Linking Landscapes Through Local Action Evaluation Report

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Prepared by the Natural Resources Commission

NSW GOVERNMENT

Enquiries

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List of acronyms

BC Act	*Biodiversity Conservation Act 2016*
BCT	NSW Biodiversity Conservation Trust
EOI	Expression of interest
LG Act	*Local Government Act 1993*
LGA	Local Government Area
OEH	NSW Office of Environment and Heritage
RFS	NSW Rural Fire Services
The Trust	NSW Environmental Trust

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Cover page images clockwise from top left:

1. Track at Garrad Reserve
2. Signage at Garrad Reserve
3. Rumbalara Reserve
4. Walkway at Puckey's Estate Reserve

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Executive summary

The Linking Landscapes through Local Action (Linking Landscapes) project, which was part of the NSW Government's Green Corridors Program, aimed to increase the condition, functional connectivity and resilience of landscapes and ecosystems in the Sydney Basin bioregion.

The project was funded by the NSW Environmental Trust (the Trust) and delivered by the NSW Office of Environment and Heritage (OEH). Its primary objective was to protect and manage conservation values by establishing biobank sites on public land in the Sydney Basin bioregion. As part of the project, OEH also developed tools to identify and display priority biodiversity investment areas.

Between 2012 and 2015, OEH selected and established BioBanking agreements for seven council-owned sites. These agreements provided ongoing funding for councils to develop and implement long-term management plans to maintain and improve environmental values at the sites.

The NSW Natural Resources Commission (the Commission) was engaged by the Trust to evaluate the effectiveness and efficiency of this project and to identify lessons for future projects funded by the Trust.

Key findings

The Commission found the project was effective in achieving its primary objective. By establishing BioBanking agreements, it resulted in increased on-ground management at all sites, which has led to improvements in site condition that would not have otherwise occurred. It increased the protection of conservation values at all sites, greatly reducing the risk of future rezoning or development. It also improved council capacity to manage public land for conservation outcomes. At all sites, we found highly motivated council staff with a deep understanding of local issues, and dedicated to the outcome of conserving local biodiversity.

However, we found a large variation in cost effectiveness across sites. Due to differences in the initial condition of the sites, the funding allocated to each site under the agreements varied widely, both in total and on a per hectare basis. We also found a large variation in the long-term viability and recoverability of each site due to the size and location of the site, its exposure to ongoing threats and other factors. Two of the sites needed relatively large investments of funds to improve and maintain their condition in the short-term, with low prospects of being restored to a resilient state in the long-term even with in-perpetuity funding.

While the project has had positive impacts at the site scale, we consider it unlikely to have had a material impact at the landscape scale. Councils face considerable challenges in addressing future threats and pressures on biodiversity values at the landscape scale. We consider that more effectively 'linking' landscapes in the Sydney Basin bioregion requires improved coordination between councils at a landscape scale, supported by additional funding for and investment in bushland management.

Recommendations

The Linking Landscapes project has demonstrated the potential for achieving long-term conservation outcomes on council-owned reserves via BioBanking, and for increasing awareness among councils of the capacity of BioBanking to support biodiversity objectives elsewhere.

The Commission recommends initiatives to improve future outcomes for similar projects. The primary recommendation is to improve selection criteria and carry out regular performance reviews to ensure environmental outcomes are cost-effective and can be sustained in the long term. Selecting, managing and protecting sites that are large, intact, and well connected to large patches of native vegetation with high initial resilience will achieve a higher return on investment.

Recommendations

Improve site selection criteria

1. Selecting sites for future investment should explicitly consider future threats to site values, the likelihood of those threats, the magnitude of impact on biodiversity values and the ability of those threats and impacts to be feasibly managed.
2. Investors should avoid small, isolated sites, particularly in highly urbanised areas, for landscape-scale outcomes.
3. Investors should seek to weight criteria in favour of connectivity, ecological function and resilience attributes over scarcity values such as listed endangered ecological communities.

Improve assurance for performance

4. In addition to compliance audits at biobank sites, performance reviews should be undertaken to ensure management outcomes are being achieved through the agreed management activities.

Improve coordination between land managers

5. Landscape-scale priority mapping should inform site selection and maximise return-on-investment. These will be useful tools to help councils and other land managers coordinate planning and implementation.

Seek alternative and additional funding

6. There is scope to encourage more active support of councils to adopt alternative funding mechanisms in addition to traditional funding sources.

Improve tools for identifying conservation investments

7. Tools that identify future investment priorities and existing commitments for conservation should be created with an end-user in mind and be integrated into existing business processes to ensure effective project and risk management and their long-term utility.

Flexible management options

8. While generic management prescriptions are important for accountability, land managers should also have flexibility to adopt appropriate action to suit circumstances at hand.
9. Land managers should be cautious in diminishing marginal returns of some management actions that may have minimal benefit to biodiversity values.
10. Management effort should be prioritised across sites once key threats are under control.

1 Key context

The NSW Government's commitment to purchase and protect strategic areas of high conservation value and ensure more green spaces across Sydney and NSW (NSW 2021 Plan) was implemented through the Green Corridors program from 2011 to 2015. As part of this $40 million program, the NSW Environmental Trust (the Trust) provided $10 million of funding for the Linking Landscapes through Local Action (Linking Landscapes) project, with the aim of increasing the condition, functional connectivity and resilience of landscapes and ecosystems in the Sydney Basin bioregion.[1]

This project was delivered by the NSW Office of Environment and Heritage (OEH) over the four-year period from 2012 to 2016. Its main component was a grant program for establishing and funding BioBanking agreements on public land under the then NSW Biodiversity Banking and Offsets (BioBanking) Scheme. It resulted in seven BioBanking agreements for sites owned by local councils across the Sydney Basin bioregion.

The Trust engaged the NSW Natural Resources Commission (the Commission) to evaluate the effectiveness and efficiency of the Linking Landscapes project and to identify and document lessons for future projects funded by the Trust. These lessons may also be of value to other agencies that work with landholders to establish conservation agreements for managing land with high biodiversity values.

To provide context for our evaluation, the sections below outline the project's objectives, the approach we used for the evaluation, and changes to the BioBanking Scheme that have occurred since the project was implemented.

1.1 What were the project's objectives?

The Linking Landscapes project's main objective was to protect and manage land with identified conservation value in the Sydney Basin bioregion. It sought to achieve this objective primarily by establishing biobank sites in the bioregion.

This biobank site component aimed to:

- provide better management and secure legal protection of bushland within green corridors, focusing on public land owned by government bodies
- stimulate interest from owners or managers of public land in using the NSW Government's BioBanking Scheme as a mechanism for providing funding and protection for bushland.[2]

In addition, the project had two supporting objectives:

1. to work with stakeholders to identify and promote priority investment areas for biodiversity management within two pilot subregions in the Sydney Basin bioregion (referred to as the Biodiversity Investment Opportunities Map, or 'BIO Map' component)
2. to produce spatial information on conservation commitments throughout NSW and display this information using a web mapping application (the spatial viewer component).[3]

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1 NSW OEH (2012) *Linking Landscapes through Local Action Project - Business Plan Part A: Four year project plan 2011 – 2015.*

2 NSW OEH (2015) *Establishing Biobank sites on public land – a report on the Linking Landscapes through Local Action grant program 2012-2015.* Available at http://www.environment.nsw.gov.au/resources/conservation/150405-linking-landscapes.pdf (accessed 5th July 2018).

3 NSW OEH (2012) *Linking Landscapes through Local Action Project - Business Plan Part A: Four year project plan 2011 – 2015.* p. 5

1.2 How did we approach the evaluation?

To guide our evaluation, the Commission developed a framework that focused on three lines of inquiry:

1. the effectiveness of the project in achieving its objectives
2. the effectiveness and appropriateness of the design and processes used to deliver the project
3. the lessons in relation to cost-effectiveness and efficiency.

For each line of inquiry, we identified key questions to scope our evaluation and focus in on the main areas of interest (see Attachment 1). We then investigated the questions using a range of data sources and approaches. For example, we:

- reviewed key project documents, including the Linking Landscapes Business Case, financial reports and summaries, grant assessment reports, BioBanking assessment reports, annual reports and audit reports
- interviewed council and OEH staff who were involved in the project
- assessed management works and outcomes at each of the biobank sites established under the project
- undertook a desktop spatial analysis of landscape ecology associated with each of these sites.

Finally, we reviewed all the findings of our inquiry to evaluate the project's overall effectiveness and efficiency in achieving its objectives and identify any lessons for future BioBanking projects. This evaluation focused primarily on the BioBanking component as it accounted for most of the project's total funding.

1.3 How has the BioBanking Scheme changed since the project was implemented?

Since the Linking Landscapes project was delivered, the Government has effectively replaced the BioBanking Scheme with Biodiversity Stewardship Agreements established by the new *Biodiversity Conservation Act 2016* (BC Act). These agreements create tradeable credits in much the same way that the BioBanking Scheme did in the past.

Land developers are now able to deposit money directly into the Biodiversity Conservation Fund, through the NSW Biodiversity Conservation Trust (BCT), in lieu of purchasing credits to offset development. The BCT can then use those funds to purchase suitable credits, potentially leading to more strategic gains.

However, there is no substantial difference between BioBanking and the new Biodiversity Stewardship Agreements as offsetting mechanisms. For example, councils can create sites for Biodiversity Stewardship Agreements and sell credits on the open market. Under the new methods to create credits, a 20 percent discount applies to credits on Community and Operational land.[4]

[4] These are categories used by councils to zone public land in their local government areas

2 Project activities and outputs

As noted above, the Linking Landscapes project's main objective was to protect and manage land with identified conservation value in the Sydney Basin bioregion. To meet this objective, OEH designed and delivered three project components:

1. a grant program to establish BioBanking agreements on sites with conservation values
2. a BIO Map to identify priority areas for investment in biodiversity
3. a state-wide spatial viewer that displays spatial information on existing conservation commitments.

Before we began our evaluation, we reviewed the funds allocated to each component, the activities these funds were spent on, and the resulting outputs. We found nearly all the funds were allocated to establishing BioBanking agreements.

Table 1 summarises the funding, activities and key outputs of each component. The sections below discuss each component in more detail.

Table 1: Linking Landscapes project summary

Element	Timing	Funding	Activities	Outputs
1. Grant program for BioBanking agreements	2012-15	$9,210,526	▪ Sought EOIs in two rounds ▪ Selected sites and allocated grants ▪ Established BioBanking agreements	▪ 345 ha protected across 7 sites in 7 LGAs ▪ Sites managed in line with agreements
2. BIO Map	2013-15	$405,000	▪ Identified priority conservation areas through stakeholder consultation ▪ Mapped priority investment areas	▪ BIO Map for Illawarra and Cumberland sub-regions
3. Spatial viewer	2013-16	$555,154	▪ Collected spatial information on conservation commitments ▪ Created database and web-based viewer	▪ Web-based viewing platform

2.1 Grant program to establish BioBanking agreements

Around $9 million (or 90 percent) of the total funding for the project was allocated to establish biobank sites on public land (Table 1). The business plan for the project allocated about $4.5 million for establishing biobank sites during the 2012-13 and 2013-14 financial years and the remaining funds for the 2014-15 financial year.

To allocate the grants, OEH sought expressions of interest (EOIs) through two rounds of the grant program:

- Round 1 was opened in August 2012 and received 56 EOIs. Most were from councils and only 7 were from non-council authorities
- Round 2 was opened in October 2012 and received 24 EOIs, all from councils.

OEH assessed these applications against selection criteria, with final site selection being based on ecological values, likely cost-effectiveness and the feasibility of sites being established within the project timeframes (Figure 1).

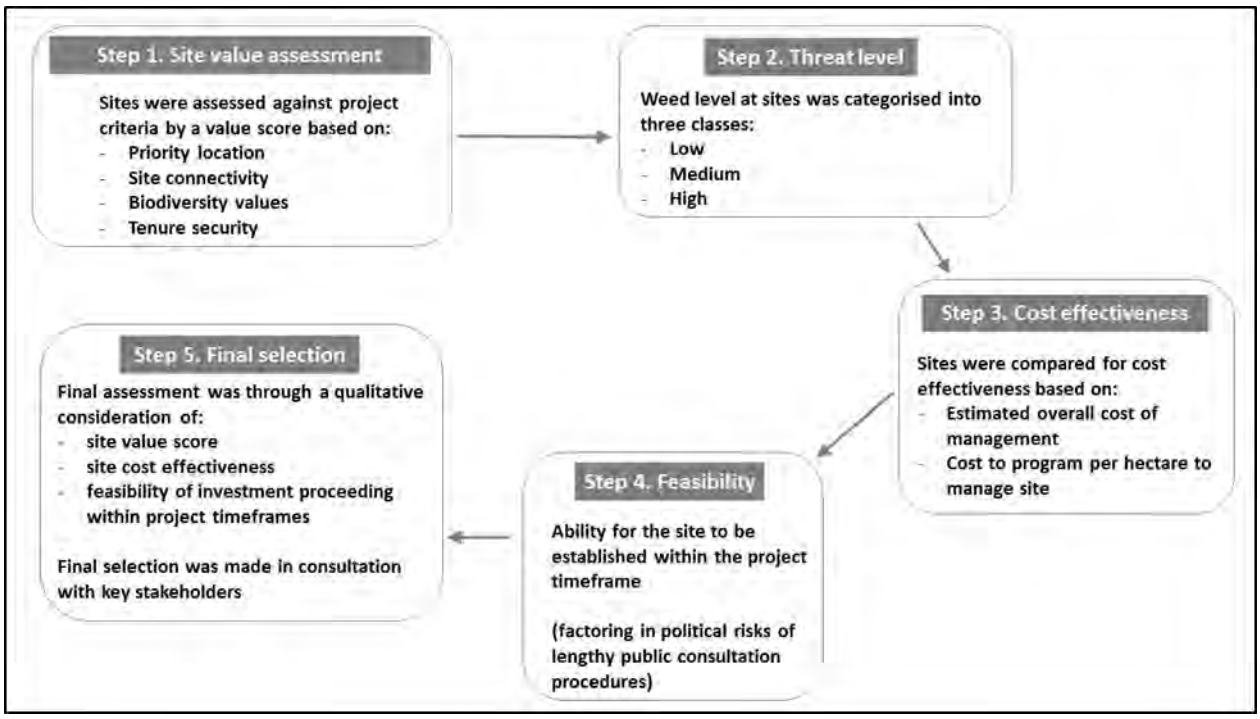


Figure 1. Assessment of expressions of interest for grant program[5]

OEH selected and established BioBanking agreements for seven council-owned sites across the bioregion, from Lake Macquarie in the north to Shoalhaven in the south (Figure 2). These agreements provided ongoing funding for councils to develop and implement long-term management plans to maintain and improve environmental values at these sites. Most of the biobank sites are located in heavily urbanised areas. The exception is Garrad Reserve, which is located in a semi-rural area in the Shoalhaven local government area.

Collectively, the sites cover a total of 345 hectares of land, ranging from about 10 to 100 hectares Table 2 provides more detail about the investment per site. In summary:

- the project grant investment for each site ranged from **$800,000 to over $2,000,000**
- additional contributions from the councils ranged from **$20,000 to $469,000**
- the investment (OEH grant plus council contribution) per hectare for each site varied from **$12,000 to $90,000**.

5 Linking Landscapes through Local Action Grant Selection Reports – Rounds 1 and 2 (2013).

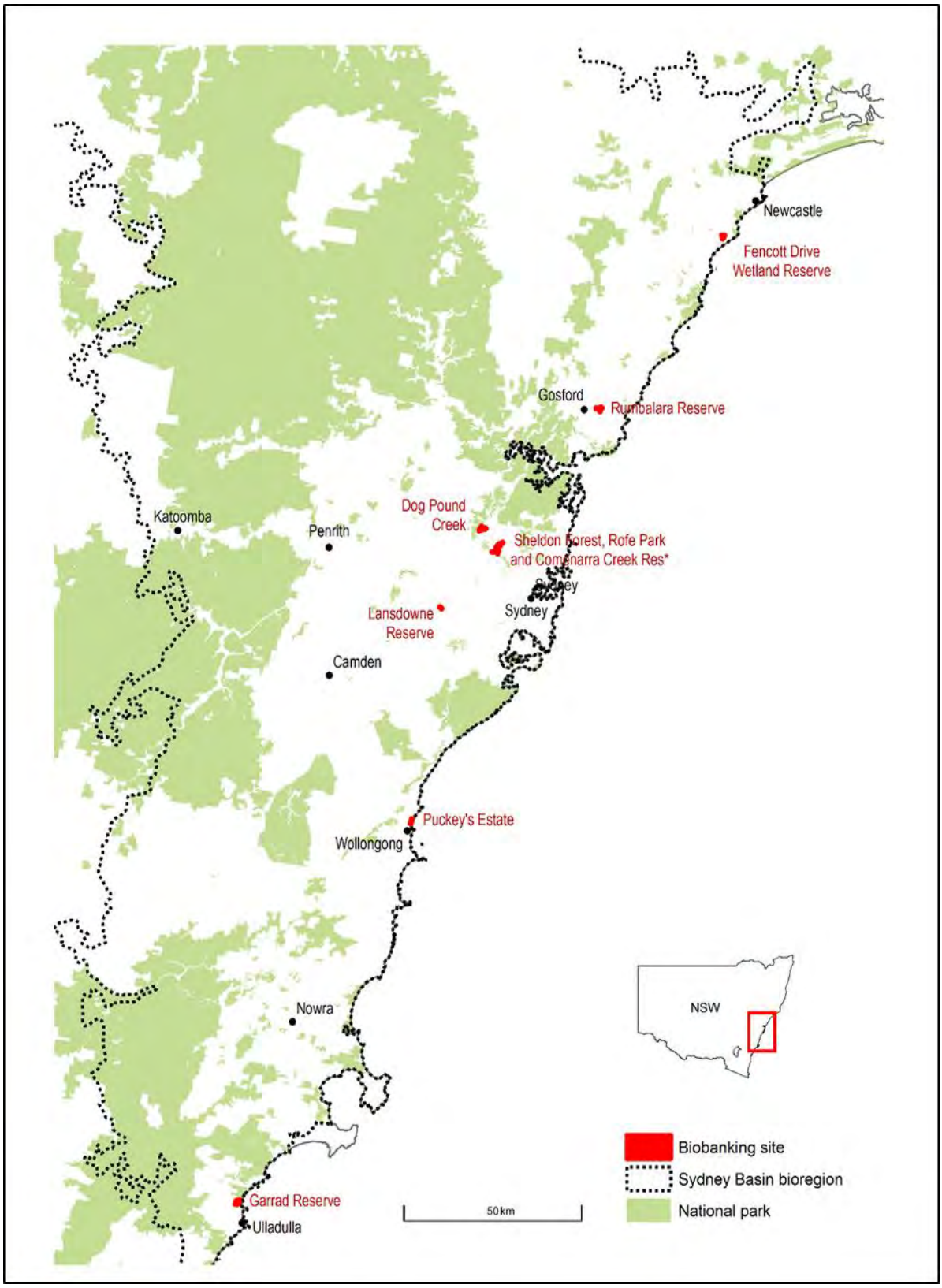


Figure 2. Location of biobank sites

Table 2. Site investment and management works under BioBanking agreements

Site name (Council)	Area (ha)	Project grant	Council contribution (% of total grant)	Total investment per ha	Management works
Garrad Reserve (Shoalhaven City Council)	66	$788,865	$0 (0%)	$11,950	▪ Fire trail and formal walking tracks upgraded to reduce erosion and sedimentation ▪ Extensive weed control works
Fencott Drive Wetland Reserve (Lake Macquarie City Council)	41	$2,074,073	$25,000 (1%)	$51,200	▪ Extensive land and aquatic weed control works ▪ Waste removal and fencing works
Sheldon Forest, Rofe Park and Comenarra Creek (Ku-ring-gai Council)	99	$1,601,382	$469,000 (29%)	$20,910	▪ Weed control and revegetation works (including installing temporary fencing to exclude grazers) ▪ Ecological burn ▪ Low-level fox baiting
Rumbalara Reserve (Gosford City Council)	59	$929,414	$50,000 (5%)	$16,600	▪ Extensive weed control works (lantana spaying and clearing) and supplementary revegetation
Puckey's Estate (Wollongong City Council)	29	$870,912	$96,000 (11%)	$33,340	▪ Weed control works and revegetation where necessary to supplement natural recruitment
Dog Pound Creek (Hornsby Shire Council)	41	$1,240,273	$35,000 (3%)	$31,105	▪ Weed control works and revegetation where necessary to supplement natural recruitment
Lansdowne Reserve (City of Canterbury Bankstown)	11	$964,264	$20,000 (2%)	$89,480	▪ Extensive weed control and revegetation works ▪ Substantial effort into fencing/bollards
Total	345	$8,469,183	$695,000	$254,585	
Average	49	$1,209,883	$99,286	$36,370	

Roughly one third of the combined area of all the sites (around 120 hectares) contain listed threatened ecological vegetation communities. Some threatened fauna and flora have also been recorded on some of the sites, including powerful owl (*Ninox strenua*), eastern bent-wing bat (*Miniopterus schreibersii oceanensis*), spiked rice-flower (*Pimelea spicate*) and black-eyed Susan (*Tetratheca juncea*) (Attachment 2).

The number of threatened ecological communities and species occurring within each site ranged from 5 to 12 per site (Figure 3). All sites had at least one listed threatened ecological community and at least three threatened animal species.

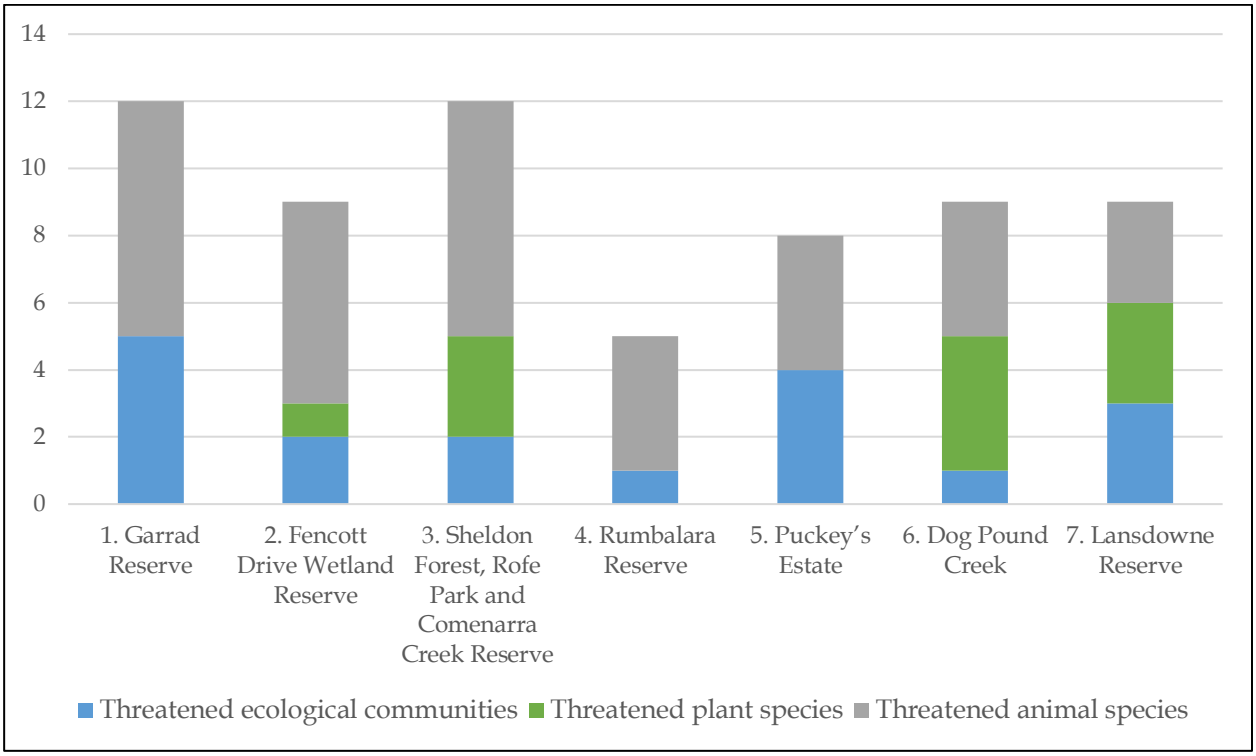


Figure 3. Number of threatened species and communities within each site

Since their establishment as biobank sites, a range of management activities has been undertaken, including managing weeds and pest animals, installing fencing and providing interpretive signage (Table 2).

OEH has undertaken compliance audits for six of the sites. Overall, these audits found all of the councils had managed the sites to a satisfactory level in line with contract conditions under the BioBanking agreements. Comprehensive compliance audits are on-going and take place at seven-year intervals.[6]

The findings of our evaluation of outcomes at the site scale are discussed in Chapters 3 and 4.

2.2 BIO Map to identify priority biodiversity areas for investment

OEH developed the BIO Map to identify priority biodiversity areas to target investment in the Illawarra and Cumberland sub-bioregions. The total expenditure for this component of the project was just over $400,000 (or around 4 percent of the total project funding).

OEH consulted 52 stakeholders from government agencies, NGOs and community organisations in developing the BIO Map to ensure it reflected both scientific and local

6 NSW OEH (2012) *BioBanking review: Discussion paper*. p. 15. Available at http://www.environment.nsw.gov.au/resources/biobanking/20120062bbrevdp.pdf (accessed 5th July 2018).

knowledge about biodiversity values and priorities. This initial engagement with councils was effective in raising awareness of government biodiversity programs. However, it is unclear whether the consultation has led to persistent or meaningful changes in community engagement in biodiversity management or awareness of government efforts.

While the BIO Map tool was developed to guide investment decisions through grant and incentive programs, it was not used to prioritise projects for the Linking Landscapes project as the tool was delivered after the biobank sites were selected.

However, it has since been used to identify priority investment areas for the NSW National Parks Association's BushMates program, which works with communities that adjoin BIO Map areas to raise awareness and understanding around the threats to these areas from garden weeds, pets and litter. OEH and BCT are also investigating options to use BIO Map to prioritise biodiversity investment delivered through other programs.

OEH established governance arrangements to maintain the BIO Map data until at least June 2019.[7] Despite the BIO Map tool providing some value in conservation prioritisation, judging the value for money of this tool is difficult because the extent of its ongoing contribution to other programs and subsequent mapping is unclear and there is no clear plan for supporting and testing its use.

2.3 State-wide spatial viewer to display information on conservation commitments

The Trust invested over $500,000 (or around 5 percent of the total project funding) in creating a state-wide spatial viewer. This tool was intended to display existing conservation commitments and inform future investments through a publicly available online portal.

This would make it easier for land managers to:

- avoid 'doubling up' conservation commitments on individual land parcels
- carry out compliance checks on conservation commitments
- monitor regional and landscape engagement
- plan future conservation investments.

However, the actual use and value of the viewer platform is unclear. The Commission found a range of shortcomings with the final product, including:

- limited function due to constraints with access to accurate data on conservation commitments – at the time of project scoping OEH assumed that all conservation commitment data would be recorded, or available in a suitable format for the viewer
- the quality and technical capability of the product appears to have been superseded through the roll-out of the biodiversity reforms and the development of potentially overlapping platforms (i.e. SEED, even though this lacks some of the data manipulation features of the spatial viewer)
- the viewer is not publicly accessible as intended partly due to OEH's concerns over the potential for it to create confusion during the biodiversity reforms and because the viewer does not comply with government accessibility standards
- the sustainability of the viewer is not certain because, while OEH supports its continued maintenance in principle, this appears to be subject to funding being available.

7 NSW OEH (2016) *Environmental Trust Major Projects Final Report – Green Corridors: Linking Landscapes through Local Action Project*.

Overall, the Commission found the viewer was not able to deliver any of the core benefits scoped in the original business plan. There is low interest within OEH to use the spatial viewer, with only 66 people registered to use it. There was limited positive feedback from them about the product. OEH acknowledge that the spatial viewer has not delivered data in an accessible and usable format, partly because of issues with compatibility with primary data sources, project delivery such as effective risk management, and partly because of the rapid pace of technological changes in this space.

Section 6.5 recommends ways to address these issues. For example, creating tools that identify future investment priorities and existing conservation commitments, with an end-user in mind and integrated into existing business processes. In particular, appropriate technical expertise is required in the scoping phase of IT/technology projects to accurately identify constraints, feasibility issues and identify and manage potential risks.

3 Project was effective at site-scale

As Chapter 2 discussed, the largest component of the Linking Landscapes project was a grant program that established BioBanking agreements for seven council-owned sites in the Sydney Basin bioregion.

As part of our evaluation, we examined the activities and outcomes on the sites resulting from these agreements to assess how effective the project was in achieving its main objective to protect and manage land with identified conservation value.

We found that the project was effective at achieving this objective at the site scale. Through the establishment of BioBanking agreements and associated ongoing management payments, it has resulted in:

- increased on-ground management and on-going payments at all sites that has led to improvements in site condition that would not have otherwise occurred
- increased protection of conservation values at all sites as the agreements have greatly reduced any risk of future rezoning or development
- improved council capacity to manage public land for biodiversity outcomes – at all sites, we found highly motivated council staff with a deep understanding of local issues, and dedicated to the outcome of conserving local biodiversity.

These findings are discussed in more detail below.

3.1 On-ground management has improved site condition

We compared the obligations and management plans for each site before and after the project. We found that before the BioBanking agreements were established, a generic plan of management was in place at all sites. The level of on-ground management activity varied, from little or no management at some sites through to moderate or high levels at others, depending on council budget allocations. We observed that sites in good condition (such as Garrad and Rumbalara reserves) typically had low levels of on-ground management, while those in poorer condition (such as Puckey's Estate, Lansdowne Reserve or Dog Pound Creek) had higher levels of management.

With the BioBanking agreements in place, there has been a marked increase in the level of on-ground management activity at all sites. Most of this activity has been aimed at controlling weeds, constructing fences to protect natural values, and revegetation work. Attachment 3 provides more detail on management activities at the sites before and after the BioBanking agreements.

These additional activities have led to improvements in the condition of all sites. For example:

- all councils have reduced the extent of weeds within the sites, including large areas of lantana (*Lantana camara*) , bitou bush (*Chrysanthemoides monilifera* subsp. *Rotundata*) and African lovegrass (*Eragrostis curvula*) being cleared (Figure 4)
- **w**here weeds have been cleared, native vegetation has regrown, or revegetation work has been carried out
- initial works have improved access and visitor control at the sites.

We consider that these outcomes are unlikely to have occurred in the absence of the BioBanking funding and, therefore represent added value for the sites. Table 3 summarises the key outcomes from increased on-ground management and their level of success at each site.

Table 3. Key management outcomes at biobank sites

Site	Outcome of management under BioBanking	Success of works to date
Garrad Reserve	▪ Reduced erosion and sedimentation from fire trail upgrade and formal access tracks and boardwalks, and fencing. ▪ Extensive weed reduction in the lower lying areas of the site.	Excellent
Fencott Drive Wetland Reserve	▪ Weed declines ▪ Aquatic weeds being managed ▪ Waste removed from site ▪ Fencing constructed	Excellent
Sheldon Forest, Rofe Park and Comenarra Creek	▪ Reduced weeds ▪ Revegetation (with temporary fencing to exclude grazers) ▪ Successful ecological burn ▪ Fox baiting	Excellent
Dog Pound Creek	▪ Effective weed control ▪ Natural recruitment supplemented by revegetation	Excellent
Rumbalara Reserve	▪ Effective lantana control ▪ Fencing constructed ▪ Revegetation	Good
Lansdowne Reserve	▪ Effective weed control ▪ Increase in the numbers of individual threatened species, e.g. *Marsdenia viridiflora*, post weed removal ▪ Fencing/bollards constructed ▪ Revegetation	Good
Puckey's Estate	▪ Decline of extensive *A. asparagoides* infestation ▪ Widespread dieback of woody shrubs ▪ Natural recruitment supplemented by revegetation ▪ Natural revegetation of native species	Fair

The additional and on-going funds available through BioBanking have also enabled the development of long-term management plans for the sites. We note that other additional activities undertaken or required under the BioBanking agreements may lead to further improvements in site condition and thus add further value in the future. These include activities to:

- control feral and overabundant native herbivores
- manage vertebrate pests
- control nutrient and contaminated run-off through restricted use of fertilisers, pesticides and herbicides
- maintain or reintroduce natural flow regimes (Puckey's Estate only).

Example of lantana control within the biobank site

Example of untreated lantana immediately south of biobank site

Figure 4. Lantana control in Rumbalara Reserve

Notwithstanding the extensive weed control work and the positive outcomes discussed above, some of the biobank sites retain a significant level of weed infestation. These include Puckey's Estate and the aquatic areas in Fencott Drive Wetland Reserve. In our view, these sites face a range of challenges typical in managing more degraded sites adjacent to highly populated areas.

In addition, all seven councils identified current and potential future challenges related to public access to the sites. These issues include illegal dumping, littering and vandalism at the site, as well as damage and disturbance due to the use of informal tracks and recreational activities such as trail and motor bike riding.

Most councils also indicated they faced difficulty in organising ecological burns within the sites. While this management action is planned at all sites, to date only one council has successfully implemented it. Ku-ring-gai council undertook a burn at Sheldon Forest by using its own specialist team. However, the other six councils indicated they are reliant on either the Rural Fire Services (RFS) or their own fire officers, who place a low priority on ecological burns.

Challenges to site management are discussed further in Chapter 4.

3.2 Increased protection of conservation value

We assessed the extent to which conservation values were protected by planning controls at the sites before and after the project. We found that BioBanking agreements have increased the level of tenure protection.

Before the project, the sites were predominantly classified as Community Land under the *Local Government Act 1993* (LG Act). Some sites, such as Rumbalara Reserve, included a small to moderate proportion of land classified as Operational Land.

Community Land has a moderate level of security in that it cannot be sold, it requires a plan of management and there are restrictions on development. However, the LG Act provides mechanisms for reclassifying this land subject to public exhibition and council approval. Operational land has a lower level of security with fewer restrictions on its development and obligations for management than Community Land.

As a result of the project, all of the sites are subject to BioBanking agreements. This means that under the BC Act, they must be managed in strict accordance with this agreement, cannot be developed, and require Ministerial approval for termination of the agreement. Should the agreement be terminated, the Minister must also ensure that there are measures to offset any impacts on biodiversity caused by terminating the agreement.

We consider the increased protection is an important outcome, given that the sites are located in urban or semi-rural areas, where the pressure to develop green space is high. For example, during our field inspection we observed significant clearing of native vegetation immediately adjacent to the eastern edge of Garrad Reserve to develop a new residential estate (Figure 5). Along with the reserve, this area was also providing important ecological function.

Figure 5. Eastern boundary of Garrad Reserve showing clearing for development of a new residential estate (Amaroo) directly adjacent to the reserve

For any biobank sites that adjoin existing residential estates, residents can request the NSW Rural Fire Services (RFS) to assess the potential fire hazards of the sites. A Bush Fire Hazard Reduction Certificate may be issued on the basis of the assessment, to allow for an Asset Protection Zone (APZ) to extend into a biobank site. In such cases, the RFS must consider the potential impact on soil erosion, slope instability, threatened species and vegetation communities[8] and ensure work undertaken is consistent with any existing land management agreements.[9]

3.3 Improved council capacity to manage public land for biodiversity outcomes

We found that the project had led to improvements in the capacity and capability of council staff to manage public land for biodiversity outcomes.

For example, the BioBanking funding allowed land managers to more effectively plan and implement management activities at the biobank sites over the long-term rather than relying on short-term grants. This long-term approach has helped ensure that these activities are appropriately prioritised and sequenced across the site, and that appropriate follow-up action is planned and implemented.

In addition, all councils noted that the new BioBanking funding had 'freed-up' existing council resources to better manage land on other council sites to support biodiversity. We found evidence of councils having undertaken weed control works across the boundary of their biobank site into neighbouring reserves, and reallocating resources to other sites within the area where targets had been achieved.

Most councils engaged contractors to complete the works undertaken at the biobank sites to date. However, City of Canterbury Bankstown (Lansdowne Reserve) and Lake Macquarie City Council (Fencott Drive Wetland Reserve) used a combination of contractors and council bush regeneration teams. For these councils, the BioBanking funding has improved the job security and capacity of the bush regeneration teams - allowing them to transition from stop-start contract-based bush regeneration to part-time or full-time contracts, and in some cases, permanent internal positions. This has facilitated improved site management, as it means the same team is dedicated to the site over the long-term, providing a better understanding of what needs to be done and developing a stronger sense of stewardship.

Finally, we found that the project had encouraged some of the councils to reconsider how they manage their natural areas in general. For example, we observed that councils were thinking more holistically about the range of management actions and scheduling required for all their reserves, and future opportunities to use BioBanking as a funding instrument elsewhere. We also observed that some councils had applied BioBanking tools to their broader land management approaches—such as using the management cost calculator to inform negotiations with developers around site dedications and management costs.

8 NSW Rural Fire Services (no date) *Application instructions for a Bush Fire Hazard Reduction Certificate.* Available at https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0009/13320/Application-Instructions-Bush-Fire-Hazard-Reduction-Certificate.pdf (accessed 5th July 2018).

9 NSW Rural Fire Services (no date) *Standards for Asset Protection Zones*. Available at https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf (accessed 5th July 2018).

4 Variable return on investment across sites

In our assessment of outcomes on the biobank sites, we also considered the cost-effectiveness and efficiency of the project in terms of the long-term capacity of the selected sites to maintain their condition and relative return on investment.

Despite the positive outcomes since investment at the biobank sites outlined in Chapter 3, we observed issues at some sites that will impact on their recoverability and the long-term viability of the ecosystems present. Levels of cost-efficiency and long-term viability vary at the site scale. In particular, we found:

- the funding per hectare allocated for the first 10 years under the BioBanking agreements varies widely across the sites, from under $400 per hectare to over $4000 per hectare, due to different initial conditions at the sites
- despite security of funding, the long-term viability and recoverability of sites varies due to their location and use and their associated ongoing exposure to threats
- sites with small areas and low levels of connectivity are prone to on-going disturbance and deterioration of conservation values.

In combination, these findings indicate that some sites require relatively large investments into the BioBanking Trust Fund to create and maintain the improvements in site condition discussed in Chapter 3, and have low prospects of being restored to a resilient state. We consider that improvements to the site selection process could improve the overall return on investment from future BioBanking projects.

4.1 Initial site condition determines management costs

We found that the initial condition of the selected sites varied substantially. For example, Garrad Reserve was relatively intact, with undisturbed areas of natural bushland and low levels of invasive species. Others, such as Puckey's Estate and Lansdowne Reserve, had a history of disturbance, including extensive weed infestations and vegetation in relatively poor condition.

We assigned a broad rating of site resilience (high, moderate or low) to each reserve (or sections of reserves where they are comprised of separate parcels of land) using results of desktop and field assessments (Table 4 and Attachment 4). We found:

- three reserves and one section of another reserve have high resilience due to factors such as excellent initial condition, effective management, large size, low edge effects, strong connectivity, limited or well-managed access, and low long-term threats
- one reserve and one section of another reserve have moderate resilience due to their limited connectivity and the risk of future habitat loss to accommodate asset protection against potential bushfires (and despite their excellent initial condition and the apparent success of management actions since the agreements have been in place)
- two reserves to have low resilience due to factors such as their relatively poor condition, challenging management context, small size, high edge effects, poor connectivity, high visitor numbers, unleashed dogs, significant evidence of anti-social behaviour, and a high level of long-term threats (and despite improvements in their condition since the agreements have been in place)

Table 4. Site resilience ratings

Site	Resilience rating	Site notes
Garrad Reserve	High	▪ High intrinsic values ▪ Good vegetation structure promoting ecological function ▪ Part of a large contiguous patch of coastal forest that enable ready movement of species ▪ Weed disturbance is relatively low and impacts from human use are well managed
Fencott Drive Wetland Reserve	High	▪ Part of a large remnant of coastal forest ▪ Weed control has visibly improved stand structure ▪ Strong evidence of ecosystem function through field observation of natural regeneration of many native plant species, and observation of a variety of fauna species on site ▪ Little evidence of disturbance by humans
Sheldon Forest, Rofe Park and Comenarra Creek Reserve (southern section)[10]	High	▪ Relatively large area for which 'passive' management is designated ▪ Large size and contiguity with Lane Cove National Park
Rumbalara Reserve	High	▪ At the southern end of a large remnant of coastal forest ▪ Weed control has visibly improved stand structure ▪ Human use is relatively low ▪ Ongoing fox baiting along with no-dog policy may be keeping predation of ground-dwelling fauna in check ▪ Strong evidence of ecosystem function through field observation of considerable forest senescence, plant regeneration, and a large number and diversity of bird species

10 Sheldon Forest, Rofe Park and Comenarra Creek Reserve comprises two separate sections with different profiles and stresses (see site profile in Attachment 5), thus resilience has been assessed for each of these sections

Site	Resilience rating	Site notes
Sheldon Forest, Rofe Park and Comenarra Creek Reserve (northern section)	Medium	▪ Potential for future clearing to expand APZs[11] ▪ Relatively narrow and subject to edge effects from adjacent houses and many users of the area
Dog Pound Creek	Medium	▪ High number of adjacent dwellings ▪ Potential edge effects due to elongated shape of the reserve ▪ Potential for future clearing to expand APZs ▪ Potential for pollution from sewage pipes that traverse the reserve
Puckey's Estate	Low	▪ Parts of the site remain infested with weeds ▪ Human use is very high ▪ The site is linear and has little core area that is free from edge effects associated with urbanisation ▪ A substantial effort to arrest weeds over many years does not appear to have controlled some major weed thickets. ▪ The site is low lying and immediately threatened by coastal erosion and sea level rise.
Lansdowne Reserve	Low	▪ Small urban parkland ▪ Experiences a high level of use and associated disturbance by local residents ▪ No core areas that are free from edge effects associated with human activities ▪ Numerous tracks and an urban inholding ▪ Isolated from larger patches of bush with little functional connectivity

11 NSW Rural Fire Services (no date) *Application instructions for a Bush Fire Hazard Reduction Certificate.* Available at https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0009/13320/Application-Instructions-Bush-Fire-Hazard-Reduction-Certificate.pdf (accessed 5th July 2018).

Under the BioBanking agreements, these sites receive annual funding which in most cases declines over three periods – years 1 to 10, years 11 to 20, and years 21 onwards. In years 1 to 10, the annual funding varies significantly across the selected sites, from under $400 per hectare for Garrad Reserve, to over $4000 per hectare for Lansdowne Reserve. The extent to which this funding declines over time also varies across sites, with some continuing to receive under $400 per hectare and others more than $2000 per hectare from year 21 in perpetuity (Figure 6).

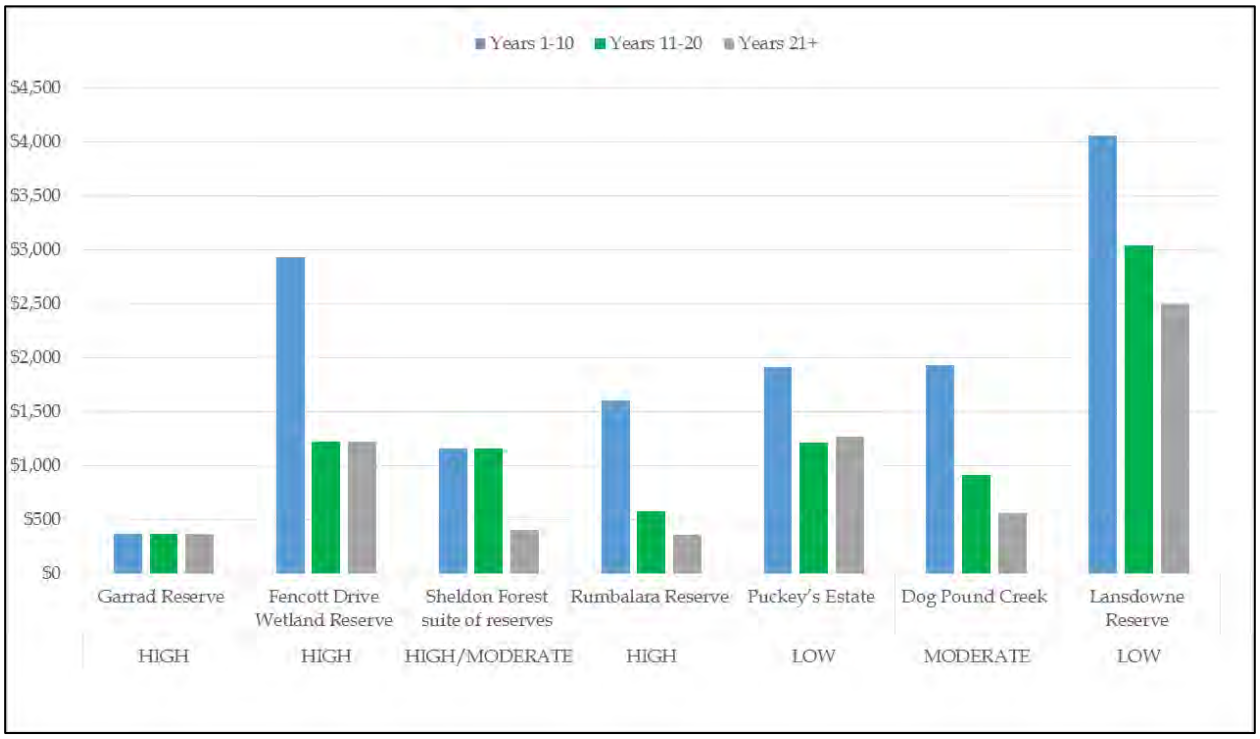


Figure 6. Annual funding ($/ha) for each site within 3 main funding periods (with initial site resilience noted[12])

We found that the initial site condition was the primary driver of the differences in the cost to manage the sites. That is, sites that were in relatively poor or average condition (typically due to high visitor use and heavy weed infestations) received the highest level of funding per hectare in years 1 to 10 and will continue to receive higher levels of funding over time. In contrast, sites in better condition (typically lower visitor use and lower levels of weed infestation) received substantially lower levels of funding per hectare in years 1 to 10 and will continue to receive lower funding over time.

Fencott Drive Wetland Reserve is an exception, with a relatively high allocation of funds for a site of high resilience. This is due to the high cost and challenges of managing aquatic weeds, which will take most of the allocated funding in future years. This is particularly challenging as the site has a large upstream catchment, which is an ongoing weed source.

Selecting sites in variable initial condition was a deliberate strategy by OEH to achieve greater conservation gains.[13] In the selection process, they recognised two competing criteria:

- sites with low-level threats are more cost effective to manage, thus allowing for larger areas of land to be managed and protected, but provide low opportunity for conservation improvements as they are in good condition

12 Results from desktop and field assessments were used to expertly assign a broad level of resilience to each site – see Attachment 4

13 This was noted in the Linking Landscapes through Local Action Grant Selection Reports – Rounds 1 and 2 (2013).

- sites with high-level threats are expensive to manage, thus limiting the area being managed and protected, but provide opportunity for high conservation benefit from improvements in the condition of threatened ecological communities.

However, to achieve a high conservation benefit at sites with high-level threats, managers would need to be able to effectively control all threats and restore vegetation condition. We consider that while weed threats can be managed to some extent, other threats may make long-term restoration to a resilient state tenuous and highly costly (discussed further below).

Success of management can only be assured in the long-term if the site possesses a level of resilience that facilitates long-term natural function. In the case of the four sites identified as possessing high resilience, we expect that ongoing site management is much more likely to ensure that outcomes are sustainable. However, ongoing management of sites of low resilience will not ensure they recover into healthy, functioning ecosystems.

4.2 On-going threats, size and location affect long-term viability of sites

Even with the additional planning and on-ground management made possible by the BioBanking agreements, we found that the long-term viability of conservation values and the ecological function in the landscape of the seven sites varies widely. This variation is largely driven by differences in the sites' ongoing exposure to threats that stem from their location and usage, or their size and connectivity. Site profiles detailing the characteristics and spatial context of the biobank sites are provided in Attachment 5.

4.2.1 Some sites are subject to ongoing threats due to their location and usage

We found that some sites are subject to ongoing threats because of their location and how they are used, and that these threats compromise their long-term viability and ecological function in the landscape.

For example, Lansdowne Reserve and Puckey's Estate are located close to major urban centres. They are easy to access as they have a high number of access points and internal tracks and easements (Attachment 4). They are heavily used by residents for low-impact activities such as walking, as well as higher impact activities such as off-lead dog walking, mountain bike riding, and trail bike riding. They are also subject to illegal camping, unplanned burns (caused by accident or arson) and informal track use. Other ongoing issues at these sites include graffiti, vandalism and dumping of water.

In addition, sites such as Puckey's Estate and Fencott Drive Wetland Reserve, are located downstream from urban catchments. This means there is potential for runoff from these catchments to contain contaminants and domestic waste, or to be an ongoing weed source. Alligator weed in areas upstream of Fencott Drive Wetland Reserve, for example, act as a continual threat to that site's conservation values.

Site condition may also be impacted by maintenance of sewer and water easements as is the case for Lansdowne Reserve, Puckey's Estate and Dog Pound Creek. Further, Puckey's Estate borders a narrow coastal dune system to the east and tide-influenced wetlands to the west, which means that sea-level rise will likely impact the site.

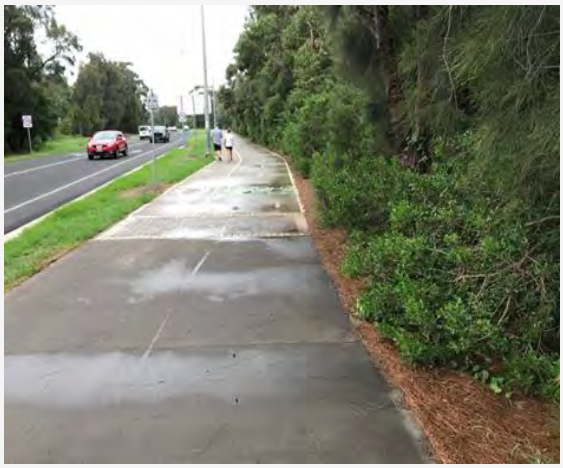
Despite efforts by site managers to fence, gate, remove informal tracks and erect signage, these activities and threats appear to be difficult to manage (Case study 1). Moreover, given the proximity of these sites to major urban areas, human use is likely to increase through time in line with population growth.

Case study 1. Challenges in restoring Puckey's Estate to a resilient state.

In addition to the funding allocated to Puckey's Estate through the Linking Landscapes project, this site receives funding and management from bush care teams, the Green Army (through a six-year environmental grant), school students undertaking tree planting, and support from Wollongong Botanic Gardens. Despite this significant and enduring funding and management, Puckey's Estate remains very degraded in areas. This site is subject to a high level of human disturbance and, in the longer term, is threatened by coastal erosion and coastal inundation. These ongoing threats compromise the capacity of land managers to recover and maintain resilience of the site.

Observed challenges with managing Puckey's Estate

Graffiti and vandalism



Isolation and edge effects

Urban stormwater pollution

Coastal erosion (undermining of Norfolk Island pine)

4.2.2 Some sites are subject to ongoing threats due to their size and connectivity

We also found that some sites are subject to ongoing threats because they are small, and not connected to larger areas of native vegetation. Small sites that have a high perimeter-to-area ratio are more likely to be impacted from surrounding land (e.g. weed or pest incursions).[14] They can also be vulnerable to localised extinction, as any species populations present are likely to be restricted in their movement. The capacity of various native species to recolonise fragmented sites in heavily urbanised environments is also low. Lack of connectivity increases this vulnerability, as the smaller the overall vegetation patch, the lower the capacity for less mobile species to persist, thus the lower the long-term biodiversity.[15]

A comparison of site areas is shown in Figure 7. Sites range from just over 10 hectares (Lansdowne Reserve) to almost 100 hectares (Sheldon group of reserves). The sizes of the vegetation patches in which the sites are located are also included in Figure 7. Puckey's Estate, the eastern parcel of Dog Pound Creek and Lansdowne Reserve are each contained within vegetation patches that are less than 200 hectares, indicating poor connectivity and potentially poor resilience. Garrad Reserve, Fencott Drive Wetland Reserve, Sheldon group of reserves and Rumbalara Reserve are all contained in much larger patches (>1,000 hectares) with good connectivity and high resilience.

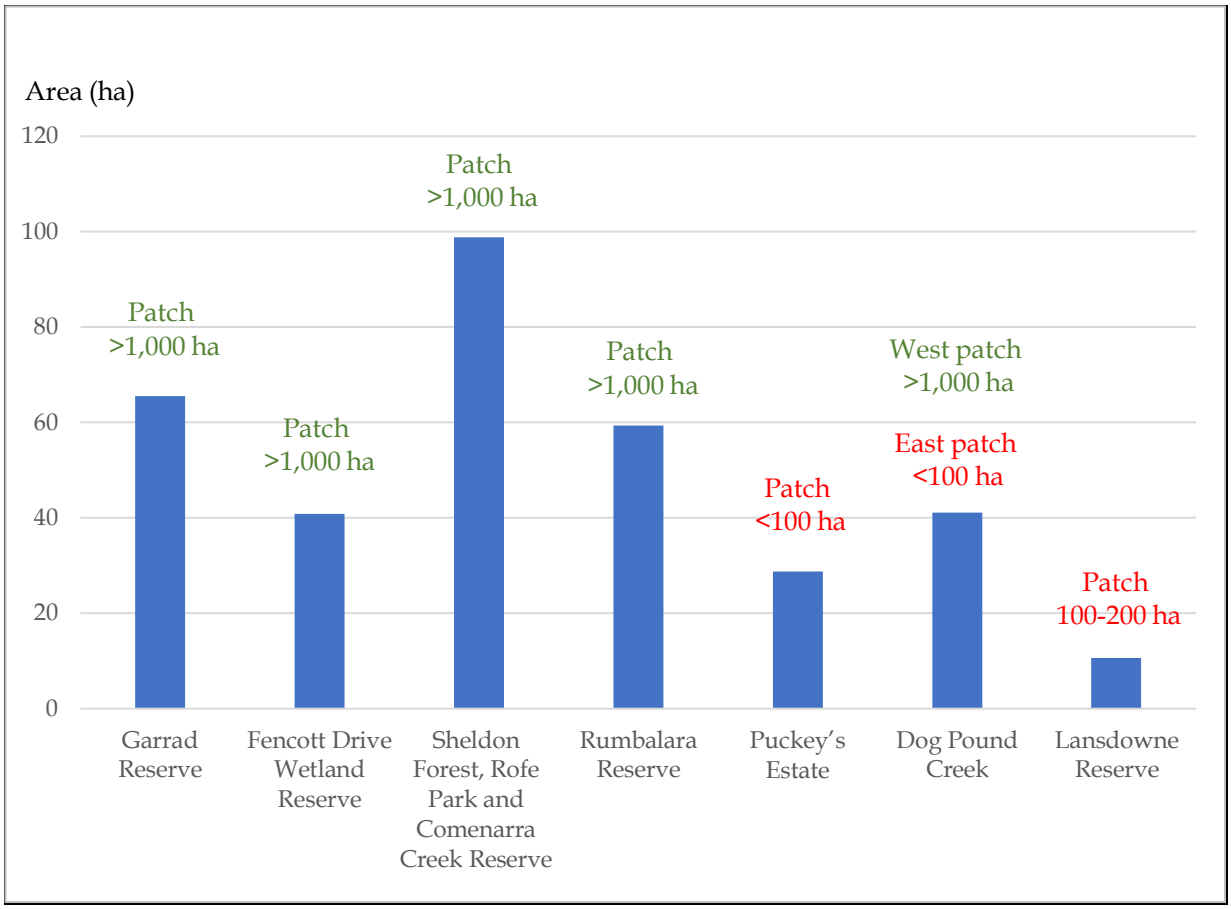


Figure 7. Area (ha) and size of parent patch(es) of each site

14 For example Williams, N. S. G., McDonnell, M. J., Seager, E. J. (2005) *Factors influencing the loss of an endangered ecosystem in an urbanising landscape: a case study of native grasslands from Melbourne, Australia*. *Landscape and Urban Planning* 71: 35-49.

15 Saunders, D.A., Hobbs, R.J. and Margules, C.R. (1991) *Biological consequences of ecosystem fragmentation: a review*. *Conservation Biology* 5:18-32.

Our analysis of the sites' landscape metrics (Attachment 4) shows that Garrad Reserve has the lowest perimeter-to-area ratio (74 meters of boundary for every 1-hectare area), indicating this patch is more compact with a more intact 'core' area. Lansdowne Reserve, on the other hand, has a comparatively large ratio (360 meters of boundary for each 1-hectare area). This site is the smallest in area, is surrounded entirely by urban areas or urban parkland, and comprises a multiple small parcels of vegetation separated by either fire trails, walking tracks or other navigable easements. These characteristics mean that every part of this site is likely to be subject to the impacts of edge effects.

Figure 8 compares the initial investment per hectare against perimeter-to-area ratios for each site. Sites with a high perimeter-to-area ratios are likely to be more expensive to manage due to greater edge effects and higher disturbance levels. For example, Lansdowne Reserve, which has the highest perimeter-to-area ratio and is in an urban setting, has the highest investment.

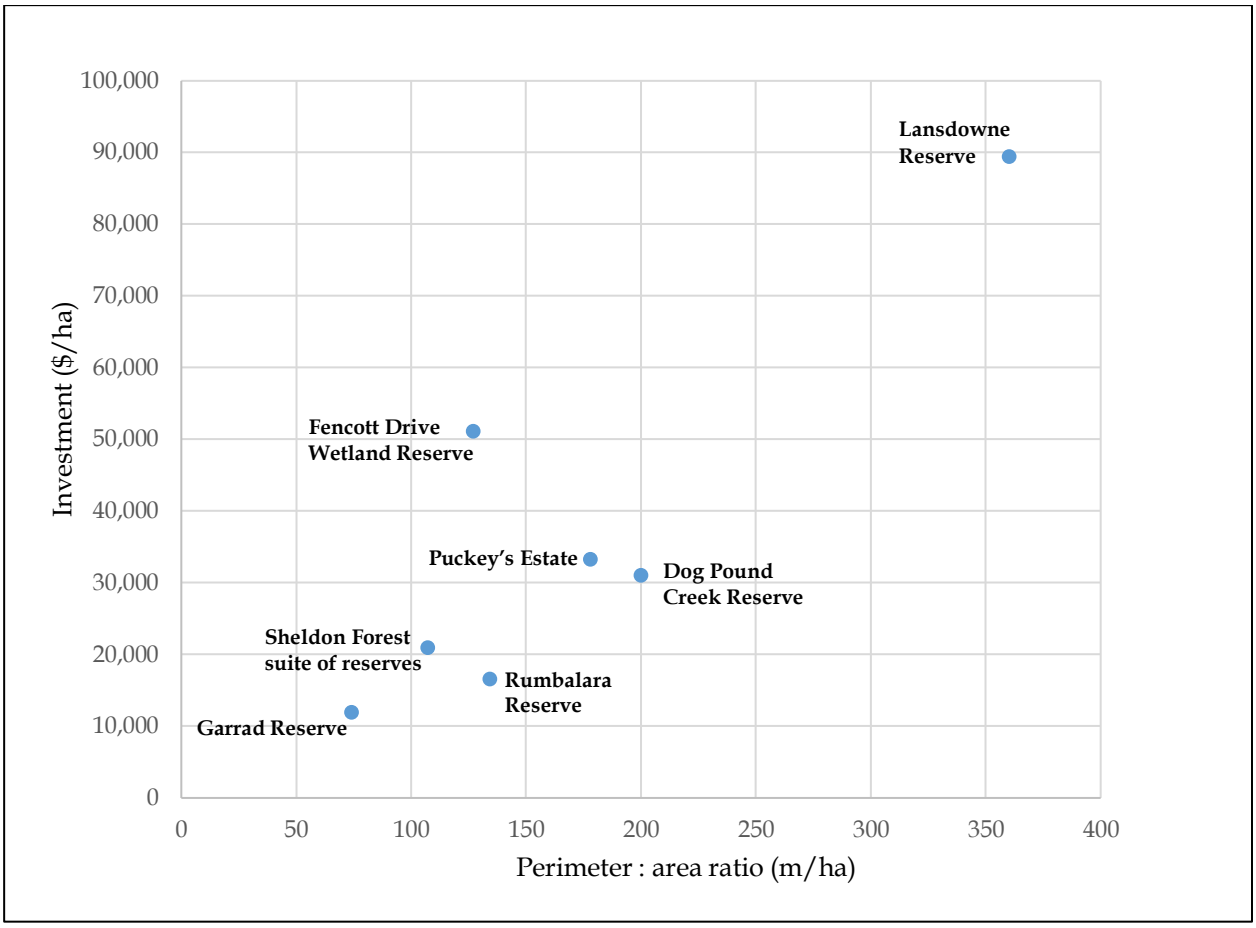


Figure 8. Perimeter-to-area ratio and investment in site management

Case study 2 illustrates the differences in site characteristics that affect resilience, using Puckey's Estate and Garrad Reserve as contrasting examples. Puckey's Estate's relative small size, isolation and ease of access leave it prone to ongoing threats and disturbance which, if not managed, would likely lead to deterioration of the conservation values at the site.

These findings suggest that if the selection process had placed more weight on the sites' exposure to ongoing threats, the extent to which these threats are manageable, and thus the long-term viability of the conservation value, the project's overall return on investment would be higher.[16]

They also point to a broader issue of balancing investment in values related to scarcity – such as listed threatened vegetation communities - against investment in values related to ecosystem function. If the selection process had placed greater priority on the sites' ecosystem function, all sites would have long-term capacity to improve in condition and continue to support biodiversity values.

Based on these findings, we consider sites that face a high level of ongoing, difficult to manage threats – such as small and fragmented sites with high perimeter-to-area ratios – present opportunity costs, diverting funds away from resilient sites, and should not be considered for future projects.

We note that the project's budget timing may have restricted the sites available for selection, and that this may have partly or indirectly led to the selection of small, fragmented sites. The budget timing required that the investment in the selected sites proceed in 2012-13 or 2013-14. Several sites in good condition with low ongoing threats were initially selected, but ultimately did not progress due to issues including:

- the site becoming subject to the Government Crown Lands Review
- concerns about possible restrictions on infrastructure access to a waste facility adjoining the site
- the council which owned the site withdrawing from the agreement.[17]

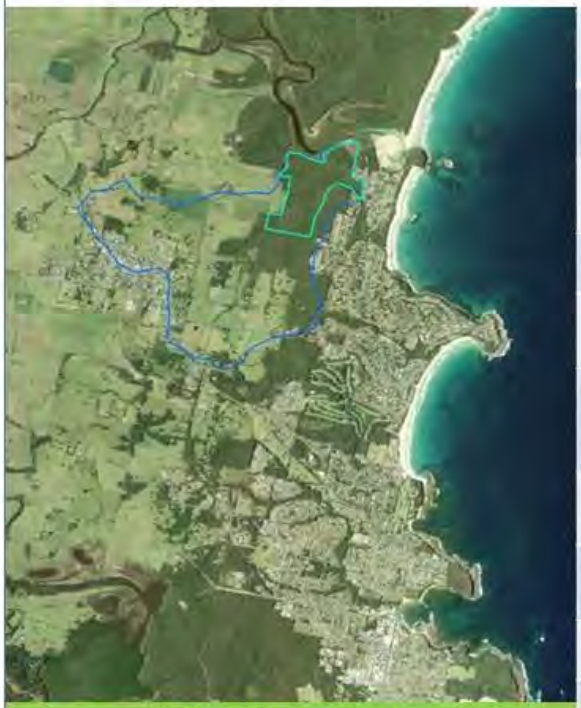
In some of these cases, issues may have been resolved and the agreements may have been able to progress if timing of implementation was not a part of the selection criteria.

16 For example Joseph, L. N., Maloney, R. F. and Possingham, H. P. (2009) *Optimal allocation of resources among threatened species: a project prioritization protocol. Conservation Biology* 23(2): 328-38.

17 Linking Landscapes through Local Action Grant Selection Reports – Rounds 1 and 2 (2013).

Case study 2: Comparison of site and landscape features between Garrad Reserve and Puckey's Estate

Garrad Reserve		Puckey's Estate
66ha	Size of reserve (ha)	29ha
>1,000ha	Size of parent patch (ha)	<100ha
Yes	Adjoins other reserve(s)?	No
74m/ha	Perimeter to area ratio	178m/ha
7% (4.5ha)	Area of reserve prone to urban edge effects	49% (14ha)
27%	% of contributing catchment that is developed	73%
20 m track/ha of reserve	Internal track density	70 m track/ha of reserve
5	Number of access points	>10
Low	Level of human use	High
Low	Observed level of weeds	High



Site resilience: high

Site resilience: low

Connectivity:

Garrad Reserve lies within a functionally connected corridor extending between two major blocks of intact bush to the north and south.

Site boundary

Catchment outline

Connectivity:

Puckey's Estate is an isolated patch of native vegetation within a high-density urban landscape

5 Limited impact of project at landscape scale

As section 1.1 discussed, while the main objective of the Linking Landscapes project was to protect and manage land of identified conservation value, its ultimate aim was to increase the condition, functional connectivity and resilience of landscapes and ecosystems.[18] The Commission supports this worthy, but challenging aspiration. However, we found that although the project has had positive impacts at the site scale, it is unlikely to have had a material impact at the landscape scale.

Councils face considerable challenges in addressing future threats and pressures to biodiversity values at the landscape scale. We consider that to more effectively 'link' landscapes in the Sydney Basin bioregion, there needs to be:

- improved coordination between councils at a landscape scale
- additional funding for and investment in bushland management
- greater awareness of and support for trialling alternative funding mechanisms.

5.1 Coordination between councils

The Linking Landscapes project's ultimate aim of increasing the condition, functional connectivity and resilience of landscapes and ecosystems fits well with contemporary approaches to biodiversity conservation. This aim reflects the concept of 'connectivity conservation', which emphasises the need for multi-directional and multi-scale connections over entire landscapes. To achieve such connections, there needs to be a coordinated approach to landscape-scale management, including:

- integrated planning across a range of land tenures
- systematic conservation planning for the long-term persistence of biodiversity, which factors in large-scale, spatially dependent, ecological and evolutionary processes.[19]

Our evaluation found that the Linking Landscapes project only partially provided such a coordinated approach.

First, the site selection process relied on the grant applicants (who were mostly councils) to identify potential sites for BioBanking agreements. This allowed for the possibility of criteria additional to those outlined for the project to be used in identifying sites (for example, local community needs or internal resourcing logistics). In addition, applicants may have placed a lower priority on bioregional context and key criteria for achieving landscape-scale outcomes, such as connectivity. This 'bottom-up' approach to site selection, while useful for identifying priorities at the council level, was ineffective for identifying priorities at the bioregional level, and ensuring investment in those priorities was coordinated.

18 OEH (2011) *Linking Landscapes through Local Action Project: Business Plan*. p. 8.

19 Mackey B, Watson J and Worboys GL of ANU Enterprises Pty Ltd (2010) *Connectivity conservation and the Great Eastern Ranges corridor, an independent report to the Interstate Agency Working Group (Alps to Atherton Connectivity Conservation Working Group) convened under the Environment Heritage and Protection Council/Natural Resource Management Ministerial Council*. Available at http://www.environment.nsw.gov.au/resources/nature/ccandger.pdf (accessed 5th July 2018).

We note that the two secondary components of the project developing a BIO Map that identifies the priority areas for investment in biodiversity and a state-wide spatial viewer that identifies existing conservation investments commitments may have supported OEH in improving prioritisation and coordination. Unfortunately, these components were not completed until after sites had been selected. There is potential for them to provide value in future conservation planning at landscape scale, particularly if that planning is focused on coordination and prioritisation across councils.

Second, as noted in Section 4.2.2, some of the selected sites had relatively poor connectivity and, in most cases, there was no clear plan for improving functional connectivity over time (at council level or otherwise). The exception to this was Rumbalara Reserve which is within the corridor of remnant bushland that Gosford council is strategically acquiring as part of its Coastal Open Spaces Strategy.

Third, the focus of site selection was on council-managed land. This investment in public land can be supported and enhanced through planning around and encouraging private land conservation adjacent to the public lands to strengthen connectivity and buffer protected areas. We note that the new BCT has been established to support private land conservation, in addition to incentives delivered by Local Land Services to conserve native plants and animals on private land.

Finally, by default, BioBanking prioritises planning and management for a discrete parcel of land over the long term. Future investment may benefit from a broader landscape-scale approach that considers multiple reserves and ensures that if diminishing marginal returns are experienced at one site, effort can be transferred to another site. While BioBanking has some flexibility in this regard (in that resources can be shifted once planned outputs are achieved), there may be value in a mechanism that more clearly facilitates or encourages management beyond the boundaries of a specific site, particularly for public land managers who oversee a diverse portfolio of land.

5.2 Funding for and investment in bushland management

The information we gathered for this evaluation indicates that councils are typically under-resourced with respect to biodiversity and bushland management across their jurisdiction. Interviews with council staff suggested that the councils that received funding under the project:

- had allocated relatively few resources to managing the sites prior to establishment of the BioBanking agreements, and the funding provided by these agreements was generally several times the level of prior investment
- were responsible for managing many other areas of bushland, and, typically allocated even fewer resources to those areas.

Given current council funding commitments and the increasing threats and pressures to public land, biodiversity values are at risk because of a lack of investment and management. Therefore, one of the key challenges for increasing the condition, functional connectivity and resilience of landscapes and ecosystems is to increase councils' capacity for further investment in bushland management. Councils will need to explore alternative sources of funding to secure management of public land values into the future.

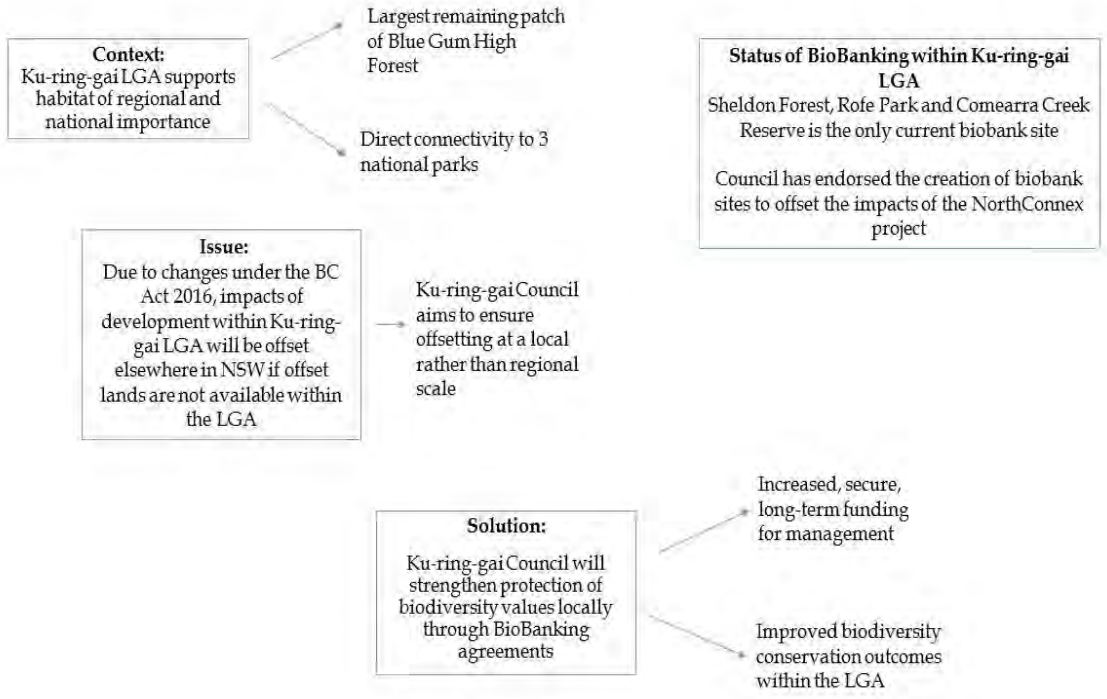
BioBanking is one potential funding mechanism and this project has shown the benefits that can be achieved through the in-perpetuity funding stream that it provides.

5.3 Awareness and support for trialling new funding mechanisms

The Linking Landscapes project was successful in creating better awareness and support for BioBanking among most of the participating councils. Five of these seven councils are now actively pursuing BioBanking/offsetting as part of their operations (Case Study 3). For example, we observed that some of these councils are:

- using BioBanking to offset their own developments
- facilitating the use of BioBanking by developers
- BioBanking other council reserves using the open market.

Case study 3. BioBanking as an ongoing biodiversity management approach within Ku-ring-gai LGA



Despite this, the project does not appear to have led to a substantial increase in the uptake of BioBanking by other councils. We found that relatively few BioBanking agreements have been made with councils outside of the Linking Landscapes project (Table 5). We also found that in delivering the project, OEH did not directly foster broader involvement, apart from:

- inviting organisations to participate in the project
- publishing a report on the BioBanking component of the project, which included brief case studies of the seven sites and a summary of lessons for other councils.[20]

[20] OEH (2015) Establishing Biobank sites on public land – A report on the Linking Landscapes through Local Action Grant Program 2012-2015.

BioBanking agreements with councils comprise 22 percent of the total number of BioBanking agreements formed since 2010. The seven sites selected in the Linking Landscapes project form 9 percent of the total number of biobank sites. BioBanking agreements formed with other councils (not part of Linking Landscapes project) since the first round of grants for the project in 2013 comprise 10 percent of the total number of BioBanking agreements. Even under the assumption that all these agreements were influenced by the Linking Landscapes project, this is a relatively low level of extension and engagement given the significant investment in the project.

Wider adoption of mechanisms for in-perpetuity funding (such as BioBanking) would require extended engagement with councils and investments in additional projects aimed at trialling and demonstrating how these mechanisms work. This might, for example, include actively working and fostering dialogue within the target audience as part of the trials, rather than relying on passive communication.

Table 5. BioBanking agreements[21] with councils between 2010 and 2018, including agreements as part of and separate to the Linking Landscape project[22]

Year	# BioBanking agreements formed	# agreements with Linking Landscapes councils	# agreements with other councils
2010	1	0	0
2011	6	0	3
2012	6	0	0
2013	9	2	1
2014	13	1	2
2015	14	4	3
2016	10	0	0
2017	16	0	0
2018	7	0	2
Total	82	7	11
Percent of total # BioBanking agreements formed		9%	13%

21 Note that a public register of offset agreements under the new *Biodiversity Conservation Act 2016* is not yet available.

22 Data sourced from BioBanking public registers http://www.environment.nsw.gov.au/bimsprapp/biobankingpr.aspx. (accessed 26th April 2018).

6 Lessons and recommendations

The Linking Landscape project has demonstrated the potential for achieving long-term conservation outcomes on council-owned reserves via BioBanking, and for increasing awareness among councils of the capacity of BioBanking to support biodiversity objectives elsewhere. Based on our evaluation of the project, we have identified important lessons for improving the outcomes of future, similar projects. These include:

- improved site selection criteria to increase return on investment
- regular performance reviews at sites to ensure on-going conservation outcomes
- improved coordination between land managers at a landscape scale
- seeking alternative and additional funding
- improved tools for identifying conservation investment priorities
- more flexible management options

6.1 Improve site selection criteria to increase return on investment

Recommendation

1. Selecting sites for future investment should explicitly consider future threats to site values, the likelihood of those threats, the magnitude of impact on biodiversity values and the ability of those threats and impacts to be feasibly managed.
2. Investors should avoid small, isolated sites, particularly in highly urbanised areas, for landscape-scale outcomes.
3. Investors should seek to weight criteria in favour of connectivity, ecological function and resilience attributes over scarcity values such as listed endangered ecological communities.

The criteria used to select sites for conservation investment have a direct influence on the long-term environmental outcomes that are achievable, the cost of achieving and maintaining those outcomes, and the overall return on the investment.

In general, sites that are in a poor initial condition and are exposed to a high level of ongoing threats due to their size, location, usage, or perimeter-to-area ratio will provide a low return on investment. Managing and protecting sites that are large, intact, and well connected to large patches of native vegetation with high initial resilience, will achieve a higher return on investment.

The site selection process should explicitly consider the initial site condition, as well as any ongoing and future threats to the site's conservation values, the magnitude of the impact of those threats on the site's biodiversity values, and the feasibility of managing those threats and impacts. Based on evidence in this review, investors should avoid small, isolated sites in highly urbanised areas compared to larger, intact sites that are more likely to provide a better return on investment.

Future investment may benefit from a more landscape-scale, rather than site-focused, approach to prioritisation. To achieve landscape-scale outcomes, the Commission suggests more weight should be placed on values such as functional connectivity, ecological function and resilience attributes, than on scarcity values such as listed endangered ecological communities.

We also note that timing restrictions in the site selection criteria can lead to increased ineligibility of sites, thus compromising potential site quality. For the Linking Landscapes project, budget timeframes were driving decisions on site selection. In such cases, establishment

of a perpetual fund to transfer the grant money to would allow for non-restricted access to the funds and thus, a larger number of eligible sites for selection.

6.2 Improve assurance for performance and outcomes

Recommendation

4. In addition to compliance audits at biobank sites, performance reviews should be undertaken to ensure management outcomes are being achieved through the agreed management activities.

BioBanking agreements provide on-going payments to maintain and improve long-term environmental outcomes. Regular performance reviews to monitor management outcomes[23] should be undertaken in addition to the compliance audits carried out for biobank sites by OEH. Such reviews would verify that management outcomes are being achieved and sites continue to deliver a positive return-on-investment for the NSW Government.

Where management actions are found not to be effective in achieving outcomes, BCT can vary the BioBanking agreement if required. If it is found that a site no longer has the capacity to achieve the purpose for which the agreement was entered into, the BC Act provides for termination of the agreement.[24] In such cases, payments could be redirected to other areas where better outcomes are likely to be achieved.

6.3 Improve coordination between land managers at a landscape scale

Recommendation

5. Landscape-scale priority mapping should inform site selection and maximise return-on-investment. These will be useful tools to help councils and other land managers coordinate planning and implementation.

Our evaluation suggests that stronger coordination between councils and other land managers would accelerate and improve outcomes and learning in respect to investment in biodiversity conservation and planning. This coordination would deliver more enduring landscape-scale benefits over time across both public and private land.[25]

In addition, better prioritisation of investment would result in higher returns on investment. To enable this prioritisation, tools such as landscape-scale priority mapping should inform site selection (see section 6.4 for specific lessons on improving such tools). This is consistent with the current approach to identify priority investment areas under the NSW Biodiversity Conservation Strategy.[26] These tools can also help councils and other land managers coordinate planning and implementation. For example, multiple proponents could coordinate to 'link-up' multiple sites across boundaries, strengthening application bids for investors.

These lessons are particularly pertinent given the amount of investment being made in private land conservation by the BCT.

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23 NSW Audit Office (2000) *Reporting performance: a guide to preparing performance information for annual reports*.

24 Part 5 Division 3 Section 5.23, *Biodiversity Conservation Act 2016*

25 Ampt P., Baumber A., Berry E., Cox T., Cross R., Metternicht G and Pfeiffer H. (2017) *Landscape scale conservation: incentives for cross-property action*. Restore, Regenerate, Revegetate Conference Proceedings.

26 See for example, OEH (2017) *Identifying priority investment areas – supplementary information to the Draft Biodiversity Conservation Investment Strategy 2017-3037*

6.4 Seek alternative and additional funding

Recommendation

6. There is scope to encourage more active support of councils to adopt alternative funding mechanisms in addition to traditional funding sources.

Our evaluation of the project has found that mechanisms, like BioBanking, that provide in-perpetuity funding for managing land of identified conservation value are effective in improving the capacity and capability of public land managers, such as councils, to achieve biodiversity outcomes.

We consider there would be benefits in encouraging councils to adopt alternative mechanisms for funding bushland and biodiversity management across their jurisdictions, in addition to traditional funding sources. For example:

- councils could create sites for Biodiversity Stewardship Agreements (which have effectively replaced BioBanking agreements) and sell credits on the open market under the new BC Act.
- councils could explore other innovate funding options such as crowdfunding, micro-levies and commissioning.

6.5 Improve tools for identifying conservation investment priorities

Recommendation

7. Tools that identify future investment priorities and existing commitments for conservation should be created with an end-user in mind and be integrated into existing business processes to ensure effective project and risk management and their long-term utility.

To allow for a landscape-scale approach to prioritisation, tools that identify future investment priorities and existing commitments for conservation should be used to inform site selection and coordinate planning and implementation of management for conservation. Such tools should be created with an end-user in mind and be integrated into existing business processes to ensure their long-term utility and effective project and risk management. Specifically, in creating these tools:

- end-users should be identified and their needs factored into the design of the tool to ensure its usefulness and relevance
- development of the mapping and IT tools should be guided by a clear purpose and a set of activities that will ensure that end users are aware of, able to access and able to use such tools
- appropriate technical expertise is required in the scoping phase of IT/technology projects to accurately identify constraints, feasibility issues and identify and manage potential risks
- agencies commit to, and invest in compiling fit-for-purpose data that shows the location of conservation agreements
- owners of the tools should be clearly identified to ensure ongoing maintenance and use of the final product.

6.6 Flexible management options

Recommendation

8. While generic management prescriptions are important for accountability, land managers should also have flexibility to adopt appropriate action to suit circumstances at hand.
9. Land managers should be cautious in diminishing marginal returns of some management actions that may have minimal benefit to biodiversity values.
10. Management effort should be prioritised across sites once key threats are under control.

Some conservation management actions will have greater impact than others depending on the site condition and location. While generic management prescriptions are important for accountability, land managers should also have flexibility to adaptively manage and adopt appropriate actions to suit circumstances at hand.[27]

For example, 'stock-proof' fencing at Rumbalara Reserve was a poor use of funding as livestock are unlikely to be present, the three-strand plain wire fence is unlikely to prevent entry of livestock, and installation and maintenance costs are very high due to accessibility constraints (see site profile in Attachment 5).

In addition, land managers should be cautious in pursuing management that has minimal benefit to biodiversity values, and bold in pursuing management that has a greater benefit to biodiversity. For example, funds spent on unnecessary fencing and fence maintenance, or control of low-threat annual weeds, may be better spent elsewhere.

Management effort should be prioritised across sites once key threats are under control. This requires clear management planning and adaptive management approaches.

27 Williams, B. K. and Brown, E. D. (2016) *Technical challenges in the application of adaptive management*. Biological Conservation, 195:255-263. Available at https://www.sciencedirect.com/science/article/pii/S0006320716300143 (accessed 5th July 2018).

Attachment 1: Key evaluation questions

Key evaluation questions/sub-questions
1. How effective has the project been in achieving specified outcomes?
a. To what extent has the project protected and helped manage land with identified conservation value within the Sydney Basin Bioregion? (BioBanking component)
b. How do the outcomes from the project differ to what would have happened in its absence and how sustainable are those outcomes? (BioBanking component)
c. Has the project identified priority investment areas for biodiversity management and to what extent has this led to better targeting of grant and conservation incentives in these areas? (BioBanking and BIO Map components)
d. Has the project produced state-level spatial information on conservation commitments and to what extent has this helped monitor, plan and manage these commitments? (Spatial viewer component)
e. What other outcomes were there from the project (positive or negative)?
2. To what extent are the design and processes used to deliver the project appropriate and effective?
a. How well planned and designed was the project with respect to the stated need it addressed, the clarity and logic of its objectives and its alignment with Environmental Trust policies?
b. How well did the project align and collaborate with similar initiatives and potential users (e.g. Growth Centres Biodiversity Offset Program, LLS)?
c. What lessons are there from the project in terms of how it was designed and delivered?
3. What lessons are there in relation to the efficiency and cost-effectiveness of the project?
a. What levels of co-contribution were achieved and how could they be improved into the future? (BioBanking component)
b. How did the costs compare with other BioBanking examples and what lessons are there for achieving value for money in future initiatives? (BioBanking component)

Attachment 2: Conservation values of project sites

Site	Area (ha)	Listed[1] vegetation communities (ha)	Listed fauna	Description of connectivity[2]
Garrad Reserve	65.6	Bangalay Sand Forest (18.5) Coastal Marsh (1.7) Illawarra Lowlands Grassy Woodland (1.2) Swamp Oak Floodplain Forest (4.4) Swamp Sclerophyll Forest on Coastal Floodplains (18.7)	*Haematopus fuliginosus* (sooty oystercatcher) *Haematopus longirostris* (pied oystercatcher) *Callocephalon fimbriatum* (gang-gang cockatoo) *Calyptorhynchus lathami* (glossy black-cockatoo) *Hieraaetus morphnoides* (little eagle) *Ninox strenua* (powerful owl) *Tyto novaehollandiae* (masked owl)	"At a landscape scale the site has excellent ecological connectivity being contiguous with a large tract of native vegetation incorporating Narrawallee Creek Nature Reserve extending northwards to Lake Conjola and beyond and a smaller patch of native vegetation extending to the Princes Highway in the south."
Fencott Drive Wetland Reserve	40.9	Swamp Sclerophyll Forest on Coastal Floodplains (18.7) Sydney Freshwater Wetlands (1.8)	*Crinia tinnula* (Wallum froglet) *Ninox strenua* (powerful owl) *Miniopterus australis* (little bentwing-bat) *Miniopterus schreibersii oceanensis* (eastern bentwing-bat) *Petaurus norfolcensis* (squirrel glider) *Pteropus poliocephalus* (grey-headed flying-fox) *Tetratheca juncea* (black-eyed Susan)	"Contributes to a regionally important network of wildlife corridors that extends along the Central Coast", from the coastal forests and heathlands inland of Nine Mile Beach to the Awabakal Nature Reserve and Glenrock State Conservation Area, south of Newcastle.
Sheldon Forest, Rofe Park and Comenarra Creek	98.9	Blue Gum High Forest (5.0) Sydney Turpentine – Ironbark Forest (1.3)	*Callocephalon fimbriatum* (gang-gang cockatoo) *Miniopterus schreibersii oceanensis* (eastern bentwing-bat) *Mormopterus norfolkensis* (eastern freetail-bat) *Ninox strenua* (powerful owl) *Pseudophryne australis* (red-crowned toadlet) *Pteropus poliocephalus* (grey-headed flying-fox) *Saccolaimus flaviventris* (yellow-bellied sheathtail-bat) *Darwinia biflora*	"Part of a three-kilometre long urban bushland corridor that stretches from the Pacific Highway in Pymble to Lane Cove National Park in South Turramurra".

1 Critically endangered, endangered or vulnerable under the *NSW Threatened Species Conservation Act 1995*

2 Case studies in: NSW OEH (2015). *Establishing Biobank sites on public land – a report on the Linking Landscapes through Local Action grant program 2012-2015*. Available at http://www.environment.nsw.gov.au/resources/conservation/150405-linking-landscapes.pdf

Site	Area (ha)	Listed[1] vegetation communities (ha)	Listed fauna	Description of connectivity[2]
			Epacris purpurascens var. *purpurascens* *Melaleuca deanei*	
Rumbalara Reserve	59.3	Lowland Rainforest (9.7)	*Calyptorhynchus lathami* (glossy black-cockatoo) *Dasyurus maculatus* (spotted-tail quoll) *Ninox strenua* (powerful owl) *Miniopterus schreibersii oceanensis* (eastern bentwing-bat)	"Biobank site and surrounding areas of the Rumbalara and Katandra reserves cover in excess of 513 hectares of connected bushland area that forms an identified coastal wildlife corridor. Part of a network of land parcels, predominantly in the ownership of the council, that have been progressively connected to each other under the city's Coastal Open Space System (COSS) to form a large contiguous area of native vegetation".
Puckey's Estate	28.8	Coastal Saltmarsh (0.5) Freshwater wetlands on Coastal floodplains (0.4) Littoral Rainforest (8.3) Swamp Oak Floodplain Forest (11.4)	*Haematopus fuliginosus* (sooty oystercatcher) *Ninox connivens* (barking owl) *Pteropus poliocephalus* (grey-headed flying-fox) *Sternula albifrons* (little tern)	"The biobank site forms an important 'stepping stone' in a discontinuous north-south coastal habitat corridor".
Dog Pound Creek	41.1	Blue Gum High Forest (7.1)	*Calyptorhynchus lathami* (glossy black-cockatoo) *Miniopterus schreibersii oceanensis* (eastern bentwing-bat) *Ninox strenua* (powerful owl) *Pteropus poliocephalus* (grey-headed flying-fox) *Galium australe* *Grammitis stenophylla* *Syzygium paniculatum* *Epacris purpurascens* var. *purpurascens*	"Biobank site is well connected to a network of green corridors that connect Berowra Valley National Park to Lane Cove National Park with a series of stepping stone linkages".
Lansdowne Reserve	10.6	Cumberland Plain Woodland (6.3 ha) Shale Gravel Transition Forest (3.8) Sydney Turpentine – Ironbark Forest (0.6).	*Daphoenositta chrysoptera* (varied sittella) *Hieraaetus morphnoides* (little eagle) *Pteropus poliocephalus* (grey-headed flying-fox) *Pimelea spicata* (spiked rice-flower) *Marsdenia viridiflora* subsp. *Viridiflora* population *Acacia pubescens* (downy wattle)	"The biobank site is located in the northern section of Lansdowne reserve. The 83 hectare reserve is located within the Cumberland Plain Recovery Plan's priority conservation lands".

Attachment 3: Site threats and management actions before and after BioBanking

Site	Main threats	Previous management	Management since BioBanking
Garrad Reserve	Low-level weed infestation Urban impacts Potential diversion of waterflows offsite	Generic plan of management in place across this and other areas of bushland reserve. Minimal management being done at Garrad Reserve, or any of the 250,000 ha of community land managed by council (noting that the site was in good condition needing relatively low levels of active management). Management limited to coastal erosion works (offsite), control of noxious weeds (in visible areas) and low-level maintenance of access trails. Bushcare/Dunecare work was being done in surrounding reserves, but not Garrad Reserve.	Most expenditure has been on capital works to upgrade access tracks, boardwalks, fencing and interpretive signage. There has also been extensive weed control works in the lower lying areas of the site. Future work will largely involve follow-up/maintenance of these weed control efforts. Works completed by contractors.
Fencott Drive Wetland Reserve	Alligator weed from upstream	Generic plan of management in place across this and other areas of bushland reserve. No or minimal management with the exception of: ▪ some weed management done at the site boundaries by weed protection officers ▪ management of asset protection zones for bushfire management	The majority of funding has supported weed control works, including expensive management of aquatic weeds. Other work has included some waste removal and fencing. Regular works completed by council bush regeneration team (charged internally at commercial rates).
Sheldon Forest, Rofe Park and Comenarra Creek	Urban impacts and disturbance Potential management for asset protection zones	Generic plan of management in place across this and other areas of bushland reserve. A history of being managed by council through their Environmental Levy. This includes: ▪ regeneration contractors in specific areas ▪ some ecological burning (by council team)	Largely weed control and revegetation works (with temporary fencing to exclude grazers). Completed successful ecological burn.

Site	Main threats	Previous management	Management since BioBanking
		▪ some track maintenance ▪ Bushcare volunteer work on weed control and revegetation Effort under the BioBanking agreement was noted to be 5-7 times greater.	Some (low level) work to address vertebrate pests (e.g. 1080 baiting for foxes). Works are mainly completed by contractors (supplemented by some volunteer effort). There has also been a supplementary grant of ~$400,000 to fund erosion control works, soil scalping and revegetation in a small corner of the reserve.
Rumbalara Reserve	Public access Potential for arson	Generic plan of management in place across this and other areas of bushland reserve. No or minimal management within the site itself. In the surrounding areas of reserve there had been (and continues to be): ▪ Bushcare volunteers doing regeneration work ▪ fox control (1080 baiting) ▪ fire trail maintenance.	Extensive work on weed control and fencing. Supplementary revegetation has also occurred. Works are done by contractors, noting that fencing costs were much higher (i.e. five times) than planned for in the BioBanking agreement.
Puckey's Estate	Vandalism Potential for arson Urban run-off Sea level rise Significant weed density	Generic plan of management in place across this and other areas of bushland reserve. Range of management occurring at the site, including a combination of: ▪ extensive volunteer effort (at least two Bushcare groups have a long history of working on the site) ▪ management of tracks by council ▪ low level of funding of contractor works by council and through grants (e.g. Environmental Trust) ▪ prior history of aerial spraying for bitou bush	Majority of work is weed control, followed by some revegetation where necessary to supplement natural recruitment. No fencing has been done as per the agreement. Work has been completed by contractors, though is supported by Bushcare groups, school groups who do planting. Centrelink mutual obligation volunteers, work funded under a separate.

Site	Main threats	Previous management	Management since BioBanking
			Environmental Trust grant and track maintenance by the botanic gardens.
Dog Pound Creek	Potential management for asset protection zones Public access	Generic plan of management in place across this and other areas of bushland reserve. Had been managed by council's program of management using contractors, though at a lower level than under the BioBanking agreement – largely weed control and track maintenance. "We'd been chipping away at different areas". Some management by Bushcare groups but this was mainly (and continues) to be in other reserves.	Majority of work is weed control, followed by some revegetation where necessary to supplement natural recruitment. Engagement with neighbours and planned burns are also planned in the short-term. Works are done by contractors and ecological burns are expected to be done as training burns by the local RFS.
Lansdowne Reserve	Rubbish dumping Potential for arson Mountain bike and motor bike riding Weeds	Generic plan of management in place across this and other areas of bushland reserve. Site had been managed by council (funding contractors) with the support of Bushcare volunteers: ▪ ~$60,000 was being spent across the broader Lansdowne Reserve (including, but not limited to the biobank site) ▪ Weed control efforts were largely along fencelines.	Majority of work has been weed control, but also substantial effort into fencing/bollards and revegetation work. Primary weed control works are done by contractors, with follow-up/maintenance work done by council Bushcare team.

Attachment 4: Site metrics and condition

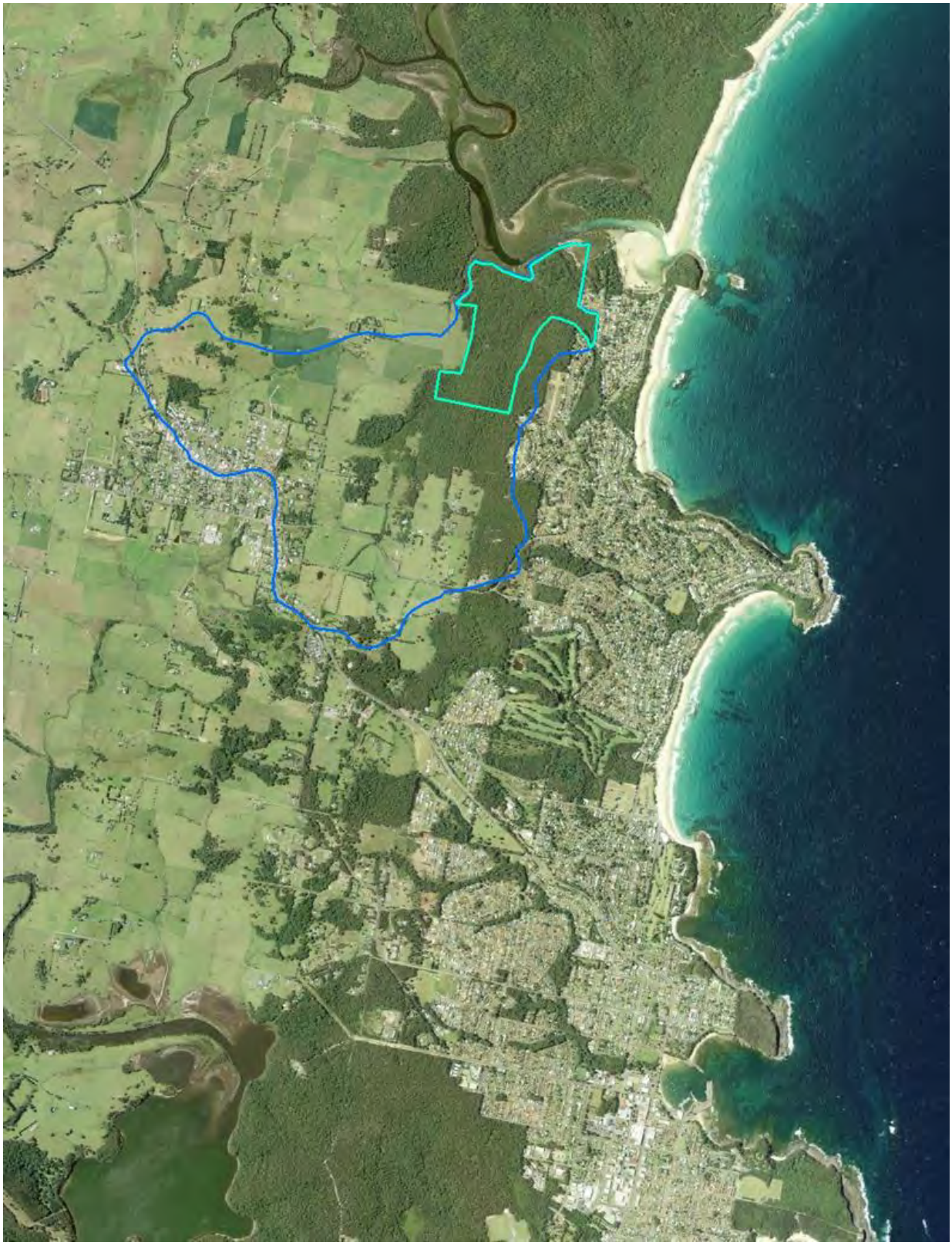
	Site								
	Garrad Reserve	Fencott Drive Wetland Reserve	Rumbalara Reserve (north)	Rumbalara Reserve (south)	Sheldon Forest, Rofe Park and Comenarra Creek	Puckey's Estate	Dog Pound Creek (east)	Dog Pound Creek (west)	Lansdowne Reserve
Area (ha)	65.6	40.9	98.8		59.3	28.8	41.1		10.6
Perimeter (m)	4,870	5,200	13,210		6,370	5.140	8,210		3,820
Perimeter : area ratio (m/ha)	74	127	134		107	178	200		360
Edge characteristics (%)[A]	22	24	60		16	53	63		100
Edge effect zone (ha)	4.5	9.8	70.5		12.5	14	36.4		10.6
Influence of edge effects (%)	7	24	71		21	49	89		100
Size class of parent patch (ha)	>1,000	>1,000	>1,000		> 1,000	<100	<100	>1,000	100-200
Adjacent to conservation reserve	yes	no	no	yes	no	no	no	yes	no
Number of vegetation types	6	4	6		3	5	3		3
Area of TEC on site (ha)	44.5	20.5	6.3		9.7	20.6	7.1		10.6
Proportion of project TEC on site (%)	38	17	5		8	17	6		9
Connectivity	high	high	moderate	high	high	low	low	moderate	low
Number of access points	~5	1	>10	8	~5	>10	>10		>10
Density of internal tracks (m/ha)	20	20	50	100	10	70	50	70	110
% contributing catchment developed	27	61	68	65	4	73	77	58	1
Vegetation condition	Excellent	Good	Good	Excellent	Excellent	Poor	Excellent	Excellent	Fair
Threat level	Low	Low	Moderate	Moderate	Moderate	High	High	Moderate	High
Relative site resilience	**High**	**High**	**Moderate**	**High**	**High**	**Low**	**Moderate**	**Moderate**	**Low**

A. Proportion of land within 100 m of site that contains urban areas (e.g. residential areas and urban parks)

Attachment 5: Site profiles

Site 1: Garrad Reserve

Manager: Shoalhaven City Council



Location of Garrad Reserve (and contributing catchment)

Site metrics:

Number of parcels	1
Total Area	65.6 ha
Total perimeter	4,870 m
Perimeter : area ratio	74 m/ha
Edge effect zone within site	4.5 ha
Influence of edge effects	7%
Size class of parent patch	> 1,000 ha
Number of distinctive vegetation types	6 (includes 5 TECs)
Extent of TEC on site	44.5 ha
Proportion of TEC on-site	68%
Proportion of project TEC on-site	38%
Number of threatened plant species	0
Number of threatened animal species	7
Number of access points	~5
Approximate length of internal tracks/roads	1.3 km (~ 20 m track for every 1 ha of bushland)

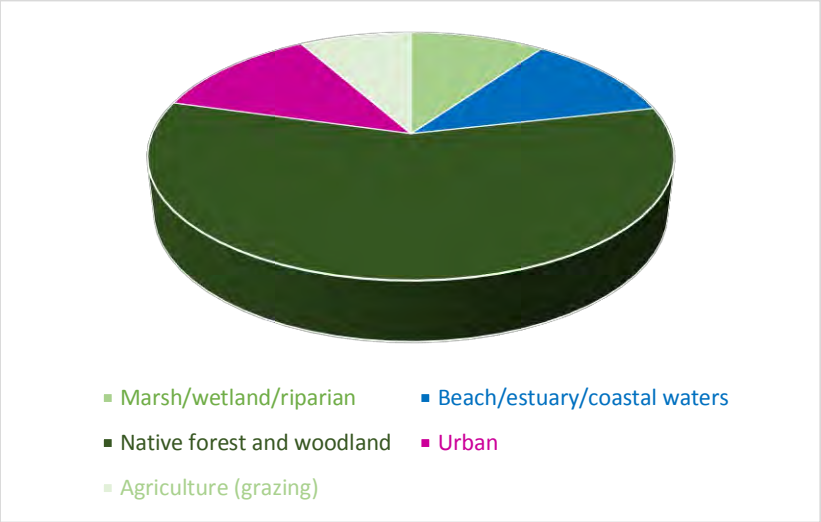
Proximity to other conservation reserves:

This site is immediately south of Narrawallee Creek Nature Reserve, separated from the reserve by a tidal section of Narrawallee Creek.

Connectivity:

Garrad Reserve is connected to a major patch of forest to the north, containing Narrawallee Creek Nature Reserve. This is likely to support ongoing functional connectivity to and from the reserve. There is also potential in the long-term to consolidate the currently discontinuous corridor that extends southwards and to the west of Ulladulla, via strategic reforestation. If restored, this disjointed corridor would likely facilitate movement of species from Meroo and Morton National Parks.

Edge characteristics (proportion of different land-uses within 100 m of the site):



Over 75% of the site is surrounded by natural systems, mainly forest and woodlands, with areas of marshland and estuary. The proportion of urban land within 100m is about 12%, although not all contributes to edge effects.

Catchment characteristics:

Area of contributing catchment	486 ha
Site as a proportion of contributing catchment	13.5%
Proportion of contributing catchment that is developed	27%

Insights from site visit

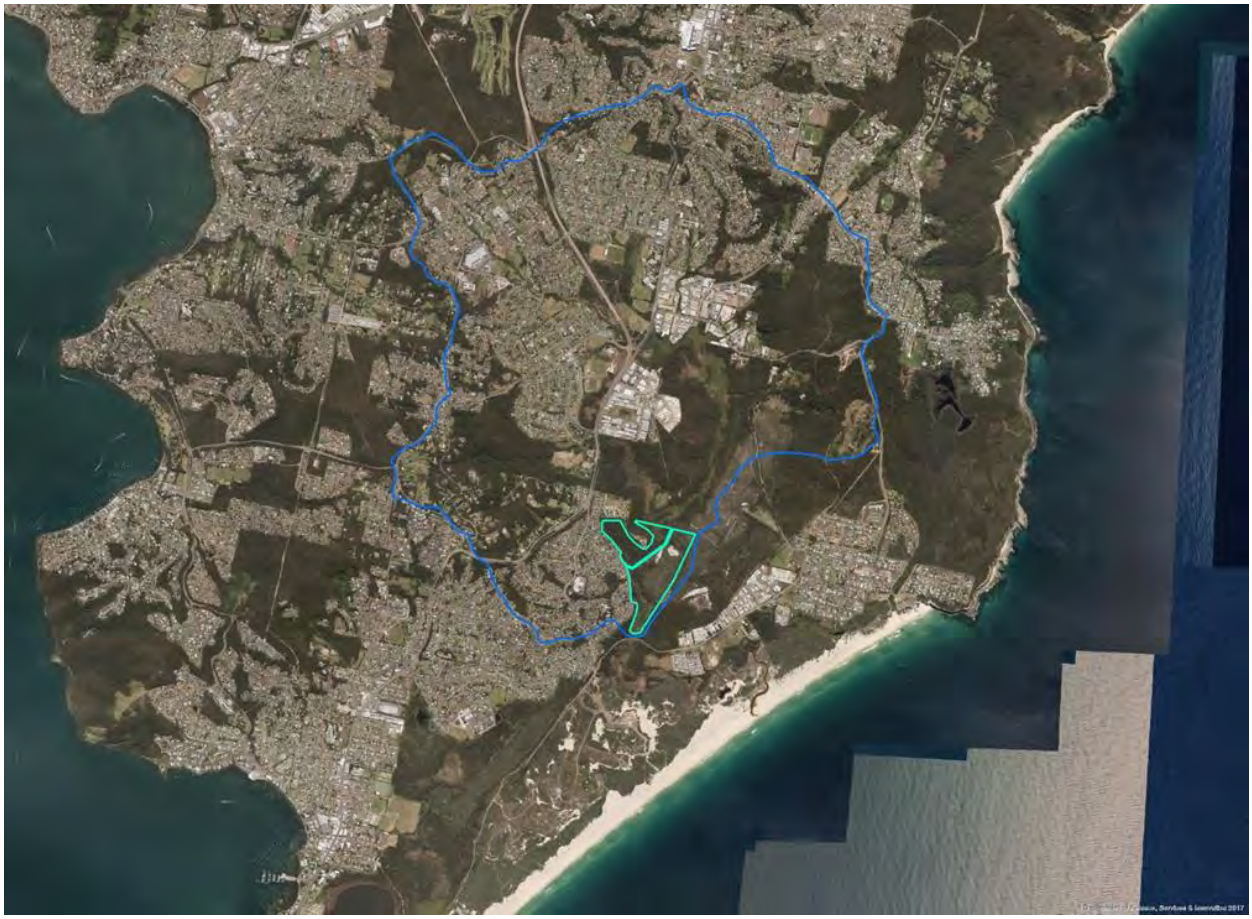
- Council staff are highly committed to managing this site for nature conservation. Part of their philosophy is to enable people to use and appreciate the site in a low impact way.
- This site is in excellent condition. It contains a mosaic of vegetation types, about 350 species of plant species, and a rich assemblage of fauna.
- The site contains significant old-growth features including several giant hollow-bearing trees. The site supports at least four large forest owl species.
- On receipt of initial funding, four main activities were undertaken:
  i. Construction of a stock-proof fence along the western boundary, adjacent to grazing land
  ii. Initial management of a small weed infested part of the Reserve in the south-west, containing privet, blackberry, milkweed and other weeds (about 0.5 ha)
  iii. Construction of a walking track (including sections of boardwalk) for visitors
  iv. Installation of high-quality interpretation signage that showcases the history and natural assets of the site
- Council has sought to showcase this reserve via installation of nature interpretation signs and building of access tracks. The intact vegetative understorey would prevent most people from leaving the tracks, so the potential for human disturbance within the site is low.
- The enduring nature of the funding stream is enabling an ongoing program of weed control and visitor management.

- Other than controlling the weed thicket, the only other control measure is periodic spot-spraying along the main tracks.
- Prior to the biobank arrangement, the site had little funding and management was largely absent. It was visited little as it was largely unknown by local residents, other than local fishermen.
- One or more fishermen continue to access the site via the main fire-trail and have damaged the new locked gates to gain access.
- There has also been a minor amount of graffiti and theft of 2 interpretation signs.
- Development of a new residential estate (Amaroo) on the eastern boundary of the site is likely to prevent ongoing access by local fishermen.
- Illegal dumping may increase as the local area becomes more populated.
- The site now experiences reasonably high use, including bird-watchers and dog walkers.
- Dog walking is permitted, but leashes are recommended to the community given an advertised program of fox baiting
- Cultural burning is being considered by Council as part of their ecological burning program, which is required as part of site management.

Boardwalk in Garrad Reserve

Site 2: Fencott Drive Wetland Reserve

Manager: Lake Macquarie City Council



Location of Fencott Drive Wetland Reserve (and contributing catchment)

Site metrics:

Number of parcels	2
Total Area	40.9 ha
Total perimeter	5,200 m
Perimeter : area ratio	127 m/ha
Edge effect zone within site	9.8 ha
Influence of edge effects	24%
Size class of parent patch	> 1,000 ha

Number of distinctive vegetation types	4 (includes 2 TECs)
Extent of TEC on site	20.5 ha
Proportion of TEC on-site	50%
Proportion of project TEC on-site	17%
Number of threatened plant species	1
Number of threatened animal species	6
Number of access points	1
Approximate length of internal tracks/roads	0.8 km (~ 20 m track for every 1 ha of bushland)

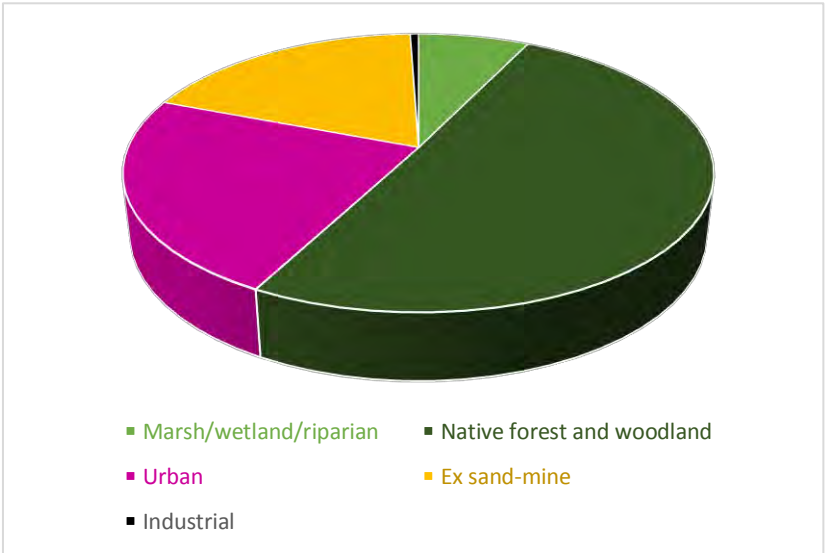
Proximity to other conservation reserves:

This site is adjacent to substantial parcels of Crown Reserve to the south, north and north-east, including Belmont Wetlands State Park. Awabakal Nature Reserve is located about 2 km to the north east and is linked via a contiguous patch of coastal vegetation.

Connectivity:

Fencott Road Wetland Reserve is a key component of a north-south corridor that provides functional connectivity for a range of coastal species to and from the coastal forests and heathlands inland of Nine Mile Beach to the Awabakal Nature Reserve and Glenrock State Conservation Area, south of Newcastle.

Edge characteristics (proportion of different land-uses within 100 m of the site):



Over half the site is surrounded by natural systems, mainly forest and woodlands, with areas of marshland and former sand mining areas that are now rehabilitating. The proportion of urban land in proximity to the site is about 24%, and there is a very small area of industrial land.

Catchment characteristics:

Area of contributing catchment	1,715 ha
Site as a proportion of contributing catchment	2.3%
Proportion of contributing catchment that is developed	61%

Insights from site visit:

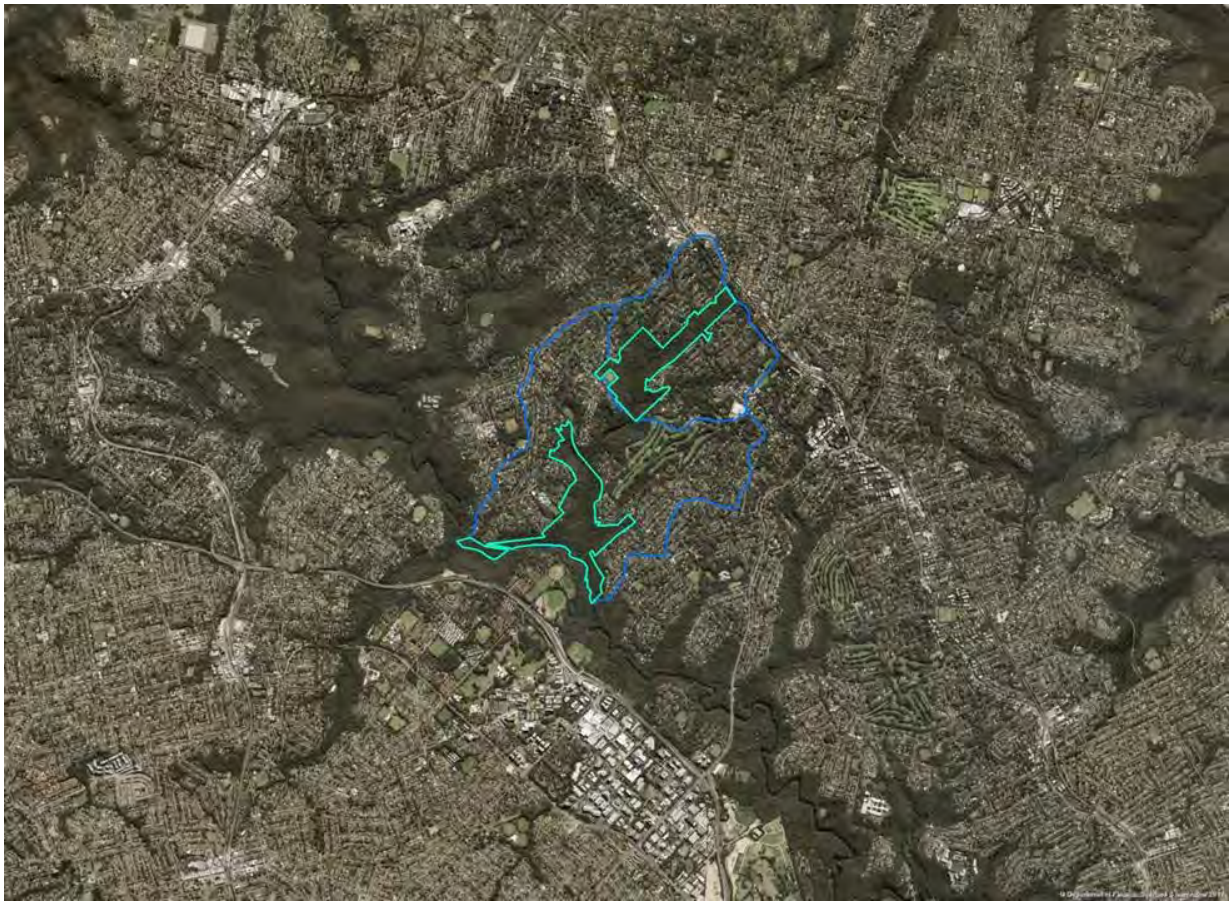
- Council staff are committed to using adaptive and integrated management to improve condition of the site over the long term.
- The enduring nature of the funding stream enables Council staff to strategically consider and plan management actions.
- The Council has recruited its own bush regeneration team on the back of this initiative. The team visits the site all year round and has an in-depth knowledge of its geography and its management priorities.
- Having an in-house bush regeneration team has benefited other sites managed by Council, so this biobank arrangement has resulted in positive outcomes elsewhere.
- Prior to the biobank deal, the site had little funding and management was reactive to specific issues (e.g. illegal dumping). Now management is proactive, and results are showing.
- Conservation works to date principally involve weed control, particularly lantana on the sandier sites, and alligator weed within the wetlands.
- Lantana control has been successful, with large thickets sprayed in the first year. Follow-up control involves targeted spraying or hand pulling of persisting or new plants.
- Removal of lantana has resulted in native plant recruitment. After 3 years the structure of the forest has visually improved. No weeds were encountered in the lantana control areas, although some weeds persist in the wetlands.
- Control of alligator weed (and other aquatic weeds) is more challenging and will take most of the allocated funding in future years. This is particularly challenging as the site has a large upstream catchment, and other aquatic weeds such as Salvinia are known from upstream.
- The site adjoins lands managed by Hunter Water Corporation and the Roads and Maritime Service, so there are future opportunities for co-management, although this has not yet been explored.
- Use of fire as a management tool is planned in the near future, possibly using mosaic burning. But it is challenging with urban areas located along the southern boundary.
- There is only 1 public access point into this site, from the southern boundary, and internal tracks are few. Thus, local residents do not tend to disturb the site.
- One neighbour has dogs which sometimes enter the site unleashed. The impact associated with this is unknown.
- There is some dumping (mainly green waste) from the adjoining public road.
- As well as a variety of birds, there was evidence of several other vertebrate species during the site visit, including lace monitor, land mullet, ring-tailed possum, and bandicoot.

- One threatened plant species is protected within the site – *Tetratheca juncea*. This occurs within a part of the forested wetland that is in very good condition, so no management over and above general weed control is used for this species.
- Powerful owl is one of the threatened species listed for the site. This has been observed on-site since commencement of the project. Large trees such as swamp mahogany and smooth-barked apple ware likely to develop more and larger hollows in future, that will facilitate residence of this and other hollow-depended species.
- Fauna survey by TAFE is planned in the near future. This will provide an opportunity to obtain a baseline dataset of fauna species.
- Unleashed dog walking is permitted, so there is likely to be pressure on native mammals. Cats and foxes also likely to be on site.

Southern access point to Fencott Drive Wetland Reserve

Site 3: Sheldon Forest, Rofe Park and Comenarra Creek Reserve

Manager: Ku-ring-gai Council



Location of Sheldon Forest, Rofe Park and Comenarra Creek Reserve (and contributing catchments)

Site metrics:

Number of parcels	3
Total Area	98.8 ha
Total perimeter	13,210 m
Perimeter : area ratio	134 m/ha
Edge effect zone within site	70.5 ha
Influence of edge effects	71%
Size class of parent patch	> 1,000 ha
Number of distinctive vegetation types	6 (includes 2 TECs)

Extent of TEC on site	6.3 ha
Proportion of TEC on-site	6%
Proportion of project TEC on-site	5%
Number of threatened plant species	3
Number of threatened animal species	7
Number of access points	Multiple
Approximate length of internal tracks/roads	~ 2 km in northern patch (~ 50 m track for every 1 ha of bushland) ~ 5.5 km in the southern patch, including part of the Great Northern Walk (~ 100 m track for every 1 ha of bushland)

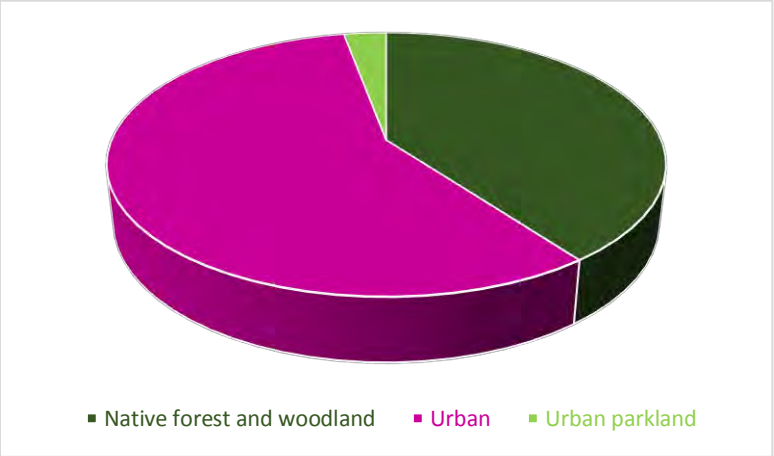
Proximity to other conservation reserves:

The southern patch shares an approximate 2 km boundary with Lane Cove National Park.

Connectivity:

These reserves are connected to a network of forested sandstone valleys that are the centrepiece of Lane Cove National Park. While the reserves contribute to functional connectivity for resident native species, some of the corridors are relatively narrow (< 200 m wide), and the forested network is entirely surrounded by north-western Sydney suburbs, so its long-term capacity to maintain a richness of biodiversity is challenged by ongoing urban pressure as well as major disturbance events.

Edge characteristics (proportion of different land-uses within 100 m of the site):



Over half the site is surrounded by residential land, with small areas of urban parkland (e.g. playing fields). About 40% of the site is surrounded by native forest, mainly around the Lane Cove River.

Catchment characteristics:

Area of contributing catchment	northern section 206 ha; southern section 589 ha
Site as a proportion of contributing catchment	northern section 23.5%; southern section 8.6%
Proportion of contributing catchment that is developed	northern section 68%; southern section 65%

Insights from site visit

- Council staff are highly committed to managing this site for nature conservation.
- The northern section is in good condition, with recent works observed to be reducing the weed load and increasing understorey and midstorey plant diversity.
- The southern section is mostly under 'passive' management and is thus likely to be in excellent condition (no inspection of this section was carried out).
- The site contains a diverse floristic structure, as well as old growth elements.
- Regeneration is evident and healthy
- Biobank funding for this site adds to other funding streams (e.g. environmental levy) as well as volunteer bush care groups that have been active for 20-30 years.
- The biobank arrangement has probably increased the quantity of on-ground management by a factor of 5 to 7.
- Biobank funding has acted to leverage work into other Council reserves.
- Native bush owned by the Ku-ring-gai Golf Club links the northern and southern sections. Council is working with the Golf Club to encourage this corridor to be biobanked as well, to ensure ongoing protection and connectivity to the north.
- Specific site management has included:
  i. Eradication of weed thickets (e.g. asparagus fern, wandering dew)
  ii. Site remediation works (e.g. erosion control, laying of biodegradable weed matting)
  iii. Targeted tree/shrub plantings
  iv. Installation of rabbit/macropod fencing to reduce browsing
  v. Rabbit and fox control
  vi. Ecological burning (including pre- and post-fire weeding)
  vii. Interpretation and track works
  viii. Strategic track closure
- Most works have been undertaken in the northern section which is subject to more impact.
- Ku-ring-gai Council has its own small bush regeneration crew, but most works are carried out by contractor teams.
- Contractors and staff may need modify weed management to align with NSW *Biosecurity Act 2015*.
- Council has also formed its own ecological burning team, and a planned schedule of ecological burns has been developed over the next 35-40 years.
- At least 1 burn has been carried out to date, and a diversity of regenerating midstorey plants has been observed despite uncommonly dry conditions that followed the burn.

- No unplanned fires have occurred in this site.
- Vandalism appears to be on the decline, and illegal dumping is infrequent.
- A key threat to this site is the potential for an Asset Protection Zone (APZ), up to 100 m from houses, to be established within the site where vegetation clearing or under-scrubbing is carried out.
- Council is working closely with RFS to avoid such an outcome but see this is a significant threat.
- Edge effects are clearly an issue for this site, which is generally long and narrow, and is immediately adjacent to houses.
- Numerous tracks radiate into the core of the northern section from adjacent premises.
- The reserve offers 'leash only' dog walking, but this is not policed (2 dogs were observed off the leash during site inspection)
- The site is in the flight path of Sydney airport and is notably affected by aircraft noise. To what extent this would reduce occupation by local fauna is unknown.
- Strategic track closure and ecological burning have been considered by Council in their management of three threatened plants species (*Darwinia biflora*, *Epacris purpurascens* var *purpurascens*, *Melaleuca deanii*).
- Powerful Owl is known from the site and microbats are known from the site.
- The ground-dwelling Echidna is also known from the site, while a bower of the Satin Bowerbird was observed on site. This suggests that predation from foxes (and possibly dogs) could be relatively low.

Macropod exclusion fencing

Site 4: Rumbalara Reserve

Manager: Gosford City Council

Location of Rumbalara Reserve (and contributing catchment)

Site metrics:

Number of parcels	2
Total Area	59.3 ha
Total perimeter	6,370 m
Perimeter : area ratio	107 m/ha
Edge effect zone within site	12.5 ha
Influence of edge effects	21%
Size class of parent patch	> 1,000 ha
Number of distinctive vegetation types	3 (includes 1 TEC)
Extent of TEC on site	9.7 ha

Proportion of TEC on-site	16%
Proportion of project TEC on-site	8%
Number of threatened plant species	0
Number of threatened animal species	4
Number of access points	~5
Approximate length of internal tracks/roads	0.7 km (~ 10 m track for every 1 ha of bushland)

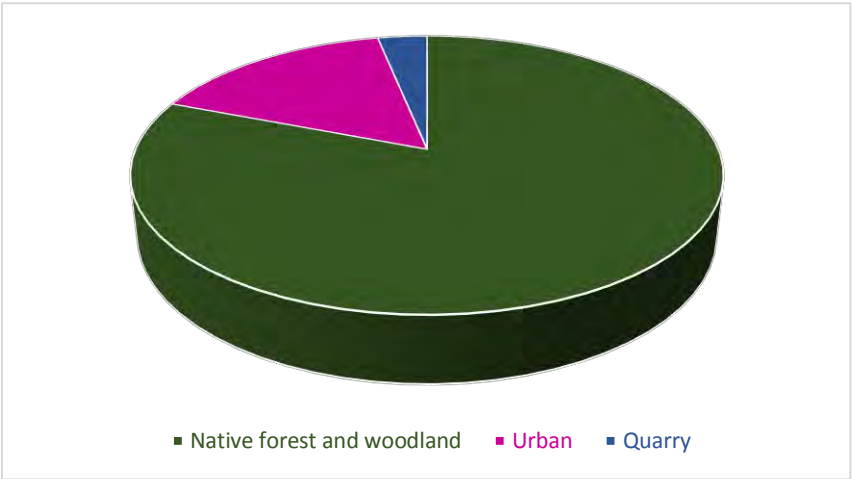
Proximity to other conservation reserves:

This site is about 700 m due east of Rumbalara Crown Reserve, with which it is linked via contiguous area of dry hilly forest.

Connectivity:

Rumbalara Reserve is located on the southern part of a large contiguous patch of vegetation that is located east of the M1 and stretches from Gosford in the south to Tuggerah in the North.

Edge characteristics (proportion of different land-uses within 100 m of the site):



Over 75% of this site is surrounded by natural bushland. About 16% is proximal to residential land, and a small area of quarrying also exists close to the site.

Catchment characteristics:

Area of contributing catchment	82 ha
Site as a proportion of contributing catchment	72.3% (Rumbalara Reserve is on a ridgeline so comprises a relatively small contributing catchment)
Proportion of contributing catchment that is developed	4%

Insights from site visit

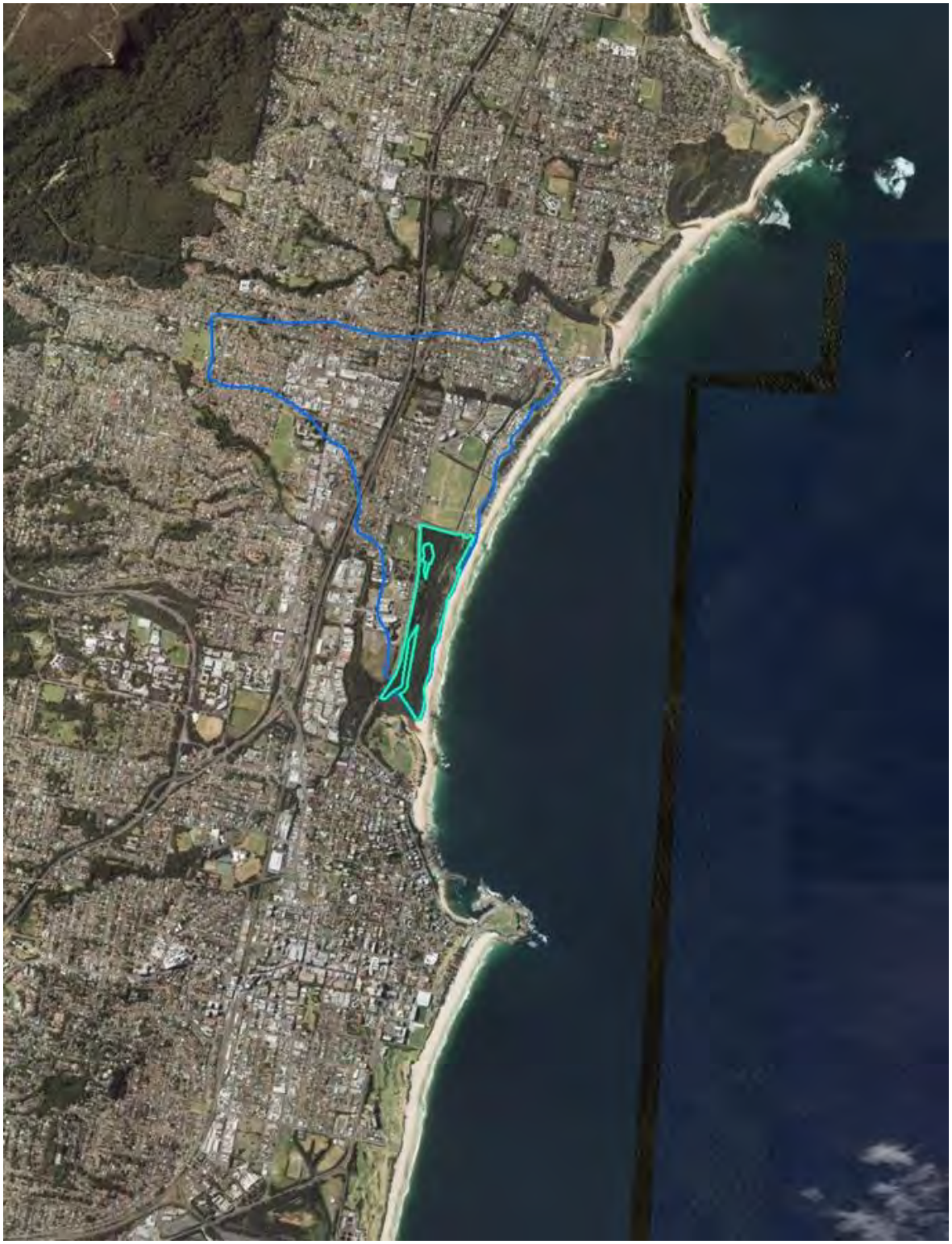
- Retiring of credits was attractive to Council staff in deciding to nominate this site.
- This site is part of Council's Coastal Open Space (COS) which is managed principally for biodiversity values. Most funding for COS is used for control of invasive species (e.g. fox baiting) and maintenance of tracks and fire-trails.
- The site has no public vehicular access as it has locked gates at every entrance. The site does not get a lot of human use given it is relatively steep, with few access points.
- The site was considered to be secure prior to its establishment as a biobank site.
- Opening the reserve up for more human use seen as a risk, particularly in the context of fires.
- The Council has a no dogs policy for this reserve.
- The site appears to be in very good condition. The ridgelines comprise a high proportion of old-growth forest that is relatively free of weeds.
- The major weed of concern is lantana, which occurs as thick, often expansive clumps within disturbed rainforest and rainforest margins in the gullies. Initial spraying of lantana in these areas appears to have been successful.
- Bell miners were observed on site, and BMAD is an issue elsewhere in the catchment. Removal of lantana may reduce the risk of BMAD onset on this site, although some of the adjoining private lands continue to support thick clumps of lantana.
- Follow-up lantana control will be undertaken each year, or maybe once every 2 years once weed outbreaks are nullified.
- The other major action required under the plan is fencing along the boundaries of urban land. In one part of the reserve, heavy 2-strand cable fencing has been placed to prohibit vehicular access and associated dumping of green waste and potentially other waste, and also the cutting and loading of firewood. This appears to have been well constructed and successful.
- In other places, lighter-duty 3-strand plain wire fencing using metal corner posts and steel pickets has been constructed to prevent stock from entering the site.
- This investment appears to have been a poor use of funding for 3 reasons:
    i. domestic livestock are unlikely to be present within adjacent private land, which is all peri-urban.
    ii. In the event that livestock were present, a 3-strand plain wire fence is not likely to prevent access
    iii. The cost of installation was a prohibitive $100 per linear metre (equivalent to $100,000 per kilometre), mainly due to accessibility constraints, and cost of ongoing maintenance may be high.
- Council staff did not consider stock-proof fencing to be a required action but felt entitled to undertake the works in keeping with the agreement.
- Council indicated that had this fencing not been required under the contract, a bigger site would have been nominated for BioBanking.
- A small amount of tree planting has occurred, using seedlings struck in the nursery from seeds collected on site. The success of this has been limited due to very dry conditions.

- Of the key fauna species that contributed to credit calculation, Powerful Owl is known to be on site, while Spotted-tailed Quoll has not been recorded from any surveys or remote cameras in recent years.
- Various bird species, both canopy and under-storey dwelling, were observed on-site.

'Stock-proof' fencing in Rumbalara Reserve

Site 5: Puckey's Estate

Manager: Wollongong City Council



Location of Puckey's Estate(and contributing catchment)

Site metrics:

Number of parcels	1
Total Area	28.8 ha
Total perimeter	5,140 m
Perimeter : area ratio	178 m/ha
Edge effect zone within site	14 ha
Influence of edge effects	49%
Size class of parent patch	< 100 ha
Number of distinctive vegetation types	5 (includes 4 TECs)
Extent of TEC on site	20.6 ha
Proportion of TEC on-site	72%
Proportion of project TEC on-site	17%
Number of threatened plant species	0
Number of threatened animal species	4
Number of access points	Multiple
Approximate length of internal tracks/roads	2.0 km (~ 70 m track for every 1 ha of bushland)

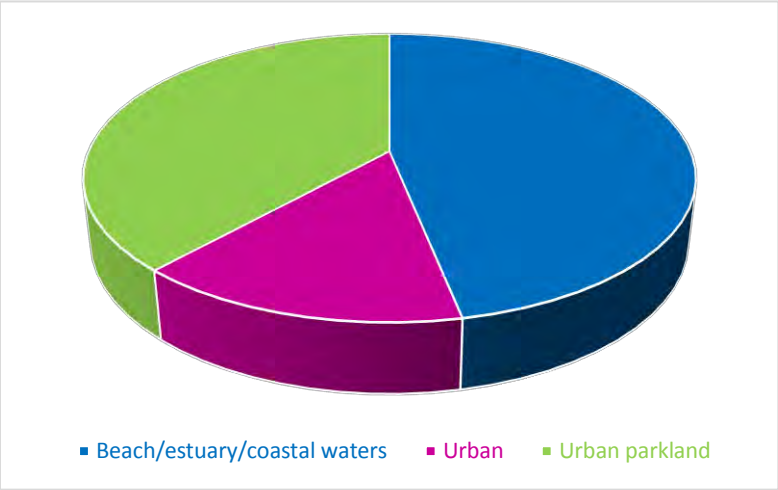
Proximity to other conservation reserves:

This site adjoins Towradgi Park Crown Reserve to the immediate north, which reserves a thin linear strip of foredune extending about 1.7 km north to the main part of the reserve around the mouth of Towradgi Creek.

Connectivity:

Puckey's Estate represents an isolated patch of coastal vegetation that is surrounded by urban land use. Other than the most mobile fauna species (such as migratory bird species), this patch is likely to have poor functional connectivity.

Edge characteristics (proportion of different land-uses within 100 m of the site):



This site is located just behind the coastal dune system. Almost half the surrounding land comprises beach or estuary. A significant area of land to the west is cleared parkland/fields. About 15% of the site is surrounded by residential land or campus buildings.

Catchment characteristics:

Area of contributing catchment	284 ha
Site as a proportion of contributing catchment	10.1%
Proportion of contributing catchment that is developed	73%

Insights from site visit

- Council staff are committed to controlling weeds and working with the community to improve the condition of this site.
- However, compared with other sites, and given 3 years since project commencement, evidence of site management is not as strong. While targeted control of weeds has been undertaken, much of the reserve maintains a significant density of weeds such as lantana, bitou bush and asparagus fern, and appears in relatively poor condition.
- Management of signage and interpretation is significantly challenged by inappropriate visitor behaviour, with evidence of graffiti and damage. Council is considering developing a smart phone application as an alternative form of interpretation for this site.
- The use of ecological burns is planned every 7 years, but is not likely for 2 reasons:
  i. Uncontrolled burns (possibly arson) occur in the site
  ii. Ecological burns are lowest priority for RFS and other fire organisations, so may be difficult to plan and implement.
- The major challenge is human use (graffiti and vandalism of infrastructure). This is always likely to be a challenge. The safety induction undertaken by Council prior to the site visit included encountering people displaying anti-social behaviour.
- This site experiences high levels of visitation, and various outdoor events are undertaken within the site.
- Leashed dog walking is permitted within the site, however unleashed dogs are permitted on the adjacent beach.

- The migratory bird species Little Tern is listed for the site. There would be little prospect of this species successfully breeding in the dune system given visitor numbers and unleashed dogs.
- While understorey bird activity was observed, the bird assemblage for this site is likely to be limited given its isolation from other areas of native vegetation.
- Many of the works being undertaken on site are likely to have occurred anyway, as several bush care groups are active, and school groups participate in revegetation projects. Part of the site was also recipient of a 6-year environmental trust funding to support works by the Green Army (this grant entering its final year).
- The site is also an annex of the Wollongong Botanic Gardens, so receives additional support for track maintenance.
- Conservation works to date have mainly been weed control, with some revegetation.
- Conservation works may improve stand structure over time, however given the effort to date, the level of current level of weediness suggests that there is a significant seed bank. New weeds such as balloon weed continue to emerge.
- Despite the considerable revenue stream from BioBanking, and the large volunteer base and support from the Wollongong Botanic Gardens, Council considers funding to be insufficient to improve this stand to the level desired.
- The capacity to improve ecosystem function is limited by the site's isolation, linearity, size and lack of connectivity, so only a sub-set of the original suite of species is likely to be present (i.e. only the most mobile species can move to and from the site).
- Puckey's Estate was originally a house and salt works in the early 1900s. The relics of this European Heritage is still apparent but has been significantly vandalised.
- The beach to the immediate east is dangerous, with several drownings encountered in recent years. There is always the chance that parts of the site may need to be cleared to facilitate emergency access.
- Urban water enters the site at a number of locations. Engineering structures have been installed to intercept waste entering the site, however pollution from urban runoff may be an issue.
- The site contains an easement for access by Sydney Water to sewerage infrastructure. Periodic disturbance is likely to occur within and adjacent to this easement.
- The site is low-lying and there is evidence of coastal erosion at the southern estuary. Forecast storm surges and sea level rise is likely to impact this site in future.

Main northern access to Puckey's Estate

Site 6: Dog Pound Creek

Manager: Hornsby City Council

Location of Dog Pound Creek (and contributing catchments)

Site metrics:

Number of parcels	4
Total Area	41.1 ha
Total perimeter	8,210 m
Perimeter : area ratio	200 m/ha
Edge effect zone within site	36.4 ha
Influence of edge effects	89%
Size class of parent patch	Western patch > 1,000 ha; Eastern patch < 100 ha
Number of distinctive vegetation types	3 (includes 1 TEC)
Extent of TEC on site	7.1 ha
Proportion of TEC on-site	17%
Proportion of project TEC on-site	6%
Number of threatened plant species	4
Number of threatened animal species	4
Number of access points	Multiple
Approximate length of internal tracks/roads	~ 1.0 km in the eastern patch (~ 80 m track for every 1 ha of bushland) ~ 2.0 km in the western patch (~ 70 m track for every 1 ha of bushland)

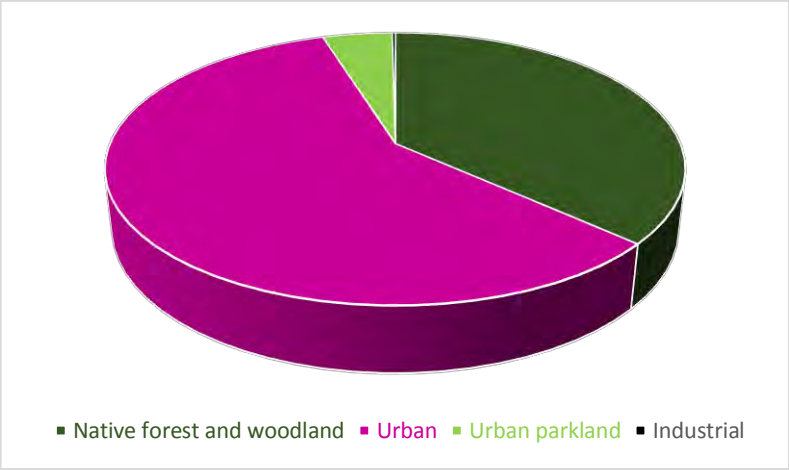
Proximity to other conservation reserves:

The western patch connects at its northern limits with Berowra Valley National Park.

Connectivity:

The western patch of at Dog Pound Creek Reserve is located at the southern extremity of a narrow finger of vegetation (<200 m width) that links northwards through a contiguous area of native vegetation into the Wollemi Wilderness. Its level of functional connectivity is thus likely to be moderate, as it has a narrowly connected access to a major block of forest that protects viable populations of most native species associated with the Sydney Basin Bioregion. In contrast, the eastern patch is disconnected from the Wollemi block by a residential strip along Valley Road, so the capacity of less mobile fauna to move to and from this patch is limited.

Edge characteristics (proportion of different land-uses within 100 m of the site)



Over half the site is surrounded by residential land, with small areas of urban parkland (e.g. playing fields). About 37% of the site is surrounded by native forest.

Catchment characteristics:

Area of contributing catchment	eastern section 72 ha; western section 229 ha
Site as a proportion of contributing catchment	eastern section 21.5%; western section 11.2%
Proportion of contributing catchment that is developed	eastern section 77%; western section 58%

Insights from site visit

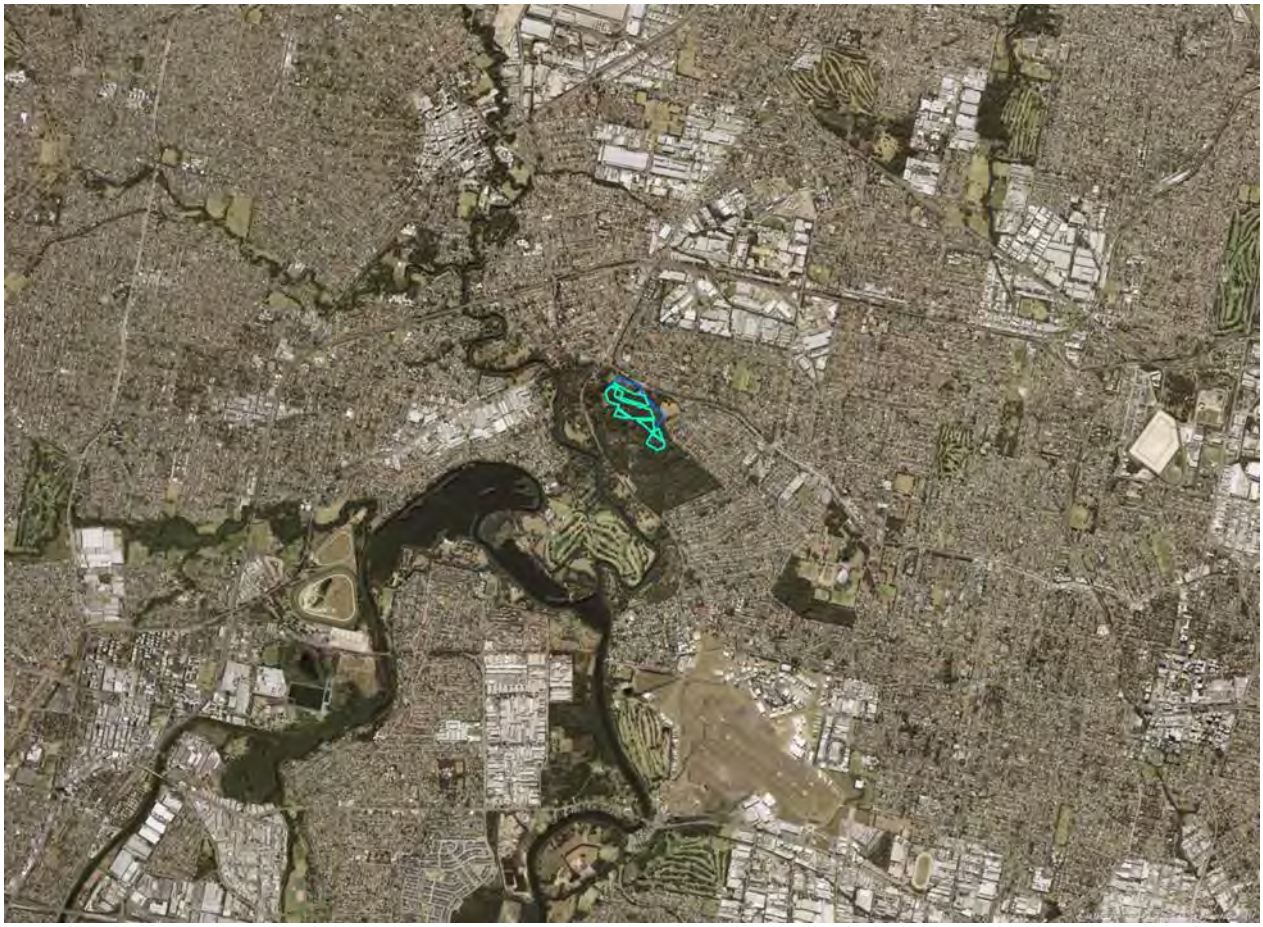
- Council staff are highly committed to managing this site for nature conservation.
- The site is in very good condition, with a complex overstorey, midstorey and understorey structure, a high diversity of native plants, and old growth elements.
- Weed control is working, and regeneration of native plants is evident and healthy.
- Tracks are in very good condition and apparently well maintained.
- The initial budget for this site was about 25K/yr. This has lifted significantly following securing the biobanking contract, with all biobank funds spent on the site.
- Initial eradication of lantana thickets would probably not have gone ahead without the security of ongoing biobank funding to keep recurring lantana on check.
- Biobank funding has acted to leverage work into other Council reserves and has facilitated better work scheduling for bush regeneration contractors.
- Council has entering into agreements to biobank adjacent reserves to offset development from the North Connex project. This is helping to consolidate the corridor into Berowra Waters NP to the north.
- Specific site management has included:
  i. Eradication of weed thickets (e.g. lantana, privet)
  ii. Targeted tree/shrub plantings
  iii. Management of minor outbreaks of *Phytophthora* and myrtle rust
  iv. Interpretation and track works.
  v. Education of neighbours

- Ecological burning is also planned within areas of recent lantana eradication.
- Ecological burning better pitched as 'training burning', to be run in winter.
- Council has set aside 5-6K to provide education to adjacent resident about the reserve, particularly in the context of weed encroachment, and to assist them with bush regeneration and management.
- No unplanned fires have occurred in this site.
- No evidence of vandalism or dumping.
- More flexibility in carrying out management is required. For example, Powerful Owl has been observed roosting in privet thickets during the day, so removal of all privet in one strike may impact the species.
- Council indicated that performance targets have been given, but no baseline data are in place against which to gauge performance.
- A key threat to this site is the potential for an Asset Protection Zone (APZ), up to 100 m from houses, to be established within the site where vegetation clearing or under-scrubbing is carried out. A number of houses are located to the back of their blocks and are on the plateau above steep slopes into the site. Future clearing for establishment of APZs could be significant.
- Edge effects are an issue for this site, which is generally long and narrow, and is immediately adjacent to houses.
- Sydney Water manage easements through both sections. At one point they almost destroyed some of the threatened *Epacris purpurascens* var. *purpurascens* plats on site. This is now managed through strategic placement of logs to prevent vehicles from impacting the plant.
- A major sewage main runs through the site – there is potential for sewerage spills into the local creek if the pipe backs up during heavy rains.
- Management of *Phytophthora* and myrtle rust include exclusion fencing and interpretation. The impacts do not appear to be significant at present.
- Runoff from industrial land has led to minor pollution in the past.
- Weed control includes keeping on top of Camphor Laurel seedlings, which will be an ongoing issue.
- The reserve offers 'leash only' dog walking.

Fencing to exclude walkers from myrtle rust outbreak

Site 7: Lansdowne Reserve

Manager: Bankstown City Council



Location of Lansdowne Reserve (and contributing catchment)

Site metrics:

Number of parcels	6
Total Area	10.6 ha
Total perimeter	3,820 m
Perimeter : area ratio	360 m/ha
Edge effect zone within site	10.6 ha
Influence of edge effects	100%
Size class of parent patch	100 - 200 ha
Number of distinctive vegetation types	3 (all TECs)

Extent of TEC on site	10.6 ha
Proportion of TEC on-site	100%
Proportion of project TEC on-site	9%
Number of threatened plant species	3
Number of threatened animal species	3
Number of access points	Multiple
Approximate length of internal tracks/roads	1.2 km (~ 110 m track for every 1 ha of bushland)

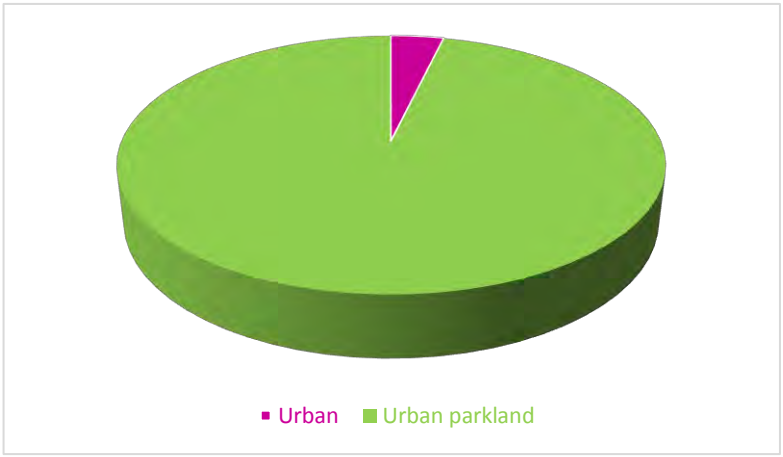
Proximity to other conservation reserves:

This site is not proximal to any conservation reserve.

Connectivity:

Lansdowne Reserve is an isolated patch of woodland that is surrounded by urban and industrial land in a very built up part of western Sydney. Other than the most mobile fauna species (some larger bird species), this patch has poor functional connectivity.

Edge characteristics (proportion of different land-uses within 100 m of the site):



Almost all of this site is surrounded by urban parkland. Small areas of residential occur to the east of the site.

Catchment characteristics:

Area of contributing catchment	17 ha
Site as a proportion of contributing catchment	62.4% (Lansdowne Reserve is located on a shallow rise so comprises a relatively small contributing catchment)
Proportion of contributing catchment that is developed	1%

Insights from site visit

- Council staff are committed to using adaptive and integrated management to improve condition of the site over the long term.
- Conservation works to date include tree planting, weed control, and erosion control, as well as clean-up of illegally dumped waste.
- Three threatened plant species are protected within the site – *Acacia pubescens*, *Marsdenia viridiflora* subsp. *viridiflora* and *Pimelea spicata*. In addition to general management, responsive management of threatened flora species includes no spray zones (i.e. hand weeding only), track closure, pruning of adjacent vegetation to minimise competition, retention of wire fence panels to assist climbing by *Marsdenia*, and staff induction on identification and management of threatened plants.
- Fire is planned as a management tool, but unplanned fires to date (possibly arson) have negated the need for controlled burns.
- The site contained spotted gum regrowth that Council staff do not believe is local to the site, despite this being a signature over-storey species of Cumberland Plains Woodland. Planned ecological thinning of spotted gum may take resources from elsewhere.
- A recent fire exposed some foundations of an old building within the site, and a resultant inspection found evidence of asbestos contamination. This part of the site has been cordoned off and may exemplify unforeseen costs associated with management of urban parkland.
- Management of African Lovegrass involves burning followed by spot-spaying new growth. However, this is only being undertaken in the site and not the surrounds, so incursion from outside the site will always be a problem.
- The major challenge is human use (trail bikes, dumping waste, and vandalism of infrastructure). This is always likely to be a challenge.
- Conservation works will probably improve stand structure over time, however capacity of this to improve ecosystem function is limited by the site's isolation, size and lack of connectivity, so only a sub-set of the original suite of species is likely to be present (i.e. only the most mobile species can move to and from the site).
- Development of old growth attributes included big old trees, large dead trees and large tree limbs (alive or dead) is a long-term objective of BioBanking, to improve stand structure and function. However, issues around public safety may require large trees and tree limbs to be removed or pruned in public spaces, and this may be significant within a site like Lansdowne which is interlaced with tracks and has lots of visitors - potentially another mismatch of BioBanking and public urban parkland
- Unleashed dog walking is permitted, so there is likely to be pressure on native mammals. Cats and foxes also likely to be on site.

Easement through Lansdown Reserve