cap and trade style incentive

Strengths	Challenges
• Provides certainty about emission for all participants and caps total emissions • Allows emissions to occur for the highest value output • Facilitates compensation to those who reduce emissions	• Needs an enforced cap • Need a clear understanding of actions and sediment transfer outcomes • Need many buyers and sellers to create a market • Requires extensive information to allocate emission permits, design and enforce rules for trade and monitoring and enforcement (which is all costly to enact and administer)

C.2.4 Rate rebate

Rate rebates are an incentive that can be applied by a local government but not directly by a regional NRM body. A local government can encourage positive NRM practices through offering an exemption from rates, differential rating or reduction in rates as a reward for adopting a voluntary conservation covenants or managing a sensitive area on a property. Rate rebates are probably best suited to areas where rates are high enough that a rebate would act as an incentive for change. However, offering a rebate can still be effective in areas where rates are low as this provides a good signal to landowners that conservation is an important land use. This is especially true if agricultural production attracts a rebate, as otherwise moving from agriculture to conservation will lead to an increase in rates.

Some challenges of rate rebates include the difficulty that might be incurred to establish the level of a rate rebate (if it is too low, the activity will not be encouraged; if it is too high the revenue loss may be higher than the outcome justifies). Some local governments in remote areas with low rate bases may also find it financially difficult to offer rate rebates. In this instance, the regional body might be able to financially support local governments offering rate rebates for certain activities that help achieve priority outcomes. If the rate rebate program were to continue indefinitely, it might be more difficult for a regional body without permanent funding to provide financial support. These bodies may be able to set a trust fund to guarantee funding for a longer period of time. In other circumstances, regional NRM bodies could let local governments know which management actions are a regional priority and encourage them to support these actions with rates rebates.

Apx Table C.10 Strengths and weaknesses of rate rebate style incentives

Strengths	Challenges
• Could engage landholders who have been difficult to engage with before	• NQDT do not have the authority to conduct a rate rebate scheme directly • Won't be an incentive of interest in areas of low Local Government rate base • Linking land management to rate rebates and ensuring outcomes over time

C.2.5 Tax concession

Tax rebates, exemptions or deductions are tools that reduce a landholder's tax burden if certain activities are conducted on-ground. The main benefit of tax concessions is that they can be delivered through the current tax system, therefore saving on administration costs. The main disadvantage to tax concessions is that they are not as useful to producers with low incomes and therefore low tax contributions, and so the strength of the incentive can be reduced. Further, it is not possible to directly target key properties with a tax concession. This tool is only open to direct use by State and Australian Governments, and consequently the primary role of LDC would be in promoting the use of current tax incentives to landholders and their financial advisers. LDC could also identify problems with current tax incentives (including whether they encourage poor NRM) and possible new tax incentives and communicate these recommendations to the government responsible. Landholders who are participating in an incentive program should be notified as to the potential tax implications of receiving incentives as this can change their opportunity costs of participation.

Apx Table C.11 Strengths and weaknesses of tax concession incentives

Strengths	Challenges
• Removes a known barrier to improved land management • Could engage landholders who have been difficult to engage with before	• NQDT do not have the authority to conduct a tax related incentive • How to ensure landholders conduct their on-ground actions

C.2.6 Low interest loans

A low interest loan provides funding for approved projects at low interest rates for repayment. Loan repayments/debt servicing has been raised as a barrier to adoption of improved land management by BBB landholders and therefore could be an incentive that engages with landholders who have not engaged in other styles of incentives in the past. The added advantage of a low interest loan is that it could be used to fund large scale engineering works to manage for erosion. This style of incentive is not without its challenges. A low interest loan still places the cost of up front and ongoing land management change on the landholder.

There are already examples of low interest loans to the Queensland agricultural community. At present the Queensland Government through the Queensland Rural and Industry Development Authority (QRIDA) has a sustainability loan which can fund up to $1.3 million to rural landholders with a loan term of up to 20 years at low interest rates fixed for 1, 3 or 5 years. Sustainability loans are available to meet long term sustainability on properties for operators: who are full time primary producers; who have been operating for at least 2 years; have sound prospects for commercial viability; demonstrate financial need; and provide an adequate management plan.

As a signatory to the Natural Capital Declaration, the National Australia Bank (NAB) is working to embed an understanding of natural capital into its business. Through partnering with the Clean Energy Finance Corporation, the NAB has been offering business clients a 0.7% discount for renewable energy and energy efficient assets. 88% of loans in this area have gone to rural clients. The NAB is working with CSIRO to understand the link between natural capital and financial

performance in the northern rangeland grazing system. Through this they have come to an understanding that lending on financial information only will result in the gradual degradation of the natural capital – natural capital stocks are an important part of the risk management profile in grazing landscapes (Bentley, 2017).

Apx Table C.12 Strengths and challenges of low interest loans

Strengths	Challenges
• Directly addresses a known barrier to adoption to land management change • Provides a large upfront amount of finances which could be useful for projects requiring large capital investment (such as engineering works) • Already exist (QRIDA)	• Loan repayments still have to be made by the landholder • Interest of banks to engage • Does not fund the ongoing lost income from land taken out of production. There is still a financial cost to landholders

C.2.7 Debt for conservation swap

A debt for conservation swap is an economic instrument intended to break the cycle of increasing debt and environmental degradation. The concept is based on the premise that entities (countries or businesses) with high levels of debt are likely to exploit natural resources at above long-term optimal levels in order to meet short term debt servicing obligations and remain solvent (Greiner & Lankester, 2007). Debt servicing was raised as an impediment to adopting conservation management practices by graziers in the Burdekin (Greiner & Gregg, 2011). This is because when graziers have high debt they operate their business with a focus of servicing debt and do not have the capacity to work for other outcomes from their property. The debt for conservation notion is to reduce debt and thereby enhance financial viability while at the same time securing environmental outcomes through contracts that stipulate swap (Greiner & Lankester, 2007).

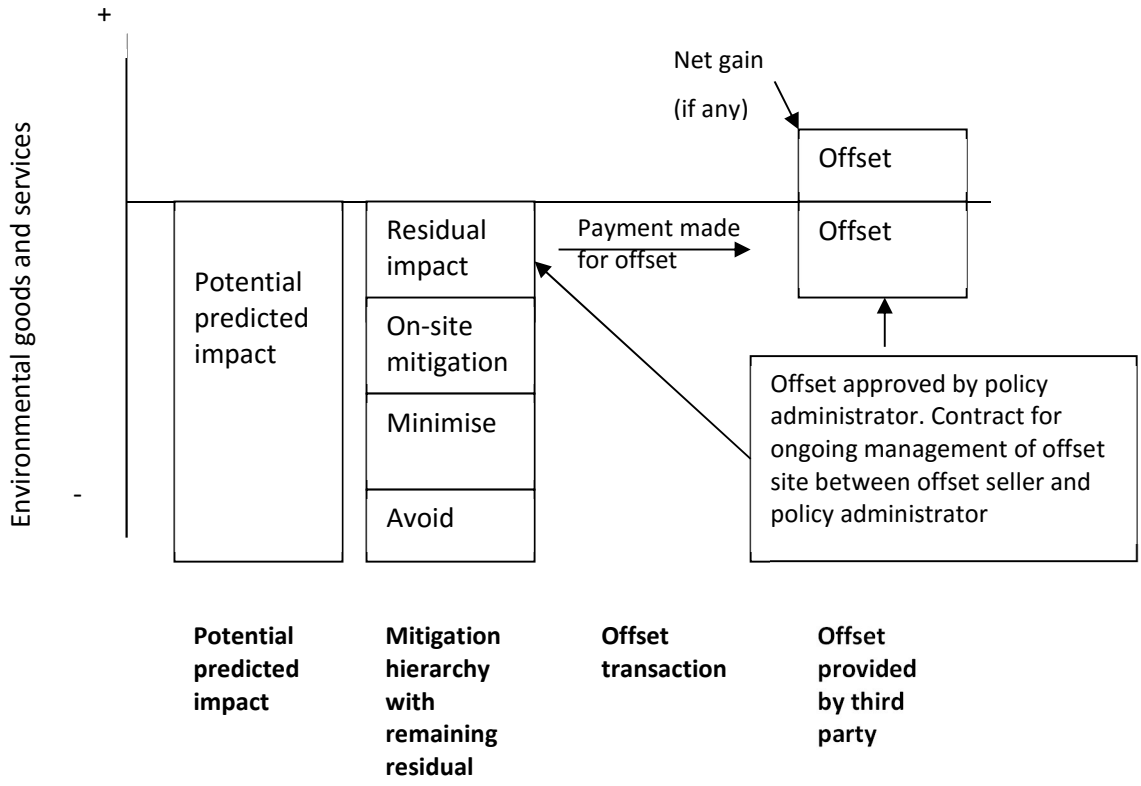
A traditional debt swap involves three parties – the debtor, an investor and a lender. In the international context, the investor (typically a conservation non-government organization) purchases the debt from the international lender (commercial bank or multilateral institution). The investor then negotiates with the debtor country to exchange the debt for a commitment by that country to use the equivalent amount of currency for an agreed purpose (such as nature conservation). Greiner and Lankester (2007) explain that the incentive for the swap in the normal context lies in the ability of the investor to purchase the debt at less than face value from the creditor and redeem it in the debtor country in local currency at face value. The discount is a result of the creditors low expectation for repayment by the debtor country and/or desire to reduce credit exposure. The proceeds of the swap – the difference between the purchase and redemption price is invested in environmental programs and projects. These proceeds are usually distributed by a local organization onto on-ground projects.

Apx Table C.13 Strengths and weaknesses of debt for conservation swap style incentives

Strengths	Challenges
• Removes a known barrier to improved land management • Could engage landholders who have been difficult to engage with before, especially if they are struggling with high debt servicing obligations	• How to ensure landholders conduct their on-ground actions

C.2.8 Offsets

Development offsets (referred to as offsets) are a form of environmental policy that allows development to impact on the environment provided that impact is mitigated on the development site, on another site (third-party offset) or in non-physical ways such that there is no net loss in the supply of environmental goods and services (Gibbons & Lindenmayer, 2007; Moilanen, van Teeffelen, Ben-Haim, & Ferrier, 2009; Norton, 2009; ten Kate, Bishop, & Bayon, 2004). There is much debate within the ecological literature surrounding what can be used as an offset (Gibbons & Lindenmayer, 2007; Maron et al., 2012). For example, offsetting activities may include planting trees or protecting existing vegetation in perpetuity. There are often limits to what can be offset, however. For instance, development approval and permitting provisions may require damage to be avoided or minimised on-site before an offset is allowed. It is also possible that some on-site impact mitigation may be required before an offset is allowed. By requiring mitigation but facilitating flexibility, in theory, offsets allow no net impact from a development to be achieved at least cost. The concept of third-party offsets, the offset scheme type concentrated on is illustrated in Figure 11.



Apx Figure C.1 Offsets within the mitigation hierarchy

Source: Adapted from Crowe and ten Kate (2010)

Apx Table C.14 Strengths and weaknesses of offsets

Strengths	Challenges
• Provides an external demand for an environmental activity • Facilitates innovation and flexibility with how environmental outcomes are achieved • Facilitates low cost environmental outcomes • Could engage landholders who have been difficult to engage with before	• Requires an impact to generate the demand for a credit which could result in a net loss • Can be very costly to create a metric that enables no net loss or net gain transactions

Appendix D Lessons learnt from previous programs

D.1 Introduction

A review was conducted of the literature (peer reviewed and grey literature) that evaluated the success of programs designed to improve land management practices of those involved in agriculture in general, and graziers in particular, within the Burdekin river basin and more widely across Australia.

In general, the review revealed a paucity of high quality impact evaluation studies regarding such programs. Ideally a study would compare the behaviors of landholders before and after their participation in such a program, whilst also comparing behavior changes over the same period of landholders that did not participate (providing a control group) allowing the evaluation of how behaviors have evolved with and without the program. Ideal studies would be able to assess additionality – that is how much additional environmental benefit has been generated from the program compared to that which would have occurred anyway. There were very few studies that fit these criteria. The review did reveal a small number of studies that focused on the behaviors of participants before and after the programs, however. Further studies based on the experiences of participants identified factors that may make the participants more or less likely to participate in future programs. The lessons learnt from both these types of studies are summarized below.

D.2 Lessons learnt and recommendations for future programs

D.2.1 Cost effectiveness of programs

No research was identified that compared the cost effectiveness of different incentive programs in delivering improvements to water quality. However, research has investigated the cost effectiveness of reductions in pollutants to different regions, determining benchmarks that can be used for assessing future projects. For the reduction of sediment load across the whole GBR region, the suggested benchmark was estimated at $259 per tonne, however reductions in the Burdekin specifically were found to be more cost effective than elsewhere with the cost for this region alone estimated at $106 per tonne (Rolfe & Windle, 2016). Research also suggested that voluntary conservation programs such as conservation covenants are likely to generate low additionality (Moon & Cocklin, 2011). This implies that financial incentives were paid for encouraging behaviors that would have occurred anyway without the incentive, due to the landholder being conservation minded or claiming incentives for committing not to use certain for production purposes when such land was non-productive anyway (Moon & Cocklin, 2011).

D.2.2 Evaluation of different methods of allocating funding:

Comparison of applications for funding by i) use of a scorecard / multi criteria analysis approach with ii) an auction approach (involving economic assessment of environmental outcome and cost

effectiveness) found that an auction approach gave better outcomes at a lower cost (Rolfe & Windle, 2009). Although widely used, the scorecard approach has a number of weaknesses: i) scorecard favours those who already have good practices so discriminates against those looking to move from poor to good practices; ii) scorecard takes account of other factors beyond cost effectiveness of delivering environmental outcomes; and iii) scorecard outcomes affected by subjective decisions on weighting of different factors and score standardization (Rolfe & Windle, 2009).

D.3 Evaluation of success of specific programs

D.3.1 Success in improving adoption of improved land management practices

Three studies were identified that considered the effectiveness of the Grazing BMP program at encouraging grazing practice change. Whilst all three studies found the program to be effective, the effectiveness rates differed greatly across the studies.

The impact of the Grazing BMP program on behavior was evaluated with a before/after approach to determine whether participants intended to make changes to their land management or indeed had actually made positive changes in (Moravek, Nelson, Anderson, & Reid, 2017) and a variant on the without/without approach to determine whether those who had made changes had been involved in the program. Moravek et al. (2017) found 78% of participants had made changes to their farming practices in some way, and 51% had made changes to their grazing land management practices. Of those graziers who had made a change in their grazing land management practices, analysis revealed they were significantly more likely to have interacted with extension (attended a workshop and/or participated in one on one) during that year or previously, indicating a relationship between extension activity and practice change adoption and suggesting maybe a time lag between extension activity and adoption. No significant difference was found in impact of different types of extension, comparing workshops attendance and/or one on one sessions.

The impact of Grazing BMP on encouraging adoption was also assessed by Long (2015) who found that the program had been highly successful in changing behaviours. In a before/after study, where 69 graziers (28 within the Burdekin) involved in the program were surveyed, it was reported that 97% had made at least one practice change following Grazing BMP participation, 86% were planning at least one change, 77% had sought additional advice regarding a potential change and 68% had requested additional training. Furthermore, the study reported that 94% of participants would recommend Grazing BMP to other graziers and 86% indicated they would complete a Grazing BMP reassessment. 80% of the graziers reported that their participation in Grazing BMP was to improve their management practices and thus were already motivated to make changes; the study made no attempt to assess the additionality of the program. The effectiveness of Grazing BMP workshops on behavior change was also assessed by eliciting participant views (from 70 participants across 13 workshops) on the completion of the workshop. The study found that 95% of participants had plans to make changes and or review their action plan (where they had identified changes); and thus concluded that this was clear evidence that workshop participants were prompted to review their business, plan changes and implement the changes. However, this

study did not follow up whether these actions/changes actually occurred, and again did not consider the additionally aspect of the grazing BMP program.

The Grazing BMP was also evaluated by Roberts Evaluation (2014). This study found that about half of participants in the program had implemented changes and found graziers were generally satisfied with the program and most would recommend the program to others, based on surveys of 41 graziers. This evaluation also reported that the project had exceeded targets with regard to the number of modules delivered to graziers, although the number of audits completed, leading to graziers receiving accreditation, were below target.

D.3.2 Success in improving profitability of program participants

The impact of the Grazing BMP program on grazier and beef industry profits was evaluated using a cost benefit approach, developing scenarios to compare the relative financial benefits of adopting the project or not over a ten-year time frame (Moravek & Nelson, 2015). The cost-benefit analysis found that participation in the program had positive net present value and thus improved profits of participating graziers, and sensitivity analysis demonstrated robustness of these findings (Moravek & Nelson, 2015).

D.4 Factors found to encourage participation in schemes and adoption of improved practices

Generally, landholders are likely to adopt new land management practices if these will help them achieve their goals, be they economic, social or environmental, or a combination of these (Waterhouse, Greiner, Bainbridge & King, 2017). These goals can be varied, and other factors relating to future ambitions and current capacities also influence whether programs are adopted. A good summary, which includes discussion specifically relating to the Burdekin region, can be found in Waterhouse et al. (2017, pp. 59-70). Furthermore, programs should be a good fit with existing land management or farming practices (Blackmore & Doole, 2013; Waterhouse et al., 2017).

D.4.1 Demographic factors

Landholders have been found to be more likely to adopt conservation practices if they are younger and better educated (Waterhouse et al., 2017).

D.4.2 Economic factors

For landholders who are driven by the desire to earn a high income or maximize profits, these financial motivations may encourage participation in programs that are seen to bring economic benefits (Waterhouse et al., 2017). Landholders with strong financial motivations are more likely to be concerned regarding the opportunity costs of participation in programs and changing practices (Waterhouse et al., 2017), and are more likely to require financial incentives to encourage participation (Greiner, Patterson, & Miller, 2009; Waterhouse et al., 2017).

Practices may be adopted if a landholder believes that the practice would bring production benefits (increase cattle weight/quality, or improve ease of managing cattle) (Lankester, Valentine,

& Cottrell, 2009). The converse is also true; landholders are less likely to participate in programs that are expected to reduce productivity/profitability. Some leasehold landholders saw participation in programs as increasing their chances of having their leases renewed. Environmental benefit may be seen as entwined with, or secondary to, production benefits, not as a driver in their own rights.

Landholders are more likely to adopt new practices if they have the financial and physical capacity to do so (Waterhouse et al., 2017), whilst farmers with larger debts may be more likely to carry more cattle and be less inclined to reduce cattle numbers due to debt servicing obligations.

D.4.3 Social factors

For landholders who are driven by the need for recognition, and to be appreciated by society and colleagues, and concerned with family tradition and social networks, then programs must satisfy these social motivations to encourage their participation (Waterhouse et al., 2017). Graziers with strong social motivations are more likely than those with conservation motivations to require financial incentives before they adopt BMP (Greiner et al., 2009).

It has been found that participation in programs can be increased by the establishment of agreeable social infrastructure, involving practices such as:

- Offering extension activities within practical social interactions with peers (Lankester et al., 2009);
- involving local farming advisors (including from non-government) (Taylor & van Grieken, 2015)) particularly from the industry/industry organisations (Waterhouse et al., 2017);
- involving local contractors (Taylor & van Grieken, 2015);
- encouraging multi-farm applications (Taylor & van Grieken, 2015); and
- promoting peer recognition for scheme participants (Taylor & van Grieken, 2015).

A lack of local leadership, and lack of local science/information can constrain adoption (Waterhouse et al., 2017). Landholders who have built a strong rapport with local implementation staff are more likely to participate in future programs (Blackmore & Doole, 2013) BUT landholders who have been well-supported and well-educated may be less likely to participate in future programs as they may feel they are able to do it themselves without further outside support (Blackmore & Doole, 2013). Conservation tender program participants felt it was important to receive monitoring visits during the contract period to provide ongoing support and reassurance as they adopt new practices (Blackmore & Doole, 2013).

Participation is more likely to be socially acceptable if institutional risk is limited: to encourage participation, conflicting signals from different tiers of government must be avoided, and there is a need to build trust that participation won't increase the risk of greater scrutiny or intrusion by government in the future (Taylor & van Grieken, 2015).

D.4.4 Environmental factors

For landholders who are driven by wanting to look after the environment, improve resource/land condition, and be able to pass on the land in a good condition to future generations, these

environmental stewardship motivations may encourage participation in land management programs designed to achieve environmental benefits (Blackmore & Doole, 2013). Within the Burdekin, graziers with conservation motivations (as compared to economic/financial and social goals) were more likely to adopt BMP (Greiner et al., 2009).

Whilst personal benefits may frequently be important, many participants in conservation tenders were found to have participated for altruistic reasons and did not expect short term financial benefits (Blackmore & Doole, 2013).

D.4.5 Scheme administration matters

To encourage participation, paperwork should be straightforward and streamlined:

- Overly complex or excessive paperwork deters participants (Blackmore & Doole, 2013);
- Local agency or implementation staff or advisors should assist with paperwork to encourage participation (Taylor & van Grieken, 2015);
- Sufficient information should be provided in advance. Conservation tender participants felt it was important to provide more information and support in advance of the process (Blackmore & Doole, 2013); and
- The length of the contract period can have an impact. Conservation tender participants found three-year contracts to be too short, believed 10-year contracts would increase chances of achieving lasting biodiversity outcomes (Blackmore & Doole, 2013). However, research with pastoralists in northern Australia has found a preference for shorter contract periods (Waterhouse et al., 2017).

D.5 Studies included within this review summarized by geographic region and agricultural activities of participants of programs

Region	Agriculture	Study/studies
Burdekin	Graziers who have participated in at least one of a range of programs offered to promote riparian vegetation management or BMP	(Greiner et al., 2009; Lankester et al., 2009)
Burdekin	Graziers and the Burdekin Grazing BMP program	(Moravek & Nelson, 2015; Moravek et al., 2017)
Burdekin	Graziers and sugarcane growers	(Waterhouse et al., 2017)
Burdekin	Sugarcane growers	(Rolfe & Windle, 2009)
GBR in general, and Burdekin specifically	Graziers and sugarcane growers in regions where programs have operated	(Rolfe & Windle, 2016)
Burdekin, Fitzroy and Burnett Mary	Graziers	(Long, 2015)
Burdekin, Wet Tropics & Mackay-Whitsunday NRMs	Sugarcane growers participating in programs such as Reef Rescue aiming to improve water quality	(Taylor & van Grieken, 2015)
Burdekin and Fitzroy	Graziers	(Roberts Evaluation, 2014)
Northern QLD – Cassowary Coast, Wet Tropics, Einasleigh Uplands, Desert Uplands	Producers and non-producers who entered various conservation covenant/nature refuge-based programs	(Moon & Cocklin, 2011)
Victoria	Participants in conservation tenders incl. Green Graze aiming to increase vegetation on livestock farms	(Blackmore & Doole, 2013)

D.6 Appendix D References

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Appendix E Incentives currently available to BBB landholders

Apx Table E.1 Incentives currently available to landholders in the Burdekin catchment

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
Extension & funding program	Growing a Great Barrier Reef	Reef Trust III/QFF/Reef Alliance Program - working with NQDT	• Seeks to provide extension and funding to advance farmer practices beyond industry best management practice (BMP) and fast track the implementation of innovative practices. • Offers a balanced and integrated approach to provision of technical support/training and funding to implement best management plans, with aim of reducing erosion loss from grazing lands.	• Closing date for applications end May 2018. • Applies to graziers within Upper Burdekin, Lower Burdekin, Bowen-Broken-Bogie and Don basins who have completed all 5 BMP modules, to help them implement projects directly related to improving water quality and reducing sediment flowing to the Reef. Works to be completed within 12 months of contract and graziers has to contribute a specified amount based on a sliding scale • https://www.qff.org.au/projects/reef-alliance/growing-great-barrier-reef/; https://drive.google.com/file/d/0BwSfElDILIEZWjNZZi1iUnFwakk/view?ts=57fb09ce; http://www.nqdrytropics.com.au/projects/sustainable-agriculture/reef-alliance-burdekin-grazing/
Extension and accreditation program	Grazing Best Management Practice Program (Grazing BMP)	AgForce QLD, Fitzroy Basin Association, QLD Gov DAF; and many other partners.	• A voluntary program designed to assist in improving environmental, ethical, economic factors as well as assist in the productivity, profitability and sustainability of enterprises. • Assists graziers to compare their performance within the industry and identify opportunities for further improvement. The aggregated information created from these self-assessments is collated for promoting industry performance and stewardship to the supply chain, governments and wider community. Grazing BMP provides graziers with the tools to identify opportunities to refine their business practices, as well as provide a pathway to progress identified issues utilising the most current methods, tools and support available. • PROVIDES: 1) A self-assessment system used by graziers to benchmark their management practices against standards set by industry utilising best available science across 5 modules Soil Health (SH); Grazing Land Management	• Available to graziers in Burdekin, Fitzroy, Burnett Mary, and SE Qld • https://www.cms.bmpgrazing.com.au/

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
			(GL); People and Business (PB); Animal Production (AP); and Animal Health and Welfare (AH). Assessment done via workshop, or one on one with facilitator, or on-line. 2) An accreditation system ratified by Industry Auditor with periodic external audits that confirms the ethical, equitable and environmental credentials of graziers. 3) Workshops and events e.g. Women in Grazing Bus Tour. BENEFITS: 1) Technical capacity building and learning support is offered along with help to develop action plan to rectify below standard practices as required. Thus, providing access to information and support 2) A graziers' accreditation will provide confidence that their performance is endorsed, scientifically robust and recognised. Also, the accreditation is designed to provide graziers, the supply chain, government stakeholders and the wider community confidence that industry best management practice standards are being adhered to.	
Information source	Future Beef	Collaboration between MLA and the governments of QLD, NT and WA.	• Source of information for graziers. Information for the beef industry in northern Australia, includes links to many other websites relevant to beef produces. Seeks to provide the north Australian beef industry with key information and tools to assist with making on-farm changes that improve business performance.	• https://futurebeef.com.au/
Funding program	Nature Assist	QLD Gov: Dept of Environment and Heritage Protection	• Aims to formally protect significant conservation values on land/properties selected for their significant conservation values, connectivity and their predicted resilience to a changing climate, and enhance the resilience of the property. Provides funding for projects likely to deliver conservation outcomes as well as benefits to sustainable production. • Can provide funding for project with clear conservation outcome, enhancing the resilience and sustainable management of a property. In many cases, projects are likely to deliver conservation outcomes as well as benefits to sustainable production. The types of activities favoured include: reducing the impacts of stock and pest animals on environmentally sensitive areas such as vine thickets, watercourses and wetlands by managing access. Examples of activities funded in previous rounds include: establishing artificial watering points away from natural springs or watercourses, erecting fencing to manage stock access, and excluding and controlling pest animals stabilising soils, improving water quality or increasing the value of wildlife habitat integrating the management of pest plants, pest animals and fire. Note: nature refuge agreement can be negotiated to allow for continuing use of the land resulting in both ecological and economic sustainability. Tax relief in form of conservation covenants also likely to be available.	• Property must be identified as being in a priority investment area and landholder must be willing to sign a Nature Refuge Agreement (which is negotiated between EHP and the landholder; provides framework for sustainably managing a nature refuge and protecting its significant values; tailored to suit the landholder's management needs; able to be negotiated with owners of freehold land, leaseholders of State land, government corporations that are separate legal entities from the QLD Government, local governments, private companies and nature conservancies; able to be negotiated over the whole or a portion of the property, depending on the conservation values and the landholder's wishes; perpetual, registrable on title and binds successive owners or lessees of the land). • https://www.ehp.qld.gov.au/ecosystems/nature-refuges/natureassist/; https://www.ehp.qld.gov.au/ecosystems/nature-refuges/the_nature_refuges_program.html

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
Tax relief	Conservation covenants	Federal Gov: ATO, DoEE QLD Gov: DoES	• Tax concessions are available for landowners who enter conservation covenants under the QLD Nature Refuge Program and Coordinated Conservation Areas Program • Recognising that entering into the agreement reduces the value of the land, landholders can claim a tax deduction for this reduction in land value. Depending on circumstances, landholder may be eligible for income tax deduction or for concessional capital gains tax treatment.	• Landholder has to have voluntarily entered into and signed a nature refuge agreement with QLD Gov. on or after 1/7/02. • http://www.environment.gov.au/biodiversity/conservation/covenants/approved-programs; https://www.ehp.qld.gov.au/ecosystems/nature-refuges/index.html; https://www.ato.gov.au/non-profit/gifts-and-fundraising/in-detail/fundraising/claiming-conservation-covenant-concessions/
Tradeable credits	Reef Credit Initiative	Green Collar	• Reef Credits are issued to projects that reduce flows of sediment, nutrients or pesticides into waterways and fulfil the schemes requirements. • An independent crediting body will issue Reef Credits to landholders that have implemented projects that comply with approved methods for reducing nitrogen, sediment or pesticide losses. These Reef Credits can then be sold to government, industry and other organisations with an interest in saving the GBR.	• Anyone who is a land owner or land manager may have the potential to undertake a Reef Credit project which must use expertly designed methodologies that calculate or model the reduction of sediment and/or nutrients and pesticides flowing onto the GBR due to land management change activities such as revegetation, riverbank stabilisation, reduction of nitrogen runoff and general system repair Current pilot project is working with Terrain in the Wet Tropics. • https://greencollar.com.au/reef-credits/
Tradeable credits	Carbon Farming Initiative	Federal Gov: DoEE	• The Carbon Farming Initiative (CFI) allows farmers and land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land. The CFI also helps the environment by encouraging sustainable farming and providing a source of funding for landscape restoration projects. • Landholders implement carbon storage or emissions abatement activities using approved methods to generate carbon credits. Under the CFI, carbon credits may be earned from activities such as: reducing livestock emissions; increasing efficiency of fertiliser use; enhancing carbon in agricultural soil; storing carbon through revegetation and reforestation. These credits can then be sold to people and businesses wishing to offset their emissions.	• Anyone who is a landholder and undertakes an eligible activity using an approved methodology may be eligible. Carbon credits cannot be issued for business-as-usual activities. To be eligible, projects must deliver extra reductions in greenhouse gas emissions. Carbon credits can also only be issued for activities that bring lasting environmental benefits, seeking to ensure that carbon stored by CFI projects is maintained for at least 100 years, while allowing flexibility to change land uses in the future

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
				• http://www.environment.gov.au/climate-change/government/emissions-reduction-fund/cfi/about
Low interest loans	Sustainability Loan - Primary producer	QLD Gov: QRIDA (QLD Rural and Industry Development Authority)	• Low rate loans available for activities that enable expansion of current operations to improve productivity or long-term sustainability. • Loans of up to $1.3m for up to 20 years at low rates fixed for 1, 3 or 5 yrs.; uses Include (i) improving enterprise efficiencies (building fences, dams, storage facilities, improving irrigation, establishing additional water points, implementing on-farm value adding, supply chain initiatives) (ii) upgrading or diversifying (buying plant & machinery, livestock)	• Be a full-time primary producer operating for at least 2 years; sound prospects for commercial viability; demonstrate financial need; provide an adequate management plan; security must be provided commensurate with the amount of the loan. • http://www.qrida.qld.gov.au/current-programs/Productivity-Loans/sustainability-loan/Sustainability-Loan-Primary-producer
Low interest loans	Drought Assistance Concessional Loans	QLD Gov: QRIDA	• Low interest loans available for debt restructuring, operating expenses, drought recovery activities and drought preparedness activities. • Loans for up to 50 per cent of a farm business's final debt position to a maximum of $1 million; variable concessional interest rate is currently set at 3.09 per cent (from 1 February 2018); Maximum loan terms of up to ten years, with interest only repayments initially available for up to five years; Principal and interest repayments apply for the remaining five years of the loan, calculated on the basis of a 10-year loan term. Can be used for: (i) Debt restructuring: Applicants can use concessional loans to restructure existing eligible debt. This includes being able to restructure existing Commonwealth concessional loans. (ii) Operating expenses: Applicants can use funds for operating expenses that are necessary to continue the normal operations of the farm business. (iii) Drought recovery activities: Applicants can use loan funds to contribute to the cost of drought recovery activities including planting and/or restocking. (iv) Drought preparedness activities: Applicants can use loan funds to assist with the cost of activities to prepare for future droughts	• Closing date for applications 30 June 2018. • Farmer and farm business must meet eligibility criteria set out in guidelines (http://www.qrida.qld.gov.au/__data/assets/pdf_file/0013/4450/20170623-Qld-guidelines-Drought-Assistance-Final.pdf). Includes they have owned and operated the Farm Business for at least the past three consecutive years, and the majority of the business is in Queensland. Plus either a) Farm Business is located in an area that has experienced a rainfall deficiency equivalent to, or worse than, a 1 in 20 year rainfall event, and is experiencing a Significant Financial Impact over at least a two year period or b) Farm Business is NOT located in an area that has experienced a rainfall deficiency equivalent to, or worse than, a 1 in 20 year rainfall event, but is experiencing a Significant Financial Impact as a direct result of the effects of drought over at least a two year period. • http://www.qrida.qld.gov.au/current-programs/drought-concessional-loans-scheme

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
Low interest loans	Natural Disaster Assistance - Primary producer	QLD Gov: QRIDA	• Low interest loan to assist re-establishing primary production enterprises after a natural disaster. • Low interest loan up to a maximum of $250,000, max of 7-year term, up to 2 years may be interest only. Specific rate offered depends on the relevant natural disaster. Costs that may be covered include: repairing or replacing damaged plant and equipment, repairing or replacing buildings, purchasing livestock to replace those lost in the disaster event, meeting carry-on requirements including re-planting, restoring or re-establishing areas affected by the disaster event, sustenance, essential property operations, and paying rent and rates	• Must have received direct damage from an eligible natural disaster and enterprise must be located in an activated local government area. Currently: Severe Tropical Cyclone Nora and Associated Flooding 24 - 29 March 2018; North Queensland Flooding 6 – 10 March 2018; North and North West Queensland Low and Associated Rainfall and Flooding, 24 February – 8 March 2018; Central Coast Queensland Severe Weather 16 - 19 October 2017; Severe Tropical Cyclone Debbie and associated rainfall and flooding, 28 March - 6 April 2017. Further, if enterprise has been affected by a natural disaster in an area which has not been activated may still be eligible to apply for assistance on an individually disaster stricken basis. NOTE: primary producers can only receive assistance under the Natural Disaster Assistance Scheme OR the Natural Disaster Assistance (Essential Working Capital) Scheme for an eligible disaster - not both. • http://www.qrida.qld.gov.au/current-programs/Disaster-recovery/natural-disaster-assistance/natural-disaster-assistance-primary-producer
Low interest loans	Natural Disaster Assistance - Small business	QLD Gov: QRIDA	• Low interest loan to assist re-establishing small businesses after a natural disaster. • Low interest loan up to a maximum of $250,000, max of 7-year term, up to 2 years may be interest only. Specific rate offered depends on the relevant natural disaster. Can be used to assist re-establishing business by covering costs such as: repairing or replacing damaged plant and equipment, repairing or replacing buildings, supplying stock for up to one month to replace lost stock and maintain liquidity of the business, meeting carry-on requirements including: sustenance, paying rent and rates.	• Must have received direct damage from an eligible natural disaster and your small business must be located in an activated local government area. Currently: Severe Tropical Cyclone Nora and Associated Flooding 24 – 29 March 2018; North Queensland Flooding 6 – 10 March 2018; Severe Tropical Cyclone Debbie and associated rainfall and flooding, 28 March - 6 April 2017. NOTE: Small businesses can only receive assistance under the Natural Disaster Assistance Scheme OR the Natural Disaster

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
				Assistance (Essential Working Capital) Scheme for an eligible disaster - not both. • http://www.qrida.qld.gov.au/current-programs/Disaster-recovery/natural-disaster-assistance/natural-disaster-assistance-small-business
Low interest loans	Natural Disaster Assistance - (Essential Working Capital) - Primary Producer	QLD Gov: QRIDA	• Low interest loans to assist with essential working capital for primary producers impacted by natural disasters. • Low interest loan up to a maximum of $100,000, max of 7-year term, up to 2 years may be interest only. Specific rate offered depends on the relevant natural disaster. Assists with essential working capital for expenses such as: paying salaries or wages, paying creditors, paying rent or rates, buying goods, including for example, fuel essential to carry on the primary production enterprise, buying fodder or water for livestock or produce or transporting livestock or product.	• Must have suffered a significant loss of income as a result of an eligible disaster and your enterprise must be located in an activated local government area. Currently: Severe Tropical Cyclone Nora and Associated Flooding 24 – 29 March 2018; North Queensland Flooding 6 – 10 March 2018; North and North West Queensland Low and Associated Rainfall and Flooding, 24 February – 8 March 2018; Central Coast Queensland Severe Weather, 16 - 19 October 2017; Severe Tropical Cyclone Debbie and associated rainfall and flooding, 28 March - 6 April 2017. NOTE: primary producers can only receive assistance under the Natural Disaster Assistance Scheme OR the Natural Disaster Assistance (Essential Working Capital) Scheme for an eligible disaster - not both. • http://www.qrida.qld.gov.au/current-programs/Disaster-recovery/natural-disaster-assistance-essential-working-capital/nda-essential-working-capital-primary-producer
Low interest loans	Natural Disaster Assistance Essential Working Capital - Small Business	QLD Gov: QRIDA	• Low interest loans to assist with essential working capital for small businesses impacted by natural disasters. • Low interest loan up to a maximum of $100,000, max of 7-year term, up to 2 years may be interest only. Specific rate offered depends on the relevant natural disaster. Assists with essential working capital for expenses such as: paying salaries or wages, paying creditors, paying rent or rates, buying goods, including for example, fuel essential to carry on the small business.	• Must have suffered a significant loss of income as a result of an eligible disaster and your enterprise must be located in an activated local government area. Currently: Severe Tropical Cyclone Nora and Associated Flooding, 24 – 29 March 2018; North Queensland Flooding 6 – 10 March 2018; Severe Tropical Cyclone Debbie and associated rainfall and flooding, 28 March - 6 April 2017; NOTE: Small businesses can only receive assistance under the Natural Disaster

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
				Assistance Scheme OR the Natural Disaster Assistance (Essential Working Capital) Scheme for an eligible disaster - not both. • http://www.qrida.qld.gov.au/current-programs/Disaster-recovery/natural-disaster-assistance-essential-working-capital/natural-disaster-assistance-essential-working-capital-small-business
Low interest loans	Business Improvement Concessional Loans	QLD Gov: QRIDA	• Low interest loans to help farm businesses restructure previous eligible loans. • Loan amounts can be up to 50% of a farm business' final debt position to a maximum of $1 million. The variable concessional interest rate is currently set at 3.09% (from 1 August 2017). Maximum loan terms of up to ten years apply, with interest only repayments initially available for up to five years. Principal and interest repayments apply for the remaining five years of the loan, calculated on the basis of a 10-year loan term. can be used to restructure Eligible Debt, including existing Commonwealth concessional loans.	• Closing date for applications 30 June 2018. • Farmer and farm business must meeteligibility criteria set out in guidelines (http://www.qrida.qld.gov.au/__data/assets/pdf_file/0003/8625/20170623-Qld-Guidelines-BICL-Final.pdf). Includes must have eligible debt and must have owned and operated the Farm Business for at least the past three consecutive years, and the majority of the business is in Queensland. • http://www.qrida.qld.gov.au/current-programs/business-improvement-concessional-loans
Grants	Natural Disaster Recovery Grants Scheme – Exceptional Circumstances, Primary producer	Qld Gov. QRIDA	• Grants to help pay for costs associated with cleaning and reinstatement activities after a natural disaster. • Grant up to $25,000 is available to assist eligible primary producers as follows: initial grant amounts to assist in cleaning and reinstatement costs to $5,000 and ii) subsequent grant amounts to assist you with additional cleaning and reinstatement costs up to a total of $20,000	• Closing date for applications 20 July 2018. • Primary production enterprise must have suffered direct damage caused by Central Coast Queensland Severe Weather 16 - 19 October 2017; Applies to Bundaberg Regional Council and North Burnett Regional Council local government areas. • http://www.qrida.qld.gov.au/current-programs/Disaster-recovery/special-disaster-assistance/special-disaster-assistance-primary-produce
Grants	Grants Hub	NQDT	• A website that provides a list of current funding opportunities in region, includes grants through NQDT and elsewhere.	• Currently no opportunities available to graziers (latest closes 31/5).

INCENTIVE TYPE	INCENTIVE NAME	ORGANISER/ GOVERNMENT	BRIEF SUMMARY	ELIGIBILITY AND FURTHER DETAILS
			• Depends on particular opportunity.	• Depends on particular opportunity • https://www.nqdrytropics.com.au/grantshub/

Appendix F Stakeholder consultation

Three stakeholder consultation events were held during the project —an expert panel, a landholder workshop and a project panel workshop. Each is summarised below. More information on the engagements can be obtained from the researchers on request.

F.1 Expert Panel

The expert panel meeting was held on the 8th May 2018 at The EcoSciences Precinct, Brisbane. Attendees and their institutions are presented below

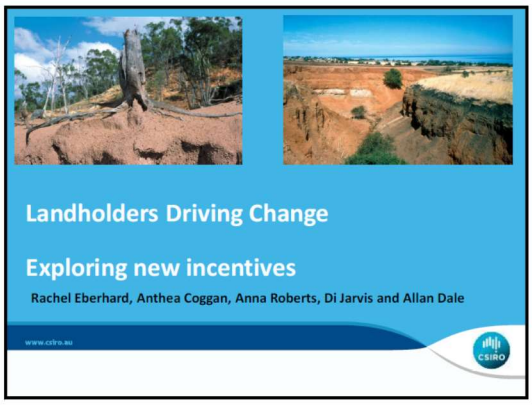
Apx Table F.1 Expert Panel Attendees

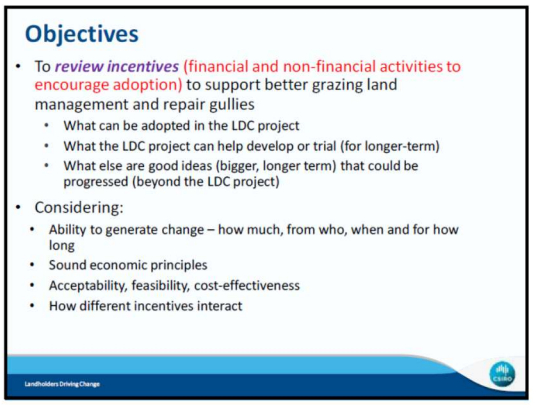
Attendee	Institution
Andrew Yates	NQDT
Stuart Whitten	CSIRO
Romy Greiner	River Consulting
Steve Skull	Alluvium
Kate Brown	DAF
Rebecca Bartley	CSIRO
Anna Roberts	Natural Decisions
Rachel Eberhard	JCU
Anthea Coggan	CSIRO

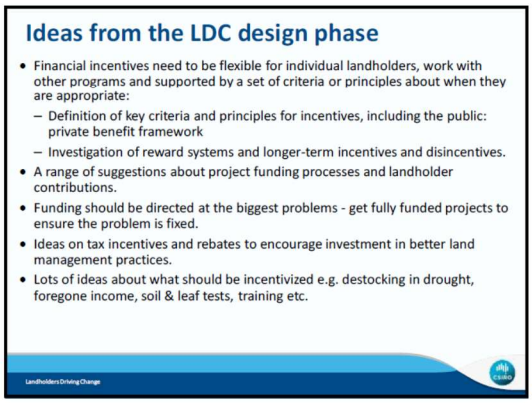
Discussion papers focussed on practice change and public private benefits (Appendix A) and incentive mechanisms (Appendix C) were circulated prior to the meeting. Discussion was focussed on these discussion papers.

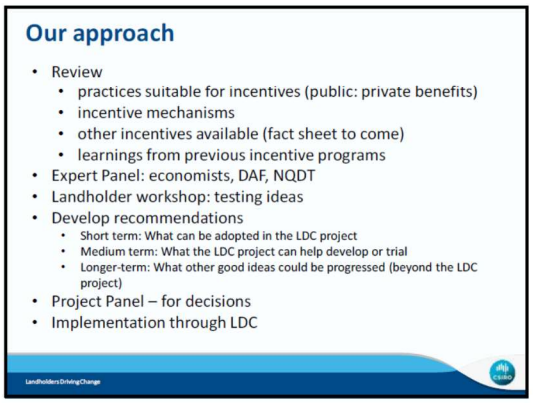
F.2 Landholder workshop

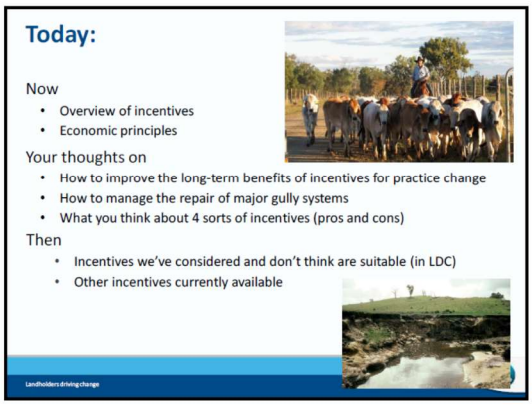
Allan Dale, Rachel Eberhard, Anna Roberts and Anthea Coggan all attended the landholder workshop held on the 22nd May 2018 in Bowen. The focus of this meeting was to present key information about public and private benefits as well as incentive mechanisms to landholders. Landholders provided feedback about the focus of the research as well as their opinions on the management of sediment broadly and sediment from, erosion gullies more specifically. The power point slides from the landholder workshop follow.

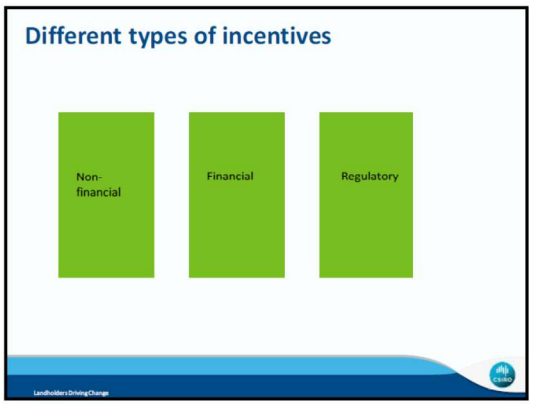




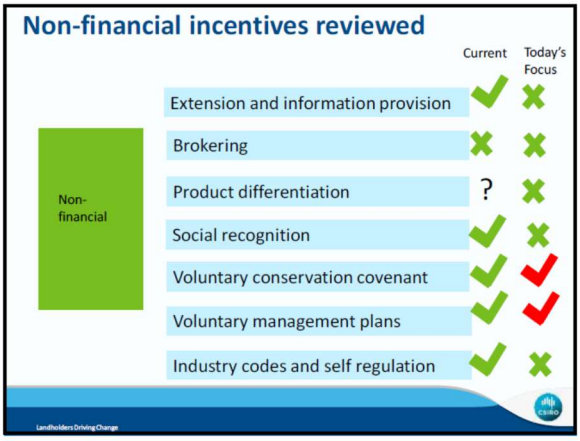




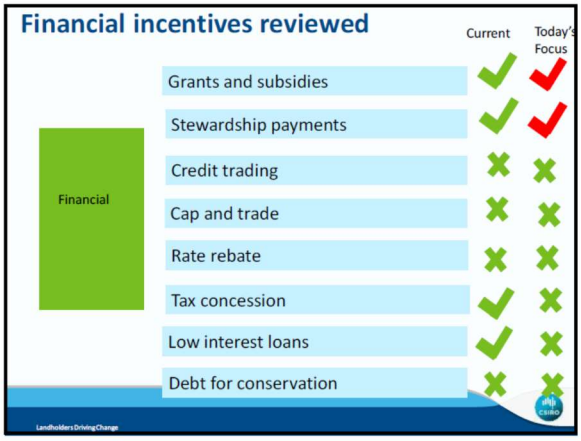




Non-financial incentives reviewed



Financial incentives reviewed



Regulatory incentives

Regulatory

- Already exist around record keeping
- Not the focus today

Landholders Driving Change

Economic principles

- Public funding to be based on benefits (sediment reduction)/public costs
  - Can improve on current incentive approach based on cost-sharing
  - Maintenance costs are important as well as upfront costs
- Should only pay for activities that cannot reasonably be expected from landholders
  - Are some gully systems too large for landholders to be expected to maintain?
- Need for long-term public benefits from public investment
  - Landholder agreements need to ensure benefits are able to be maintained
  - Need to be clear about time-frames and change in property ownership
  - Follow up monitoring is also important

Landholders driving change

Group discussion #1 – Maintaining benefits of public investments

- From first principles and based on Victorian riparian management example:
  - Landholder agreement to extend to future landowners (i.e. on the title)
  - Individual agreements tailored to specific context (project details)
  - Monitoring to ensure benefits are maintained
  - Clear understanding of what happens (within and beyond landholder control) if things go wrong
- Which elements are you most and least comfortable with?
- Other ideas for maintaining the benefits of public investment?

Landholders driving change

Group discussion #2 – Remediated big gullies

- Are there some gullies which are beyond landholder capacity to maintain benefits, even if initial costs of remediation are paid?
- Could someone else own and maintain these areas?
- What would need to happen if so?
  - Management agreements?
  - Covenants?
  - Excise of some property titles?
- Other options which could work?

Making the most of our conservation dollars

Group discussion #2 – Remediated big gullies

- Are there some gullies which are beyond landholder capacity to maintain benefits, even if initial costs of remediation are paid?
- Could someone else own and/or maintain these areas?
- What would need to happen if so?
- Other options which could work which will maintain the benefits?

Landholders driving change

lunch

Landholders driving change

Group discussion #3 – Most promising incentives

Feedback on the acceptability and feasibility of different sorts of incentives – focus on 5 possible options for further consideration (covenants, mgt. agreements, grants & subsidies, stewardship payments)

Then summary slide of the 4, ask each LH to nominate most preferred and least preferred at the end.

Landholders driving change

Stewardship payments

What are they:
- Ongoing (over the life of the contract) payments on outcomes.
- These can be determined individually or allocated as a part of a competitive process such as a tender.

Strengths:
- Payment on results
- Can make payments over time
- Can use a competitive process to optimise on the differences between landholders and properties (efficient and reveals information)
- Rewards innovation

Challenges:
- How to design so that you don't crowd out those that are intrinsically motivated or send negative signals about sustainable land management and profit
- Requires good contracts and follow up monitoring
- Transaction cost of competitive processes against benefits

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Grants

What are they:
- Usually a one-off direct payment
- Usually with cost sharing from landholder
- Should be used for projects that generate public benefit but would not be done due to cost of resources

Strengths:
- Well known and understood
- Flexible – can be used on big and small projects
- Cost sharing

Challenges:
- Flat rate does not reward innovation
- Does not optimise on differences in the landscape and between landholders
- Provider needs to work out how much to pay (high information cost)
- Should be accompanied by follow up monitoring

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Subsidies

What are they:
- One off indirect payment on an input to production
- Eg: fuel, fencing, training programs

Strengths:
- Well known and understood
- Flexible – can be used on big and small projects

Challenges:
- Flat rate does not reward innovation
- Does not optimise on differences in the landscape and between landholders
- Should be accompanied by follow up monitoring

Landholders driving change

Conservation covenants

What are they:

- Voluntary
- Legally binding contracts binding on title
- Specifies activities to be conducted
- Can be linked to a grant or stewardship payment

Strengths:

- Binding on title
- Maintains benefits over time

Challenges:

- Authority to apply
- Attracting the non-engagers

Landholders driving change

Voluntary management agreements

What are they:

- Voluntary agreement
- Specifies activities to be conducted on ground
- Can be linked to a payment

Strengths:

- Well known and understood
- Flexible – can be used on big and small projects
- Voluntary so may attract the non-engagers

Challenges:

- Not attached to title so not binding on future owners
- Should be accompanied by monitoring
- Voluntary so may not attract the non-engagers

Landholders driving change

What is happening with the other incentives?

Non-financial	Extension and information provision	Ongoing
	Brokering	Not currently feasible for LDC
	Product differentiation	Niche and researching
	Social recognition	Niche and researching
	Voluntary conservation covenant	✓
	Voluntary management plans	✓
	Industry codes and self regulation	Ongoing

Landholders Driving Change

What is happening with the other incentives?

Financial	Grants and subsidies	✓
	Stewardship payments	✓
	Credit trading	Not feasible for LDC
	Cap and trade	Not feasible for LDC
	Rate rebate	Not feasible for LDC
	Tax concession	Exists not feasible for LDC
	Low interest loans	Exists not feasible for LDC
	Debt for conservation	Not feasible

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Other incentives currently available

Extension & grants – various, managed by NQDT in the Burdekin

Grazing Best Management Practice (BMP) – self-assessment & accreditation

Future Beef – information source for nthn. Aust. beef producers

Nature Assist – projects in priority areas where Nature Refuge agreements in place (Qld. Govt.)

Tax concessions for loss of land value with conservation covenants (e.g. Nature Refuge agreements)

Low interest loans – various categories e.g. drought assistance, disaster recovery, sustainability - QLD Rural and Industry Development Authority (QRIDA)

Carbon Farming initiative – carbon credits for approved methodologies (e.g. soil carbon, deforestation)

Reef credits – under development – tradeable credits for water quality improvement

Making the most of our conservation dollars

Summary of new incentives work

- Progress to date – review from 1st principles, now landholder feedback
- Recommendations will go to Project Panel for decisions
- Seeking
  - Short term: What can be adopted in the LDC project
  - Medium term: What the LDC project can help develop or trial
  - Longer-term: What other good ideas could be progressed (beyond the LDC project)

Landholders driving change

F.3 Project panel workshop

Rachel Eberhard and Anthea Coggan travelled to Bowen on the 30th June to present the key findings of the research to the project panel. The key objective of this meeting was to inform the project panel of the research progress and draft recommendations. Power point slides used at the workshop follow.

Review of public: private benefits of relevant practices

Agree on erosion types: hillslope erosion, hillslope gullies, alluvial gullies, streambank erosion (Noting gully classification work just starting).

Develop a practice list for each erosion type: current average practice, minimum acceptable standard and improved practice (private benefits are assessed in relation to current average practice).

Assess criteria to guide the use of incentives for each practice: level and scale of adoption, public net benefits, private net benefits, estimate technical feasibility and costs (upfront, on-going maintenance and non-profit related).

Identify the characteristics of management practices best suited to direct financial incentives

Recommendations regarding financial incentives given the variability of benefits and costs associated with gully management practices

Recommendations arising:

Landholder agreements: There needs to be strong and binding agreements with landholders with clearly stated responsibilities and time-frame. Tailored to specific context, but with common elements.

Follow-up Monitoring : Monitoring for compliance with the agreement is essential. Landholder needs to agree to compliance inspection.

Prioritisation of eligible projects should be based on benefits (sediment reduction)/public cost: based on technical assessment and preferably development of a calculator. Costs need to include up-front costs & on-going maintenance payments or other public costs.

Change current LDC incentives approach: If prioritisatise incentives on basis of public benefit/cost, then the current cost share approach used by LDC would be changed.

Alternative financing mechanisms for gullies that are beyond landholder capacity to manage: Major gullies require alternative conservation financing mechanism.

When to use financial incentives: Economic principles

- Public funding to be based on benefits (sediment reduction)/public costs
  - Can improve on current incentive approach based on cost-sharing
  - Maintenance costs are important as well as upfront costs
- Should only pay for activities that cannot reasonably be expected from landholders
  - Are some gully systems too large for landholders to be expected to maintain?
- Need for long-term public benefits from public investment
  - Landholder agreements need to ensure benefits are able to be maintained
  - Need to be clear about time-frames and change in property ownership
  - Follow up monitoring is also important

Lessons from other programs

- Very little information re. implementation learnings is available (not evaluated, not shared, lost)
- Limited academic literature
  - Cost-effectiveness of different incentives not evaluated, but regional cost benchmarks available e.g. Burdekin $10/tonne sediment
  - Low additionality (they would often have done it anyway)
  - Auction approach using formal cost-benefit > scoring metrics (for WQ)
  - BMP program is effective (but very different estimates of practice change and poor evaluation design)
  - Grazing BMP positive impacts on profitability
  - Factors associated with adoption – age, education, motivations (financial, conservation, social), financial & logistical capacity, local leadership, local science, trust, perceptions of risk
  - Scheme administration matters -- simple paperwork, local support, contract period

Other incentives currently available

Extension & grants – various, managed by NQDT in the Burdekin (refer grants hub)

Grazing Best Management Practice (BMP) – self-assessment & accreditation

Future Beef – information source for nthn. Aust. beef producers

Nature Assist – projects in priority areas where Nature Refuge agreements in place (Qld. Govt.)

Tax concessions for loss of land value with conservation covenants (e.g. Nature Refuge agreements), depreciation on capital e.g. , fencing, landcare,

Low interest loans – various categories e.g. drought assistance, disaster recovery, sustainability - QLD Rural and Industry Development Authority (QRIDA)

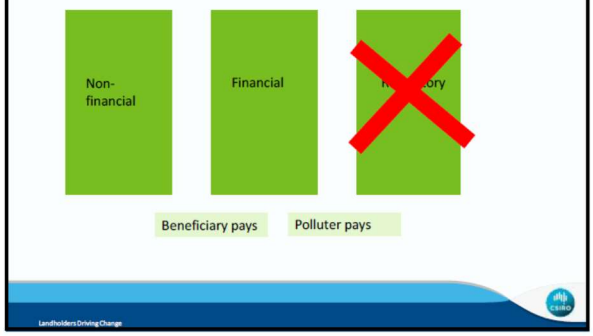
Carbon Farming initiative – carbon credits for approved methodologies (e.g. soil carbon, deforestation)

Reef credits – under development – tradeable credits for water quality improvement

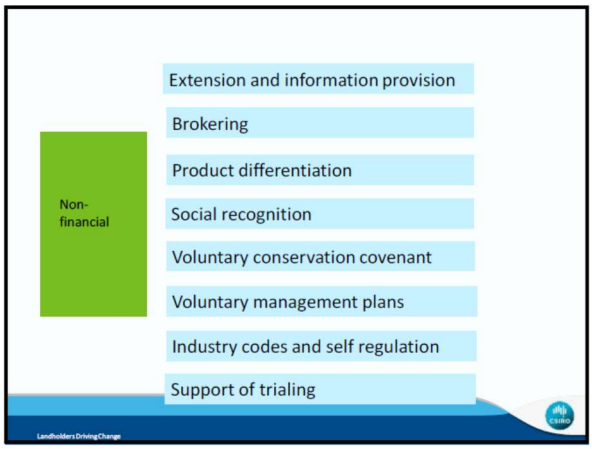
Review of incentive mechanisms: What are incentives?

- Landholders make decisions about production and land management according to the incentives that they face
- Markets, through prices signal value of beef production
- But not value of land management outcomes (public good)
- Potential for incentives to signal the value of improved land management

What are incentives?



Landholders Driving Change



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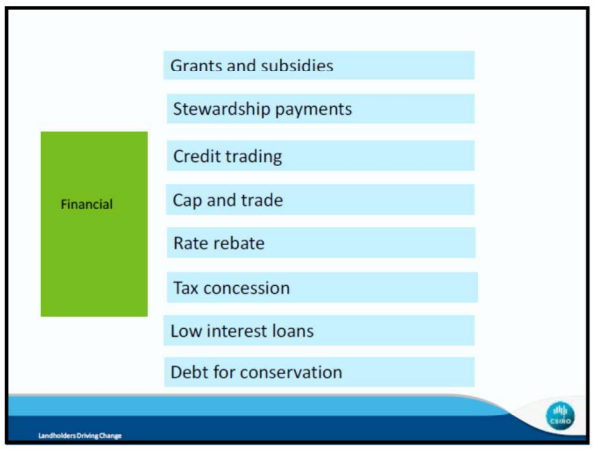


Landholders Driving Change

Landholder workshop 22nd May 2018. APPROACH

- Discussed:
  - First principles from economics on when you would use incentives
  - Spectrum of incentives considered and/or available
  - Focus given scale, scope and institutional feasibility
- Workshopped:
  - How investment benefits could be maintained through time
  - What incentives could be designed for big gully remediation

Landholders Driving Change

Landholder workshop 22nd May 2018. FEEDBACK

- Landholders were interested in tailored grants, subsidies for training and stewardship payments
- Keen on recognition and reward for high achievers and those that have made large steps
- Saw education and cultural change as fundamental to practice change
- Not comfortable with agreements on title (land value, biosecurity, 3rd party insecurity)
- More comfortable with longer term management agreements or rolling agreements and enhanced monitoring
- For gullies – interest in leases or contractual agreements for long term maintenance (incl 3rd parties) but not title excision
- Not large interest in conservation covenants (due to title)
- Comfortable with layering incentives to support spectrum of landholder interest and ability
- Supportive of LDC role in brokering arrangements for maintenance of benefits (holding funds)

Landholders Driving Change

From the workshop...

Landholders Driving Change

From the workshop….

Financial	Grants and subsidies	Assess targeting, investigate tailored grant
	Stewardship payments	Potential to trial as a tailored grant. Trust for risk
	Credit trading	Watch
	Cap and trade	Limited scope due to institutions
	Rate rebate	Ongoing, inform, influence
	Tax concession	Ongoing, inform, influence
	Low interest loans	Ongoing, inform
	Debt for conservation	Not well enough understood. Issues with title

Landholders Driving Change

Synthesis of findings so far

1. Thinking about incentives: what mix of incentives
   - First principles of economics for financial incentives
   - Incentives for a spectrum of :
     - Current management,
     - Landholder experience and
     - Engagement history
   - Layering of incentives
2. Recommendations
   - Implementable within the LDC project
   - Actions to maintain long term benefit
   - Influence long term outcomes

Landholders Driving Change

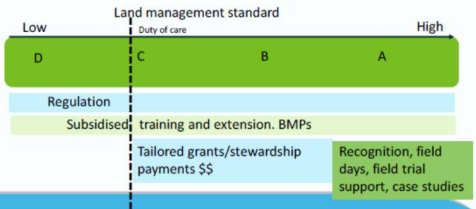
When to use financial incentives: Economic principles

- Public funding to be based on public benefits (sediment reduction)/public costs
  - Upfront cost
  - Maintenance costs
- Should only pay for activities that cannot reasonably be expected from landholders (limited ongoing private benefit)
  - Are some gully systems too large for landholders to be expected to maintain?
- Need for long-term public benefits from public investment
  - Landholder agreements need to ensure benefits are able to be maintained
  - Need to be clear about time-frames and change in property ownership
  - Follow up monitoring is also important

Landholders driving change

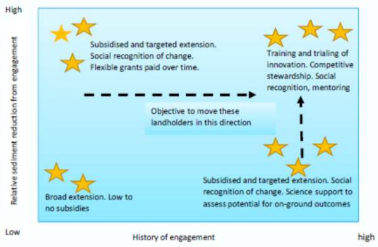
Incentives and a spectrum of current land management

- Incentives vary in their potential to generate change
- Landholders vary in engagement, interest and impact potential
- Match incentives to land management types
- Layers of incentives



Landholders driving change

Also match incentives to landholders



Landholders driving change

Recommendations

There are different groups of graziers (motivations, engagement, practices)

Incentives to:

- Engage previously unengaged graziers;
- Accelerate adoption of good practices across the full spectrum of graziers
- Support innovation

Layer complementary incentives to support different groups of graziers

Think about scaleability – beyond LDC and BBB

1. Implement within the LDC project
2. Maximise the benefits
3. Influence long term outcomes

Landholders driving change

1. Implement within LDC project

1. **access to information and assistance** from other sources
2. **Strong engagement, education and extension** are the foundation, provide multiple pathways
3. **Training / mentoring** approaches – different services for different graziers. Careful use of subsidies. Evaluate practice change benefits
4. **Grants** – inc. public benefit:cost principles and flexibility.
5. **Stronger social recognition** of good practice
6. **Support next generation innovation** through connections

Landholders driving change

2. Maximise the benefits

1. Develop **monitoring and evaluation to support learning within the project** (what works for who, and why)
2. Improve **design of grant processes for enduring benefits**. Tighten up Adjust landholder agreements to support enduring benefits, incl. staged payments, longer-term contracts, follow-up monitoring and clear agreement about on-going maintenance responsibilities.
3. **Develop a gully calculator to estimate public benefits of sediment reduction** and underpin current and future incentive programs.

Landholders driving change

3. Influence longer-term outcomes

1. **Engaging with emerging opportunities** and initiatives
2. **LDC advocate for the development of enduring incentives**
3. Collaboratively **exploring governance mechanisms (e.g. a trust) to enable enduring support and benefits** (beyond short-term funding)
4. **Institutional arrangements to underpin long-term asset management of gully restoration efforts**
5. Closer engagement with government to understand and proactively **manage long-term regional system of grazier support regulatory barriers to improved practices**
6. The best for practice improvement incl. BMP, regs, research, NRM etc.

Landholders driving change

After dinner options

1. Suggest ideas for greater social recognition
2. Discuss recommendations for influencing longer-term opportunities
3. Criteria for prioritising next steps
4. Process for finalising report

Landholders driving change

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