Government of South Australia
South Australian Murray-Darling Basin
Natural Resources Management Board

BushBids

Lock 3 to Swan Reach

2013

River Bend BushBids:

Conservation along the River Murray and surrounding plains of the South Australian Murray-Darling Basin

Woodland BushBids: Conservation along the Rivery Murray and surrounding plains of the South Australian Murray-Darling Basin

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Funded by Caring for Our Country and the Native Vegetation Council (South Australia)
Delivered by O'Connor NRM

CARING FOR OUR COUNTRY

Native Vegetation Council

Government of South Australia
South Australian Murray-Darling Basin Natural Resources Management Board

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Abbreviations

BBI:	Biodiversity Benefits Index
BBU:	Biodiversity Benefit Unit
BCM:	Bushland Condition Monitoring
DEH:	Department for Environment and Heritage
DENR:	Department of Environment and Natural Resources
DEWNR:	Department of Environment, Water and Natural Resources
EMLR:	Eastern Mount Lofty Ranges
EOI:	Expression of Interest
EPBC:	Environment Protection and Biodiversity Conservation
GIS:	Geographic Information System
MDBSA:	Murray-Darling Basin South Australia
NRM:	Natural Resources Management
RCT:	Resource Condition Target
SABAT:	South Australian Biodiversity Assessment Tool
SAMDB:	South Australian Murray-Darling Basin
SAMDB NRM Board:	South Australian Murray-Darling Basin Natural Resources Management Board

Executive Summary

River Bend BushBids used a single-sealed bid reverse auction to allocate payments to managers of remnant vegetation on privately managed land. The program successfully established conservation agreements over 5,757 ha of native vegetation on private land in the northern Murray Plains, Northern Mallee and the southern Rangelands of the South Australian Murray-Darling Basin region. *River Bend BushBids* followed the conservation tender methodology of previous successful *BushBids* programs.

The project greatly exceeded initial targets, with:

- More than two and a half times the expected area contracted for conservation management,
- Two and a half times the expected area of new sites assessed for ecological values, mapped and supplied with management plans, and
- More than three times the number of management plans produced than originally expected.

The *River Bend BushBids* project had five key objectives with performance information provided below*:*

OBJECTIVE 1: Allocate contracts for cost-effective native vegetation management using an evidence-based prioritisation method implemented at low overhead:on-ground costs

The *River Bend BushBids* project created a market for the allocation of contracts for a total of 142,249 BBUs (Biodiversity Benefit Units). The auction efficiently selected value-for-money contracts for 130,762 BBUs (92 % of the market total) for 32 % of the total price of all BBUs in the market. Efficient contract selection was achieved with low overhead costs. Seventy-seven cents per dollar was allocated to landholder management service payments. Twenty-three cents in the dollar was spent on project implementation overheads to secure contracts and produced the additional benefits of; management information to 28 landholders, management plans written for 7,704 ha of native vegetation, new management information tools created for weed, feral animal and other management, data gathered on the condition of native vegetation at 90 sites (including of 7,704 ha of vegetation on private land), and the establishment of an ecological performance monitoring baseline. The 557 ha represented in unsuccessful bids did not offer value-for-money in the *River Bend BushBids* auction and were not funded by the program.

OBJECTIVE 2: Protect and manage native vegetation, threatened species habitat and threatened ecological communities within the *River Bend BushBids* project area

Native vegetation will be actively managed at 32 sites; including sites where three threatened plant communities, twenty-nine rare/threatened fauna species and three rare/threatened flora species have been recorded. Four properties with successful bids are receiving funds to protect and actively manage 338 ha of threatened/significant plant communities.

OBJECTIVE 3: Increase the area of native vegetation on private property with management information and direction

Comprehensive management plans were prepared for 7,704 ha of native vegetation on private land (target was 3,100 ha).

OBJECTIVE 4: Increase the area actively managed to improve the condition of native vegetation

The active maintenance and improvement of native vegetation condition is being funded on 5,757 ha of privately managed land. The outcomes of this management will be assessed in future years through repeat assessment and analysis of ecological monitoring sites established through the projects monitoring and evaluation processes.

OBJECTIVE 5: Increase the area of native vegetation protected under long-term conservation agreements

All *River Bend BushBids* funded sites will be protected and managed for a 5-year period under a *River Bend BushBids* Management Agreement. Sites representing 5 existing Heritage Agreements were funded for comprehensive (and additional) management and a further 2 new Heritage Agreement applications (representing 307 ha across 3 sites) were initiated by *River Bend BushBids* successful agreements (target was 300 ha of new Heritage Agreements).

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1 Introduction

The primary aim of *River Bend BushBids* is to improve native vegetation on private land, in the area between Lock 3 and Swan Reach in the South Australian Murray-Darling Basin, by establishing multi-year protection and conservation management through agreements with private landholders. *River Bend BushBids* followed the procedure of the existing *BushBids* (O'Connor, Morgan and Bond 2008b) and *Woodland BushBids* (O'Connor, Morgan, Bond and Lawley 2012) conservation tenders, extending the conservation tender approach into new areas along the Murray River and surrounding plains.

River Bend BushBids is an ecosystem services payment scheme focused on protecting and managing existing native vegetation. The program complements investment in biodiversity conservation through projects such as landscape scale feral animal control programs, wetland management, NatureLinks, Regent Parrot and other threatened species recovery projects. Like previous *BushBids* programs, *River Bend BushBids* was developed to provide a cost-effective, proactive approach to managing threats in high conservation value areas that are still relatively intact and to facilitate the efficient, accountable and targeted allocation of funds. The program aims to improve the conservation of biodiversity on private freehold and leasehold land by enhancing active conservation management and protection of existing ecosystems as habitat for native plants and animals.

River Bend BushBids was established with funding from the Native Vegetation Council of South Australia and the Australian Government's Caring for Our Country program. The program is a partnership between O'Connor NRM Pty Ltd and the South Australian Murray-Darling Basin Natural Resources Management Board. Landholder contracts were designed to achieve conservation gains within a 5-year-period of comprehensive management of threats to biodiversity on private land.

The program developed a competitive market for management contracts to achieve conservation gains by:

- protection through Heritage Agreements (i.e. in-perpetuity conservation covenants),
- grazing pressure reduction (including fencing),
- threat abatement (including weed and feral animal management), and
- revegetation and restoration for increased connectivity of landscapes.

Detailed site assessments were carried out on properties of participating landholders and management plans were developed in consultation with landholders. Management plans were based on the commitments and actions that landholders were willing to provide, within the guidelines of the program's objective of achieving measurable improvements in vegetation and habitat condition. Landholders submitted single-price sealed bids which were assessed using a metric developed for *BushBids* and funding was allocated to bids representing acceptable value-for-money. Landholders with successful were invited to enter into an agreement with the South Australian Murray-Darling Basin Natural Resources Management Board to implement the management plan and receive payment of the tendered price over the period of the contract.

The project aims to contribute to targets in State and regional Natural Resources Management Plans

The project directly contributes to:

- Terrestrial biota Resource Condition Targets (RCT) in the South Australian Murray-Darling Basin Natural Resource Management Board Regional NRM Plan (2009):
  - RCT B1: Native ecosystem extent increased to 53% of the region and native ecosystem condition improved across the region by 10 % by 2030.
  - RCT B3: No species or ecosystem moves to a higher risk category and 50% of species move to a lower risk category by 2030.
- Targets of the SA Strategic Plan:
  - Target 69: Lose no native species as a result of human impacts.

- Target 72: Increase participation in nature conservation activities by 25 % by 2015.
- Objectives of "No Species Loss - A Nature Conservation Strategy for South Australia 2007-2017":
  - Obj. 1.1: To create public and private land protected areas.
  - Obj. 1.2: To maintain, improve and reconstruct landscapes.
  - Obj. 1.3: To maintain, improve and reconstruct species and ecological communities.
  - Obj. 1.4: To facilitate the sustainable use and management of native species.
  - Obj. 2.2: To raise community capacity, stewardship and decision making for biodiversity conservation.

1.1 Objectives

Ecological objectives:

- Protect and manage native vegetation, threatened species habitat and threatened ecological communities within the project area
- Increase the area of native vegetation on private property with management information and direction
- Increase the area actively managed to improve the condition of native vegetation
- Increase the area of native vegetation protected under long-term conservation agreements

Project management targets:

- Allocate contracts for cost-effective native vegetation management using an evidence-based prioritisation method implemented at low overhead:on-ground costs
- Prepare management plans for a minimum of 3,100 ha of native vegetation on private land.
- Improve the condition of vegetation on a minimum of 2,100 ha through establishment of contracts for cost-effective native vegetation management using an evidence-based method implemented at low overhead:on-ground costs
- Increase the area of native vegetation under long-term conservation covenants (Heritage Agreements) by at least 300 ha
- Establish baseline monitoring of vegetation condition and the outcomes of management through a Before-After-Control-Impact design (extending the *BushBids* monitoring and evaluation plan (O'Connor et al. 2008a))

1.2 Geographic area and extent

The *River Bend BushBids* project boundary in the South Australian Murray-Darling Basin covered an area of 578,450 ha (Figure 1). It extended from Swan Reach in the south to Lock 3, and 25 km on either side of the River Murray. The project area included the towns of Swan Reach, Blanchetown, Morgan, Waikerie and Kingston-on-Murray.

1.3 Land use

The main land uses in the *River Bend BushBids* region are grazing modified pastures and rangelands, crop/grazing rotations, horticulture and conservation.

1.4 Biodiversity

Approximately 60% of the total *River Bend BushBids* area is mapped as native vegetation, however only 3% of the native vegetation is found within the public reserve system. The majority (97%) of native vegetation is found on private land that has undergone differing levels of degradation. Threats

to biodiversity in this area include the effects of habitat degradation and loss, fragmentation, isolation and small remnant size, competition from weed species, grazing and predation from feral animal species, competing land use priorities and inappropriate land management practices.

The project area contains important native habitats, including wetlands, woodlands, mallee and shrublands and many plant and animal species threatened at the regional, State and national levels. Threatened species such as the Regent Parrot, Malleefowl and Carpet Python rely on habitat within this area for their survival.

Figure 1. ***River Bend BushBids*** **project boundary within the Murray-Darling Basin, South Australia**

2 Development and implementation of the *River Bend BushBids* tender process

River Bend BushBids land management contracts were developed based on field assessments of distinct units of native vegetation and from discussions with landholders about the most appropriate and achievable management actions for each site. The selection of contracts for investment was undertaken through a competitive tender, where landholders submitted a bid price to undertake the actions described in their site Management Plan. Contracts were awarded based on value-for-money in achieving biodiversity conservation objectives. The contract design follows that of *BushBids* and *Woodland BushBids.*

The steps undertaken in the development and implementation of *River Bend BushBids* and descriptions of selected aspects of these processes are outlined in Figure 2 and Table 1.

2.1 Steps involved in the development of the *River Bend BushBids* tender process

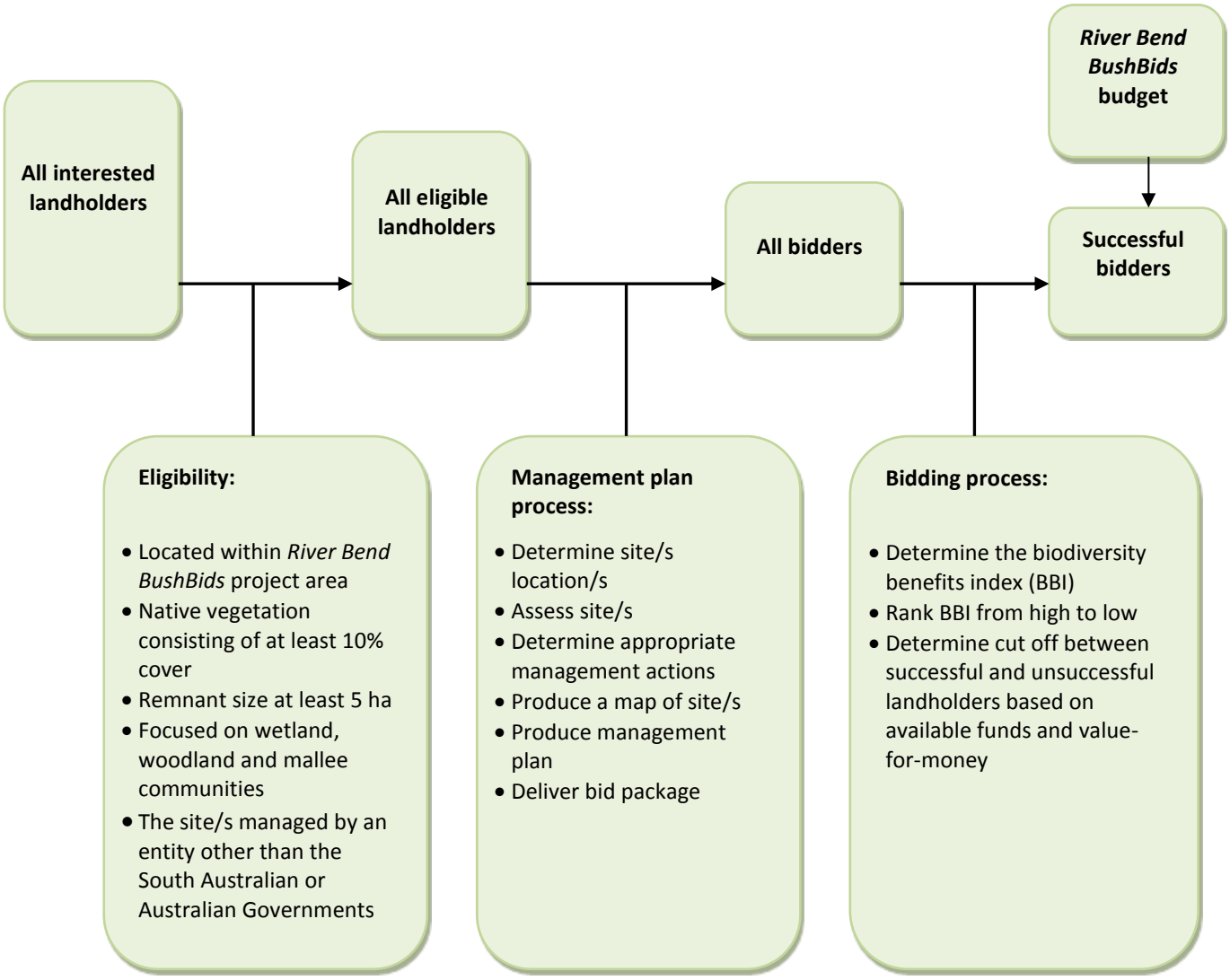


Figure 2. *River Bend BushBids* process

Table 1. The steps and procedures involved in the development of *River Bend BushBids*

Steps	Procedures
Assessed / controlled the size of the market	The approximate area of native vegetation on private property was determined. An open-ended Expression of Interest (EOI) period was used to reach the desired amount of hectares and participants.
Determined landholder and property eligibility for participation in *River Bend BushBids*	Project area boundaries were determined from landscape features and plant community types (refer to Figure 1 for project boundaries). Sites were visited to determine eligibility (vegetation communities present, location, size, cover of native vegetation and ownership).
Determined available information and datasets on native vegetation	Used existing datasets (e.g. plant lists, locations of threatened species, Heritage Agreements, conservation reserves, native vegetation cover and floristic datasets).
Established project data and database management systems	Database systems were established for: Expression of interest data Site assessment / Management Plan data Mapping data Database generated scores Bid assessment data Management Agreement contract data Project management data Annual reporting data
Established vegetation benchmarking procedures	Used the Bushland Condition Monitoring method and benchmarks for the SAMDB region (Croft, Pedler and Milne 2009).
Established landholder essential commitments and minimum management standards	Established and communicated essential commitments and minimum management standards for management services.
Established procedures for dealing with Aboriginal heritage issues	Established procedures and protocols for dealing with Aboriginal heritage in site assessment and management plan development.
Developed project management process and timeframe	Gantt chart and project milestone plan developed.
Determined best advertising/ communication methods for expression of interest from landholders	*River Bend BushBids* was advertised in local papers and radio interviews, by regional NRM officers who contacted landholders and by word of mouth. A brochure and five factsheets were developed and disseminated detailing the project and process. Three information sessions, at Swan Reach, Waikerie and Morgan were conducted for interested landholders (advertised in local papers).
Modified SABAT (SA Biodiversity Assessment Tool Database)	SABAT from *BushBids* was used with slight modifications to the landscape context for the *River Bend BushBids* area.
Used established scoring system and Biodiversity Benefits Index	The metric used to assess the value for money offered by bids was *Biodiversity Benefit Index =* *Conservation Value Score x Management Service Score / Bid Price* Conservation Value Score was based on habitat condition, landscape context and conservation significance. Management Service Score was based on the management service the landholder agrees to undertake. The landholder

Steps	Procedures
	determined the bid price. Refer to section 2.3 for a more detailed explanation.
Used established processes to interact and fit with existing schemes and legislation	Existing schemes and legislation included the Native Vegetation Act 1972, Heritage Agreement scheme, fire management, Natural Resources Management Act 2004 (animal and plant control statutory obligation), non-market based incentive programs and future incentive schemes. Landholders agreeing to seek covenants under the Heritage Agreement scheme were eligible to offer the biodiversity services of permanent protection with stipulation that application to DEWNR must occur within the first year of *River Bend BushBids* funding.
Used established site assessment methods	Information and guidelines for site assessments were modified from *Woodland BushBids* (Bond et al. 2009). Field datasheets for the site assessments were modified from *Woodland BushBids* and NCSSA's Bushland Condition Monitoring method (Croft, Pedler and Milne 2009). The established NCSSA's Bushland Condition Monitoring method (techniques and benchmarks) was used to assess the condition of the sites. Site assessors attended a session in assessing bushland condition and determining appropriate management services.
Developed Management Plan outline and mapping layout	*BushBids* templates were revised for the *River Bend BushBids* Management Plan, including weed and animal control procedures and mapping layout. New documents addressing revegetation principles and feral animal control principles were developed.
Established site assessment data storage	SABAT database was provided for data entry. Site data was also entered into the Management Plan template.
Developed probity protocols	Probity protocols: • Probity briefings • Bid evaluation plan • Conflict of interest policies
Established quality control protocols	Consistency protocols were established for: • Site assessments • Landholder discussions • Management plan development • Data management • Information and communication management
Established rules for evaluation of bids	Developed an evaluation process (including bid evaluation plan).
Drafted contract agreement and payment schedules	Developed contract agreements and payment schedules.
Developed monitoring, evaluation and auditing methods	Developed guidelines and protocols based on those of the *BushBids* and *Woodland BushBids* projects.

2.2 Implementation

There were eight main steps to implementing *River Bend BushBids*.

1. Expression of Interest:

The project called for expressions of interest from landholders. Landholders registered their interest by telephoning *River Bend BushBids*. Information packs sent to landholders who expressed interest. Eligible landholders had patches of eligible native vegetation, natural wetland or revegetation located in the project area, where the vegetation patch was greater than 5 ha and 10% cover.

2. Site Assessment (management):

Site assessors visited interested landholders for a discussion of best practice and achievable management actions for native vegetation/wetland or revegetation on their property. Management may include the fencing of native vegetation, preventing /reducing grazing, and controlling weeds and feral animals.

3. Site Assessment (biodiversity value):

An assessment of the biodiversity value of each site was undertaken, including a site assessment of native vegetation condition (structure, function and diversity); calculations of landscape values built from best available data (using GIS); and conservation priorities of the project, State and Australian Governments. In addition, 21 reference sites were assessed to facilitate the evaluation of the project's outcomes.

4. Site Information:

Landholders received Management Plans outlining agreed targets for conservation management and improvement of native vegetation condition, agreed management actions for the 5 years of the contract agreement, a list of minimum standards specific to management actions, a plant species list and a map of the site/s. Included with this Management Plan were measures of the management service being offered, the bushland condition or ('health') of the native vegetation.

5. Bidding:

The landholder was asked to submit a sealed bid nominating the price that they were seeking to implement the agreed Management Plan.

6. Bid Evaluation:

All bids were assessed objectively on the basis of current conservation value of the vegetation, the services (management actions) to be supplied and the bid price that the landholder provided. Bids were converted to a ranking of biodiversity value-for-money and the highest value-for-money bids were funded with the available funding to undertake the agreed actions.

7. Contract:

Successful landholders were invited to sign a Management Agreement (contract) based on the agreed Management Plan.

8. Payment:

Payments are staggered over the 5-year contract based on the landholder undertaking the agreed management actions and documenting actions and progress as part of the annual reporting process.

2.3 Assessing bid value

The metric

The metric used was modified from *Woodland BushBids* (O'Connor et al. 2012). Landscape context attributes were modified for relevance to the *River Bend BushBids* region.

The score used to rank the bids in order of biodiversity value-for-money is referred to as the Biodiversity Benefits Index (BBI) and was based on the calculation shown in Figure 3.

Assessing bushland condition

The condition of native vegetation at each proposed site was assessed using the Bushland Condition Monitoring (BCM) method developed by the Nature Conservation Society of South Australia. This method examines a range of indicators of bushland health relating to structure, function and diversity and is based on measurements taken in representative assessment patches. Selected indicators used for *River Bend BushBids* assessments are described in more detail in Appendix 1. For a complete description of the method see Croft, Pedler and Milne (2009).

The BCM method of condition assessment was selected because it offered the best opportunity to meet multiple project objectives. The accuracy and validity of this method ensured project decisions were based on reliable and current evidence from sites. The BCM offered an excellent balance of accuracy and efficiency, allowing implementation costs to be kept to a minimum.

By adopting the published method, *River Bend BushBids* was able to save the cost of developing a new method and, at the same time, increase the capacity of NRM practitioners to understand the existing method's application and value. *River Bend BushBids* was also able to add value by significantly increasing the bushland condition monitoring dataset for South Australia and establish an appropriate monitoring program for the project investment. An additional benefit of using the BCM method is that landholders could be trained in the method to monitor their sites.

Assessing landscape context

Landscape context scoring was based on the work of Oliver (2002) and Oliver and Parkes (2003) and was operationalised in the GIS environment of the South Australian Biodiversity Assessment Tool (SABAT).

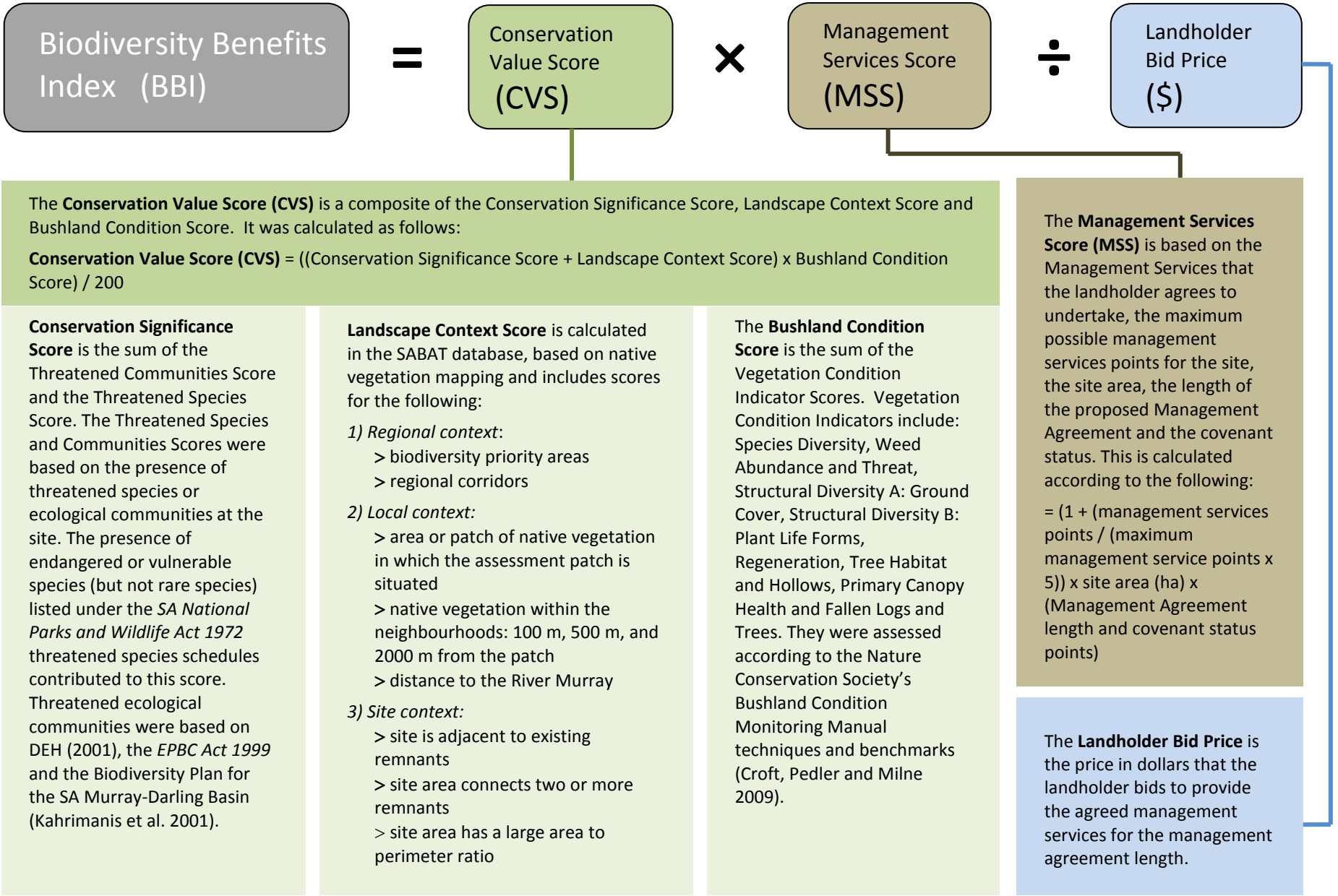
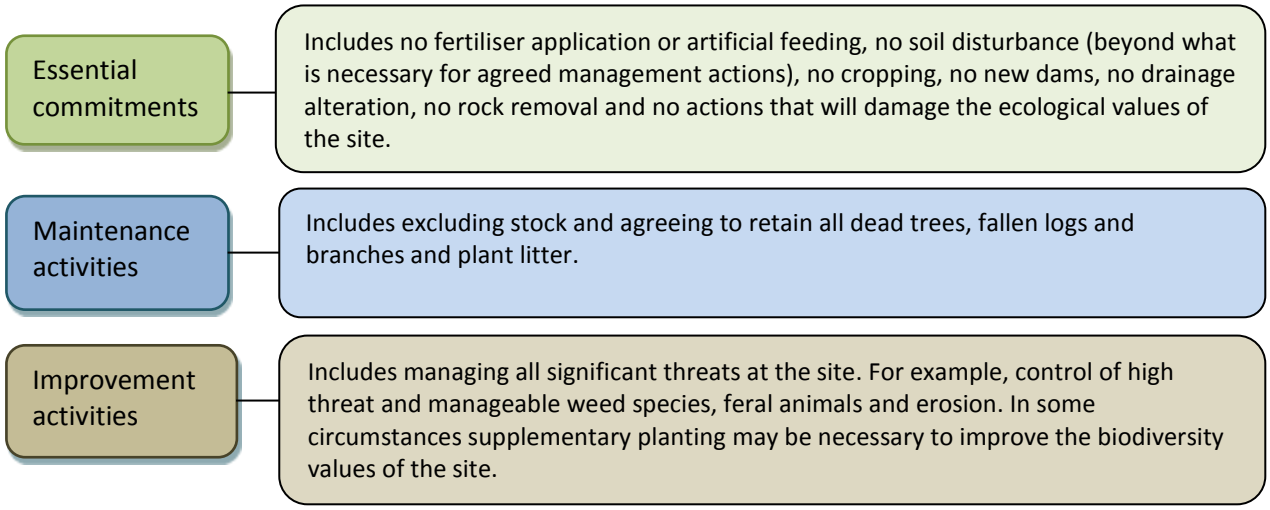


Figure 3. Diagram of the components of the Biodiversity Benefits Index

Assessing management services

Management services were classified into three groups: essential commitments, maintenance activities and improvement activities:



Management points were awarded for the maintenance and improvement activities proposed, and scoring was structured to account for the current condition of the site and the expected outcome of undertaking the proposed management services. The covenant status (Heritage Agreement) of the site was also valued in the management services score.

As part of the site assessment, *River Bend BushBids* site assessors discussed management options and intentions for management with the landholder, using the information from the site assessment as a basis for determining biodiversity assets and threats. Landholders received a record of this discussion and this information was then used to draft the Management Plan. Minimum standards for management actions were provided to landholders in factsheets prior to the site assessment.

2.4 GIS and data management

River Bend BushBids used the South Australian Biodiversity Assessment Tool (SABAT) to manage data and for the assessment of bids. Both GIS and database functions are used by SABAT to allocate a Biodiversity Significance Index to a site of native vegetation. Each patch of native vegetation was mapped using ArcGIS and both the vegetation condition information and the spatial location of the sites were stored within the Geodatabase. Modifications made to SABAT through *BushBids* included the incorporation of facilities for storing additional information, scoring conservation value and management services, and using these in the calculation of the Biodiversity Benefits Index. Refer to *BushBids* final report for more details (O'Connor et al. 2008b).

ArcGIS was used to provide a preliminary assessment of site eligibility (based on location and vegetation coverage); preparation for on-site assessments (reviewing existing data e.g. the presence of threatened species or previous vegetation survey sites); to map participating sites accurately and to provide this information graphically in the Management Plan. GIS was also used to assess the landscape context based on native vegetation extent mapping, distance to the River Murray and on-site verification.

All data entered or calculated in SABAT were verified by cross-checking data entry and a random sampling method for identifying anomalies.

2.5 Communication

Effective communication of the project's objectives and processes was critical to the success of *River Bend BushBids*. As the tender mechanism used in *River Bend BushBids* was new to part of the project area, some information barriers had to be overcome to provide confidence in the approach and recruit landholders willing to supply bids and enter into contracts for multi-year conservation. Key approaches to ensuring effective and effectively targeted communication included:

- Understanding the market (characteristics, values, aspirations).
- Using a variety of communication channels that landholders are likely to respond to.
- Advertising the *River Bend BushBids* program in local newspapers, radio and providing information to NRM officers.
- Encouraging the established NRM officer networks to connect with landholders.
- Providing a 1300 telephone number for access to information and registration.
- Providing information packages for interested parties.
- Holding three information sessions in the region (advertised in local papers).
- Providing information on the project at appropriate stages in the process.
- Key issues communicated to participants regarding bid development.

It was made clear to the landholders that no information or advice would be given to landholders about anticipated cost of management services or likely bid prices. Participants were advised to give primary consideration to the cost of undertaking the agreed actions, and secondly to consider the competitiveness of the total cost. They were advised to seek independent advice regarding the tax implications of receiving funding through this scheme, and were at liberty to seek independent advice and support in formulating bids.

In order to assist the participants to understand how their bid might be valued in relation to the maximum value possible for their bushland, a report with ratings for Bushland Condition and Management Services was provided with the Management Plan package. The Bushland Condition ratings provided information about current vegetation condition at the *River Bend BushBids* sites and the Management Services rating showed the agreed commitments and actions relative to the to the complete suite of *River Bend BushBids* commitments and actions.

Bushland Condition Indicators were reported to landholders on a five-point scale from excellent, through good, moderate and poor, to very poor. Ratings do not necessarily indicate the entire conservation value of the bushland. These ratings were provided as advice about the current condition of vegetation at the sites with respect to benchmarks and may also be used to assist with tracking changes in site condition over time. Figure 4 shows an example of the Bushland Condition Indicators and ratings given for a site.

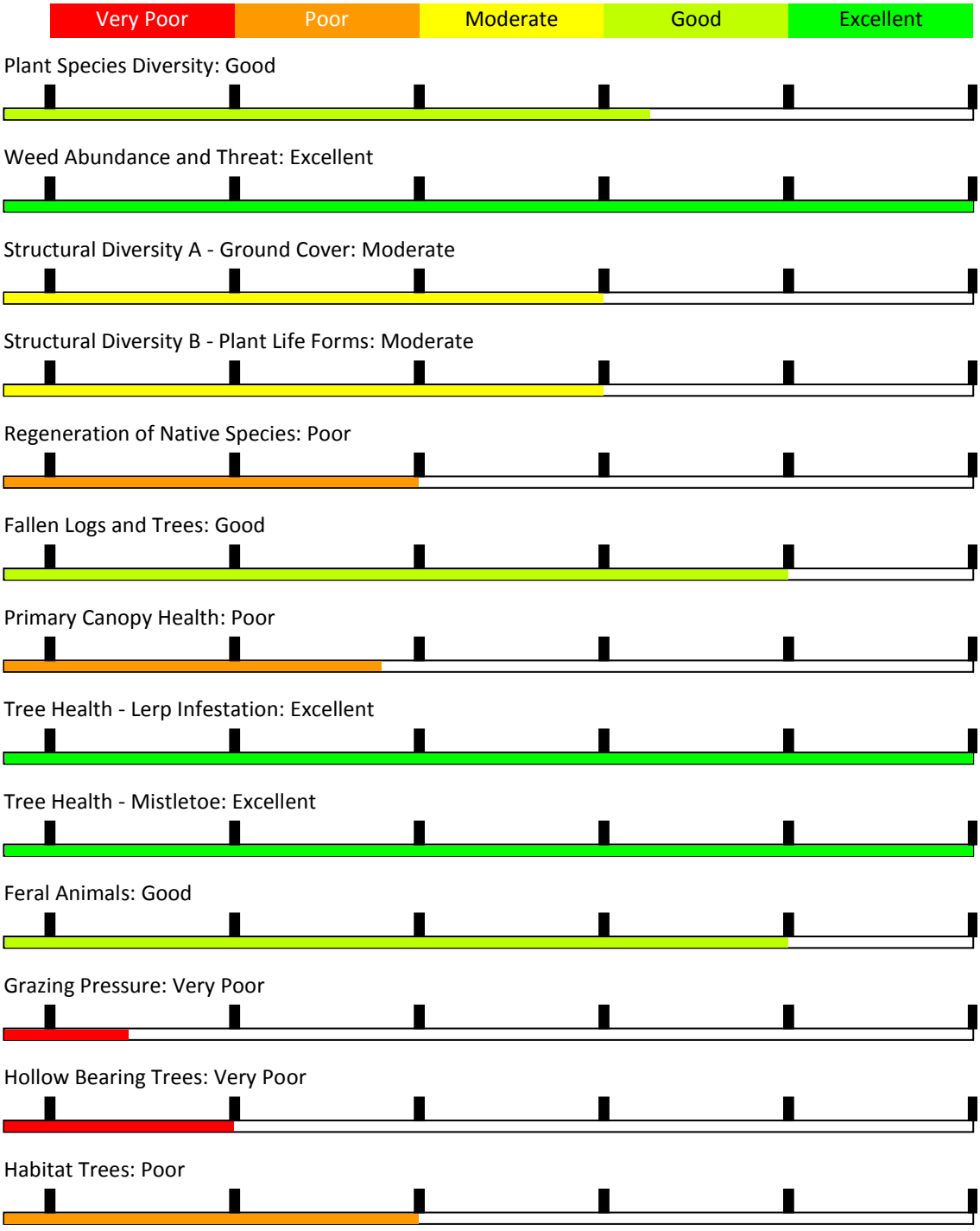


Figure 4. Bushland condition ratings for an example site

For further explanation of bushland condition indicators and interpretation of the condition ratings please refer to Appendix 1.

3 River Bend BushBids results

3.1 Results of tender

The *River Bend BushBids* project developed native vegetation Management Plans for 77 sites representing 7,704.2 ha (see Table 2 for a summary of the enquiries, expressions of interest and bid results). Thirty-two landholders submitted expressions of interest resulting in the development of 29 Management Plans (note some landholders had multiple plans). 19 bids were submitted before close of the tender.

The total price for the 19 bids submitted was $1,836,731.50. The Tender Assessment Panel had discretion to recommend contracts up to a cumulative total reserve price of $563,000 under the funding arrangements with the Native Vegetation Council of South Australia. The marginal cost curve indicated a slow rising trend until bid 13 and a jump in bid price per benefit (1/BBI) between the 13th and 14th bid (Fig. 6). The evaluation panel decided that bids ranked 1 to 8 offered good value for money and could be funded with the available funds. It was agreed bid 9 also offered good value for money and additional funds were sought to fund this bid. Overall $596,590.00 was committed for investment in landholder payments for the 9 comprehensive conservation agreements (representing 32 sites and 5,757 ha).

3.2 Biodiversity gains along the Murray River and surrounding plains

The locations of sites assessed in *River Bend BushBids* (successful and unsuccessful) and the reference sites (monitoring control sites) are shown in Figure 7. The successful sites are scattered throughout the *River Bend BushBids* region except for the most northern section.

Nineteen vegetation sub-community types (Figure 8, Table 3) were offered for assessment and management in the project. Thirteen vegetation sub-community types were allocated contracts and funding based on value-for-money assessment in the auction. (Table 3). Sub-communities MDBSA 2.1, MDBSA 4.2 and MDBSA 5.1 together represent 72 % (4,170 ha) of the total area of successful bids.

Table 4 shows that both conservation and implementation efficiency targets for the project were achieved or exceeded, with:

- more than two and a half times the expected area contracted for conservation management,
- two and a half times the expected area of new sites assessed for ecological values, mapped and supplied with management plans,
- more than three times the number of management plans produced than originally expected, and
- the targeted amount of area of funded sites registered for new Heritage Agreements.

The project created a market for the allocation of contracts for a total of 142,249 BBUs (Biodiversity Benefit Units[1]). The auction efficiently selected value-for-money contracts for 130,762 BBUs (92 % of the market total) for 32 % of the total price of all BBUs in the market. Efficient contract selection was achieved with low overhead costs. Seventy-seven cents per dollar was allocated to landholder management service payments. Twenty-three cents in the dollar was spent on project implementation overheads necessary to make the evidence-based decisions for securing contracts. This overhead also produced the additional benefits of; management information to 28 landholders, management plans written for 7,704 ha of native vegetation, new management information tools created for weed, feral animal and other management, data gathered on the condition of native vegetation at 90 sites (including of 7,704 ha of vegetation on private land), and the establishment of an ecological performance monitoring baseline.

[1] A BBU represents the expected biodiversity benefits accumulated at the site by the end of the *BushBids* contract. A BBU = CVS x MSS **score (see Fig 3 for definitions).**

The 557 ha represented in unsuccessful bids did not offer value-for-money in the *River Bend BushBids* auction and were not funded by the program. Unfunded sites did offer positive biodiversity benefits but included a number of smaller sites, sites with poor landscape context and sites without threatened species habitat or ecological communities.

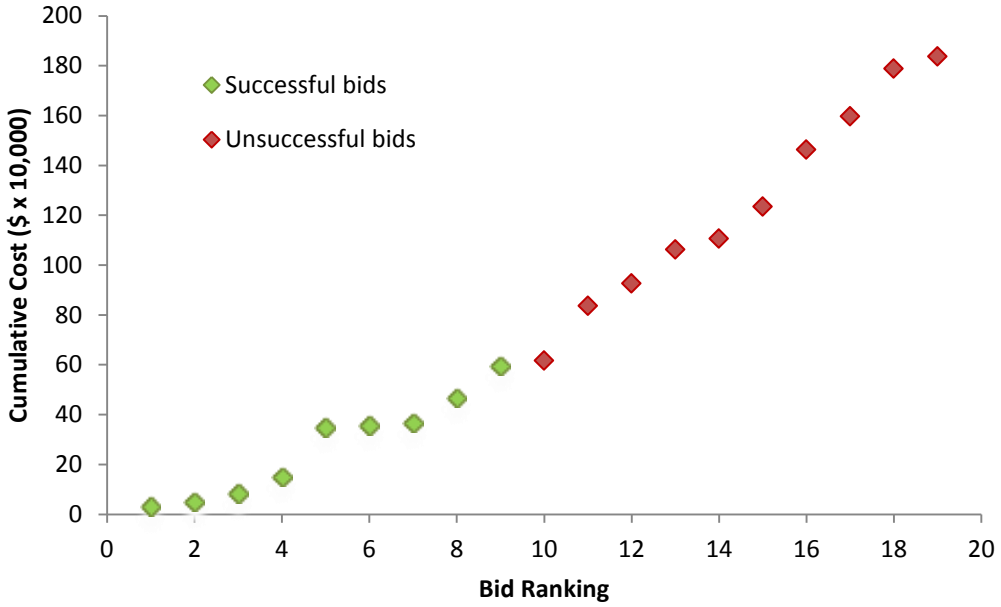


Figure 5. Cumulative cost of successful and unsuccessful bids

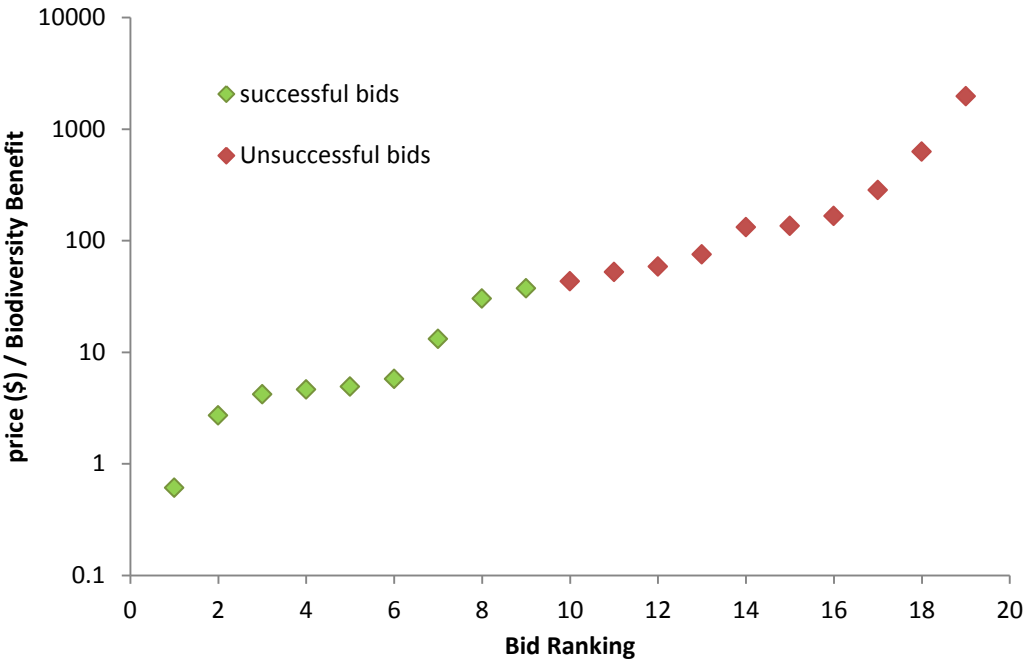


Figure 6. Marginal cost of biodiversity benefits of successful and unsuccessful bids (NB: Y-axis on $\log_{10}$ scale)

Table 2. Summary of enquiries, expressions of interest and bid results from *River Bend BushBids*

Stages	Details	River Bend Results
Number of landholder enquiries	Number of interested landholders enquiring during Expression of Interest (EoI) period	32
	Number of landholders enquiring after EoI had closed	3
Eligible Expression of Interests following site assessment	Number of landholders	28
	Total area of land	Approximately 7,704 ha (average 308 ha per property, 100 ha per site)
	Percentage of known (mapped) native vegetation on private property within *River Bend BushBids* project boundary	2.26 %
	Number of sites requiring management plans	77
	Number of management plans prepared (= number of potential bids)	29
Bids submitted	Number of bids submitted[1]	19 (55 sites)
	Total area of land in bids submitted	6,316 ha (average 332 ha per bid, 115 ha per site)
	Total price of all bids submitted	$1,836,731.50
	Average $ / biodiversity benefit	$190.91 per biodiversity benefit
	Average bid price	$577.15 ha/year
	Percentage of known (mapped) native vegetation on private property within *River Bend BushBids* project boundary	1.85 %
Successful bids/ agreement contracts accepted	Number of contract agreements accepted	9 (32 sites, 9 landholders)
	Total land area of accepted bids	5,757 ha (average 640 ha per bid, 180 ha per site)
	Total price of accepted bids	$596,590.00
	Average $ / biodiversity benefit	$11.5 per biodiversity benefit
	Number of management plans that have a Heritage Agreement (HA), or HA being processed	5 bids (= 8 sites, 5 landholders, 2397 ha)
	Number of new HA applications	2 bids (= 3 sites, 2 landholders, 307 ha)
	Percentage of known (mapped) native vegetation on private property within *Woodland BushBids* project boundary	1.69 %
Unsuccessful bids	Number of unsuccessful bids	10 (23 sites, 8 landholders)

Stages	Details	River Bend Results
	Total land area of unsuccessful bids	557 ha (55.7 ha per bid, 24 ha per site)
	Total price of unsuccessful bids	$1,240,141
	Average $ / biodiversity benefit	$ 352.4
	Number of management plans that have a Heritage Agreement (HA), or HA being processed	0
	Percentage of known (mapped) native vegetation on private property within *Woodland BushBids* project boundary	0.16 %

[1] 9 landholders did not submit a bid (representing 1,458 ha and 22 sites)

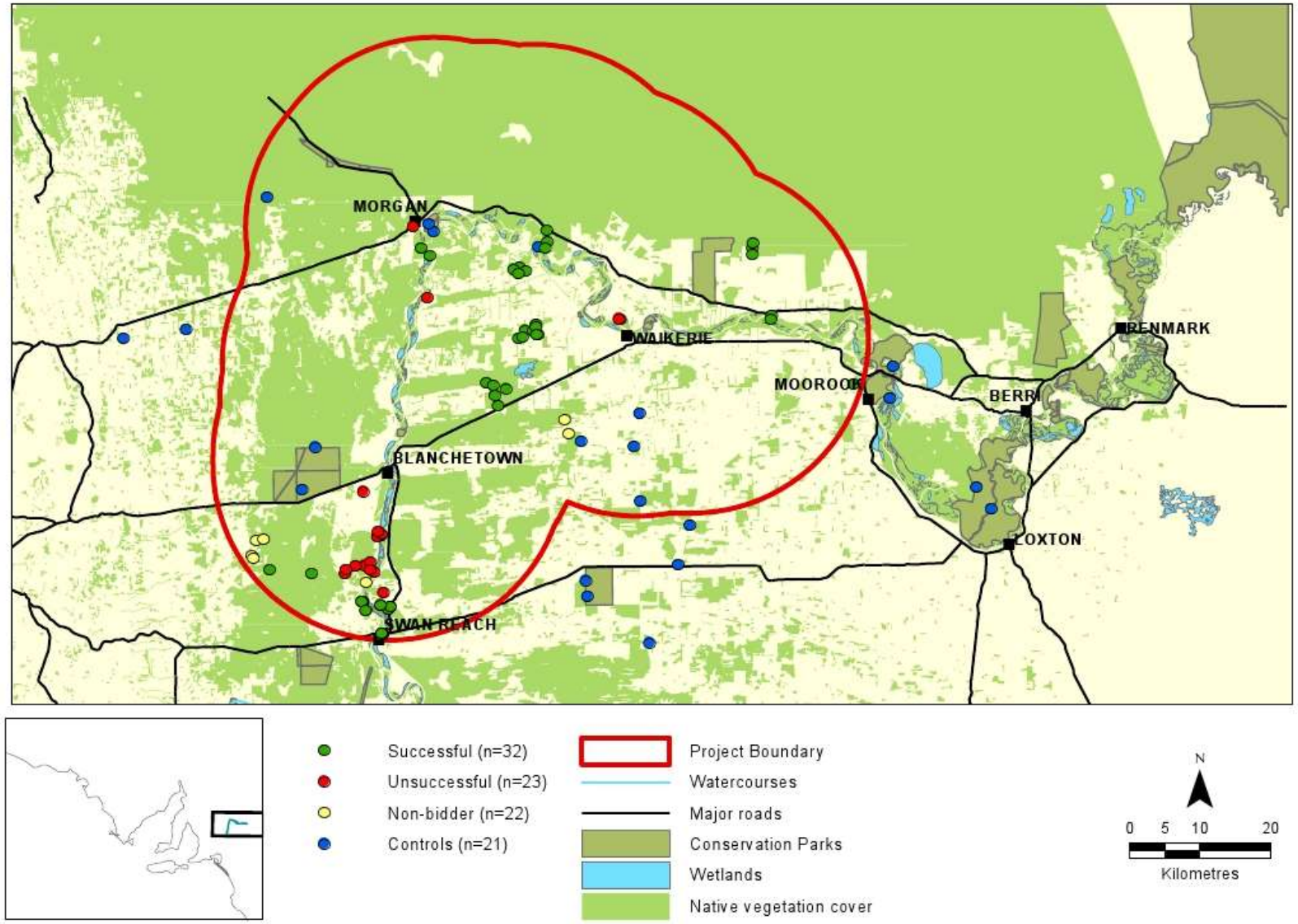


Figure 7. Distribution of successful, unsuccessful, withdrawn bids and reference sites for *River Bend BushBids*

Figure 8. Photographs of the main vegetation sub-communities assessed

Open Woodlands with open arid-adapted shrub understorey on limestone plains (MDBSA 1.1)

Tall Shrublands with open arid-adapted understorey on limestone plains (MDBSA 1.2)

Open mallee or low open woodlands with chenopod shrub understorey (MDBSA 2.1)

Chenopod open shrublands (MDBSA 2.2)

Mallee with very open sclerophyll and chenopod shrub understorey on calcareous loams of flats/swales (MDBSA 3.1)

Mallee with open sclerophyll and chenopod shrub understorey on calcareous loams of flats/swales (MDBSA 3.2)

Mallee with open sclerophyll and chenopod shrub understorey +/- Triodia on sandy-loam swales and isolated shallow sandy flats (MDBSA 3.3)

Mallee with open shrub understorey on tall red-sand dunes or deep sand flats (MDBSA 4.1)

Mallee with understorey dominated by Triodia on mod/low red-sand dunes or flats (MDBSA 4.2)

Shrublands on low &/or isolated red-sand dunes (MDBSA 4.3)

Red Gum Woodlands with dense Lignum Shrub understorey (MDBSA 10.4)

Red Gum Forests & Woodlands with open shrub, herb and grassy understorey (MDBSA 10.5)

Lignum Shrublands +/- Red Gum, River Box, Cooba (MDBSA 10.6)

River Box Woodlands with open shrub, herb and grassy understorey (MDBSA 10.7)

River Box Woodlands with saline tolerant Chenopod understorey (MDBSA 10.8)

Table 3. Vegetation communities and sub-communities assessed for condition during the *River Bend BushBids* project

Vegetation community types	Sub-community reference types	Funded (ha)	Non-funded (ha)	Non-bidder (ha)
Open Woodlands, shrublands and Grasslands on low rainfall, limestone plains (MDBSA Community 1)				
Open Woodlands with open arid-adapted shrub understorey on limestone plains	MDBSA 1.1	28.5	140	182.6
Tall Shrublands with open arid-adapted understorey on limestone plains	MDBSA 1.2	87.1		
Open Mallee and Low Open Woodlands with a Chenopod shrub understorey and Chenopod Open Shrublands (MDBSA Community 2)				
Open Mallee or Low Open Woodlands with Chenopod shrub understorey	MDBSA 2.1	1017.5	61.4	20.5
Chenopod Open Shrublands	MDBSA 2.2	107.2	31.9	347.9
Mallee +/- Native Pine with open sclerophyll and Chenopod shrub understorey on calcareous loams of flats or swales (MDBSA Community 3)				
Mallee with very open sclerophyll & Chenopod shrub understorey on calcareous loams of flats/swales	MDBSA 3.1	51.2		
Mallee with open sclerophyll & Chenopod shrub understorey on calcareous loams of flats/swales	MDBSA 3.2	304.5	20.8	296.0
Mallee with open sclerophyll & Chenopod shrub understorey +/- Triodia on sandy-loam swales and isolated shallow sandy flats	MDBSA 3.3	142.2		
Mallee with open shrub understorey +/- Triodia and Shrublands on deep red or loamy sands (MDBSA Community 4)				
Mallee with open shrub understorey on tall red-sand dunes or deep sand flats	MDBSA 4.1	289.4		339.9
Mallee with understorey dominated by Triodia on moderate/low red-sand dunes or flats	MDBSA 4.2	1769.2	10.8	
Shrublands on low &/or isolated red-sand dunes	MDBSA 4.3	240.8	92.2	
Mallee with open sclerophyll shrub understorey on clay and clay-loam flats and swales (MDBSA Community 5)				
Open Mallee with open sclerophyll shrub understorey on clay/clay-loam flats	MDBSA 5.1	1383.6		
Open Mallee with mid-dense shrub and tussock understorey and Shrublands on limestone soils ((MDBSA Community 6)				
Open Mallee with mid-dense shrub & tussock understorey on limestone soils	MDBSA 6.1		112.2	
Woodlands with an open grassy understorey & Grass and Mat-rush Sedgelands (MDBSA Community 9)				

Vegetation community types	Sub-community reference types	Funded (ha)	Non-funded (ha)	Non-bidder (ha)
Grass & Mat-rush Sedgelands	MDBSA 9.2		4.3	
Riparian, Freshwater and Brackish Swamp and Floodplain Vegetation – River Murray Corridor and lower Lakes (MDBSA Community 10)				
Red Gum Woodlands with dense Lignum Shrub understorey	MDBSA 10.4		1.5	40.9
Red Gum Forests & Woodlands with open shrub, herb and grassy understorey	MDBSA 10.5		21.7	
Lignum Shrublands +/- Red Gum, River Box, Cooba	MDBSA 10.6	177.4	11.4	7.2
River Box Woodlands with open shrub, herb and grassy understorey	MDBSA 10.7		7.9	11.6
River Box Woodlands with saline tolerant Chenopod understorey	MDBSA 10.8		3.2	
Revegetation sites				
Revegetation			2.6	71.4
Wetland				
Wetland		158.1	37.4	70.5
TOTAL AREA		**5756.6**	**559.3**	**1388.4**

Table 4. Achievements against *River Bend BushBids* objectives

Objective	Target	Achievements	Comments
Allocate contracts for cost-effective native vegetation management using an evidence-based prioritisation method implemented at low overhead:on-ground costs	Create a market for purchase of cost-effective conservation management contracts	The *River Bend BushBids* project created a market for the allocation of contracts for a total of 142,249 BBUs (Biodiversity Benefit Units). The auction efficiently selected value-for-money contracts for 130,762 BBUs (92 % of the market total) for 32 % of the total price of all BBUs in the market. New management information tools were created for weed, feral animal and other management. Data was gathered on the condition of native vegetation at 90 sites (including of 7,704 ha of vegetation on private land) for the establishment of an ecological performance monitoring baseline.	Efficient contract was achieved with low overhead costs. Seventy-seven cents per dollar were allocated to landholder management service payments. Twenty-three cents in the dollar were spent on project implementation overheads to secure contracts and produced the additional benefits of; management information to 28 landholders The 557 ha represented in unsuccessful bids did not offer value-for-money in the *River Bend BushBids* auction and were not funded by the program.
Protect and manage native vegetation, threatened species habitat and threatened ecological communities within the project area	Protect habitat for the Regent Parrot, Malleefowl and other threatened species and communities.	Native vegetation is being actively managed at 32 sites; including sites where three threatened plant communities, twenty-nine rare/threatened fauna species and three rare/threatened flora species have been recorded. Four properties with successful bids are receiving funds to protect and actively manage 338 ha of threatened/significant plant communities.	Four threatened plant communities and wetlands occur at 18 unfunded sites, generally as small remnants. Six threatened plant species *(Brachycome basaltica* var*. gracilis, Calotis scapigera, Corynotheca licrota, Maireana rohrlachii, Muehlenbeckia horrida* ssp*. Horrida, Picris squarrosa)* occur at unfunded sites only. Three endangered, 7 vulnerable and 11 rare fauna species occur at or close to unfunded sites only. Note that 9 landholders (representing 22 sites and 1,458 ha) did not enter bids in the auction.

Objective	Target	Achievements	Comments
Increase the area of native vegetation on private property with management information and direction	Prepare management plans for a minimum of 3,100 ha of native vegetation on private land.	Comprehensive Management Plans were prepared for 7,704 ha of native vegetation on private land.	Approximately 75 % of the area prepared for management plans was funded for active management by the project.
Increase the area of native vegetation actively managed for conservation	Improve the condition of vegetation on a minimum of 2,100 ha through establishment of contracts for cost-effective native vegetation management.	The active maintenance and improvement of native vegetation condition is being funded on 5,757 ha of privately managed land.	The outcomes of this management will be assessed in future years through repeat assessment and analysis of ecological monitoring sites established through the project's monitoring and evaluation processes.
Increase the area of native vegetation protected under long-term conservation agreements	Increase the area of native vegetation under long-term conservation covenants (Heritage Agreements) by at least 300 ha.	Two new Heritage Agreement applications (representing 307 ha across 3 sites) were initiated by *River Bend BushBids* successful agreements.	All *River Bend BushBids* funded sites will be protected and managed for a 5-year period under a *River Bend BushBids* Management Agreement. Sites representing 5 existing Heritage Agreements were funded for comprehensive (and additional) management.

Table 5. Significant ecological communities recorded at funded and unfunded *River Bend BushBids*

Threatened plant Community[1]	Threatened category	No. sites (area)	
		Funded[2]	Unfunded[3]
Muehlenbeckia florulenta Shrubland	Regionally significant	2 (177.5 ha)	4 (36.9 ha)
Alectryon oleifolius Tall Open Shrubland	Vulnerable	1 (1.9 ha)	
Eucalyptus camaldulensis Woodland	Regionally significant		3 (23.2 ha)
Eucalyptus largiflorens Woodland	Regionally significant		3 (27.5 ha)
Lomandra effusa Grassland	Endangered		1 (4.3 ha)
Wetlands	Endangered	1 (158.1 ha)	7 (107.9 ha)
Total sites with threatened / significant communities (area)		**4 (337.5 ha)**	**18 (199.8 ha)**

[1] Conservation status from: EPBC Act 1999 http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl; DEH (2001) unpublished Provisional List of Threatened Ecosystems in South Australia; Biodiversity Plan for the South Australian Murray-Darling Basin (Kahrimanis et al. 2001)
[2] Represents successful bids
[3] Represents unsuccessful bids, did not enter a bid or withdrew from agreement contract

Table 6. Threatened plant species recorded at funded and unfunded *River Bend BushBids* sites

Threatened flora species	Common name	Threatened category[1]	Number of sites (area)	
			Funded	Unfunded[2]
Brachycome basaltica var. *gracilis*	Swamp Daisy	Rare		1 (34.9 ha)
Callistemon brachyandrus	Prickly Bottlebrush	Rare	1 (384 ha)	
Calotis scapigera	Tufted Burr-daisy	Rare		2 (13.5)
Corynotheca licrota	Sand Lily	Rare	1 (127.9 ha)	1 (38.6)
Eragrostis lacunaria	Purple Love-grass	Rare	1 (384 ha)	
Maireana rohrlachii	Rohrlach's Bluebush	Rare		2 (88.7 ha)
Muehlenbeckia horrida ssp. *horrida*	Spiny Lignum	Rare		4 (36.9)
Picris squarrosa	Squat Picris (record from 1973)	Rare		1 (10.1 ha)
Number of threatened flora species			3	4
Number of sites with threatened flora species[3]			3	11
Number of hectares with threatened flora species[4]			511.9	220.8

[1] SA conservation status from *National Parks and Wildlife Act 1972* (Version: 1.6.2010) http://www.legislation.sa.gov.au/LZ/C/A/NATIONAL%20PARKS%20AND%20WILDLIFE%20ACT%201972/CURRENT/1972.56.UN.PDF#page=92
[2] Unsuccessful bids, did not enter a bid or withdrew from agreement contract
[3] A site may contain more than one threatened species
[4] The number of hectares is the total area of all sites that have one or more threatened flora species present

Table 7. Threatened fauna species recorded within 2 km of funded and unfunded *River Bend BushBids* sites

Threatened fauna species	Common name	Threatened category[1]	Number of sites		
			Funded[2]	Unfunded[3]	Total[4]
Anhinga novaehollandiae	Australasian Darter	Rare	19	20	39
Anas rhynchotis	Australasian Shoveler	Rare	16	8	24
Ardeotis australis	Australian Bustard	Rare	5	1	6
Ixobrychus dubius	Australian Little Bittern	Endangered		1	1
Tyto novaehollandiae	Australian Masked Owl	Endangered		1	1
Rostratula australis	Australian Painted Snipe	Vulnerable		1	1
Cladorhynchus leucocephalus	Banded Stilt	Vulnerable	6	4	10
Ninox connivens	Barking Owl	Rare		4	4
Oxyura australis	Blue-billed Duck	Rare	1	2	3
Entomyzon cyanotis	Blue-faced Honeyeater	Rare	1	5	6
Neophema chrysostoma	Blue-winged Parrot	Vulnerable		4	4
Chelodina expansa	Broad-shelled Tortoise	Vulnerable		1	1
Morelia spilota	Carpet Python	Rare	9	15	24
Ardea ibis	Cattle Egret	Rare		1	1
Cinclosoma castanotum	Chestnut Quailthrush	Rare	11	4	15
Trichosurus vulpecula	Common Brushtail Possum	Rare	6	7	13
Actitis hypoleucos	Common Sandpiper	Rare		4	4
Emblema guttata	Diamond Firetail	Vulnerable		4	4

Threatened fauna species	Common name	Threatened category[1]	Number of sites		
			Funded[2]	Unfunded[3]	Total[4]
Neophema elegans	Elegant Parrot	Rare	1	4	5
Stictonetta naevosa	Freckled Duck	Vulnerable	1	4	5
Pachycephala inornata	Gilbert's Whistler	Rare	17	10	27
Plegadis falcinellus	Glossy Ibis	Rare	2	1	3
Accipiter novaehollandiae	Grey Goshawk	Endangered		4	4
Melanodryas cucullata	Hooded Robin	Rare	10	17	27
Ardea intermedia	Intermediate Egret	Rare		5	5
Microeca fascinans	Jacky Winter	ssp fascinans is Rare	21	5	26
Egretta garzetta	Little Egret	Rare		4	4
Philemon citreogularis	Little Friarbird	Rare	4	5	9
Emydura macquarii	Macquarie Tortoise	Vulnerable		1	1
Cacatua leadbeateri	Major Mitchell's Cockatoo	Rare	1		1
Leipoa ocellata	Malleefowl	Vulnerable	7	1	8
Biziura lobata	Musk Duck	Rare	15	5	20
Turnix varia	Painted Button-quail	Rare		2	2
Falco peregrinus	Peregrine Falcon	Rare	4	20	24
Meliphaga virescens	Purple-gaped Honeyeater	Rare		4	4
Pachycephala rufogularis	Red-lored Whistler	Rare	2	2	4
Polytelis anthopeplus	Regent Parrot	Vulnerable	23	27	50
Myiagra inquieta	Restless Flycatcher	Rare	11	6	17
Neophema splendida	Scarlet-chested Parrot	Rare	1	1	2
Calamanthus cautus	Shy Heathwren	Rare	5		5
Litoria raniformis	Southern Bell Frog	Vulnerable		15	15
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	Rare		1	1
Porzana tabuensis	Spotless Crake	Rare		4	4
Amytornis striatus	Striated Grasswren	Rare	1		1
Plectorhyncha lanceolata	Striped Honeyeater	Rare	17	3	20
Coracina papuensis	White-bellied Cuckooshrike	Rare		5	5
Haliaeetus leucogaster	White-bellied Sea-Eagle	Endangered	6	5	11
Corcorax melanorhamphos	White-winged Chough	Rare	26	18	44
Tringa glareola	Wood Sandpiper	Rare		4	4
Antechinus flavipes	Yellow-footed Antechinus	Vulnerable		4	4
Number of threatened fauna species			**29**	**47**	**50**

[1] SA conservation status from *National Parks and Wildlife Act 1972* (Version: 1.6.2010) http://www.legislation.sa.gov.au/LZ/C/A/NATIONAL%20PARKS%20AND%20WILDLIFE%20ACT%201972/CURRENT/1972.56.UN.PDF#page=92

[2] Represents successful bids

[3] Represents unsuccessful bids, did not enter a bid or withdrew from agreement contract

[4] Total number of sites represented by successful and unsuccessful bids

4 Monitoring and evaluation

Monitoring and evaluation processes were built into *River Bend BushBids* to ensure that learning was captured and that outcomes could be measured in the future. The processes follow the monitoring and evaluation procedures for *BushBids*. The monitoring and evaluation approach has three components:

- Evaluation of landholder participation – to improve *BushBids* projects between tender rounds and to learn from implementation for future conservation tenders.
- Reporting and compliance – to continue to engage with participating landholders and to ensure that agreed activities are being undertaken and outputs achieved.
- Evaluation of biodiversity outcomes – to measure the improvement in biodiversity conservation at funded sites.

4.1 Evaluation of landholder participation

A questionnaire was sent to the successful and unsuccessful landholders. The questionnaire:

- gauges landholders' attitudes and satisfaction with the process.
- seeks to collect evidence to help to understand the motivations of the landholders and how they determined their bid price.

The results from this questionnaire will be used to improve the design and implementation of future rounds of *BushBids* and other conservation tenders.

4.2 Reporting and compliance

To ensure landholders are undertaking agreed management actions and meeting the obligations of the Management Agreement, landholders are required to submit annual reports in order to receive the annual staged payments. As part of the annual report process, landholders are sent an annual report form for each site. The report form is pre-filled with information on the agreed management actions specified in the Management Plan. Landholders are required to complete the annual report and return it with an invoice for payment. Each year a number of sites will be visited for compliance monitoring. Refer to the *BushBids* final report for compliance protocols (O'Connor et al. 2008b).

4.3 Evaluating biodiversity outcomes

The site assessment protocols for this project are designed to provide a baseline for monitoring of vegetation condition change after management. The approach to measuring outcomes at the end of the contracts will follow that established for *BushBids*. This includes:

- Using the Nature Conservation Society of South Australia's Bushland Condition Monitoring method, a rapid vegetation assessment method sensitive enough to detect changes due to management.
- Establishing a baseline monitoring site on nearly every site assessed.
- Establishing baseline monitoring sites as control sites on public land or where management is documented (i.e. establishing a Before-After-Control-Impact design). The *River Bend BushBids* project established 21 reference (control) sites in similar vegetation on public land in the area.
- The evaluation of biodiversity gain can be undertaken after reassessment of funded (impact) and reference (control) sites and changes in vegetation condition is calculated.

The monitoring design will allow six key evaluation questions to be answered:

1. How much does the condition of native vegetation improve with described management?

2. Which indicators of vegetation condition are most sensitive (and most useful for future programs)?
3. How well does the transformation function (estimate of change over time with different actions) predict change?
4. How much does the measured improvement in vegetation condition cost?
5. How much improvement is due to information and how much is due to financial incentive?
6. What is the predicted market price of key conservation targets in the *River Bend BushBids* project area?

This approach is already operating in the *BushBids* and *Woodland BushBids* project areas and can be extended to the *River Bend BushBids* project area to improve cost effectiveness. Methods are consistent with and build on other data collection being undertaken in the SAMDB region. A report on the baseline vegetation condition in the Eastern Mount Lofty Ranges was completed in 2009 (O'Connor et al. 2008a) and a Regional Baseline report has been completed for the Murray-Darling NRM region (Mahoney et al. 2011).

This evaluation design has the potential to assist future programs to calculate the biodiversity gains which can be achieved through different suites of management actions.

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Appendix 1 Explanation of bushland condition indicators

The following explanation of the indicators has been adapted from the Bushland Condition Monitoring Manual for the Murray Darling Basin, South Australia (Croft, Pedler and Milne 2009).

Plant Species Diversity: As a general rule, the greater the number of species found at a site the better the condition. Variety in plants provides habitat for a variety of animals.

Weed Abundance and Threat: Weed invasion is one of the greatest and most common threats to bushland health and ecological integrity. Weeds displace native plants and therefore reduce the amount of good habitat for animals and other native plants. An 'excellent' rating for weed abundance and threat indicates a site with few or no weeds.

Structural Diversity A Ground Cover: In most healthy communities in South Australia the ground is protected by a layer or crust of mosses, lichens and leaf litter and there is very little bare ground or exposed soil. The living crust and litter help maintain a living soil, prevent soil erosion, provide a seed germination bed and help to recycle nutrients. Bare ground will decrease as plant cover, mosses and lichens and leaf litter increase.

Structural Diversity B Plant Life Forms: In healthy plant communities there will be a wide variety of native plant life forms present, such as trees, shrubs, herbs and grasses. Even in communities that naturally lack trees, there will be a wide range of plant life forms. Absent or reduced life forms usually indicate past disturbance. In degraded communities weed species tend to dominate the cover of one or more vegetation layers. Weeds also reduce the diversity of other life forms in the lower layers, leading to a reduction in the overall rating.

Regeneration of Native Species: Vegetation in good condition will continually regenerate itself. A 'poor' or 'very poor' rating for regeneration indicates that very few individuals are either germinating or surviving through to seedling establishment. This may be due to poor health of the adult plants, reducing flowering and/or seed set, or threats that make conditions unfavourable for seed germination or seedling survival. A low regeneration rating would be expected in bushland that has previously had long-term, high levels of disturbance but may also occur when the plant community requires relatively uncommon episodic for plant recruitment.

Tree Habitat: In a healthy community, most adult trees should have a nearly complete canopy. Ideally, a scattering of trees should be old enough to contain hollows. There should be a range of tree sizes including some large individuals as well as seedlings and saplings. All these factors contribute to the availability of tree habitat for fauna.

Primary Canopy Health: The health of trees and shrubs often reflects the overall ecological health of a vegetation remnant. In a healthy community, most adult trees should have a canopy which is complete or nearly complete. Poor health in trees may be caused by one or more stresses such as soil compaction, increased nutrient loads, altered soil water regimes, pathogens, drought and damage by unnaturally high numbers of insects, birds or other animals.

Tree Health - Dieback: In most ecosystems, some level of stress and/or insect attack on trees is a normal component of a healthy ecosystem. Dead trees still have high habitat value and play a role in the nutrient cycle. However, high incidence of tree dieback may be a sign of native vegetation condition decline.

Tree Health - Lerp Damage: Lerps are small insects that suck sap from leaves. They are a natural part of plant communities and normally their numbers will fluctuate both throughout the year and between years. Healthy trees will recover well from lerp damage; however prolonged heavy damage is a symptom of general stress in the ecosystem.

Tree Health - Mistletoe: Mistletoe is a native plant that attaches to trees or shrubs, using them as a source of water and nutrients. Mistletoes are a vital link in the life cycle and survival of many native animal species such as butterflies and birds. A healthy tree can support, outlive, and shed the occasional mistletoe during its lifetime with no adverse effects.

However, trees with a high number of mistletoes may become stressed if their ability to supply the mistletoes with water and nutrients is overstretched. This may contribute to a decline in tree health with a significant loss of foliage and vigour. However, such trees are likely to have been under stress from other causes before the mistletoes became established. Heavy mistletoe infestations are often a symptom of an ecosystem under stress from causes such as changes in watertable, soil compaction, increased nutrients and loss of diversity in the understorey.

The *Native Vegetation Act 1991* protects mistletoe and therefore any removal must be done in accordance with Native Vegetation Council requirements, policies and guidelines.

Total Grazing Pressure: Unnaturally high grazing levels in bushland may be the result of domestic stock grazing, feral animals and/or if they are present in unnaturally high densities, native herbivores. Heavy or inappropriate grazing may damage or remove individual plants and change the understorey composition, leading to the removal or partial removal of plants that form the natural shrub and ground layers.

Fallen Logs and Trees: Because the number of fallen logs or trees will vary between tree species, age of trees, and climatic factors, it is not possible to say how many fallen trees or logs is “natural” for a plant community. However, in general, the more fallen logs or trees the higher the habitat value of a bushland because animals such as echidnas, small reptiles and insects use fallen timber for food and shelter.