Conservation auctions: dealing with scope and scale issues in metric design

Paper presented at the 52nd annual conference of the Australian Agricultural and Resource Economics Society, Canberra, February 2008

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Abstract

Competitive tenders can be used to purchase environmental improvements from landholders. The bid selection process is facilitated by a bid assessment metric, where a summary of environmental improvements is compared to the cost of each bid. That assessment process may be complicated by increasing the scope of the conservation tender, as it expands the range and type of environmental improvements that may need to be assessed. Tender assessment may also be complicated by differences in scale and auction design, as more differentiation between bids might be required in the assessment process. In this paper, these design issues are canvassed in relation to a water quality improvement tender being conducted in the Burdekin region of North Queensland.

Key words: Market based instruments, metric design, water quality
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1. Introduction

Conservation tenders generate economic efficiencies in several ways (Latacz-Lohmann and van der Hamsvoort 1997, 1998; Stoneham et al. 2003). At a primary level they are more cost-effective than many other funding allocation methods because they focus on selecting the most efficient proposals from landholders to generate desired outcomes. As well, conservation tenders can generate other efficiencies by providing more appropriate incentives to landholders to innovate and search for better ways of achieving outputs. While these advantages are well understood in theoretical terms, a particular challenge in the performance of a conservation tender is to achieve them in practice.

To achieve efficiencies from the performance of a conservation tender, three key tasks need to be performed. The first is to have an appropriate auction design in place so that feasible and cost-effective proposals are submitted by landholders. The second is to have an adequate selection process in place so that when the different proposals are evaluated, the ones that generate efficient outcomes are chosen. The third is to ensure that the auction design, metric design and contract design stages generate appropriate incentives for landholders, and do not create (or at least minimise) perverse incentives.

The focus of this paper is on the second of those goals: the metric design and selection process stage. However, metric design cannot be considered in isolation from the other key tasks, particularly the auction design process. The information needed to select the cost-efficient proposals is influenced by the way that the auction process has been designed, the rules for entry and engagement, the conditions that will be employed, and the reactions of different participants to the opportunities that can be presented. This means that the selection process between landholder proposals is dependent on the context and rules under which proposals have been submitted, and these need to be at least implicitly considered in the design of an auction metric.

The bid selection process can also be influenced by the frame of a conservation tender, particularly in terms of scale and scope issues. Issues of scale relate to the size of a program because the proportion of fixed administration and operating costs tend to reduce as the funding level increases. Issues of scope relate to the coverage of a program across geographic and industry types, as well as to coverage over institutional and political boundaries. There is often commonality in scale and scope issues, with larger scale programs often encompassing increased scope. Increases in scope tend to generate greater challenges in the assessment of proposals because they increase the range of different actions and outputs that may need to be evaluated and compared when bids are being assessed.

Differences in the way in which auctions are framed and implemented suggest that the bid selection process needs to vary between different conservation tenders. As well, metric design needs to vary according to the environmental improvements being purchased. Conservation tenders focused on the purchase of biodiversity (e.g. Stoneham et al. 2003) will differ from other auction formats that purchase a different suite of environmental improvements. The challenge is to develop a bid selection process that is relevant to the auction design and the environmental issue that is being addressed.

In this paper the task of developing a metric for assessing water quality improvement proposals is outlined. The context in which these proposals are to be evaluated is the application of a water quality improvement tender in the Lower Burdekin region in North Queensland. The paper is structured in the following way. In the next section, the background to the case study is provided, followed by an overview of tender, contract and metric design issues in Section 3. A review of the metric design undertaken for this project is provided in section 4, followed by conclusions in Section 5.

2. Conceptualising the Issues

Conservation auctions such as the Conservation Reserve Program (CRP) in the United States (Kirwan et al. 2005) and the BushTender program in Australia (Stoneham et al. 2003) have been used to identify landholders who can provide on-farm conservation and biodiversity protection actions at lowest cost. Under the programs, landholders are invited to submit tenders specifying their proposed actions and compensation (bid) levels, and a subsequent evaluation process identifies the biodiversity benefits involved and the most cost effective proposals. Use of these mechanisms reflects growing interest in the adoption of market-based instruments to improve natural resource management and environmental outcomes (Latacz-Lohmann and van der Hamsvoort 1997, 1998; Cason and Gangadharan 2004).

Competitive auction mechanisms have two theoretical advantages over fixed rate conservation payments. Auction prices are more likely to reflect the marginal value of the resources being used to produce the good or service, and as the mechanism introduces an element of competition between producers, the scope for rent seeking behaviour is reduced (Latacz-Lohmann and van der Hamsvoort 1998). These advantages mean that competitive bidding, as compared to fixed rate payments, can significantly increase the cost effectiveness of conservation contracting on private land (Latacz-Lohmann and van der Hamsvoort 1997, 1998).

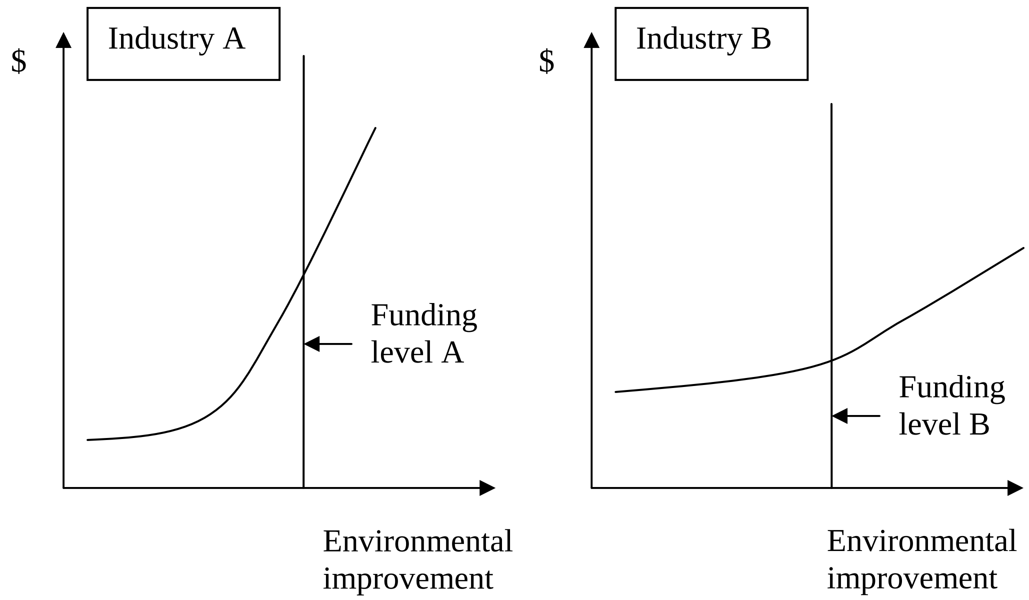
Competition in a conservation auction is enhanced when the scale and scope of a tender is larger, because there are more potential participants in an agricultural region. Some mechanisms, such as the Conservation Reserve Program in the United States, have a broad scope so as to increase participation, give near-universal access for equity purposes, and generate administration efficiencies (Kirwin et al. 2005). However, a broadly scoped tender comes at a cost. Because they may encompass multiple agricultural sectors, different geographic areas and a variety of potential actions, it is more difficult to target specific outcomes without generating substantial design complexities. For these reasons, competitive tenders in Australia have tended to be more targeted, often focused on specific areas (e.g. catchments), industry types (e.g. broadscale agriculture) and actions (e.g. protection of native vegetation).

The key benefits of holding smaller scale auctions are that the risk of failure or some mis-allocation of funds are lower, implying that the design and allocation stages may not need to be as rigorous. The key benefits of having narrowly scoped auctions are that the design and assessment processes tend to be simpler, and that the number of issues and stakeholders to engage with are minimised. Other potential benefits are that it may be easier to target issues or equity outcomes specific to industries or regional areas. These are key reasons why many of the trials for conservation auctions have been exploratory in nature and relatively narrow in terms of scale and scope.

However, there are also a number of challenges in running a number of auctions that are narrow in scale and scope. The first is that it may be very difficult to allocate an appropriate level of funding to each program to generate efficient outcomes. In economic terms, efficiency will be reached when the marginal cost of achieving an environmental outcome is just equal to the marginal benefit gained, and that these costs and benefits are equivalent across allocation tasks. This latter condition ensures that further efficiencies can not be gained by reallocating funding between tasks.

The allocation problem can be illustrated with the aid of Figure 1, where the opportunity costs of generating environmental improvements in two different industries are represented. The diagrams represent ascending bid curves for landholders in Industries A and B to generate a supply of environmental services. The variations in opportunity costs between industries means that the supply functions have very different shapes.

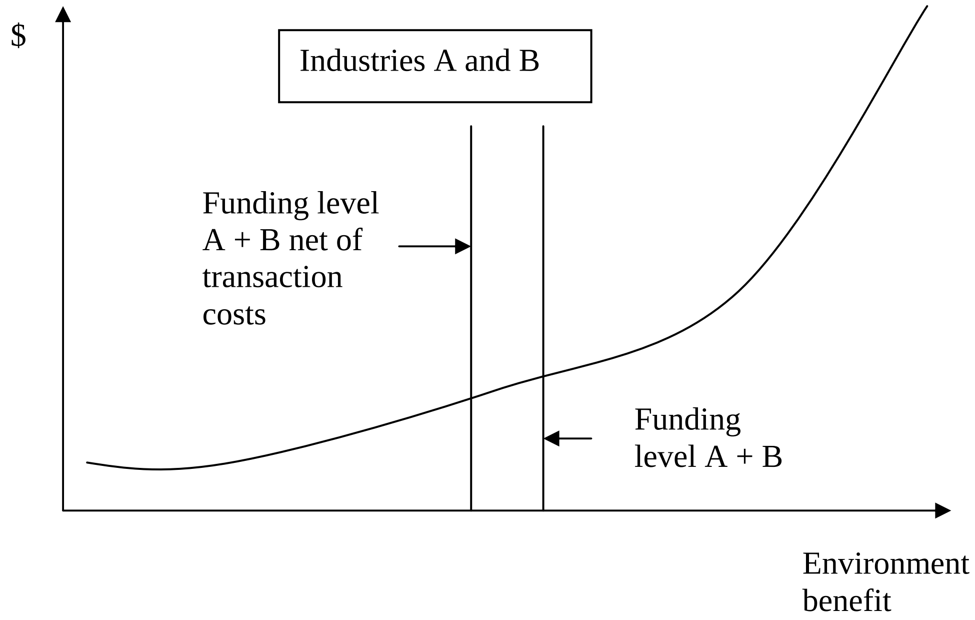
Figure 1. Opportunity costs separately by industry



Because the potential supply of environmental services is difficult to predict before a conservation auction is run, it is very unlikely that funding can be allocated so that the last bids funded delivers equivalent costs per unit of environmental benefit. This means that separate conservation auctions will always differ in the efficiency of outcomes because the issues about the initial allocation of funding.

There are potential efficiencies in running a single auction, where the bids are combined into a single opportunity cost curve. This ensures that there is more consistency in the funding for environmental improvements across industry, and that there are not differences in the investment for the last unit of marginal benefit gained. The allocation problems are minimised, as increasing the scale and scope of conservation auctions helps to ensure that more actions are available for a given level of funding. These benefits are shown in Figure 2, where the potential bids from landholders across two industries are combined into a single bid function.

Figure 2. Opportunity costs jointly across industry



There may be different cost structures associated with increasing the scale and scope of conservation auctions. At one level, administration costs may be streamlined by having only a single auction to organise and perform. However, there may be a range of different administration and transaction costs to consider when moving to more consolidated auction formats. Transaction costs relevant to NRM issues can include additional engagement, negotiation, institutional and compliance costs associated with changing management practices by landholders (McCann et al. 2005). Key administration and transaction costs to consider in larger scale and scope auctions include:

- political economy costs of dealing with a wider range of interests across institutional boundaries,
- transaction costs of designing a conservation auction with a range of different stakeholders and partners,
- transaction costs of engaging and negotiating agreements with a wider range of landholders,
- auction design costs associated with more complex contingencies such as varying engagement rates and the setting of reserve prices,
- contract design costs associated with more complex contingencies such as setting performance indicators and monitoring conditions across different industries,
- metric design costs associated with achieving increased preciseness of information and dealing with a wider range of potential actions and environmental improvements,
- The effect of larger scale auctions on incentives, including effects on participation and engagement rates, and crowding-out and crowding-out impacts on voluntary conservation efforts and attention to duty-of-care.

The implication of this framework is that while a number of issues can be identified relevant for determining the scale and scope of conservation auctions, these can be summarised into two key considerations:

1. The efficiency gains associated from holding larger scale and scope auctions (or the efficiency losses associated with smaller ones),
2. The change in transaction costs (including administration costs) associated with holding larger scale and scope auctions.

3. Water quality issues in the Lower Burdekin region

These design issues are being applied in a case study application. The conservation tender is being implemented within the Burdekin Dry Tropics, with a specific focus on two main agricultural industries (cattle grazing and sugarcane production) in areas within the Lower Burdekin region to the south of Townsville (Figure 1). The auction is being run by the Burdekin Dry Tropics Natural Resource Management Group in 2007 – 2008, in partnership with Central Queensland University, River Consulting, and the University of Western Australia.

The Lower Burdekin region includes the lower part of the Burdekin catchment, which is below the Burdekin Falls Dam, as well as two smaller coastal catchments: the Haughton River and Barratta Creek catchments. The three adjacent waterways share the coastal floodplains and are hydrologically linked through the Burdekin Irrigation Area. Land use in the Haughton and Barratta catchments are similar to the Lower Burdekin, with grazing and sugarcane production the dominant agricultural land uses. Characteristics of the relevant catchments are outlined in Table 1.

Table 1. Characteristics of the catchment

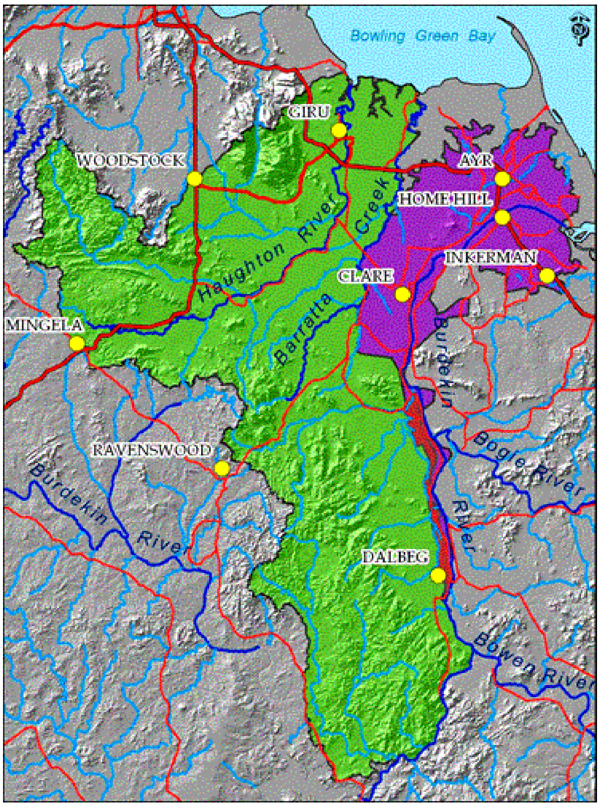
	Burdekin River Catchment[1]	Haughton River and Barratta Creek Catchments
Area (km^2)	130,126	4, 044
Population	17, 497	10, 343
% Cleared	73	77
Area under grazing (km^2)	128, 640	3, 441
Area under sugar (km^2)	193	528

Source: GBRMPA 2001

[1] Information relates to the entire catchment area, The Lower Burdekin section is only a small proportion (<5%) of total catchment area.

There are a number of linkages between agriculture and water quality issues. The application of nutrients and pesticides in the floodplain areas has increased the risk of offsite contamination in surface and groundwater resources (GBRMPA 2001). The presence of elevated nutrient levels has reduced water quality within groundwater aquifers and the unmetered extraction of groundwater for agricultural production has led to saltwater intrusion (GBRMPA 2001). Only a small percentage of land within the catchments is under any form of conservation protection, accounting for one per cent of the entire Burdekin and eight per cent of the Haughton and Barratta systems (GBRMPA 2001).

Figure 1. Map of eligible areas in the conservation tender



Source: Map courtesy of Burdekin Dry Tropics NRM

The aspects of water quality which are most important to the health of the Great Barrier Reef are suspended sediment as well as nutrient and pesticide concentrations. Quantifying the exact contributions to the Great Barrier Reef lagoon from catchments and establishing targets for these contributions is a complex task given the variables to be addressed. There are a number of projects underway to attempt to establish this data, however, the best available guidelines at the present are those set by the Great Barrier Reef Marine Park Authority (GBRMPA 2001) in a report to the Ministerial Council on targets for pollutant loads. Pesticide application rates in the catchments are recorded in Table 3, with target reduction levels set at 50%. The current and targeted sediment and nutrient contributions from the catchments are detailed in Table 4.

Table 3. Pesticide application rates (Kg active ingredient/yr)

Pesticide	Lower Burdekin Catchment	Haughton and Barratta Catchments
Atrazine	19, 300	24, 299
Diuron	3, 272	4, 123
2-4D	5, 465	6, 887
Chlorpyritos	207	285
MEMC	196	247

Source: GBRMPA 2001

Table 4. Sediment and nutrient exports and targets for the catchments

	Burdekin Catchment			Haughton and Barratta Catchments		
	2001 Tons/year	2011 Target Tons/year	Reduction Target	2001 Tons/year	2011 Target Tons/year	Reduction Target
Sediment export	2, 442, 232	1, 221, 616	50%	172, 454	115, 544	33%
Total N export	11, 134	7, 460	33%	801	401	50%
Total P Export	2, 438	1, 219	50%	175	88	50%

Source: GBRMPA 2001

The sugarcane industry

The sugarcane industry within the Burdekin region is recognised as the major sugar producing region in Australia, supporting four sugar mills operated by CSR Sugar. Average farm size in the region is 105 hectares. There are approximately 695 growers in the Lower Burdekin (Morgan 2007).

The availability and affordability of water is a key production issue for the sugarcane industry in the Lower Burdekin as cane is being irrigated, predominately through furrow irrigation. Furrow irrigation is often associated with high application rates which can lead to excess surface runoff and leaching into groundwater resources. The off-farm movement of water containing nutrients and pesticides can be expected to have an adverse impact on water quality. The industry is recognised as a contributor of nutrient exports to the Great Barrier Reef (Beare et al. 2003).

The grazing industry

Beef cattle production has a much lower level of economic importance in the Lower Burdekin compared to sugarcane, even though the area of land available for grazing exceeds the irrigation area. There are approximately 30 commercial graziers and a number of recreational and mixed grazing enterprises.

Grazing is recognised as having the potential to do considerable damage to land and waterway condition, with increased sedimentation from erosion the main threat to water quality. A total of 868, 000 hectares within the Lower Burdekin and Haughton Barratta catchments have been deemed 'hot spot' locations, on the basis that they are contributing one tonne or more of sediment per hectare a year to the coast (Beare et al. 2003).

Based on the recognised best management practices to improve water quality leaving farms, in this case study, the types of actions that can be considered to improve water quality in the Burdekin can be summarised into the following broad groups:

1. Nutrient management
    - *such as better nutrient budgeting and fertiliser application processes leading to lower application rates and reductions in N and P.*
2. Waste water management
    - *such as recycle pits, sediment traps, drain design, road design, tailwater management, riparian and wetland management, buffer zones.*
3. Pesticide management
    - *such as reductions in the application of key herbicides and pesticides*
4. Sediment management
    - *such as improved ground cover, minimum tillage, reduced stocking rates.*

The groups of actions that are relevant to sugarcane growers are nutrient management, waste water management and pesticide management. As sugarcane is cultivated in very flat areas of the Burdekin, soil erosion is not considered to be an issue of environmental concern. For grazing enterprises, sediment management is likely to be the only action that will be relevant as soil erosion and associated sediment (and phosphorus) loads are the key impacts on water quality. There are very low levels of nitrogen and pesticides emitted from grazing.

4. Issues to address in the tender, contract and metric design

The tender process is essentially a price-based mechanism for auctioning off Government support (in the form of incentive payments) to landholders. Auction theory and other inputs into the design of auctions can therefore help to design the most efficient form of the tender process (Klemperer 2002). Among the key aims for conducting a tender process are:

1. To ensure that there is enough participation to ensure a competitive bidding system,
2. To ensure that there is adequate information for bid construction purposes,
3. To minimise opportunities for collusive or strategic behaviour among participants and,
4. To ensure that optimal outcomes are generated (in terms of reallocating resources efficiently).

There are three key stages in a conservation tender that govern the process and influence the final outcomes. They need to be designed carefully and effectively. The processes include:

- Auction design, involving tender rules and process design, which will help to determine:
    - The environmental services to be purchased,
    - Eligiblity for participation,
    - Expected or probable participation rates, and
    - The process for engaging and accepting proposals;
- Contract design, which will determine the rules of the agreement between buyers and sellers and may also have an impact on participation rates.
- Metric design, which will determine which bids are selected and what environmental benefits are being purchased.

There are four broad categories of costs involved in the implementation of conservation auctions. It is important to recognise and minimise them in the design process:

- Direct design and administration costs,
- Costs involved in assessing proposals,
- Transaction costs for both the landholders and the implementing agencies to find and achieve successful agreements; and
- Indirect impacts on participation and other relevant factors.

As the complexity of a conservation tender increases, the different costs involved in implementing and performance of a tender are likely to rise. The challenge in designing a tender typically involves balancing the trade-off between achieving more detailed and efficient outcomes on the one hand, and minimising the different costs involved on the other hand. These trade-offs are often reflected in the metric, where the level of precision involved in assessing proposals is balanced against the costs involved in gaining extra precision.

Auctions are typically tailored to suit the situation in which they are being applied (Klemperer 2002). This means that the design of the tender process, and the subsequent design of the metric for bid assessment have to be sensitive to the frame in which the tender is applied. In the next section, the design of the tender process and metric design for the Burdekin case study is reported.

4.1 The design of the auction process for the Burdekin case study

The key issues relevant to designing the water quality tender for the Burdekin were

- Establishing the target outputs,
- Identifying the scope of the auction,
- Identifying the scale of funding and application,
- Designing a process that was consistent with the current institutional structure.

The **target outputs** were identified as those relevant to improving water quality. Water quality would be improved through the reduction in emission of diffuse source pollutants

- Sediments (from grazing land)
- Nutrients (primarily nitrogen, from sugarcane land)
- Residual pesticides (pesticides, herbicides, fungicides)

Other impacts on water quality were not considered because the additional costs of measuring them and including them in the metric would not have been productive.

The **scale of the auction** (the size and intensity of the process) was largely driven by funding availability. In this case study, a total of $600,000 has been made available for landholder incentives from two separate programs. The total funding has been allocated across two sections of the Lower Burdekin as a part of the experimental design of the project. One half ($300,000) will be available for both cattle and cane projects in the Haughton River, Barratta Creek, Landers Creek and Stones Creek catchment areas (green area in Fig 1), while the other half ($300,000) will be available for sugarcane growers in the remainder of the Lower Burdekin area (purple area in Fig 1).

The **scope of the auction** (the coverage across a range of factors) was set with reference to both scale and institutional factors. In this case study the scope encompasses industry differences (cane and grazing industries), as well as geographic differences (two different river systems).

A **range of institutional factors** was considered in the design of the tender mechanism, with particular focus on avoiding overlap with other funding mechanisms. The MBI incentive program was merged with the water quality program for sugarcane producers in the Lower Burdekin (i.e. the MBI incentive program effectively subsumed the other incentive), while any overlap with the horticultural incentive program in the same region was avoided.

Other issues in tender design are summarised in Table 7.

Table 7. Issues in tender design

Issue	Considerations	Implementation
The number of bidding rounds	Multiple rounds can result in cost efficiencies and are more suitable if coordination between landholders is required. But, more time is needed and they add to the complexity of process	Single bidding round
Sealed or open bid	Landholders more likely to participate if their bid details are confidential	Sealed bid
Discriminatory or uniform pricing	With discriminatory pricing, winning bidders get paid their asking level. With uniform pricing, winning bidders get paid the same amount as the highest winning bid. With uniform pricing, there needs to be more control over what actions are offered	Discriminatory bid pricing
Reserve price	Reserve price may be necessary to reject over-priced bids, particularly if there is limited competition.	An unspecified reserve price applies
Efficiency and participation	Maximum bid levels can be set to ensure maximum involvement by landholders. Having no caps on bid levels means a small number of efficient bids may get most of the funding. Landholders may increase their chances of success by entering multiple bids.	Multiple bids allowed No cap on bid levels

Issue	Considerations	Implementation
Cost share arrangement	Fixed-price grant schemes often incorporate a cost share principle which generally does not exist in a conservation tender.	A cost share component will be recorded but will not affect the assessment.

4.2 Contract design

The contract determines the details of any management agreement and is designed to ensure the projects are completed as stated. The key issues that were considered in the contract design are summarised the in Table 8.

Table 8. Issues in contract design

Issue	Considerations	Implementation
Time period for contract	Longer time periods preferred, but there are government constraints on funding period available.	One year contracts April 08 to April 09
Payment periods	There are benefits in tying funding to performance, but also in minimising the number of payments. Some up-front payment may be needed for projects with high capital costs.	Two payment periods. 60% upfront and 40% on successful completion.
Form of security	Some conservation tenders have involved high levels of security, such as covenants over land titles. Simpler agreements are more likely to be accepted by landholders.	Simple contracts to be used.
Form of contracts	Preferable to have simple form of contract that is easy to understand.	Standard simple contract to be used, with bid forms to be attached as a schedule when signing agreements.
Monitoring	Very simple process preferred	Simple report and evidence based monitoring process with agreed conditions attached as a schedule when signing agreements. All projects will be subject to a random audit

If contract design and/or enforcement of contracts are weak, then more effort has to go into auction and metric design to avoid adverse selection. In this project, some of the industry representatives were concerned about compliance issues and it was considered important that projects should be only accepted when there was a high likelihood that landholders would complete the actions. This meant that some assessment of the risk of adverse selection had to be included in the metric, which is discussed in more detail in the next section.

4.3 Issues to consider in metric design

A key step in the development of a conservation tender is the development of the metric, which provides the tool for assessing the environmental benefits of a proposal and comparing it to the asking bid value. The metric is important because it:

(a) represents the process for evaluating bids, and
(b) provides clarity to bidders about the evaluation process.

Some of the key elements to consider in metric design are summarised in Table 9, with additional information about the relevance to the case study.

Table 9. Key elements of metric design

	Issue	Description	Relevant to Burdekin	Included in metric
1.	Quantity / quality	Assessing the quantity and quality of environmental benefits associated with a proposal, and registering any tradeoffs between those factors.	Yes	Yes
2.	Spatial relations	Impact of spatial coordination in regards to management changes yielding greater outcomes, including the specific areas to be included in the tender.	No	No
3.	Relative change	The extent to which marginal improvements register as having significant environmental impact.	Yes	No
4.	Location	The specific location of the proposal and how this may affect the environmental benefits generated.	No	Soil type included
5.	Timing	The timeframe in which the management action will deliver its objective and/or the time taken to achieve that outcome.	Yes	Yes, for capital works
6.	Implementation risk	The commitment from the landholder that the funded management action will actually be implemented.	Yes	Yes
7.	Outcome uncertainty	The probability of success of the action in achieving its objective.	Yes	Yes
8.	Irreversibility / thresholds	How the proposals might contribute to meeting or avoiding particular thresholds.	No	No
9.	Spillover impacts	How to ensure that there are no negative impacts or problems created by the management action adopted.	Yes	No – dealt with in auction rules

Source: Adapted from Whitten (2006)

In a broadly scoped industry tender there is a broad range of management activities that landholders might adopt to achieve the required environmental outcomes. In a small scale tender, there might only be a limited range of potential management activities, where the limited variation between projects makes the metric design simpler. Expanding the scale and scope of a tender normally makes the metric more complex. In the Burdekin tender the challenge was to design an evaluation tool which could compare projects:

- Across different industries;
- Across different management activities;
- Across areas with different environmental pressure;
- Across type – where type can include infrastructure or land management--some projects are more verifiable and therefore the expected outcomes are more likely to be realised;
- Across time – where some project may provide more permanent structures that will continue providing environmental benefits well after the completion of the one year contract; and
- Across the scope of management approaches, i.e. from a single uncoordinated action to one that is part of a more integrated farming systems approach.

To address these issues and ensure consistency in the bid evaluation process, a set of guiding principles were established as outlined in Table 10.

There were two major challenges to address in the design of the metric. The first was to compare different types of emissions in different catchments. Comparability was achieved by estimating the proportional reduction that each bid proposal made against the specific catchment targets. Some draft guidelines for water quality targets (e.g. GBRMPA 2001) have been set for major catchments such as the Burdekin and Haughton/Barratta systems. These targets for reductions in sediment, nutrient and pesticide loads were then used as a basis for evaluating how well different landholder proposals will help to achieve the desired target.

The second major challenge was to develop some consistency between the desired auction design/metric design process and a more traditional approach of simply scoring the different proposals. An important and influential group of stakeholders in the sugar industry (the Lower Burdekin Sugar Working Group) have been active in the development and promotion of best management practices in the region. They have developed a farm level BMP ‘scorecard’, which assesses how well a cane grower does in minimising diffiuse source pollution from his land. The scorecard involves a range of different management activities being assessed under the following six broad categories:

- Management Skills & Property Planning
- Land Preparation & Management
- Crop Management
- Water Management
- Nutrient Management
- Pesticide Management

Table 10. Principles guiding the evaluation of projects

Design principle	Explanations
Environmental outcomes	Proposals to be assessed against the types and extent of estimated improvement in water quality they achieve. The metric will estimate the reduction of farm emissions in the key areas of * sediments * nutrients (nitrogen, phosphorus) * pesticides (pesticides, herbicides, fungicides, etc) Emission reductions of the various pollutants to be compared on the basis of their relative contribution of improvements to regional (Lower Burdekin and Haughton/Barratta) water quality targets.
Total emissions	For the purpose of this market based incentive the avenue of emission is not relevant. While sediment can only be lost through surface flows, nutrients may be lost through lateral flows (surface water), leaching (ground water) or denitrification (atmosphere). Bids will be assessed on the predictions for total emission reduction and its contribution to achieving regional water quality targets.
Value	Proposals from landholders will stipulate a bid amount, i.e. the amount of money that the bidder would like to receive from BDTNRM to facilitate implementation of the proposed activity/infrastructure. Bids will be rated on the basis of $/unit of water quality improvement, as calculated from total emission reduction.
Implementation risk[1]	Proposals need to be verifiable. Verification can include photographic evidence, invoices and farm/paddock records. To demonstrate improvement it is essential that the prior situation can be demonstrated, e.g. through at least two years of fertilizer purchase invoices. Verification provides confidence to the participating landholder as well as the BDTNRM that contract conditions have been met.
Permanency	Proposals which offer lasting improvements will rate higher than temporary changes. For example, the construction of sediment traps and the establishment and fencing of riparian filter strips will generate benefits in years to come while a one-year reduction in fertilizer application yields water quality benefits in that year only.

[1] Some elements in the verification process are incorporated in the contract monitoring process and some in the metric.

Under the scorecard approach each activity within a category is assigned a score, which are then summed and weighted by category to generate a total score (see Appendix 1 for details). The idea behind the scorecard is to be able to use it as both an extension and assessment tool. It can be used to discuss a range of different BMPs with landholders as well as collecting information for a performance based assessment. For the latter, the scorecard can be used to make an initial assessment which will set a benchmark for a landholder’s management practices, upon which any further management changes which improve water quality can be assessed.

Members of the Lower Burdekin Sugar Working Group had committed considerable time and resources into the development of the BMP Scorecard and it was their expectation that this would be used to assess projects for the proposed incentive scheme. However, there were several factors that limited the use of the scorecard in the Burdekin WQ tender:

- The scorecard is used to measure inputs to the farm system, not outputs as required by the tender;
- The scorecard has an internal reference point: an 'optimal' farming system achieves a score of 110.
- No equivalent tool had been developed for the grazing industry, impeding the comparison of scores between cattle and cane submissions;
- No benchmark assessments had been made on which to base any improvements. This would require two assessments to be made; one to set the benchmark and another based on the proposed management changes;
- Some activities have a wide range of potential scores, ie. 0-100, making it harder to assure consistency in valuations across different field assessors; and
- The scorecard is quite lengthy and takes considerable time to complete.

While there were some difficulties associated with using the scorecard approach as a primary method of project assessment, it could still be used to:

- help determine some of the adjustment factors;
- assist in the contract monitoring process; and
- remain part of the important on-going extension activities.

An overview of the bid assessment process is provided in Appendix 2 and full details of the key elements in the metric design are presented in the next section.

5. Bid assessment metric

There is an extensive suite of management actions and infrastructure establishment that landholders could conceivable undertake and submit as proposals to improve water quality. These can be grouped into four main categories:

- Nutrient management
- Pesticide management
- Water management
- Sediment management

Evaluating the environmental benefits associated with each of these management practices was the primary objective in the metric design. However, two other critical components, shown in Table 10, were also considered.

- Effectiveness factors – which include an assessment of the permanency of the project (projected time span of benefits). Other influential factors that might detract from the project effectiveness also needed to be considered.
- Implementation risk factors – these form an assessment of the likelihood that landholders can implement the actions and verify that they have occurred.

The need for these components of the metric assessment is largely driven by the scope of the conservation tender across industries and catchments. Increases in heterogeneity between proposals generates requirements for more detailed assessment, in contrast to narrowly scoped tenders where uniformity between bids limits assessment needs.

In this case study, the process for assessing bids can be outlined as follows:

1. Collect relevant information for each bid;
2. Assess potential reductions in nutrients, pesticides and sediment emissions for each bid;
3. Make **effectiveness** adjustments where
    a. benefits are likely to occur over longer periods of time,
    b. other factors may reduce the effectiveness of the project;
4. Identify proportional reductions for emissions for each bid against GBRMPA regional targets (**Environmental score**);
5. Sum proportional reductions and adjust for **implementation risk** factors (**Total assessment score**); and
6. Compare Total Assessment Score to costs (**Relative bid value**)

The most notable part of the metric is the way in which the environmental scores are generated by calculating the proportion of reductions against catchment targets. This allows reductions for different factors such as nutrients and sediments to be compared and then summed. After this critical step, bids can be assessed and ranked in terms of their relative bid value, followed by the selection process until the budget funding limit has been reached.

There is some risk that landholders may not perform the management actions as specified in their bid proposals. While the tender contract can be designed to incorporate specific monitoring and evaluation conditions, it cannot deal with the issue of adverse selection. In order to minimise the risk of moral hazard, implementation risk factors will be incorporated into the metric design and selection process.

Some management actions proposed by landholders, such as the construction of physical infrastructure are easily verified, but other actions might have important environmental benefits but not be so readily substantiated. For example, an applicant might submit a proposal that states they will reduce their fertiliser use, but without some kind of evidence-based verification, there is no way of knowing if the project will really be implemented. The implementation risk score was designed in part to assess the likelihood that any stated action could be validated and subsequently tracked in the monitoring process.

However, the second aspect of the implementation risk score related to the likely effectiveness of the proposed actions in terms of the applicants' management capacity. For example, a single action such as building a tail water dam may be better designed and lead to better environmental outcome if the applicant has good management skills and training, and/or who adopts a farming systems applications. Some of the factors that could be considered in the implementation risk score were:

1. **Monitoring systems and record keeping**: e.g. paddock records, monitoring sites, pasture budgeting records. Consider both existing systems and proposals for new ones will be considered.
2. **Farming systems management**: e.g. extent to which the adjustment is part of a holistic strategy or a one-off attempt, which may not be well coordinate with other farm management practices.

3. **Track record:** e.g. extent to which the applicant has been involved with conservation organisations and/or extent of participation/compliance in previous schemes.
4. **Physical evidence**: e.g. ability to provide physical evidence such as photos, records and invoices to demonstrate outcomes. The challenge is will be with management change, as capital change is easy to verify.
5. **Management skills, capacity and accreditation** e.g. extent to industry participation and training.

6. Conclusions

There is potential for efficiency gains to be realised when conservation auctions are implemented at increasing levels of scale and scope. Improving the coverage of the conservation auction increases the pool of potential bidders and actions, hence allowing more cost-effective proposals to be submitted and selected. Conversely, smaller scale auctions may restrict funding to programs with large opportunity costs.

There are tradeoffs involved with increasing the scale and scope of conservation tenders in the form of increased administration and transaction costs, as well as increased risk that a program may not work as planned. This means that the efficiency benefits from increasing the scale and scope of an auction need to be weighed up against the increased costs and risks involved. A key area where additional costs may be incurred is in the bid selection process, where more complex metrics may be required.

In this case study application of a conservation tender in the lower Burdekin region, there are three notable factors associated with the increase in scale and scope. First, there has been a significant increase in transaction costs, particularly dealing with the political economy issues involved in combining different funding programs. This has generated some organisational costs, as well as some compromises in design and delivery.

Second, there needed to be more explicit recognition of physical differences across the case study region, particularly where increases in scope involve different environmental issues and goals. This has placed requirements on the metric, and the underpinning science, to be more explicit in modelling the potential environmental improvements. The third area of difference focused on the recognition that there may be varying levels of success associated with different proposals. Account needed to be taken of the risk that some activities may not generate planned environmental improvements, and that landholders may not perform the actions that have been promised. In this metric, the use of adjustment factors and a verification score are used to account for these issues.

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Appendix 1. Extract from the sugarcane BMP scorecard

Phase	Management Considerations	Management Options	Phase Weighting	MO rating
Management Skills & Property Planning	***Management Capacity***	Accreditation (Chemcert, progrow, LWMP's etc)	**5**	0-20
		Record keeping (Economics, farm operations etc).		0-10
		Communication with R&D activities		0-2.5
	Farm design	Match row length and slope for soil type.		0-40
		Separate farm into discrete soil units in blocks.		0-15
		Vegetate riparian zones and waterways.		0-2.5
	Infrastructure	Water outlets, pipelines provision for recycling		0-10
				Max 100
Land Preparation & Management	***Land preparation***	Laser level blocks and fallow plots as required.	**2.5**	0-20
		Treat each soil type discretely.		0-10
		Adopt GPS controlled traffic technology.		0-10
	Fallow management	Maintain a weed free fallow.		0-10
		Use appropriate fallow crops.		0-10
	Tillage operations	Adopt a minimum or zero tillage system.		0-10
		March row width to machinery.		0-10
	Soil amelioration	Use appropriate soil ameliorant		0-20
				Max 100
Crop Management	***Crop husbandry***	Maximize crop potential with good husbandry.	**2.5**	0-40
		Spray out to eradicate crop on permanent beds.		0-10
	Harvesting	Green cane harvest (GCTB) where appropriate.		0-40
		Optimize harvester efficiency.		0-10
				Max 100
Water Management	***Irrigation management/ control***	Match water use to crop requirements.	**30**	0-15
		Use water meters to know water application volume.		0-5
		Adjust inflow rates (furrow)		0-2.5
		Adopt efficient application methods (OHLP,drip)		0-30
		Customize furrow shape to maximize efficiency.		0-2.5
		Minimize runoff by management & infrastructure.		0-40
		Minimize run-off from post harvest irrigations.		0-2.5
		Mix groundwater with surface water appropriately.		0-2.5
				Max 100

Phase	Management Considerations	Management Options	Phase Weighting	MO rating
	Irrigation timing & scheduling	Employ tools to improve irrigation efficiency.	**10**	0-70
		Irrigate prior to fertilizing in burnt cane system.		0-10
		Delay irrigation after fertilizer application.		0-20
				Max100
Nutrient Management	***Fertilizer rate***	Soil testing to optimize nutrient application.	**30**	0-10
		Nutrient budgeting to apply optimum rate.		0-90
				Max 100
	Fertilizer timing	Time application to maximise efficiencies.	**10**	0-100
				Max 100
	Fertilizer placement	Place fertilizer to maximise efficiency & uptake	**10**	0-100
Pesticide Management	***Product***	Use low risk products where possible.	**10**	0-50
	Rate	Adopt an integrated pest management strategy.		0-15
		Use at recommended label rate.		0-20
	Application	Use most efficient methods for spraying.		0-10
		Ensure effectively functioning spray rigs.		0-5
WQ points			**110**	MAX100

Appendix 2. Project assessment and evaluation overview