



Five Rivers Reserve

Management Plan



Five Rivers Reserve - Andy Townshend

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Five Rivers Reserve Management Plan 2014 - 2019

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Front Image: The Five Rivers Reserve landscape © Andy Townsend

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Acknowledgements

The Five Rivers Reserve is owned by the Tasmanian Land Conservancy and managed as a permanent reserve for its conservation values. Skullbone Plains, which is part of the Five River Reserve, was purchased through a combination of generous donations, specifically the philanthropy of Rob and Sandy Purves, Graham Wood, the Australian Government's National Reserve System and many other individuals and companies. The Bronte properties were purchased with the generous assistance of Jan Cameron through the Elsie Cameron Foundation. Since their acquisition, a very significant financial partnership has been established with BHP Billiton and their global partner Conservation International, to ensure the conservation values of this area are managed and protected in perpetuity.

The development of a separate Skullbone Plains Reserve Management Plan was administered by a Steering Committee comprising representatives from the Australian Government, Tasmanian Parks and Wildlife Service and TLC. The TLC would like to particularly acknowledge the guidance from this steering committee (Nadia Babicka, Damian Wrigley, Leanne Wilks, Don Thompson and Barry Batchelor). This management plan has been prepared by TLC staff with input from our project partners Conservation International, and assistance from the Aboriginal Land Council of Tasmania, Michael Johnston, Forestry Tasmania, Hydro Tasmania, DPIPWE and other scientific experts and interest groups. This management plan was peer reviewed by the TLCs Conservation Science and Planning Advisory Council and a final version approved by the TLC Board in 2013.

The TLC would also like to acknowledge the generous support given by a range of stakeholders such as the Tasmanian Parks and Wildlife Service Lake St Clair District, David Hean, Kathy Van Dullemen, members of the Bronte Deer Stalkers especially Wayne Turale and the Bronte Park general store owner Shane Hedger.

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The TLC greatly appreciates the assistance of its many supporters and volunteers who continue to contribute time and labour towards management and in particular the Purves Environmental Fund, Purryburry Trust, BHP Billiton and Conservation International who have supported on-ground research, monitoring and management of this area since its acquisition.

Acronyms and Abbreviations

Bush Blitz	A partnership between the Australian Government, BHP Billiton Sustainable Communities and Earthwatch Australia that aims to fill gaps in biological knowledge in Australia's national reserves.
CI	Conservation International. CI is a nonprofit environmental organization headquartered in the USA whose mission is to protect nature and its biodiversity for the benefit of humanity.
DFTD	Tasmanian devil facial tumour disease
DPIPWE	Tasmanian Government's Department of Primary Industries, Parks, Water and Environment
DSEWPC	Commonwealth Government's Department of the Sustainability, Environment, Water, Population and Community
EA	Environment Australia
EPBC Act	Australian <i>Environment Protection and Biodiversity Conservation Act 1999</i>
Five Rivers	The Five Rivers Reserve comprises Skullbone Plains and the Bronte properties previously known as Viormy, Pine Tier Lagoon, Roscarborough and Serpentine. The Five Rivers are the Nive, Serpentine, Pine, Little and Little Pine rivers.
FPA	Forest Practices Authority
IBRA	Interim Biogeographic Regionalisation for Australia. A planning framework for the systematic development of a comprehensive, adequate and representative ' <u>CAR</u> ' National Reserve System.
IFS	Inland Fisheries Service, Tasmania
IUCN	International Union for Conservation of Nature
NC Act	Tasmania's <i>Nature Conservation Act 2002</i>
NRM	Natural Resource Management
NRS	National Reserve System
NVA	Natural Values Atlas database, DPIPWE
PWS	Parks and Wildlife Service, Tasmania
STTDP	Save The Tasmanian Devil Program, DPIPWE
TLC	Tasmanian Land Conservancy
TSP Act	Tasmania's <i>Threatened Species Protection Act 1995</i>
TSS	Threatened Species and Marine Section, DPIPWE
UNESCO	The United Nations Educational, Scientific and Cultural Organization (WHA nominations and listings)
UTAS	University of Tasmania
WHA	World Heritage Area

INTRODUCTION

The Tasmanian Land Conservancy

The Tasmanian Land Conservancy (TLC) is a non-profit, non-political, private organisation that works towards achieving sustainability and biodiversity conservation in Tasmania.

The TLC 2050 Mission

In partnership with other organisations, communities, individuals and governments, the TLC will:

- 1 *Take a lead role in building a landscape scale approach to conservation including a world-class system of reserves complemented by sustainable development.*
- 2 *Demonstrate excellence in management for biodiversity conservation.*
- 3 *Contribute to Tasmania becoming a centre for knowledge and expertise for nature conservation and planning.*
- 4 *Develop and implement innovative mechanisms for achieving sustainability and biodiversity conservation.*
- 5 *Provide opportunities and mechanisms for communities and individuals to achieve conservation.*
- 6 *Demonstrate organisational leadership through exceptional governance, a positive working environment and financial sustainability.*

This management plan and the implementation of the strategies and actions within it, including monitoring and reporting, contribute to the TLC achieving its mission.

The Five Rivers Project

In October 2010 the TLC purchased Skullbone Plains and 34 additional properties comprising over 28,000 hectares of the Gunns Ltd native forest estate, in the largest private conservation purchase in Australia's history - the New Leaf Project. This purchase was made possible with the help of private philanthropists Jan Cameron, Rob and Sandy Purves, Graeme Wood, the federal government's National Reserve System (NRS) program and donations from over 1,000 TLC supporters. These properties are now being managed for conservation through a variety of mechanisms including permanent reservation and perpetual covenant.

The Five Rivers Project was established in 2012 as a partnership between the TLC, BHP Billiton and its global alliance partner Conservation International, for the sustained conservation and management of a cluster of New Leaf properties located in the Bronte region. The properties consist of Skullbone Plains, Viormy, Roscarborough, Serpentine and Pine Tier Lagoon, which collectively span over 11,113 ha and embrace the tributaries of five river systems: the Nive, Serpentine, Pine, Little and Little Pine rivers. This very important landscape, now called the Five Rivers Reserve, contains open grassland valleys, old-growth forests and woodlands, native grasslands, cushion plants, endangered sphagnum moss beds and habitat for threatened wildlife and important endemic species.

Skullbone Plains has now been included in the NRS and a conservation covenant was registered on the land title in February 2013 under Tasmania's *Nature Conservation Act 2002*. In 2013 Skullbone Plains was given World Heritage Area status as an extension to the Tasmanian Wilderness World Heritage Area. A separate management plan was prepared for Skullbone Plains in accordance with the NRS requirements and adopted in 2013. This plan has now been incorporated into the Five Rivers Reserve Management Plan to ensure a coordinated conservation focus across the entire region.

Five Rivers Reserve

The Five Rivers Reserve spans 11,113 ha of predominantly eucalypt forest and woodland interspersed with a rich and diverse range of other alpine and sub-alpine vegetation communities and habitats of high conservation value. The area embraces a network of natural and artificial freshwater systems and is the first location where water enters private land from Australia's only natural upland glacial lakes district. The Five Rivers Reserve has been subject to various intensities of commercial timber harvesting in the past but still retains substantial areas of unlogged and regenerating forest plus other priority forest types, grasslands, wetlands and non-forested areas such as moorland, all in varying size and condition. These large and structurally intact forest patches contain functioning ecosystems and vegetation communities expressed at a landscape scale.

Prior to the TLC taking ownership in 2010, the reserve comprised a total of 24 separate land titles all of which had a range of property names (Table 1, Figure 1).

Table 1 Properties comprising the Five Rivers Reserve prior to TLC ownership in 2010.

Previous Property Name	Size ha	No of Titles	Location and general description
Skullbone Plains (also known as Forbes)	1618.2	1	Skullbone Plains is included in Tasmania's Wilderness World Heritage Area and adjoins the Central Plateau Conservation Area to the west and to the east is adjoined by State forest land and the Viormy property.
Viormy [includes Viormy Peninsula and Viormy Pine Tier Lagoon]	2265.5	8	This property includes parcels of land known as Viormy, Viormy Peninsula and Viormy Pine Tier Lagoon and is accessed off the Gowan Brae Road. They are a cluster of almost fully forested blocks, close to Bronte Park, some adjoining the Nive River and Pine Tier Lagoon. Surrounding land includes State forest and a significant boundary with the private 'Pine Tier' pastoral estate.
Roscarborough	2581.7	8	Large block accessed via the Marlborough Highway and traversed by the Little Pine River and Serpentine River. Gentle to medium to steep gradient with excellent views of valley and wide scenic vistas. Good access points to marshland and grassland and with diverse vegetation. Surrounding land includes State forest, Central Plateau Protected Area, and the privately owned 'Gowan Brae' and 'Pine Tier' estates.
Serpentine	3535.5	6	Large block accessed via the Marlborough Highway and traversed by the Little Pine River and Serpentine River. Gentle to medium to steep gradient with excellent views of valley and wide scenic vistas. Good access points to marshland and grassland and with diverse vegetation. Surrounding land includes State Forest, Top Marshes Conservation Area and the private 'Highland Waters' pastoral estate.
Pine Tier Lagoon	1113	1	Commences 2km north of Bronte Park township and is a topographically varying title, including extensive marshes and the forested, steep slopes and plateau of Great Pine Tier. The property is bounded to the west by Pine Tier Lagoon and to the south and east by the Serpentine Rivulet. The title encompasses Bawley's Peak in the south, and a large section of Great Pine Tier. The Marlborough Highway dissects the property in the east. Smaller public roads pass through the property near the western boundary, providing public access to Pine Tier Lagoon and the adjacent private 'Pine Tier' estate.
Total	11,113.9	24	Five Rivers Reserve

Location and tenure

The Five Rivers Reserve is located in Tasmania's Central Highlands approximately 10 km east of Lake St Clair and 15 km northwest of Bronte Park, at latitude 42 02 28.21 S and longitude 146 20 23.79 E (Figure 1). The reserve boundary extends from approximately 2 km north of the Bronte Park township and continues north along the Marlborough Highway and to the west via the Gowan Brae Road. The reserve is situated at elevations ranging from 600 m to over 1,100 m and receives on average over 2,500 mm of rainfall per year, together with prolonged frost and heavy snowfalls in winter.

The Five Rivers Reserve is owned by the TLC as private freehold land. Part of it is included within, and the remainder adjoins, the Tasmanian Wilderness World Heritage Area. It has a range of other neighbouring land tenures including State and private conservation reserves, State and privately managed forests, pastoral land, private shacks, and hydro-electricity impoundments/lagoons (Figure 2). The reserve is within close proximity to many well-known fishing and boating lakes and major access routes to the wider Central Highlands area.

Access

The main approach to the area is via the township of Bronte Park which is approximately 13.6 km northeast of Derwent Bridge, 188 km north of Hobart or 188 km south of Launceston. There are multiple entry points to the reserve off the Marlborough Highway or Gowan Brae Road via well roaded major arterial routes affording in most cases 2WD access. Access crosses a range of land tenures and is gained via a network of roads and locked gates which are managed by the TLC.

Bioregional and Landscape Context

IBRA

The Five Rivers Reserve occurs in the Tasmanian Central Highlands IBRA region.

Catchment values

The Five Rivers Reserve falls within the upper catchments of the River Derwent, which flows through to Hobart, Tasmania's capital city, and is one of the primary sources of water downstream for many agriculture, hydro power, industry and domestic water supply purposes. Maintaining or enhancing the condition of these upper catchments through conservation management will contribute to ecosystem function and help provide ecosystem services.

Regional values

The Five Rivers Reserve has excellent context with surrounding protected areas, which include shared boundaries with the Walls of Jerusalem National Park and the Central Plateau Conservation Area and Protected Area, both of which are contained within the Tasmanian Wilderness World Heritage Area. Other neighbouring properties include State forest, which are managed for their forestry values, Top Marshes Conservation Area, and several private titles including 'Gowan Brae' owned by the Tasmanian Aboriginal community.

Skullbone Plains forms the heart of a focal landscape as identified by a bio-regional planning process for Tasmania carried out by the NRS's Protected Areas on Private Land Program in 2009. Under this process, more than half of Skullbone Plains Reserve (~950 ha) falls within the top 10% of the highest rated conservation areas in the State and about 250 ha is in the top 1% of the State. The protection of Skullbone Plains Reserve secured over 70% of the private land in this focal landscape.

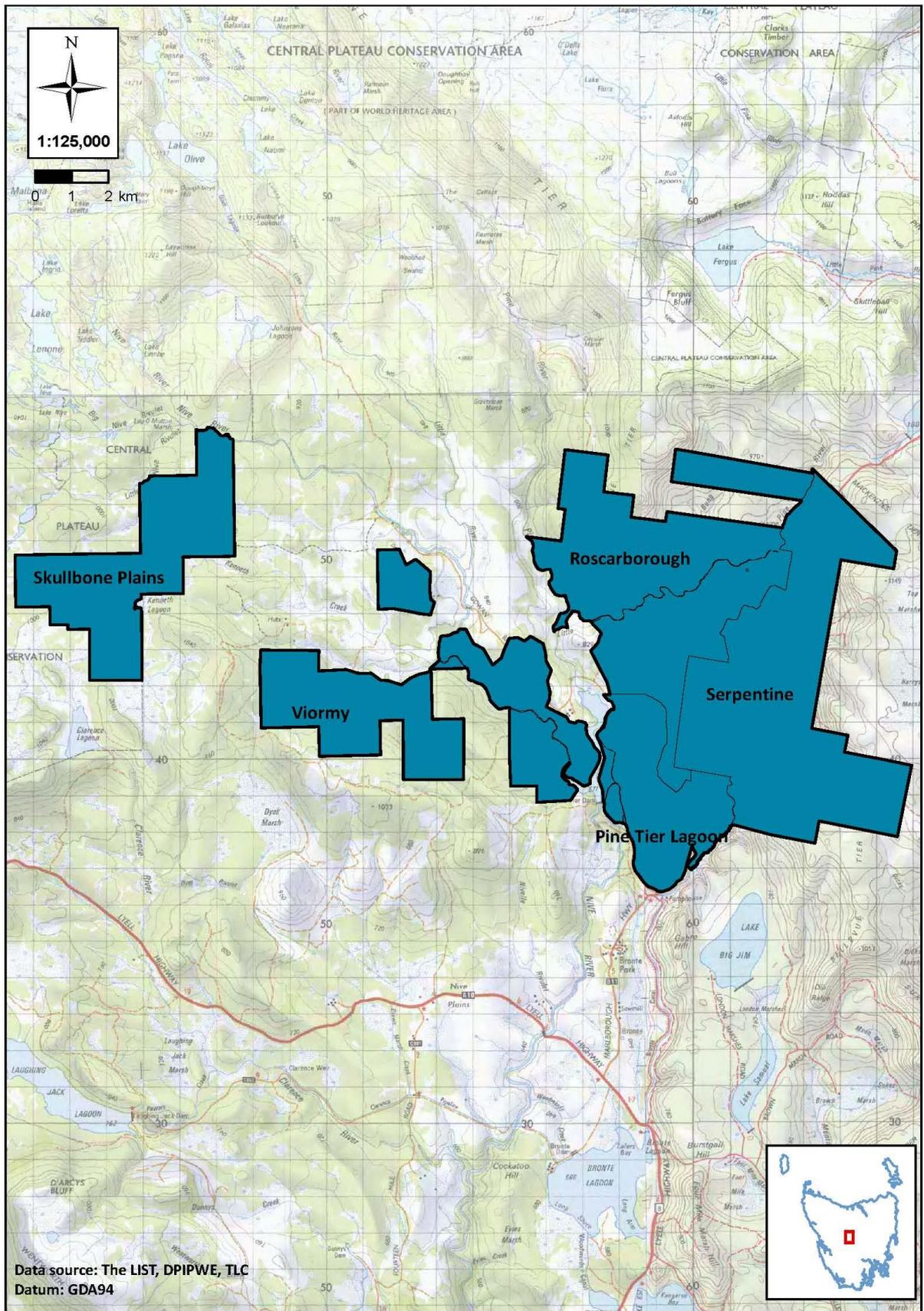


Figure 1 Location and property composition of the Five Rivers Reserve in Tasmania's Central Highlands.

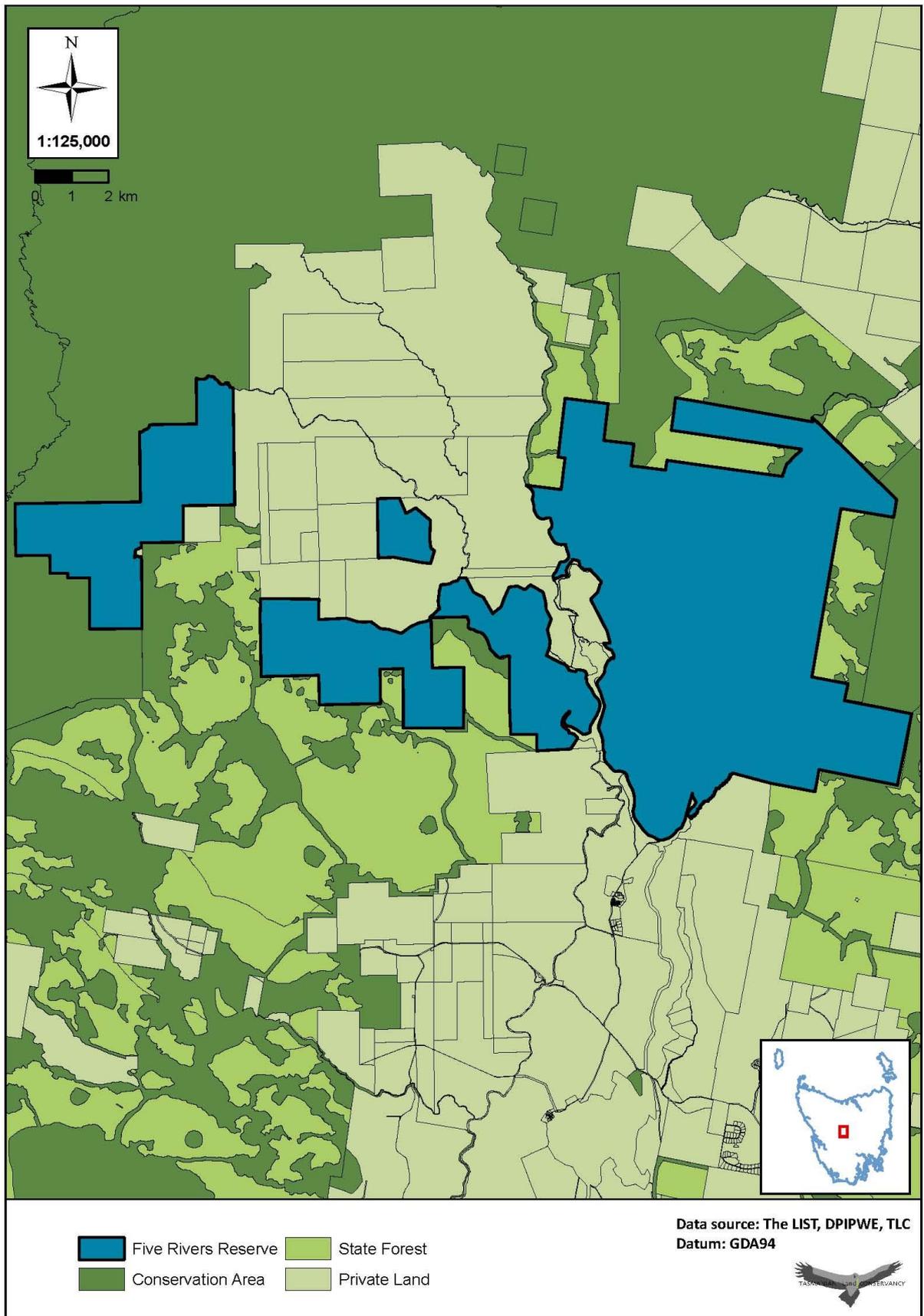


Figure 2 Range of land tenures surrounding the Five Rivers Reserve.

RESERVE STATUS

IUCN Protected Area Management Category

The Five Rivers Reserve meets the criteria for protected area management at two differing levels based on the quality and extent of natural values (Dudley 2008).

Due to its outstanding natural values and landscape context the Skullbone Plains Reserve has World Heritage status and meets IUCN Protected Area Category IV. The Bronte properties meet IUCN Protected Area Category V.

Skullbone Plains Reserve - Category IV - Habitat/Species Management Area

Primary objective: To maintain, conserve and restore species and habitats.

Other objectives:

- To protect vegetation patterns or other biological features through traditional management approaches;
- To protect fragments of habitats as components of landscape or seascape-scale conservation strategies;
- To develop public education and appreciation of the species and/or habitats concerned;
- To provide a means by which the urban residents may obtain regular contact with nature.

Bronte Properties - Category V - Protected Landscape

Primary objective: To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.

Other objectives:

- To conserve the composition, structure, function and evolutionary potential of biodiversity;
- Contribute to regional conservation strategies (as core reserves, buffer zones, corridors, steppingstones for migratory species etc.);
- Maintain diversity of landscape or habitat and of associated species and ecosystems;
- Be of sufficient size to ensure the integrity and long-term maintenance of the specified conservation targets or be capable of being increased to achieve this end;
- Maintain the values for which it was assigned in perpetuity;
- Be operating under the guidance of a management plan, and a monitoring and evaluation programme that supports adaptive management;
- Possess a clear and equitable governance system.

Management of the Five Rivers Reserve will be in accord with these IUCN categories.

Legal Status and Compliance

In February 2013 a conservation covenant was registered on the property title of Skullbone Plains under Tasmania's *Nature Conservation Act 2002* (NC Act). This covenant has the force of a statutory document that binds the TLC to its provisions in perpetuity. A conservation covenant is now being prepared for the Bronte properties. In addition to the conservation covenant, the TLC could apply to the Tasmanian Government to have these areas declared a Private Nature Reserve under the NC Act. This will assist in ensuring that conservation management is consistent across the multiple tenures that exist in the area.

In 2013 Skullbone Plains was added to the Tasmanian Wilderness World Heritage Area by UNESCO.

The Central Highlands Planning Scheme 1998 is the local government planning instrument covering this area and any proposed developments may need to meet the requirements of this scheme and be assessed by the Central Highlands Council.

Constraints may apply to activities which could adversely affect species and vegetation communities listed as threatened under Australian and Tasmanian legislation, and special permits for works or research are required. The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's primary legislation which protects threatened species and ecological communities. Tasmania's *Threatened Species Protection Act 1995* (TSP Act) lists species threatened in Tasmania and it is an offence to knowingly disturb or destroy a listed species without a permit. Schedule 3A of the NC Act lists threatened native vegetation communities and any disturbance to listed communities is regulated through revisions to Tasmania's *Forest Practices Act 1985*.

Vegetation Communities

The Five Rivers Reserve is predominantly a contiguous highland eucalypt forest ecosystem that is regenerating after low intensity forest harvesting over the past 40 years. In addition to highland eucalypt forest there are a number of non-forest vegetation communities of conservation significance, including threatened highland grasslands and marshlands (Table 2, Figure 3, Figure 4). These are scattered across the reserve in low lying areas or where poor drainage and heavy winter frosts inhibit the growth of forest vegetation. The distribution of vegetation communities on Skullbone Plains is slightly different and largely controlled by drainage and frost. In areas where neither drainage nor frost prevent establishment and survival then eucalypts dominate the vegetation to form forests or woodlands. Where frost prevents trees from surviving, grasslands, moorlands and heathlands occur, and where drainage is very poor, wetlands and aquatic systems dominate. Fire is an additional controlling factor to the distribution of vegetation across the reserve, with the frequency and intensity of past fires limiting the re-establishment of fire-sensitive vegetation. Highland Poa grasslands (listed as rare and endangered in Tasmania) form a part of this native ecosystem.

Alpine sphagnum peat bogs are endangered nationally and these vegetation communities have been declining across their entire range (Commonwealth of Australia 2009). Sphagnum bogs are extensive on Skullbone Plains in areas where fire has been either absent or present with very low frequency and intensity. With the adjoining areas that span Clarence Lagoon to Lake Ina, the Skullbone Plains region comprises one of the most extensive areas of sphagnum bogs in Tasmania, including areas containing some scientifically unique 'standing wave' structures unknown elsewhere in the world (Morgan *et al.* 2010). Smaller patches of Sphagnum occur in localised areas on other parts of the Bronte properties.

Flora species of conservation significance

Preliminary surveys to date have identified a number of flora species of high conservation significance on the reserve (Table 3). These predominantly occur in non-forest vegetation, especially grasslands (Figure 5, Figure 6). The endemic nationally endangered Miena cider gum *Eucalyptus gunnii* subsp. *divaricata*, is restricted to Tasmania's Central Plateau and surveys undertaken in 2011 identified a stand of this species at McKenzies Tier (TLC 2012). The population is in good condition with recruitment of seedlings and saplings occurring along with healthy mature adult trees. Clasp leaf heath *Epacris acuminata* occurs on the eastern edge of the Central Plateau in subalpine heathy woodland exclusively on Jurassic dolerite (Threatened Species Section 2010). A small patch of this nationally vulnerable heath was identified on a rocky escarpment below the Little Pine River in 2013, close to the confirmed locality for the rare mountain purplepea *Hovea montana*. The nationally vulnerable clover glycine *Glycine latrobeana* has been recorded along the Marlborough Highway and the state vulnerable drooping pine *Pherosphaera hookeriana* occurs at several locations along the edges of the Nive River near Skullbone Plains. A small population of the rare yellow leaf sedge *Carex capillacea* occurs on the wetter southern parts of Thompsons Marsh and the upper reaches of Serpentine Rivulet (P. Collier survey 2013).

Table 2 Vegetation communities on the Five Rivers Reserve (TasVeg mapping units).

Community (TasVeg code)	Area ha	NCA status	EPBCA status
Freshwater aquatic sedgeland and rushland (ASF)	15.48	e	
<i>Eucalyptus amygdalina</i> forest and woodland on dolerite (DAD)	7.56		
<i>Eucalyptus coccifera</i> forest and woodland (DCO)	555.88		
<i>Eucalyptus dalrympleana</i> – <i>Eucalyptus pauciflora</i> forest and woodland (DDP)	530.91		
<i>Eucalyptus delegatensis</i> dry forest and woodland (DDE)	4455.98		
<i>Eucalyptus delegatensis</i> wet forest (WDU)	2.97		
<i>Eucalyptus gunnii</i> woodland (DGW)	62.05		
<i>Eucalyptus pauciflora</i> forest and woodland on dolerite (DPD)	2091.38		
<i>Eucalyptus pauciflora</i> forest and woodland not on dolerite (DPO)	1279.42		
<i>Eucalyptus rodwayi</i> forest and woodland (DRO)	577.49		
Highland Poa grassland (GPH)	407.43	r, e	
Eastern alpine heathland (HHE)	139.11		
Eastern alpine sedgeland (HSE)	257.41		
Highland grassy sedgeland (MGH)	474.79	r	
Restionaceae rushland (MRR)	57.03		
Sphagnum peatland (MSP) (TasVeg analog of Alpine Sphagnum Bogs)	107.12	r	EN
Nothofagus – Leptospermum short rainforest (RML)	1.57		
Nothofagus – Atherosperma rainforest (RMT)	3.71		
Subalpine heathland (SHS)	10.48		
Water, sea (OAQ)	3.09		
Leptospermum with rainforest scrub (RLS)	7.26		
Riparian scrub (SRI)	37.49	v	
Leptospermum scrub (SLW)	31.11		
Extra-urban miscellaneous (FUM)	10.69		
Regenerating cleared land (FRG)	37.09		
TOTAL	11,137.55		

EPBC EN, Listed as endangered under the Commonwealth *EPBC Act 1999*

NCA e, v, r Listed as endangered, vulnerable or rare under Tasmania's *NC Act 2002*

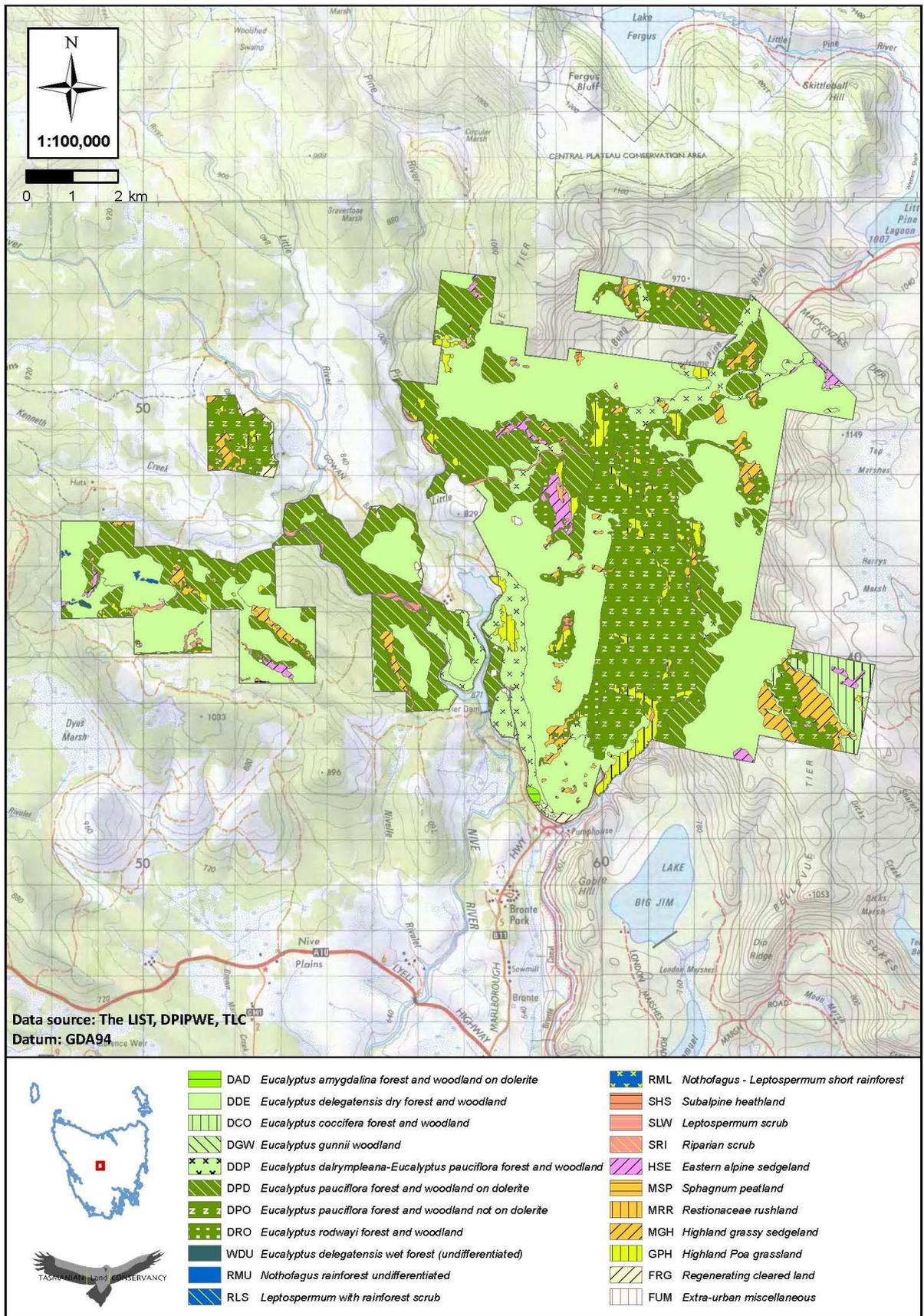


Figure 3 Vegetation communities on the Bronte properties of the Five Rivers Reserve (TASVEG).

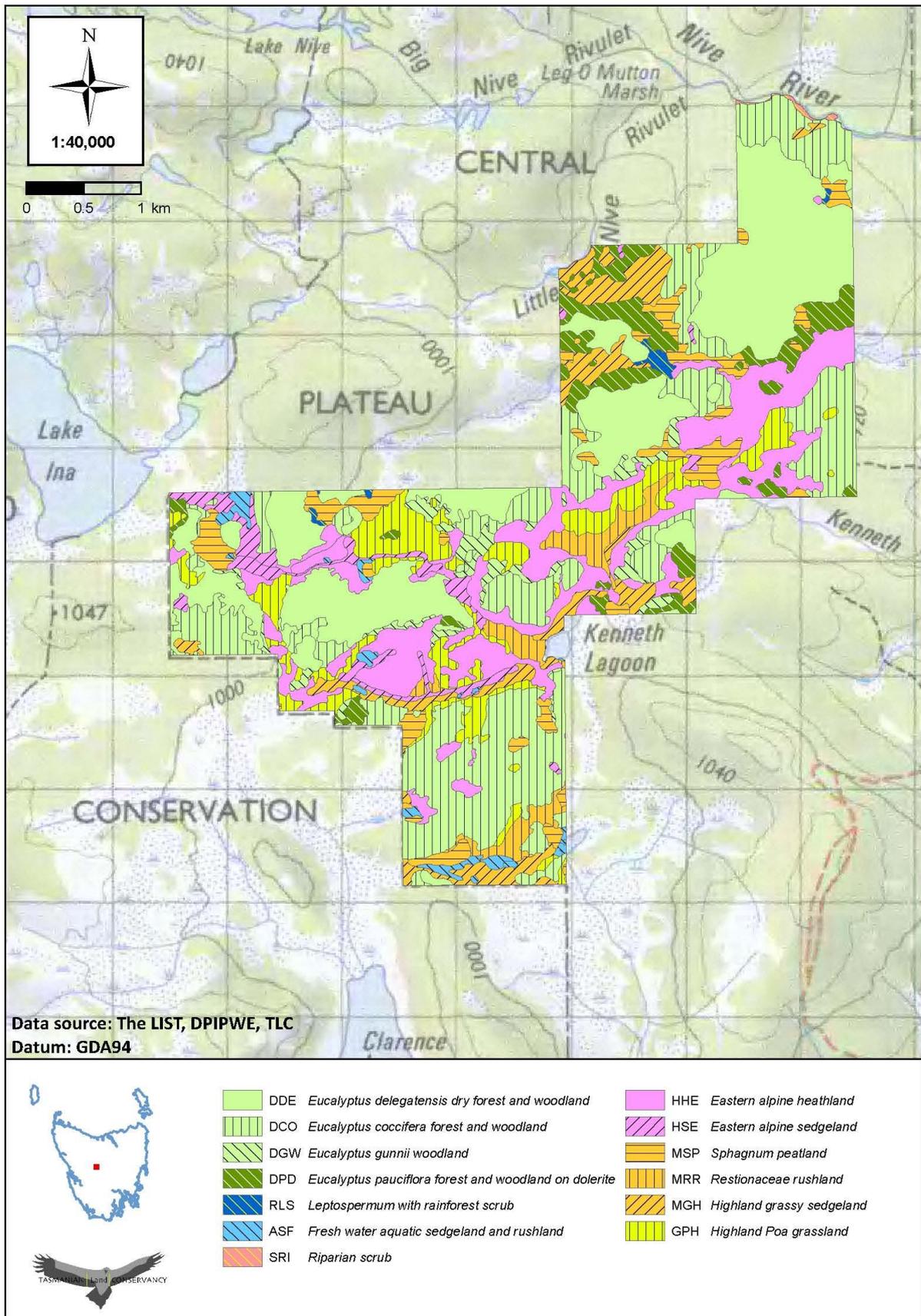


Figure 4 Vegetation communities on Skullbone Plains in the Five Rivers Reserve (TASVEG).

Table 3 Flora species of conservation significance on the Five Rivers Reserve.

Species	Scientific name	Confirmed #	EPBCA	TSPA	Endemic
Miena cider gum	<i>Eucalyptus gunnii</i> subsp. <i>divaricata</i>	Yes	EN	e	Yes
Claspleaf heath	<i>Epacris acuminata</i>	Yes	VU	-	Yes
Clover glycine	<i>Glycine latrobeana</i>	Yes	VU	v	
Yellow leaf sedge	<i>Carex capillacea</i>	Yes	-	r	
Small alpine leek orchid	<i>Prasophyllum tadgellianum</i>		-	r	
Rayless starwort	<i>Stellaria multiflora</i>		-	r	
Mountain purplepea	<i>Hovea montana</i>	Yes	-	r	
Drooping pine	<i>Pherosphaera hookeriana</i>	Yes	-	v	Yes
Narrowleaf westringia	<i>Westringia angustifolia</i>	Yes	-	r	Yes
Ferny buttercup	<i>Ranunculus pumilio</i> subsp. <i>pumilo</i>	Yes	-	r	
Grassland cupflower	<i>Colobanthus curtisiae</i>	Yes	VU	r	Yes
Mount Mawson pine	<i>Pherosphaera hookeriana</i>	Yes	-	v	
Matted lignum	<i>Muehlenbeckia axillaris</i>	Yes	-	r	
Alpine violet	<i>Viola cunninghamii</i>	Yes	-	r	
Fine frillyheath	<i>Pentachondra ericifolia</i>	Yes	-	r	Yes
Handsome hooksedge	<i>Ucinia elegans</i>	Yes	-	r	
Small star plantain	<i>Plantago glacialis</i>	Yes	-	r	

confirmed: Yes sighted since acquisition, otherwise species recorded in the NVA

EPBCA: Listed as endangered EN or vulnerable VU under the Commonwealth EPBC Act 1999

TSPA: Listed as endangered e, vulnerable v or rare r under Tasmania's TSP Act 1995

Small populations of the alpine violet *Viola cunninghamii* occur on the Viormy property and clover glycine *Glycine latrobeana* and matted lignum *Muehlenbeckia axillaris* have been recorded at Bens Marsh. The ferny buttercup *Ranunculus pumilio* subsp. *pumilo* – a rare herb species, has been confirmed across the reserve and the narrowleaf westringia *Westringia angustifolia* has been identified near the Nive River on the boundary of Viormy.

In 2012 a comprehensive flora survey was undertaken on Skullbone Plains as part of the national Bush Blitz program (<http://www.bushblitz.org.au/>, Bush Blitz 2014) and during this survey the tufted perennial sedge *Ucinia elegans* and perennial herb *Plantago glacialis* were recorded there. In 2014 a second Bush Blitz survey was undertaken across the Bronte properties, during which fine frillyheath *Pentachondra ericifolia* was identified on Roscarborough and grassland cupflower *Colobanthus curtisiae* was identified near Thompsons Marsh, on Serpentine. Information collected during the 2014 Bush Blitz survey is still being processed and will be available in the future.

The small alpine leek orchid *Prasophyllum tadgellianum* has yet to be identified and NVA records dating from the 1980s need to be reconfirmed for rayless starwort *Stellaria multiflora*.

Fauna species of conservation significance

The Five Rivers Reserve supports populations of several conservation significant fauna species (Table 4, Figure 5, Figure 6). A total of 239 faunal species have been recorded on the reserve, which includes 15 species of mammal, 44 bird species, 8 reptile and 3 amphibian species. Skullbone Plains is key habitat for the nationally endangered Clarence galaxias *Galaxias johnstoni*, an endemic freshwater fish that occurs in several lagoons, marshes and streams in the Clarence, Nive and Little River sub-catchments. The Bronte region is a long-term monitoring site for the nationally endangered Tasmanian devil *Sarcophilus harrisii*. Regular trapping and spotlight transects by the STDP have monitored the movement of Tasmanian devils across this landscape and mapped the rate of spread of the lethal Tasmanian devil facial tumour disease (DFTD). Tasmanian devils are regularly recorded on the reserve, as are the nationally vulnerable spotted-tail quoll *Dasyurus maculatus* and the eastern quoll *Dasyurus viverrinus*. These three carnivorous marsupial species have been detected on roads, tracks and by using motion sensor cameras. The Tasmanian bettong *Bettongia gaimardia* has been identified on Skullbone Plains and its preferred habitat occurs more widely across the reserve. Historical records indicate that the nationally threatened eastern-barred bandicoot *Perameles gunnii* once occurred in the area but no recent sightings are known. The white-footed dunnart *Sminthopsis leucopus* is an IUCN Red List species that occurs in a variety of habitats from rainforest, open forest to dry coastal heath. This species has been recorded nearby at Liawenee and potentially occurs in the reserve. The IUCN Red Listed and nationally vulnerable green and gold frog *Litoria raniformis* is predominantly a lowland species in Tasmania and while it is unlikely to occur on the reserve due to the high altitude, extension surveys are needed to confirm this.

A number of bat species have been recorded on Skullbone Plains by Lisa Cawthen (pers. com) and possibly occur more widely across the reserve: Eastern falsistrelle *Falsistrellus tasmaniensis*, long-eared bat *Nyctohophilus sp.*, Gould's wattled bat *Chalinobius gouldii* and a forest bat *Vespadelus sp.*

The extensive highland eucalypt forests support large hollow bearing trees which provide nesting habitat for threatened bird species such as the masked owl *Tyto novaehollandiae* and a number of other hollow dependent bird and mammal species. Five nests of the nationally endangered wedge-tailed eagle *Aquila audax fleayi* are known on the reserve. Two nests are now dilapidated and 3 nests are monitored on an annual basis including one nest that was newly discovered in 2013. The State threatened white-bellied sea-eagle *Haliaeetus leucogaster* regularly forages over water bodies a few kilometres to the south of the reserve and areas such as adjacent to Pine Tier Lagoon are suitable for breeding. Nesting habitat for the grey goshawk *Accipiter novaehollandiae* is abundant along rivers and riparian zones across the reserve and this species is occasionally seen foraging in the wetter forest margins. The nationally endangered swift parrot *Lathamus discolor* utilises forests across the reserve during its northward migration before crossing Bass Strait to overwinter on mainland Australia. More recently, a flock of six swift parrots were observed foraging on Viormy in April 2014.

While the invertebrate fauna is less well known, the ptunarra brown butterfly *Oreixenica ptunarra* has been recorded in the past in several grasslands containing *Poa* tussocks near Bronte. In 2013 the endangered Miena jewel beetle *Castiarina insculpta* was identified in *Ozothamnus hookeri* habitat near Liawenee, so it is likely that future surveys may detect this species in suitable habitat on the reserve. During the national Bushblitz survey in 2012 a range of key invertebrate taxa were collected on Skullbone Plains. A total of 17 species of land snails, 30 species of chrysomelid beetles, 48 species of geometrid moths, 5 species of butterflies, 11 species of Odonata, 9 species of caddis flies, and 66 species of spiders were found. At least four new species of Tasmanian spiders were collected however this information was still being processed at the time of writing (<http://www.bushblitz.org.au/>).

Table 4 Fauna species of conservation significance on the Five Rivers Reserve.

Species	Scientific name	Confirmed #	EPBCA	TSPA	IUCN
Tasmanian devil	<i>Sarcophilus harrisii</i>	Yes	EN	e	
Spotted-tailed quoll	<i>Dasyurus maculatus</i>	Yes	VU	r	
Eastern quoll	<i>Dasyurus viverrinus</i>	Yes	-	-	
White-footed dunnart	<i>Sminthopsis leucopus</i>		-	-	C2a(i)b
Eastern-barred bandicoot	<i>Perameles gunnii</i>		VU	-	
Tasmanian bettong	<i>Bettongia gaimardi</i>	Yes	-	-	
Green and gold frog	<i>Litoria raniformis</i>		VU	v	A2ae
Clarence galaxias	<i>Galaxias johnstoni</i>	Yes	EN	e	
Wedge-tailed eagle	<i>Aquila audax fleayi</i>	Yes	EN	e	
Grey goshawk	<i>Accipiter novaehollandiae</i>		-	e	
Masked owl	<i>Tyto novaehollandiae castanops</i>		VU	e	
Swift parrot	<i>Lathamus discolor</i>	Yes	EN	e	
White-bellied sea-eagle	<i>Haliaeetus leucogaster</i>		-	v	
Ptunarra brown butterfly	<i>Oreixenica ptunarra ptunarra</i>		EN	v	

confirmed: Yes sighted since acquisition, otherwise species recorded in the NVA
 EPBCA: Listed as endangered EN or vulnerable VU under the Commonwealth *EPBC Act 1999*
 TSPA: Listed as endangered e, vulnerable v or rare r under Tasmania's *TSP Act 1995*
 IUCN Red List

Figure 5 and Figure 6 show the current location of a range of threatened fauna and flora species known from the Five Rivers Reserve. This information will change as more surveys are conducted. Some species, such as the Tasmanian devil, are wider ranging than indicated by the map symbols.

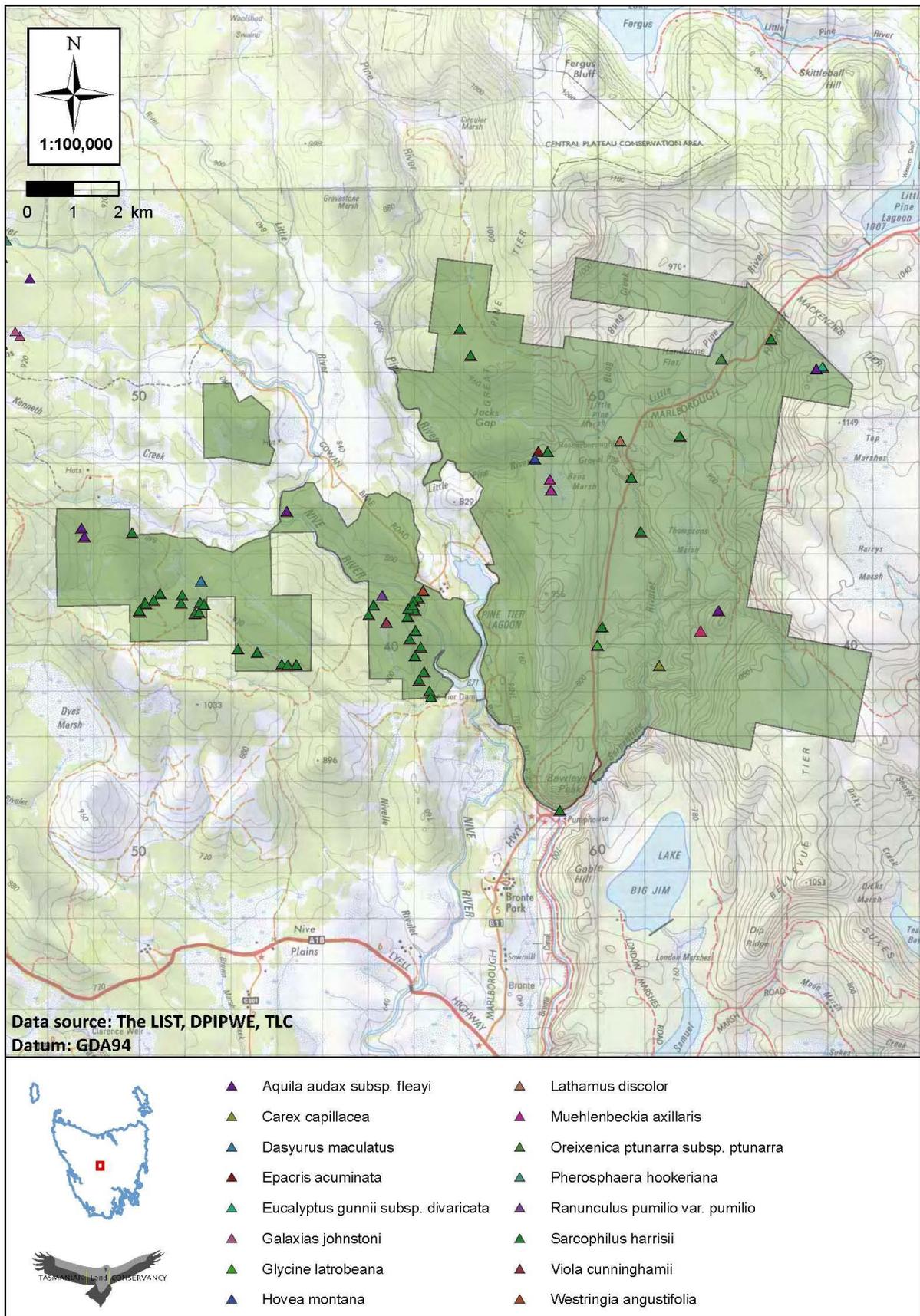


Figure 5 Threatened species records on the Bronte properties in the Five Rivers Reserve (includes 2013 NVA data). Some species are more wide ranging than indicated by the symbols.

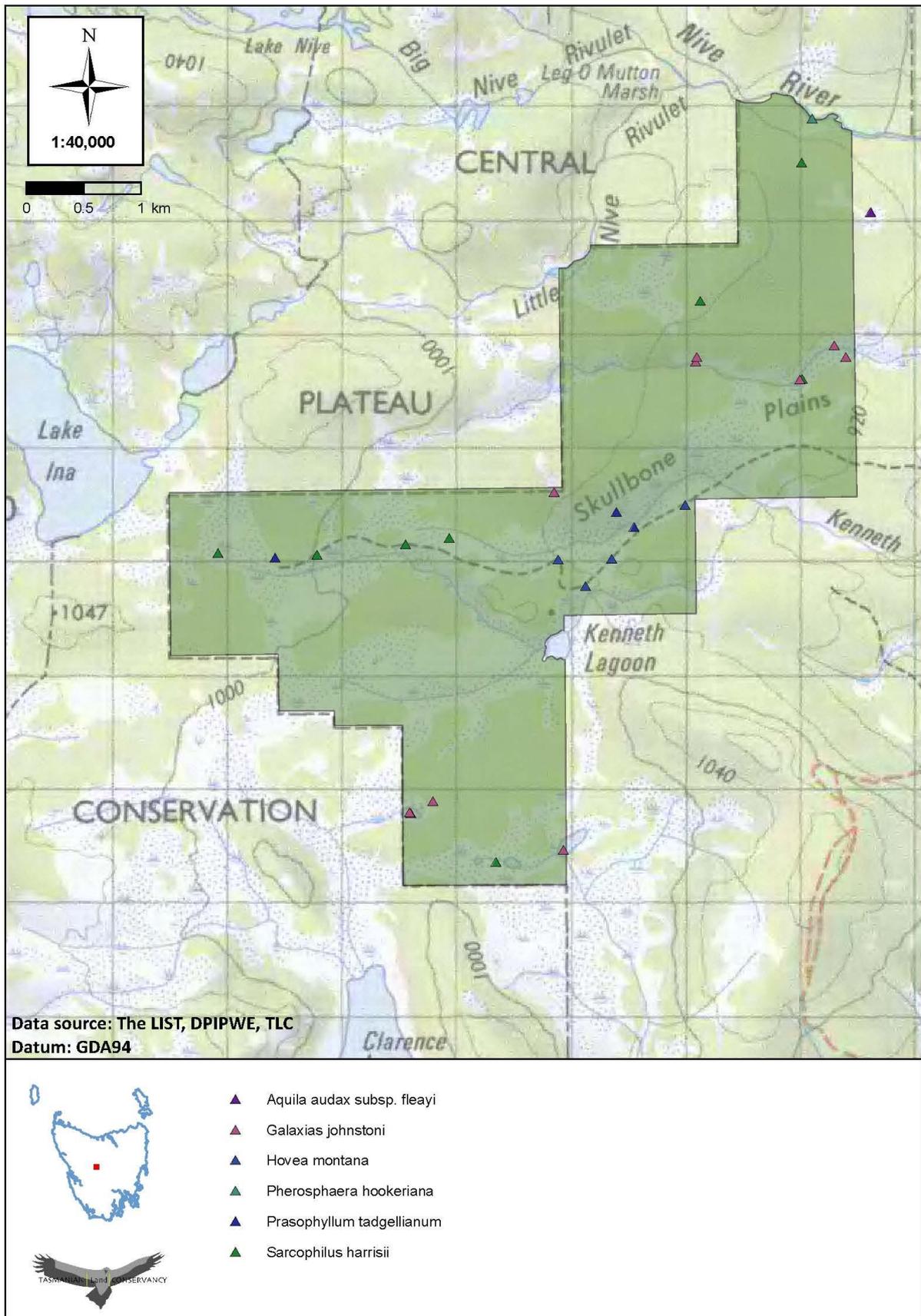


Figure 6 Threatened species records on Skullbone Plains in the Five Rivers Reserve (includes 2013 NVA data).

Geo-conservation values

The Five Rivers Reserve contains several features identified on the Tasmanian Geo-conservation Database (<http://www.dpiw.tas.gov.au>) which are of geo-conservation significance. Parts of the reserve occur on the Central Plateau Terrain or have sites containing Western Tasmania Blanket Bogs, both of which are of world significance. The reserve is located within the Central Highlands Cainozoic glacial area, a geo-conservation site of Australian significance and areas on the Serpentine property contain regionally significant sites of Great Pine Tier Tertiary Fault Trace. Many of these geo features are easily degraded by activities such as inappropriate vehicle use, gravel extraction, excavation or construction or other activities that lead to impeding water runoff and erosion.

The presence of three moraines at Skullbone Plains forms part of the Central Highlands Cainozoic Glacial Area, which is listed as a nationally significant geo-conservation feature in the Tasmanian Geo-conservation Database. These moraines are the Central Plateau Terrain, Clarence Lagoon String Bogs and the Western Tasmania Blanket Bogs (DPIPWE Natural Values Atlas), all of which were significant during the last glaciation which peaked between 18,000 and 22,000 years BP (Forest Practices News 2006).

The Serpentine Rivulet is an example of an incised meandering stream.

Invasive Pest Species

There are a number of invasive weeds and feral fauna on the reserve. Weeds particularly scotch thistle *Onopordum acanthium*, ragwort *Senecio jacobaea*, great mullein *Verbascum thapsus* and Californian thistle *Cirsium arvense* are a legacy of stock grazing, soil disturbance and the movement of heavy machinery and vehicles along roads and during commercial timber harvesting. Small localised outbreaks of gorse *Ulex europaeus* and Californian stinkweed *Navarretia squarrosa* occur on the Reserve and canary broom *Genista monspessulana* is known from neighbouring properties with a high probability of future invasion. Other small infestations of Yorkshire fog *Holcus lanatus*, spear thistle *Cirsium vulgare* and the aquatic sedge *Juncus articularis*, have been noted on roadsides and the Serpentine Rivulet.

Fallow deer *Dama dama* and European rabbit *Oryctolagus cuniculus* are widespread across the Central Highlands including the Five Rivers Reserve and threaten the diversity of the grasslands and the regeneration of the woodlands (Locke 2002). Fallow deer damage young and emergent vegetation and are also responsible for over-browsing of grasslands and succulent grasses and herbs in marshland and wetlands. This invasive species is partly protected in Tasmania and can only be destroyed under permit either during the recreational hunting season or for crop protection purposes (crop can also include conservation assets).

Feral cats *Felis catus* occur on the reserve and are widespread in the region and regularly trapped by land managers or shot by recreational hunters. A fox skull and several alleged sightings of the European red fox *Vulpes vulpes* have been made in the Central Highlands near Interlaken (<http://www.abc.net.au/news/2010-02-10/fox-skull-found-in-central-highlands/326836>) by members of the public and fox baiting has been undertaken by the Tasmanian Government's Fox-Free Task Force (DPIPWE). These two predators impact upon critical-weight range mammals and birds and data is needed to determine their presence, density and most effective means of control.

Brown trout *Salmo trutta* are common in most of the waterways and larger water bodies on the reserve, many of which are regularly stocked by the Inland Fisheries Service for recreational fishing. Brown trout *Salmo trutta* are the primary threat to the endangered Clarence galaxias *Galaxias johnstoni* and have the potential to exterminate local populations of this endemic fish species. There are several streams in which brown trout do not occur, possibly due to surrounding moraine barriers and the marshy, braided nature of the wetland areas. It is critical to ensure that brown trout do not expand their range in the Skullbone Plains area.

While little is known of invasive invertebrate pests, the bumblebee *Bombus terrestris* and European wasp *Vespula germanica* both occur on the reserve and are known to compete for nectar resources and can potentially impact on threatened species. Information is lacking on these species.

Scientific Studies

There have been a number of scientific studies, surveys and monitoring activities undertaken on the Five Rivers Reserve, or in the surrounding area, in recent times. These are:

- National BushBlitz Survey 2014 Five Rivers Reserve (<http://www.bushblitz.org.au/>)
- National BushBlitz Survey 2012 Skullbone Plains (Bush Blitz 2014)
- Miena Cider Gum survey (TLC 2012)
- Long-term monitoring of eagle nest sites (in collaboration with FPA and Gunns Ltd)
- Skullbone Plains montane conifer monitoring (Fitzgerald 2012)
- Aging of the sphagnum peat profile (Hope *et al.* 2013)
- Wind-controlled linear patterning and cyclic succession in Tasmanian Sphagnum mires (Morgan *et al.* 2010)
- Tasmanian Devil Facial Tumour Disease monitoring in the Bronte region (conducted by the STDP)
- Endangered Clarence Galaxias annual monitoring program (IFS and Threatened Species Section 2006)
- Fallow Deer Monitoring (Locke 2002)
- Endangered Miena Jewel Beetle surveys (surveys by Tasmanian Field Naturalists in 2013, www.threatenedspecieslink.tas.gov.au/miena-jewel-beetle-discovery)
- Microbial diversity in Australian soils (Bioplatforms Australia, CSIRO Plant Industry, Canberra)
- Macro-invertebrate sampling in the waterways (NRM North supported program)
- Preliminary acoustic survey of bats (L. Cawthen UTAS School of Zoology)

References are provided in this plan and more information on these studies is available from the TLC.

CULTURAL VALUES

The traditional aboriginal owners of the area around the Five Rivers Reserve were the Big River nation, with the Trowutta and the Larmairrermener clans most closely associated with it. The families and clans were resident in this area during the warmer months of the year, travelling down to the lowlands of the Derwent River valley in the cooler months. Aboriginal heritage surveys have yet to be undertaken on the reserve. However, evidence of aboriginal occupation including artefact scatters has been found at several sites.

With European settlement, farms were established and traditionally stock was driven up to the central highlands to rest the lowland paddocks during the summer months. A series of accommodation paddocks were provided on-route where the sheep were held overnight. Some of the paddocks are still used today when sheep are driven from farms near Ouse and Bothwell to highland locations surrounding the reserve like Liawenee Moor for the summer. Several homesteads, sheds, shack and hut sites are known throughout the reserve, as well as evidence of outbuildings, camp-grounds and disused tracks. The Roscarborough homestead was a well-known historic landmark which was destroyed by fire a decade or so ago. Stone chimneys, stone and wooden fences, shepherd and trappers huts persist in various states of decay reflecting past uses of the area. Protecting these cultural sites is an important component of managing this reserve for the Tasmanian community.

The neighbouring land to the west and north of Skullbone Plains was gazetted as the Central Plateau Conservation Area in 2001, and forms part of the Tasmanian Wilderness World Heritage Area. Lake Ina, which is contained within the World Heritage Area and managed by the Tasmanian Parks and Wildlife Service, is a key focal point for public recreation, with the primary activities including bushwalking, camping and trout fishing.

Past and Current Management

The properties of Skullbone Plains, Serpentine and Roscarborough properties were purchased by Tasmanian Board Mills Ltd in the 1950s for timber extraction then changed ownership to Forest Resources, Boral Timber and then Gunns Ltd. In the late 1980s Forest Resources purchased the Viormy property from the Viormy family and the Pine Tier property in lieu of forest operations on London Marshes. Except for a small area of about 50 ha that was clear-felled on the Serpentine property, the typical extraction method used was selective logging, originally sourcing timber for saw logs but from the 1970s onwards also for woodchip.

The TLC acquired the Five Rivers Reserve in 2010 from Gunns Ltd and now manages the area specifically for biodiversity conservation, carbon sequestration and the maintenance of ecosystems services. There are a number of user groups who retain a strong desire to access the area and therefore facilitating visitation remains a priority.

Recreational Use

Recreational access to Lake Ina has been via the Lake Ina Track, a rough 4WD track that traverses through the middle of Skullbone Plains. The challenging nature of this track, and the previously unrestricted access, has resulted in track degradation and numerous additional side tracks being created in an ad-hoc fashion. Several huts are known in the region, and these have mainly been developed by avid bushwalkers and fishers.

Members of the Bronte Deer Stalkers use parts of the reserve on a seasonal basis for the recreational shooting of fallow deer. Prior to TLC taking ownership of the reserve the group also shot native wallaby and possum but this is no longer permitted. The group have constructed a small shack on Roscarborough for member use and are permitted to gather small quantities of firewood for use at the site.

The Five Rivers region is a central point for recreational fishers and bushwalkers to access the Central Plateau Protected Area and the many walks and fishing lakes within the local region. Various four-wheel drive clubs of Tasmania and 'Tas Trail' have also sought to cross the reserve to access destinations such as Lake Olive and Circle Marsh.

RESERVE MANAGEMENT FRAMEWORK

Management Plan Vision: The Five Rivers Reserve should be managed for the biodiversity values that most depend on it for their survival.

Adaptive Management

The TLC protects important natural areas as permanent reserves. A mission of the TLC is to demonstrate excellence in management for biodiversity conservation. To achieve this mission the TLC has adopted the *Open Standards for the Practice of Conservation*, which is an international system of adaptive management developed by the Conservation Measures Partnership for use in conservation projects (<http://www.conservationmeasures.org>). The *Open Standards* provide a guide to planning and implementing conservation actions. The model of adaptive management used by the *Open Standards* is shown in Figure 7.

The TLC uses Miradi project management software for reserve management planning, monitoring, evaluation and reporting. The software was developed by the Conservation Measures Partnership for use in conservation and land management. Miradi provides the TLC with a tool to prioritize threats, develop objectives and actions, and select monitoring indicators to assess the effectiveness of our management strategies. Miradi also provides a toolkit for storing and using monitoring data and links monitoring data to specific reserve management objectives. The integration of a planning process and a monitoring database makes Miradi a powerful adaptive management tool.



Figure 7 Open Standards adaptive management model, developed by the Conservation Measures Partnership (CMP).

Conservation Action Planning

This management plan represents the outcomes of the first and second stages of Conservation Action Planning, using the *Open Standards* adaptive management model. Conservation targets have been selected that describe broad ecosystem classes or habitat types, often with nested targets that are dependent upon the protection of the primary target (e.g. critical populations of a grassland dependent species are notable as a target, yet are wholly dependent upon the primary target and so are not selected as an independent target). Consistent ecological indicators are selected for each target to monitor changes in the condition of the targets. Threats to each of the targets are then identified, along with the factors that contribute to the threats, and these are prioritised depending on the extent, likelihood and severity of the impact of these threats to the conservation targets.

Strategies to manage these threats are developed, with consideration given to their environmental, social and economic feasibility of each strategy.

Implementation of Management Strategies

Strategies to mitigate the threats to conservation targets are assessed for their feasibility and prioritised based on a combination of factors. These include likelihood and extent of mitigating the threat, the resources required and the resources available to implement the strategy.

Five-year work plans are subsequently developed for each property to implement the management strategies. These work plans identify specific activities to be undertaken, the timing of these and the resources required. Work plans also allocate budgets, allowing the TLC to plan ahead to ensure appropriate capacity to deliver reserve management activities.

Ecological parameters are also considered when scheduling works, to ensure that projects are undertaken when they are most likely to succeed. Progress against activities in the work plan is reviewed annually.

Monitoring and Evaluation

The TLC implements a monitoring and evaluation strategy across all of its permanent reserves. Monitoring of specific ecological indicators enables the collection of scientifically robust information on the status and trends of the conservation targets. Measuring the success of management actions is also critical for ensuring successful long-term management of the targets. A monitoring and evaluation plan is prepared for each reserve, and describes how each of these monitoring streams is delivered at the reserve. The TLC Monitoring and Evaluation Framework has four types of monitoring conducted at intervals ranging from 1 to 5 years:

- *Long-term ecological monitoring* will establish baseline measures of ecological indicators and subsequently provide early warning of deleterious changes in the conservation targets. The results of this monitoring allow reserve managers to develop mitigation measures and reduce future costs of remedial management.
- *Annual reserve assessments* are undertaken by TLC reserve management staff across all permanent reserves to identify any new or emerging threatening processes that have the potential to reduce the viability of the targets. Early identification of threats allows early management interventions to mitigate a threat.
- *Management effectiveness evaluation* provides land managers with information that is essential to determine the adequacy of management efforts. Data are collected on management inputs and biodiversity outputs, with indicators selected that are specific to measuring the success of management strategies. This information is then used by TLC reserve managers to make better-informed decisions on land management, measure progress towards performance objectives and determine the effectiveness of management strategies.
- *Change detection analysis* of remote sensing data using GIS, is undertaken to assess the impact of management strategies on vegetation cover. The surrounding region is also assessed to identify changes in land cover that could indicate threatening processes that have the potential to impact on a reserve. This wider analysis provides an indication of any 'leakage' – shifting of threatening process from a reserve to surrounding areas. Where this is identified, the TLC works with neighbouring landholders to develop local or regional mitigation strategies.

Reporting

The results obtained from the monitoring program are used to adapt and direct on-ground works programs and update annual work plans and reserve management plans.

The status of conservation targets, trends in ecological indicators and outcomes of reserve management activities are communicated to the TLC Board and TLCs Science Council, stakeholders and the community through a range of regular communication channels including an annual report.

MANAGEMENT PLAN STRATEGY

CONSERVATION TARGETS

Highland Marshes

Streams and Wetlands

Highland Forest and Woodland

Carnivorous Marsupials

Ecosystem Services

SOCIAL TARGETS

Community Connection with the Landscape

Cultural Heritage Values

Regional Capacity

STRATEGIES

Build Resilience to Climate Change

Access Management

Fire Management

Clarence Galaxias Protection

Threatened Species Protection

Carnivorous Marsupial Management

Feral and Domestic Animal Management

Weed Management

Visitor Management

Enhance Regional Capacity and Ecosystem Services

Neighbour Relations

Protect Cultural Heritage Sites

Community Engagement

GOALS

Maintain or improve the floristic diversity of Highland Marshes

Maintain or improve the structural complexity of Highland Marshes

Maintain recruitment of Miena cider gum

Maintain the extent of Sphagnum Peatland

Maintain or improve the vertebrate fauna diversity of Highland Marshes

Maintain the diversity of aquatic biota

Maintain or improve floristic diversity of streams and wetlands

Maintain or improve structural complexity of streams and wetlands

Maintain or improve vertebrate fauna diversity in streams and wetlands

Maintain populations of drooping pine *Pherosphaera hookeriana*

Maintain or increase populations of Clarence galaxias

Maintain or improve floristic diversity of Highland Forests and Woodlands

Maintain or improve structural complexity of Highland Forests and Woodlands

Maintain or improve recruitment of canopy sp. of Highland Forests and Woodlands

Maintain of Highland Forests and Woodland forest cover within 2% of 2010 baseline

Maintain or improve vertebrate fauna diversity of Highland Forests and Woodlands

Maintain wild, free ranging populations of carnivorous marsupials

Maintain or enhance all ecosystem services

GOALS

Provide ways for people to achieve and enjoy the benefits of conservation

Harness knowledge of the Bronte landscape to enhance management and support healthy communities

Protect, enhance and rediscover the cultural heritage values of the reserve

Find ways to generate revenue and to enhance regional capacity

OBJECTIVES

Ecological monitoring ensures new management actions are implemented

Unauthorised access is reduced by 80% by 2020

No unauthorised fires start on the reserve by 2020.

All reasonable measures are taken to prevent the spread of any fires originating on the reserve

No introductions or expansion of brown trout on the reserve

Improved conservation outcomes for threatened species by 2016

Improved management of native carnivorous marsupials

By 2016 distributions of key feral species are mapped and management strategies identified

Existing infestations of weeds are eradicated from the reserve by 2017

People are encouraged to visit the reserve every year and are complying with TLC policies

Ecosystem service derived income supplements reserve costs by 10% annually and contributing to the local Bronte community

Regular communications are maintained with all neighbours

By 2016, cultural heritage sites are documented and a protection strategy planned

Increasing number of people accessing the reserve are engaged in TLC activities

Highland Marshes

Conservation priority: High

Description

Highland marshes typically occur in valleys where impeded drainage and severe frosts restrict the growth of most tree species. Seven TASVEG communities are grouped under this conservation target – *Eucalyptus gunnii* woodland (DGW), *Eucalyptus rodwayi* woodland (DRO), Highland Poa grassland (GPH), Eastern alpine heath (HHE), Eastern alpine sedgeland (HSE), Highland grassy sedgeland (MGH), Restionaceae rushland (MRR), *Sphagnum* peatland (MSP), Subalpine heathland (SHS) and *Leptospermum* scrub (SLW). GPH, MGH and MSP are listed as threatened communities under the NCA 2002, and MSP is also listed as threatened under the EPBCA 1999. Highland marshes are floristically diverse, and perform important ecological functions related to water cycling and carbon sequestration. They act as natural filters to water runoff, and by absorbing rainfall and slowly releasing it they reduce erosion and the severity of flooding events. The diverse shrubs that occur in these areas flower for an extended period over summer and provide an important food resource for migratory and resident bird species, and insectivorous species in particular. Wetter areas provide habitat for frogs and provide breeding habitat for many invertebrate species.



Nested targets

Highland Grassland

Highland grassland occurs in areas with better drainage and soils derived from dolerite. The diversity of herbaceous taxa in this vegetation type is of particular conservation significance and several threatened plant species occur in grassland areas. The highland grasslands provide potential habitat for the Ptunarra brown butterfly and support a high abundance of marsupial herbivores and carnivores.

Sphagnum Peatland

Sphagnum peatland occurs in small scattered areas across the Five Rivers Reserve, with a significant wave patterned community occurring on Skullbone Plains. Sphagnum peatland occur in areas with impeded drainage, or where springs bring water to the surface, and perform important functions in water and carbon cycles. The dense soils and vegetation regulate stream flows by storing and slowly releasing water into the headwaters of river systems. Significant amounts of carbon are stored in the deep organic soils and vegetation which can accumulate over thousands of years.

Miena Cider Gum

The Miena Cider Gum (*Eucalyptus gunnii* subsp. *divaricata*) is an endangered eucalypt species that is endemic to the central plateau of Tasmania. It occurs in frost-hollows and is regarded as the most cold tolerant of all eucalypts. The past 20 years has seen a significant decline in the species due to a combination of drought and grazing by stock and other browsers. A population of Miena Cider Gum on Mackenzie's Tier was assessed in 2011 and found to be in good condition. The population contained large mature trees, saplings and many seedlings, which indicates it has been reproducing successfully over a long time period (TLC 2012).

Goals

Maintain or improve the floristic diversity of Highland Marshes
 Maintain or improve the structural complexity of Highland Marshes
 Maintain recruitment of Miena cider gum
 Maintain the extent of Sphagnum Peatland
 Maintain or improve the vertebrate fauna diversity of Highland Marshes

Viability

Key Environmental Attribute	Indicator
Vegetation condition	Floristic diversity
	Structural complexity
	Miena Cider Gum Recruitment
Highland Sphagnum peatland spatial extent	Area
Vertebrate fauna	Mammal diversity
	Bird diversity

The viability of the target has been rated as very good, following a assessment of the above condition indicators of the target. The trends of the ecological indicators will be better quantified over time.

Threats and management

Unplanned fires may affect fire sensitive vegetation and peat soils. In the absence of fire, encroachment of shrubs and trees into marshes may reduce floristic diversity. A high density of feral browsers affects vegetation across the reserve, and particularly the Miena cider gum and weed invasion reduces the integrity and diversity of grasslands. Off-road vehicle use has caused significant local disturbance in some areas, such as Skullbone Plains.

Threat	Impact	Threat rating	Management strategy
Inappropriate fire	Vegetation is generally tolerant of burning, but a fire in dry conditions has the potential to burn peat soils	moderate	<ul style="list-style-type: none"> • Fire management • Access management • Visitor management • Neighbour relations • Threatened species assessments (Ptunarra brown butterfly)
Over browsing and weeds	Grazing and browsing of vegetation by deer and rabbits or domestic stock, especially of Miena Cider Gum seedlings. Weed invasion reduces vegetation diversity and viability	moderate	<ul style="list-style-type: none"> • Feral and domestic animal management • Weed management • Neighbour relations
Off-road vehicle use	Physical disturbance of sensitive vegetation and soils	low	<ul style="list-style-type: none"> • Access management • Visitor management • Neighbour relations
Climate Change	Loss of species at risk eg Miena Cider gum, Sphagnum, alpine conifers etc	moderate	<ul style="list-style-type: none"> • Build resilience to climate change

Streams and Wetlands

Conservation priority: High

Description

The Five Rivers Reserve is nestled between the Nive, Serpentine, Pine, Little and Little Pine rivers and surrounded by Lake Ina, Clarence Lagoon, Kenneth Lagoon and Pine Tier Lagoon and their associated tributaries and creek systems.

These water systems are invaluable ecosystems and corridors for a range of aquatic dependent and associated plants and animal species. The riparian vegetation is intact and is dominated by diverse native vegetation with no or few weeds occurring in this area.



Three vegetation types are recognised under the target – Freshwater aquatic sedgeland and rushland (ASF), Riparian scrub (SRI), and Highland grassy sedgeland (HSE) which occur predominantly within a 10 metre zone along the water edge. Staircase ponds are a landscape feature where pools occur in a ‘stepped’ formation down a slope. The ponds are usually separated by bands of vegetation. They tend to dominate in permanently water saturated situations exposed to extreme conditions of wind and prolonged snow. These unusual wetland types are recognised as features of geo-conservation significance.

Nested targets

Clarence Galaxias

The Clarence galaxias *Galaxias johnstonii* occurs in the Clarence, Nive and Little River catchments in streams and wetlands where brown trout are absent (Threatened Species Section 2006). On the Five Rivers Reserve it occurs in small wetlands and headwater streams on Skullbone Plains where natural barriers in the landscape have prevented the establishment of trout. Critical conservation actions for this species include the protection of existing populations from brown or rainbow trout and increasing the species area of occupancy within its known range through introduction at strategic locations.

Drooping Pine

Drooping pine *Pherosphaera hookeriana* is an endemic Tasmanian conifer that occurs in a narrow band of riparian vegetation along the Nive River. Conservation measures for the threatened drooping pine are protection of its riparian habitat from fire, due to its fire sensitive nature and poor regeneration capacity (Threatened Species Section 2009).

Goals

Maintain the diversity of aquatic biota

Maintain or improve floristic diversity of streams and wetlands

Maintain or improve structural complexity of streams and wetlands

Maintain or improve vertebrate fauna diversity in streams and wetlands

Maintain populations of drooping pine *Pherosphaera hookeriana*

Maintain or increase populations of Clarence galaxias *Galaxias johnstonii*

Viability

Key Environmental Attribute	Indicator
Water quality	Macro-invertebrate abundance
Vegetation condition	Floristic diversity
	Structural complexity
	Miena Cider Gum Recruitment
Clarence galaxias presence	Galaxias, brown trout

The viability of the target has been rated as very good, following an assessment of the condition indicators of the target. The trends of the ecological indicators will be better quantified over time.

Threats and management

The introduction of brown trout into areas where Clarence galaxias occur poses a serious threat to their persistence in the wild. Unplanned fire has the potential to eliminate populations of a range of species including Drooping Pine, which occupy a narrow band of protected habitat along the Nive River. Off- road vehicles have already caused significant damage to some wetland areas at Skullbone Plains and pose an ongoing threat. Visitors to the reserve have the potential to introduce diseases such as Chytrid unless visitation is carefully managed and biosecurity procedures are implemented.

Threat	Impact	Threat rating	Management strategy
Brown trout	Competition and predation of Clarence galaxias causing a decline in populations and potential for local extinction	high	<ul style="list-style-type: none"> • Access management • Feral and domestic animal management • Clarence galaxias protection
Inappropriate fire regime	Burning of riparian vegetation and local extinction of populations of Drooping Pine, Miena cider gum and Sphagnum	low	<ul style="list-style-type: none"> • Fire management • Access management • Neighbour relations • Visitor management
Off-road vehicle use	Physical disturbance of sensitive vegetation	low	<ul style="list-style-type: none"> • Access management • Visitor management • Neighbour relations
Animal and plant diseases	Introduction of Chytrid disease to frogs or Mucor disease to platypus and other diseases to plants and animals. Increased Phytophthora risk due to climate change	medium	<ul style="list-style-type: none"> • Access management • Visitor management • Threatened species protection (green and gold frog)
Climate change	Reduction in water availability and general drying of the reserve	medium	<ul style="list-style-type: none"> • Build resilience to climate change

Highland forest and woodland

Conservation priority: Medium

Description

The highland forests and woodlands of the Five Rivers Reserve are a significant conservation feature of the landscape. Diverse eucalypt species occur as a mosaic, where dominance is determined by minor changes in topography, aspect, drainage and geology. Eleven forest or woodland types are



recognised in this area under the TASVEG classification, which range from tall forest dominated by *Eucalyptus delegatensis*, through to low open woodland dominated by *Eucalyptus pauciflora*. TASVEG classifications include – *Eucalyptus coccifera* woodland (DCO), *Eucalyptus delegatensis* dry forest (DDE), *Eucalyptus pauciflora* forest on dolerite (DPD), *Eucalyptus pauciflora* forest on sediments (DPO), *Eucalyptus dalrympleana* – *Eucalyptus pauciflora* forest (DDP), and *Leptospermum* with rainforest scrub (RLS). The forests are floristically diverse and are structurally complex. Several vegetation strata are present.

Nested targets

Wedge-tailed eagle

There are five wedge-tailed eagle nests on the Five River Reserve, two nests are now dilapidated, 2 nests are monitored on an annual basis and one nest was newly discovered in 2013. Wedge tailed eagles are a nationally endangered species that require large areas of mature forest for breeding habitat. Disturbance of the areas around a nest are a threat to eagle breeding success. Over time, the logged areas of eucalypt forest of the Five Rivers area will regenerate and provide additional nesting opportunities for this iconic species.

Native fauna diversity

The diversity and complexity of the forest provides excellent habitat to diverse native fauna, with many species of birds, mammals and reptiles present in this area. The flowering of shrubs hakea, teatree and waratah over summer months attracts many species of birds to the area and *Ozothamnus hookeri* is critical habitat for the Miena jewel beetle. The large old trees provide hollows for roosting and nesting and fallen limbs provide decaying logs for shelter and food resources.

Goals

- Maintain or improve floristic diversity of Highland Forests and Woodlands
- Maintain or improve structural complexity of Highland Forests and Woodlands
- Maintain or improve recruitment of canopy species of Highland Forests and Woodlands
- Maintain of Highland Forests and Woodlands forest cover within 2% of 2010 baseline
- Maintain or improve vertebrate fauna diversity of Highland Forests and Woodlands
- Maintain or improve reproductive success of the wedge-tailed eagle

Viability

Key Environmental Attribute	Indicator
Vegetation condition	Floristic diversity
	Structural complexity
	Recruitment of canopy species
Vertebrate fauna	Mammal diversity
	Bird diversity
Wedge-tailed eagle reproductive success	Nest activity
Forest cover change in reserve	Area
Forest cover change in 20km buffer of reserve	Area

The viability of the target has been rated as very good, following an assessment of the above condition indicators of the target. The trends of the ecological indicators will be better quantified over time.

Threats and management

These forests are generally fairly resilient to most types of activities with the exception of landscape scale modification through actions such as land clearance, dam construction and too frequent firing and commercial harvesting. Reservation has mitigated most of these threats but those remaining include: illegal firewood cutting, invasive weeds especially as a result of timber harvesting and feral browsers.

Threat	Impact	Threat rating	Management strategy
Eagle nest disturbance	Desertion of eagle pairs, loss of nest productivity, nest abandonment	Low	<ul style="list-style-type: none"> • Access management • Visitor management • Threatened species assessments (wedge-tailed eagle)
Feral herbivores and weeds	Reduced recruitment of canopy trees and damaging seedlings from deer and rabbit browsing. Weed invasion reduces vegetation diversity and viability.	Low	<ul style="list-style-type: none"> • Feral and domestic animal management • Weed management • Neighbour relations
Illegal wood hooking	Potential impact on the structural diversity of the vegetation. However the remoteness and large scale of the reserve limits this.	Low	<ul style="list-style-type: none"> • Access management • Neighbour relations
Lack of information	Lack of information of the Miena jewel beetle and white-footed dunnart leading to inappropriate management	Medium	<ul style="list-style-type: none"> • Threatened species assessments (Miena jewel beetle, white-footed dunnart)

Carnivorous Marsupials

Conservation priority: High

Description

The Bronte region is one of the few areas in Tasmania that retains an intact guild of large carnivorous marsupials, the Tasmanian devil *Sarcophilus harrisii* (endemic), spotted-tail quoll *Dasyurus maculatus* and eastern quoll *Dasyurus viverrinus* (endemic). The Tasmanian devil and spotted-tail quoll are nationally threatened and the eastern quoll is a species of conservation concern. The Tasmanian devil is a wide ranging species that forages over large distances in search of carrion or prey. The devil favours mixed aged forest often bordering grasslands, pasture and disturbed sites, and will readily use roads and tracks. In 2006, 35 devils were trapped at Bronte; of which 13 were suspected with the fatal Devil Facial Tumour Disease DFTD (Devil News March 2006). The mosaic of open areas, woodland and forest supports high population densities of prey species such as wallaby and possum and large fallen trees and rocky areas provide den sites. The spotted-tailed quoll and eastern quoll have been detected on the property using camera traps, and at dusk on roads and grassland.



Goal

Maintain wild, free ranging populations of carnivorous marsupials.

Viability

Key Environmental Attribute	Indicator
Presence, density and population trends of Spotted tailed quoll, Eastern quoll and Tasmanian Devil	The indicators are still being resolved, but include occurrences/site, mean number of sites occupied, number of individuals sighted, relative abundance
Tasmanian devil disease status	Percentage of devil sites with DFTD
Population trend of feral cats	Some of the indicators are still being resolved, but include occurrences/site, mean number of sites occupied, number of individuals sighted, relative abundance

This target is currently rated as good, due to the co-existence of the three carnivorous marsupial species but the widespread prevalence of Devil Facial Tumour Disease is impacting on Tasmania devil numbers and the presence of feral predators can potentially impact all three dasyurid species.

Threats and management

Devil Facial Tumour Disease poses a critical threat to the Tasmanian devil. The Five Rivers Reserve road network may provide a vector for the spread of the disease therefore the closure of redundant roads is a management priority. Feral animals e.g. cats and foxes pose a threat to devils and quolls, through competition and predation.

Threat	Impact	Threat rating	Management strategy
DFTD	Loss or reduced population viability of devils.	Very high	<ul style="list-style-type: none"> Threatened species assessments (Tasmanian devil)
Feral predators	Competition for resources and predation of dasyurid young.	Medium	<ul style="list-style-type: none"> Feral and domestic animal management Neighbour relations Carnivorous Mammal Monitoring
Roadkill/disturbance	Reduced population viability for three dasyurid species.	Low	<ul style="list-style-type: none"> Access management Threatened species assessments (Tas devil)
Lack of information	Loss of carnivorous marsupials from the Five Rivers landscape	Low	<ul style="list-style-type: none"> Carnivorous Mammal Monitoring (four species – 3 marsupials and cats)

SOCIAL TARGETS

Community Connection with the Landscape

Conservation priority: Medium

Description

Members of the community hold valuable knowledge about the history, conservation values and management of the Five Rivers landscape. Engaging with interested parties provide TLC with opportunities to focus its efforts on developing and implementing effective conservation strategies by learning from community knowledge.



Many members of the community also have valuable skills that may help the TLC to assist with management and monitoring of the reserve, substantially increasing protection of this area. Working alongside and sharing conservation knowledge with the broader community can also improve community understanding and appreciation of conservation, and result in changed attitudes and behaviours. Maintaining and providing the community with regular and new opportunities to use the reserve will also improve stewardship and shared custodianship of the land.

In a broader sense, the TLCs capacity to actively manage its reserve portfolio relies heavily on income generation from supporters, which in turn, relies on people's connection with the landscape. A critical function of TLC's activity is to ensure that people retain and expand this connection.

The remoteness and isolation of this region has long attracted recreational users who over many generations have fostered a sense of community and ownership, eg fishers, recreational hunters, firewood collectors, bushwalking, boating and camping. Large pastoral estates surround the Five Rivers Reserve and expansion of the forest industry has encouraged the growth of a range of small service providers. A range of stakeholders hold valuable information on the previous history of the area and its future management needs.

Goal

Provide ways for people to achieve and enjoy the benefits of conservation
Harness knowledge of the Bronte landscape to enhance management and support healthy communities.

Key Attribute	Indicator
Community involvement	Number of people engaged in activities Number of visitors per annum
Volunteer activity	Volunteer days
Money generated from ecosystem services	Income

Viability

Yet to be formally assessed

Threats to the values

The loss of knowledge, understanding and appreciation of the special values of the landscape are the primary threat to achieving this objective. This may arise from a lack of, or poor communication with stakeholders or the lack of opportunities for the wider community to become, or remain, engaged with the TLC.

Threat	Impact	Threat rating	Management strategy
Loss of knowledge	Lost opportunities to better understand and manage the reserve or to expand the reserve's potential to deliver ecosystem services.	Low	<ul style="list-style-type: none"> • Access management • Community engagement • Neighbour relations
Loss of management capacity	Loss of income or capacity compromising ongoing management of the reserve and wider community benefits	medium	<ul style="list-style-type: none"> • Ecosystem services • Enhance Regional capacity

Cultural Heritage Values

Conservation priority: Medium

Description

The Five Rivers Reserve in the wider central highland landscape contains a number of important cultural sites for Aboriginal people and also areas depicting early European settlement. Although a detailed Aboriginal cultural survey has yet to be undertaken, many artefact scatters and traditional campsites are known to occur across the reserve. The ruins of several shack and hut sites are known (eg Kenneth Lagoon), as well as evidence of outbuildings, camp grounds and disused tracks. Documenting and protecting the entire range of these cultural sites is an important component of managing the values of this area.



Goals

Protect, enhance and rediscover the cultural heritage values of the reserve

Viability

Yet to be formally assessed

Threats

The key threats to cultural heritage values are the continued loss and decay of sites due to lack of information, protective management and vandalism. Better site knowledge and survey will help to abate this threat.

Threat	Impact	Threat rating	Management strategy
Vandalism	Physical disturbance of site.	Low	<ul style="list-style-type: none">• Access management
Lack of Information	Site disturbance and loss of values due to poor site knowledge and documentation	Med	<ul style="list-style-type: none">• Community engagement• Neighbour relations
Lack of action	Deterioration of cultural heritage sites	Low	<ul style="list-style-type: none">• Protect cultural heritage

Regional Capacity

Conservation priority: Medium

Description

The Five Rivers Reserve is located in the heart of the Central Highland's small regional Bronte community. Expenditure on management and any revenue generated from our activities on the reserve should wherever possible have a flow-on effect to this community to help maintain or improve its capacity to manage the broader landscape. Revenue generated through ecosystem services such as carbon trading, firewood gathering, deer shooting and other authorised activities will also help the local community enjoy the benefits of conservation.

Goals: Find ways to generate revenue and to enhance regional capacity

Key Attribute	Indicator
Carbon Program	Income generated from carbon
Ecosystem Services	Income or benefits from other ecosystem services
Benefits generated from conservation activities	Income and benefits flowing to Bronte community

Viability

Yet to be formally assessed but income generated from ecosystem services due to sale of carbon credits is good.

Threats

The key threats to a less sustainable local community are increasing pressure on the reserve from a reduced provision of services [fuel, accommodation, groceries etc.] and increase in illegal activities.

Threat	Impact	Threat rating	Management strategy
Degraded conservation	Reduced local community increases risk to conservation assets	Low	<ul style="list-style-type: none">• Access management• Enhance regional capacity

MANAGEMENT STRATEGIES

Build Resilience to Climate Change

Priority: High

Objective: Climate change impacts on all conservation targets are being addressed

Climate change is recognised as a key threat to many conservation values state-wide and nationally (Climate Futures Tasmania 2012). Changes in climate will affect most conservation targets in the reserve, but particularly sphagnum peatlands, wetlands and moorlands. Sphagnum peatlands and Miena cider gum are under direct threat from climate change due to their narrow environmental niche (Taylor 2012). Other species, like *Pherosphaera hookeriana* and other dwarf conifers, are also particularly sensitive to changes due to fire. Helping conservation targets to adapt to climate change is the most useful strategy that can be undertaken in the immediate term. Improving the resilience of the conservation targets will help to limit the impacts of other stressors and actively help recruitment and population replacement where appropriate. Long-term monitoring across the reserve is essential to identify any change in extent or condition of conservation targets and when remedial recovery actions are needed.

Key Actions	Details
Devise adaptation pathways for targets (where applicable)	Identify species at risk and feasible adaptation strategies.
Consider climate change when developing and revising management strategies	Consider the impact of climate change on threats and targets when developing, implementing and adapting management strategies and act accordingly.

Monitoring

Key monitoring activities	Details
Monitor health of conservation targets and nested targets most at risk	Install and maintain long-term ecological monitoring of conservation targets to inform management and trigger intervention if needed. Continue 3-5 yearly climate change monitoring of <i>Pherosphaera hookeriana</i> and <i>Diselma archeri</i> initiated by DPIPWE in 2012.
Review adaptation pathways	

Access Management

Priority: High

Objective: Unauthorised access is reduced by 80% by 2020

The aim of this strategy is to regulate access to the reserve and to prevent illegal access. Unregulated access has caused significant impacts to TLC reserves, and unauthorised access continues to be an issue at the Five Rivers Reserve, as it was during its previous ownership. Unauthorised access is associated with a range of activities that impact on the natural values of a reserve, including hunting, wood-hooking, campfires, dumping of rubbish, off-road vehicle use, and damage to infrastructure such as gates and fences. A variety of mechanisms are used to regulate access including infrastructure such as fences and gates, earthworks, information provided in signs, and direct communication with the local community and potential visitors.

Key Actions	Details
Maintain key arterial routes	Maintain key access roads in good repair to ensure management and visitor services are facilitated, maintained and more easily monitored. This involves road grading and maintenance such as clearing culverts, removing debris and wildlings, etc.
Rationalise road network	Develop and implement the road rehabilitation strategy to reduce the road network unnecessary for land management.
Maintain reserve security	Retain key distribution system via the Bronte Shop. Rotate the master key system on a 5 yearly basis and audit the number and distribution of keys every two to three years. Repair gates as necessary. Maintain trenches and other physical barriers as unauthorised access is usually associated with the removal of barriers or filling in trenches. Regular maintenance of these barriers is required. Remote cameras are installed at access points where regular illegal access or vandalism occurs and information is passed to enforcement authorities as appropriate.
Reserve biosecurity	Ensure entry signs inform visitors about natural values, conditions of entry, TLC policies and management objectives. Ensure vehicles or visitors entering sensitive areas are free of dirt carrying disease such as Phytophthora, or weed seeds and do not transfer soil or water across the reserve. Activate TLCs hygiene protocols for vehicles and footwear using certified disinfectants in footbaths and wash down stations.

Monitoring

Key monitoring activities	Details
Illegal access	All incidences of illegal access are monitored, eg, no of gates and locks damaged, track barriers breached, campsites detected, signs damaged etc
Road and associated infrastructure condition	Monitor road surface, culvert, bridge , gate, etc and document indicators such as road repair, culverts cleared, etc.

Fire Management

Priority: High

Objectives: No unauthorised fires start on the reserve by 2020. All reasonable measures are taken to prevent the spread of any fires originating on the reserve (ongoing)

While fire can be a natural process, the TLC recognises the threat posed by unplanned fires to human life, property and the environment. Fire is an ecologically important part of the Tasmanian landscape. Its effect can be positive in terms of habitat maintenance and renewal, but it can also be a destructive agency if it occurs at frequencies, intensities or seasonality that is inappropriate to a particular habitat or species.

Fire should be excluded from sensitive area such as rainforest, wetlands, riparian zones and sphagnum peatland and from fire sensitive species such as dwarf conifers.

The key objectives of fire management on TLC land are to protect human life and property from fire and to maintain or enhance the natural diversity of species and communities through appropriate ecological fire regimes, in so far as this is consistent with the first objective. We achieve these objectives by reducing fuel loads around infrastructure; maintaining access tracks for the purpose of firefighting where these are required; co-operating with neighbours, local councils, Parks and Wildlife Service and the Tasmanian Fire Service to prevent the spread of bushfires; and working closely with relevant experts, including the Tasmanian Fire Service, fire ecologists, botanists and zoologists, to determine the fire regime prescriptions for hazard reduction and ecological maintenance.

Key Actions	Details
Build staff fire response capacity	Ensure TLC reserve staff are appropriately trained in fire evaluation procedures and OH&S requirements during periods of high fire rating.
Prepare fire management plan	A comprehensive fire management plan is needed to cover bushfire control, fuel reduction burning and undertaking ecological burning to maintain conservation targets in good condition.
Implement fire management plan	Details to be added once the fire management plan has been prepared.

Monitoring

Key monitoring activities	Details
Fire danger	Monitor the fire index rating on the Tasmanian Fire Service web site and associated outlets, to ensure preparedness
Fire boundaries	Map fire incidence and boundaries

Clarence Galaxias Protection

Priority: High

Objective: No introductions or expansion of brown trout on the reserve

A critical recovery action for the Five Rivers Reserve is to ensure ongoing protection of the Clarence galaxias, a nationally endangered endemic fish that is confined to this local region. This protection can be achieved primarily by ensuring that their major threat i.e. brown trout, do not reach any of the waterways where small localised populations of Clarence galaxias occur. Access management plays a key role by regulating visitors to the area, and ensuring that the organisation's biosecurity protocols are adhered to prior to entry. Additional recovery actions are to investigate the potential to eradicate trout from other small water bodies on the Reserve to expand this species range, and to survey for trout-free areas which may be suitable as future translocation sites. Tasmania's Inland Fisheries Service is the body with statutory authority for this species and its staff conducts annual surveys and other extension work. Working closely with the Inland Fisheries Service and the wider angling community will improve education about the security and conservation status of this fish.

Key Actions	Details
Develop a brown trout mitigation plan with Inland Fisheries Service	Develop a works program with Inland Fisheries Service for the long-term control of brown trout across Skullbone Plains and for habitat protection including maintaining trout barriers, removal and exclusion of other introduced fish and/ or physical habitat restoration. Investigate the feasibility of removing brown trout from other waterways on the reserve eg Kenneth Lagoon
Extension surveys	Conduct extension surveys to identify trout-free areas potentially suitable as translocation sites

Monitoring

Key monitoring activities	Details
Galaxias and brown trout occupancy	Use electrofishing techniques to monitor presence / absence and extent of the two species

Threatened Species Protection

Priority: High

Objective: Improved conservation outcomes for threatened species by 2016

There are a number of threatened species on the Five Rivers Reserve that are either poorly known or for which more information is required. Extension surveys are required to better understand the distribution and status of fauna species such as the Ptunarra brown butterfly, Miena jewel beetle, Masked owl and Grey goshawk, etc and threatened plant species such as the grassland cupflower, claspleaf heath and small alpine leek orchid. Improving knowledge of the age, integrity and composition of Sphagnum peatlands, particularly the striated mires on Skullbone Plains will help us to better understand the function of this threatened ecosystem. Another priority is collection of seed from threatened plant species for storage by the Tasmanian Seed Conservation Centre (RTBG), particularly for those species that are most at risk from climate change.

Assessments are required to locate Tasmanian devil latrine sites and maternal den sites on the reserve for Tasmanian devils, spotted-tail quoll and eastern quoll. Ongoing survey and assessment of eagles will ensure this shy nesting species is not disturbed during the breeding season and that breeding success and productivity is being maintained.

Key Actions	Details
Tasmanian devil and spotted-tail quoll recovery	Contribute to the Tasmanian devil recovery program through data provision on life history aspects, diet, DFTD reporting, protection of maternal den sites and Special Management Zone provisions. Expand habitat and ecological information on spotted-tail quoll and eastern quoll to improve their protection.
Improve knowledge	Undertake extension surveys for the masked owl, grey goshawk, Ptunarra brown butterfly, white-footed dunnart, green and gold frog and Miena jewel beetle and for threatened plant species Miena cider gum, <i>Pherospaera hookeriana</i> , <i>Hovea montana</i> , <i>Prasophyllum tadgellianum</i> and <i>Stellaria multiflora</i> to improve our knowledge of their distribution and management needs. Improve knowledge on age, integrity and composition of Sphagnum peatlands.
Seed collection	Assist the Royal Tasmanian Botanical Garden to collect seed from stands of Miena cider gum and drooping pine and any other targeted species, for storage in the Tasmanian Seed Conservation Centre.
Eagle nest protection	Continue annual monitoring of eagle nests to determine productivity and manage visitation around active eagle nests during the breeding season.

Monitoring

Key monitoring activities	Details
Extension and location surveys as above	Conduct species specific work to improve knowledge or security for threatened species and monitor populations

Carnivorous Marsupial Management

Priority: High

Objective: Improve management of native carnivorous marsupials

To better manage the wider ranging native species on the reserve, information is required to determine the distribution and relative abundance of Tasmanian devil, spotted-tailed quoll and eastern quoll. Ongoing monitoring can then assist with identifying any local changes in population size and extent, whether any native species are at risk, or areas of the Five Rivers Reserve that can be enhanced or better protected to conserve these native species.

Monitoring can improve information on threats such as feral predators, particularly feral cats, that can potentially threaten Dasyurids at sensitive times of the year (eg when young in dens). By adopting standardised methodologies and protocols this information will contribute to the Save the Tasmanian Devil Program. Additional data collection, e.g. scat collection, can contribute specimens and information to state wide programs investigating invasive species.

Key Actions	Details
Long-term monitoring of carnivore species	<p>Implement monitoring of the Tasmanian devil, spotted-tail quoll and eastern quoll to determine baseline populations and trends of these three species over time. This work should aim to contribute information to the Save the Tasmanian Devil Program and wherever possible incorporate additional data collection of aspects which can contribute to management (eg predator scat collection).</p> <p>Determine the population base of feral predators, such as feral cats, to better inform management and control strategies.</p>

Monitoring

Key monitoring activities	Details
Extension and location surveys as above	Track presence / absence, health and distribution of populations of three Dasyurid species across the landscape

Feral and Domestic Animal Management

Priority: Medium

Objective: By 2016 distributions of key feral species have been mapped and management strategies identified.

The aim of this strategy is to better understand the impact of feral fauna species on the natural values of the reserve and to develop appropriate strategies for their management. While eradication is usually difficult to achieve, a variety of control methods can effectively reduce populations and consequent impacts at sensitive times of the year. Methods that may be used for fallow deer and feral cats for example include shooting, trapping, baiting and exclusion fencing. As large fauna species are often widespread and mobile, it is always beneficial to work with neighbours and land management organisations to tackle populations at a regional level. Mapping and targeted monitoring using remote cameras and other methods will identify a baseline measure of feral terrestrial fauna populations that will be used to determine the effectiveness of control measures. A Feral Animal Action Plan will be prepared to identify the magnitude of the problem and the most effective ways of reducing populations of species such as cats, deer, rabbit and European wasps or their impact. This may require input and or advice from DPIPW, PWS, IFS and other key organisations. For example brown trout management will be undertaken in conjunction with IFS as part of the Clarence galaxias threatened species recovery program.

The Five Rivers Reserve is bordered on several sides by pastoral properties which traditionally have stock either permanently or seasonally on site. For example Pine Tier Estate grazes cattle on the entrance route to the Pine Tier, Viormy and Roscarborough portions of the reserve. At times it is necessary to undertake fencing or other management actions to ensure domestic stock do not enter the Five Rivers Reserve boundaries.

Key Actions	Details
Develop feral animal action plan	A feral animal action plan is necessary to determine the baseline population size of feral animals, identify priority areas for control, plan and deliver work programs and monitor outcomes.
Implement feral animal control activities	Specific activities will be added once the plan has been developed.
Domestic animal management	Undertake boundary fencing, gate maintenance and other actions to ensure domestic animals, especially stock, do not enter the reserve boundaries.

Monitoring

Establish feral animal monitoring program	Identify distributions of target species and commence monitoring of feral fauna across the reserve to determine a baseline measure of population size and monitor change in populations over time. Key invertebrate species include European wasps. Combine feral mammal monitoring with carnivorous marsupial monitoring. Brown trout monitoring will be incorporated into IFS management of the Clarence galaxias.
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Weed Management

Priority: Medium

Objective: Existing infestations of weeds are eradicated from the reserve by 2017

The aim of this strategy is to eradicate existing infestations of weeds on the reserve by 2017 and implement biosecurity procedures to prevent or minimise the infestation of new weed species. The impact of different weed species varies with environmental conditions therefore it is important to priorities species and areas for control across the Five Rivers Reserve. Weed control is usually a long term commitment as soil-stored seed may continue to germinate for decades. Monitoring and follow-up control are therefore essential for successful weed eradication. When tackling weeds it is always beneficial to work with neighbours on what is often a regional issue. Ragwort and California thistle occur along roads and at logging landings in the reserve. Although weeds are not extensive or widespread on the reserve at present, their eradication should be undertaken in a timely and effective manner before they increase in range. A weed action plan for the reserve is needed to ensure the weed works already underway on the reserve are built into works programs and undertaken effectively over the coming a five year period.

Key Actions	Details
Develop weed action plan	A comprehensive weed action plan is necessary to identify priority areas for control, plan and deliver work programs and monitor outcomes. This weed plan will identify biosecurity procedures needed to prevent or minimise new infestations.
Weed control	TLC Reserve Managers undertake weed control and follow-up annually.

Monitoring

Complete weed mapping	Significant effort has been made to map and priorities weed infestations and this work is ongoing.
Follow up survey of control efficacy	Repeat surveys to ensure no re-infestations occur.

Neighbour Relations

Priority: Medium

Objective: Regular communications are maintained with all neighbours

The aim of this strategy is to ensure that potential threats from neighbouring lands don't impact on the values of the reserve, and vice versa. It is also important that wherever possible or appropriate management actions may be shared and coordinated across neighbouring properties in a strategic way. The TLC recognises the importance of maintaining good relationships with neighbouring landowners and regularly communicates with neighbours about shared management issues. Regular communication between TLC Reserve Managers and neighbouring landowners facilitates cooperative approaches to regional land management issues such as feral animals, weeds and fire management. Neighbours are informed about any TLC management strategies or issues that have the potential to impact on their land. Similarly, TLC talks to neighbours about activities or management issues on adjoining land that have the potential to impact on the values of TLC reserves. Neighbouring landholders may also be the holders of important historic and cultural knowledge of the landscape which can assist the TLC in improving protection of culturally sensitive and other important sites.

Key Actions	Details
Contact neighbours to discuss management	Neighbours include private landowners and government organisations such as Forestry Tasmania, Hydro Tasmania, Parks and Wildlife Service.
Seek information from neighbours on specific issues as they arise	Ensure neighbours include private landowners and government organisations such as Forestry Tasmania, Hydro Tasmania, Parks and Wildlife Service are kept informed of TLC management and are included in any activities onsite.

Monitoring

Key monitoring activities	Details
No specific monitoring needed	

Enhanced Regional Capacity and Ecosystem Services

Priority: High

Objective: Ecosystem service derived income supplements reserve costs by 10% annually and contributing to the local Bronte community

The TLC strives to generate revenue to support reserve management costs and by doing so provide additional social and cultural benefits to the broader community. A sustainable Bronte community will enhance the TLCs long term vision to support healthy communities to underpin healthy landscapes. In practice, this is can be challenging, especially when circumstances may arise which could potentially compromise the conservation values for which the reserve was acquired. The ecosystem services framework has been used by TLC as a way to structure thinking around income generation from reserves. It provides an excellent, environmentally rigorous and valid way to consider a range of options and impacts. In addition, keeping track of the money spent by TLC and revenue generated in the local area is one way the TLC can determine the financial contribution from its conservation activities adds to the local community.

Key Actions	Details
Explore ecosystem services that can be monetized	Use existing frameworks developed and reported in the literature to identify potential sources of income
Conduct feasibility and impact assessments	For each priority opportunity identified, conduct feasibility and impact assessment to ensure that the option is likely to have a net positive return, and that the environmental impacts on conservation targets is acceptably minimal or non-existent.
Implement priority actions	After impact assessments have identified a low or no risk venture then proceed with development while ensuring safeguards and mitigation strategies are built into the process at every level.
Track revenue from conservation activities	Report annually on TLC expenditure and revenue generated from conservation in the local Bronte community

Monitoring

Key monitoring activities	Details
Monitor biophysical impacts	Depending on the ecosystem service, this can be very brief or quite comprehensive. For instance, monitoring under the Voluntary Carbon Standard for carbon credits is resource intensive, whereas monitoring the impact of recreational walking may be procedural.
Record income	Record income generated and identify where it has been directed.

Visitor Management

Priority: Medium

Objective: People visit the reserve every year and are complying with TLC policies

The TLC encourages visitation at its reserves and recognises the importance of natural places to human wellbeing. The aim of this strategy is to ensure that reserve visitation is undertaken in a safe and sustainable manner. All visitors to the reserve are provided with information about natural values, management issues, threats and a map. TLC reserves provide the community with fantastic opportunities for recreation and enjoyment of beautiful and unique natural environments. Regulation of reserve visitation ensures that the natural values of a reserve are protected. Recreational activities in the Five Rivers Reserve such as bushwalking, camping, bird-watching, cycling and trout fishing, are generally compatible with its conservation. Some activities that pose a threat to the natural values of reserves are controlled or prohibited, such as four-wheel driving, hunting and lighting campfires. Infrastructure such as tracks and camping platforms help to minimise visitor impacts. All visitors to TLC reserves are advised to ensure that weeds and pathogens such as phytophthora are not introduced to the site.

Key Actions	Details
Develop visitation plan	A plan is required to ensure that people visit the reserve regularly, have rich and rewarding experiences and minimise their impact on the environment. The plan needs to identify and restrict access to sensitive areas or visitation during sensitive times of the year (e.g. breeding periods), biosecurity procedures and other appropriate information.
Prepare information and provide to visitors	Prepare information (e.g. brochure) for visitors about access, the natural values, and reserve management.
Install and maintain signs	Signs inform visitors about natural values, conditions of entry, TLC policies and management objectives.
Maintain roads and walking tracks	Roads and walking tracks are required to provide visitors and TLC staff with access to the reserve.
Identify appropriate camping / visitor facilities	Identify appropriate camping platforms or visitor facilities to enhance visitor experience while ensuring no / minimal environment impact.
Biosecurity procedures	Ensure visitation complies with biosecurity procedures via TLCs hygiene protocols for vehicle and footwear to prevent the entry and spread of weeds, seeds and disease.

Monitoring

Key monitoring activities	Details
Ongoing monitoring of compliance	Monitor compliance of visitor to TLC policy

Protect Cultural Heritage Sites

Priority: Medium

Objective: By 2016, cultural heritage sites are documented and a protection strategy planned.

Sites of indigenous cultural significance, and sites and structures depicting early European settlement are poorly understood on the Five Rivers Reserve. Cultural sites and remnants of huts, tracks, fences and other structures have already, or continue to fall into disrepair and will disappear before they can be documented or attempts made for their restoration. Landscape surveys by Aboriginal cultural heritage experts will increase the range and number of known indigenous values that were previously unknown or poorly understood. Community knowledge and a willingness to be involved with surveys, documentation and restoration activities are essential to the success of this management strategy.

Key Actions	Details
Improve indigenous knowledge	Undertake cultural heritage surveys of the Five Rivers landscape to identify indigenous sites. Seek advice from the aboriginal community on the best ways of documenting and protecting these values.
Record and protect heritage sites	Ensure the known heritage sites are identified on TLCs GIS layers. Each site requires documentation on its status. Seek advice from heritage experts on procedures for documentation, prioritisation of sites and feasibility of restoration.
Preserve knowledge of the landscape	Find ways of supporting the documentation, written or oral of the Five Rivers landscape so that the heritage and natural values history information is not lost from the Tasmanian community.

Monitoring

Key monitoring activities	Details
(TBD)	

Community Engagement

Priority: Medium

Objective: Increasing number of people accessing the reserve are engaged in TLC activities.

Skullbone Plains and the Bronte area more generally have a long cultural tradition as a recreational destination for activities include e.g. fishing, hunting, volunteering, and opportunities for learning and experiencing Tasmania's wild and remote areas. The TLC aims to continue to provide opportunities for the wider community to remain engaged with this natural area and to foster improved conservation outcomes. Where possible the TLC will foster community partnerships for the Five Rivers Reserve and across the Bronte landscape, by engaging neighbouring landholders and closely aligned user groups to connect with the Reserve and become more involved with conservation activities of the organisation.

Key Actions	Details
Develop a communication and volunteer strategy	Work with a diverse range of stakeholders including PWS, FT, DPIPW, IFS, Central Highlands Council, NRM South and private other recreational groups to determine the priorities for access to Five Rivers Reserve and how best they could be accommodated. Identify opportunities for volunteers to assist with reserve management and monitoring activities and ensure this information is included in the organisations TLC volunteer policy.
Foster community engagement	Explore avenues to foster community engagement with the Five Rivers Reserve, by canvassing a wide range of interest groups through TLC communication channels, eg web, newsletter, blog, public events etc.

Monitoring

Key monitoring activities	Details
Record numbers of people accessing the reserve	

MANAGEMENT PLAN PROCESS

Management Plan Status

This Five Rivers Reserve Management Plan has been developed in consultation with a range of project partners and stakeholders. Earlier drafts of this document were circulated to the wider community. The final draft plan was reviewed and approved by the TLCs Science Council before being submitted to the TLC Board for approval.

As part of the Open Standards Adaptive Management process, information on progress on conservation management actions, threat abatement and management effectiveness monitoring, will be kept current using Miradi software. This management plan will be reviewed within a five year period.

Management Responsibilities

TLC staff are responsible for undertaking the management of the reserve. This includes the co-ordination of contractors, consultants and volunteers where they are required to implement the management actions outlined in this Management Plan. Relevant experts from the TLC Board and Science Council will also be requested to provide advice and guidance where needed.

Wherever possible, the TLC works with neighbours to manage cross-tenure threats. The TLC will endeavour to act as a good neighbour to all parties and, where possible, undertake co-operative or complementary management where both parties seek a similar outcome (e.g. weed control and fire management). Insofar as it is practical, the TLC will ensure that management of the reserve does not have a detrimental impact on adjoining areas.

Long-term management costs will be met through the TLC Foundation, an endowment fund that seeks to use compounding interest to pay for the costs of the organisation, and by ongoing fundraising or through relevant partnerships and grant opportunities as they become available.

Stakeholder Involvement

The major land management stakeholders to this plan are the Parks and Wildlife Service, the Tasmanian Aboriginal community for 'Gowan Brae', Hydro Tasmania, DPIPW, Forestry Tasmania, Inland Fisheries Service and the Central Highlands Council. The Private Land Conservation Program will monitor the status of the conservation values identified in the covenant. These major stakeholders will be involved with practical implementation of these management actions and any monitoring or adaptive changes needed.

Management Plan Review

This document will guide on-ground conservation management of the reserve over the coming years, and be the basis to develop annual work plans and budgets. The plan identifies a range of conservation targets, threats, strategies and actions based on our best current knowledge but these may change over time as our information increases and monitoring data can better inform our activities.

In implementing the adaptive management process identified by the TLC's Reserve Management Policy, progress towards meeting the objectives of this plan will be reviewed at regular intervals not exceeding every two years. These reviews may lead to minor amendments to the plan.

A full review of the plan will occur at a time no earlier than five years and no later than ten years from the date of adoption of this plan.

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