

Sustainability and Environmental Advisory Panel

AGENDA – 16 MAY 2023

Sustainability and Environmental Advisory Panel (SEAP)

Date & Time:	16 May 2023 – 5:00pm
Location:	Council Chambers, 21 Saunders Street Wynyard
Council Representatives:	Cr Celisa Edwards (Chair), Cr Andrea Courtney (Deputy Chair)
Members:	Brenton Hosking, Colin Hocking, Fiona Loughran, Hannah Sadler, Ian Ferris, Ian Newman, Peter Lawrence, Robin Krabbe, Sarah Smith, Wendy Bryant
Staff in Attendance:	Daniel Summers, Dana Hicks, Kassandra Steward, Bill Walker
Guest Presenter:	Nil

1 WELCOME

- Ensure a quorum is achieved before opening up to official business
- Take note of opening time

2 CONFIRM MINUTES

- Motion to confirm minutes from previous meeting.

3 REVIEW OF ACTIONS LIST

- Actions list attached to this agenda

4 WWC TREES POLICY & STRATEGY

- The Waratah-Wynyard Council's Tree Policy is being reviewed by SEAP members to achieve better balance between conservation and environmental protection. P. Lawrence has provided a draft outline for discussion and C. Hocking has provided thoughts on the review of the current policy and strategy.
- In addition, Council officers wish to invite discussion around the tree and vegetation vandalism policy documents submitted for SEAP consideration and discussion. These documents were previously provided as attachments to the March SEAP agenda.

5 ARBORETA, BIODIVERSITY, VEGETATION PLANNING & WILDLIFE CORRIDORS

- The SEAP is encouraged to discuss a number of items raised by members which fall under objective 3 per action plan brainstorming sessions during the January meeting. These agenda items include but are not limited to;
 - Potential arboreta projects, seeking guidance on possible locations and methodology.
 - Tiny Pocket Forests for consideration as a potential future project(s) in the Waratah-Wynyard municipality.
 - A vegetation management plan with consideration given to scope, content and timeframes for action.
 - Wildlife corridors and habitat linkages

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- Additional discussion point requested on behalf of Wynyard Landcare which seeks to determine the SEAPs level of support in framing an environmental/biodiversity event using the plantings at Fossil Bluff as a focus.

6 PROPOSED SISTERS BEACH SUB-DIVISION

- A major sub-division having been proposed for Sisters Beach, SEAP member F. Loughran wishes to proactively discuss environmental issues surrounding the application that sit outside the planning process such as the traffic implications and/or considerations where a major development is in close proximity to a National Park.
- Suggested discussion points include; increased traffic on Sisters Beach Road, potential reduction in speed limit, roadkill, endangered species (devils), maintenance of the virtual fencing, expansion of the virtual fencing network, communications (signage, education etc.).

7 UPCOMING MEETINGS

- 18 July 2023 at Council Chambers
- 19 Sept 2023 at Council Chambers
- 21 Nov 2023 at Council Chambers

8 GENERAL BUSINESS

- Call for members to raise other general business.
- Initial thoughts on the Regional Renewable Energy Projects proposal.
- The SEAP Food Security sub-group (H. Sadler, W. Bryant and R. Krabbe) are currently working on a discussion paper regarding Food Security for Waratah-Wynyard in the context of sustainability. The group will meet to discuss timelines, including whether possibility of a draft ready document by the July meeting.

9 CLOSURE

- Take note of closing time

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Action List as at 21 March 2023

No.	Action	Meeting	Responsibility	Due	Status
1	Review meeting frequency at the third official meeting of the group (six months).	31 Jan 23	Group	16 May 23	Not Started
2	Formalise meeting frequency for the third Tuesday of every other month commencing from March 2023.	31 Jan 23	D. Hicks	Before March meeting.	Complete
3	Consolidate the products of the brainstorming session, provide draft for consideration.	31 Jan 23	D. Hicks / D. Summers	Before March meeting.	Complete
4	Review state of agapanthus around the Sisters Beach. Look at education and transfer of strategy to weed reduction program.	31 Jan 23	F. Loughran & B Walker	Before March meeting	Complete
5.	Form a sub-group looking at a weed reduction program including education and transfer of knowledge into Council a strategy.	21 Mar 23	F. Loughran, B. Walker & C. Hocking	By July meeting	In Progress
6.	Provide details and/or a contact at Central Coast Council re: HEAT home energy tool and associated community outreach	21 Mar 23	P. Lawrence & K. Steward	Before May meeting	TBC
7.	Seek further information on possible funding for waste education through the state government.	21 Mar 23	Cr. A. Courtney & D. Summers	For July meeting	In Progress
8.	Adjust and reorganise the Action Plan produced as part of the January brainstorming session. Soft copy of native file to be provided.	21 Mar 23	C. Hocking, Cr C. Edwards, D. Summers & K. Steward	Before May meeting	In Progress
9.	Provide an outline of a food security proposal for the group to consider actions for.	21 Mar 23	R. Krabbe & H. Sadler	For May meeting	In Progress

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No.	Action	Meeting	Responsibility	Due	Status
10.	Provide examples and case studies to assist progress for easily achievable Community adaptation and resilience projects. E.g., Camp Creek, Inglis River	21 Mar 23	B. Hosking & C. Hocking	For July meeting	In Progress
11.	Send NRM link to SEAP group	21 Mar 23	H. Sadler	Before May meeting	Complete
12.	Approach Spring Loaded organisers re: Eco Fest contacts.	21 Mar 23	D. Summers & Cr A. Courtney	Before May meeting	Complete
13.	Review, research and make recommendations for a revised/new Tree Policy for the consideration of the group.	21 Mar 23	C. Hocking & I. Ferris	For July meeting	In Progress
14.	Wildlife corridor concepts and management including threatened species (urban greening links/corridors) – Research and provide case studies for the group’s consideration.	21 Mar 23	W. Bryant.	For Sept meeting	In Progress
15.	Share the FOGO feasibility study from 2020 with SEAP ahead of recommendations to April Council meeting.	21 Mar 23	D. Summers	Before May meeting	Complete
16.	Provide information on the shared environmental officer discussion with Cradle Coast Authority	21 Mar 23	P. Lawrence	Before May meeting	TBC
17.	Send a link to the City of Power Partnership site for member’s review - Cities Power Partnership: local councils leading the charge to net zero.	21 Mar 23	K. Steward	Before May meeting	Complete

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INFORMATION FOR DISTRIBUTION

ATTACHMENTS LIST:

1. SEAP Trees Energy – Outline
 2. Proposal for WWC Tree Policy
 3. Frenches Road Nature Reserve Management Plan
 4. CCC Draft NRM Management Plan
 5. Tiny Forest Handbook
 6. Fragments & Islands – Isolated Natural Communities
 7. Biodiversity Corridors For Waratah-Wynyard Council
 8. Town Power – Regional Renewable Energy Projects (Letter)
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1 WWC TREES POLICY & STRATEGY REVIEW

- Members have formed a sub-group for the review of WWC’s Tree Policy and have provided initial outline documents as well as content around how the WWC Tree Policy and Strategy might be reviewed. (attachments 1 and 2)
- A management plan for Frenches Road Nature Reserve, adopted by Council in 2020, provides further background for future drafting of tree policy & strategy. (attachment 3)
- Additionally, a draft NRM Management Plan for the Central Coast Council has been submitted for consideration of SEAP as a similar plan to be created for WWC. (attachment 4)

2 POTENTIAL PLANTING PROJECTS

- The Tiny Forest Handbook (attachment 5) provides an outline of the creation of tiny forests using the Miyawaki method. In summary, they are densely planted small areas of forest using different layers of locally native vegetation to represent a complete ecosystem. The Miyawaki method has shown to result in accelerated growth and more biodiversity compared to traditional plantings, and they are growing in popularity as a local, community-based solution to climate change and localised environmental concerns.
- These Tiny Forests are popping up all over the world and being incorporated into schools where children can have an active part in planting, growing and monitoring the forest as it grows alongside them. They have been grown in public parks with natural art installations, outdoor classrooms and nature playgrounds, and are also being used to transform empty public spaces into urban biodiverse havens as an environmental solution for polluted or built-up areas.
- As well as the environmental and biodiversity benefits of these forests, there are also positive social outcomes as local community members are directly connected to the project throughout the stages, and there are many opportunities for nature positive education and citizen science.
- Background which may provide insight to some of the relevant concepts outlined by the tiny forest project has also been attached for reference during discussion under agenda item 5 “arboreta, biodiversity, vegetation planning & wildlife corridors”. (attachment 6)

3 DEVELOPMENT OF BIODIVERSITY CORRIDORS PROPOSAL

- Council’s iCEP includes an action (38) to Protect, enhance and recover biodiversity in the municipality while collaborating with partner agencies to enhance and extend biodiversity corridors.
- Through research and discussion, a proposal for the development of wildlife corridors within the municipality has been compiled. *“The purpose of this proposal is to raise the prospect for, and promote ideas about, how best to identify, maintain and enhance biodiversity corridors within Waratah-Wynyard Council.”* – C. Hocking (attachment 7)

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4 TOWN POWER PROJECTS

- An outline for a future regional town power project has been proposed for consideration. It is suggested that the Town Power projects could provide regional communities, through their councils, with cost-effective, secure, and deliverable sources of renewable energy. This document is provided for information and discussion. (attachment 8)

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Attachment 1: SEAP Trees Energy – Outline

Tree Policy – draft outline

The current WWC tree policy is focussed on risk management. Here is a suggested outline what a tree policy could include.

Purpose

- To provide clear strategic direction for the management of trees throughout all towns

Scope

- Trees located on Council owned, leased or managed land (eg parklands, road verges, coastal reserves, nature reserves, bushland)
- Trees on land to be donated to Council (eg subdivisions being developed)
- Trees on private land that may impact Council owned, leased or managed land)

Benefits of trees

- Enhances aesthetic appeal of streets and facilities
- Provide shade, wind suppression, reduction in noise and air pollution
- Habitat for wide range of biodiversity

Management of trees

- Maintain existing trees on Council owned, leased or managed land, and land to be donated to Council.
- Maintain existing trees in wildlife corridors between biodiversity bushland habitats
- Pruning only performed to maintain tree health, provide clearance for essential services, or mitigate risk
- Pruning not warranted for: too tall; aesthetics; perceived risk; nuisance by way of leaf, flower, fruit, bark stripping, or sap; tree shading lawns, garden, houses, solar panels; to enhance clear views; wildlife nuisance; due to allergies or health problems; installation of non-essential services
- Pruning in accordance with Australian Standard 4373, Pruning of Amenity Trees.
- Allocate budget resources for tree maintenance, new tree planting projects, tree replacement and tree removal
- Plant new trees as part of Council projects where appropriate
- Maintain existing trees on new subdivisions as appropriate and require new trees to be planted as part of developments and subdivisions to be funded by the developer
- Utilise the “Tree and Plant preferred species” list for guidance
- Ensure tree roots, trunks and branches are protected during works
- Maintain a Significant Tree Register
- Encourage, support and advise organisations in planting and management of trees
- Provide information to landowners regarding appropriate plantings on private property

Legislation and related documents

- Local Government Act 1993
- Neighbourhood Dispute about Plants Act 2017
- Australian Standard AS4373-2007 Pruning of Amenity Trees

Home Energy Audit Toolkit (HEAT)

In a typical Tasmanian home, 50% of energy is used for heating, 25% for hot water, 9% for cooking, and 7% for fridge and freezer. A recent report from the climate Council calculated that the average 2-star energy rated home in Hobart could save \$1561 per annum by upgrading thermal efficiency (ceiling & wall insulation, draught ceiling, secondary glazing). However, every household is different and HEAT, developed by the City of Hobart, can help understand electricity use by various household appliances and improve home energy efficiency by upgrading insulation, plugging draft gaps, and installing double glazed windows. A number of Tasmanian councils support the HEAT approach.

Each HEAT contains:

- Power-Mate, to measure electricity consumption of electrical appliances
- infrared radiometer to check for leaks around home and fridge doors, effectiveness of ceiling insulation
- stopwatch to measure flow rate of hot water from showers and taps
- compass to identify home's orientation for installing solar panels
- thermometer to measure air temperature around house, hot water water systems

The Toolkit is fairly easy to use kit and has guides and explanatory notes to help the process. However It's probably not for everyone - it assumes a level of literacy and the most vulnerable people often need individual help and advice.

Sustainable Living Tasmania ran a programme (funded by state government) which included energy audits for people in rented accommodation. Julie Hargreaves conducted over 1000 audits that involved walking around their home, asking questions to understand their lifestyle and needs and looking for ways they could reduce their energy use or save on costs. She also helped them to understanding their power bills, what tariff they were on. This type of energy audit is very specific to each household and the information is tailored to specific needs rather than being more general in nature. There is a cost to this process as it involves the time of a consultant: 1-2 hours depending on size of house and complexity of needs.

There is a lot of energy efficiency information online

<https://www.hobartcity.com.au/City-services/Sustainable-Hobart/Sustainable-homes/Energy-efficiency/Home-Energy-Audit-Toolkit-HEAT>

<https://www.energy.gov.au/households/household-guides>

https://www.slt.org.au/practical_actions

<https://www.climatecouncil.org.au/resources/smarter-energy-use-how-to-cut-energy-bills-and-climate-harm/>

Another option for education on household energy use is in the form of information sessions/workshops. However Julie Hargreaves experience is that people tend to glaze over when there is too much to think about at once, so targeting the approach and the audience is important.

Upgrading energy efficiency for households can be a win-win for householders and our environment, and can be promoted and made easier with support from Council.

A new joint report by the Property Council of Australia and the Green Building Council of Australia calls for every Australian home to be given an energy performance rating, allowing buyers or renters to know the energy efficiency of their home before moving in.

Land for Wildlife

The Land for Wildlife program is a nonbinding voluntary scheme which encourages, supports and recognises private landowners, including councils, who are taking a positive approach to land management by incorporating nature conservation on their properties. Land for Wildlife makes a valuable contribution to protecting nature, thanks to the strong conservation ethic of its members, and the effective community participation that is helping to safeguard wildlife across the state.

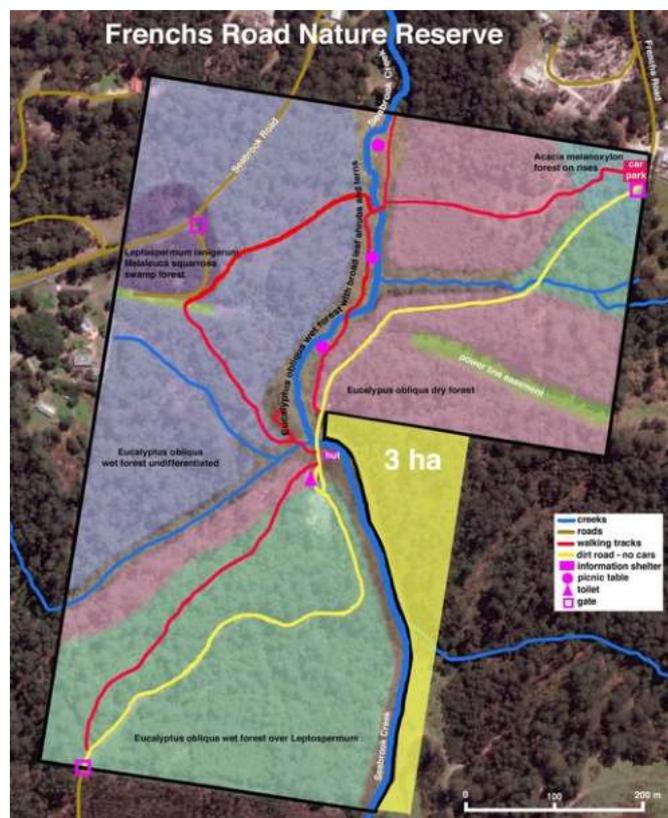
<https://tasland.org.au/programs/land-for-wildlife/>

Council could start by registering one reserve as Land for Wildlife. Frenchs Road Nature Reserve would be ideal. This 34ha of remnant bush is a valuable patch of intact vegetation community in the fertile farming region of north-west Tasmania. The biodiversity conservation reserve is home to a wide range of flora and fauna including giant freshwater lobster, burrowing crayfish, Tasmanian devil, spotted tailed quoll, and 10 endemic bird species. Council adopted a management plan for the reserve in 2020 (attached); and in the last three years volunteers have upgraded the walking tracks, replaced the bridge crossing the creek, and installed track signage. Daily, many locals and tourists enjoy and appreciate the reserve.

Declaring Frenchs Road Nature Reserve as a Land for Wildlife Reserve would exclude visitors bringing their dogs whilst walking around the reserve. Currently the sign at the entrance allows dogs on leads. The reserve could also be declared as a cat-free managed area.

To enhance the biodiversity of the reserve Council should seriously consider purchasing a portion of land east of Seabrook Creek (refer to the Frenchs Road Nature Reserve Management Plan adopted by Council in 2020). The main threat to the survival of the endangered Giant Freshwater Lobster is sedimentation in Seabrook Creek. Hence expanding the Seabrook Creek riparian zone in the reserve would help protect the Lobster. Plus, the additional land is wet eucalypt forest that is home to seven bird species whose numbers have declined dramatically over the last two decades: Grey Goshawk, Brush Bronzewing, Scrubtit, Tasmanian Thornbill, Pink Robin, Bassian Thrush, and Yellow-throated Honeyeater.

This addition to the reserve would help meet the national 30/30 biodiversity target to protect 30% of lands by 2030 with particular attention on under-represented ecosystems.



Food Organics and Garden Organics (FOGO) composting

Food Organics and Garden Organics (FOGO) is 44% of general waste (Waratah Wynyard 2019-2024 Waste and Resource Recovery Strategy). An unknown small number of households in town composite their own organic waste.

A few councils in Tasmania have already commenced kerbside collection and processing of organic waste. In addition some councils provide information but no financial incentives for household composting. Hobart City Council provide tips on home composting and the Central Coast Council provide a guide “Healthy Hens Happy Humans” as an alternative to processing household organic waste. The Waratah-Wynyard Council are evaluating their options.

The 2019 MRA Organics Processing Review for the Waratah-Wynyard and Circular Head Councils evaluated different organic collection and processing systems on a town-wide basis of 7,000 to 10,000 tonnes/annum. The 2020 MRA FOGO Options Review assumed a kerbside collection system and undertook a cost benefit analysis on different large scale processing systems.

The two MRA reviews did not consider household composting. How many households composite their own organics? Can council facilitate this approach? What are the pros and cons as compared to kerbside collection with large scale processing? How best to encourage citizens to actively participate in recycling waste, small scale or large scale?

There is significant information on-line about household organic composting



<https://www.youtube.com/watch?v=HngvowScx6g>

<https://www.hobartcity.com.au/files/content/public/residents/recycling-and-rubbish/fogo-and-compost/home-composting-in-hobart.pdf>

<https://www.centralcoast.tas.gov.au/wp-content/uploads/2019/02/Healthy-Hens-Happy-Humans.pdf>

<https://www.slt.org.au/compost>

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Attachment 2: Proposal for WWC Tree Policy

For Waratah-Wynyard SEAP Meeting on Tues 23/5/23

Developing a Revised WWC Tree Policy & Strategy

Colin Hocking ideas 3/5/23

Why Does the Current WWC Tree Policy & Strategy Need to Be Changed?

The current WWC Tree Policy and Strategy is primarily focused on risk management and minimization (see detailed analysis below under 1.0). This is despite the overall purposes of the policy recognizing the various values of trees.

Other Councils in Australia have tree management approaches with similar overall purposes as WWC, but are able to implement these in ways that implement their full range of policy purposes, with a strong focus on trees as assets rather than as problems– for example, see analysis of Hume City Council below, which is a similar mix of urban, semi-rural and rural council areas as those in WWC.

While WWC may have limitations on the budget it can allocate to tree management, there is a need to shift the focus of the Tree Policy and Strategy towards valuing trees, rather than considering them as problems that need to be managed. This will require WWC to review what the overall purposes of the Policy & Strategy are, how these are implemented.

In doing this, it will also be important for Council to identify who makes the decision within WWC about trees and how these decisions are made, and for Council to be transparent about their decision-making processes.

Currently, many residents are dissatisfied with the ways trees are managed in WWC areas, in a variety of ways. Upgrading the Tree Policy & Strategy and its implementation will reduce conflict between different residents, and between residents and Council, and lead to better outcomes for everyone: community and environment.

Ideas for Re-framing the Waratah-Wynyard Tree Policy & Strategy

The WWC Policy needs to move away from framing trees primarily as a risk to be dealt with, and frame trees as assets with multiple values. Management of trees needs to include risk management, but be wider than this.

One way to do this would be to identify the different contexts within which trees are to be managed on land for which Council has responsibility. For each of these contexts, the asset values of the trees could be identified, relevant to the site at which they are growing and management of the trees at this site could be outlined accordingly.

One possible set of categories for the types of areas in which Waratah-Wynyard Council manage trees are as follows (this may need further work). For each of these, policies and guidelines could be clearly identified:

- i. Urban street trees
- ii. Trees along road-sides and paths in peri-urban bushland areas
- iii. Trees along road-sides and paths in country areas
- iv. Trees in High Use Reserve Areas
- v. Trees in Low Use Reserve Areas

(Note: there may be other context areas not yet identified)

For each of these areas, the details of guidelines could be developed with input from, and consultation with, local communities and land-owners. In some instances, this development of guidelines could be community and land-owner led, if there are clear policies guidelines within which they need to work to develop these.

The WWC Tree Policy & Strategy could then be revised and re-developed as follows:

- i. For all areas, a set of over-arching policies and strategies for managing trees that account for all of their values, based on trees as assets, as well as risks.
- ii. This set of policies and strategies would set out goals and broad plans for enhancing the social and environmental values of trees, and what the goals are for each of the sub-areas for management.
- iii. For each designated context area, develop purposes, policies, strategies and guidelines for how to assess and manage trees in line with the values and issues of trees in each of these areas

The value of this approach is that trees that might need lower level management (e.g. in Trees in Low Use Reserve Areas) can be actively managed, rather than by benign neglect, but without needing lots of Council resources. Then resources can be appropriately directed towards areas that need more active management, for risk, for human amenity and for environmental benefit.

An active plan for maintenance and enhancement of the overall tree stock will mean that, when trees need to be trimmed or removed in each area, there is already a plan for how to manage, replace and enhance the trees in the specific area, as well as how to enhance the environmental and social values the overall tree stock in adjacent areas, for example by complementary planting to compensate for trees removed – and also plan ahead for replacement of trees in identified areas with trees that better suit the purpose of the area, so that removal of risky trees does not lead to an overall decline in tree stock.

An example of how this might be done is at the Playground and Picnic Area at Sisters Beach. Currently this had very large, old eucalypt trees (mostly Swamp Gums) on the perimeter. These are valuable for a range of social and environmental reasons, including heritage (many are at least as old as the settlement itself), shade, landscape values, and feeding and nesting birds and animals. However, over the next 10-20 years, some of these trees are likely to need major trimming to prevent large limbs from dropping on the area below.

Ultimately it is likely that some of these trees will need to be removed. One way to deal with this is to identify now the risk that these trees pose, which alternative trees would most beneficial for this area (for example, blackwoods and native Pittosporum trees have lower overall height and fewer large limbs) and begin planting these among the existing tall trees. At the same time, seed from these trees could be collected, and the seedlings from these could be planted into adjacent natural areas where there is no or limited human activity.

MORE DETAILED ANALYSIS OF WWC TREE POLICY & STRATEGY:

The WWC Tree Policy & Strategy states, under 1.0 Purpose, lists the following:

1.2 It is recognised that trees and associated vegetation form an integral component of the natural environment:

- (a) Provide a habitat for fauna;
- (b) Provide a pleasing vista in our streets and may provide a distinctive 'local character' for certain streets;
- (c) Make parks and reserves a pleasant place to visit;
- (d) Maintain or improve air quality;
- (e) May have heritage values;
- (f) Blend new developments with the established environment; and
- (g) In some instances, trees may represent the last areas of remnant vegetation.

1.3. There is a need to ensure the impact of trees on the built environment and human activity is managed to minimize the possibility of damage and injury occurring.

1.4. The task of maintaining balance between the needs of the natural environment and that of the built environment is a difficult one for the Council and the establishment of policies for the care and management of its tree stock will provide a consistent approach.

The overwhelming focus of the current WWC policy & strategy is risk management & minimization.

Under 3.0 Scope:

While ...

3.1 This policy applies to the entire stock of trees situated on land owned or controlled by Council including all Council reserves, road reservations, parks and other Council controlled areas. Council is required to obtain permission from Crown Land Services to remove any tree situated on Crown land held under leases or license

In practice:

3.2 Council will develop a procedures manual which will outline the following matters as described in section 4.0 and 5.0 of this policy:

- (a) New/Re-planting species selection;
- (b) Determination of High-Risk Areas;
- (c) Determination of High-Risk trees;
- (d) Inspection program;
- (e) Replacement, regular pruning and maintenance strategies, with timeframes;
- (f) Allocation of resources, and

(g) Management of electricity line clearance.

This contrasts with the Tree Policy & Strategy for other jurisdictions with a combination of urban and rural to semi-rural settings.

For example for Hume City Council in Victoria:

www.hume.vic.gov.au/files/sharedassets/public/residents/parks-and-reserves/po

1. POLICY STATEMENT

1.3 Street and reserve trees contribute to the appearance of the City through their aesthetic value, by providing identity and character. In addition, trees contribute to improving urban environments by absorbing heat, providing shade, reducing solar radiation, providing habitat, utilising storm water run-off and assisting in air purification.

1.4 In order to sustain this contribution, maintain community safety and satisfy the community's needs, trees need to be consistently managed according to current 'best practice' in arboriculture and Council's commitments, as documented in the Council Plan.

1.5 Management of trees from planting to removal includes planning for new trees, community consultation, determining planting location, tree species selection, planting, maintenance and pruning methods and removal of dead or dangerous trees.

3 SCOPE

The scope of this Policy covers the planning, planting, maintenance and removal of trees and stands of trees on Council owned parks, reserves, open space and road reserves.

Under **4 OBJECTIVE** there are four sections

4.1 Tree Planting

4.2 Tree Pruning

4.3 Tree Removal

4.4 Significant Trees

The criteria for tree removal are laid out in Appendix 4

Tree removal, will be approved if the tree meets one or more of the criteria set out below. The tree removal criterion is used to prevent indiscriminate removal. Safety is the priority, however, aesthetic and ecological factors, including wildlife habitat will be considered when making all tree management and removal decisions.

The tree or tree group needs to be inspected and assessed for the above criteria by a qualified arborist. Tree health (vigour), structure, Useful Life Expectancy (ULE), and hazard potential must be assessed.

Trees that are to be handed over to Council from developers must have a ULE of greater than ten years otherwise the trees should be removed prior to hand over to Council management. The exception is in areas of high conservation where the trees

contribute to the habitat values of a site. In these cases, public safety will be addressed through the use of appropriate pruning works, advisory signage and design of open spaces to discourage / prevent public access.

Council acknowledges that some residents have concerns with the leaf litter, fruit, bark or other debris that a tree may shed over the seasons. However, tree removals will not be authorised based on this reason alone.

Trees and groups of trees may be removed only when one or more of the following criteria are met.

- That is dead or close to death. Exceptions considered where tree or tree group is located in indigenous vegetation conservation sites.
- Infected with a disease where the recommended control is not applicable and removal is the recommended practice to prevent transmission.
- Poses a severe safety hazard that cannot be corrected by pruning, transplanting or other treatments.
- Severely interferes with a neighbouring tree or tree group to the extent that neither tree can develop to its full potential. The more desirable tree will be preserved.
- The aesthetic values are so low or negative that the site is visually enhanced by the tree removal.
- Work improvements or infrastructure repair or maintenance required to be made around the tree or tree group will kill or render the tree a hazard or significantly impact on the trees condition and useful life expectancy.
- The tree is currently or has future potential to substantially contribute to damages or nuisance to public or private property and no other viable means are available to mitigate the situation.
- The tree or group of trees is included in the street tree rejuvenation program as identified by Council.

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Attachment 3: Frenches Road Nature Reserve Management Plan

Frenchs Road Nature Reserve – Management Plan

Summary

This valuable 34ha of remnant bush is quite rare in the fertile farming region of north-west Tasmania. The biodiversity conservation reserve is home to a wide range of flora and fauna including giant freshwater lobster, burrowing crayfish, Tasmanian devil, spotted tailed quoll, and 10 endemic bird species. Over the past three decades “friends” of the reserve have removed invasive weeds; re-vegetated degraded areas; erected boundary fences to keep out stock; and constructed tracks, bridges and amenity facilities for recreational visitors. Community interest in observing and appreciating biodiversity has increased in recent years, and the Reserve is ideal to meet this demand for nature-based educational activities. However, there is little educational and interpretative information for visitors, a pedestrian bridge washed away in a flood has not been replaced, and some tracks have fallen in to disrepair. This management plan outlines a strategy to facilitate recreational users to appreciate and enjoy the flora and fauna whilst ensuring weeds and feral animals are controlled, and most importantly, biodiversity conservation is not compromised.

Objectives

- To protect the habitat of flora and fauna in this valuable patch of remnant bush
- To monitor significant fauna and flora species and manage the vegetation communities to protect and enhance environmental and aesthetic values
- To facilitate the local community and visitors to safely enjoy, appreciate and utilise the reserve for recreational and educational purposes, by providing flora and fauna information in appropriate formats for visitors
- To minimise the impact of visitors on the flora and fauna by maintaining walking tracks and bridges.

Management responsibilities

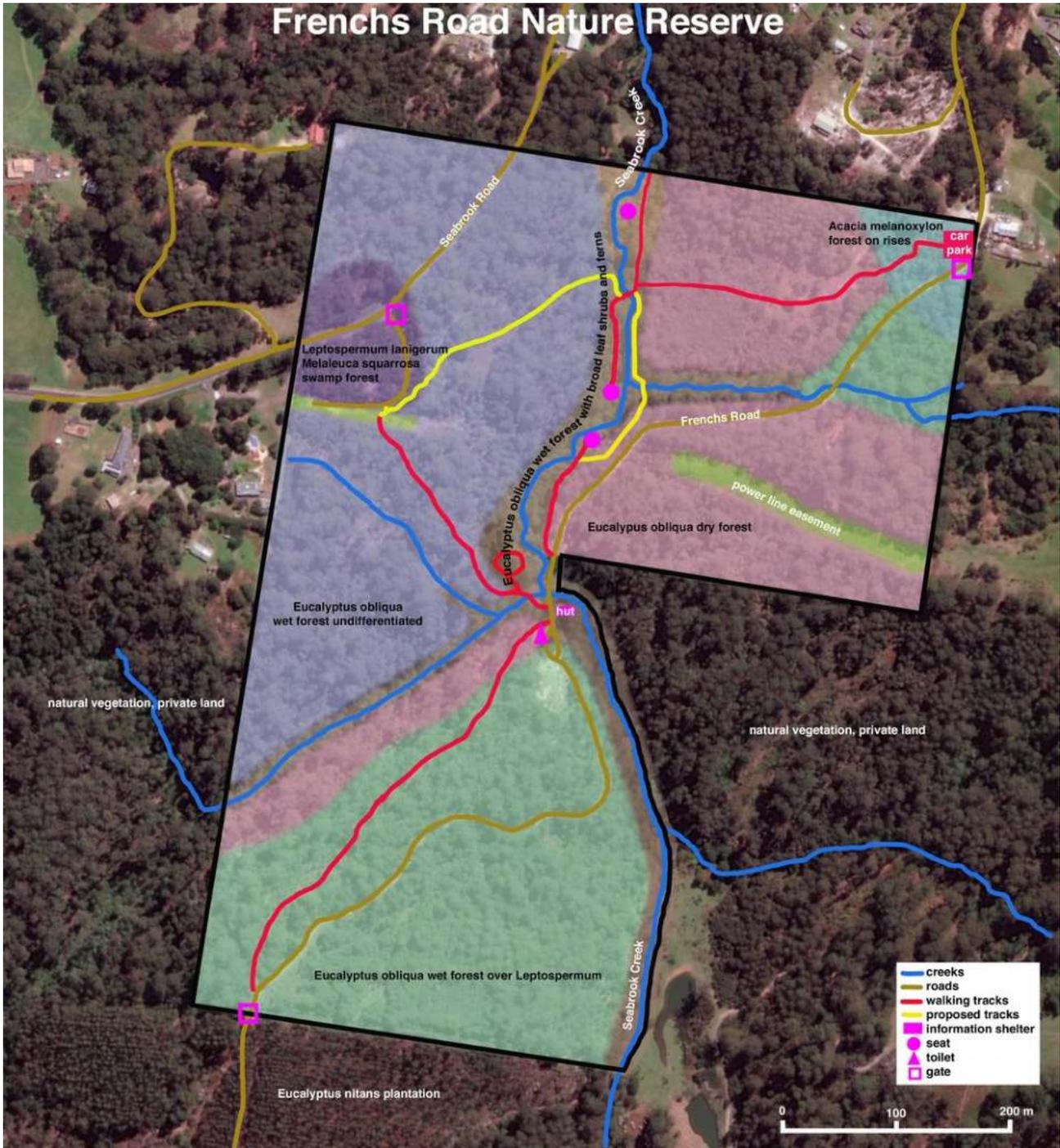
- The Waratah-Wynyard Council has primary management responsibility for the Reserve, particularly policy, infrastructure, and visitor information.
- The Council will delegate some responsibilities to Wynyard Landcare and/or other volunteer conservation groups through a Memorandum of Understanding with each group. Conservation volunteers have expertise and could undertake tasks such as biodiversity monitoring, control of weeds through hand-weeding, conducting guided tours, and providing advice to council.

Natural assets: vegetation communities, flora and fauna

Stringybark wet forest communities cover most of the reserve, and are regenerating well from historic disturbances.

The native vegetation communities, none of which is listed as threatened, are:

- Stringybark, *Eucalyptus obliqua*, dry forest (TASVEG code DOB)
- Stringybark, *Eucalyptus obliqua*, wet forest over teatree, *Leptospermum* (WOL)
- Stringybark, *Eucalyptus obliqua*, wet forest with broadleaf shrubs (WOB)
- Stringybark, *Eucalyptus obliqua*, wet forest (undifferentiated) (WOU)
- Blackwood, *Acacia melanoxylon*, forest on rises (NAR)
- Blackwood, *Acacia melanoxylon*, swamp forest (NAF)
- Teatree-paperbark, *Leptospermum lanigerum*-*Melaleuca squarrosa*, swamp forest (NLM)



At least 100 native vascular plant species have been recorded in the reserve, plus 31 introduced species. No threatened flora species have been found. Seven orchid species have been recorded so far, and more may be found. The reserve is most notable for the diversity of ferns, of which there are 20 species.

42 bird species have been recorded during the breeding season. Nine of the 12 Tasmanian bird endemics have been observed in the Reserve. The high bird species diversity reflects habitat diversity, structure and condition. Many of the birds in FRNR are habitat generalists that occur in both wet and dry forests but several like the Grey Goshawk, Brush Bronzewing, Scrubtit, Tasmanian Thornbill, Pink Robin and Bassian Thrush prefer wet forests such as wet eucalypt forests and rain forest. Within a particular habitat birds have specific nesting, dietary and foraging

requirements (Table 2). Different bird species use different elements of habitat to live and reproduce. For example, Bassian Thrush forage in ground litter for worms and build a nest coated with green moss so it breeds in wet shady gullies of wet mature and old forests. Endemic Yellow-throated Honeyeater forage on the trunks and branches of eucalypts for high-energy foods and build a nest low in dense understorey so it mostly resides in forests with a eucalypt canopy and a dense understorey of short wattles, tea-tree and other shrubs. The number of bird species in forests is determined largely by forest structure and plant species diversity as well as size of the patch, its condition and the extent to which it is linked to other forest patches. The five main structural elements of forest habitat for birds are:

- large old trees with hollows,
- large trees with greater canopy, foraging sites for insect prey, nest building
- diverse understorey shrubs for foraging, nesting, shelter
- ground layer vegetation like grasses & sedges for nesting sites
- decaying logs, litter for insects, spiders, lizards

Six threatened fauna species are known in the reserve:

- Giant Freshwater Crayfish, *Astacopsis gouldi*
- Burnie Burrowing Crayfish, *Engaeus yabbimuna*
- Tasmanian Devil, *Sarcophilus harrisii*
- Spotted-tail quoll, *Dasyurus maculatus*
- Grey Goshawk (actually white)
- Wedge-tailed Eagle (uncommon visitor)
- Swift Parrot (occasional summer visitor)

Astacopsis gouldi is a Tasmanian endemic species, and is the largest freshwater crayfish in the world. Indeed, it is the largest freshwater invertebrate in the world. It has a restricted distribution across northern rivers of the state. Ideal nich habitats are overhanging banks, tree trunks in the stream bed, logs and woody debris from flood events, and large rocks to burrow under. It is threatened by habitat loss, particularly stream sedimentation from up-stream forestry and agricultural disturbance, and poaching.

Engaeus yabbimuna is a Tasmanian endemic species, with a restricted distribution. In the past it has been known as the Burnie Burrowing Crayfish, when it was considered to reside only in Burnie. The discovery of its occurrence at Frenchs Reserve by the Central North Field Naturalists provided a new distribution separate from Burnie. This distribution has now been mapped and extends to Yolla, and provides a much greater sense of security to the species.

Bats were recorded in the reserve in 2011 using ultra-sonic bat detector, but these observations were not documented.

Future strategies and actions

Re-vegetation

The forest in the reserve is now vigorously regenerating naturally, due in part to the outstanding work by 'Friends' of the Reserve in removing weeds and planting native plants - many trees are now 25 years old. The only vegetation management required is ongoing control of opportunity weeds and revegetation of small areas like the disused quarry.

It should be noted that with the vegetation constantly growing and maturing and in this damp environment this may result in a loss of habitat opportunities as the vegetation communities tend towards mature wet stringybark forest. Consideration should be given to deliberately maintaining some other vegetation communities that used to exist in north-west Tasmania but have now been lost.

The power-line easement should be regularly maintained as low vegetation with trees removed as part of the easement maintenance program. Small to medium height shrubs, herbs, ferns, grasses, sedges and rushes, eg *Poa*, *Carex*, *Lepidosperma*, *Lomandra*, plus litter on bare ground would provide a different habitat suitable for some bird species and other small fauna.

Replanting with grasses such as *Poa labillardierei* on the drier banks, and sedges and rushes in the wetter drainage areas will not only reduce the chance of weed encroachment but will also provide habitat for bird species such as the Beautiful Firetail, (*Stagonopleura bella*), that depend on scrub and grasses for nesting and foraging.

Control of invasive weeds

Over the past two decades “friends” of the reserve have removed willows, pine trees, blackberries and other invasive weeds. Natural regeneration of shrubs and bushes is now basically controlling the spread of weeds in most areas. But regular hand weeding is required to prevent weeds like periwinkle, caper spurge, ? colonizing small local areas and spreading.

Control of feral animals

Feral cats prey on small animals and birds. As well as direct predation, feral cats can impact on native herbivores through the spread of toxoplasmosis. If infra-red camera monitoring indicates a high population of cats, assistance should be sought through the DPIPWE Cat Management Program.

Rabbits are present in neighbouring farms but do not appear to be a problem in the reserve which does not have any grassland communities.

Fire management

Stringybark wet forest vegetation community covers most of the reserve. This wet sclerophyll vegetation community has evolved in the absence of fire. The last fire in the reserve was in the 1940s when some logging also occurred, the vegetation has largely recovered. Frequent fires will eliminate ferny and broad-leaved understories, thereby converting wet forest to dry forest, and changing the balance of the whole ecosystem. Fire in wet forest can be dangerous because fuel levels are high, therefore the best strategy is to prevent external fires entering the reserve. This will require the consultation and cooperation with neighbours. The neighbouring property on the south boundary is a *Eucalyptus nitans* plantation that has been harvested. A 3-6m fire buffer maybe desirable but then a cleared buffer is a prime source of weed spread into the reserve. Further consultation with the land owner is required.

Track maintenance and pedestrian bridges

The map shows current tracks, proposed new tracks, and tracks requiring repair. Construction of steps is required along some steeper sections of these track, one place in particular definitely requires wooden steps. Timber from the washed away bridge could be used for constructing steps.

The map also shows proposed spots for seats and benches to enable visitors to relax and appreciate the natural environment.

The map shows two proposed new tracks, one to by-pass the washed-away pedestrian bridge, and the other to form a circuit link with a current track. If desired in the future there is a better site for a pedestrian bridge that is much higher above river levels than the previous washed-away bridge.

Poaching – giant freshwater crayfish

Ironically, removing blackberry infestation along the creek has made it easier for poachers. Erecting warning signs against poaching might alert the unscrupulous to the presence of the species. Any sightings of bait lines in the water, or baited ring nets should be reported to the authorities in DPIPW.

Facilities for visitors

- Improve signage to the Reserve so that visitors can easily find the carpark
- Improve information signage, including a map, at the parking area, the shelter hut, and may at key prominent spots along the track.
- The shelter and toilet are adequate
- Encourage visitors to be self sufficient and not to leave rubbish.
- Make the Reserve off limits to all domestic animals. Dogs can kill platypuses, and even on leads can disturb birdlife. This might not be popular with some visitors as dogs are currently allowed in the reserve. Horses and other herbivores introduce weeds in their droppings and destructively compact the soil.
- Prevent dirt-bike riders and other inappropriate users by having a strict policy of no motorised vehicles access and keeping the gate locked.

Information for visitors

- Produce a single page brochure describing the features of the reserve including a map with walking tracks, and a link to further detailed flora and fauna information. The pamphlet to be available through Wonders of Wynyard and the Council website.
- Erect suitable large sign at the carpark entrance with a detailed map and web address for further information. Update the information signage at the shelter hut.
- Develop an app that can be downloaded to a smart phone containing information on flora and fauna species and vegetation communities in the reserve. Signs with QR codes to be placed at appropriate locations throughout the Reserve, enabling the smart phone app to read the QR code and thereby provide information to the user. Frenchs Road Nature Reserve is in a valley and mobile phone reception is poor, so a downloadable app that contains the relevant information is preferred.
- The signs located in the Reserve with the QR codes, could also have some brief information together with images for the benefit of visitors without smart phones.

Education and research activities

- Setup infra-red wildlife cameras to monitor nocturnal mammals like spotted tailed quoll, Tasmanian devil, feral cats. The images would enable facial tumours of devils to be detected and monitored.

- Monitor birds by sight and sound or with automatic sound recorders, with a focus on uncommon, rare and threatened species.
- Monitor stream health by sampling and counting the presence/absence of specific aquatic invertebrates.
- Monitor the condition of large old trees and trees with hollows
- Record the presence of flora and fauna species and upload the information to the Natural Values Atlas
- Survey and identify orchid species. To facilitate taxonomic identification surveys must be undertaken when orchids are flowering, and different orchid species flower at different times of the year.
- Conduct guided tours 2-3 times per year that are open to the general public and lead by local field naturalists (Burnie Field Naturalists, Central North Field Naturalists)

Management guidelines to enhance biodiversity

1. Monitor condition of native vegetation with a focus on large, old trees and trees with hollows.
2. Leave fallen branches, logs, rocks and leaf and bark litter as shelter for fauna, as foraging and nest sites for birds, and as shelter & food sources for platypus and freshwater crayfish.
3. Continue to monitor birds by sight and sound and with automatic recorders with a focus on uncommon, rare and threatened species.
4. Monitor nocturnal fauna, spotted tailed quoll, Tasmanian devil, feral cats, with cameras.
5. Monitor stream health of Seabrook Creek with a focus on the Giant Freshwater Crayfish and platypus. The presence/absence of specific invertebrates is a good measure of stream health.
6. Continue to control invasive environmental weeds and restore habitat using local tree and understorey plant species.
7. Cease management activities during Spring and Summer (avian breeding season) that may cause nest desertion and interfere with breeding.
8. Secure the future viability of the Reserve by investigating the neighbouring properties with native vegetation. Including 4ha of the *Eucalyptus obliqua* dry forest, being used for farm timber, that is east of Seabrook Creek would provide a contiguous forest canopy and conserve the riparian vegetation along Seabrook Creek. Acquisition is one option, but encouraging the owner to place a covenant on the area maybe a more realistic option. The land to the west is also important in terms of contiguous habitat. Encouraging the owner to establish a conservation covenant is desirable.
9. Link the Reserve with existing riparian native vegetation and bush remnants along Seabrook Creek; and link the extended Seabrook Creek native vegetation corridor to the nearest large bush remnant in an adjacent catchment.

Attachments

- Vegetation Management – Anna Povey
- Birds – Richard Donaghey
- Platypus – James Macgregor
- Crayfish – Todd Walsh

Acknowledgements

Waratah-Wynyard acknowledge the assistance of Wynyard Landcare

Sustainability and Environmental Advisory Panel

AGENDA – 16 MAY 2023

Attachment 4: CCC NRM Management Plan

Central Coast Council

Draft Natural Resource Management Plan

MAY 2023

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ACKNOWLEDGMENT OF COUNTRY

The Central Coast Council acknowledges the palawa–pakana people as the Traditional Custodians of lutruwita (Tasmania), including the land, community, sea and waters where we live and work.

Our community respectfully acknowledges the Punnilerpanner tribe of the Northern Country of Tasmania, their continuing relationship to this land and their ongoing living culture.

We recognise that we have much to learn from the First Nations Peoples who represent one of the world’s oldest continuing cultures, and we pay our respects to Elders past and present and to all First Nations Peoples living in and around the Central Coast Community.

INTRODUCTION

The Natural Resource Management Plan was initiated through both the Greening Central Coast Strategy and the Central Coast Council Annual Plan 2021–2022 which identified the need for the development of a Natural Resource Management Plan with a focus on identifying at risk vegetation communities (including riparian areas), as well as conserving and enhancing areas within the municipality that are highly valued by its residents.

NRM in the Central Coast is about meeting the aspirations of the community and the Central Coast Council 10–year Strategic Plan to use and conserve our natural assets on Council owned and/or licenced/leased managed land. The NRM Plan is designed to align strategies, goals, and directions of other plans and specifically:

- Central Coast Council Strategic Plan 2014–2024
- Vegetation Management Policy 2019
- Greening Central Coast Strategy 2021
- Central Coast Municipal Weed Management Plan 2023

The aim of the NRM Plan is to provide a concise document which outlines nineteen identified sites for prioritised natural resource management in managing threats to protect environmental, social, cultural, and economic values over the course of the next three (3) years from 2023–2026.

This Plan also consolidates various site and/or vegetation management plans from throughout the municipality, many of which have not been recently updated. These plans are still relevant; most only partially implemented because they contain long–term objectives which remain applicable in most cases. These management plans were reviewed, and any current and ongoing actions have been brought forward as actions within each NRM Plan site. Please see Appendix A for the full list of referenced Management Plans.

Other plans, e.g., the Open Space and Recreation Plan 2012–2022 either include or focus on economic development and tourism, infrastructure and human amenity, recreation, and urban living. This Plan, however, is primarily concerned with long-term natural area management with consideration regarding more minor infrastructure such as beach paths, walking and vehicular access or benches, fences and viewing platforms to allow people to appreciate and engage with nature or merely pass through it with minimal impact.

The goal for this NRM Plan is that it can be readily accessed by anyone within the municipality for them to gather information regarding their local sites and what is being actioned in their area. The information presented should be simple to understand, however detailed enough to drive the considered actions to help positively conserve and enhance each NRM site.

Partnerships

Ongoing partnerships are integral in looking after the natural assets in the municipality and the Council welcomes the support and knowledge of many groups operating within Tasmania, and specifically the Northwest region. Central Coast Council partners with the Cradle Coast Authority NRM and Landcare Tasmania to provide ongoing support for local volunteer groups. Both organisations provide technical advice, support and grant funding to these important groups and Council assist with advocating for the protection of our natural assets. Council also partakes in advisory groups such as the Northwest Weeds Group and multi-municipality Council NRM Working Groups.

Central Coast Council encourages and will look to support ongoing citizen science and observation data in the municipality. Bird surveys and bandicoot trapping are some of the current data studies being conducted in the community and we will look to encourage any activities that will increase the ecological data in the municipality. These data surveys will be particularly important for the sites that rank low-medium in the Biodiversity Index as having species records will increase the priority of these sites.

Volunteer Groups

The Central Coast Council proudly supports and assists in facilitating works with multiple volunteer groups throughout the municipality. Many of these groups have been operational for decades and their dedication and efforts are greatly valued by the Council. These volunteer groups continue to undertake some incredible work to maintain and protect our beautiful dune and bush reserves, focusing on weed control, revegetation and cleaning up their natural areas.

While there are currently seven active groups within the community, it is noted that there have been other groups who have now disbanded that have also contributed greatly to the local community.

The active Council-supported volunteer groups are:

- Friends of East Buttons Beach
- Friends of Reid Street Reserve
- Friends of the Leven
- Riverside Rivercare
- Sulphur Creek/Preservation Bay Coastcare
- Turners Beach Coastcare
- Ulverstone Coastcare

Governing Legislation

The Central Coast Council is bound by and works under Legislation at both the National and State level. Council decisions within the NRM space are guided by the following overreaching Acts; the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the *Tasmanian State Threatened Species Protection Act 1995* and *Biosecurity Act 2019*.

The Tasmanian Planning Scheme provides the guidelines and zoning areas considered within the NRM Plan. Within this, the NRM Plan specifically evaluates areas zoned as 22.0 Landscape Conservation and 23.0 Environmental Management. It is noted that some sites cross into other layers such as 28.0 Recreation. Sites such as Buttons Beach or Bicentennial Park are zoned as Recreation, however border with an Environmental Management zone. These sites are considered under the NRM plan as they provide access into the Environmental Management zones. These sites are also important in the protection against NRM issues such as coastal erosion.

This NRM Plan aims to enhance the natural areas of the municipality in line with the above Acts and any additional relevant Legislation which can be found in Appendix B.

Revegetation Works

Any revegetation work undertaken as an action within the NRM Plan should be guided by best practice methods. Using native plant species and seedlings of local provenance is essential in obtaining better long-term success. Documents such as the Central Coast Local Planting Guide from the Cradle Coast NRM, and vegetation community information will provide a list of species that will be suitable in the applicable environment.

Consideration to the Biodiversity Index trigger species should be given to revegetate areas with species that will promote and enhance specific habitat, like that for the Eastern Barred Bandicoot.

VEGETATION MANAGEMENT

The positive values of vegetation include maintaining biodiversity, providing fauna habitat, erosion control, creating wind breaks, wildlife corridors, improving water quality, nourishing soil, inhibiting weed growth, storing carbon, improving visual amenity, and providing a sense of place.

Vegetation Management Framework



Vegetation Management Policy 2019

The Central Coast Council's Vegetation Management Policy is designed to support the Council's vision and strategic objectives to ensure that a high standard of vegetation management is achieved. The Policy is to also provide a consistent and sustainable approach towards the management of all vegetation within Council owned and managed land.

The purpose of this Policy is to set out guidelines for the management, maintenance, and preservation of vegetation on all Council owned and/or managed land.

The vegetation encompassed within the Policy includes but is not limited to; rural and urban trees, park and street trees, roadside vegetation, natural areas such as foreshore, inland and riparian reserves, perennial and annual gardens, grass and weed species.

Greening Central Coast Strategy 2021

The Greening Central Coast Strategy was initiated and developed from the Council's Annual Plan 2019/2020 that identified the strategic action to develop a Central Coast Tree Strategy. The Greening Central Coast Strategy is supported by the Vegetation Management Policy.

The vision of the Greening Central Coast Strategy is for an increase in the Green Infrastructure of the Central Coast municipality. The aspirational target of 30% canopy cover by 2030 will enhance the Central Coast's unique identity, landscape and lifestyle and will be delivered through key objectives including Enhancement, Identity, Landscape and Community.

Weed Management Plan 2023

The Weed Management Plan 2023 specifically covers weed management on Council managed land; owned and leased. The goals of the Central Coast Council's Weed Management Plan 2023 are:

- Responsibility for regional weed control is shared by all stakeholders and community.
- Weed management practices support healthy, diverse, and connected natural environments.
- Weed management support profitable, productive, and sustainable primary industries.
- Weed management is supported by coordinated, collaborative and innovative leadership.

METHODOLOGY

The adoption of the Tasmanian Planning Scheme by Central Coast Council and the introduction of the associated Natural Assets Code has led to the Council revising their approach for the management of biodiversity, particularly at the landscape scale.

Each NRM site will be given a total rating which encompasses multiple factors that have been considered. Each site's Biodiversity Index ranking is a maximum of four (4) points, while there are six additional factors each with a maximum of one (1) point, giving an overall site ranking out of ten (10) points.

This total rating will then order and prioritise sites of higher ecological and community value, to which the Council can be guided for budget and works allocation. This ranking will enable the Council to identify priority rehabilitation areas, guide site-specific restoration actions and determine where Council resources are best directed to achieve the most effective conservation outcomes.

Regional Ecosystem Model

The Regional Ecosystem Model (REM) was a landscape-level assessment which provided for the classification and ranking of relative conservation significance, landscape ecological function and management priority. This assessment system is attributed to Knight & Culler (2009, 2010).

The REM spatial analysis identifies:

- Native vegetation and threatened species and their relative conservation status and management priority.
- The characteristics of the landscape that may affect its ability to sustain these elements.

The REM data provides a basis for the Tasmanian Panning Scheme Priority Vegetation Area (PVA) and forms part of the Tasmanian Planning Scheme Natural Assets Code.

Natural Assets Code

The Natural Assets Code (NAC) provides consistency across the state of Tasmania for the protection of natural values and clarifies under what circumstances development can take place under the Tasmanian Planning Scheme. The NAC seeks to protect the ecological function of many natural areas such as waterways, shorelines, wetland, sand dunes and riparian areas. The NAC also applies to areas identified as comprising priority vegetation, protecting the habitats of important flora and fauna.

The Priority Vegetation Areas comprises seven attributes based on the Regional Ecosystem Model (REM). A description of these features is provided in Table 1 below:

Table 1: Tasmanian Planning Scheme Priority Vegetation Area Overlay– the Regional Ecosystem Model Features and Descriptions

Feature	Description
Threatened vegetation communities	Tasveg code for the threatened vegetation communities listed as threatened under the EPBC Act or Nature Conservation Act.
Threatened flora species	Derives entirely for the generic rule sets for threatened species habitat modelling from NVA records.
Threatened fauna species	Derived either from the generic rule sets for species habitat modelling from NVA records or more detailed species-specific models developed for each species.
Landscape dependent threatened fauna species	This class of species is for species whose habitat is very widespread (e.g., Tasmanian Devil, Spotted-tailed Quoll) for which no particular area may be sensitive. Within these areas there may be sites sensitive or significant sites, and these are modelled separately where data is available (e.g., known den sites of Devils and Quolls).
Relative reservation	Native vegetation communities that are <30% reserved in the bioregion.
Relative rarity	Native vegetation communities that have <2,000Ha mapped extent in the bioregion.
Remnant vegetation	Native vegetation polygons that are remnants (<200Ha) that occur on land components that have been more than 70% cleared of native vegetation.

Figure 1 below visualises the PVA for the entire Central Coast municipality. It is easy to distinguish areas of high biodiversity throughout the landscape against areas of lower biodiversity, or not triggered at all.

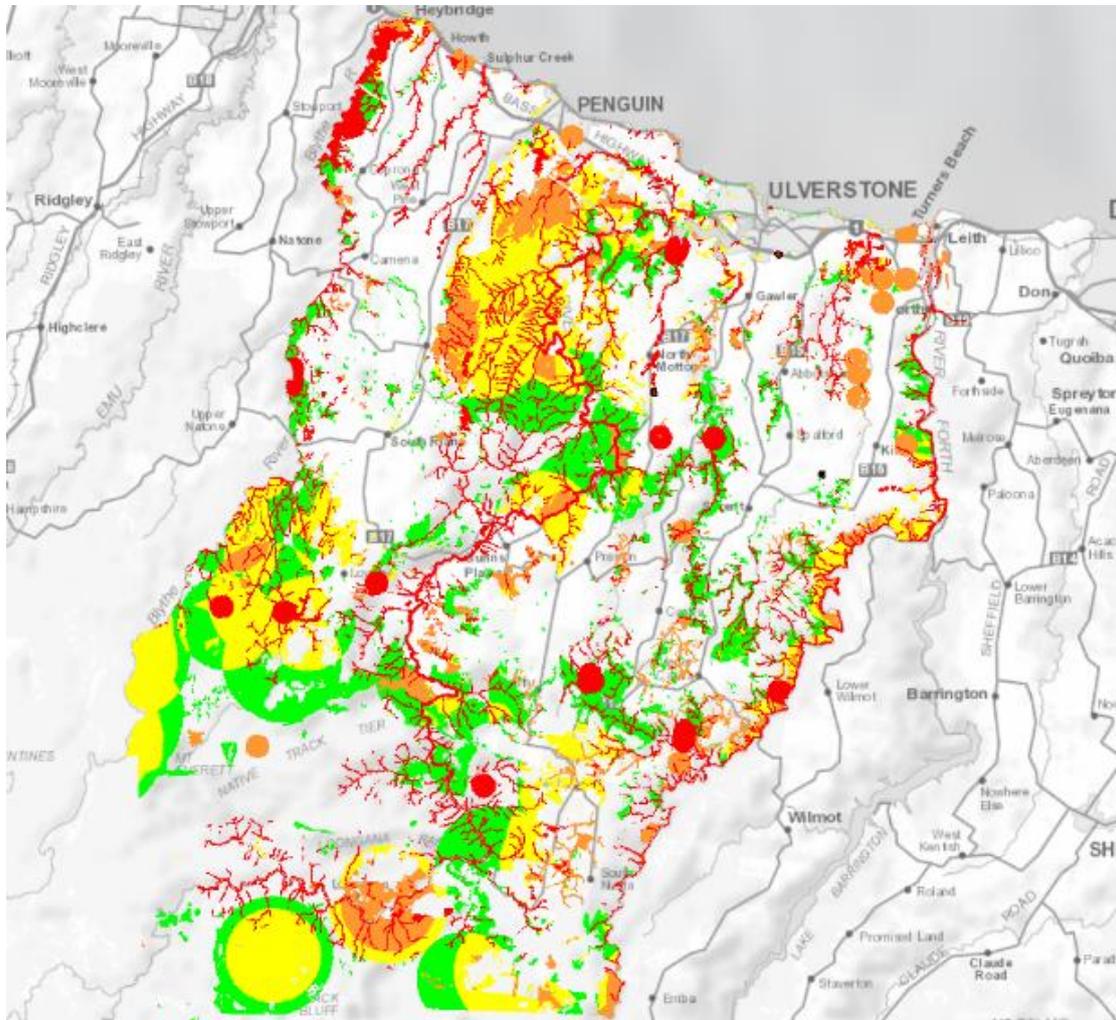


Figure 1: Central Coast Council Priority Vegetation Area Overlay – Biodiversity Index Rating

Central Coast Council Biodiversity Index

The concept of a Biodiversity Index originated through the development of the Greening Central Coast Strategy as Action 3.2 Establish a biodiversity index and apply to key Green Infrastructure areas.

It was through this process and the recently adopted Tasmanian Planning Scheme at Central Coast Council that overlaying PVA attributes in separate spatial layers showed certain areas of ecological ‘richness’ or differences in biodiversity. It was thought that a Biodiversity Index could be aligned using the PVA to visualise categories such as low, medium, and high to create the Biodiversity Index.

Central Coast Council engaged RMCG to assist in developing this NRM Plan formulating the criteria for the Biodiversity Index.

To enable prioritisation of the seven features from the State-wide Planning Scheme Priority Vegetation Area overlay, the features were split into two to recognise the level of current protection (i.e., species listed under State legislation, the Threatened Species Protection Act 1995 and the National Environmental Protection and Biodiversity Conservation Act 1999).

It was also identified that a fourth priority level ‘Very High’ was required in the matrix to distinguish between State and National listed species and to assist in the prioritisation of the number of landscape dependant threatened fauna species.

This resulted in ten Biodiversity Features and four levels of prioritisation in the matrix and the following rules were allocated:

- Any threatened native vegetation community, flora or fauna species record listed at the National level, is allocated a ‘Very High’ priority.
- Any threatened native vegetation community, flora or fauna species record listed at the State level, is allocated a ‘High’ priority.
- Landscape dependant threatened fauna species are prioritised based on the number of species recorded in each polygon. These records are based on modelled habitat suitability and ranging boundaries; therefore, the more landscape dependant species recorded the greater potential for the polygon to provide important habitat. 1 recorded species is allocated ‘Low’, 2 ‘Medium, 3 ‘High’ and 4 ‘Very High’.
- Relative reservation, relative rarity and remnant vegetation are prioritised based on a cumulative total of all three features i.e., if vegetation is recorded as having relative reservation only, it scores ‘Low’, if it is also remnant vegetation, it scores ‘Medium’, if all three, it scores ‘High’.

Table 2: Prioritisation Matrix of Biodiversity Features for the Biodiversity Index.

Biodiversity Feature	Biodiversity Index Priority			
	Low	Medium	High	Very High
Threatened native vegetation communities (TPSA – State)			>1	
Threatened native vegetation communities (EPBC – National)				>1
Threatened flora species (TPSA – State)			>1	
Threatened flora species (EPBC – National)				>1
Threatened fauna species (TPSA – State)			<1	
Threatened fauna species (EPBC – National)				<1
Landscape dependent threatened fauna species	<1 >	<2 >	<3 >	>3
Relative reservation Relative rarity Remnant vegetation	<1 >	<2 >	<3 >	

Application to Central Coast Municipality

The Biodiversity Index was applied to Central Coast Council managed/leased land using the below spatial layers:

- Land Tenure - land parcels owned by Central Coast Council.
- Leases - land parcels leased from Crown Land Services.
- Licences - land parcels under licence from Crown Land Services.

Some sites triggered by the Biodiversity Index have also not been included as they are classified as Local, District or Regional Parks and Reserves under the Open Space & Recreation Plan 2012. As a result, Bicentennial Park in the NRM Plan includes only the wetland and direct coastal area and not the entire park reserve area.

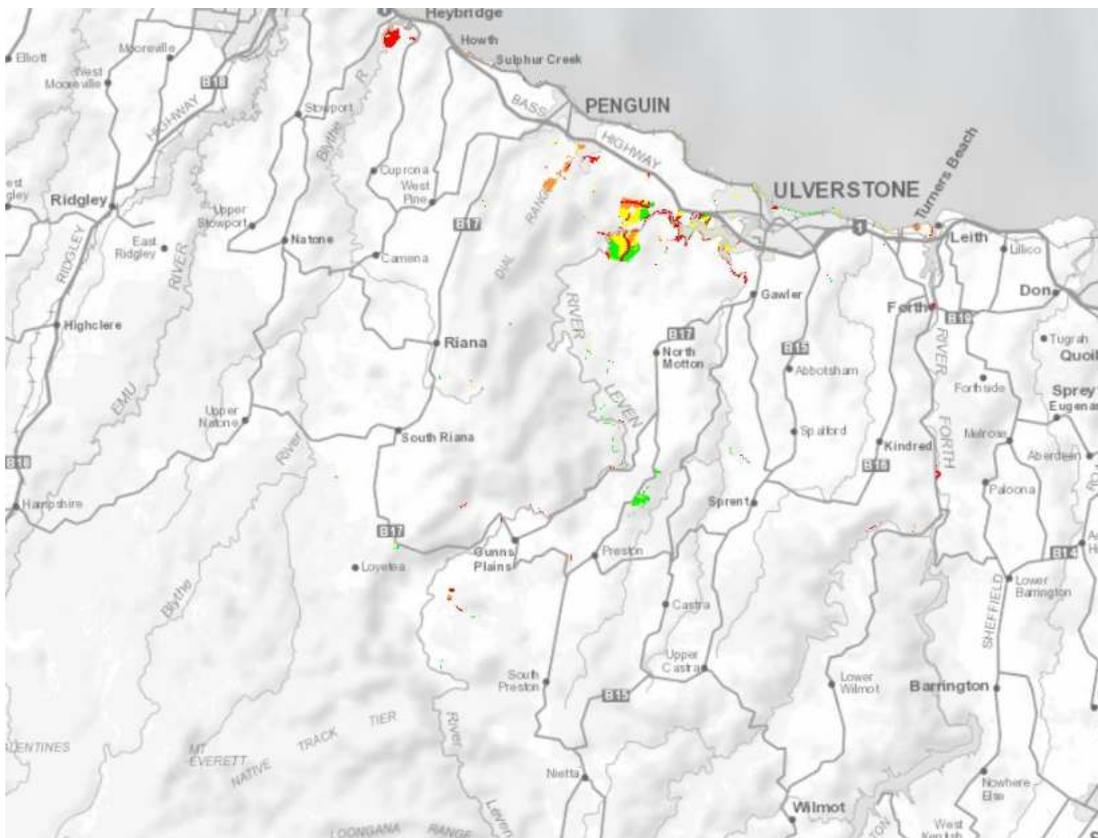


Figure 2: Central Coast Council Priority Vegetation Area Overlay – Biodiversity Index Rating applied to Council Managed Land

Within the Central Coast Council municipality, there is 36,577ha of vegetation mapped within the PVA Overlay. Within this, there is approximately 434 hectares of land that is being considered within the NRM Plan that is Council owned and/or managed land.

Additional Factors Considered

In addition to the Biodiversity Index which only considers the environmental values, cultural, social, and economic values also need to be considered. Two threats were also included, the invasion of weed species and erosion, given the high number of sites located within riparian and coastal areas.

These factors are both positive and negative influences on the overall ranking of each site and have been allocated a value accordingly. Each of these factors allocate a ranking score up to one (1) point as per the overview in Table 3 below:

Table 3: Biodiversity Index Additional Factors Considered Scoring Overview

Factors	Score				
	0	0.25	0.5	0.75	1
Cultural & Community Values	0 values	1–2 values	3–4 values	5–6 values	7 values
Weed Status	11+ species	8–10 species	4–7 species	1–3 species	0 species
Erosion Risk	Very high risk	High risk	Medium risk	Low risk	No risk
Volunteer Support	No group support	Sporadic group support	Potential group support	Regular group support	Monthly group support
Other native animals	0 species	1–2 species	3–4 species	5–6 species	7+ species
Current Investment	No NRM budget allocated	Over budget by 10%+	Over budget by up to 10%	Under budget	100% budget allocation expenditure

Cultural & Community Values:

Cultural and Community Values covers the common uses and interactions of the NRM sites by the public, both municipal residents and visitors. The sites which have a greater number of categories within this factor scored a higher value, resulting in the site receiving a higher overall ranking as these are valued by the community.

Each NRM site is required to have only one value in each of the seven categories below to score in this factor. Any sites that have multiple values within one category (e.g., multiple playgrounds) will receive the same score as those sites with a single value.

The Central Coast Council acknowledges the importance of Aboriginal cultural values and heritage within our municipality. In preparing this plan, the Council undertook a search of the Aboriginal Heritage Register (AHR) to identify Aboriginal Heritage sites that have been recorded within the boundaries of NRM locations captured by the plan.

The specific results of the AHR search are for research purposes only and not reproduced here, however, have been considered under Cultural & Community values.

Those categories that were considered include:

1. Formal beach/river/bushway access points.
2. Formal pedestrian walkways present (including the Shared Pathway).
3. Local business operations are present (Café, Kiosk, Caravan Parks, tourism).
4. Community facilities present (playgrounds, BBQ/picnic sites, public toilets).
5. Tourist features present (interpretive signage, lookouts, notable areas – Crown Reserves, geological sites).
6. Recreational activities undertaken by the community (swimming, fishing, boating etc.).
7. Recorded Aboriginal Heritage items.

Weed Status:

Through site inspections, the number of weed species sighted were considered at each site. The more weed species present within the site, the more resources are required for control/eradication and therefore negatively impacts the site. For this reason, an inverse scoring system has been applied whereby the higher the number of weed species present, the lower the score. Rather than considering the density of each infestation, each weed species will be considered to have the aim of control or eradication within the site plan. There are additional details on common weeds found in the municipality in the Central Coast Council Weed Management Plan 2023.

Erosion Risk:

The risk of erosion throughout the municipality is ever present and changing over time, whether it be beach, river, or sloping land environments. Erosion is evident at many beaches and river sites, especially following the 2022 floods. The Coastal Erosions Hazard Bands from the Coastal Hazards Report have been considered for climate change impacts. Where applicable, with other sites scored based on visual inspection. Again, an inverse scoring system has been applied, so the higher the risk of erosion, the lower the score received within the grading as this is a negative factor in the management of the site.

Volunteer Support:

The Central Coast Council has many volunteer groups throughout the municipality, but most of them are concentrated along coastal areas. Given the tremendous support that these groups provide to the areas and the community, the more active the group is, the higher the score given. Potential group support is considered where there are active community groups within the sites, however these are not necessarily NRM focused groups (e.g., North West Environment Centre or Cradle Coast Mountain Bike Club).

Other Priority Fauna Species:

This category considers the other priority animals in Central Coast municipality that are either otherwise protected or highly valued for conservation but are not included within the PVA of the Natural Assets Code. This includes known colonies or breeding areas of Little Penguins (*Eudyptula minor*) along the coastline as noted in the “Coastal Observed Fauna Habitat” layer in LISTMap. The “Shorebird and seabird breeding habitat and access recommendations” LISTMap layer was also considered in the protection of nesting resident shorebirds within the sites. This LISTMap layer reflects the conservation status of the six focal species under EPBC and TSPA legislation. The layer signals the risk/vulnerability of the bird breeding/nesting habitat to human-related disturbance during their breeding season (nominally 1 September to 31 March). The species included in this are:

- Hooded Plover (*Thinornis rubricollis*)
- Red-capped Plover (*Charadrius ruficapillus*)
- Australian Pied Oystercatcher (*Haematopus longirostris*)
- Sooty Oystercatcher (*Haematopus fuliginosus*)
- Fairy Tern (*Sternula nereis*)
- Little Tern (*Sternula albifrons*)

Current Investment:

Current Investment is a reflection on the allocated funding of each NRM site by Central Coast Council including expenditure as an average of the past two full financial years. Each site plan budget reflects the current 2022/2023 financial year budget allocation for each relevant site.

NRM site budgets can be further supported through alignment with weed management priorities from the Municipal Weed Management Plan 2023. This budget has not been included during this scoring as it would not be uniform annually.

Limitations

There are noted limitations to the Natural Assets Code PVA dataset as there has been a substantial amount of time since the PVA was last modelled. An NVA gap analysis was conducted from the date of the last run of the NAC to mid-2022 when the Council’s Biodiversity Index was developed, with no new species records to cause changes in the ratings.

Although the data may not be the most current available, the information sourced is trusted and legislated and gives a base as to build upon priority vegetation areas throughout the municipality. The Council would welcome future spatial remodelling of the REM to further collate up-to-date information contained within the NRM Plan.

If the NAC was to be updated it would be ideal for data contained within the shorebirds and penguin LISTMap layers to be included at the Biodiversity Index level, rather than a later consideration. Including this data at a NAC level will ensure that sites who currently rank lower in the Biodiversity Index factor may see an increase in the value allocated.

SITE RANKINGS

Each of the nineteen (19) sites have been evaluated and allocated a total score out of ten (10) as per the methodology. The sites are then ordered from the highest to lowest in their respective rating score, which provides clarity as to which sites are a Council priority for NRM works. A detailed breakdown of individual site scores is in Appendix C.

Table 4: Overall Site Rankings with All Factors Considered

Ranking	Site #	Location	Site Name	TOTAL RATING /10
1	1	Turners Beach	Forth River	8
2	9	Sulphur Creek	Sulphur Creek Beach East	7.5
3	2	Turners Beach	Turners Beach	7.25
4	6	East Ulverstone	Bicentennial Park	7
5	8	Preservation Bay	Preservation Bay Beach	6.75
	16	West Ulverstone	Reid Street Reserve	6.75
6	3	Ulverstone	Maskells Road	6.5
	10	Sulphur Creek	Sulphur Creek Beach West	6.5
7	19	Penguin	Dial Range	6.25
	4	East Ulverstone	Fishponds	6.25
8	13	West Ulverstone	Leven River	6
9	11	Ulverstone	Henslowes Road	5.5
10	7	West Ulverstone	West Ulverstone Beach	5.25
	12	West Ulverstone	Knights Road	5.25
11	18	West Ulverstone	Resource Recovery Centre	5
12	5	East Ulverstone	Buttons Beach	4.75
13	15	Ulverstone	Riverside Avenue	4.5
14	14	West Ulverstone	Amy Street	4
15	17	North Motton/Preston	Preston WTC	3.5

SITE PLANS

Following a site inspection, each NRM area has had a site plan developed as a concise overview of the following:

- Aerial imagery of the site.
- Biodiversity Index triggers.
- Description of the land, common uses, and any other relevant details.
- Ongoing maintenance actions – including weed species present.
- Suggested new future actions.
- Budget allocations.

These site plans are designed to give brief, targeted information on each site and create a clear guide to actions considered by the Council. Aligned with the ranking, these site plans will give strong guidance on what work is undertaken and the rationale behind prioritising one site over another.

SITE ONE: FORTH RIVER



Biodiversity Index Drivers	
Very High	<i>Lathamus discolor</i> – Swift Parrot
High	<i>Eucalyptus viminalis</i> – <i>Eucalyptus globulus</i> Coastal forest and woodland (DVC) <i>Dasyurus viverrinus</i> – Eastern Quoll <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Medium	N/A
Low	N/A

Description: Area (8.2ha)

The Forth River area is valuable and appreciated by residents for its native vegetation, which scores “Very High” in the site’s Biodiversity Index rating. Maintaining the native vegetation would be advantageous to draw tourism due to the high value of the native aesthetic, adjacent caravan park and formal access points to the beach. The area also contains multiple community facilities such as barbeque/picnic areas, public toilets, outdoor showers, a boat ramp, and carparks.

Weeds sighted seem to be sporadic in specific areas of the site and can be targeted directly for successful eradication. Other weeds such as Sea Spurge should have the intent to control infestations.

Erosion risk of the river is medium, most concern surrounding any flooding events in the future. There are obvious signs of dune erosion surrounding the point and further west along the beach, in particular underneath formal stair access points. While the high tide line is made up of majority small rock, the dunes are sand, also creating issues for the shorebirds in breeding season.

A boardwalk across the saltmarsh/wetland area has connected the Shared Pathway from Leith into Turners Beach with minimal disturbance on this sensitive tidal environment. Interpretive signage for the tidal saline sedgeland should be considered for further education of the area’s natural value.

The Leith section of the site will be a new lease taken over from Natural Resources & Environment Tasmania (NRE) for Council operations to manage this section of the Shared Pathway. Cape Ivy is a large problem in this area with infestations growing over the groundcover and up tree trunks, this should be controlled with an ongoing follow up plan to produce success.

The assistance of the Turners Beach Coastcare has been greatly appreciated in the ongoing maintenance and restoration of the area, including weed control and revegetation works. Current investment levels are good and have been utilised to assist the group in materials for weed control and revegetation efforts.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> Blue Periwinkle – <i>Vinca major</i> Bridal Creeper – <i>Asparagus asparagoides</i> Cape Ivy – <i>Delairea odorata</i> Mirror Bush – <i>Coprosma repens</i> Sea Rocket – <i>Cakile maritima</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	Agapanthus – <i>Agapanthus praecox ssp. orientalis</i> Fat Hen – <i>Chenopodium album</i> Scotch Thistle – <i>Onopordum acanthium</i>

- Provide technical support with the development of the Shared Pathway through Turners Beach
- Enhance existing vegetation through revegetation as required to further improve and solidify areas that have been degraded by vehicles and access tracks.
- Assess and improve all information signage including dog notifications, boat ramp and reserve signs.
- Continue to support and work with Turners Beach Coastcare in preserving, enhancing, and maintaining this area.
- Engage the community regarding responsible use of the coastal reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.
- Monitor encroachment issues with the OC Ling Caravan Park as well as residents.

New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Increase interpretational signage to raise awareness of the significance, natural attributes, and threats to both the beach landscape and the saltmarsh areas.
- Management of weeds such as Cape Ivy, Blue Periwinkle and Blackberry at Leith.
- Erosion management of the beach stair access at the intersection of the beach & Forth River.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$13,500
Capital Proposal	\$10,000

SITE TWO: TURNERS BEACH



Biodiversity Index Drivers	
Very High	N/A
High	<i>Accipiter novaehollandiae</i> - Grey Goshawk
Medium	<i>Acacia Longifolia</i> Coastal Scrub (SAL) <i>Perameles gunnii</i> - Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> - Tasmanian Devil
Low	N/A

Description: Area (8.5ha)

The Turners Beach site is highly utilised by the community and visitors due to the formal beach access and toilet facilities located close to this main strip of beach. While highly valued by the community, this site is very vulnerable to negative human effects with the proximity of residential houses to the native vegetation, particularly adjacent to the dune system.

The site ranks “High” in the Biodiversity Index as the surrounding dunes is ideal vegetation for species such as the Eastern Barred Bandicoot. Conserving the vegetation along the dunes will also assist in negating the effects of erosion from the ocean and enhance the area for shorebird breeding.

Weed infestations are quite large surrounding the caravan park and within the dune area north of Lethborg Avenue. The risk of garden escapes and community members inappropriately dumping garden waste is ever-present and will require ongoing monitoring.

The assistance of the Turners Beach Coastcare has been greatly appreciated in the ongoing maintenance and restoration of the area, including weed control and revegetation works. The current investment assists the group with their actions.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.

- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	African Daisy – <i>Dimorphotheca fruticosa</i> Blackberry – <i>Rubus fruticosus</i> Blue Periwinkle – <i>Vinca major</i> Bridal Creeper – <i>Asparagus asparagoides</i> Cape Ivy – <i>Delairea odorata</i> Scotch Thistle – <i>Onopordum acanthium</i>
Eradicate	Cotoneaster – <i>Cotoneaster species</i> Myrtle-leaf Milkwort – <i>Polygala myrtifolia</i> Radiata Pine – <i>Pinus radiata</i>

- Enhance existing vegetation through revegetation as required to further improve and solidify areas that have been degraded by vehicles and access tracks.
- Assess and improve all information signage including dog notifications, beach access and reserve signs.
- Continue to support and work with Turners Beach Coastcare in enhancing, preserving, and maintaining this area.
- Engage in the community regarding responsible use of the coastal reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.

New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$8,000
Capital Proposal	\$8,000

SITE THREE: MASKELLS ROAD



Biodiversity Index Drivers	
Very High	<i>Lathamus discolor</i> – Swift Parrot
High	N/A
Medium	<i>Acacia Longifolia</i> Coastal Scrub (SAL) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	N/A

Description: Area (5.4ha)

This site allows access to an area of beach that is not often frequented, however has public access points from Fairair Court and Maskells Road. While the beach is not frequently accessed, the Shared Pathway follows through the western section of the site, allowing pedestrian travel between Ulverstone to Turners Beach. The beach itself is bordered by two private landowners and the railway line, and the site lacks all other considered community and cultural values as well as volunteer support.

The dune areas are thin and will be prone to further erosion over time, also negatively impacting any shorebirds within the site. Ongoing revegetation within the frontal dunes will be required, alongside partnering with the bordering private landowners to continue this initiative. Gorse is a major inhibitor of the dune area, particularly north of Fairair Court where there are many large, mature plants. Other weeds are located along the coastline and should be controlled rather than attempting eradication.

The greenbelt along the Shared Pathway will continue to be revegetated with plant species that will survive the boggy conditions after high rainfall. This greenbelt will be used to screen the Shared Pathway from the industrial area coming west into Ulverstone to make the pathway more enjoyable to pedestrians. Ongoing plantings of species known to self-seed and expand will make this area more successful in the long-term rather than the current mowing and slashing that is required to maintain the site.

Current investment is lacking and is mostly utilised by the Works Depot for ongoing grass maintenance. A mix of Council staff and contractors is used for the open space area which has led to some damage to plants within the revegetation beds.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	African Daisy – <i>Dimorphotheca fruticosa</i> Blackberry – <i>Rubus fruticosus</i> Gorse – <i>Ulex europaeus</i> Sea Rocket – <i>Cakile maritima</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	N/A

- Enhance existing vegetation through revegetation as required to further improve and condense areas that have been degraded by vehicles and access tracks.
- Assess and improve all information signage including dog notifications, beach access and reserve signs, particularly at the northern point of Maskells Road.
- Engage in the community regarding responsible use of the coastal reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.

New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Development of new planting beds within the greenbelt to continue to expand this area as a natural screen from the industrial area.
- New planting areas in the coastal dunes to the north of 25 Maskells Road land.
- Large scale gorse control within the sand dune area.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$10,000
Capital Proposal	\$10,000

SITE FOUR: FISHPONDS



Biodiversity Index Drivers	
Very High	N/A
High	N/A
Medium	<i>Acacia Longifolia</i> Coastal Scrub (SAL) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	<i>Acacia Longifolia</i> Coastal Scrub (SAL) <i>Perameles gunnii</i> – Eastern Barred Bandicoot

Description: Area (6.9ha)

The Fishponds is a protected haven for shorebirds and penguins. Bird breeding habitat and access recommendations are to “avoid disturbance” from 01 September to 31 March at the Fishponds itself, while the remaining beach section is “minimise disturbance” during the same period. Avoid disturbance indicates that the area is of a higher risk and is more vulnerable to human-related disturbance than other coastal areas in the municipality during the breeding season. Erosion of the beach and dunes is not an immediate risk as the beach is mostly rocky and the vegetation behind is quite thick compared to other sections along the coastline.

The area includes a section of private, unoccupied land which is adjacent to the Council boundaries as well as three private residences to the south-east of the Fishponds. The residents of these houses form the volunteer group Friends of East Buttons Beach, who have focused on restoring the coastal dunes through weed and rubbish removal as well as revegetation works. The assistance of this group is greatly appreciated in maintaining and improving the area for the shorebirds and penguins to live and breed safely within the site. Current investment supports this groups’ actions in the environment.

The area allows beach access from the Beach Road U-turn area with an interpretational sign giving information on the site and its importance. The area does not contain any other considered cultural values. While access to the Fishponds via the beach is difficult, this provides improved safety for the shorebirds resulting in less foot-traffic and disturbance. Any additional formal access points should be avoided to protect this area from foot traffic.

Weeds found on site are mostly a result of the surrounding private land being in a less-than-desirable state with weeds and scrap materials scattered throughout. There are many species being controlled within the site. There have been previous issues with dogs and other animals targeting and killing penguins and other native animals in the area.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Scotch Thistle – <i>Onopordum acanthium</i> Sea Rocket – <i>Cakile maritima</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	Radiata Pine – <i>Pinus radiata</i> Red Hot Poker – <i>Kniphofia uvaria</i> Swan Plant – <i>Gomphocarpus physocarpus</i> Wild Mignonette – <i>Reseda lutea</i> Willow – <i>Salix spp.</i>

- Enhance existing vegetation through revegetation as required to further improve and solidify areas that have been degraded by vehicles and access tracks.
- Assess and improve all information signage including shorebird information, dog notifications, and reserve signs.
- Continue to support and work with the Friends of East Buttons Beach in preserving and maintaining this area.
- Engage the community regarding responsible use of the coastal reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.

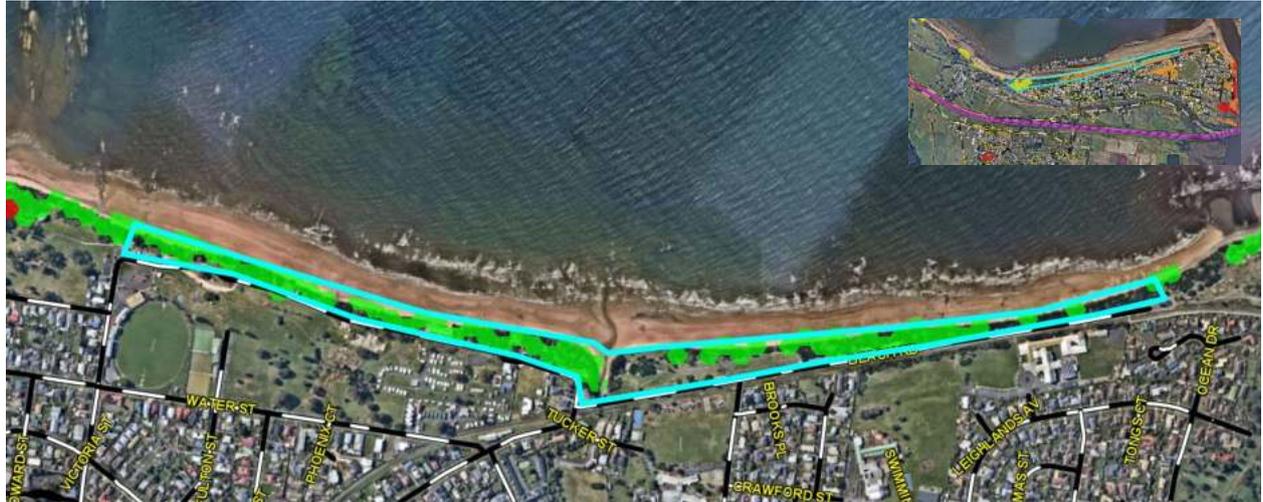
New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Close any informal vehicle access points with large temporary rocks and revegetate any closed tracks to prohibit access.
- Reinforce Little Penguin habitat by installing and maintaining penguin boxes as vegetation is sparse in headland areas of the Fishponds. This will provide stronger cover and protection for the penguins.
- Propose Council to purchase the land at 29 Beach Road, Ulverstone should the property come on the market. This land should be rehabilitated and utilised to protect this area.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$2,500
Capital Proposal	\$8,000

SITE FIVE: BUTTONS BEACH



Biodiversity Index Drivers	
Very High	N/A
High	N/A
Medium	N/A
Low	<i>Acacia Longifolia</i> Coastal Scrub (SAL) <i>Perameles gunnii</i> – Eastern Barred Bandicoot

Description: Area (9.7ha)

Although rating as “Low” in the Biodiversity Index, this site highly utilised by the community for beach access due to several factors such as dog on-leash areas, the surf club and café facilities. The area adjoins Fairway Park which also contains multiple community facilities such as play equipment, skate park, barbeque/picnic areas, and carparks.

A large weed infestation of Cape Ivy particularly west of Buttons Creek is known; however large volumes of work have already been undertaken to control this species. Other species are sporadic throughout the area and can be controlled and eradicated with a controlled approach.

Erosion risk from both tides and foot traffic are issues with the current vegetation levels fluctuating between sections of wide vegetation and narrow vegetation. Closure and formalisation of beach access will assist with the erosion due to increased foot traffic.

Current investment has been to control weed species, provide technical advice to the development of the Shared Pathway through the site as well as revegetate the dunes along the finished pathway. A large capital budget has assisted with the Beach Road Coastline Expansion project as well as multiple maintenance budgets under NRM.

The assistance of the Ulverstone Coastcare has been greatly appreciated in the ongoing maintenance and restoration of the area, including weed control and revegetation surrounding Buttons Creek.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations and vandalism.

- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Bridal Creeper – <i>Asparagus asparagoides</i> Cape Ivy – <i>Delairea odorata</i> Fat Hen – <i>Chenopodium album</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	Agapanthus – <i>Agapanthus praecox ssp. orientalis</i> Scotch Thistle – <i>Onopordum acanthium</i> Stinging Nettle – <i>Urtica urens</i>

- Provide technical support with the development of Shared Pathway along Beach Road, Ulverstone.
- Enhance existing vegetation through revegetation as required to further improve and solidify areas that have been degraded by vehicles and access tracks.
- Assess and improve all information signage including dog notifications and reserve signs.
- Continue to support and work with Ulverstone Coastcare in enhancing, preserving, and maintaining this area.
- Engage the community regarding responsible use of the coastal reserve and impacts of such activities as the dumping of garden waste, responsible pet ownership and the use of formalised tracks to access the beach as necessary.

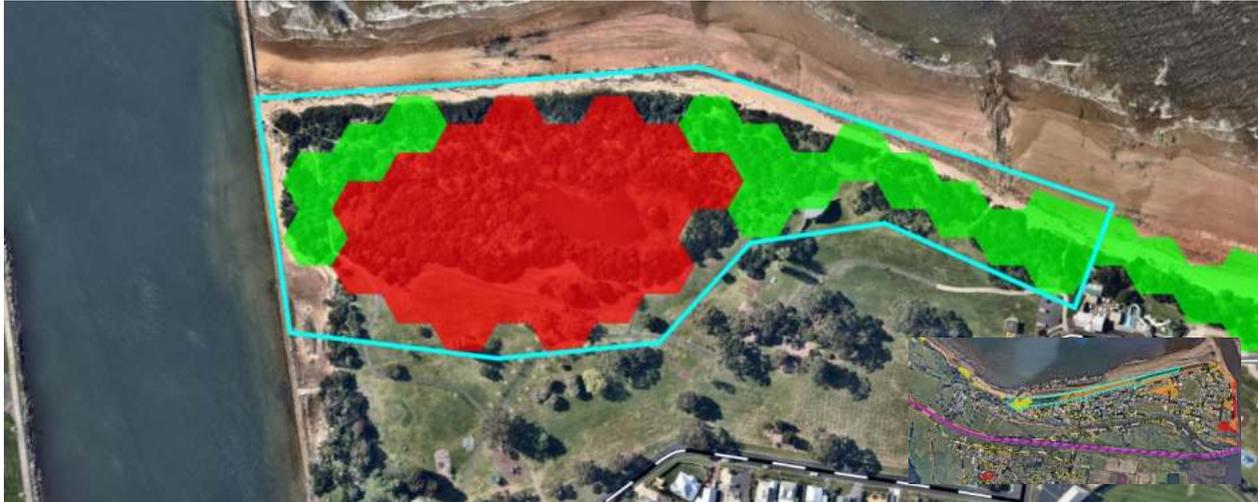
New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Increase interpretational signage to raise awareness of the significance, natural attributes, and threats to both the beach landscape.
- Install further fencing surrounding the dunes at the overflow caravan park to reinforce the use of formal access paths and allow the vegetation to regenerate naturally.
- Erosion management of the beach stair access.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$11,000
Capital Proposal	\$12,000

SITE SIX: BICENTENNIAL PARK



Biodiversity Index Drivers	
Very High	<i>Limonium australe var. australe</i> – Yellow Sea-Lavender <i>Perameles gunnii</i> – Eastern Barred Bandicoot Succulent saline herbland (ASS)/Saltmarsh (undifferentiated) (AUS)
High	N/A
Medium	N/A
Low	<i>Acacia longifolia</i> Coastal Scrub (SAL)

Description: Area (5.7ha)

This site is also covered within the Central Coast Council’s Parks & Open Spaces Plan 2023. The NRM Plan will cover the immediate coastal dunes and pond area only as pictured.

The area is highly utilised by the community with the dog beach area and adjacent café, parkland, and river mouth. The Ulverstone Soundshell provides an area for larger community events such as Christmas Carols. There are one or two informal camps in the coastal zone with ongoing issues of youths damaging the vegetation.

Cape Ivy infestations are an ongoing issue that has previously been managed with eradication zones approximately 180m east of the Leven River. Controlling Cape Ivy should be prioritised before any further revegetation projects occur. Erosion risk in the thinner areas of vegetation as well as the lack of volunteer support cause issues in the ongoing maintenance and care of the area.

Mirror Bush is an issue within the Nature Trail track both along the track and further into the bushland, this includes larger canopies and smaller seedlings of the weed. In March 2023 control methods including ringbarking and cut & paste were completed to kill off the mature plants and any visible seedlings. Follow-up efforts for the next 1–2 seasons should include controlling re-growth before revegetation is considered at groundcover level.

As the site is rated “Very High” in the Biodiversity Index, there is scope in the long-term to actively improve and increase biodiversity which is particularly important as this site has good habitat values for Eastern Barred Bandicoot and potential habitat for other fauna. Fieldwork undertaken in September 2022 showed Eastern Barred Bandicoots are present within the site. Revegetation works should be based around species that will support the habitat for the Bandicoot and other similar animals.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Bridal Creeper – <i>Asparagus asparagoides</i> Cape Ivy – <i>Delairea odorata</i> Mirror Bush – <i>Coprosma repens</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	African Daisy – <i>Dimorphotheca fruticosa</i> Myrtle-leaf Milkwort – <i>Polygala myrtifolia</i>

- Enhance existing vegetation through revegetation as required to further improve and solidify areas that have been degraded by vehicles and access tracks. Consideration should be first given to controlling the Cape Ivy within the site, then revegetating with the aim of improving the habitat for the Eastern Barred Bandicoot.
- Assess and improve all reserve signage including beach access and reserve signs.
- Maintain the informal track/ “Nature Trail” through the scrub to ensure that vegetation is not damaged from use.
- Education of residents regarding pet control, impose control measures and increase signage e.g., dogs on leash areas.

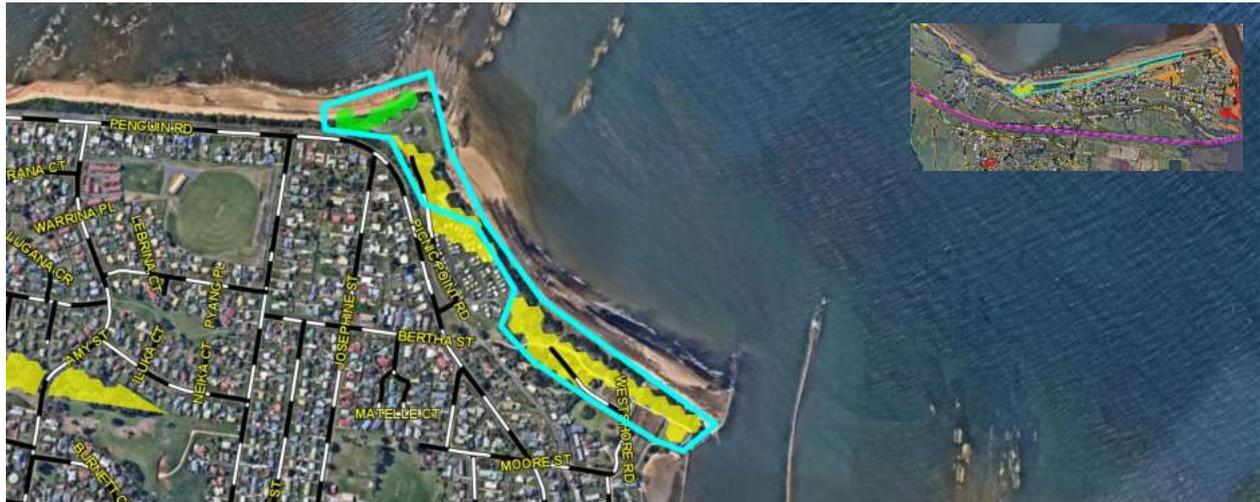
New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Revegetate any side tracks from the Nature Trail to prevent further access to the beach through the dunes.
- Increase interpretational signage to raise awareness of the significance, natural attributes, and threats to both the beach landscape and the saltmarsh areas.
- Sustainably re-establish the tidal pond with consideration of continual flow and reconstruct an appropriate viewing point. Maintain current vegetation and implement revegetation as appropriate.
- The area from the Ulverstone Soundshell to the Café should be considered first for out fill revegetation works as this is the thinnest vegetation within the site.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$8,000
Capital Proposal	\$50,000

SITE SEVEN: WEST ULVERSTONE BEACH



Biodiversity Index Drivers	
Very High	N/A
High	N/A
Medium	Coastal Scrub (SSC)
Low	<i>Acacia longifolia</i> Coastal Scrub (SAL)

Description: Area (7.9ha)

This site area has undergone upgrades alongside the Central Coast Shared Pathway project. Upgrades include re-surfacing pedestrian walkways, upgrading formal beach access tracks with boardwalk, parking facilities and playground equipment. The area is highly recreational with the two caravan parks, tennis club and playground adjacent to the Leven River. While the recreational value is high, the lack of volunteer support is evident in the degraded vegetation.

Weed infestations are large and control continues to be an issue with many species in particular Cape Ivy, Blackberry and Bridal Creeper. Ongoing weed control efforts should be planned and targeted to be successful. Marram Grass is known to be naturalised within the dunes. Like other coast sites, erosion is present and a high risk, causing issues for the shorebirds and penguins in the area.

Little penguins are noted to breed in the dune areas, particularly behind the Apex Caravan Park. The penguins have been noted to enter the caravan park which should be avoided to minimise interactions with humans. A penguin fence should be considered in this instance, however, may not be practical as this may prevent other animals from passing through the area.

The current investment in the site is being fully utilised, however there would need to be large capital and an increase in ongoing maintenance budgets to clean up the area of weeds.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	African Daisy – <i>Dimorphotheca fruticosa</i> Blackberry – <i>Rubus fruticosus</i> Black Nightshade – <i>Solanum opacum</i> Bridal Creeper – <i>Asparagus asparagoides</i> Cape Ivy – <i>Delairea odorata</i> Scotch Thistle – <i>Onopordum acanthium</i> Sea Rocket – <i>Cakile maritima</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	Caper Spurge – <i>Euphorbia lathyris</i> Mirror Bush – <i>Coprosma repens</i>

- Ongoing revegetation works to restore burnt and weedy areas will assist with habitat connectivity and better utilise the area for penguin habitat and weed suppression.
- Assess and improve all reserve signage including beach access and reserve signs.
- Education of residents regarding pet control, impose control measures and increase signage e.g., dogs on leash areas.

New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Reinforce the Little Penguin habitat and consider the need for artificial penguin burrows across the site, especially surrounding the caravan parks to reduce the risk of penguins entering the park and being disturbed.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$1,000
Capital Proposal	\$5,000

SITE EIGHT: PRESERVATION BAY BEACH



Biodiversity Index Drivers	
Very High	<i>Lathamus discolor</i> – Swift Parrot <i>Prototroctes maraena</i> – Australian Grayling
High	N/A
Medium	<i>Acacia longifolia</i> Coastal scrub (SAL) <i>Perameles gunnii</i> – Eastern Barred Bandicoot Remnant Vegetation <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	N/A

Description: Area (9.0ha)

This site rates high on cultural values as it is a sheltered, patrolled swimming beach with the Penguin Surf Life Saving Club located at this beach. The Shared Pathway follows both the railway line and road, inland of the dunes providing high foot-traffic through the coastal strip.

Preservation Bay/Sulphur Creek Coastcare have previously undertaken a tremendous amount of work to get weeds such as Sea Spurge under control. However, this group now undertake working bees a couple of times a year within this site, focusing on the Hall Point end of the coastline.

There are some points within the dunes that have had informal clearing and seemingly used for camping that should be revegetated to reduce the effects of adjacent erosion that is evident from both the beach and the spillway from under the road. Revegetation of the dunes should be considered a high priority due to erosion on the beach. With consideration of the railway line, road, and adjacent residential houses, solidifying of the frontal dunes will be effective in maintaining what is left of the land mass for high tides, as well as creating more breeding grounds for the shorebirds.

There is no current NRM budget allocation for works, however other overarching budgets may be utilised within the site for weed control.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	African Daisy – <i>Dimorphotheca fruticosa</i> Cape Ivy – <i>Delairea odorata</i> Gazania – <i>Gazania rigens</i> Sea Spurge – <i>Euphorbia paralias</i>
Eradicate	Fennel – <i>Foeniculum vulgare</i> Scotch Thistle – <i>Onopordum acanthium</i>

- Ongoing revegetation works to maintain the frontal dunes and help erosion control.
- Assess and improve all information signage including beach access and reserve signs.
- Education of residents regarding pet control, impose control measures and increase signage e.g., dogs on leash areas.

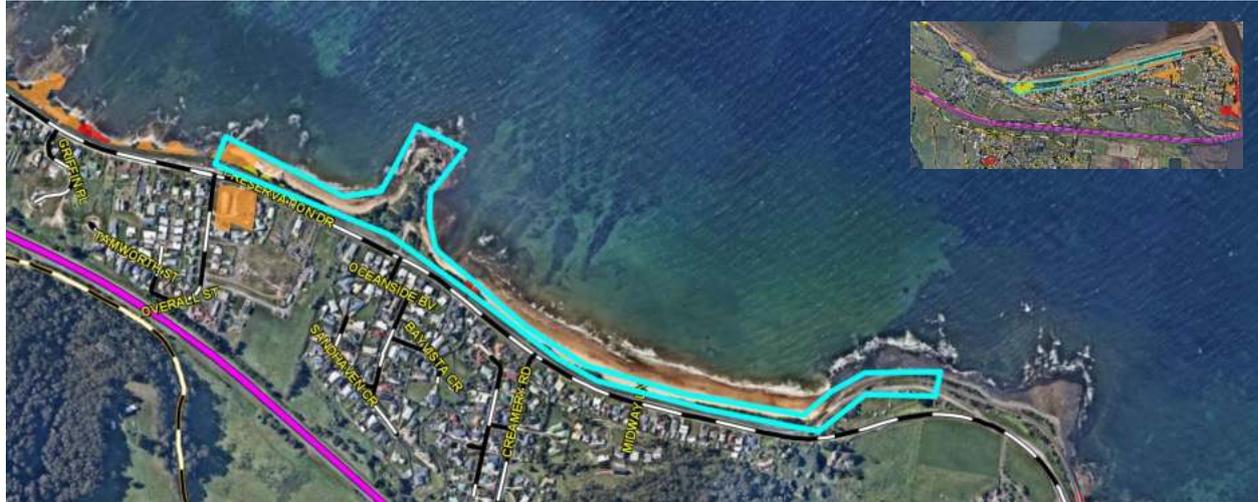
New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Weed management and revegetation of the waterway and surrounds opposite 100 Preservation Drive to prevent further erosion of the dunes in this area.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$1,000
Capital Proposal	\$5,000

SITE NINE: SULPHUR CREEK BEACH EAST



Biodiversity Index Drivers	
Very High	<i>Prototroctes maraena</i> – Australian Grayling
High	<i>Accipiter novaehollandiae</i> – Grey Goshawk Coastal scrub (SSC) <i>Perameles gunnii</i> – Eastern Barred Bandicoot
Medium	<i>Coastal scrub (SSC)</i> <i>Perameles gunnii</i> – Eastern Barred Bandicoot
Low	N/A

Description: Area (7.1 ha)

This site rates highly on cultural values and is utilised by the public for beach access, access to the shared pathway and community facilities at Hall Point including parking and picnic benches.

Cape Ivy control is a high priority due to the large percentage of coverage already occurring over the native species, which provide coverage for penguin habitat. Control efforts are ongoing including the use of heavy mulch and hand removal by Sulphur Creek/Preservation Bay Coastcare members. The assistance of the Sulphur Creek/Preservation Bay Coastcare group has been greatly appreciated in the ongoing maintenance and restoration of the area, including weed control.

The elevated headland remains as good habitat for penguin populations. Previous recommendations have been adopted in recent times with penguin nesting boxes installed. These have been shown to be successfully adopted and utilised by the local penguin population through the 2022/2023 breeding season. In early 2023 however there have been instances of negative human interaction towards penguins and they have showed signs of neuro-functional declines.

Erosion control is an ongoing issue with the dunes receding close to the railway lines with previous control efforts not providing long-term success. Reduction in the beach and dunes will result in potential breeding habitat loss for shorebirds as well as increased risk to assets such as the railway, Shared Pathway, and carparks at Hall Point.

Capital investments have greatly assisted the rehabilitation of the Hall Point area in returning the area to penguin-friendly habitat after previous uses of dumping rubbish. Ongoing maintenance of initial weed control measures are being bolstered by the Weed Management budget as well as maintenance budgets for the site.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> Blue Periwinkle – <i>Vinca major</i> Cape Ivy – <i>Delairea odorata</i> Fat Hen – <i>Chenopodium album</i> Kikuyu Grass – <i>Pennisetum clandestinum</i> Scotch Thistle – <i>Onopordum acanthium</i> Sea Rocket – <i>Cakile maritima</i>
Eradicate	African Boxthorn – <i>Lycium ferocissimum</i> Black Nightshade – <i>Solanum opacum</i> Cumbungi – <i>Typha latifolia</i>

- Protect and enhance areas of excellent and good native vegetation and penguin habitat.
- Ongoing revegetation works to maintain the frontal dunes and current vegetation to help erosion control.
- Assess and improve all to signage including special values of the area, access, and reserve signs.
- Continue to support and conduct research on native wildlife in the area using counting, observations, and trapping where appropriate.
- Education of residents regarding pet control, impose control measures and increase signage e.g., dogs on leash areas.

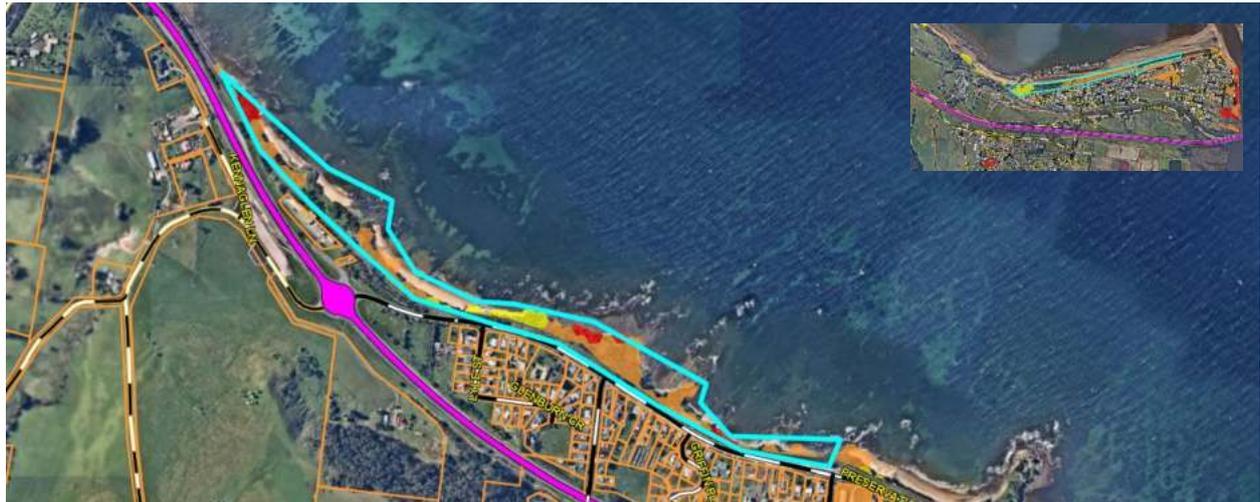
New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Reinforce the Little Penguin habitat:
 - o Additional penguin fencing especially along the railway line to reduce the risk of penguins entering the rail or roadways.
 - o Regular maintenance checks and works to ensure fencing is secure and cannot be breached.
 - o Additional artificial penguin burrows across the length of the site could improve habitat across the site.
- Develop possibilities and consideration for the old railway station platform to be reutilised- perhaps community initiative – e.g., Penguin information centre, caring for our coast information, interaction along the Shared Pathway
- Formalise signage in place at Hall Point, include Central Coast Council logo.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$5,000
Capital Proposal	\$10,000

SITE TEN: SULPHUR CREEK BEACH WEST



Biodiversity Index Drivers	
Very High	<i>Accipiter novaehollandiae</i> – Grey Goshawk Coastal scrub (SSC) <i>Lathamus discolor</i> – Swift Parrot <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Prototroctes maraena</i> – Australian Grayling <i>Sarcophilus harrisii</i> – Tasmanian Devil
High	<i>Accipiter novaehollandiae</i> – Grey Goshawk Coastal scrub (SSC) <i>Dasyurus vuverrinus</i> – Eastern Quoll <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Medium	Coastal scrub (SSC) <i>Dasyurus vuverrinus</i> – Eastern Quoll <i>Perameles gunnii</i> – Eastern Barred Bandicoot
Low	N/A

Description: Area (10.3ha)

This area is mostly utilised for the boat ramp and carpark at the Highway Halt take-away shop (also known as “Dunkies”). Signage at the boat ramp carpark educates visitors about the Sulphur Creek Geological Site. The vegetation in the immediate carpark area is of good health and provides multiple levels of native vegetation including shrubs and ground cover, Bower Spinach (*Tetragonia implexicoma*) is particularly thick within the area.

The weeds sighted at the boat ramp carpark are being actively controlled and have reduced in number, thanks to initial and follow up efforts. This area should be of high priority to control weeds due to the area being highly trafficked by vehicle and foot. The area approximately 50m west of the carpark, however, is extremely infested with weeds. Many species of weed, including Arum Lily, Hemlock, and other garden varieties, are found and provide complete ground cover over this area. This area will require a large initial effort and continual follow up to have successful control.

There is evidence of shorebird and Little Penguin activity throughout the area and this habitat should be considered before doing any works on revegetation or weed control. Previous budgets for the implementation of penguin fencing have assisted, however more funds would be required to extend this and maintain accordingly.

The assistance of the Sulphur Creek/Preservation Bay Coastcare group has been greatly appreciated in the ongoing maintenance and restoration of the area, including weed control.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Arum Lily – <i>Zantedeschia aethiopica</i> Blue Periwinkle – <i>Vinca major</i> Cape Ivy – <i>Delairea odorata</i> Fat Hen – <i>Chenopodium album</i> Kikuyu Grass – <i>Pennisetum clandestinum</i> Scotch Thistle – <i>Onopordum acanthium</i> Sea Rocket – <i>Cakile maritima</i>
Eradicate	African Boxthorn – <i>Lycium ferocissimum</i> Agapanthus – <i>Agapanthus praecox ssp. orientalis</i> Black Nightshade – <i>Solanum opacum</i> Mirror Bush – <i>Coprosma repens</i>

- Protect and enhance areas of excellent and good native vegetation and penguin habitat.
- Ongoing revegetation works to maintain the frontal dunes and current vegetation to help erosion control.
- Assess and improve all to signage including special values of the area, access, and reserve signs.
- Continue to support and conduct research on native wildlife in the area using counting, observations, and trapping where appropriate.
- Education of residents regarding pet control, impose control measures and increase signage e.g., dogs on leash areas.

New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Reinforce the Little Penguin habitat:
 - o Additional penguin fencing especially along the railway line to reduce the risk of penguins entering the rail or roadways.
 - o Regular maintenance checks and works to ensure fencing is secure and cannot be breached.
 - o Additional artificial penguin burrows across the length of the site could improve habitat across the site.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$5,000
Capital Proposal	\$10,000

SITE ELEVEN: HENSLOWES ROAD



Biodiversity Index Drivers	
Very High	<i>Astacopsis gouldi</i> – Giant Freshwater Crayfish <i>Ceyx azureus supsp. diemenensis</i> – Tasmanian Azure Kingfisher <i>Eucalyptus viminalis</i> – Wet Forest (WVI) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Prototroctes maraena</i> – Australian Grayling <i>Sarcophilus harrisii</i> – Tasmanian Devil
High	<i>Eucalyptus viminalis</i> – Wet Forest (WVI) <i>Perameles gunnii</i> – Eastern Barred Bandicoot Remnant vegetation <i>Sarcophilus harrisii</i> – Tasmanian Devil
Medium	<i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	N/A

Description: Area (36.1 ha)

This site includes the Old Nietta Railway Reserve, Henslowes Park and the banks of the Gawler River which is under Crown Licence. The site does not include the Gawler River waterway. Henslowes Park features a well-maintained track out and around the headland with excellent vegetation and minimal weed infestations.

Despite being a historical point of interest, this site is mostly used by nearby residents only and with no volunteer group support has been largely unmaintained until recent years. Sheltered from the nearby Bass Highway, the path is secluded by large Eucalypts dominating the canopy with good scrub species sighted down the steep riverbanks. Promoting the natural and historical values of the area, as well as involving the residents in the weed control and revegetation programs could lead to an increased awareness of the importance of this area, this may lead to further community volunteer support in the area.

Previous issues include private landowner encroachment, illegal dumping of garden waste and removal of trees as well as foot traffic on informal tracks creating erosion issues. Ongoing weed control efforts have been focused on the riverbank side of the reserve path, however weed control is difficult on the residential side of the pathway.

The close vicinity of flourishing gardens is providing an ongoing source of introduced species into the adjacent bushland. Landowner co-operation is important for the ongoing regeneration of the bushland and weed control effort success.

Revegetation works on the riverbank has been mostly successful, with some areas obviously more wet than others, requiring little intervention regarding ongoing watering. Since weed control has begun, natural regeneration is occurring within the site.

Recent investment has driven initial weed control works and revegetation down towards the river level to help to stabilise the riverbanks beneath the slopes.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	African Daisy – <i>Dimorphotheca fruticosa</i> Arum Lily – <i>Zantedeschia aethiopica</i> Bamboo – <i>Bambusa species</i> Blackberry – <i>Rubus fruticosus</i> Forget-me-not – <i>Myosotis sylvatica</i>
Eradicate	Agapanthus – <i>Agapanthus praecox ssp. orientalis</i> Mirror Bush – <i>Coprosma repens</i> New Zealand Flax – <i>Phormium tenax</i> Sweet Pittosporum – <i>Pittosporum undulatum</i>

- Undertake ongoing revegetation works to maintain the riparian vegetation at riverbank level and current vegetation on site, which will assist with erosion control within the riparian zone.
- Engage the community regarding responsible use of the coastal reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.

New Capital Actions:

- Rationalise the number of required tracks to the river level. Several informal tracks can be closed and create one or two formal and maintained tracks that will reduce the risk of further erosion and trampling of vegetation.
- Conduct erosion control on the steep slopes where weed control has begun.
- Consider further research activities to help promote the diversity and importance of this strip of natural bushland e.g., Bird surveys, bandicoot counting.
- Flyers and interpretive signs could be produced to increase appreciation of the natural and historical values of the site.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$6,000
Capital Proposal	\$12,000

SITE TWELVE: KNIGHTS ROAD



Biodiversity Index Drivers	
Very High	<i>Astacopsis gouldi</i> – Giant Freshwater Crayfish <i>Ceyx azureus supsp. diemenensis</i> – Tasmanian Azure Kingfisher <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Prototroctes maraena</i> – Australian Grayling <i>Sarcophilus harrisii</i> – Tasmanian Devil
High	N/A
Medium	<i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	<i>Perameles gunnii</i> – Eastern Barred Bandicoot

Description: Area (10ha)

This land was purchased by Council from a private owner due to dust issues from the adjacent Batten Park/Rodeo Association grounds. The house in the south-west of the site is leased privately to a tenant with vehicle access from Knights Road only. There is a fire trail north of the house which is held only as an emergency exit from Batten Park. There is an approximate 40m elevation gain from the river/house area to the top of the hill adjacent to the highway. The unsealed driveway is to the east of the rise and is mostly flat.

Despite not being regularly maintained or funded by Council, the surrounding bushland is in very good condition – dry eucalypt forest dominates the canopy, and a variety of understory and groundcover species occurs throughout. There were no formal tracks found within the bushland itself or down to the Leven River from the house where Swamp Paperbark (*Melaleuca ericifolia*) is dominant.

There is good birdlife heard throughout the site and could be a target area for ongoing bird and wildlife surveys in conjunction with research groups. The site should be left as untouched as possible, however the requirement for a small number of tracks to safely undertake research should be considered.

There is a non-native garden immediately surrounding the house which has several garden species of weeds. This area is to be managed by the private tenant as per their lease agreement.

Weed management should focus on the mature and seedling Radiata Pine throughout the site and weed/garden waste dumping at the entrance. Monitoring of the northern edges for weed encroachment from the highway should be a priority.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> Radiata Pine – <i>Pinus radiata</i>
Eradicate	Blackberry – <i>Rubus fruticosus</i> Cotoneaster – <i>Cotoneaster species</i> English Ivy – <i>Herea helix</i> Mirror Bush – <i>Coprosma repens</i> Radiata Pine – <i>Pinus radiata</i> Sweet Pittosporum – <i>Pittosporum undulatum</i>

- Engage tenants regarding responsible use of the bushland and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.

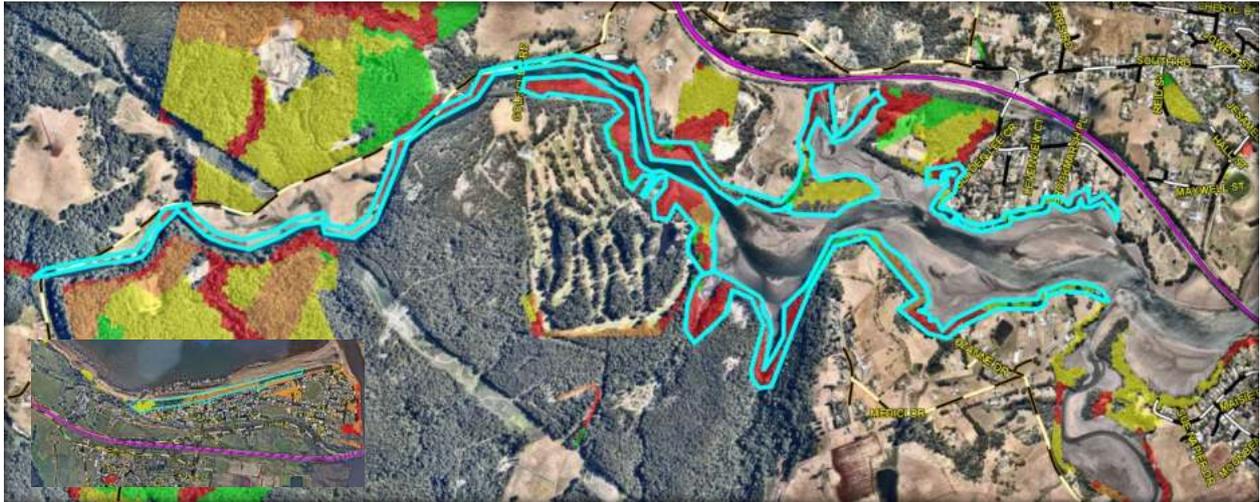
New Capital Actions:

- Foster and assist with research activities to help promote the diversity and importance of this strip of natural bushland e.g., Bird surveys, bandicoot counting.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	No NRM budget allocated.
Capital Proposal	\$2,000

SITE THIRTEEN: LEVEN RIVER



Biodiversity Index Drivers	
Very High	<i>Accipter novaehollandiae</i> – Grey Goshawk <i>Aquila audax</i> – Tasmanian Wedge-Tailed Eagle <i>Astacopsis gouldi</i> – Giant Freshwater Crayfish <i>Ceyx azureus supsp. diemenensis</i> – Tasmanian Azure Kingfisher <i>Dasyurus maculatus</i> – Spotted-Tailed Quoll <i>Eucalyptus viminalis</i> – Wet Forest (WVI) <i>Melaleuca ericifolia</i> – Swamp Forest (NME) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Prototroctes maraena</i> – Australian Grayling <i>Sarcophilus harrisii</i> – Tasmanian Devil <i>Tyto novaehollandiae</i> – Masked Owl
High	<i>Eucalyptus viminalis</i> – Wet Forest (WVI) <i>Perameles gunnii</i> – Eastern Barred Bandicoot Remnant vegetation <i>Sarcophilus harrisii</i> – Tasmanian Devil <i>Haliaeetus leucogaster</i> – White-Bellied Sea-Eagle <i>Melaleuca ericifolia</i> – Swamp Forest (NME)
Medium	<i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil Succulent Saline Herbland (ASS)
Low	<i>Sarcophilus harrisii</i> – Tasmanian Devil

Description: Area (63.7ha)

This site covers the riparian zone of the Leven and Gawler River, which is under Crown Land licence. Limited access points are an issue, with many areas only accessible from the waterways. Partnering with private landowners will be important in targeting any problematic areas for weeds or vegetation damage. The site’s cultural values include river access, local business (river tours) and recreational boating and fishing.

This site is not regularly maintained by Council operations and yearly inspections should be conducted to monitor weed infestations and any other issues. Illegal dumping of rubbish and damaged vegetation issues should be monitored due to the closeness of the Resource Recovery Centre and private landowners close to the riparian zone of the river.

Weeds within this site will be difficult to eradicate given changing river levels due to tidal flows and lack of access points from land. The aim of control should be taken as initial control and follow up works will be difficult. Upon assessment, with limited access points, majority of weed species we're west of the Golf Club Road bridge.

With lack of volunteer support, clear access points along the length of the river and erosion issues presenting after large rain or flood events, the site will be difficult to maintain to the highest standard. The small budget allocated will cover limited maintenance costs and the Weed Management budget may be implemented at this site.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance.

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> Elishas Tears – <i>Leycesteria formosa</i> Foxglove – <i>Digitalis purpurea</i> Miscellaneous garden dumped varieties New Zealand Flax – <i>Phormium tenax</i> Old Man’s Beard – <i>Clematis vitalba</i> * Ricegrass – <i>Spartina anglica</i> Sycamore Maple – <i>Acer pseudoplatanus</i> Willow – <i>Salix spp.</i>
Eradicate	N/A

- o *Plant was not in flower at time of site inspection, temporary identification as *Clematis vitalba* but the NRM Officer should return to correctly identify when plant is flowering.
- Engage any adjacent private landowners regarding responsible use of the reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.
- Monitor encroachments onto Crown Land.

New Capital Actions:

- N/A

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$1,000
Capital Proposal	\$2,000

SITE FOURTEEN: AMY STREET



Biodiversity Index Drivers	
Very High	N/A
High	N/A
Medium	<i>Eucalyptus amygdalina</i> – Forest and Woodland on Dolerite (DAD) <i>Perameles gunnii</i> – Eastern Barred Bandicoot Remnant Vegetation
Low	N/A

Description: Area (2.5ha)

This site is a shelterbelt area on a slope of approximately 20m elevation in the centre of West Ulverstone. Despite being surrounded by residential housing, the area is not known to be frequently utilised by the public, ranking it low on cultural values. There are no known volunteer support groups at this site.

The bush area west of Amy Street was previously leased land from Council, however this lease has lapsed in 2022. Council contractors have been sent for ongoing mowing and maintenance of the grass in this section. The Eastern side of Amy Street is maintained by contractors on request, however due to budget limitations, it is not maintained to a high standard.

Due to previous budget limitations, the eastern section has many weed species in varying sizes of infestation. Eradication would not be possible with the given budget so regular, targeted, control methods should be undertaken to reduce the size and spread of the current weeds.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.

- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> English Ivy – <i>Hedera helix</i> Mirror Bush – <i>Coprosma repens</i> Scotch Thistle – <i>Onopordum acanthium</i> Sweet Pittosporum – <i>Pittosporum undulatum</i>
Eradicate	N/A

- Engage nearby residents regarding responsible use of the reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.

New Capital Actions:

- N/A

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	No NRM budget allocated. \$6,000 maintenance budget shared with Works Depot.
Capital Proposal	\$10,000

SITE FIFTEEN: RIVERSIDE AVENUE



Biodiversity Index Drivers	
Very High	N/A
High	N/A
Medium	<i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	<i>Perameles gunnii</i> – Eastern Barred Bandicoot

Description: Area (4.9ha)

This site is licenced Crown Land which covers the riverbank and riparian areas from Nicholson's Point to the Bass Highway. The site is adjacent to both residential and industrial areas. The area connects to the eastern pathway along the Leven River through the free camp/boat ramp area at Nicholson's Point.

The Riverside Rivercare Management Plan 2021 has been considered within the actions of this site. The Riverside Avenue riverbank's more recent history is one of ecological restoration and is probably in a more natural state than it has been for much of its European past. The vegetation is in good condition with a variety of canopy cover and scrub species within the area.

Riverside Rivercare are a volunteer group made up of mostly nearby Riverside Avenue residents who focus on weed removal encouraging the regeneration of the riparian vegetation and conducting in-fill planting along the river. Weeds will be an ongoing control issue with the close vicinity of residential houses and issues with garden waste dumping in the area.

An erosion control assessment was completed in August 2021, which recommends the need for a 40m riparian vegetation buffer zone from the shoreline. The assessment highlights the western ends of Jetty Street, Marion Street, and Riverside Avenue as an erosion issue in which revegetation would be the most effective method of erosion control.

An unsealed track follows the bush and river south from the end of Riverside Avenue. There are some informal tracks that have been created to access the river itself from the road level. These should be considered under the beach access plan and maintained or closed and revegetated to avoid further erosion.

Illegal clearing is an ongoing issue at Riverside Avenue. The trees are fully protected by the *Crown Lands Act* and as part of the Environmental Zone under the *Central Coast Council Interim Planning Scheme 2013*. In addition to these protections the *Melaleuca ericifolia* vegetation community is further protected under Schedule 3A *Nature Conservation Act 2002* as a threatened vegetation community. Any clearing, pruning or damage in any form is not permitted.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism. Monitor the natural regeneration of *Melaleuca ericifolia* within the site due to continued disturbance in the past.
- Target priority weeds and exotic plants to conduct regular weed maintenance. Employ a specialist contractor for a twice-yearly weed sweep for large infestations unable to be controlled by the Riverside Rivercare group.

Weeds Species Present	
Control	Arum Lily – <i>Zantedeschia aethiopica</i> Blackberry – <i>Rubus fruticosus</i> Black Nightshade – <i>Solanum opacum</i> Cape Ivy – <i>Delairea odorata</i> Kangaroo Apple – <i>Solanum laciniatum*</i> Montpellier Broom – <i>Genista monspessulana</i> Petty Spurge – <i>Euphorbia peplus</i> Scotch Thistle – <i>Onopordum acanthium</i>
Eradicate	N/A

- o *As per previous discussions with Riverside Rivercare *Solanum laciniatum* has been considered a weed in this environment and permission has been granted to remove this plant from the river reserve.
- Ongoing revegetation works to maintain the frontal banks and help erosion control.
- Continue to support and work with Riverside Rivercare in preserving and maintaining this area, particularly with weed control. The previous Management Plan noted weed control actions for the named weeds above and outlined ongoing efforts for the group to monitor and report any new weed incursions found.
- Engage nearby residents regarding responsible use of the reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas.

New Capital Actions:

- Maintain, formalise, or close existing beach access points as per the Beach Access Review. Revegetate any closed tracks to prohibit access.
- Implement erosion control recommendations as per the August 2021 Site Assessment conducted by Barbara Alsop (River Geomorphologist).

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$5,000
Capital Proposal	\$6,000

SITE SIXTEEN: REID STREET RESERVE



Biodiversity Index Drivers	
Very High	<i>Prototroctes maraena</i> – Australian Grayling
High	N/A
Medium	Forest and Woodland on Dolerite (DAD) <i>Perameles gunnii</i> – Eastern Barred Bandicoot Remnant vegetation <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	Forest and Woodland on Dolerite (DAD) <i>Perameles gunnii</i> – Eastern Barred Bandicoot

Description: Area (4.9ha)

Reid Street Reserve is the largest remnant of native bushland near Ulverstone and the Leven River. The site had a management plan created in 1998, then updated in 2007 and 2011. Ongoing restoration and revegetation works have seen the Reserve improve its natural values through mechanical control and revegetation works to improve natural weed suppression.

The Friends of Reid Street Reserve group is pivotal in the success of the restoration of the Reserve and their ongoing enthusiasm for weed control and promoting the Reserve is invaluable to the Reserve. The group focuses on manual removal of plants to avoid bringing chemical into the Reserve, reducing the risk of native species being affected.

Training workshops and events by Landcare and others have occurred in the Reserve which have good numbers attended. Bird surveys have been undertaken by local community members. The Central North Field Naturalists have undertaken fauna surveys using motion-detection cameras and have had success with sighting animals such as the long-nosed potoroo.

Previous efforts have been undertaken to re-claim Hall Street as a wildlife corridor to link the Reserve directly with the Leven River riparian zone south of River Road. This wildlife corridor should be further strengthened naturally to protect this vital link for fauna to move, breed and feed within.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> Bluebell Creeper – <i>Billardiera heterophylla</i> (prev. <i>Sollya</i> sp.) Forget-me-not – <i>Myosotis sylvatica</i> Holly – <i>Ilex aquifolium</i> Montpellier Broom – <i>Genista monspessulana</i> Onion Weed – <i>Asphodelus fistulosus</i> Scotch Thistle – <i>Onopordum acanthium</i> Spanish Heath – <i>Erica lustranica</i>
Eradicate	N/A

- Continue to support and work with the Friends of Reid Street Reserve in preserving and maintaining this area. Provide technical support to any future grant applications that will assist implementing ongoing actions.
- Continue to manage and enhance ongoing revegetation works to maintain the good condition bushland and steep quarry bank to help erosion control. Retaining organic matter, fallen branches and logs in the understorey will help with weed suppression and create cover for fauna to live.
- Maintain formal bush tracks and continue to revegetate informal and closed tracks to reduce the impact of human interaction with the bushlands and spread of weeds.
- Support and encourage ongoing research activities and training workshops to help promote the diversity and importance of this strip of natural bushland e.g., Bird surveys, bandicoot counting, learning opportunities.
- Engage nearby residents regarding responsible use of the Reserve and impacts of such activities as the dumping of garden waste, encroachments, responsible pet ownership and the planting of non-native species surrounding native bushland areas as necessary.
- Continue to revegetate and strengthen the wildlife corridor along the Hall Street entrance.

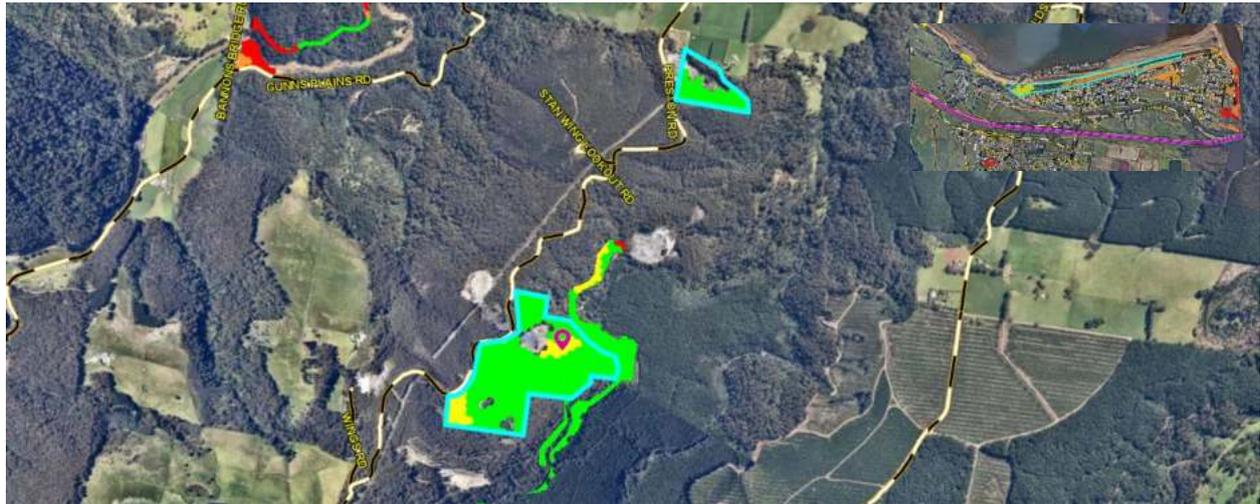
New Capital Actions:

- Maintain and update signage as required.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	\$8,000
Capital Proposal	\$5,000

SITE SEVENTEEN: PRESTON WTC



Biodiversity Index Drivers	
Very High	N/A
High	N/A
Medium	Forest on Mudstone (DAM) <i>Sarcophilus harrisii</i> - Tasmanian Devil <i>Tyto novaehollandiae subsp. castanops</i> - Masked Owl
Low	Forest on Mudstone (DAM) <i>Sarcophilus harrisii</i> - Tasmanian Devil

Description: Area (27.4ha)

Council property at Preston Road, North Motton (PID: 6986763) is land-locked by private land as well as private forestry land. There is a private quarry between this land and Preston Road that is seemingly over-reaching the property boundaries. Other background information on this land is unclear.

The property at 1311 Preston Road is used locally as the Preston Waste Transfer Station. This land is bordered by private forestry land and Preston Road and is majority bushland, apart from the clearing of the transfer station and a quarry to the north of the site.

This site falls under the direction of the Waste Services Resource Recovery Centre and Country Transfer Stations Site Operations Manual. The transfer station was tidy and appeared to be well maintained upon inspection.

Surrounding vegetation is of good health and there are good layers of canopy cover, understory and groundcover surrounding the open areas. Miscellaneous rubbish is seen littered throughout the surrounding bushland and is evident that this has not been tidied in a long time.

Despite noise pollution from trucks in area, many species of native wildlife were sighted with a good range of bird calls heard, and pademelons are also present within the bushland. The spotting of a feral cat in the surrounding bush area may indicate that there are more surviving within this site and surrounds.

Weeds within the Preston WTS are found on the outlying perimeter of the cleared space. Montpellier Broom is found sporadically around the southern tracks, only small plants but some are of flowering age. There are larger infestations of Foxglove, Twigg Mullein, Caper Spurge, and larger Montpellier Broom on the slope to the north of the scrap metal heap. A large-scale initial control would be required with multiple years of follow up to control regrowth.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Caper Spurge – <i>Euphorbia lathyris</i> Foxglove – <i>Digitalis purpurea</i> Montpellier Broom – <i>Genista monspessulana</i> Scotch Thistle – <i>Onopordum acanthium</i> Twigg Mullein – <i>Verbascum virgatum</i>
Eradicate	N/A

- Protect and enhance areas of excellent and good native vegetation. Clean up rubbish littered throughout surrounding bushland.
- Continue to provide technical advice to Waste Management Services as well as contractors using the site.
- Evaluate contractor water monitoring reports and action any applicable recommendations or urgent actions as required.

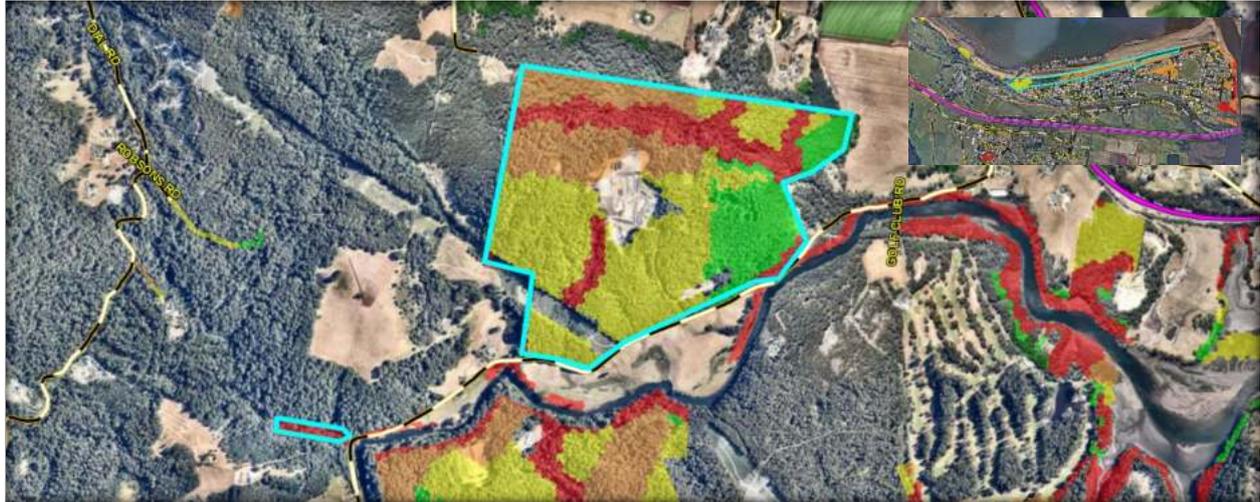
New Capital Actions:

- Consider the requirement for cat trapping in the bushland area to protect native wildlife habitat and breeding areas.
- Weed management plan for the larger infestations sloping north of the Transfer Station area.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	No NRM budget allocated. Waste Management & Aftercare Monitoring budgets applicable for other costs.
Capital Proposal	\$5,000

SITE EIGHTEEN: RESOURCE RECOVERY CENTRE



Biodiversity Index Drivers	
Very High	<i>Accipiter novaehollandiae</i> – Grey Goshawk <i>Astacopsis gouldi</i> – Giant Freshwater Crayfish <i>Ceyx azureus supsp. diemenensis</i> – Tasmanian Azure Kingfisher <i>Dasyurus maculatus</i> – Spotted-Tailed Quoll <i>Melaleuca ericifolia</i> – Swamp Forest (NME) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Prototroctes maraena</i> – Australian Grayling <i>Sarcophilus harrisii</i> – Tasmanian Devil
High	<i>Dasyurus maculatus</i> – Spotted-Tailed Quoll <i>Sarcophilus harrisii</i> – Tasmanian Devil Lowland grassland complex (GCL) <i>Perameles gunnii</i> – Eastern Barred Bandicoot
Medium	<i>Dasyurus maculatus</i> – Spotted-Tailed Quoll <i>Perameles gunnii</i> – Eastern Barred Bandicoot Remnant vegetation <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	<i>Dasyurus maculatus</i> – Spotted-Tailed Quoll <i>Sarcophilus harrisii</i> – Tasmanian Devil

Description: Area (127.2ha)

The Resource Recovery Centre (RRC) is utilised by the local municipality for resource recovery and landfill. This site falls under the direction of the Waste Services Resource Recovery Centre and Country Transfer Stations Site Operations Manual.

Ongoing weed control is important in containment of infestations within the RRC. Given the nature of the RRC and frequency of incoming plant/garden waste matter, eradication is not possible. Control of the target weeds within the RRC Weed Management Plan is essential. Continuing staff education and training of identification and control procedures paired with regular monitoring for new or reoccurring weed species would be helpful in the long-term goal of weed control. Alongside this training, education and identification on native plants is important to reduce the risk of damage to the bushland due to incorrect weed control methods. Community education on identification and management of common weeds may be beneficial in the long-term of managing weeds coming into the RRC site.

The small piece of bushland to the south-west of the RRC is very steep and is bordered by private land excluding a small opening and pull-out area on Lobster Creek Road. It is likely that this is Council owned land due to the convergence of many creeks on this slope joining to the Leven River. There is infrastructure underneath the road at this point to assist the water running into the Leven River without effecting the road surface. Past, present, and future use of this land is unclear.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance.

Weeds Species Present	
Control	Blackberry – <i>Rubus fruticosus</i> Blue Periwinkle – <i>Vinca major</i> Californian Thistle – <i>Cirsium arvense</i> Cumbungi – <i>Typha latifolia</i> Foxglove – <i>Digitalis purpurea</i> Gorse – <i>Ulex europaeus</i> Montpellier Broom – <i>Genista monspessulana</i> Pampas Grass – <i>Cortaderia species</i> Paterson’s Curse – <i>Echium plantagineum</i> Scotch Thistle – <i>Onopordum acanthium</i> Slender Thistle – <i>Carduus pycnocephalus</i> Spanish Heath – <i>Erica lustranica</i> St John’s Wort – <i>Hypericum perforatum</i> Vipers Bugloss – <i>Echium vulgare</i>
Eradicate	N/A

- Continue to support and provide technical advice to the Waste Services Team regarding weed control, revegetation works and good bushland management practices.
- Continue to manage and enhance ongoing revegetation works to maintain good condition bushland and any steep banks to help erosion control. Retaining organic matter, fallen branches and logs in the bushland understorey will help with weed suppression and create cover for fauna to live.
- Evaluate contractor water monitoring reports and action any applicable recommendations or urgent actions as required.
- Engage community members regarding responsible use of the RRC and impacts of such activities as the dumping of garden waste in incorrect areas and in non-designated areas around the municipality.
- Review and upgrade information and mapping in the RRC Weed Management Plan. Previous mapping was undertaken in 2016 and further works have not occurred since this time.

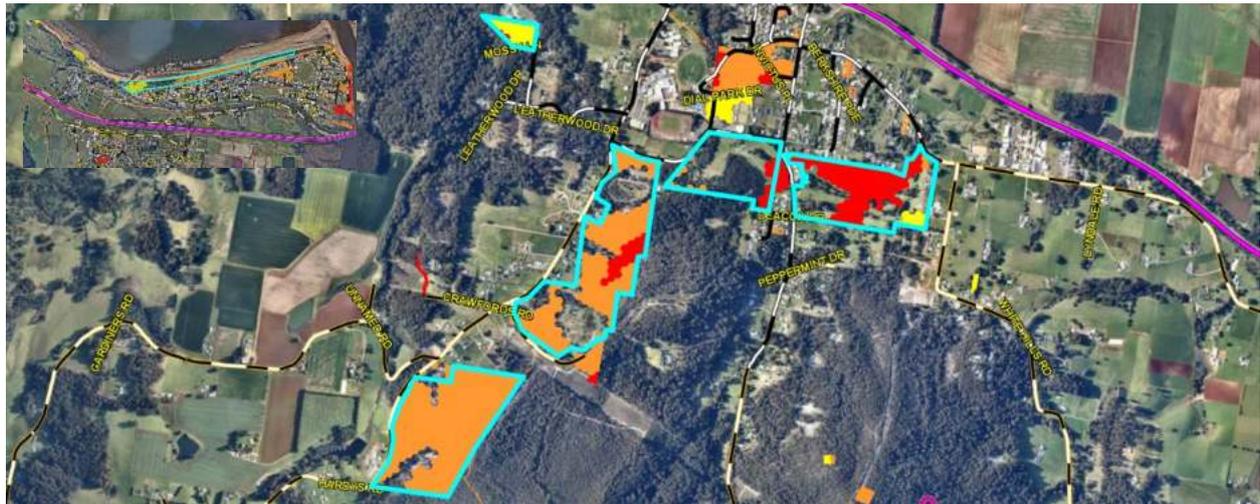
New Capital Actions:

- N/A

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	No NRM budget allocated. Waste Management & Aftercare Monitoring budgets applicable for other costs.
Capital Proposal	N/A

SITE NINETEEN: DIAL RANGE



Biodiversity Index Drivers	
Very High	<i>Astacopsis gouldi</i> – Giant Freshwater Crayfish <i>Ceyx azureus supsp. diemenensis</i> – Tasmanian Azure Kingfisher <i>Dasyurus maculatus</i> – Spotted-Tailed Quoll <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Persicaria decipiens</i> – Slender Water Pepper <i>Prototroctes maraena</i> – Australian Grayling <i>Sarcophilus harrisii</i> – Tasmanian Devil
High	<i>Dasyurus maculatus</i> – Spotted-Tailed Quoll Forest and Woodland on Sandstone (DAS) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Persicaria decipiens</i> – Slender Water Pepper <i>Sarcophilus harrisii</i> – Tasmanian Devil
Medium	<i>Dasyurus maculatus</i> – Spotted-Tailed Quoll Forest on Mudstone (DAM) <i>Perameles gunnii</i> – Eastern Barred Bandicoot <i>Sarcophilus harrisii</i> – Tasmanian Devil
Low	N/A

Description: Area (79.2ha)

This site consists of multiple land areas and tenures:

- *PID: 7331443 (Leatherwood Drive) – Council Owned – no current active land use.*
 - o No valuable background information has been found on the land at Leatherwood Drive and it's previous, current, or future use is unclear.
- *PID: 3567002 (45 Montgomery Road) – Council Owned – Old Penguin Refuse Disposal Site.*
 - o The Old Penguin Refuse Disposal Site has been closed for a long period of time, however ongoing water monitoring and weed control measures are undertaken regularly to maintain the area. Control efforts for Foxglove and Montpellier Broom are ongoing to try to reduce the spread of these weeds to the low-lying areas north of the site.

- *PID: 7679183 (22 Sports Complex Road) – Council Owned, leased to Penguin Golf Club Inc.*
 - o Penguin Golf Club Inc manage their leased land within their own means. NRM support is not readily required, however can be called upon for any issues. Ongoing volunteer work to control mature and young Radiata Pine began in late 2022, this will be ongoing in the area, including on surrounding private land with permission.
- *PID: 7679191 (175 Ironcliffe Road) & PID: 3566990 / Title: 236123/1 (207 Ironcliffe Road) – Council Owned – Penguin Mountain Bike Park (managed by Cradle Coast Mountain Bike Club).*
 - o The mountain bike park in Penguin is a big draw for locals and tourists to visit the site and the town. Council is looking to promote and upgrade the park as part of the long-term plan for the area. NRM facets of this plan should be considered within these upgrades regarding weed management and minimising impact on the vegetation in the area while still creating a premier venue to rival others in Tasmania. Biosecurity and weed control should be a high priority with the equipment used on the tracks likely to carry unwanted seeds and other matter into the park. Note, the MTB Park also flows into Parks & Wildlife Service land south of Montgomery Road, any works in this section will be referred to Parks & Wildlife Service.
- *PID: 3566990 / Title: 147552/1 (207 Ironcliffe Road) – Council Owned – managed by North West Environment Centre.*
 - o This land has been the previous site of the Penguin Community Garden and has since been managed by the NWECC. The NWECC also assist in ongoing water monitoring from the PRDS upstream, which includes the treatment ponds located within the site.
- *PID: 6763543 (3 Hardys Road) – Crown lease to Council – managed by Penguin Clay Target Club.*
 - o Weed control efforts have occurred for approximately eight years in a volunteer capacity – weed species targeted include Spanish Heath, Pampas Grass, Gorse and Thistles.

Actions:

Ongoing Maintenance Actions:

- Conduct regular site inspections to monitor native vegetation health, weed infestations, illegal dumping, and vandalism.
- Target priority weeds and exotic plants to conduct regular weed maintenance:

Weeds Species Present	
Control	Common Centaury – <i>Centaurium erythraea</i> Cumbungi – <i>Typha latifolia</i> Foxglove – <i>Digitalis purpurea</i> Gorse – <i>Ulex europaeus</i> Montpellier Broom – <i>Genista monspessulana</i> Pampas Grass – <i>Cortaderia species</i> Radiata Pine – <i>Pinus radiata</i> Scotch Thistle – <i>Onopordum acanthium</i> Spanish Heath – <i>Erica lustranica</i> Wild Mignonette – <i>Reseda lutea</i>
Eradicate	N/A

- Liaise with and educate land management/lease groups regarding best practice for maintenance of the vegetation on site. Protect and enhance areas of excellent and good native vegetation. Clean up rubbish littered throughout surrounding bushland.
- Provide ongoing technical natural resource management support to all land management and lease groups as required. Ensure that all future developments, including tourism, have NRM works prioritised with minimisation of impact on vegetation and wildlife present.

- Update information and signage at each site to provide information to visitors regarding access, uses and potential hazards. Signage regarding spotting and reporting target weeds should be considered to assist with ongoing control measures within all sites.

New Capital Actions:

- Increase information and awareness signage of weed management and identification.
- Provide equipment cleaning stations for areas such as the Mountain Bike Park and Mount Montgomery carpark to help with biosecurity measures and reduce the risk of weed matter.
- Provide technical support and align NRM values to future tourism and development propositions.

Budget:

Budget as per 2023/2024 Financial Year	
Current Maintenance	No NRM budget allocated – \$3,000 from Weed Management budget. Waste Management & Aftercare Monitoring budgets for other costs.
Capital Proposal	\$15,000

GLOSSARY

Term	Definition
Biodiversity	The variety of life forms: different species of plants, animals and micro-organisms, the genes they contain and the ecosystems they form.
Capital (Budget)	The costs incurred when a council spends money to buy, construct, renovate or require an asset.
Climate Change	An increase in the average temperature of the air and oceans due to burning of fossil fuels and deforestation. Also known as Global Warming. Greenhouse gasses such as carbon dioxide trap solar radiation causing an increase in temperature.
Coastal Processes	The action of natural forces (wind, waves, tides, currents) on the shoreline and near-shore seabed. These include the effects of storms, erosion and deposition, movement of dunes, longshore drift and inundation.
Coastal Reserve	An outdated but commonly used term for reserved land under the National Parks and Reserves Management Act 2002 between the low water mark and approximately 30 meters inland. Now coastal reserves are reclassified into the new terms: State Reserve, Nature Reserve, Conservation Area or Nature Recreation Area depending on the values and objectives for the area.
Conservation (Flora/fauna)	In relation to biodiversity, conservation is the protection, maintenance, management, sustainable use, restoration, and improvement of the natural environment. In relation to natural and cultural heritage, conservation is, generally, keeping in safety or preserving the existing state of a heritage resource from destruction or change.
Council	Central Coast Council, Tasmania.
Endemic/Endemism	Not found anywhere else in the world.
Erosion	Removal of soil particles by wind or water.
Greening	All vegetation including grasslands, turf, shrubs, thickets, single trees, and forests.
Habitat	The place or type of site where an organism or population naturally occurs.
High conservation value	Specialist unput is required to determine if land has a high conservation value e.g. A vegetation specialist can identify plants and habitats where threatened, vulnerable, or rare species may be present.

Invasive species	Often referred to as “weed species”. A species occurring, as a result of human activities, beyond its accepted normal distribution, which threatens valued environmental, agricultural or personal resources by the damage it causes
LIST/LISTMap	Land Information System Tasmania. Central Tasmanian Government land information (e.g., topographic mapping) data system, operated by NRE Tasmania.
Maintenance	Regular ongoing day-to-day work necessary to keep assets operational.
Natural Resource Management (NRM)	The management of natural resources such as land, water, soil, plants, and animals.
Natural Values	The variety of different plant communities, animal habitats and coastal landforms, land and seascapes, water quality and quantity. Also called natural resources.
Revegetation	The re-establishment of vegetation in areas that have been cleared or highly modified. The mix of plant species may not be the same as that of the original vegetation (Williams 2005).
Shorebird	Also referred to as migrant shorebirds, nesting shorebirds and breeding shorebirds. Includes species such as plovers, sandpipers, snipe, and curlews. They often nest just above high water and are vulnerable to human use of the beach.
Shorebird (Resident)	Year-round resident birds who breed and feed in one area (e.g., Pied Oystercatcher, terns, and Gulls).
Strategy	Greening Central Coast Strategy 2021.
Threatened species	A plant or animal listed as endangered (Schedule 3), vulnerable (Schedule 4), or rare (Schedule 5) of the Tasmanian <i>Threatened Species Protection Act 1995</i> . Endangered listings mean the species is in danger of extinction and long-term survival is unlikely unless the factors causing it to be so are corrected. Vulnerable listings are likely to become endangered while factors causing it to be vulnerable continue operating. A species is listed as rare if it has a small population in Tasmania that is at risk.
Tree	Vegetation taller than 3m in height with a trunk or trunks and a defined canopy. Includes deciduous, evergreen, native, or exotic.
Vegetation Community	An assemblage of plant species that have a floristically uniform structure and composition, often described by its upper storey dominant species, that form a repeating ‘unit’ across the landscape. (Australian Native Vegetation Assessment 2001; Williams 2005; NVIS 2004).

BIBLIOGRAPHY

Central Coast Council, Greening Central Coast Strategy 2021

Central Coast Council, Open Space and Recreation Plan 2012

Central Coast Council, Open Space Tree Strategy 2016

Central Coast Council, Street Tree Strategy 2010

Central Coast Council, Vegetation Management Policy 2019

Central Coast Council, Weed Management Plan 2023

Cradle Coast NRM, Central Coast Local Planting Guide 2013

Land Use Planning and Approvals Act 1993

Land Use Planning and Approvals Amendment (Tasmanian Planning Scheme) Act 2015

LISTMap, Bird breeding habitat and access recommendations (Updated October 2021)

LISTMap, Coastal Observed Fauna Habitat (Updated March 2007)

Tasmanian Coastal Works Manual: A best practice management guide for changing coastlines (published December 2010).

APPENDIX A – PREVIOUS SITE MANAGEMENT PLANS

East Ulverstone Coastal Reserve Vegetation Management Plan 2010

Gables Management Plan 2017

Penguin Habitat Management Plan West Ulverstone 2009

Reid Street Reserve 2011

Riverside Rivercare Management Plan 2021

Sulphur Creek Coastal Reserve Vegetation and Habitat Management Plan 2010

Turners Beach Fauna Values and Management Plan Recommendations 2005

Turners Beach Vegetation & Fire Management Plan 2011

APPENDIX B – GOVERNING LEGISLATION

State Legislation:

Aboriginal Heritage Act 1975

Animal Welfare Act 1993

Biosecurity Act 2019 (previously Weed Management Act 1999)

Environmental Management and Pollution Control Act 1994

Historic Cultural Heritage Act 1995

Nature Conservation Act 2002

Threatened Species Protection Act 1995

Commonwealth Legislation:

Aboriginal and Torres Strait Islander Heritage Protection Act 1984

Crown Lands Act 1976

Environment Protection and Biodiversity Conservation Act 1999

APPENDIX C – DETAILED SITE RANKINGS

NRM Plan 2023 - Site Rankings

Ranking	Site #	Location	Site Name	Section Name	Quick BI Rating	Biodiversity Index	Cultural & Community Values	Weed Status	Erosion Risk	Volunteer Support	Other Priority Fauna Species	Current Investment	TOTAL RATING /10
1	1	Turners Beach	Forth River	Forth River	VH	4	0.75	0.25	0.5	1	0.75	0.75	8
2	9	Sulphur Creek	Sulphur Creek Beach East	Sulphur Creek Beach Hall Point/Station Beach "Dunkies"	VH VH	4	0.75	0.25	0.25	1	1	0.25	7.5
3	2	Turners Beach	Turners Beach	Turners Beach	H	3	0.75	0.25	0.5	1	0.75	1	7.25
4	6	East Ulverstone	Bicentennial Park	Bicentennial Park	VH	4	0.75	0.5	0.5	0	1	0.25	7
5	8	Preservation Bay	Preservation Bay Beach	Preservation Bay	VH	4	0.75	0.5	0.25	0.25	1	0	6.75
	16	West Ulverstone	Reid Street Reserve	Reid Street Reserve	VH	4	0.5	0.25	0.75	1	0	0.25	6.75
6	3	Ulverstone	Maskells Road	Maskells Road	VH	4	0.5	0.5	0.5	0	1	0	6.5
	10	Sulphur Creek	Sulphur Creek Beach West	Hogarth Reserve	VH	4	0.75	0	0.25	0.25	1	0.25	6.5
7	19	Penguin	Dial Range	Golf Club	VH	4	0.75	0.25	0.75	0.5	0	0	6.25
				Dial Mountain Bike	VH								
NWEC Ponds				VH									
Old Penguin Refuse Disposal Site				H									
Gun Range				H									
Leatherwood Drive	VH												
4	East Ulverstone	Fishponds	Fishponds	M	2	0.5	0.25	0.5	1	1	1	6.25	
8	13	West Ulverstone	Leven River	Leven River	VH	4	0.5	0.25	0.5	0	0	0.75	6
9	11	Ulverstone	Henslowes Road	Gawler River/ Henslowes Road	VH	4	0.5	0.25	0.5	0	0	0.25	5.5
10	7	West Ulverstone	West Ulverstone Beach	West Ulverstone Beach	M	2	0.75	0.25	0.25	0	1	1	5.25
	12	West Ulverstone	Knights Road	2 Knights Road	VH	4	0	0.5	0.75	0	0	0	5.25
11	18	West Ulverstone	Resource Recovery Centre	RRC	VH	4	0.25	0	0.75	0	0	0	5
				Lobster Creek Road	VH								
12	5	East Ulverstone	Buttons Beach	East Buttons Beach West Buttons Beach	L L	1	0.75	0.5	0.25	1	1	0.25	4.75
13	15	Ulverstone	Riverside Avenue	Riverside Avenue	M	2	0.5	0.25	0.5	1	0	0.25	4.5
14	14	West Ulverstone	Amy Street	Amy Street	M	2	0	0.5	0.75	0	0	0.75	4
15	17	North Motton/Preston	Preston WTC	Preston Road	L	2	0.25	0.5	0.75	0	0	0	3.5
				Preston WTC	M								

** Where sites have multiple Biodiversity Index priorities, the highest value has been applied for scoring.

Sustainability and Environmental Advisory Panel

AGENDA – 16 MAY 2023

Attachment 5: Tiny Forest Handbook



earthwatch
AUSTRALIA



Tiny Forests

Growing Resilient Cities

What is a Tiny Forest?

Tiny Forests are densely planted indigenous vegetation representing a complete ecosystem. They use a particular planting method developed in the 1970's by Dr Akira Miyawaki, therefore called the 'Miyawaki method'. The method involves intense soil remediation to incorporate nutrients and soil enhancers, and a dense planting structure that is 30 times denser than traditional forests. This results in accelerated growth of about 10 times faster than traditional forests; and as it establishes and attracts more species, becomes up to 100 times more biodiverse than monoculture forests.



Building a Tiny Forest in Leicester, England. © Earthwatch UK

“Miyawaki forests are becoming increasingly popular for urban greening to rehabilitate degraded areas and increase biodiversity”

Dr Grey Coupland

Tiny Forest outcomes

Tiny Forests can help address a range of environmental and social issues, and help achieve relevant strategies and targets. Below are some of the outcomes that Tiny Forests can provide:

Environmental Outcomes

Restore biodiversity

By planting a dense forest using locally native plants encourages native faunal species to return and inhabit the forest too. First insects and soil microbes appear, followed by birds, reptiles, and then mammals. Overall, this results in a rich biodiversity, which can be up to 100 times more biodiverse than a monoculture forest.

Reduce Urban Heat Island effect

The dense planting structure of the Tiny Forest acts like a natural air conditioner, providing cooling through transpiration and shade, helping create a place of respite for hot summer days.

Trap storm water

The deep soil remediation and dense structure of the plants helps to trap storm water in the forest, preventing it from entering waterways; where it often collects pollutants along the way.

Carbon sequestration

One of the most effective methods of carbon sequestration is tree planting, as trees convert atmospheric CO₂ into carbon stored in their leaves, wood and roots. In total, about half the dry weight of a tree is carbon! And as Tiny Forests are so dense, that's a lot more carbon per square metre than a traditional forest.

Reduced maintenance

Due to the dense planting method, and the layers representing a traditional forest structure, it is expected that the Tiny Forest will need very little maintenance after about 2 years as it becomes self-supporting.

Tiny Forest outcomes



March 2020, the UK's first Tiny Forest in Witney is planted. © Earthwatch UK

One year of growth



May 2021, the Tiny Forest after one year. © Earthwatch UK

Tiny Forest outcomes

Social outcomes

Community and corporate groups

Local community members are directly connected to the project, learning about biodiversity, climate change, and how their own private gardens are part of a wider biodiversity corridor. The activities provide basic horticultural training, encouraging greening in the private realm. Social cohesion and wellbeing of residents is improved by providing incorporated seating, or an outdoor classroom within the forest, giving people a place to spend time interacting with each other, and with nature. Corporate organisations can sponsor Tiny Forests as part of their Corporate Social Responsibility (CSR) and Environment, Social and Governance (ESG) commitments.

Schools

Teachers are equipped with the tools, confidence and knowledge to teach students about the value of biodiversity and climate change resilience in urban landscapes. Schools use the Tiny Forest as an outdoor classroom, teaching students about the value of biodiversity and climate change; and learning the skills and knowledge to take action including how to plant native and biodiverse gardens at school or home.

Tertiary

Tertiary institutions use the tiny forest to teach undergraduates urban greening methods including the Miyawaki method. Students will understand the importance of soil properties and amendments when selecting native plans for successful establishment and growth of urban greenspace.

Environmental Education Centres

EEC's use the Tiny Forest as an outdoor classroom and develop modules for teaching about biodiversity and climate resilience in urban landscapes.

30 times denser than traditional forests

Improves social cohesion and liveability

Up to 100 times more biodiverse than monoculture forests

Reduces urban heat island effect

Grows 10 times faster than traditional forests



A low-management urban wildlife oasis

Dense carbon storage

Improves soil condition and structure

Traps stormwater runoff

Tiny Forest criteria

A Tiny Forest is a dense, fast-growing, native woodland around the size of a tennis court (approximately 200 m²), which is combined with an engagement programme to support community ownership and provide social benefits.

The Tiny Forest criteria includes physical characteristics, social characteristics and scientific monitoring as follows:

Physical characteristics

- Only contains native trees and shrubs representing all layers within the forest
- Is the product of field and literature research to select indigenous species and proportions
- Has soil that has been prepared according to the Tiny Forest planting method
- Uses no chemicals (fertilisers or pesticides)
- Has sufficient number and type of different tree species (determined in liaison with scientific team)
- Has at least 3 trees per square metre
- Provides space for the trees to grow undisturbed for at least 10 years (no tree thinning or timber harvesting unless in exceptional circumstances (e.g. disease, safety))
- Branches, leaves, and dead trees are left to lie where they have fallen
- Is at least 4m wide across the full length of the forest, without interruptions (such as a path)
- Has a layer of mulch (such as straw) at least 15cm deep

Social characteristics

- Includes an outdoor classroom where feasible
- Has a local partner (volunteer / community group / council)
- Was planted by local residents, corporate employees and/or school children
- Can be used as a place for local residents to come together and for outdoor lessons with school children
- Enables engagement opportunities for local residents, corporate employees and/or school children
- Is maintained (weeding/watering/litter picking) by a "Keeper Team" team of 4-5 local volunteers for the first 2 years

Monitoring requirements

- Using Earthwatch's methodology, carry out monitoring a minimum of 2 times a year for the first 2 years after planting, preferably through citizen science
- Submit the monitoring data collected to Earthwatch at the end of each growing season

Tiny Forest site criteria

- Need a site of approximately 200m² for the actual Tiny Forest, plus space for heavy machinery to do preparation work so total space possibly up to 500m². This area can be of any shape/orientation, but the forest must not be narrower than 4m across at any given point
- No underground infrastructure: soil typically excavated to 1m depth
- No overhead infrastructure: trees could grow to 20m+
- Need a site that is accessible for large machinery: mini digger needed for soil preparation, plus truck delivery of straw and other soil supplements
- Possible water access point: trees may need watering during first 2 years of maintenance, so either a water access point located nearby, or access for a vehicle and water bowser to the site
- Need a site that is not causing obstruction to people's right of way (the forest becomes very dense and impassable unless a specific pathway is incorporated into the design)
- Need a site that is within an urban setting and that is easily accessible to users (e.g. local residents, school children, employees)
- Site should not be designated as sensitive in any way, eg Ramsar site etc.
- Site should be an open area (we do not want to remove trees to plant new ones!), some scrub or low vegetation is fine, as are trees on the edge of the proposed site as these could potentially be incorporated into the design
- The forest should be as compact as possible and is not suitable for using as hedging
- Paths and an open classroom can be included into the design. The forest is fenced at least for the first 2 years with access through an open gate

Engagement programme

Earthwatch will facilitate the following engagement works:

Citizen science activities

- Baseline biodiversity survey
- Soil remediation day
- Planting day
- Monitoring surveys:
 - Growth-rate
 - Thermal comfort
 - Pollinators
 - Ground dwellers
 - Butterflies
 - Carbon capture
 - Flood management

Workshop options*

- Traditional Custodians share knowledge about forest species and other cultural stories
- Professional Development workshops for local educators including how they can use the Tiny Forest as an outdoor classroom
- Professional Development workshops for landscapers, detailing the Miyawaki planting method and learning more about indigenous plants
- Scientist-for-a-day (S4AD) workshops for corporate employees

Resources*

- How-to guides for planting indigenous plants and developing your own Tiny Forest
- Indigenous seedlings for local participants to take home
- Learning materials for corporate groups on climate change and biodiversity
- Informative signage
- Social surveys to better understand the benefits of the Tiny Forest on the community
- Lesson plans and learning modules developed for schools and Environmental Education Centres

Maintenance

- A group of 4-5 "Keeper Team" members are identified, trained and provided the responsibility of watering, weeding and rubbish-removal for the first two years.

**some of these activities will be optional*

Project timeline

FUNDING RECEIVED

LAND SECURED

A suitable site has been identified that meets the Tiny Forest criteria

FOREST DESIGNED

Through consultation with our research partners and landscape designers

VEGETATION SURVEY

Desktop study combined with ground truthing to determine the remnant vegetation type and suitable species for the Tiny Forest

PLANTS ORDERED

Nurseries need 6-12 months notice to plant and establish seedlings

ENGAGE KEY GROUPS

Local schools, community groups and/or corporate employees are engaged to assist with citizen science activities.

SOIL SURVEY

Assess soil texture, pH, Carbon, Nitrogen and microbes to determine the best materials for soil enrichment (i.e. compost, manure etc.)

SOIL REMEDIATION

Includes excavation by machinery followed by manual engagement activity to incorporate soil enrichments.

PLANTATION

The species are laid out as per design to represent forest layers; then are planted, staked and provided optional tree guards. Mulch is then laid out

MAINTENANCE

"Keeper Team" will water and weed the Tiny Forest at designated intervals for the first two years

MONITORING

Citizen science activities to monitor biodiversity, temperature, growth and biomass.

DATA ANALYSIS

Interpretation of the data to quantify the benefits the Tiny Forest provides, and promote the Miyawaki method more widely

References

Western Australia's Tiny Forest

https://www.murdoch.edu.au/news/articles/western-australia-s-first-tiny-forest-for-community-led-urban-greening_

Canberra's micro forests

Based on the same methodology as Tiny Forests
<https://climatefactory.com.au/projects/>

Tiny Forests Earthwatch UK

<https://tinyforest.earthwatch.org.uk/>

The Miyawaki method

Detailed methodology for the Miyawaki method
<https://www.afforestt.com/methodology>

Results from the Miyawaki method

<https://www.afforestt.com/results>

About Earthwatch

Earthwatch is a global environmental charity founded in 1971. We take action to address global change through a time-tested model of citizen science and education that inspires behaviour change, and positive action for nature.

By engaging all sectors of society directly with researchers in the field, and educators in outdoor classrooms, Earthwatch teams have helped to safeguard critical habitats, conserve biodiversity, and promote the sustainable use of natural resources.

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Sustainability and Environmental Advisory Panel

AGENDA – 16 MAY 2023

Attachment 6: Fragments & Islands – Isolated Natural Communities

Fragments and Islands – Isolated Natural Communities; a brief overview

Ian Ferris GCNatRes

Maxims: Everything is related to everything else

- Everything goes somewhere

- Too much of anything is bad for something
- Given time, nature always wins

Depending on scale, many ecological communities can be called “isolated”. For a fish, a lake is isolated. For a small bird, a patch of trees in a grassland is an island. A mudflat, cutoff by headlands, the sea and dry land, is also an island, isolated from other mudflats. At a larger scale, Tasmania is cut-off from outside influences for many of its species, as is Australia.

An ecological community is a collection of species living at the same time, in the same place, made up of populations of individuals that are spatially interspersed and among which direct and indirect interactions can potentially take place. Often numbers of similar communities occur within larger bio-geographical regions that comprise many different habitats and that have unique evolutionary histories. Species can disperse among suitable habitats in the region and thus define the species genetic pool for communities occupying those habitats. Usually, varying ecosystems are at varying stages in their natural development.



Figure 1: Natural isolate with a narrow escape route, SW Tas

Ecological Isolation is loss of connectivity – land, sea, or air – that becomes lost through some occurrence, or is too wide or dangerous for effective passage by organisms, or even by water or nutrient sources. The connection might be a stream with a vegetated riparian zone, a ditch, a forested area, or a grassland. If the streamside is cleared, the ditch gets a culvert, the forest gets a walking track, or the grassland becomes a ploughed field; the connections become barriers.

Isolated areas can be formed by a wide range of natural occurrence – sea level rise, fire, river meanders and floods, grassland formation, and so on. Over time, species that inhabit an isolated area adapt or perish, and those remaining may live a life of tenuous survival, or thrive in the medium term. Some species can genetically modify quite quickly, but for most, the process is far too slow for adaptation. Consider that many species have taken millions of years to arrive at their present state, and many are very similar to their predecessors.

The fates of many inhabitants of isolated areas is highly dependant on a range of conditions: size and shape of the habitat, ecological diversity within that habitat, demand for food and other resources (e.g. nest sites), desiccation (drying out), genetic factors (e.g. female/male ratios, variation within the species, fecundity, etc) and many others. Isolated marine systems have a range of other potential conditions, including water chemistry, temperature, water depth etc.

The isolated areas have formed naturally, often following “disturbance”, and certain species have learnt to adapt to them over time. What happens when humans get involved is that time between repeated disturbance is dramatically compressed, and adaptation demand exceeds the adaptation capability. Disturbances that are not rapid are generally called a “stress” that may not have such effects – an example being a disease or insect infestation: serious at the time but quite rare, and often a one-off. The way that isolated areas are formed by humans also varies in many cases from those that form naturally.

Disturbance by humans can be deliberate, or accidental. Obviously, fire, clearing, watercourse obstruction or draining, or species introduction are serious disturbances, but other factors including light sources, noise, disease, and particularly edge effects can also result in areas becoming isolated. Edge effects – ecotones - include desiccation (drying out due to loss of cover) and the creep of foreign species introduction (e.g. weeds/crops, animals such as sheep, goats, rabbits, cats, dogs or cattle that may not enter the main system but encroach from the boundaries). The actual stable area of an isolate can be significantly less than the visible boundary; remove 50m or so from all edges from simple dessication. Clearly, areas isolated by sea level rise or climate change caused by human activity are also islands. Regular walking or riding through a patch of bushland can isolate a portion, and may have a significant effect on the potential habitat of a range of species.

It is well understood that some degree of disturbance is potentially beneficial for some ecosystems, but this is highly dependant on frequency and intensity. Disturbance can remove smothering plant species, remove or deplete insect populations, and the like. It can also force or enhance genetic spread. However the frequency often must be quite low for a system to achieve its climax, where equilibrium and maturity is attained. High intensity just means that the time to reach equilibrium is extended.

It is important to understand that the fragmentation of a habitat is less serious than habitat loss, although fragmentation usually (but not always) leads to habitat loss. Fragmentation can actually favour some species, such as birds which can escape from a predator by moving to the next isolate, leaving the predator stuck in the isolate. A dominant plant or insect can take over the isolate, to the cost of other species. Alternatively, fragmentation reduces the size of an isolate to a number of smaller isolates, meaning that some species that require large areas to forage, e.g. larger carnivores, have both fewer resources and greater competition. As these species decline in number, so does their genetic capacity to survive.

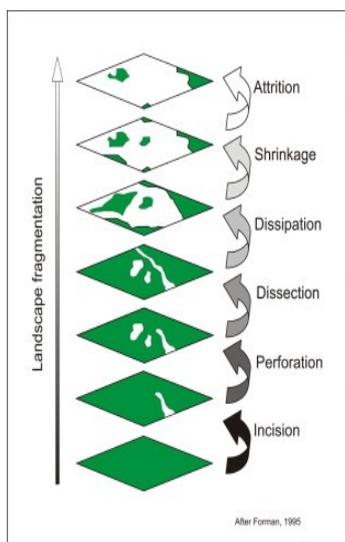


Figure 2: Stages in gradual fragmentation

The formation of isolates can be gradual or sudden, and often proceeds via a series of stages. The chance nature of negative impact of the disturbance in a **sudden** catastrophic event such as fire or flood is called **demographic stochasticity**, and survival much depends on chance, on the resilience of the species, and the intensity and duration of the disturbance. This applies to any ecosystem but the stakes are greatly amplified for isolates. This is partly due to isolated communities having lower genetic diversity within species, and potentially the lacking of “**key**” species, especially following a disturbance.

The **gradual** stages may be as in Figure 2:

- ◆ Incision is the initial excursion by an activity into a previously pristine (untouched) area. Usually a track. This permits disturbance entry to otherwise less accessible areas.
- ◆ Perforation is where small areas close to the track cause isolated disturbances. The bulk of the site remains viable, but the perforations rarely return to the original, and are usually connected to incisions.
- ◆ Dissection is where the track or especially a bikeway is extended and cut the area into parts. This is the major damage, as it separates species from others of similar genetic source. Species diversity and populations decline significantly from this point.
- ◆ Dissipation is the widening by various processes of the gap between the parts – edge effects. Islands are marginally viable for reduced populations of some species, but ecological processes are highly modified.
- ◆ Shrinkage is the general loss of the original landscape. This can be quite slow but inevitable.
- ◆ Attrition is complete loss of the original to a few small separated islands.

The concept in this diagram works at both small and large scale. The square shape can be an island, a mudflat, a buttongrass plain or a paddock. The process is the same. Once the disturbance process starts it is hard to stop.



Figure 3: Islands in a sea of green, Central Nth Tas

Sudden disturbances in the Tasmanian landscape are commonly either clear-fell logging, intense clearing from agriculture or urban development, and fire (natural or human sourced). The catastrophes are often absolute, and generally irreversible in human time scales (less than 100 years). If the catastrophe occurs within an isolated community, then even a partial recovery will not result in a complete functioning ecosystem, as many of the original and potentially “key” species may be absent. Such key species (the absence of which results in a skewed or failed ecological system) can include such lowly species as subsurface fungus or bacteria, up to major predators. What we often see as “recovered” is just a portion of the mature ecosystem that used to be present, even though it might appear similar at first glance to the original.

In particular, fire is often misunderstood in the general society, as it is devastating for most ecosystems and species. Apart from immediate mortality, it removes many food sources, from surface mulches and dead wood, up to flowers, fungi, nematodes and insects. The re-establishment of these critical links in the food chain over even small areas of an isolate, usually means introduction of less mobile species to the isolate, which is often impossible or highly unlikely at best in the short to medium term (i.e. 3-50 years) as many are virtually immobile. Very often, reduction in competition results in dominance of a fire tolerant species, and reduction in diversity in the short to medium term.

Fires and other disturbances such as logging can also FORM isolates, at different stages of what is known as “**succession**”, the phased development of dominant species over time. These isolates will often have few tree hollows, fewer mature seed producing trees, many species of the same age, and missing species, compared to their surrounds. At the edges and boundaries of these disturbances, as for isolates, there is a fierce competition.

Examples of this are well documented, in particular with fire regimes. Following a fire, a succession of species will re-establish, often with fierce competition and lower diversity. Fire tolerant or stimulated species that survive may do so

with a climax burst – a competitive bid for survival by large numbers of an organism that can overwhelm other species, and/or create masses of fire fuel. Given sufficient time, other species will return to the area, as senility increases mortality in the original species range, and eventually the ecosystem will return, perhaps not to the original as conditions may be different, but to an equilibrium condition. If the disturbance recurs in that succession stage, then the system starts from the beginning, but often without the survivors of the initial disturbance. It is this type of disturbance that creates high fuel load, monocultured, low diversity pockets in areas of higher diversity and uniform age.



Figure 4: Forestry forming isolates

Also well documented is the disturbance time scale. This is less well understood, despite the research, as so few areas are ever undisturbed. However, it is clear that grasslands tolerate fire or other disturbance at much greater frequency (as many are annuals) than alpine or wet forests, for which a 100 year old tree might not yet be in its prime. Isolates that are disturbed at even moderate frequency are highly likely to become virtual monocultures as the less tolerant species are killed off. If the species that disappear are key species, the entire system can collapse. It is also clear that some species have life cycles that are counted in decades or even centuries, and management programs that consider a fire cycle of 5 or 10 years are designed without understanding of these species. Examples include cicadas, with a life-cycle of 1-2 decades, or many plants which do not even commence to reproduce in similar timescales.

Humans might fail to grasp the difficulties faced by isolated communities, as we are highly mobile, and often can adapt our environment to suit us, rather than find ourselves by chance in an environment that suits us. We are also “apex predators” in that we don’t live in constant fear of being something’s next meal. Adapting our environment to suit ourselves nearly always comes at a significant price, paid in habitat loss, for innumerable other organisms.



Figure 5: Henry Somerset Reserve, Railton, surrounded by tree plantation monocultures

Case Study: Henry Somerset Reserve, Railton

This is a narrow island in a sea of timber plantation, which has great significance for its floristic values. Only a few hundred metres wide, it clearly suffers from desiccation, encroachment of weeds and over-management. The frequent burning has resulted in an apparent decrease in orchid species and numbers as well as loss of undergrowth species, and in recent years, many larger trees were cut down for “safety” reasons and wood theft, removing numerous nest hollows and general habitats. The reserve was initially too small to provide adequate habitat for larger species, which have a “pest-control” function. As seen in the “Gradual” process above, the area is in the Dissipation mode.

In summary, isolated pockets can be viewed as prisons, with deteriorating or rapidly changing conditions, limited capacities, and high degree of fragility. Most ecological communities should be left free, as far as possible, to determine their fate – to self-organise. In the form of the genetic codes of its constituent species, the undisturbed ecosystem carries a tremendous quantity of information with regard to its structure and function. Particularly since we know and understand only a small part of this information, we should be loath to subvert ecosystem self-organisation, by “management” processes. The difficulty is that to develop complete, highly functioning and resilient ecosystems, with adequate levels of diversity to support a healthy ecological community, large areas and extended time are required.

Humans seem to have difficulty with both understanding the concept, and not preventing fragmentation occurring.

Some references:

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Sustainability and Environmental Advisory Panel

AGENDA – 16 MAY 2023

Attachment 7: Biodiversity Corridors For Waratah-Wynyard Council

Biodiversity Corridors For Waratah-Wynyard Council

Colin Hocking 5/5/2023

The purpose of this proposal is to raise the prospect for, and promote ideas about, how best to identify, maintain and enhance biodiversity corridors within Waratah-Wynyard Council.

A significant number of Councils, Shires and other agencies across Australia now have biodiversity corridors of some type as part of their overall environmental strategy (sometimes called other names: ecological linkages, wildlife corridors, wildlife connection plans, biolinks, habitat corridors, etc.).

Redlands Council, in Queensland, have a comprehensive and comprehensible strategy for biodiversity corridors across their area of jurisdiction (attached and linked to at https://www.redland.qld.gov.au/download/downloads/id/2773/wildlife_connection_plan_2018_-2028.pdf

Redlands Council describe Wildlife Corridors as follows:

“Fragmentation of wildlife habitat in the Redlands has resulted in smaller disconnected patches of wildlife habitat that has reduced wildlife movement and has led to a reduction in biodiversity. Wildlife habitat, networks and corridors are the areas of connected native vegetation that enable the maintenance of ecological processes, the movement of wildlife and support the continuation of viable populations.”

The Redlands Council plan, and similar plans from other Councils, could be used as one template for how Waratah-Wynyard can develop a Biodiversity Corridor Policy and Strategy.

Relevance of Biodiversity Corridors to Waratah-Wynyard Council

WWC covers public and private land rich in biodiversity, with many areas that maintain high ecological integrity. WWC is habitat for rare plant and animal species, many of which are significant at State and National level. They include the Eastern Barred Bandicoot, the Eastern Brown Bandicoot, the Tasmanian Devil, Eastern and Spotted Tail Quoll, Tasmanian Wedgetail Eagle, Swift Parrot, etc., as well as numerous threatened plant species

Over time, it is apparent that the habitat of these and other significant species is being fragmented and otherwise divided by physical and other ecological barriers. There needs to be action now to head off these isolating effects of fragmentation and development.

Biodiversity corridors have already been identified as significant for WWC

In the WWC iCE,P under Item 38. *Protecting, enhancing and recovering biodiversity*, there is an action specific to biodiversity corridors

“38.3 Work with appropriate partner agencies to enhance and extend biodiversity corridors throughout Waratah-Wynyard, prioritising those currently at high risk.”

This is rated as Essential within the iCEP list of actions, with identified NRM as the lead within Council

(WWC iCEP Summary, at pg. pg. 22, under Theme 5 Environmental Stewardship)

Priority Actions for Developing Biodiversity Corridors

There is a priority now to:

1. Identify what the high significant corridors for biodiversity are within WWC, , in as far as these are known, on both public and private land.
2. Develop a set of interim protocols for how these corridors should be protected.
3. Set up a number of pilot projects to investigate the effectiveness and value of the interim protocols, primarily around highly significant locations.
4. Establish interim protocols for wildlife corridor management, as well as areas identified as significant corridors, and in the longer term, develop detailed Council Policy, Strategy and Guidelines for wildlife corridor identification and management, and embed these across the range of relevant WWC strategies (e.g. Settlement Strategy).

In this process, interested local and regional communities and organisations with interest in wildlife corridors should be invited to participate in helping to identify significant wildlife corridors, and what the interim protocols for management should be.

Next Steps

The next steps in the process for developing a WWC Biodiversity Corridor Policy, Strategy and Guidelines might be to:

Identify the range in people within WWC Council who have a responsibility, as well as interest, in developing biodiversity corridors.

Identify which WWC policies and strategies are relevant to the development of WWC biodiversity corridors , so that consideration can be given to adjustment of these in future, in the light of the development Biodiversity Corridors Policy and Strategy.

Identify which local communities, formalized community groups and organisations have an interest and need to identify, protect and enhance biodiversity corridors.

Set up a process for how Council Officers and community representatives can work through the processes for identifying corridors and developing interim protocols.

Note: UTas and Other Organisations as Partners and Resources

The University of Tasmania (UTas) and Bush Heritage Australia are partners in a major biodiversity corridor project to connect Tasmania's Eastern Tiers and Western Tiers via biodiversity corridors – see <https://www.bushheritage.org.au/places-we-protect/tasmania/midlands#:~:text=Between%20Tasmania's%20Eastern%20Tiers%20and%20Great%20Western%20Tiers,the%20west%20C%20south%20and%20north%20of%20the%20state.>

UTas have significant expertise in the identification and development of biodiversity corridors, and may be interested, with their students, in a project within WWC to identify and developing management plans, for biodiversity corridors – see attached guide for biodiversity corridors.



REDLAND CITY COUNCIL

Wildlife Connections Plan

2018 - 2028





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Executive Summary

Fragmentation of wildlife habitat in the Redlands has resulted in smaller disconnected patches of wildlife habitat that has reduced wildlife movement and has led to a reduction in biodiversity. Wildlife habitat, networks and corridors are the areas of connected native vegetation that enable the maintenance of ecological processes, the movement of wildlife and support the continuation of viable populations. The Wildlife Connections Plan 2018-2028, aims to geographically identify, at a city wide scale, and provide priority actions for the management, protection and enhancement of a network of core wildlife habitat and connecting corridors in Redland City.

Development of this plan utilised spatial modelling (CircuitScape) to identify areas of key terrestrial wildlife corridor values that occur between core vegetation areas throughout Redland City. The modelling was based on the most up-to-date research, technology and available ecological and anthropogenic data. The modelling outputs and expert local knowledge were used to develop the high priority wildlife habitat networks and corridors detailed within this plan. The priority corridors have been assigned target widths and buffers, based on wildlife corridor ecology literature and principles.

The identified priority wildlife habitat corridors are assigned names and values, connectivity, threats and priority management actions have been recorded to increase the understanding of each corridor. The corridors link the critical areas of Core Habitat, based on interior areas of remnant vegetation.

Five categories of wildlife habitat corridors have been defined:

- Established Corridors - high ecological value and strong wildlife movement;
- Regional Riparian Corridors - high ecological value and identified as a state significance riparian corridors;
- Coastal Foreshore Corridors - coastal fringe corridor of mainland and islands;
- Enhancement Corridors - sufficient ecological values and linkages with scope for enhancement; and
- Stepping Stone Corridors - isolated patches of functional connected habitat.

Priority objectives and outcomes are listed for each individual corridor to:

- Improve Corridor Habitat
 - Rehabilitation of gaps and pinch points.
- Prevent Wildlife Deaths
 - Safe fauna passage across road (or rail) barriers.
- Reduce Impacts on Corridors
 - Management of urban and/or peri-urban and/or rural area impacts; and
 - Management of storm tide and sea level rise impacts
- Protect Corridor Habitat
 - Review City Plan to determine any necessary consequential amendments.

Strategic corridor locations identifying key values and associated priority outcomes are found in the associated document, Corridor Descriptions and Locations (Appendix 4-7). The implementation of the priority outcomes will be achieved through a variety of methods and will be the responsibility of several areas within Council.

It is important to recognise that the identified mapped core habitat and corridors represent only the high value habitat and corridors. Many of the areas not identified within this plan will still play a vital role in providing habitat and safe movement opportunities for many wildlife species.

Introduction

The Redland City Council local government area is made up of both mainland and island communities. It includes developed urban areas in the north of the City, rural and bushland habitat areas in the south as well as North Stradbroke Island, Coochiemudlo Island and the Southern Moreton Bay Islands (Macleay, Lamb, Karragarra and Russell Islands). The Redlands contains a diverse array of wildlife habitats, including dry and wet eucalypt forests, littoral and riparian rainforest, various wetland and heathland habitats, mangrove and saltmarsh. These habitats all accommodate wide-ranging populations of plants, animals and fungi. To ensure the healthy function of our natural environment, Council is focussed on ensuring habitat is properly mapped, connected, enhanced and protected using a mixture of scientifically rigorous methods and expert knowledge and skills.

Fragmentation of wildlife habitat in the Redlands is caused by the clearing of native vegetation for agricultural, industrial and urban development. Fragmentation results in smaller disconnected patches of wildlife habitat that reduces the ability of wildlife movement, and ultimately leads to a reduction in biodiversity. (Brearley 2011 & Ndubisi et al. 1995)

The Redland City Council area contains many existing wildlife habitat networks and corridors with various values. These corridors and networks are essential for viable flora and fauna populations as they enable migration, colonisation and breeding within a fragmented landscape.

Networks and corridors of wildlife habitat may consist of a combination of environmental (bushland habitat) areas, street tree plantings, recreational parks and reserves, residential backyards, non-urban private lands, foreshore areas, waterways and riparian areas. Effects from transport networks (road and rail), urban areas and other developments can have a detrimental impact on flora and fauna populations.

For the purposes of this plan, wildlife habitat networks and corridors are the areas of land or water (physical connections) that link and provide plant and animal habitats, therefore reducing the impacts of the fragmented landscape. The term network refers to the broad connectivity between patches of core wildlife habitat and the corridors that link them.

All native flora and fauna are protected by a suite of legislative and non-legislative tools in South East Queensland, including planning and non-planning instruments. In recent years, government responses at both the State and Federal level have strengthened and enhanced corridor connections. With development and population growth in Redland City continuing, Council is committed to ensuring wildlife habitat corridors and networks are protected and enhanced for the conservation of our valued wildlife and their natural habitats.

The challenge for this non-statutory plan is to re-evaluate, document and consolidate Council's approach to corridor conservation and management, by identifying and focusing effort on outcomes that are viable, and identify new and innovative actions.

Objectives of the Plan

The Wildlife Connections Plan 2018-2028 aims to, at a city wide scale, geographically identify and provide priority actions for the management, enhancement and protection of core wildlife habitat patches and to facilitate improved connection of wildlife corridors in Redland City.

It is important to recognise that as this plan is at the city wide scale, only the highest priority corridors are presented. Areas not identified as core habitat or corridors will continue to play a vital role in providing habitat and movement opportunities for wildlife.

This plan aims to include terrestrial (land), riparian (waterway) and coastal foreshore corridors to provide ecologically appropriate wildlife habitat networks and corridors for a range flora and fauna.

This non-statutory plan will form a guide to strengthen corridors by recognising opportunities for the management and enhancement of existing Council reserves and managed land. This plan will also be used to inform Council's extension and community education programs, conservation land acquisitions program and assist in identifying potential offset sites. A review of City Plan will also be undertaken to determine any necessary consequential amendments.

The wildlife habitat corridors are identified by local geographic location, aimed to engender local community recognition, acceptance and ownership.

The plan aims to facilitate a number of key outcomes to achieve these objectives through a targeted and prioritised action plan. The action plan addresses the key risks to the function, protection and management of corridors and networks.

Action Plan Objectives

- **Improving Corridor Habitat**

Outcome 1: Rehabilitation of gaps and pinch points.

- **Preventing Wildlife Deaths**

Outcome 2: Safe fauna passage across road (or rail) barriers.

- **Reduce Impacts on Corridors**

Outcome 3: Management of urban and/or peri-urban and/or rural area impacts; and

Outcome 4: Management of storm tide and sea level rise impacts.

- **Protecting Corridor Habitat**

Outcome 5: Review City Plan to determine any necessary consequential amendments.

Legislation, Policy and Plans relevant to Strategic Corridors

National, State and Regional Corridor Strategic Planning

Successful strategic planning for wildlife habitat networks and corridors must involve participation from local, regional, state and national levels. Table 1 below outlines the relevant national, state and regional plans and strategies involving wildlife habitat networks and corridors planning. Appendix 1 provides a summary and review of these Federal, State and Regional documents.

Table 1: Summary of Corridor Planning

Scale	Program
National	National Wildlife Corridors Plan (Department of Sustainability, Environment, Water, Population and Communities, 2012)
State	Corridor identification through the Biodiversity Planning Assessments (Queensland Department of Environment and Heritage Protection, 2015)
Regional	Shaping SEQ - Draft South East Queensland Regional Plan (Department of Infrastructure, Local Government and Planning, 2016) Biodiversity Planning Assessment for the Southeast Queensland Bioregion – Version 4.1 (Department of Environment and Heritage Protection, 2016)

Redland City Council Corporate Plan 2015-2020

The Redland City Council Corporate Plan 2015-2020 establishes a commitment to promoting:

“A diverse and healthy natural environment, with an abundance of native flora and fauna and rich ecosystems, will thrive through awareness, commitment and action in caring for the environment.

- 1. Redland’s natural assets including flora, fauna, habitats, biodiversity, ecosystems and waterways are managed, maintained and monitored.*
- 2. Threatened species are maintained and protected, including the vulnerable koala species.”*

Council understands that key to the delivery of this outcome is the maintenance of sufficient wildlife habitat across the City to support the ecological functions of the flora and fauna that live within or migrate through the Redlands.

Redland City Council - Natural Environment Policy

In June 2015, Council adopted the *POL-3128 Natural Environment Policy*, consolidating former environmental policies. Council resolved to prepare updated strategies and plans to progress the Natural Environment Policy, identifying a number of priorities; including corridors. This plan will relate to the following sections of the Natural Environment Policy:

- “1. *Protect, enhance, restore the natural values of the City that include:*
 - a. Koalas and other native animal and plant populations and habitats;*
 - b. core habitat areas as sanctuaries for wildlife;*
 - c. safe wildlife movement corridors across the landscape;*
 - d. maintaining no net loss of native vegetation as defined in the Vegetation Management Act 1999;*
 - e. biological diversity and ecosystem services;*
 - f. waterways, foreshores, wetlands, coasts, aquatic ecosystems and Moreton Bay;*
2. *Enhance and restore Council’s protected areas and strengthen the connections between core habitats through public open space plantings, pest management and appropriate street tree planting programs in accordance with SEQ Natural Resource Management targets.*
3. *A conservation acquisition program that prioritises acquisition of land for rehabilitation, offsets, corridors and long term protection to achieve cost effective environmental outcomes that contribute to facilitating biodiversity conservation (eg koala survival) and has community benefits.*
4. *Manage protected areas to provide the best possible buffering of the City’s natural and cultural heritage values from the impacts of a changing climate.”*

Local Corridor Strategic Planning

Although strategic corridor planning is undertaken at a federal, state and regional level it is at the local level that the implementation of corridor management usually occurs. Over the past twenty years Redland City Council has developed and implemented a number of plans, strategies and mapping tools relating to wildlife habitat networks and corridors, including:

- Redland City Council Plans and Strategies:
 - Bushland and Habitat Corridor Plan 2004; and
- Mapping Tools:
 - Environmental Inventory (Chenoweth) 1996 to 2007;
 - Green Infrastructure 2009;
 - Wildlife Corridor Mapping Using Species Indicator Model 2010;
 - Natural Environment Decision System (AECOM and BAAM) 2011;
 - Redlands Trunk Green Corridors 2013; and
 - Wildlife Corridor Mapping (BAAM) 2014.

The implementation and success of these plans has been varied. Appendix 2 provides a summary and review of these Redland City Council documents and mapping products.

The most recent review of the Bushland and Habitat Corridor Plan 2004 (the precursor to this plan) revealed that of the 41 recommendations made within the 2004 plan, 17 have been implemented (or are ongoing), 15 were partially implemented and 9 were not implemented. It is noted that several of the implemented recommendations involved the development of a plan, strategy, mapping tool, research or advocacy, and that the on-ground actions derived from these may not have been realised.

Successful implementation of recommendations from the 2004 plan included:

- Surveys, reports and installation of treatments for fauna crossing points of roads in Redland City;
- Incorporation of the Environmental Inventory mapping into Redland Planning Scheme; and
- Koala habitat mapping projects.

Ecology and Principles of Wildlife Habitat Networks and Corridors

The basic ecological principles of wildlife habitat networks and corridors involve linking and improving connectivity between patches of core habitat in a fragmented landscape. Wildlife habitat networks and corridors must provide functional connectivity for flora and fauna species to move through fragmented landscapes to larger core habitat patches that contain greater resources and are more suitable for survival (Hess & Fischer 2001). A lack of connectivity in a fragmented landscape results in the isolation of flora and fauna populations, which reduces the possibility of demographic or genetic rescue (Doerr & Davies 2010).

The ability of networks and corridors to increase connectivity and provide for dispersal depends primarily on the dispersal behaviour of the species involved, as well as the characteristics of the corridors, core habitat patches and the surrounding matrix (Heinz et al. 2007). Wildlife behaviours (including home range, diet and social structure) and habitat preferences of locally relevant species should be used to determine the design and management of corridors and networks (Lindenmayer & Nix, 1993). The requirements of species most threatened by habitat fragmentation and also species acting as vectors for ecological processes (e.g. seed dispersers, pollinators, predators) are critical for successful wildlife habitat networks and corridors (Scotts & Cotsell 2014).

Wildlife habitat networks and corridors have multiple benefits, they are important for:

- Providing residential habitat for some species;
- Providing movement habitat for wide-ranging species, nomadic and migratory species, and dispersing individuals;
- Maintaining or enhancing genetic interchange between otherwise isolated animal or plant populations; and
- Facilitating the continuity of ecological processes through healthy and resilient animal and plant populations (Bennett 1998; Beier & Noss 1998; Lindenmayer & Franklin 2002; Hilty et al. 2006; Chester & Hilty 2010; Doerr et al. 2010).

The ecology and principles of wildlife habitat networks and corridors is a relatively well-studied and researched area. Appendix 3 provides a literature review on the major components of this topic. To summarise this work Table 2 describes the guiding principles for a functional wildlife habitat corridor.

Table 2 - Summary of Wildlife Habitat Networks and Corridors attributes functions and guiding principles.

<u>Core Habitat Patches</u>	
Large as Practical	To provide necessary resources and environmental conditions required for survivorship, reproduction and movement of a species core habitat patches should be as large as practical.
Circular Shape	The perimeter of core habitat patches should be minimised to reduce the impacts of edge effects (such as weed infestation, human-generated damage, microclimatic variables, and predation).
> 60m Buffer	A minimum 60m buffer of native vegetation should be provided for core habitat patches to reduce the risk of edge effects.
< 1100m Gaps	Core habitat patches should be no more than 1100m apart (even where structurally intact corridors are linking the core habitat patches).
<u>Wildlife Habitat Corridors</u>	
< 106m Gaps	To facilitate wildlife movement gaps (open areas) in habitat along wildlife habitat corridors should be no more than 106m.
> 100m Width	Wildlife habitat corridors should have a minimum width of 100m (preferably 250m to retain variety of bird species and complete suite of arboreal mammals).
> 50m Buffer	A minimum 50m buffer of native vegetation should be provided for wildlife habitat corridors to reduce the risk of edge effects.
Feathered Edge	To minimise exposure to edge effects and keep species movements within the corridor, wildlife habitat corridors should have an edge with a feathered shape.
Diverse Structure	A diversity of native flora (for example layers including grasses, small shrubs, and variety of trees) will benefit a greater number of species moving through wildlife habitat corridors.
Minimise Barriers	Minimising the number and impact of barriers (for example highways, railway lines and impermeable fences) will increase the success of wildlife habitat corridors.
Stepping Stones	Identification of critical stepping stone corridors (for example scattered street or paddock trees) will increase the success of wildlife habitat networks.

Wildlife habitat networks and corridors can operate at a variety of scales:

- National corridors operate at the continental scale, aiming to create or enhance major landscape links. The 'National Wildlife Corridors Plan: A framework for landscape-scale conservation 2012' provides the framework for Australia's national corridor network.
- Regional corridors are connections between larger areas of generally protected habitat. They provide a range of ecosystem processes and are capable of supporting viable wildlife populations within the corridors. Regional corridors are generally greater than 500m in width and typically connect along altitudinal or migratory ecological gradients such as coast to hinterland (DECC 2004). The South East Queensland Regional Plan and the South East Queensland Biodiversity Planning Assessment (State Significance Corridors) provide the framework for regional corridors in Queensland.
- Sub-regional corridors facilitate species movement and dispersal opportunities for a wide range of species, but are not wide enough to support an extensive range of viable populations. Sub-regional corridors are generally greater than 300m wide and typically link larger vegetated landscape features (DECC 2004). The South East Queensland Biodiversity Planning Assessment 2016 (Regional Significance Corridors) provides the framework for regional corridors in Queensland. The Gold Coast Bioregional Corridor Plans are an example of implementation of a sub-regional corridor planning (Conics 2009).
- Local scale corridors function as conduits for wildlife movement between patches of core habitat by providing adequate cover and refuge for the duration of the wildlife movement, but generally do not provide habitat which is able to sustain viable populations within the corridor (Bennett 2003). The wildlife habitat corridors presented within this plan are local scale.

Modelling of Redlands Wildlife Habitat Networks and Corridors

Biodiversity Assessment and Management (BAAM) ecological consultants were commissioned by Redland City Council to geographically identify a well-defined wildlife habitat network of core habitat patches and connecting corridors in Redland City. The resulting 'Wildlife Habitat Networks and Corridor Mapping – Redland City' report (BAAM 2016), used spatial modelling to generate a heat map of key terrestrial wildlife corridor values that occur between core vegetation areas throughout Redland City.

The work was based on the refinement of a previous study (BAAM 2014), which provided a contemporary approach to modelling and mapping wildlife networks and corridors in Redland City using a network modelling tool called CircuitScape. CircuitScape is a connectivity analysis software package which uses algorithms from electronic circuit theory to predict patterns of movement among plant and animal populations. Circuit theory considers the effects of all possible pathways across a landscape simultaneously. (BAAM 2016) This modelling tool was again used to develop wildlife habitat network and corridor value maps for Redland City, based upon the attribution of several key anthropogenic and ecological parameters. These parameters included:

- Remnant vegetation mapping, with edges treated separately;
- Regrowth vegetation mapping, with edges treated separately;
- Urban trees - small patches of trees or isolated clumps of vegetation;
- Open areas - very sparse canopy, infrequent artificial obstacles;
- Urban land - lots equal to, or less than 2000m² were classified as urban land; and
- Transport infrastructure - major, secondary and local roads, and the rail network.

Separate spatial layers were created for each parameter and the parameters were given a ranked score, based upon key assumptions about their relative conductivity contributions to wildlife movement. These layers were all used to inform the creation of a single raster suitable for input into the modelling software.

A separate raster of core habitat was created to identify the connectivity source points, which form a critical component of the model. The core habitat raster is based on interior areas of the remnant vegetation mapping (with a 60m edge-affected rim removed).

Each of the Redland City land areas (mainland, Coochiemudlo Island, the inhabited Southern Moreton Bay Islands and North Stradbroke Island) were modelled independently.

The model revealed a series of wildlife networks across Redland City, as shown in Figure 1. These are particularly well-defined on the mainland, but also evident on the Southern Moreton Bay Islands and, to a lesser extent, on North Stradbroke Island, which is comprehensively dominated by remnant vegetation (core habitat).

The output rasters were relativised and transformed into a single vector. The vector was then simplified into two levels of attribution (based on their medium–high “heat” scores outside of core areas) to represent two different types of wildlife corridor (as shown in Figure 2):

- **Established Corridor Values:** these are areas of particularly high ecological value that hold strong, pre-existing values in providing movement opportunities for wildlife in general; and
- **Enhancement Corridor Values:** these are areas that exhibit sufficient ecological value and linkages that would be appropriate targets for strategic enhancement to strengthen Established Corridors.

The output of networks and wildlife corridors were then critiqued using a series of overlays. These included local waterways, corridor dependent species database records, the Queensland Government Biodiversity Planning Assessment (BPA) regional and state corridors layer and a public land layer. This interrogation of the model outputs indicated that these corridors, despite being simplified versions of the model output, correspond closely with vegetated waterways, corridor dependent species records, and the independently derived BPA corridors.

This automated modelling system provided an objective connectivity map that can be used in conjunction with complimentary studies, land tenure data, key habitats, corridor-dependent species data and expert knowledge of the area to identify potential terrestrial wildlife corridors.

The mapping outputs from the CircuitScape modelling (core habitat patches, raster heat mapping outputs and Established and Enhancement Corridor layers) are used to help the visual identification of priority wildlife corridors throughout Redland City. These mapping outputs will be useful to inform planning and management of:

- Existing Council reserves
- Waterway, wetland and riparian programs
- Individual property planning
- Potential offset sites
- Conservation land acquisitions, and
- City wide land use planning

The mapping report recommends an analysis is undertaken to identify corridors for strategic protection and enhancement in future planning instruments. This recommendation has been implemented by the delineation of the priority wildlife habitat corridors, outlined in the following sections of this plan.

Limitations of Modelling Redlands Wildlife Habitat Networks and Corridors

Issue: Defining Established and Enhancement Corridor layers from heat mapping vector.

- **Reason:** Allows areas with higher connectivity value to stand out, which assist in prioritising decision making.
- **Limitation:** Areas of habitat that did not meet the cut-off for Established and Enhancement Corridors may still be important for the linkage of key core habitat areas.
- **Options to address:** Secondary rehabilitation of areas between enhancement corridors may result in additional areas being included in Established and/or Enhancement Corridor layers in the future.

Issue: Focus on terrestrial corridors.

- **Reason:** The BAAM report and modelling exercise is limited to the recognition of terrestrial wildlife corridors.
- **Limitation:** The modelling does not address non-terrestrial fauna movement, such as the movement of migratory shorebirds between intertidal areas.
- **Options to address:** The scope of the Wildlife Connections Plan is terrestrial fauna movement, in line with the current priority of Council. A change in scope, or separate plan would be required to address non-terrestrial fauna movement.

Issue: The formation of the model's core habitat layer did not include areas of regrowth vegetation.

- **Reason:** All areas of regrowth vegetation were excluded from the core habitat layer, as regrowth vegetation was not deemed to have sufficient habitat values to be considered as core habitat.
- **Limitation:** Some areas of high-quality regrowth vegetation with important habitat features were excluded from the core habitat layer. These areas of habitat may still include features of core habitat and they may still support a diversity of wildlife.
- **Options to address:** Include regrowth vegetation in core habitat layer in future runs of the model.

Issue: Removal of 60m edge-affected rim from core habitat.

- **Reason:** A minimum 60m buffer of native vegetation should be provided for core habitat patches to reduce the risk of edge effects. The core habitat is based on interior areas of the remnant vegetation mapping (with a 60m edge-affected rim).
- **Limitation:** Certain areas of recognised habitat value were excluded from the core layer in the model by applying and removing the 60m wide edge-affected rim. This does not necessarily suggest these areas are not ecologically important, and it should be recognised they may still support a diversity of wildlife.
- **Options to address:** Width of buffer could be adjusted in future runs of the model, in accordance with changes to contemporary knowledge and practice.

Issue: Habitat features beyond the Redland City boundary were excluded in the modelling. This could potentially influence wildlife network and corridor values within Redland City.

- **Reason:** The western edge of the city is largely bounded by remnant bushland areas with contiguous core habitat areas extending within and along the boundary itself (such as Tingalpa Creek Conservation Park, Daisy Hill Conservation Park, Venman Bushland National Park, Cornubia Nature Refuge and the Bayview, Days Road, Kidd Street and Serpentine Creek Conservation Areas).
- **Outcome:** The inclusion of areas outside of Redland City in the modelling process was considered likely to have little influence on the identification of wildlife network and corridor values within Redland City.
- **Options to address:** The scope of the Wildlife Connections Plan is terrestrial fauna movement throughout Redland City, in line with the current priority of Council. A change in scope, or separate plan would be required to address fauna movement across local government boundaries with neighbouring local governments.

Figure: 5.1
Title: Results of the Redland City Council Corridor Modelling

Project: Redland City Wildlife Habitat Networks & Corridor Mapping
Client: Redland City Council

Legend

- Core vegetation areas
- Corridor heat values
 High : 1484.84
 Low : 0

Metadata:
 Coordinate System: GDA 1984 MGA Zone 55
 Projection: UTM
 Datum: GDA 1984
 Peak Elevation: 500.000000
 Peak Sighting: 100.000000
 State Plane: 100.000000
 State Factor: 1.000000
 Units: Meter
 1:625,000

Scale: 0 0.5 1 2 3 4 Kilometers

Date: 13 Dec-18 **Drawn By:** MJS **Reviewed by:** PL

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 ECOLOGICAL CONSULTANTS

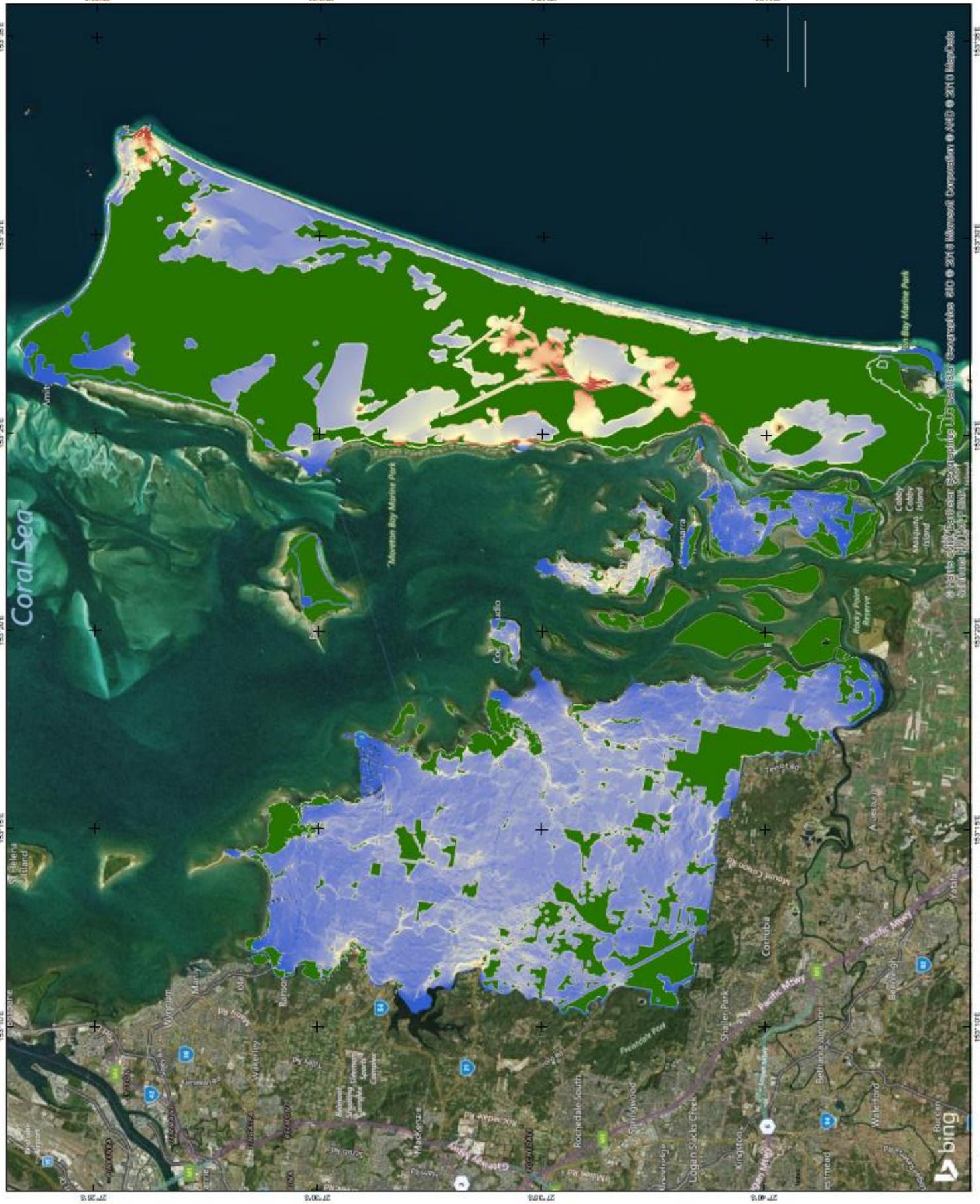


Figure 1 - Raster heat map output from CircuitScape modelling.

Figure: 5.2a
 Title: Redland City Council Wildlife Corridor Mapping (Mainland)
 Project: Redland City Wildlife Habitat Networks & Corridor Mapping
 Client: Redland City Council

Legend
 Established Corridor
 Enhancement Corridor

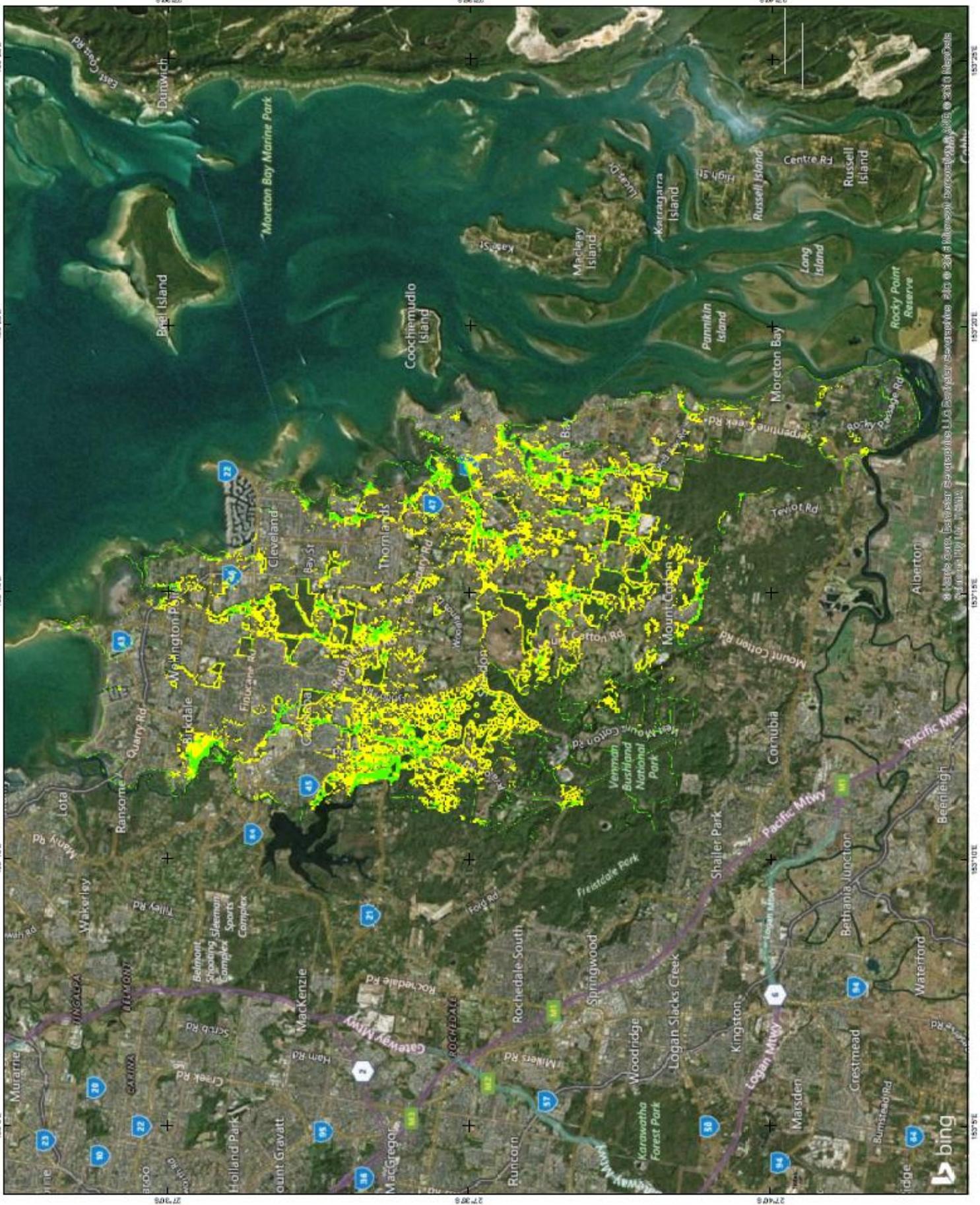


Figure: 5.2a
 Title: Redland City Council Wildlife Corridor Mapping (Mainland)
 Project: Redland City Wildlife Habitat Networks & Corridor Mapping
 Client: Redland City Council

Legend
 Established Corridor
 Enhancement Corridor

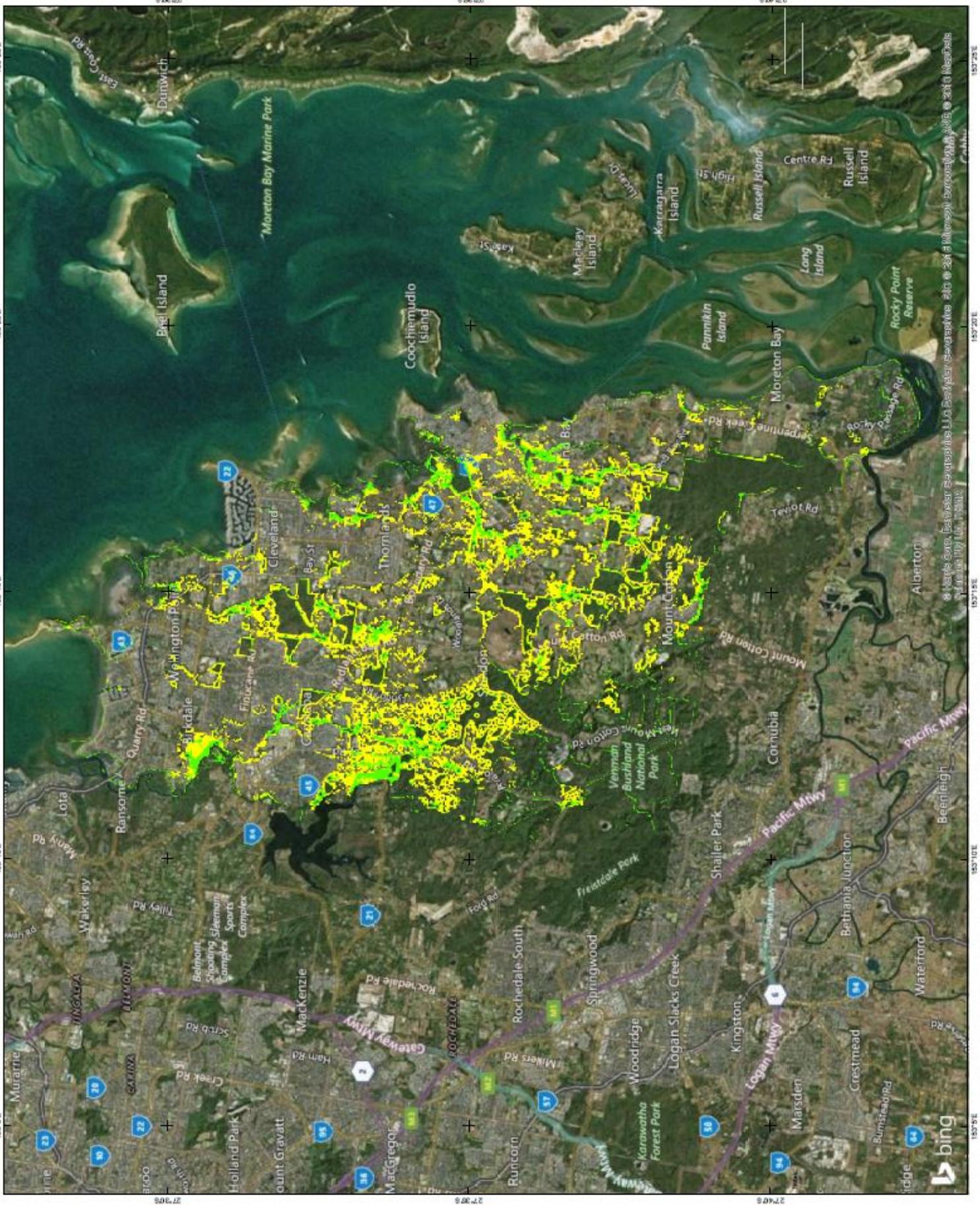


Figure 2 - Core Habitat, Established and Enhancement Corridors from CircuitScape Modelling

Coordinate System: GDA 1984 MGA Zone 55
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 File Size: 10,000,000
 File Date: 12/01/2018
 File Time: 10:00:00
 File Type: Image
 File Extension: .img

Scale: 1:111,000 at A4
 North Arrow
 Scale Bar: 0 0.5 1 2 3 4 Kilometers

Date: 15-Dec-18
 Drawn By: MGS
 Reviewed By: PL

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Developing the Redlands Wildlife Habitat Networks and Corridors

The CircuitScape modelling outputs have been used to develop the high priority corridors outlined in the proceeding sections of this plan. A series of workshops and working groups utilised expert local knowledge of habitat, wildlife, land use, connectivity and the CircuitScape modelling outputs to develop the wildlife habitat networks and corridors. The principles and data sets used to develop these priority networks and corridors were:

- The Core Habitat identified by the wildlife habitat networks and corridors modelling formed the 'core hubs' that the corridors aim to connect;
- The modelling was the primary source used to delineate the Established Corridors and the Enhancement Corridors;
- Where possible, multiple corridors were provided as alternative links between Core Habitat patches to account for potential disturbance events (such as fire, storms, flooding, disease and impacts from development); and
- Council owned and managed land was favoured to form the trunk centre line of corridors.

Whilst this plan only represents the corridors identified as containing a high level of corridor value, it is imperative to understand that many of the areas not identified will still play a vital role in providing habitat and movement opportunities for many species of wildlife.

The corridors have been assigned target widths and buffers, based on wildlife corridor ecology literature and principles (refer to Appendix 3). Based on these targets, the corridors have been presented as defined 'strips' through the landscape. However, it must be recognised that corridors should not always be viewed as clear pathways. For many wildlife species, movement is diffused through the landscape, and they may not adhere to bushland corridors.

Wildlife Habitat Networks and Corridors

Five categories of wildlife habitat corridors have been defined in this plan (Table 3).

The corridors are assigned names to engender local community recognition, acceptance and ownership. The naming reflects the corridor's local geographic location (Figure 3 and 4).

Core Habitat: The patches of Core Habitat (based on interior areas of remnant vegetation) form the 'core hubs' that the corridors aim to connect. The areas of Core Habitat are all of very high ecological value and a very high priority for protection and rehabilitation.

Table 3 - Definition of Wildlife Habitat Corridor Types

Corridor Type	Definition	Ecological Value	Priority for Rehabilitation
Established	Corridors of particularly high ecological value that hold strong, pre-existing values in providing movement opportunities for wildlife in general.	Highest Ecological Value	Highest Priority for Rehabilitation
Regional Riparian	Particularly significant riparian corridors for biodiversity that form a major element of habitat continuity, as identified in the Biodiversity Planning Assessment (BPA) for the Southeast Queensland Bioregion (EHP 2016).	Highest Ecological Value	Highest Priority for Rehabilitation
Coastal Foreshore	Coastal fringe corridor of the Redland City mainland, Southern Moreton Bay Islands, Coochiemudlo Island and the township areas of North Stradbroke Island. May contain Established, Enhancement or Stepping Stone values.	High Ecological Value	High Priority for Rehabilitation
Enhancement	Corridors that exhibit sufficient ecological value and linkages that would be appropriate targets for strategic enhancement to strengthen Established Corridors.	Medium Ecological Value	Medium Priority for Rehabilitation
Stepping Stone	Corridors of isolated patches of habitat that, while not physically connected, are functionally connected, allowing movement between larger patches.	Less Ecological Value	Lower Priority for Rehabilitation

For each of the wildlife habitat corridors, the values, connectivity, threats and priority management outcomes have been identified to increase the understanding of these priority corridors.

The following specific attributes are assigned to each of the priority corridors:

- Description
 - Location, orientation and linkages to Core Habitat patches.
- Environmental Values
 - Dominant vegetation types and keystone wildlife values.
- Core Habitat Linkages
 - Number of Core Habitat patches linked by corridor; and
 - Maximum distances between Core Habitat patches
- Land Uses
 - Tenure and planning scheme zonings.
- Community Uses
 - Values and potential uses.
- Threats and Barriers
 - Edge effects from urban, peri-urban and rural land use;
 - Road and rail infrastructure; and
 - Development potential within the planning scheme.
- Gaps and Pinch Points
 - Significant gaps (greater than 106m) of open or developed areas along the corridor; and
 - Narrow points of corridor (where width is less than 100m).
- Priority Outcomes
 - Mitigation of current threats and barriers; and
 - Rehabilitation of gaps and pinch points (focusing on where maximum distances between Core Habitat patches is more than 1100m apart)

The above attributes for each corridor are presented in the associated document 'Corridor Descriptions and Locations' (Appendix 4-8). Within this document all corridors display the mapped vegetation within the corridor as a solid colour (with the colour dependent on the corridor type). The areas within the corridor that do not contain mapped vegetation are presented with a transparent colouring. This presentation allows clear distinction between the higher ecological function sections of a corridor (i.e. mapped vegetation represented as solid colours) and other buffer areas of human uses (residential areas, roads etc.) or potential gaps or pinch points for rehabilitation. Please note that while every effort has been made to use the most up to date aerial imagery in the maps presented, not all images may be current.

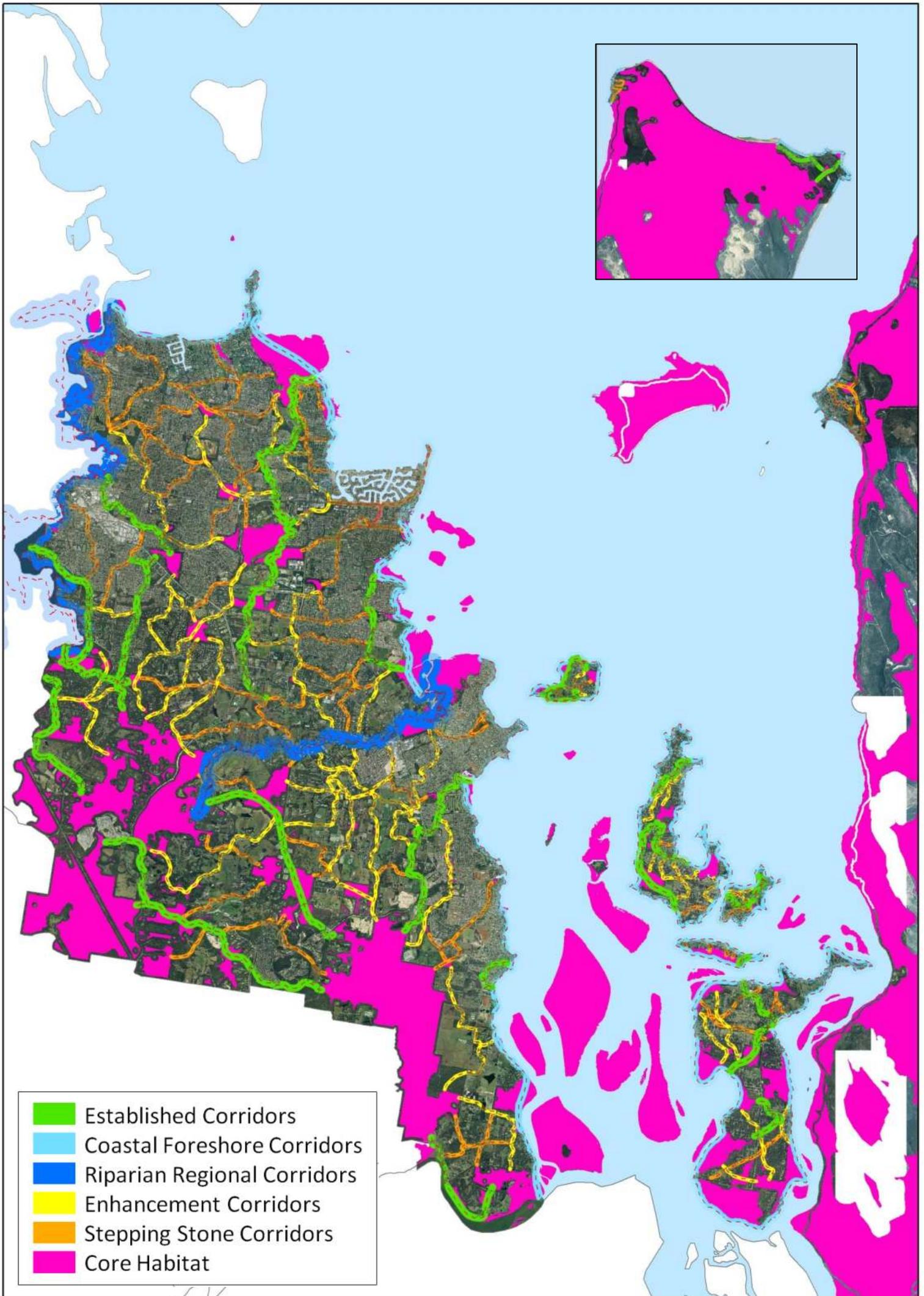


Figure 3 - Wildlife Habitat Network and Corridors in Redland City

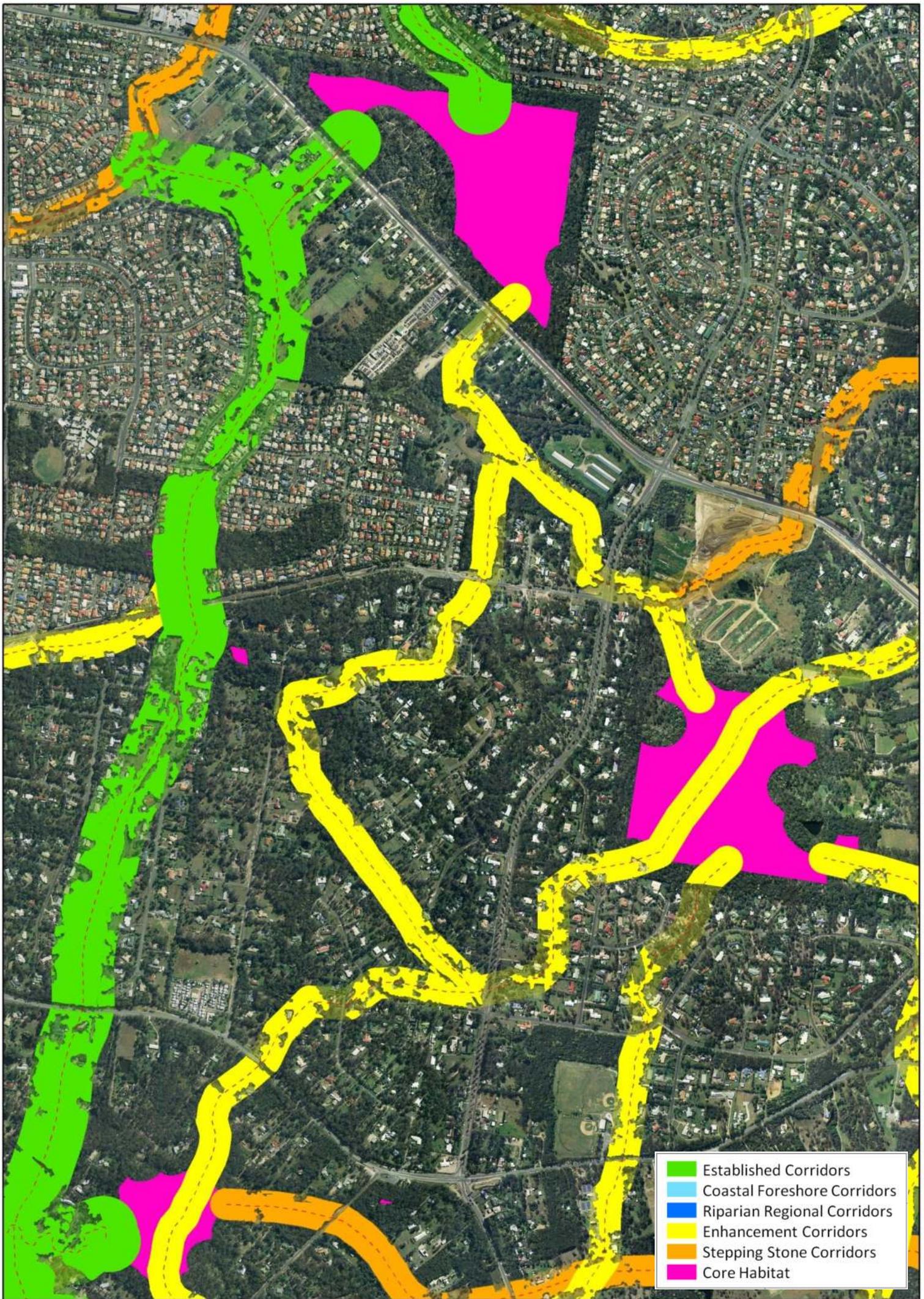


Figure 4 - Wildlife Habitat Network and Corridors – Detailed Example

Established Corridors

The Established Corridors are local scale corridors, and have been defined and mapped within the Redland City local government area. The Established Corridors are areas of particularly high ecological value that hold strong, pre-existing values in providing movement opportunities for wildlife.

To retain a variety of bird species and complete suite of arboreal mammals, the Established Corridors are defined as having a width of 100m, with a minimum 50m buffer of native vegetation (on each side) to reduce the risk of edge effects, resulting in a 200m wide corridor.

The Established Corridors are the highest priority for protection and rehabilitation, as they represent the best value in terms of financial and ecological benefits. The priority outcomes outlined in Appendix 4 should be implemented in the Established Corridors first.

A total of 24 Established Corridors have been identified in Redland City (Figure 5). Appendix 4 provides the full details (name; map; description; environmental values; core habitat linkages; land uses; community uses; threats and barriers; gaps and pinch points; and priority outcomes) for each of these corridors.

Table 4 provides a summary of the attributes of the Established Corridors.

Table 4 - Summary of the values and threats for the Established Corridors

Attributes	Amount	Percentage of Total Corridor
Total number of Established Corridors	24	
Total area of all Established Corridors (200m wide)	1775 ha	
Total area of mapped vegetation (Regional Ecosystem) within all Established Corridors	1320 ha	74%
Total area of open area, urban area, road and rail within all Established Corridors	455 ha	26%
Total area of Council owned land within all Established Corridors	589 ha	33%

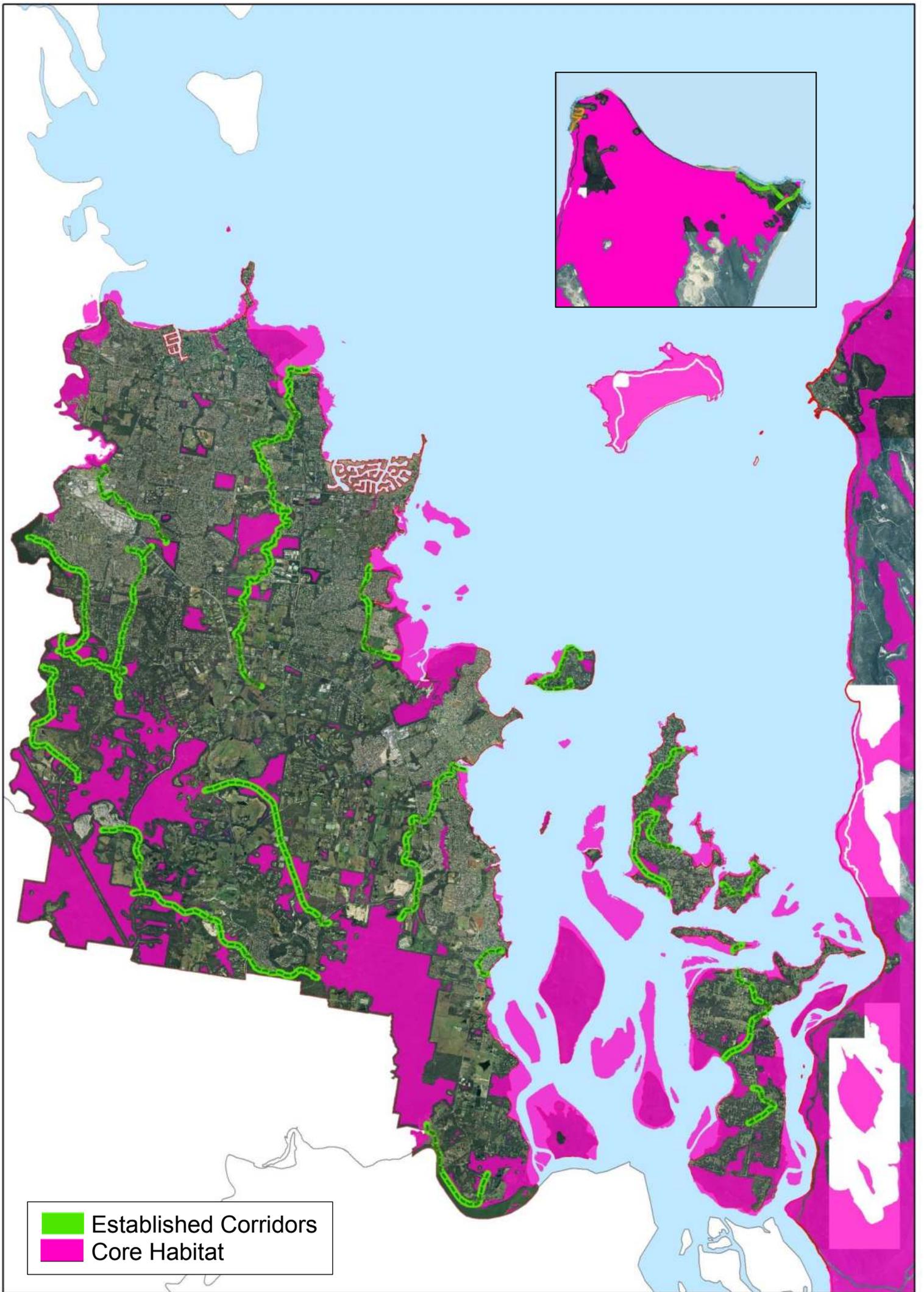


Figure 5 - Established Corridors

Regional Riparian Corridors

The Regional Corridors are identified in the Biodiversity Planning Assessment (BPA) for the Southeast Queensland Bioregion (EHP 2016). The riparian corridors from the BPA are included within this plan as they represent local scale corridors. The terrestrial BPA corridors are not included as they represent state and regional scale planning, beyond the scope of this plan.

The Regional Riparian Corridors are equal priority to the Established Corridors for protection and rehabilitation, as they represent the best value in terms of financial and ecological benefits. The BPA has assigned the regional riparian corridors a target width of 400m. The priority outcomes outlined in Appendix 5 should be implemented in the Established and Regional Riparian Corridors first.

A total of two Regional Riparian Corridors are located in Redland City (as shown in Figure 6). Appendix 5 provides the full details (name; map; description; environmental values; core habitat linkages; land uses; community uses; threats and barriers; gaps and pinch points; and priority outcomes) for each of these corridors.

Table 5 provides a summary of the attributes of the Regional Riparian Corridors.

Table 5 - Summary of the values and threats for the Regional Riparian Corridors.

Attributes	Amount	Percentage of Total Corridor
Total number of Regional Riparian Corridors	2	
Total area of all Regional Riparian Corridors (400m wide – within Redland City)	1065 ha	
Total area of mapped vegetation (Regional Ecosystem) within all Regional Riparian Corridors (in Redland City)	600 ha	56%
Total area of water reservoir, open area, urban area, road and rail within all Regional Riparian Corridors	465 ha	44%
Total area of Council owned land within all Regional Riparian Corridors	167 ha	16%

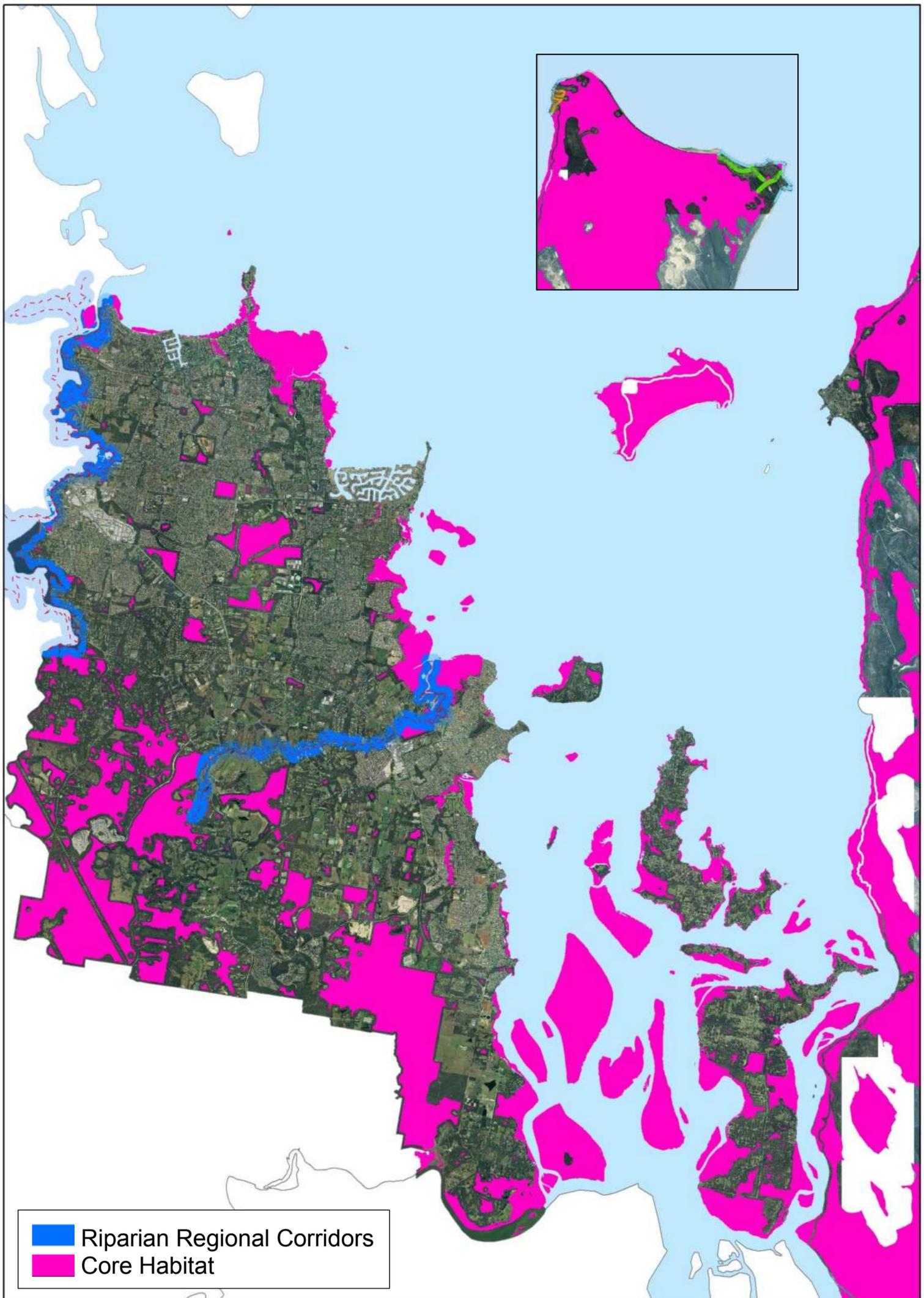


Figure 6 - Regional Riparian Wildlife Habitat Corridors

Coastal Foreshore Corridors

The Redlands Coastal Foreshore Corridors are local scale corridors, and have been defined and mapped within the Redland City local government area. The coastal foreshore corridors make up the coastal fringe of the Redland City mainland, Southern Moreton Bay Islands, Coochiemudlo Island and the township areas of North Stradbroke Island. Although these corridors may exhibit characteristics of Established, Enhancement or Stepping Stone Corridors, they have been grouped together as they have similar values, threats and management actions.

The Coastal Foreshore Corridors are a high priority for protection and rehabilitation, as they represent the value in terms of financial and ecological benefits. The priority outcomes for the Coastal Foreshore Corridors outlined in Appendix 6 should occur, following the implementation of actions in the Established and Regional Riparian Corridors.

The Coastal Foreshore Corridors predominately comprise of tidal flats, mangrove, saltpan, saltmarsh and casuarina habitats and may incorporate other fringing woodland vegetation (on coast dunes or alluvial land). These coastal foreshore corridors are crucial habitat for wader birds, intertidal marine vertebrates and invertebrates, and specialist species such as the Water Mouse.

To retain a variety of species the Coastal Foreshore Corridors are defined as having a width of 100m, with minimum 50m buffer (on each side) to reduce the risk of edge effects, resulting in a 200m wide corridor.

A total of 14 Coastal Foreshore Corridors have been identified in Redland City (as shown in Figure 7). Appendix 6 provides the full details (name; map; description; environmental values; core habitat linkages; land uses; community uses; threats and barriers; gaps and pinch points; and priority outcomes) for each of these corridors.

Table 6 provides a summary of the attributes of the Coastal Habitat Corridors.

Table 6 - Summary of the values and threats for the Coastal Foreshore Corridors

Attributes	Amount	Percentage of Total Corridor
Total number of Coastal Foreshore Corridors	14	
Total area of all Coastal Foreshore Corridors (200m wide)	2407 ha	
Total area of mapped vegetation (Regional Ecosystem) within all Coastal Foreshore Corridors (Please Note: does not include inter-tidal open areas)	908 ha	38%
Total area of marine zone, open area, urban area, road and rail within all Coastal Foreshore Corridors	1499 ha	62%
Total area of Council owned land within all Coastal Foreshore Corridors	295 ha	12%

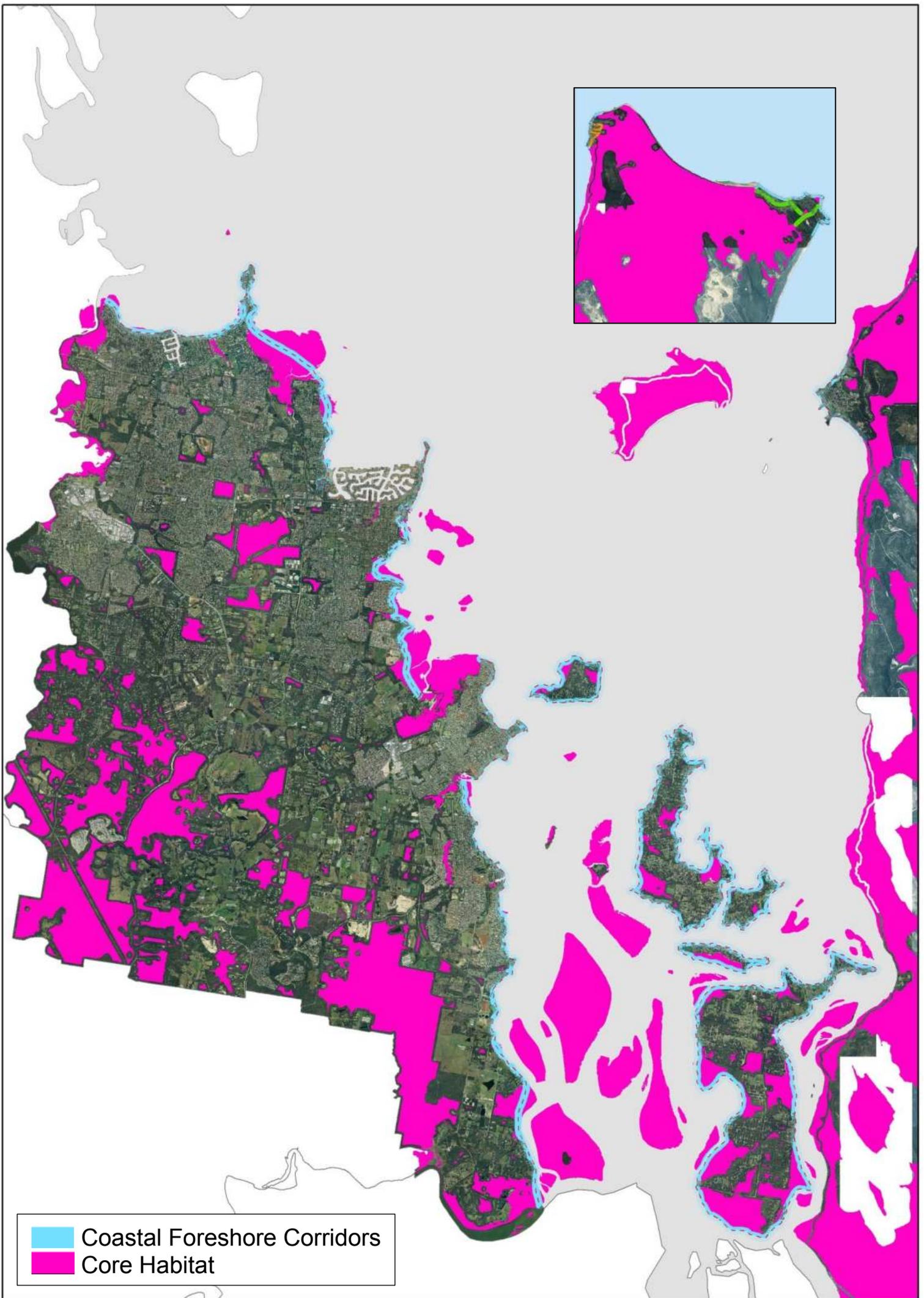


Figure 7 - Coastal Foreshore Wildlife Habitat Corridors

Enhancement Corridors

The Enhancement Corridors are local scale corridors, and have been defined and mapped within the Redland City local government area. The Enhancement Corridors are areas that exhibit sufficient ecological value and linkages that would be appropriate targets for strategic enhancement to strengthen Established Corridors.

The Enhancement Corridors are the second highest priority for protection and rehabilitation. The priority outcomes outlined in Appendix 7 should occur, following the implementation of actions in the Established, Regional Riparian Corridors and Coastal foreshore.

To retain a variety of bird species and complete suite of arboreal mammals, the Enhancement Corridors are defined as having a width of 100m.

Enhancement Corridors in Known Development Areas Corridors is a subgroup of Enhancement Corridors that are recognised as part of an identified development area under a planning instrument or existing approval (refer to Appendix 7a – Enhancement Corridors in Known Development Areas Corridors). These areas include Kinross Road Thornlands, South East Thornlands, Shoreline Redland Bay and the Bunker Road Victoria Point emerging community area. Additional 'property scale' corridors may be identified in these (and future) identified development areas, and established as different parts of the City are developed or as land uses change. It should be noted that it is not the role of the Wildlife Connection Plan to identify 'property scale' corridors.

A total of 44 Enhancement Corridors have been identified in Redland City (Figure 8). Appendix 7 and 7a provide the full details (name; map; description; environmental values; core habitat linkages; land uses; community uses; threats and barriers; gaps and pinch points; and priority outcomes) for each of these corridors.

Table 7 provides a summary of the attributes of the Enhancement Corridors.

Table 7 - Summary of the values and threats for the Enhancement Corridors

Attributes	Amount	Percentage of Total Corridor
Total number of Enhancement Corridors	44	
Total area of all Enhancement Corridors (100m wide)	1207 ha	
Total area of mapped vegetation (Regional Ecosystem) within all Enhancement Corridors	830 ha	69%
Total area of open area, urban area, road and rail within all Enhancement Corridors	377 ha	31%
Total area of Council owned land within all Enhancement Corridors	280 ha	23%

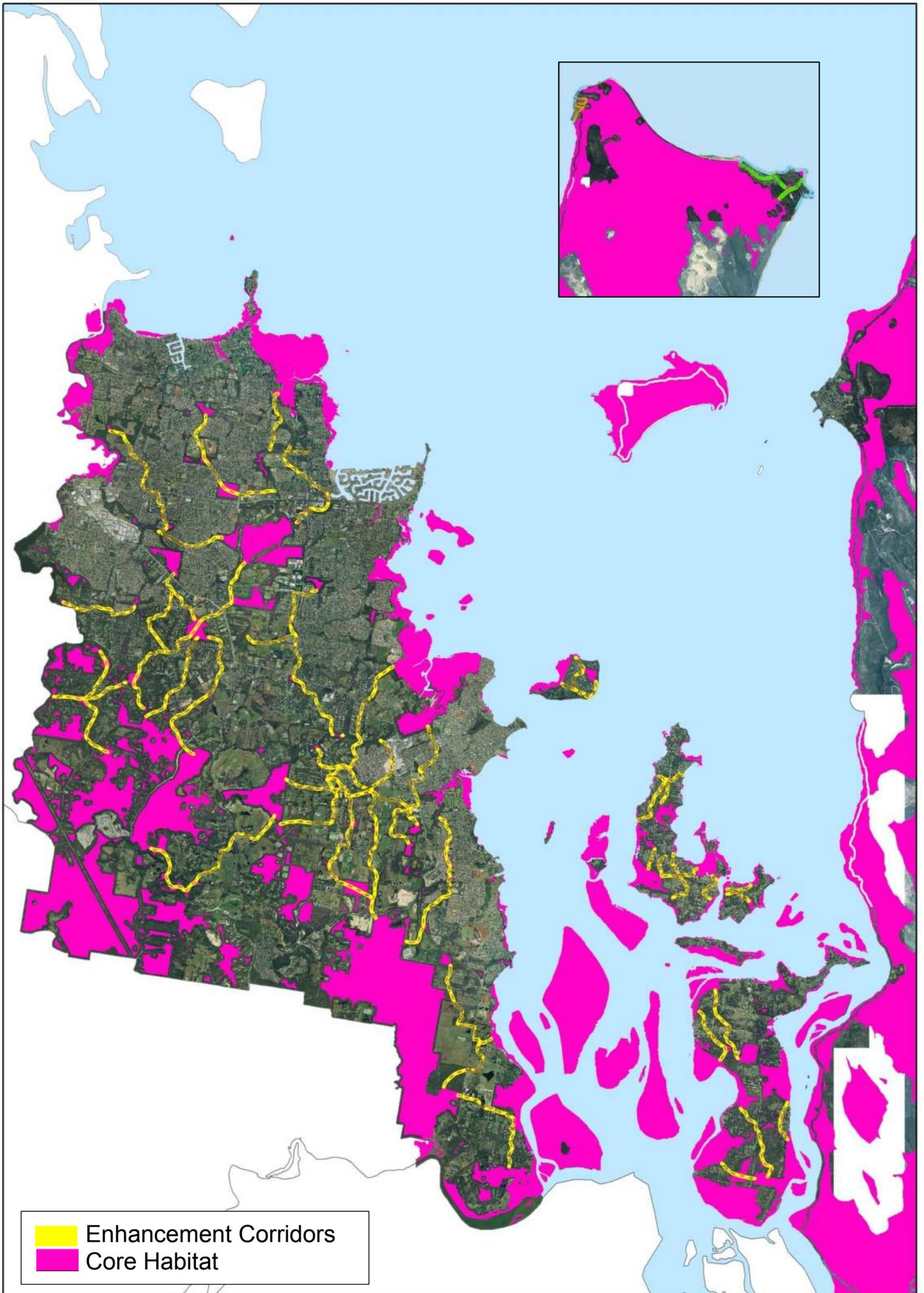


Figure 8 - Enhancement Corridors

Stepping Stone Corridors

The Stepping Stone Corridors are local scale corridors, and have been defined and mapped within the Redland City local government area. The Established and Enhancement Corridors represent predominately continuous and diversely structured habitat, and are generally the most appropriate for facilitating wildlife movement. However it is recognised that Stepping Stone Corridors (such as scattered trees) can be equally effective for certain species while dispersing or migrating. (Forman 1995 & Bennett 2003)

Stepping stones can be defined as isolated patches of habitat that, while not physically connected, are functionally connected, allowing movement between larger patches (National Wildlife Corridors Plan 2012). Stepping Stones of suitable habitat enhance connectivity in developed landscapes for species able to make short movements through disturbed environments. Stepping Stones may be natural patches, such as wetlands or patches of rainforest within drier forests or they may be small remnant patches of vegetation in a developed landscape. Scattered trees or patches of habitat are the most recognised form of Stepping Stones and are important to native fauna for movement, shelter, foraging habitat and nesting resources, especially in urban areas.

The Stepping Stone Corridors are a lower priority for protection and rehabilitation. The priority outcomes outlined in Appendix 8 should occur, following the implementation of actions in the Established, Regional Riparian, Coastal Foreshore and Enhancement Corridors.

To retain a variety of bird species and arboreal mammals, the outline of Stepping Stone Corridors are defined as having a width of 100m. However, by their nature, the Stepping Stone Corridors consist of patches of vegetation and not a continuous vegetated corridor.

A total of 62 Stepping Stone Corridors have been identified in Redland City (Figure 9). Appendix 8 provides the full details (name; map; description; environmental values; core habitat linkages; land uses; community uses; threats and barriers; gaps and pinch points; and priority outcomes) for each of these corridors.

Table 8 provides a summary of the attributes of the Stepping Stone Corridors.

Table 8 - Summary of the values and threats for the Stepping Stone Corridors

Attributes	Amount	Percentage of Total Corridor
Total number of Stepping Stone Corridors	62	
Total area of all Stepping Stone Corridors (100m wide)	1332 ha	
Total area of mapped vegetation (Regional Ecosystem) within all Stepping Stone Corridors	622 ha	47%
Total area of open area, urban area, road and rail within all Stepping Stone Corridors	710 ha	53%
Total area of Council owned land within all Stepping Stone Corridors	377 ha	28%

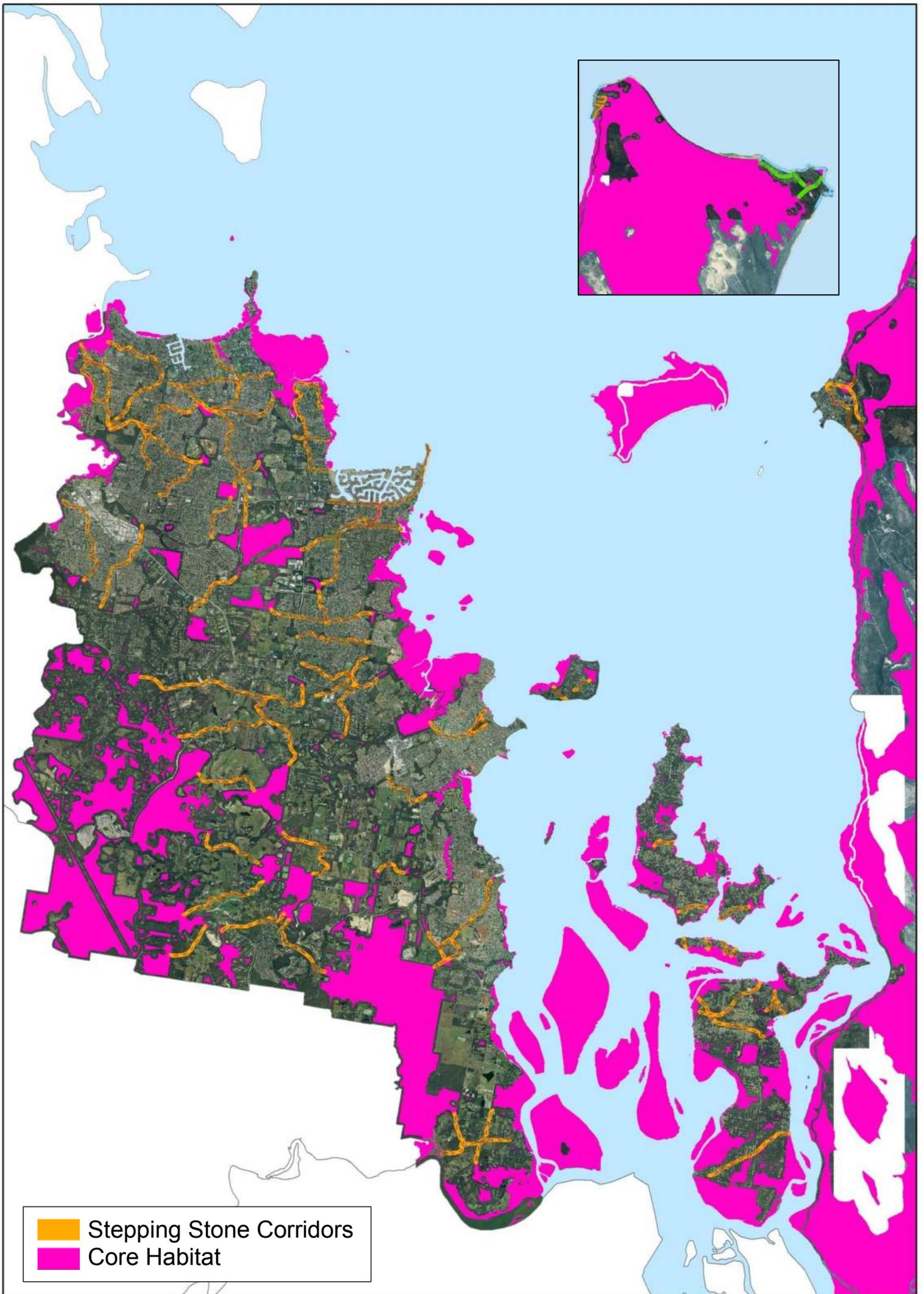


Figure 9 - Stepping Stone Corridors

Priority Outcomes for Wildlife Habitat Network and Corridors

Within associated document 'Corridor Descriptions and Locations (Appendices 4, 5, 6, 7 and 8), the priority outcomes are listed for each individual Established, Enhancement, Regional Riparian, Coastal Foreshore, and Stepping Stone Corridors. These priority outcomes aim to address the threats, barriers, gaps and pinch points for each, which are also listed for each corridor within Appendices 4, 5, 6, 7 and 8. Location descriptions are provided for each of the priority outcomes that recommend rehabilitation of gaps and pinch points. A summary of the types and number of priority outcomes for each corridor classification is provided in Table 9.

Table 9 - Summary of priority outcomes by corridor type

Priority for Rehabilitation	Corridor Type	Number of Corridors	Priority Outcomes	Number of Priority Sites
1	Established	24	Improve Corridor Habitat	28
			<ul style="list-style-type: none"> • Rehabilitation of gaps and pinch points 	
			Prevent Wildlife Deaths	34
			<ul style="list-style-type: none"> • Safe fauna passage across road (or rail) barriers 	
1	Regional Riparian	2	Protect Corridor Habitat	0
			<ul style="list-style-type: none"> • Provide input into planning scheme 	
			Reduce Impacts on Corridors	
			<ul style="list-style-type: none"> • Manage impacts of urban and/or peri-urban and/or rural areas 	24
1	Regional Riparian	2	Improve Corridor Habitat	3
			<ul style="list-style-type: none"> • Rehabilitation of gaps and pinch points 	
			Prevent Wildlife Deaths	6
			<ul style="list-style-type: none"> • Safe fauna passage across road (or rail) barriers 	
1	Regional Riparian	2	Protect Corridor Habitat	0
			<ul style="list-style-type: none"> • Provide input into planning scheme 	
			Reduce Impacts on Corridors	
			<ul style="list-style-type: none"> • Manage impacts of urban and/or peri-urban and/or rural areas 	2
2	Coastal Foreshore	14	Improve Corridor Habitat	31
			<ul style="list-style-type: none"> • Rehabilitation of gaps and pinch points 	
			Prevent Wildlife Deaths	0
			<ul style="list-style-type: none"> • Safe fauna passage across road (or rail) barriers 	
2	Coastal Foreshore	14	Protect Corridor Habitat	1
			<ul style="list-style-type: none"> • Provide input into planning scheme 	
			Reduce Impacts on Corridors	14
			<ul style="list-style-type: none"> • Manage impacts of urban and/or peri-urban and/or rural areas • Management of impacts from storm tide and sea level rise impacts 	14
3	Enhancement	44	Improve Corridor Habitat	95
			<ul style="list-style-type: none"> • Rehabilitation of gaps and pinch points 	
			Prevent Wildlife Deaths	59
			<ul style="list-style-type: none"> • Safe fauna passage across road (or rail) barriers 	
3	Enhancement	44	Protect Corridor Habitat	12
			<ul style="list-style-type: none"> • Provide input into planning scheme 	
			Reduce Impacts on Corridors	44
			<ul style="list-style-type: none"> • Manage impacts of urban and/or peri-urban and/or rural areas 	
4	Stepping Stone	62	Improve Corridor Habitat	118
			<ul style="list-style-type: none"> • Rehabilitation of gaps and pinch points 	
			Prevent Wildlife Deaths	55
			<ul style="list-style-type: none"> • Safe fauna passage across road (or rail) barriers 	
4	Stepping Stone	62	Protect Corridor Habitat	
			<ul style="list-style-type: none"> • Provide input into planning scheme 	2

Protecting and rehabilitating the highest value corridors will result in the best cost efficiency and often provides the greatest ecological benefit.

The Established Corridors and the Regional Riparian Corridors are equally the highest priority corridors, as they represent the most intact, connected and high ecological value corridors. The cost to protect and rehabilitate will provide the most ecological benefits for any investment.

The Coastal Foreshore are the second highest value ecological corridors, however may require significant investment for protection and rehabilitation, and consequently are lower priority for rehabilitation than the Established and Regional Riparian Corridors. The Enhancement Corridors are the third highest priority for protection and rehabilitation, as they will require a greater level of investment in protection and rehabilitation to achieve a high level of ecological benefit.

The Stepping Stone Corridors would require the greatest level of investment in protection and rehabilitation, and are therefore a lower priority.

It is important to note that the recommended priority actions for each corridor are developed based on a desktop assessment, utilising all available mapping resources, such as aerial imagery, vegetation mapping and the model outputs. The first step of implementation of any action is verifying the suitability of the recommendations on ground.

The priority outcomes listed for the management of impacts from urban, peri-urban and rural areas are somewhat general descriptions, and further work (including ground-truthing) is required to allow effective implementation of these actions.

Action Plan

The Wildlife Connections Action Plan lists the work areas within Council with responsibility for each action; implementation methods; implementation partners; performance measures; timeframe; and indication of cost of implementation.

The implementation of the priority outcomes within associated document 'Corridor Descriptions and Locations (Appendices 4, 5, 6, 7 and 8) can be achieved through a variety of methods based on tenure and location; and will be the responsibility of several areas within Council.

Implementation of the Action Plan will be undertaken with the following prioritisation considerations:

1. All areas of Core Habitat are a high priority for protection and rehabilitation. All actions within the Action Plan can be implemented in the identified Core Habitat areas;
2. The Established, Regional Riparian Corridors and Coastal Foreshore are the highest priority for protection and rehabilitation;
3. The Enhancement Corridors are the second highest priority for protection and rehabilitation;
4. The Stepping Stone Corridors are a lower priority for protection and rehabilitation;
5. All corridor rehabilitation and enhancement of buffer areas should follow South East Queensland (SEQ) Ecological Restoration Framework (SEQ Catchments, 2012); and
6. All corridor rehabilitation and enhancement of buffer areas must take into account fire management planning

Monitoring of Action Plan Implementation

The implementation of the actions in the plan will be reviewed annually. The review will assess the success of each action based on the 'Performance Measures' listed in the Wildlife Connections Action Plan. Information from each of the Council areas and external partners will be collated for the annual review.

If available, updated mapping (such as new Regional Ecosystem mapping or planning scheme zones) and other environmental data sets will be used to monitor changes to the values, attributes and threats of the wildlife habitat network and corridors.

Funding of the priority actions is critical to the success and performance of this plan. Delivery of the action plan will be funded through a combination of business as usual, general revenue, environment separate charge, reserve funds and resources obtained through external funding sources.

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Appendix 1 - Summary and review of Federal, State and Regional Corridor Plans and Strategies

National Wildlife Corridors Plan 2012

The *National Wildlife Corridors Plan* is an Australian Government document that highlights the need for habitat connectivity throughout the country (Department of Sustainability, Environment, Water, Population and Communities, 2012). The purpose of the national plan is to enable and coordinate efforts of landscape connectivity from all parties throughout Australia (Department of Sustainability, Environment, Water, Population and Communities, 2012). It is important that Australia's cities, rural areas, reserves, and national parks are connected to ensure movement through the landscape. The document consists of a five-point plan of action to be implemented gradually, and includes:

1. "Developing and supporting corridor initiatives
2. Establishing and ensuring institutional arrangements
3. Promoting strategic investment in corridors
4. Working with key stakeholders and supporting regional natural resource management planning
5. Monitoring, evaluating, and reporting"

(Department of Sustainability, Environment, Water, Population and Communities, 2012)

In order to be successful, the plan must incorporate a collaborative approach in the planning, management, and reporting of wildlife corridors. The government can plan corridors at a national, regional, or local scale, but they will not be successful without the cooperation of the community (Landcare Australia, 2011). The plan highlights that private land holders, community groups, NRM groups, Landcare, state agencies, and local government all have a role to play in managing and maintaining wildlife corridors.

The document examines why wildlife corridors need to be implemented, and provides limited information on how or what to implement. A number of existing national and state corridor initiatives are referenced including "the Gondwana Link, the Great Eastern Ranges Initiative, Habitat 141, NatureLinks, Trans-Australia Eco-Link, and the Tasmanian Midlandscapes" (Department of Sustainability, Environment, Water, Population and Communities, 2012). The Plan also promises to support and encourage regional and local corridor initiatives, which has had little success in implementation.

Corridor identification through the Biodiversity Planning Assessments 2015

This document was released by the Queensland Government in 2015, and highlights the key riparian and terrestrial corridors throughout the state. A number of specific state, and regional corridors are cited, accompanied with maps on different bioregions. The south east Queensland region consists of 48 state and regional terrestrial corridors that connect land to other regional areas (EHP 2015). Corridors were selected based on a number of factors, including the quality of existing habitat, location of existing regional corridors, altitudinal/geological/climatic gradients, ability to connect large tracts of habitat, and location of watershed, catchment, and coastal boundaries (EHP 2015). A map showing Queensland's State terrestrial corridors is seen in Figure 10 below.

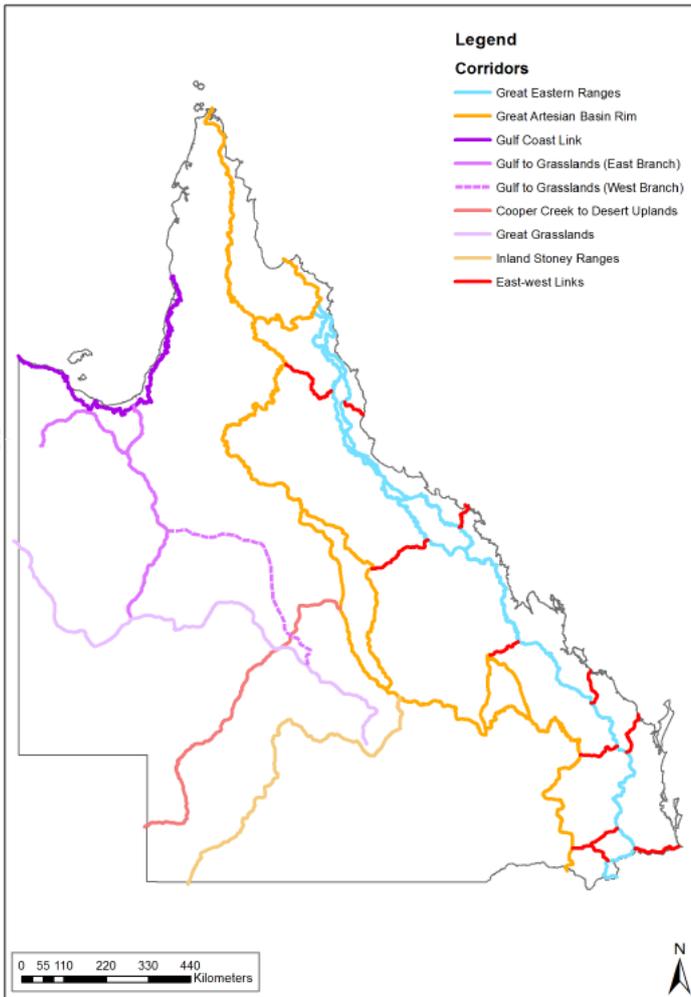


Figure 10 - Map of Queensland showing state-wide conservation corridors (Howell, et al., 2015)

Shaping SEQ - South East Queensland Regional Plan (Department of Infrastructure, Local Government and Planning, 2016)

ShapingSEQ is the Queensland Government’s plan to guide the future of the South East Queensland (SEQ) region, prepared in collaboration with the region’s 12 local governments. It aims to accommodate future growth sustainably and in a way that responds to change positively, and enhances the social, economic and environmental systems that support the region’s liveability. For the purposes of the *Sustainable Planning Act 2009*, ShapingSEQ is the statutory regional plan for the SEQ region.

ShapingSEQ differs from previous regional plans in several new headline initiatives and key new functions including “Identifying and mapping regional biodiversity corridors and values to support the protection of these values.”

Community consultation for ShapingSEQ revealed residents want to protect SEQ’s natural environment, including: establishing wildlife corridors to allow safe passage and protection for the region’s fauna. ShapingSEQ recognises fragmentation and degradation of natural corridors and habitats, has resulted in significant species decline.

Within ShapingSEQ, Goal 4: Sustain, Element 2: Biodiversity states “The regional biodiversity network is protected and enhanced to support the natural environment and contribute to a sustainable region.” The strategies proposed to achieve this are:

1. Protect regional biodiversity values (including koala habitat), and ecological processes that support them, from inappropriate development;
2. Focus coordinated planning, management and investment, including offset delivery, in regional biodiversity corridors;
3. Avoid fragmentation of regional biodiversity corridors; and
4. Maintain and enhance the value of biodiversity corridors to optimise biodiversity conservation outcomes.

The regional biodiversity corridors aim to connect or improve connectivity through targeted rehabilitation of natural assets, including between existing areas of Matters of State Environmental Significance (MSES) or regional biodiversity values. These corridors are to be investigated and refined by local government for consideration as Matters of Local Environmental Significance (MLES) where MSES do not already exist.

Biodiversity Planning Assessment - Southeast Queensland Bioregion, Queensland Environmental Protection Agency, 2007

A Biodiversity Planning Assessment (BPA) identifies the terrestrial ecological values in a region, or bioregion, according to their conservation significance. BPAs are used by governments, members of the community and landholders to make planning decisions about appropriate land use.

The SEQ Bioregion shares its western boundary with the Brigalow Belt Bioregion, and extends from the New South Wales border, north to the dry coastal corridor between Gladstone and Rockhampton that forms part of the Brigalow Belt Bioregion.

The SEQ BPA relied on a Biodiversity Assessment and Mapping Methodology (BAMM, Version 2.2) to provide a consistent approach for assessing biodiversity values at the landscape scale in Queensland using vegetation mapping data generated or approved by the Queensland Herbarium as a fundamental basis. The SEQ BPA also identifies and maps landscape scale corridors at a state-wide level for most of the state. The network is being expanded as BPAs are completed for each bioregion. Their broad purpose is to provide for ecological and evolutionary processes at a landscape scale by:

- maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations over long periods of time;
- maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;
- maintaining seasonal migrations and movement of fauna;
- maximising connectivity between large tracts/patches of remnant vegetation; and
- identifying key areas for rehabilitation and offsets.

The corridors have been selected to reflect:

- major watershed and catchment boundaries;
- intact river systems;
- major altitudinal/geological/climatic gradients;
- connectivity between remnant vegetation in good condition;
- linkages between bioregions; and
- linkages between permanent waterholes.

The methods used to identify bioregional terrestrial and riparian corridors, and gaps and critical weaknesses in terrestrial corridors, are outlined in Corridor Identification through Biodiversity Planning Assessments (EHP 2015). Corridors that form part of the state-wide network are assigned State significance. Other corridors providing connectivity at a sub-regional scale are assigned Regional significance.

The landscape expert panel workshops reviewed the existing network of corridors from version 3.5 of the BPA, making amendments and adding new corridors. The panel also discussed whether the definitions of corridors need to be modified in a highly fragmented bioregion like SEQ.

Appendix 2 – Summary and review of Existing Corridor Strategies and Actions for Redland City Council

A review and summary of the status of the strategies, plans, actions and mapping for corridors planning produced for Redland City Council is provided below.

Bushland and Habitat Corridor Plan - 2004

This document was adopted by Council in August 2004 and sets out a series of principles for protecting, managing and enhancing wildlife habitat and corridors in Redland City. This plan also outlines existing 'tools' for conserving habitat and makes recommendations for future directions. The Environmental Inventory Mapping (Stage 4) forms the basis of this plan.

The first part of the Plan describes objectives and principles. The objectives of the plan are to:

- identify and protect all core habitat areas in the Shire;
- manage and enhance corridors for wildlife movement;
- identify, protect, manage and enhance species and areas of special interest; and
- manage and enhance all core habitat areas and the balance habitat areas of the Shire.

The second part of the Plan describes the threats to habitat, seven primary and ten secondary tools and recommended actions. The threats include: development allowed under the planning scheme; existing and future roads; indiscriminate clearing; bushfires; and pest plants and pest animals.

The Primary Tools listed are: The Redland Environmental Inventory; State Planning Policy 1 / 97 – Conservation of koalas in the Koala Coast (subsequently superseded by SPP 1/05); Redland Shire Planning Scheme and the draft Redland Planning Scheme; Local Law No.6 – Protection of Vegetation; Environment Charge; Voluntary Conservation Agreement program; and Research.

The Secondary Tools are: Land for Wildlife Program; Transferable development rights; Conservation tax incentives; Rural Support program; Statutory Covenants on property title; Easements for management purposes; Voluntary land exchange; Councillor advocacy; Bushcare program; and Alternative forms of residential development.

41 specific recommendations are provided to meet the principles and concepts of the Plan and the associated 7 primary and 10 Secondary Tools. A recent review of the 41 recommendations found that 17 were implemented (or ongoing), 15 were partially implemented and 9 were not implemented. Successful implementation of recommendations from the plan included:

- Surveys, reports and installation of treatments for fauna crossing points of roads in Redland City;
- The incorporation of the Environmental Inventory mapping in the Redland Planning Scheme; and
- Koala habitat mapping projects.

It is noted that several of the implemented recommendations involved the development of a plan, strategy, mapping tool, research or advocacy, and the on-ground actions derived from these may not have been realised.

Environmental Inventory - 1996 to 2007

The Redland Shire Environmental Inventory is a spatial tool used to understand environmental priorities. The Environmental Inventory uses a Geographic Information System (GIS) database of mapped Conservation Management Areas (CMAs) and additional polygons selected as potential corridor links and environmental enhancement areas. The CMAs are prioritised according to four categories (Priority, Major, General and Enhancement) and are also assigned functional roles (Habitat, Corridor, Tidal, Patch etc) as part of a city-wide conservation network for retaining biodiversity, based on the principles of conservation biology.

This method was developed in 1996 by Chenoweth, prior to the availability of State Government mapping of Regional Ecosystems. The 2007 project review updated the boundaries of mapped CMAs and incorporated the State Government Regional Ecosystem and biodiversity mapping data (EPA) to review categories. The CMA system has proven to be an adaptable basis for land use planning and management. In 2011, version 4.3 of the Environmental Inventory was created by updating ground-truthed data and inputting additional survey data. The Environmental Inventory V4.3 was used as one of the primary inputs to NEDS.

Green Infrastructure - 2009

The Green Infrastructure Mapping (GIM) project was a geographic information system (GIS) based initiative that;

1. developed understanding of the relationship between remaining habitat across the city;
2. facilitated analysis of emerging issues and their impacts on the biodiversity of the Redlands; and
3. directed and prioritises the resources of the community, Redland City Council, the State and other stakeholders.

The GIM project aimed to improve Council officers understanding of the connectivity between remaining habitats, streamline service delivery and generate cost savings. The GIM project was a requirement of the Biodiversity Strategy 2008-2012 and the Redlands Koala Policy & Implementation Strategy 2008.

The GIM project was based on GIS layers for: Redland City Council Land; Environmental Inventory 4 (EI4); Road treatments; Interim State Koala areas; Extension Program participants; Urban Tree project and the Culvert Study.

The end product of the GIM was the identification of principal patches of habitat and priority corridors.

Wildlife Corridor Mapping Using Species Indicator Model - 2010

This internal Council report outlines the use of an Indicator Species Model (ISM) to identify critical wildlife corridors for seven indicator species throughout Redland City's mainland. The ISM utilises Geographic Information Systems (GIS) to determine the optimal locations for new corridors to link currently unconnected patches of vegetation.

The report uses Habitat Suitability Models, Patch Habitat Model, Corridor Modelling and Critical Corridor Analysis. The corridor maps produced illustrate the movement preferences of different

species between patches of habitat. These maps improve the ability of managers to identify the most favourable locations for corridor restoration or impact mitigation. By comparing corridors with the overlays of other planning intentions such as proposed development, managers can foresee and proactively contend with possible conflicts.

The seven key indicator species being utilized to assess the viability of the City's green infrastructure were:

- Koala *Phascolarctos cinereus*;
- Squirrel Glider *Petaurus norfolcensis*;
- Swamp Wallaby *Wallabia bicolor*;
- Northern Brown Bandicoot *Isodon macrourus*;
- Large Footed Myotis *Myotis macropus*;
- Striated Pardalote *Pardalotus striatus*; and
- Tusked Frog *Adelotus brevis*.

The report recommends implementation of the modelling by:

1. Applying Indicator Species Model to property/area in question to identify 'critical corridor' or 'species corridor' locations;
2. Performing field survey to ground-truth GIS analysis of area;
3. Determining extent of restoration and other enhancement actions required on site; and
4. Select the relevant program or plans most suitable to implement on site (including acquisitions, offsets, environmental education, Habitat Protection Programs and Bushcare).

Natural Environment Decision System - 2011

Natural Environment Decision System (NEDS) is a spatial model developed by AECOM and Biodiversity and Assessment Management (BAAM) designed to provide an expression of conservation value within Redland City. NEDS aims to supersede the Environmental Inventory mapping. In Phase 1 of NEDS, the system was developed and implemented. Phase 2 involved a number of changes to the spatial layers. This innovative tool delivers a highly sophisticated mapping and data management system that provides strong evidence to assist with environmental policy planning.

NEDS accepts all common digital data and integrates with all Councils existing systems. It primarily utilises updated information layers from the Regional Ecosystems, Wetlands, Conservation Significant Fauna and Flora records, Biodiversity Planning Assessment (BPA) Version 3.5 and Koala Habitat data sets. The supplementary data layers include LiDAR, Protected Areas, Nature Refuges, Essential Habitat and the Environmental Inventory v4. The final output of NEDS is the mapped expression of "Conservation Values" for Redland City.

Redlands Trunk Green Corridors - 2013

The Redlands Trunk Green Corridors was a GIS mapping exercise used to inform large-scale corridor, or connectivity conservation projects. The exercise primarily utilised the Environmental Inventory mapping as the basis for identification of corridors. The mapping was also used to review the list of Council conservation acquisitions and the investigation of potential Council conservation land surplus to requirement.

Wildlife Corridor Mapping - 2014

A report on Wildlife Corridor Mapping for the Redland City Council Mainland was prepared by Biodiversity Assessment and Management Pty Ltd (BAAM). The report generated a heat map of key wildlife corridors that occur between core vegetation areas throughout Redland City's mainland areas.

The wildlife corridor mapping exercise involved:

- Literature review on current wildlife corridor mapping, positioning and ecological function;
- Analysis, weighting and scoring of key factors that impact wildlife corridor formulation and function;
- Identification of a core vegetation areas to find wildlife corridor linkages; and
- Using spatial datasets and the scoring system to create a map rating the level of connectivity between the core vegetation areas.

This completely automated system provided an indicative wildlife corridor map that can be modified and enhanced by expert knowledge and other key habitats and conservation significant species data. It was anticipated that the maps would inform the 2015 Redlands Planning Scheme and set the scene for future detailed work. Ultimately, the development of this mapping is intended to facilitate scientifically robust decision making of wildlife corridors within Redland City.

Redlands Planning Scheme Version 7

The Redlands Planning Scheme 2006 v7 is the primary tool through which land use and development decisions are made across the city.

The policy intent of the Redlands Planning Scheme is underpinned by six 'Desired Environmental Outcomes' which relate to:

"Natural Environment, Character and Identity, Community Health and Well Being, Access and Mobility, Essential Services, Economic Development"

These outcomes are supported by maps that indicate different zoning and attributes of the city. A 'Rural and Habitat Corridor Network' is identified, along with existing 'Urban Habitat Corridors'. The 'Habitat Protection' overlay also provides 'enhancement corridors' which trigger a table of assessment for any development applications. To achieve the 'Natural Environment' desired outcomes, the plan aims to enhance existing natural environment, and support significant ecosystems by providing corridor linkages that support wildlife throughout the city.

Draft City Plan

Council is preparing a new planning scheme. Draft City Plan was released for public notification in late in 2015 and in February 2017 Council resolved to forward the draft planning scheme to the Planning Minister for approval to adopt. The draft City Plan will commence following the Minister's approval and Council adoption.

The draft City Plan incorporated updated mapping of regional ecosystems, koala habitat and waterways, and integrated matters of national, State and local biodiversity significance.

The draft City Plan includes in its strategic framework a strategic outcome for the natural environment specifically addressing corridors that states:

“Viable and resilient wildlife corridors link habitat areas and facilitate the movement and migration of native fauna throughout the Redlands and beyond. Corridors connect terrestrial and aquatic environments (including waterways, wetlands and along the foreshore) and significant habitat. Ecological corridors are primarily protected by the environmental significance and waterway corridors and wetlands overlays as well as the conservation, environmental management and recreation and open space zones. However, other land may also perform corridor functions that are to be protected.”

This is then implemented primarily through the Environmental Significance overlay and the Waterway corridors and wetlands overlay, which together with the Environmental Management, Conservation, and Recreation and Open Space zones identify the city’s areas of environmental value, and include specific provisions within the relevant codes that require development to provide for viable and resilient wildlife corridors.

Appendix 3 – Literature Review of Ecology and Principles of Wildlife Habitat Networks and Corridors

Core Habitat Patches

Core habitat patches are discrete areas of habitat surrounded by areas that are unsuitable as habitat for specific species. A core habitat patch must provide the necessary resources environmental conditions required for survivorship, reproduction, and movement of a species (Hess & Fischer 2001). Smaller habitat patches generally result in smaller flora and fauna populations and this can increase levels of inbreeding, reduce genetic variability, and increase sensitivity to environmental events (Doerr & Davies 2010). To ensure species populations have the required resources for survival, the patch size should be as large as possible to reduce mortality due to movement into unsuitable habitats.

The size and shape of a patch is important in determining suitable habitat for species in the area. For example, an irregular shaped patch will incur maximized edge effects as the area of perimeter is increased, and the area of high quality 'inner' habitat is decreased. This theory therefore favours a circular patch, as the area of perimeter is minimised, along with the presence of edge effects (Forman & Godron, 1986). A buffer of native vegetation also reduces the risk of edge effects, resulting from weed infestation, human-generated damage, microclimatic variables, and predation. A study conducted in New South Wales concluded that a buffer width of 60m was suitable to minimise adverse edge effects from a neighbouring urban environment (Smith & Smith, 2010).

Core habitat patches can be connected by corridors and networks (Milne, 1996). To maximise the use of habitat patches, the patch should be located adjacent to a corridor, and be as large as the environment can accommodate (Fleury & Brown, 1996). The home range of fauna species is also an important factor to consider, as species tend to increase their home range in a more fragmented landscape (Mabry & Barrett, 2002).

Gaps

Doerr & Davies 2010 used literature on bird and mammal species inhabiting wooded habitats to calculate a mean gap-crossing threshold of 106m, indicating that many species are unable to cross open areas that exceed this distance. It was also calculated an interpatch-crossing threshold of 1100m, indicating that many species are unable to disperse between patches of habitat separated by >1100m, even where structural connectivity exists between the patches (Doerr & Davies 2010). Although these calculations were based on limited data, and it is important to remember that different species will have different gap-crossing thresholds, they can provide a useful starting point for modelling and planning.

Length

The length of a successful wildlife corridor is species specific and will alter depending on the fauna being examined. Speed and movement behaviours vary the amount of time a species occupies a corridor, and therefore the required resources for survival. For example, burrowing animals may only move 1m a day, while some birds can travel 100km or more in the same time (Fleury & Brown, 1996). Shorter lengths are ideal to minimise the time spent in corridors, and to maximise

usage of habitat patches (Fleury & Brown, 1996). This also ensures habitat patches are linked closely within a network, and are easy to travel between for a variety of species.

Width

The width of a corridor is vital to its success, influencing edge effects and mortality of the inhabiting species. The wider the corridor, the more successful it tends to be in reducing mortality (Fleury & Brown, 1996). The area of high value habitat is increased in a wider corridor, and edge effects such as predation, solar radiation, wind, humidity, temperature, and pollution are reduced (Sunshine Coast Council, 2011).

Assuming land is available, the width of the corridor should be based on the requirements of a species found in the area that is 'high on the food chain' (Fleury & Brown, 1996). This ensures that the structure of the corridor is suitable for a variety of species, and is specific to the area.

It is important that an appropriate buffer width is provided for wildlife habitat networks and corridors to minimise edge effects and increase efficiency. For riparian corridors, studies have shown that a buffer width of 40m is appropriate to maintain ecological functionality and to minimise impacts from human activities (Seng Mah, et al., 2015). For terrestrial corridors, studies have determined that 50m is an appropriate buffer to minimise edge effects (Cardo Chenoweth, 2012; Smith & Smith, 2010). These width recommendations were determined by the distance human-generated damage, weed invasion, microclimatic variation, predation, and parasitism has been recorded by previous studies conducted in Australia, New Zealand, and the United States (Smith & Smith, 2010).

A study of wildlife presence within corridors in Eden, New South Wales, determined that the optimum corridor width is 250m (Cardo Chenoweth, 2012). A corridor of this width was able to retain a variety of local bird species, along with a complete suite of arboreal mammals from the area. A corridor of 100m or less was able to retain most of the same arboreal mammals, although lacked diversity in other species (Cardo Chenoweth, 2012). Based on this study, a highly successful corridor should be 350m wide, including the 50m buffers to reduce edge effects.

Corridors of varying width can perform different ecological functions. The 'Landscape Corridors of the Coffs Harbour Local Government Area' (Scotts & Cotsell 2014) adopted the following corridor with classifications:

- Regional Corridors: 650 metres wide;
- Subregional Corridors: 350 metres wide;
- River Corridor: 100 metres wide;
- Local Corridors: 80 metres wide;
- Riparian Corridors: 80 metres wide (on 3rd & 4th order streams); and
- Urban Links: variable width but typically less than 80 metres.

Shape

The shape of a corridor affects what species can successfully enter and move through the corridor to reach suitable core habitat patches. It is important that the corridor is easily accessible, with as much linearity as possible (Fleury & Brown, 1996). This ensures that species don't reside in the edge of the corridor where there is a higher risk of mortality. Generally corridors are rectangular in shape, although this is sometimes restricted due to land use. When conflicting land use is a factor, alternative areas of vegetation might become vital in the connectivity of the corridor network. This

can include stepping stones such as street trees and residential gardens that aid in providing a linear corridor to a habitat patch (Hess & Fischer, 2001). Studies have shown that a constant width with 'feathered edges' is the preferred corridor shape, as it minimises exposure to any edge effects, and keeps species movements within the corridor (Fleury & Brown, 1996).

Edge Effects

Edge effects are commonly known as the negative effects on wildlife and natural environments caused by urbanisation (Villasenor, et al., 2014). The effects are due to edge contrast, which is defined as being the compositional or structural difference between adjacent ecosystems at either side of the boundary (Villasenor, et al., 2014). Edges with a high contrast often present greater risks for wildlife, with more elements entering the corridor or habitat patch, and stronger barriers to movement. These hard edges are often formed with urban development such as roads, residential areas, and commercial or industrial developments (Brearley, 2011). Soft edges are preferred, and provide easier permeability to species. These types of edges are formed by wildfires, and vegetation with different ages that eventually blend together (Brearley, 2011).

Abiotic and biotic changes in vegetation can be a result of edge effects in urban environments. A primary response is a direct result of edge creation, which results in abiotic changes such as increased light pollution, fluctuations in temperature, and increased wind speed (Brearley, 2011). As a result of these ecological changes, secondary responses are observed including alterations in vegetation structure and composition (Brearley, 2011). This can include decreased canopy cover, sparse vegetation, and increased debris due to the exposure to the bordering environment.

Other negative edge effects created from an encroaching urban environment include increased competition, predation, changes in microclimate, and human-generated damage (Smith & Smith, 2010). Flora and fauna both experience competition, with invasive weeds becoming a major cause of environmental degradation (Smith & Smith, 2010). Predation by domestic cats on small mammals and birds has been widely researched, and is a common cause of mortality in urban-edge forests (Brearley, 2011). Microclimatic changes are often found up to 50m from the habitat edge, which can affect the native species diversity of the area (Smith & Smith, 2010). Human-generated damage is due to a variety of causes including the dumping of waste and green waste, firewood gathering, destruction of trees, and destruction of understory due to usage as a recreational area. These effects usually occur within the first 30m of the habitat edge, although can often be experienced up to 100m away from the edge (Smith & Smith, 2010).

As edge effects have such a detrimental effect on occupying wildlife, it is importance that an appropriate buffer is maintained around significant habitats. Research indicates that a minimum buffer width of 60m should be applied around all edges of habitat patches to minimise the negative effects of a neighbouring urban environment (Smith & Smith, 2010). The buffer should be comprised of native vegetation, and appropriate measures such as fencing and weed control may be necessary to reduce impacts on the interior habitat (Smith & Smith, 2010). A buffer of 50m should be applied on each side of corridors to reduce edge effects (Cardo Chenoweth, 2012). The purpose of a buffer is to provide protection to the interior habitat without requiring constant active management.

Structure

The structure and composition of wildlife habitat networks and corridors is generally related to the flora species present (Hess & Fischer, 2001). Species requirements of food source trees, vegetation density, and canopy cover will vary. A corridor with diverse flora will generally benefit a greater number of species, and any discontinuity in the composition of the corridor should be avoided (Fleury & Brown, 1996). To increase the structural diversity of a corridor, layers should be incorporated, including grasses, small shrubs, and a variety of native trees (Fleury & Brown, 1996). This increases the habitat available within the corridor by providing a number of horizontal and vertical nesting and foraging sites. Regional Ecosystems can be used to determine the appropriate composition of vegetation communities for a specific area. Other elements such as rock piles, hollows and brush piles can also add to corridor diversity by providing nesting sites and protection.

While wildlife habitat corridors containing continuous and diversely structured habitat are generally the most appropriate for facilitating movement, stepping stone corridors (such as scattered paddock trees) can be equally effective (Doerr & Davies 2010). These stepping stone corridors are not continuous, and may be broken by currently degraded or cleared areas. Stepping stone patches provide connectivity and can function as corridors for mobile species, particularly those willing to cross expanses of cleared land (Scotts & Cotsell 2014).

Barriers

Barriers to species movement along wildlife habitat corridors can come in many forms. Barriers such as highways, railway lines and impermeable fences can increase the mortality rate of some wildlife attempting to cross the barrier (Selles, O'Hare & Veage, 2008). Roads can be particularly significant barrier to wildlife movement, causing deaths and enabling behavioural avoidance due to traffic density, noise, and lighting (Clevenger & Kociolek, 2013). To encourage safe movement across roads, crossing infrastructure can be implemented in hot spots (areas with a high wildlife presence) (Garrah, et al., 2015). Crossing infrastructure includes underpasses such as culverts, passages, and tunnels, and overpasses such as bridges (Lister, et al., 2015). Barrier fencing can be a useful strategy to filter wildlife and ensure crossing is made at these underpasses or overpasses, which are often known as 'fauna guiding fences' or drift fences' (Gleeson & Gleeson, 2012). However not all barriers present a complete impasse for all wildlife movement, some barriers may be a hindrance for certain species and not others. For example, barbed wire fences allow passage for many species however fruit bats and gliders are susceptible to being caught on these structures.

Stepping Stones

Stepping Stones can be defined as patches of habitat that, while not physically connected, are functionally connected, allowing movement between larger patches (National Wildlife Corridors Plan 2012). Stepping stones of suitable habitat enhance connectivity in developed landscapes for species able to make short movements through disturbed environments. Connectivity is achieved by a sequence of short movements or 'hops' from stepping stone to stepping stone along the length of the linkage, or by the combined dispersal movements of numerous individuals moving between populations resident within a chain of stepping stone habitats (Bennett 2003).

Stepping stones may be natural patches, such as wetlands or patches of rainforest within drier forests or they may be small remnant patches of vegetation in a developed landscape. They can also be anthropogenic in form of forestry plantations, artificial water bodies or urban. Scattered trees are the most recognised form of stepping stones and are important to native fauna for movement, foraging habitat and nesting resources (Gleeson & Gleeson 2012). Vegetated stepping stones are used by various mobile species, and are important sources of seed for regeneration of adjacent vegetation.

Stepping stones are likely to be an effective approach to maintaining landscape connectivity:

- for species that regularly move between different resource patches in the landscape (such as temporally varying food sources, or spatially separated nesting and foraging habitat);
- for species that are relatively mobile and able to move substantial distances in relation to the intervening distance between fragments;
- for species that are tolerant of disturbed landscapes, although not necessarily able to live within the modified zone; and
- where the objective is to maintain continuity of ecological processes that depend on animal movements and the animal vectors are capable of movement across gaps (Bennett 2003).

**For Appendices 4 to 8 refer to associated document
'Corridor Descriptions and Locations 2018-2028'**

Appendix 4 – Established Corridors

Appendix 5 – Regional Riparian Corridors (BPA)

Appendix 6 – Coastal Foreshore Corridors

Appendix 7 – Enhancement Corridors

Appendix 7a – Enhancement Corridors in Known Development
Areas Corridors

Appendix 8 – Stepping Stone Corridors



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Fragments of native vegetation in the Tasmanian Midlands. As habitats become increasingly fragmented, the importance of fine-scale landscape features, such as paddock trees and strips of roadside vegetation, are becoming more apparent.

Photo: Suze Gaynor

Planning wildlife corridors at the regional scale: a tool for conservation planners

Using the GAP CLoSR decision-support tool, conservation planners throughout Australia can:

- plan connectivity of fragmented landscapes at the regional scale while taking into account small, but potentially important, landscape features such as paddock trees and strips of roadside vegetation,
- include property/site-scale connectivity implications in regional-scale biodiversity assessments,
- compare the connectivity implications of multiple regional-scale plans and strategies.

Research summary

As habitats become increasingly fragmented, the importance of fine-scale landscape features, such as paddock trees and strips of roadside vegetation, are becoming more apparent. These features can act as stepping stones for birds and animals. Importantly, models for planning regional-scale connectivity do not represent fine-scale landscape features.

We developed the GAP CLoSR decision-support tool to overcome this limitation. Conservation planners can use it to plan connectivity of fragmented landscapes at the regional scale while taking into account the connectivity implications of fine-scale landscape features. They can also use the tool to compare the connectivity implications of multiple regional-scale plans and strategies.

Animals and plants need room to move

Whether to disperse their seed or to travel to a breeding site, all species need room to move in the landscape.

As natural landscapes become more fragmented due to land clearing, the populations of native plants and animals that the remaining patches of habitat can support become smaller and more isolated. Small, isolated populations are less viable, which increases the risk of the species becoming locally extinct.

Small features are important for connectivity

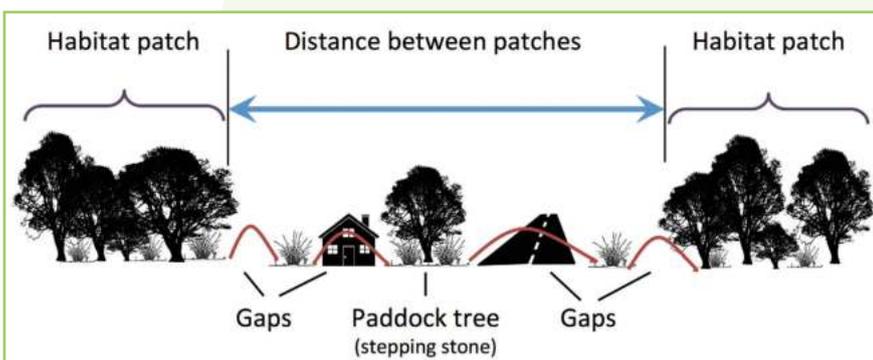
To give plants and animals more room to move in a fragmented landscape, conservation managers often focus on identifying, conserving and restoring patches of habitat that increase connectivity.

Yet, even with wildlife corridors in place, a species may be unable to travel across a gap in the vegetation. Some woodland birds, for example, will readily fly up to 100 metres from one group of scattered trees to another on farmland, but no further. Increasingly, we are observing that very small strips of roadside vegetation and small, isolated features such as scattered paddock trees, shrubs and rocky outcrops, or small clusters of these features, can function as stepping stones for some species.

The limitations of current connectivity models

The models available to conservation planners for planning connectivity over large geographic areas have three limitations:

- Models are unable to represent fine-scale features such as paddock trees which, apart from being valuable in their own right, are the necessary stepping stones that allow some species to cross gaps within and between patches of habitat.
- Often, models do not represent movement thresholds for species.
- Current methods are too complex and practically impossible to implement within a reasonable time frame and at a reasonable cost for land use planning.



Movement dynamics. Every species has a distance threshold beyond which it will not move. For example, some woodland birds will fly over open ground for a maximum of 100 metres. A feature such as a paddock tree can act as a stepping stone for a species to reach a patch of habitat within its threshold, while gaps in the vegetation caused by roads, intensive agriculture, cities and towns, for example, may prevent a species from reaching its threshold.

What can GAP CLoSR do?

We designed GAP CLoSR (General Approach to Planning Connectivity from Local Scales to Regional) to overcome the limitations of current connectivity models. The GIS-based framework and tool allow conservation planners across Australia to plan wildlife corridors at the regional scale while taking into account the movement characteristics of species, such as the greatest distance of open ground animals will cross and the longest distance they will move in a connected landscape.

GAP CLoSR can:

- identify the most important patches and appropriate locations for wildlife corridors,
- assess, quantitatively, the impact of land-use change, such as urbanisation, on connectivity at the local and regional scale for a range of planning scenarios,
- identify the optimal pathway between habitat patches based on the location of fine-scale connectivity elements (for example, scattered trees) and barriers such as cities and towns,
- characterise how species move between patches and identify pinch points where they have few options for moving between patches.

How GAP CLoSR works

We designed GAP CLoSR to be readily applied by natural resource managers, consultants, and conservation planners in both government and non-government agencies. It runs on a standard desktop computer using readily available GIS software and spatial data (Graphab and Circuitscape).

The tool comes with a six-step framework to guide planners through the modelling process.

Planners first populate the model with data about the region's species, including their movement thresholds, and data about the fine-scale connectivity

features of the landscape which can be derived from satellite data.

The tool rescales the fine-scale data to a coarser resolution, preserving the species' movement dynamics and thresholds, and then builds regional- and local-scale connectivity models.

The outputs support regional decision-making about where to focus efforts to manage and restore connectivity, as well as local decision-making about how best to support and improve connectivity in priority areas.

Lower Hunter and Tasmanian Midlands case studies

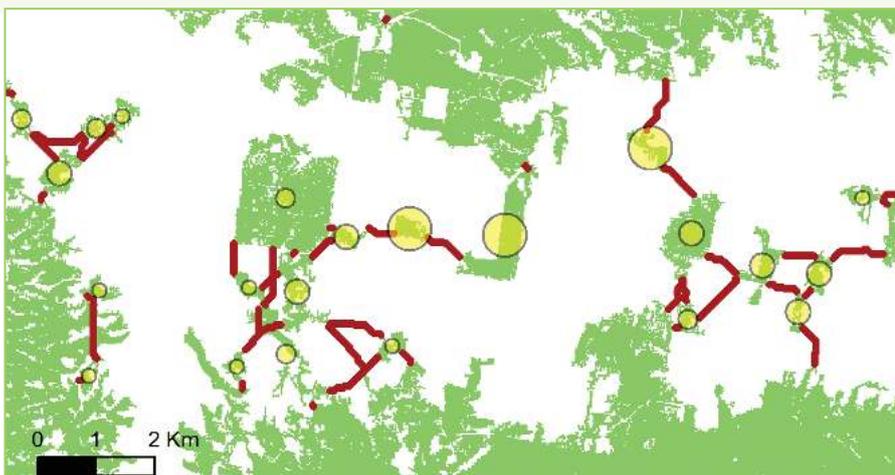
We trialled GAP CLoSR in the Lower Hunter region of New South Wales and in the Tasmanian Midlands.

In the Lower Hunter, we mapped connectivity between patches of woody vegetation. Our analysis showed that most of the region's native vegetation is confined to two large groups of patches, which are isolated from each other.

In the Tasmanian Midlands, we identified groups of species with similar dispersal and habitat characteristics and identified which of these groups had high or low connectivity across the region according to these characteristics.

For both regions, we identified areas where protecting patches of vegetation, managing scattered trees and restoring connectivity will best contribute to the overall connectivity of the region. We also produced a series of maps identifying habitat patches that are important as stepping stones and critical for preserving connectivity across the region.

Planners can use these results to guide them in selecting the most promising locations to restore connectivity and which species to target in order to build resilience to changes in land use and climate.



GAP CLoSR map output example.

The red lines indicate the optimal pathways between habitat patches (green). The relative size of the circles at the centre of the patches represents the importance of those patches for connectivity.

Where to from here?

The GAP CLoSR tool and its open-source code are free to download from: http://www.nerplandscapes.edu.au/GAP_CLoSR

In December 2014, we are training land-use planners from the Tasmanian Government Department of Primary Industries, Parks, Water and Environment and from non-government agencies such as the Tasmanian Land Conservancy and Bush Heritage Australia in how to use GAP CLoSR.

Who are the researchers?

Dr Alex Lechner



Alex is a multidisciplinary researcher at the University of Tasmania, with skills and experience in applying spatial analyses to ecological problems.

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Professor Ted Lefroy



Ted is the Hub Director and leads the Communication and Knowledge Brokering Team which integrates the research and delivers the research outputs to people involved in biodiversity conservation.

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Further reading

Lechner AM, Brown G & Raymond C (2015) Modelling the impact of future development and public conservation on landscape connectivity for conservation planning. *Landscape Ecology*. April 2015, Volume 30, Issue 4, pp 699-713. doi: 10.1007/s10980-015-0153-0

Lechner AM, Doerr V, Harris RMB, Doerr E & Lefroy T (in press) A framework for multi-scale connectivity modelling incorporating fine-scale dispersal behaviour. *Landscape and Urban Planning*.

Lechner AM & Lefroy EC (2014) General Approach to Planning Connectivity from Local Scales to Regional (GAP CLoSR): combining multi-criteria analysis and connectivity science to enhance conservation outcomes at regional scale in the Lower Hunter. University of Tasmania, Hobart, Tasmania.

About the NERP Landscapes and Policy Hub

The Landscapes and Policy Hub is one of five research hubs funded by the National Environmental Research Program (NERP) for four years (2011–2014) to study biodiversity conservation.

We integrate ecology and social science to provide guidance for policymakers on planning and managing biodiversity at a regional scale. We develop tools, techniques and policy options to integrate biodiversity into regional-scale planning.

The University of Tasmania hosts the hub.

www.nerplandscapes.edu.au



March 2015

Sustainability and Environmental Advisory Panel

AGENDA – 16 MAY 2023

**Attachment 8: Town Power – Regional Renewable Energy Projects
(Letter)**



Venture Private Infrastructure
Infra Pty Ltd. ACN 663311064
L4, 10 Market Street, Brisbane QLD 4000
www.infra.earth

Waratah-Wynyard Council

Attention: Mayor Mary Duniam
By email: Mayor.mduniam@warwyn.tas.gov.au

1 March 2023

Dear Mayor Duniam

Re: Town Power – 2GW regional renewable energy projects

I am writing to respectfully invite Council to consider a proposal to provide your communities with exclusive access to utility-scale renewable energy generation and storage, and to make an important contribution to achieving Australia’s renewable energy goals.

Infra Pty Ltd is a developer of private infrastructure projects. We are proposing to develop a national portfolio of up to 80 new solar PV and battery storage projects representing 2GW of generating capacity and 4GWh of storage in total. We call these the “**Town Power**” projects. Each Town Power project will be located adjacent to a regional community which, through its council, will have exclusive rights to its capacity. Individual projects will be in the range of 10MW/20MWh to 50MW/100MWh, or equivalent in capacity to rooftop PV and home batteries for between 2,000 and 10,000 households.

Currently, most utility-scale renewables projects are or are planned to be located *in* regional areas, but they do not and will not generate power *for* the regions. Their power is sold into the National Electricity Market (the “**NEM**”) based on their distance from the central nodes of the national transmission network, and they require hundreds of kilometres of high voltage transmission lines to connect to distant consumers of their power.

Our proposal is different. We propose to build new utility-scale solar PV and battery storage in regional areas to generate and store power entirely *for* local communities by embedding them into the existing local medium-low voltage distribution networks. The Town Power projects will provide all the benefits of community-owned renewable energy projects (“**CORE**”) but with real size and without the formidable financing and co-ordination obstacles that have made the development of even small CORE projects extremely difficult.

The Town Power projects

Key features of the Town Power projects:

- Each project will connect directly to the existing local medium-low voltage distribution network serving its community, providing embedded generation and storage.
- The council representing the community will enter an agreement with Infra’s project company under which it will be allocated exclusive rights to the project’s capacity in exchange for a fixed annual capacity payment over circa 20 years. There may be multiple projects in a given council area.

- The capacity payments will be fixed to recover the financed capital cost of the project and its operating costs. They will **not** be benchmarked or otherwise referenced to energy prices in the NEM.
- Each project is expected to be eligible to receive large-scale generation certificates. These will all be allocated to the council, which will be able to retain them or sell them in the market to offset the capacity payments.
- The council will make capacity or power from the project available to households and businesses in the manner that it and the community chooses.
- The council will enter agreements with the distribution company that owns and manages the local distribution network to deliver power from the project to households and businesses on its behalf.
- For the avoidance of doubt, it is **not** proposed that the local distribution network be separated or islanded from the national transmission network. Rather, the projects are intended to substantially reduce the communities' demand for power from the NEM.

The Town Power projects will provide regional communities, through their councils, with cost-effective, secure, and deliverable sources of renewable energy, avoiding the disadvantages of rooftop PV and home battery systems, on the one-hand, and NEM-connected, utility-scale renewables projects, on the other.

Compared to rooftop PV and home battery systems, the Town Power projects should –

- Enjoy economies of scale in procurement and construction and use more economically efficient (and safer) flow battery technology, giving a lower capital cost per unit of energy capacity.
- Make capacity available to all community members, including renters and lessees, strata-owners, social housing tenants, and low-income and commercially unsophisticated homeowners who cannot access rooftop PV and home battery systems.
- Avoid the adverse impacts of rooftop PV on the transmission and distribution networks, including two-way energy flow and lack of visibility for systems operators, which is likely to result in the imposition of costs on owners and increasing forced curtailment.

Compared to NEM-connected, utility-scale renewables projects, the Town Power projects should provide lower cost and more secure power to regional communities because they should -

- Be insulated from volatile power prices in the NEM.
- Not suffer transmission losses.
- Not have to bear, directly or indirectly, the costs or risks of the construction of new high voltage infrastructure, or the ongoing costs of balancing and stabilising mechanisms, required by the national transmission network.
- Not be subject to suboptimal operation or forced outages of the national transmission network or have their energy production curtailed due to overcapacity of renewables at certain times or locations on that network.

- Be insulated from future revisions of the NEM and transmission network regimes as those evolve uncertainly towards the net zero target in 2050, accommodate the loss of baseload fossil fuel generation, and attempt to satisfy many incumbent and competing interests¹.

An important contribution

The Australian Energy Market Operator is forecasting a shortfall in generation capacity, even if all the currently proposed new NEM-connected projects go ahead². However, for the reasons above, there are serious challenges to the bankability of new NEM-connected renewables projects which cast significant doubt even on that assumption³. The evidence is that large-scale investment in renewables has stalled, and we are very far from adding the capacity we need based on existing approaches.

In fact, billions of dollars of institutional capital are currently available for investment in renewables but are not being deployed because of the lack of bankable investment opportunities at sufficient scale. One of the first priorities in the design of the Town Power proposal was that the portfolio be unquestionably bankable, which we believe we have achieved. The targeted 80 Town Power projects will be developed and financed together as a single 2GW/4GWh portfolio, mobilising up to \$3 billion of new bank and institutional capital.

The Town Power projects will **not** compete with other new renewables projects. As a nation we are at a critical point where we need to exploit all readily available sources of renewable energy. And by embedding utility-scale PV generation *and storage* within regional distribution networks where there is the land area and local demand to do so, the Town Power projects will reduce the demand and stress on the national transmission network. This will help facilitate its orderly development, and thus the development of the NEM-connected renewables projects that we still need to replace fossil fuel generation and meet demand in our major urban areas. Regional councils and communities that participate in Town Power projects will be filling what we believe is currently a critical gap in our national energy strategy⁴.

Next steps

We are seeking to begin a dialogue with Council which could lead, in the first instance, to a preliminary, non-binding expression of interest in hosting one or more Town Power projects. Once we have non-binding interest in a critical mass of projects, albeit not for the full target 80 projects, we will then also seek to –

- Formally engage with the relevant distribution companies and energy regulators.
- Commence the detailed design and procurement process with our preferred EPC contractor.
- Commence the portfolio funding process with our lead project finance banks and institutional investors.

¹ See, for example, <https://www.theguardian.com/environment/2023/feb/24/australian-renewable-energy-struggles-to-hit-grid-with-one-solar-farm-wasting-half-its-yearly-output>

² See “2022 Electricity Statement of Opportunities.” Australian Energy Market Operator. August 2022. https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2022/2022-electricity-statement-of-opportunities.pdf?la=en&hash=AED781BE4F1C692F59B1B9CB4EB30C4C

³ See Sriandarajah, Nesanathan & Wilson, Stephen J. & Chapman, Archie C., 2022. "From green to amber: is Australia's National Electricity Market signalling a financial warning for wind and solar power?" Energy Policy, Elsevier, vol. 167(C).

⁴ See McIlwaine et al., 2021. “A state-of-the-art techno-economic review of distributed and embedded energy storage for energy systems” Energy, Elsevier, vol. 229. Section 5.

- Continue to build out the full project portfolio by securing interest from additional councils and communities.

Please let me know if you would like to meet to discuss this proposal further, and if you have any questions or would like any further information please do not hesitate to ask.

Kind regards



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