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National Recovery Plan

North Rothbury Persoonia *Persoonia pauciflora*

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Recovery Plan for the North Rothbury Persoonia *Persoonia pauciflora*

Foreword

This document constitutes the national recovery plan for the critically endangered shrub *Persoonia pauciflora* and, as such, considers the conservation requirements of the species across its known range. It identifies the actions to be taken to ensure its long-term viability in nature and the parties who will undertake these actions.

Persoonia pauciflora is listed as critically endangered under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Threatened Species Conservation Act 1995*. This taxon is a highly restricted NSW endemic restricted to the North Rothbury area in the lower Hunter Valley. Much of the species' habitat has been cleared for rural-residential development and it is estimated less than 350 mature individuals remain, across a linear range of only 4.3 km. The main immediate threats to the persistence of *P. pauciflora* are continued habitat loss and fragmentation due clearing for residential development; illegal clearing and picking; and habitat degradation resulting from grazing and slashing.

The overall objective of this recovery plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long term persistence of *P. pauciflora* in the wild. Specific recovery objectives include:

- minimise the loss and fragmentation of *P. pauciflora* habitat;
- distribute information that assists in conserving and managing *P. pauciflora*;
- raise awareness of *P. pauciflora* and facilitate community involvement in the recovery program;
- facilitate conservation of *P. pauciflora* on private property;
- identify and minimise the threats operating at sites where *P. pauciflora* occurs and ensure appropriate ecological restoration where necessary and feasible;
- develop and implement a survey and monitoring program that will provide information on the extent and viability of *P. pauciflora*; and
- obtain the necessary prerequisite knowledge required to implement ex-situ conservation and *in-situ* translocation projects.

It is intended that the recovery plan will be implemented over a ten year period, with review after five years. This recovery plan is to be implemented by the NSW Office of Environment and Heritage, Cessnock City Council, Department of Lands, and the Hunter-Central Rivers Catchment Management Authority.

Acknowledgments

This recovery plan was prepared by the Office of Environment and Heritage, Department of Premier and Cabinet, with financial support from the Australian Government and under the guidance of the Hunter Valley Threatened Flora Recovery Team.

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The development of this recovery plan was assisted greatly by Gordon Patrick of Trees in Newcastle who, on behalf of OEH, documented information on the taxonomy, distribution, habitat and ecology of North Rothbury Persoonia (Patrick 2006). Allan Richardson (RPS Harper Somers O'Sullivan) is acknowledged for his assistance in community field days and survey and members of the Sweetwater Action Group for their assistance in community field and survey days.

Table of Contents

Figures

Tables

1. Introduction

Persoonia pauciflora P.H. Weston (Proteaceae) is commonly known as the North Rothbury Persoonia. North Rothbury Persoonia is a highly restricted NSW endemic occurring only in the North Rothbury area in the lower Hunter Valley. Much of the species' habitat has been cleared for rural-residential development and it is estimated less than 350 mature individuals remain across a linear range of only 4.3 km.

North Rothbury Persoonia was discovered only relatively recently, in 1997, with the species being formally described in 1999 (Weston 1999).

The main immediate threats to the persistence of North Rothbury Persoonia are continued habitat loss and fragmentation due to clearing for residential development and illegal clearing/picking; and habitat degradation resulting from grazing and slashing.

This document constitutes the national recovery plan for North Rothbury Persoonia and, as such, considers the requirements of the species across its known range. It identifies the actions to be taken to ensure the long-term viability of the species in nature and the parties who will undertake these actions. The attainment of the objectives of this recovery plan is subject to budgetary and other constraints affecting the parties involved.

This plan has been prepared by the Office of Environment and Heritage, Department of Premier and Cabinet (OEH), in consultation with the Hunter Valley Threatened Flora Recovery Team. The development of this recovery plan was assisted greatly by Gordon Patrick of Trees In Newcastle who, on behalf of OEH, documented information on the taxonomy, distribution, habitat and ecology of North Rothbury Persoonia (Patrick 2006).

2. Legal status

North Rothbury Persoonia is listed as a critically endangered species on Schedule 1A of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and as a critically endangered species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In preparing a national recovery plan, consideration must be given to the role and interests of Indigenous people in the conservation of Australia's biodiversity. An objective of this plan is to involve the broader community, including Aboriginal communities, in the recovery program for North Rothbury Persoonia. As the species is listed under the EPBC Act, actions with a significant impact on the species are prohibited without approval. In deciding whether or not to approve an action, the Minister cannot act inconsistently with this recovery plan. Furthermore, Commonwealth agencies must not take any action that contravenes the recovery plan.

A review of the current conservation status of North Rothbury Persoonia confirms that the species is eligible for listing as critically endangered. In summary, the main factors contributing to its eligibility for critically endangered are: restricted extent of occurrence; severely fragmented population; >90% of individuals are restricted to a single location; continuing decline observed in area of occupancy, habitat area/extent/quality, and number of mature individuals; extreme fluctuations in the number of mature individuals are expected given that the species is most likely a fire sensitive obligate seeder; and that no sites are currently free of Class I and Class II threats.

3. Biological Information

3.1 Taxonomy and description

3.1.1 Description

North Rothbury Persoonia is a small spreading shrub typically 0.4 to around 1.4 m in height, (although the largest mature specimen recorded was 1.8 m in height) (Patrick 2006). The foliage, which comprises soft, narrow (<1mm) needle-like leaves 3 to 4 cm long is often strikingly bright green to almost fluorescent on some individuals. The flowers are moderately small and yellow, typical of all *Persoonia*. Flowers are usually in low number, in comparison to other *Persoonia* species (hence the name), and are located towards the ends of the branches. Fruit is a fleshy light green to yellow drupe which contains a seed roughly the size and shape of a coffee bean (Patrick 2006). Bark is usually smooth and grey, to slightly fissured in older specimens on the lower portion of the main stem.

An abbreviation of the formal description of North Rothbury Persoonia by Weston (1999) follows:

Spreading, apparently non-lignotuberous shrub, 0.4 - 1.4 m high, 0.4 - 2.0 m wide; bark smooth, grey. Leaves alternate, linear-filiform, acuminate, (0.3-) 1.7 - 3.5 cm long, (0.4-) 0.6 - 0.8 mm wide, terete, spreading to suberect and usually slightly to moderately incurved, more or less laterally symmetrical, bright green, concolorous, sparsely to moderately hairy when immature, sparsely hairy to glabrescent when mature, smooth; venation obscure. Inflorescences growing from terminal or lateral buds, 1 - 9 flowered; rachis 0 - 1.1 cm long. Pedicels 0.7 - 2.5 mm long, moderately hairy. Perianth actinomorphic, the tepals 4.5 - 8.0 mm long, acute, not keeled, moderately hairy on the abaxial surface, dull yellow. Drupes dull green or green with reddish purple striations, glabrous; pyrene broad-obovoid to broad-ellipsoid, 9.4 - 11.1 mm long, 4.6 - 5.5 mm wide. Seed 1.

3.1.2 Relationship to other taxa

North Rothbury Persoonia most closely resembles *Persoonia isophylla*, and, to a lesser extent, *P. pinifolia*, which are probably its closest relatives (Weston 1999).

Morphologically there appears to be apparent hybridisation between North Rothbury Persoonia and the widespread and common *P. linearis* (Patrick 2006) although the extent of hybridisation is not known.

3.1.3 Distinguishing from similar species

Fortunately, the morphologically similar *P. isophylla* and *P. pinifolia*, do not occur within the same geographical locations as North Rothbury Persoonia, and consequently cannot be confused with the species. The northern distribution of these species is some 50 km to south of North Rothbury (Patrick 2006). North Rothbury Persoonia is most easily distinguished from these two species by its inflorescence, which is fewer flowered, and shorter (Weston 1999).

North Rothbury Persoonia co-occurs with *P. linearis* and *P. levis*. North Rothbury Persoonia can be easily distinguished from these two taxa by the smooth grey bark on its main stem and lower branches, which contrasts with the brown-reddish flaky lamellose to paper-like bark of the other species.

3.2 Distribution, abundance and land tenure

3.2.1 Current distribution

North Rothbury Persoonia is a NSW endemic restricted to the North Rothbury area in the Cessnock local government area in the lower Hunter Valley (Figure 1). The species has a mature population size of approximately 350 mature individuals (Patrick 2006) and is restricted

to only two populations[1], with 98.9% of all mature individuals restricted to the 'southern' population.

The species' restricted distribution is presumably influenced by soil type and geology given that it is restricted to silty sandstone soils derived from sediments of the 'Farley Formation' (see Section 3.4).

The taxon's current distribution equates to a restricted linear range of only 4.3 km, Extent of Occurrence[2] of only 2.5 km^2 and a current Area of Occupancy[3] (AOO) of only 29 hectares.

Numerous surveys in the Cessnock and Singleton Council areas have been undertaken for the species outside of its current distribution (Patrick 1999, 2000, 2006; S. Bell and Collin Driscoll pers. com. 2006). Despite these surveys, in both the North Rothbury/Branxton area and further afield, no additional populations have been recorded (Patrick 2006).

Given concerns that the publication of exact location details may compromise conservation, detailed population specific information is not provided in this plan. General locational information (1 km accuracy) is available via the NSW Wildlife Atlas (http://wildlifeatlas.nationalparks.nsw.gov.au). Public authorities, land managers, or others with genuine reasons for requiring accurate data, may direct requests to the wildlife data unit via the wildlife atlas home page.

Persoonia pauciflora may be present at sites where no above ground plants are apparent due to fluctuations in the number of above ground plants and also the presence of a soil stored seed bank (Section 3.5.3).

3.2.2 Historical distribution

The range of North Rothbury Persoonia prior to European settlement is likely to have been similar to its current range. However, considerable losses from within its range are likely to have occurred, due to loss of habitat for timber-getting, agriculture, residential and rural-residential development (Patrick 2006). In recent years losses have also occurred from alleged unauthorised picking. Much of the habitat of North Rothbury Persoonia is now highly fragmented. Within the last three years at least 290 mature individuals (approximately 35% of total population) have been lost to residential development or alleged unauthorised removal (see section 4.1).

[1] Populations have been recognised as 'geographically or otherwise distinct groups between which there is little demographic or genetic exchange (typically one successful migrant individual)' (IUCN 2000). Given the absence of information on gene flow in North Rothbury Persoonia, populations have been delineated using the 'rule of thumb' provided by Keith et al. (1997) of geographic discontinuity of more than 1 km.

[2] Based on lowest/pessimistic estimate. *Extent of occurrence* is the 'area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of a taxon…' (as defined by IUCN (2000)). 'This measure may exclude discontinuities or disjunctions within the overall distributions of a taxa' and in the case of North Rothbury Persoonia the unoccupied area between the main population and the second disjunct population has been excluded.

[3] Lower estimate. *Area of occupancy* is defined as the area within its 'extent of occurrence' which is actually occupied by a taxon (IUCN 2000). AOO has been identified by ground survey based on the occurrence of adult plants. Actual AOO may be greater based on the presence of the species in the soil stored seed bank.

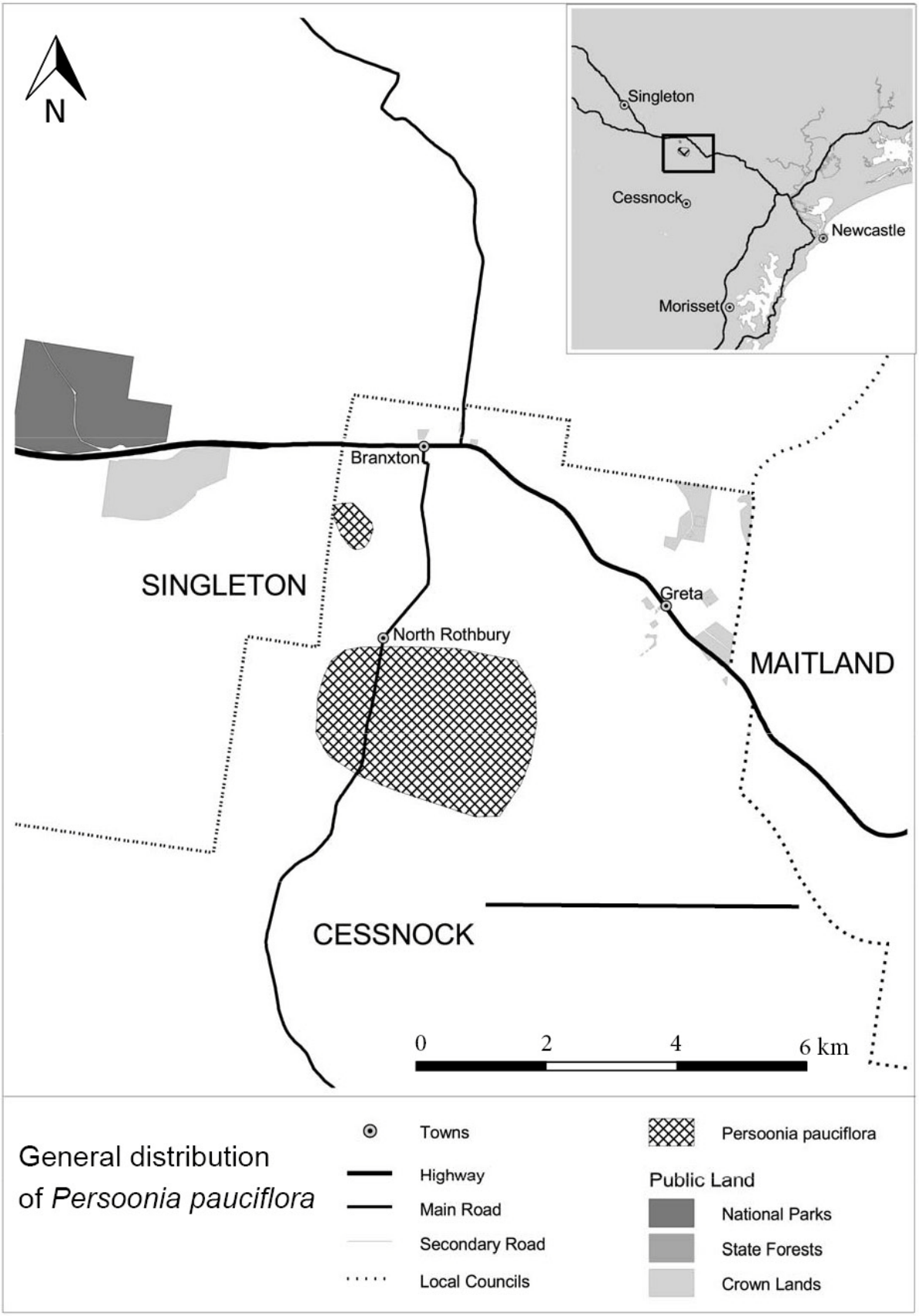

Figure 1. **General distribution of North Rothbury Persoonia**

This map does not identify the specific location of individual plants or sites given concerns that the publication of exact location details for populations of North Rothbury Persoonia may compromise conservation.

3.2.3 Population size and area

The species currently has a population size of only approximately 350 mature individuals and is restricted to only two populations, with 98.9% of all mature individuals restricted to the 'southern' population. In 2006, Patrick estimated 107 seedlings and juvenile plants occurred across the species' range (Patrick 2006).

Given that the species is now restricted to only two populations, both populations are important and necessary to long term recovery and survival.

Individuals are spread across at least 19 sites (defined in most cases by lot boundaries). Of these 19 sites, only two sites support greater than 20 individuals (Table 1a). Only three sites have an AOO of two hectares or greater (Table 1b). The majority of the remaining sites contain either isolated individuals or small groups of individuals (Patrick 2006).

Given that North Rothbury Persoonia is a fire sensitive obligate seeder, does not tolerate frequent disturbance such as slashing, and can die off in dry conditions, the species will exhibit considerable fluctuations in the number of mature individuals over time. Consequently, estimates of above ground abundance at a site should be viewed with caution as they may be a poor indicator of the true abundance, given that the majority of the population may be represented in the soil-stored seed-bank (Section 3.5.3). For example, as indicated in Table 2, the overall numbers of 'known' mature individuals have fluctuated over time. Although there was an increase in mature specimens between 1997 to 2001 (in part due to increased survey effort), there was a decrease in overall numbers of mature (and immature) individuals in 2002. The majority of these fluctuations appear to have been caused by natural factors, primarily long-term dry conditions leading to the senescence of adult plants and also occasional favourable conditions such as good soaking rain, promoting germination from the seed bank (Patrick 2006). The potential role of *Phytophthora cinnamomi* in the 'senescence of adult plants' warrants investigation (see section 4.1).

Table 1. **Current size class distribution based on (a) number of mature individuals and (b) area of occupancy for sites supporting North Rothbury Persoonia**

(a) number of mature individuals

Size class	Number of sites
≤ 5	13
6 ≤ 10	2
11 ≤ 20	2
≥21	2

(b) Area of occupancy (Hectares)

Size class	Number of sites
≤ 0.5	12
0.6 ≤ 1	4
2 ≤ 5	1
6 ≤ 10	1
≥11	1

Table 2. **Mature North Rothbury Persoonia individuals recorded over the period 1997 – 2006 (Patrick 2006)**

Survey Year	Number of mature individuals (estimates)
1997	33*
1998	79*
1999	220
2000	220-40
2001	350
2002	80 - 125
2003	450
2004	550
2005	550
2006 (March)	631 (extant)
2006 (June)	348 (extant)

The increase from 1997/8 – 1999 largely reflects an increase in survey effort.

3.3 Land tenure and zoning

3.3.1 Land tenure

Half of all known North Rothbury Persoonia individuals currently occur on freehold land (Table 3), with the remainder occurring within undeveloped Crown Roads (e.g. 'Washery Rd') and Council managed road reserves. No individuals currently occur within formal conservation reserves, although a number of plants occur within at least two areas identified for transfer to OEH as part of an off-set package for a proposed development ('Huntlee'). Two national parks occur within the vicinity (Belford National Park - approximately 5 km to the northwest; and Werakata National Park - approximately 9 km to the south), although these two reserves do not support North Rothbury Persoonia habitat.

Table 3. **Land tenure and land managers for sites known to support North Rothbury Persoonia**

Tenure	Land Manager Extant	Number of sites	Percentage of Individuals
Private	Various landholders	15	50%
Council Road Verge	Cessnock City Council	3	4%
Crown Road	Department of Lands	1	46%

Table 4. **Land-use zoning for all recorded North Rothbury Persoonia sites**

Zoning	Number of sites
Rural (small holdings)	7
Rural	6
Rural-residential	2
Crown Road	1
Council managed road verge	3

3.3.2 Zoning

The zoning of areas supporting North Rothbury Persoonia is summarised in Table 4. The majority of sites occur on land zoned for rural or rural-residential use.

3.3.3 Adequacy of representation in conservation reserves

North Rothbury Persoonia is not adequately represented within conservation reserves, with no individuals, nor potential habitat, occurring within any formal conservation reserves.

3.4 Habitat

3.4.1 Landform, geology and soils

The entire North Rothbury Persoonia population appears to be almost wholly located on soils derived from the Farley Formation, formed during the early Permian, and primarily comprising silty sandstones (Patrick 2006). The exception is the northern disjunct population, which occurs just outside the mapped Farley Formation. However, given the scale and suspected reliability of geological maps, it is feasible the northern population does occur on the Fairly Formation.

Soils are mostly moderately deep, consisting primarily of sand and silt. To a lesser extent, the species is located on lateritic soils, which often appear unstable and open to erosion (Patrick 2006).

3.4.2 Associated vegetation

Persoonia pauciflora is primarily located in areas of dry open forest and woodland, although the species occasionally occurs within areas of dense heath-like vegetation. The main vegetation association across the species range is of Spotted Gum and Ironbark, with a sparse to moderately dense shrub cover and a grassy to sometimes herbaceous understorey (Patrick 2006). A vegetation map and revised classification was recently completed for the region (DECC 2008). All North Rothbury Persoonia sites except one occur within vegetation classified as Central Hunter Grey Box – Spotted Gum – Ironbark Forest. Sub units supporting North Rothbury Persoonia include:

- Hunter Narrow-leaf Ironbark-Spotted Gum Forest
- Hunter Redgum-Ironbark Forest
- Hunter Red Ironbark-Spotted Gum Forest.

One site occurs on an interesting outlier of Kurri Sand Stringybark Forest (a sub-unit of the endangered ecological community Kurri Sand Swamp Woodland) which occurs on a single ridgeline (DECC 2008). Additional detail regarding associated vegetation can be found in both Patrick 2006 and DECC 2008.

3.4.3 Habitat critical to survival

Habitat critical to the survival of North Rothbury Persoonia includes the area of occupancy of the two remaining populations (Figure 1) and vegetated areas within and surrounding the species extent of occurrence, and includes habitat that connects the two populations (Section 3.2). Habitat areas need not be occupied by North Rothbury Persoonia to be critical to its survival. It is critical that habitat connectivity be maintained across the species' distribution. Local extinction is likely to be relatively common (due to fluctuations in number of individuals over time (Section 3.2) and susceptibility to frequent disturbance (Section 3.5)) and recolonisation is dependent upon seed dispersal (likely to be facilitated by macropods and birds) which in turn will be dependent upon retaining connectivity between North Rothbury Persoonia habitat.

3.5 Life History and Ecology

3.5.1 Life-history

North Rothbury Persoonia is likely to be an obligate seed regenerator. In the event of a fire or other form of physical disturbance that removes the above ground plant (e.g. slashing), individuals are likely to die, with regeneration dependent upon recruitment from a long-lived soil-stored seed bank. Consequently, North Rothbury Persoonia populations are likely to be dynamic throughout the landscape, and fluctuations in space and time of above ground individuals will be a natural occurrence.

Observations by G. Patrick indicate plants do not reach reproductive maturity until an estimated 18 months to three years of age. Obligate seeding *Persoonias*, in general, typically having long primary juvenile periods (Auld et al. 2007, Benson 1985). North Rothbury Persoonia appears to have a relatively short lifespan of around 7 – 12 years (pers. Obs. G. Patrick).

3.5.2 Pollination and seed production

Peak flowering is in the warmer months from October through to April/May, with sporadic flowering all year round (Patrick 2006). As the species name '*pauciflora*' suggests, plants typically have a lower density of flowers than is typical for other *Persoonia* species.

Although many insect species have been observed on North Rothbury Persoonia, specific pollinators are yet to be positively identified (Patrick 2006). Bees and wasps appear to be the major foragers on the flowers of *Persoonia* in eastern Australia (Bernhardt and Weston 1996). It is unknown as to whether the species is strictly outcrossing or is capable of self-pollination.

Given the relatively low density of flowers, fruit density is equally low. The fruit is a drupe with a pulpy flesh surrounding a hard woody pyrene (Weston 2002). Fruit are shed at maturity, typically in spring and summer (Patrick 2006). Monitoring has revealed fruit can take many months to mature (Allan Richardson pers. com.).

3.5.3 Seed dispersal and seed bank dynamics

Seed is likely to be dispersed, after consumption of the fruit, by large birds such as Currawongs, and mammals such as macropods and possums (Low 1991; Benson and McDougall 2000; Rymer 2006; Auld et al. 2007). Studies on other *Persoonia* species have found wallabies removed large numbers of *Persoonia* seeds and viable *Persoonia* seeds were found in numerous wallaby scats (Rymer 2006; Auld et al. 2007). Fauna recorded in the region (NSW Wildlife Atlas March 2008) that may play a role in dispersing North Rothbury Persoonia fruit include: Eastern Grey Kangaroo, Red-necked Wallaby, Swamp Wallaby, and the Common Brushtail Possum. Observations by Patrick (2006) also indicate that ants disperse the seed when fallen on the ground, although research on other *Persoonia* has revealed removal of seed by invertebrates is uncommon. Seed not dispersed by animals are likely to remain directly below adult plants.

Historically, indigenous peoples may have also dispersed seed. *Persoonia* species were a popular Aboriginal food source and large quantities of the fruit was eaten when in season (Low 1991; Wreck Bay Community and Renwick 2000; Mason 2001). 'They swallowed the pulp and the stone, which they squeezed from the skin with their fingers' (Low 1991).

North Rothbury Persoonia maintains a soil-stored seed-bank, with studies by G. Patrick indicating there is likely to be a soil-stored seed-bank directly below most adult plants, with the density of seed dependent upon plant age, health, size and location. Nothing is known of the longevity of the seed-bank, although presumably as is typical for *Persoonia*, it is likely to be persistent.

Very little is understood of the factors that trigger seed germination, although observations indicate germination may be triggered by good rain, with numerous seedlings observed in April 2000 following heavy rain (Patrick 2006). Given the hard-coated seed, fire or physical disturbance may trigger germination, as is typical for many other Persoonia. Anecdotal evidence suggests fire has not occurred within the habitat of North Rothbury Persoonia in at least 20 years.

3.5.4 Disturbance ecology

Being an obligate seeder, disturbance influences the persistence of North Rothbury Persoonia populations. Adult plants are killed by fire and other forms of physical disturbance such as slashing and grazing. Adult plants do not have a lignotuber (Weston 1999) and have an extremely small root system (pers. obs. T. Hogbin and G. Patrick) and consequently are not likely to resprout following extensive disturbance of the above ground plant. The presence of a persistent soil-stored seed-bank buffers populations against local extinction following loss of above ground plants. However, as for all obligate seeders, repeat disturbance before seed-banks are replenished may cause population declines or local extinction.

4. Threats and Management Issues

4.1 Threats

The main immediate threats to the persistence of North Rothbury Persoonia are habitat loss and fragmentation due to clearing for development; accidental and unauthorised picking/removal; slashing and grazing; and habitat degradation. The species may also be threatened by the pathogen *Phytophthora cinnamomi*. Over the longer term, the species is also potentially threatened by the demographic, environmental and genetic stochasticity associated with such a restricted distribution and small population size.

Given that North Rothbury Persoonia does not occur within any formal conservation reserves, all sites are subject to these threats.

4.1.1 Habitat loss and fragmentation due to clearing for development

The key threatening process *'Clearing of native vegetation'* is one of the major threats to the survival of North Rothbury Persoonia. The species does not currently occur within any conservation reserves, with 50% of individuals occurring on private property and the remainder occurring within Crown and Council managed road reserves/verges (Table 3). Given the restricted area of the road reserves c. 93% of all occupied habitat is on private property and notably at least six of these sites are currently subject to development applications for subdivision and residential development or have had development applications recently approved. Much of the habitat on private land is currently subject to development applications, which may result in the local extinction of the northern population, substantially decrease the species' range, and place the species at increasingly higher risk of extinction.

Increased fragmentation across the habitat of North Rothbury Persoonia is of particular concern given that it decreases the chances of recolonisation (for example via seed dispersal by kangaroos) following local extinction.

4.1.2 Accidental and unauthorised picking/clearing

In 2006, approximately 250 North Rothbury Persoonia plants (then approximately 35% of total population) 'disappeared' from one of the largest sub-populations. No other species or habitat features were destroyed or impacted upon and, consequently, it is presumed the plants were picked. A OEH investigation of the circumstances under which the plants were removed failed to determine who removed the plants. The majority of the removed plants had been tagged with flagging tape. This flagging tape presumably made the plants readily identifiable to a layperson. Consequently this plan does not support the use of flagging tape or any other visible means to identify individual North Rothbury Persoonia plants.

A number of plants have also been 'accidentally' destroyed during road maintenance activities.

4.1.3 Slashing and Grazing

North Rothbury Persoonia does not tolerate slashing or extensive grazing. Removal of all or most of the above ground plant is likely to cause plant death given the lack of a lignotuber. RPS Harper Somers O'Sullivan Pty Ltd (2007) found that of 28 North Rothbury Persoonia individuals monitored in 2005 and again in 2007, over half had been impacted negatively by grazing from macropods and domestic stock.

Grazing by domestic stock is highly likely to ultimately cause plant death, particularly when grazing intensity is high. In contrast, anecdotal observations suggest that grazing from macropods is rarely intense enough to cause plant death, except in areas of degraded habitat or in particularly dry conditions combined with low North Rothbury Persoonia density (T. Hogbin pers. obs). The threat of plant death from grazing by macropods needs to be balanced with the important role macropods play in seed dispersal (Section 3.5).

4.1.4 Habitat degradation

Given that all North Rothbury Persoonia habitat currently occurs either on private property or along road verges it is subject to a range of activities which degrade it, making it less suitable for North Rothbury Persoonia. Activities include grazing by domestic stock and the associated trampling, introduction and maintenance of pasture grasses and landscapes areas (including use of fertilizers), road maintenance, trampling and damage due to unrestricted access, weed invasion, dumping of rubbish and garden waste, slashing, mowing, and inappropriate weed control.

4.1.5 *Phytophthora cinnamomi*

Several species of Persoonia are known to be highly susceptible to infection by *Phytophthora cinnamomi* (Evans et al. 1999; NSW Scientific Committee 2002). *Phytophthora cinnamomi* kills susceptible plants by invading their root systems and severely reducing their ability to take in water and nutrients. The pathogen may contribute to plant death where there are other stresses present (e.g. waterlogging, drought, and perhaps wildfire) (NSW Scientific Committee 2002). As discussed in Section 3.2, over 200 North Rothbury Persoonia senesced in 2002. Patrick (2006) noted that the deaths appeared to be natural senescence due to drought. Given that the senescing plants all appeared to be in the same area(s) (G. Patrick pers. comm.) perhaps *Phytophthora cinnamomi* infection played a role in the plants' susceptibility to drought.

Given that North Rothbury Persoonia has an extremely restricted geographic range, the presence of *Phytophthora cinnamomi* within its habitat could dramatically increase extinction probability.

4.1.6 Long-term consequences of small population size

Over the longer term, the species is also potentially threatened by the demographic and environmental stochasticity associated with such a restricted distribution and small total population size. The species is likely to be a fire sensitive obligate seeder, and monitoring by G. Patrick since 1999 has revealed considerable fluctuations in the number of mature individuals over time (Table 2).

Theoretically, the species is also at risk of a reduction in fitness due to inbreeding depression. The species is likely to have once been more continuous across its distribution and gene flow would have been higher due to seed dispersal across its entire range by birds and macropods. However, habitat loss has increasingly fragmented the species' distribution, potentially resulting in a reduction in gene flow and a resultant loss of genetic diversity due to genetic drift in the small and isolated populations. For example, the smaller of the two identified populations now only supports an estimated three individuals.

5. Previous/Existing Recovery Actions

5.1 Recovery team

A Hunter Valley Threatened Flora Recovery Team was established in May 2006 to guide the OEH in the preparation and implementation of recovery plans for this and other threatened flora in the Hunter Valley. The recovery team contains representatives from the OEH, Cessnock City Council, Energy Australia, Forests NSW, Hunter-Central Rivers Catchment Management Authority (HCRCMA), Hunter Water, Department of Lands (DoL), Roads and Traffic Authority, Muswellbrook Shire Council, Port Stephens Council, Rural Fire Service, Singleton Council, and also includes representatives from environmental consulting, research, industry, and the local community.

5.2 Status report

Shortly after the establishment of the recovery team, Gordon Patrick was contracted by DECCW to collate and document information on the taxonomy, distribution, habitat and ecology of North Rothbury Persoonia (Patrick 2006). This report provided information that greatly assisted in the drafting of this recovery plan.

5.3 In-situ protection and habitat management

5.3.1 Washery Road and other 'unformed' crown roads

A number of unformed crown roads ('paper roads') occur across the habitat of North Rothbury Persoonia. Some parts of these roads are no longer obvious on the ground, whereas others are

clearly marked by fence lines or tracks. Although relatively small and narrow, given the small area of North Rothbury Persoonia habitat remaining and the lack of formal conservation reserves, these areas provide very important habitat for North Rothbury Persoonia. Washery Road is currently considered the most significant of these, supporting the largest stand of North Rothbury Persoonia plants.

A collaborative project between the OEH and HCRCMA implemented site protection works in 2008 at Washery Road. Gates were installed to exclude vehicular access. As part of this project, the boundaries of Washery Road were surveyed, revealing the fence adjoining the road reserve and adjacent properties is in the wrong location in some areas. OEH is currently coordinating the ongoing maintenance of the site protection works, with fence repairs occurring in early 2009.

Given the significance of the Washery Road site and that it is not used as a road, OEH has commenced negotiations with the DoL regarding formally closing the road and establishment of a conservation reserve.

5.3.2 Road verge habitat

A range of measures were implemented in 2008/09 to minimise the chance of 'accidental' destruction of North Rothbury Persoonia during road maintenance activities.

- A site meeting was held with Cessnock City Council road maintenance workers and weed control staff to raise awareness of North Rothbury Persoonia and its habitat.
- 'Significant Roadside vegetation' signs were erected at the extremes of road verge North Rothbury Persoonia habitat.
- A North Rothbury Persoonia field identification guide was produced for Cessnock City Council field staff.

5.3.3 Proposed Conservation Reserves

Current development proposals include proposed conservation lands, which may result in the protection of areas of habitat for the species.. .

5.4 Community education, awareness and involvement

A range of community education and awareness activities have been undertaken for North Rothbury Persoonia.

- Guided walks through the species' habitat were held in 2006, 2008 and 2010.
- Two community survey days were held in 2008 and a third in 2010 (see Section 5.6).
- An information and identification profile was sent to residents in early 2009.
- North Rothbury Persoonia was profiled in a Teacher Resource Kit for teachers of the Cessnock and Maitland Local Government Areas (DECC 2007b).

5.5 Profile and environmental impact assessment guidelines

A species' profile and environmental impact assessment guidelines for North Rothbury Persoonia were published in 1999 and 2000 respectively. Both documents are currently available via the NSW threatened species website (www.threatenedspecies.environment.nsw.gov.au).

5.6 Survey and monitoring

North Rothbury Persoonia has been the subject of a number of targeted surveys across its range, including annual surveys since 1997 (Patrick 1998, 1999, 2000, 2001 and 2006). Targeted surveys have occurred along the 'paper roads' within the region and also within selected private properties, with the local community invited to assist in the surveys. Community Survey days occurred in June 2008, August 2008 and September 2010. Targeted surveys have also been undertaken within a number of lots as part of pre-development surveys (e.g. Bell and

Driscoll 2005; RPS Harper Somers O'Sullivan 2007; Sinclair Knight Merz 2005). Not all properties within the species range have been surveyed and it is likely that additional plants will be discovered with increasing survey effort.

Very little monitoring of individual plants has occurred. RPS Harper Somers O'Sullivan (2007) surveyed and mapped 28 plants on and near the 'Huntlee' lands in 2005 and 2007, noting reproductive status and health. In 2008 a number of these plants were monitored regularly over a two month period to ensure seed collection occurred at the appropriate time (unpublished data Allan Richardson 2008) (see Section 5.7).

5.7 Seed collection and propagation research

The biodiversity offset package for 'Huntlee' included the provision of funds towards research into the development of propagation techniques for North Rothbury Persoonia. This research is currently being conducted by Mount Annan Botanic Gardens.

5.8 Preliminary genetic study

The University of Wollongong undertook preliminary genetic screening of a small number of North Rothbury Persoonia individuals in 2006 to investigate the feasibility of undertaking a genetic study on North Rothbury Persoonia. Six individuals were subject to preliminary screening for variable microsatellite loci. Only two potentially useful loci were located, with at least six required if further genetic research was to occur (pers. comm. D. Ayre). Further screening would be required if a genetic study was to occur.

5.9 Ecological studies

There has been very little research into the ecology of North Rothbury Persoonia. Knowledge is largely restricted to anecdotal observations, with the exception of a seed bank study by G. Patrick.

6. Recovery Objectives, Actions and Performance Criteria for this recovery plan

The overall objective of this recovery plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long term persistence of North Rothbury Persoonia in the wild.

Specific Objective 1: Minimise the loss and fragmentation of North Rothbury Persoonia habitat.

North Rothbury Persoonia does not occur within any conservation reserves (Section 3.2) and given development pressures within the area, habitat loss and fragmentation is likely to continue across the species' range (Section 4.1). This objective aims to minimise the loss and fragmentation of North Rothbury Persoonia habitat.

Performance Criterion 1: The extent of occurrence and area of occupancy of North Rothbury Persoonia habitat remains stable over the 10 years of the plan.

Action 1.1 OEH to revise Environmental Impact Assessment Guidelines for P. pauciflora*.*

In particular the guidelines will clearly highlight that:

- any further habitat loss in the area should not increase fragmentation of existing habitat and, in particular, should not decrease habitat connectivity across the species' range;
- all potential habitat for the species (see Sections 3.4), should be assumed to support the species, irrespective of whether or not the species has been detected, given the potential occurrence of a soil stored seed bank.

Action 1.2 OEH to evaluate the value of nominating critical habitat for North Rothbury Persoonia under the TSC Act and, if deemed appropriate, prepare a nomination.

The area over which critical habitat may be nominated is yet to be determined.

Action 1.3 OEH to coordinate continued survey of the unformed crown roads within the region to assess their value as habitat for North Rothbury Persoonia and also their value as fauna corridors.

The unformed crown 'paper roads' within the region (see section 5.3) offer an opportunity to maintain some connectivity (albeit narrow) across the species' habitat. Survey of these roads has commenced with the assistance of the local community (see Section 5.5) and additional surveys are planned for 2009.

Action 1.4 OEH, DoL, and the HCRCMA to liaise regarding the long term security and management of the unformed roads within the region, particularly the road known as 'Washery Road'.

Specific objective 2: Distribute information that assists in conserving and managing North Rothbury Persoonia

The prompt and effective distribution of information on North Rothbury Persoonia is an important component of ensuring that its conservation requirements are appropriately considered in decisions regarding land management, land-use planning, development control, and hazard reduction activities.

Performance Criterion 2: Information available to other public authorities and the general public, particularly via the OEH Wildlife Atlas and threatened species website, is maintained and up-to-date over the 10 years of the plan.

Action 2.1 OEH will coordinate the prompt distribution of site records for North Rothbury Persoonia through the Atlas of NSW Wildlife.

Action 2.2 OEH will update information sources available on the DECC threatened species website for North Rothbury Persoonia (e.g. Priorities Action Statement and Information Profile) to incorporate recommendations of, and information acquired during, the implementation of this recovery plan.

Specific Objective 3: Raise awareness of North Rothbury Persoonia and facilitate community involvement in the recovery program

Increased community awareness and involvement is vital for the effective implementation of this recovery plan and will enhance the social benefit of the program.

Performance Criterion 3: At least one community activity promoting the recovery program is held each year of the plan.

Action 3.1 OEH, in consultation with the recovery team, will distribute general information on the progress of the recovery program to raise awareness of the recovery program and encourage community involvement in its implementation.

OEH will prepare an annual newsletter on threatened species recovery planning in the Hunter Valley and will include information on the progress of the North Rothbury Persoonia recovery program. The newsletter will be distributed to selected stakeholders, landholders, community groups and local schools.

Action 3.2 OEH, HCRCMA, Cessnock City Council, and the DoL will raise awareness of, and encourage community involvement in, the recovery program.

Under this action, OEH, HCRCMA, Cessnock City Council, and the DoL will raise awareness of the recovery program amongst community groups and interested individuals, and will encourage involvement in the implementation of recovery actions including rubbish removal, targeted survey, weed control, bush regeneration, site protection and community education.

Action 3.3: OEH will engage with Mindaribba Local Aboriginal Land Council and the Aboriginal community when undertaking recovery actions on sites of cultural significance..

North Rothbury Pauciflora occurs in a number of areas of cultural significance to Aboriginal people. Prior to the commencement of on-ground recovery actions in such areas, OEH will seek to engage Mindaribba Local Aboriginal Land Council and the Aboriginal community through the *HCRCMA Aboriginal Cultural and Environmental Network* to identify any issues that may be of concern to Aboriginal people and to seek opportunities for involvement in the recovery actions

Performance criterion: The engagement of relevant Local Aboriginal Land Councils and Aboriginal communities is sought prior to the implementation of on-ground recovery actions in areas of cultural significance to Aboriginal people throughout the life of the plan.

Specific objective 4: Facilitate conservation of North Rothbury Persoonia on private property

North Rothbury Persoonia is not known to occur within any current conservation reserves, and its conservation will depend greatly on conservation on private property. This objective aims to improve the management and long-term protection of North Rothbury Persoonia on private property.

Performance Criterion 4: All landowners of land that supports North Rothbury Persoonia are aware of the species and are provided advice regarding its management by year one of the plan and at least five landholders have been notified of the opportunities and advantages of entering into a conservation agreement by year five of the plan.

Action 4.1 OEH will develop a North Rothbury Persoonia identification and management guide for landholders.

The guide will include information on the identification and management of North Rothbury Persoonia and will direct landholders to additional resources and contacts, particularly in regard to opportunities for funding. The guide will be sent to all landholders of land known, or considered likely, to support North Rothbury Persoonia.

Action 4.2 The HCRCMA and OEH will advise selected landholders of the opportunities and advantages of entering into conservation agreements and covenants.

Opportunities for such agreements include Voluntary Conservation Agreements (VCAs) under the NP&W Act, Property Vegetation Plans under the NV Act and appropriately worded covenants under the *Conveyancing Act 1919*.

Specific Objective 5: Identify and minimise the threats operating at sites where North Rothbury Persoonia occurs and ensure appropriate ecological restoration to aid in the ongoing survival of the species

Threats operating at sites supporting North Rothbury Persoonia include clearing, grazing, mowing and slashing, dumping of rubbish and garden waste, weed invasion, and potentially an inappropriate disturbance regime. Actions under this objective aim to manage these threats through the implementation of appropriate *in-situ* threat abatement measures.

Performance Criterion 5: No decrease in the area and quality of North Rothbury Persoonia habitat within public lands over the ten years of the plan and at least one landholder provided with site specific and targeted advice regarding conservation of North Rothbury Persoonia each year of the plan.

Action 5.1 OEH, HCRCMA, and the DoL will facilitate the maintenance of site protection works for the Washery Road reserve.

Site protection measures have been installed to protect North Rothbury Persoonia habitat within the Washery Road reserve (Section 5.3). It is important these site protection measures be maintained.

Action 5.2 Cessnock City Council and OEH will implement and maintain measures to protect and manage road verge habitat for North Rothbury Persoonia.

The effective management of road-verge habitat, particularly along the council managed Tuckers and Littlewood Lanes, is vital for maintaining connectivity between sites and for ensuring the long-term survival of the species. The main threat to this road verge habitat is damage during road maintenance activity. Consequently, OEH has implemented measures to assist in the identification of road verge North Rothbury Persoonia habitat (e.g. significant road side vegetation signage and site meetings with council road staff) (see Section 5.3). It is vital that these measures be maintained and that all road maintenance activity is preceded by appropriate environmental assessment and staff awareness training.

Action 5.3 OEH and HCRCMA will liaise with selected landholders/managers of private land supporting North Rothbury Persoonia to facilitate the implementation of appropriate threat abatement measures. OEH will liaise with Energy Australia regarding the protection of North Rothbury Persoonia habitat in power line easements.

Specific Objective 6: Develop and implement a survey and monitoring program that will provide information on the extent and viability of North Rothbury Persoonia and its habitat.

Performance Criterion 6: A long-term monitoring and survey program to be designed by year one and implemented by year two, with the community invited to participate in implementation.

Action 6.1 OEH will design and facilitate a long-term monitoring program that monitors the viability North Rothbury Persoonia, including monitoring for signs of Phytophthora cinnamomi and monitoring the extent and quality of the habitat.

Action 6.2 OEH to facilitate surveys of potential habitat and to promote community involvement in the surveys.

Given that North Rothbury Persoonia has a persistent soil-stored seed-bank and exhibits considerable fluctuations in the number of mature individuals over time, it feasible that the species may appear at a site where it may not have been seen previously. Consequently, there is value in surveying the same sites every few years.

Specific Objective 7: Obtain the necessary prerequisite knowledge required to implement ex-situ conservation and in-situ translocation projects.

Performance Criterion 7: Seed storage and propagation research commenced by year one of the plan, translocation proposal complete by year three of the plan and experimental translocation commenced by year five.

Given the extreme rarity of North Rothbury Persoonia and continuing threatening processes, in the future we may become dependent upon ex-situ conservation and/or translocation to ensure the species' survival. Translocation is not currently considered feasible for North Rothbury Persoonia as we are not yet able to successfully propagate the species (Section 5.7) and a range of pre-translocation questions (as described in Vallee et al. 2004) require assessment. Given the restricted range of North Rothbury Persoonia; the limited number of individuals remaining; and the potential for *Phytophthora*, there is a real risk that a poorly designed translocation could decrease the species' survival prospects in the wild.

Action 7.1 OEH (Mount Annan Botanic Gardens) to undertake research into propagation and ex-situ storage North Rothbury Persoonia.

Action 7.2 OEH to design and implement an experimental translocation project North Rothbury Persoonia.

7. Implementation

Table 5 outlines the implementation of recovery actions specified in this recovery plan by relevant government agencies and/or parties for the period of ten years from publication.

The total cost to implement this plan is estimated to be at least $437,800 over ten years.

$40,000 has already been provided by external sources and the OEH will make an in-kind contribution of approximately $36,100. The remaining $361,700 will be sought from external sources. Tasks still requiring external funding include development and implement a long-term monitoring program; targeted survey; design and implement an experimental translocation program; and continued research into propagation and ex-situ storage.

8. Social and economic consequences

8.1 Social consequences

Negative social impacts are not envisaged as the implementation of this recovery plan is not expected to affect public land usage to any great extent, and modification of private land management will occur at the land managers' discretion. Continued liaison with the local community, affected landholders and government agencies will address and minimise any unforseen negative social impacts arising from the conservation of North Rothbury Persoonia.

It is expected that recovery plan implementation, including a community education and awareness program, will have positive social impacts on the local North Rothbury and Branxton communities.

8.2 Economic consequences

The economic consequences of this recovery plan are those costs that are associated with its implementation. These include on-ground habitat management, conducting vegetation survey and mapping, community education and awareness, and on-going recovery program coordination. These costs can be off-set and minimised by seeking funds from external sources and adopting a cooperative approach to management, involving the relevant land managers and the community.

The improved environmental impact assessment that will result from mechanisms established in this recovery plan will assist consent and determining authorities to meet their statutory responsibilities and will decrease the costs and time associated with undertaking impact assessment for North Rothbury Persoonia.

It is anticipated that the overall benefits to society of implementation of the recovery plan will outweigh any specific costs.

8.3 Role and Interests of Indigenous People

The Mindaribba Local Aboriginal Land Council (LALC) represents the indigenous people in the areas where the North Rothbury Persoonia occurs. It is the intention of the Recovery Team to consider the roles and interests of the Aboriginal community in the implementation of the actions identified in this plan. An opportunity for engaging with the Aboriginal community will be sought through the Hunter-Central Rivers CMA Aboriginal Cultural and Environmental Network (ACEN) and through the Mindaribba LALC.

9. Biodiversity Benefits

The conservation and study of North Rothbury Persoonia will benefit a number of threatened species that share its habitat and also at least one threatened ecological community: Kurri Sand Swamp Woodland (specifically a disjunct stand of Kurri Sand Stringybark Forest as defined by DECC 2008). The regionally significant Central Hunter Ironbark – Spotted Gum – Grey Box Forest is also likely to benefit from the recovery program.

Threatened fauna species sharing the same habitat as North Rothbury Persoonia and potentially benefiting from its conservation include a range of threatened birds including Swift and Turquoise parrots, Regent Honeyeater, Grey-crowned Babbler, Brown Treecreeper,

Powerful Owl, Speckled Warbler, and Square-tailed Kite. Threatened mammals that may benefit include the Squirrel Glider, and a number of bats including the Grey-headed Flying Fox, Eastern Freetail-bat and the Little Eastern and Bentwing-bats.

A number of threatened flora species are also likely to benefit from the conservation of North Rothbury Persoonia including *Eucalyptus glaucina* and the northern most population of *Acacia bynoeana.*

10. Preparation Details

This recovery plan has been prepared by Tricia Hogbin of the OEH's Biodiversity Assessment and Conservation Section, North East Branch in consultation with the Hunter Valley Threatened Flora Recovery Team. The development of this recovery plan was assisted greatly by Gordon Patrick of Trees In Newcastle, who on behalf of DECC, documented information on the taxonomy, distribution, habitat and ecology of North Rothbury Persoonia (Patrick 2006).

11. Review Date

The Australian Government will review this plan in five years.

12. References

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13. Acronyms Used in this Document

HCRCMA	Hunter-Central Rivers Catchment Management Authority
CCC	Cessnock City Council
EIA	Environmental Impact Assessment
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
NSW	New South Wales
NPW Act	NSW National Parks and Wildlife Act 1974
NV Act	NSW Native Vegetation Act 2003
OEH	Office of Environment and Heritage
RFS	Rural Fire Service

RTA	Roads and Traffic Authority
TSC Act	NSW Threatened Species Conservation Act 1995
VCA	Voluntary Conservation Agreement

Table 5. Estimated costs of implementing the actions identified in the recovery plan

Action No.	Description	Priority[1]	Cost Estimate ($'s/yr)[2]										Total Cost	Responsible party[3]	Fund source[4]
			Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10			
1.1	Revise EIA Guidelines	2	3,800	-	-	-	-	-	-	-	-	-	$3,800	OEH	In kind
1.2	Evaluate critical habitat	2	3,800	3,800	-	-	-	-	-	-	-	-	$7,600	OEH	In kind
1.3	Coordinate survey of unformed roads	2	1,900	-	-	-	-	-	-	-	-	-	$1,900	OEH	In kind
1.4	Management unformed crown roads	2	*	*	*	*	*	*	*	*	*	*	-	OEH, Lands, HCRCMA	In kind
2.1	Distribute site records via wildlife Atlas	2	#	#	#	#	#	#	#	#	#	#	-	OEH	In kind
2.2	Maintain information sources	2	#	#	#	#	#	#	#	#	#	#	-	OEH	In kind
3.1	Distribute general information	2	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	$9,500	OEH	In kind
3.2	Raise community awareness and encourage involvement	2	*	*	*	*	*	*	*	*	*	*	-	OEH, Lands, HCRCMA, CCC	In kind/Unsecured
3.3	Indigenous community consultation	2	#	#	#	#	#	#	#	#	#	#	-	OEH	In kind
4.1	Identification and management guide	2	3,800	-	-	-	-	-	-	-	-	-	$3,800	OEH	In kind
4.2	Advise re agreements and covenants	2	#	#	#	#	#	#	#	#	#	#	-	OEH, HCRCMA	In kind
5.1	Maintain protection of Washery Rd	1	*	*	*	*	*	*	*	*	*	*	-	OEH, Lands, HCRCMA	In kind/Unsecured
5.2	Manage road verge habitat	1	#	#	#	#	#	#	#	#	#	#	-	OEH, CCC	In kind
5.3	Threat abatement on private land	2	#	#	#	#	#	#	#	#	#	#	-	OEH, HCRCMA	In kind
6.1	Long-term monitoring program	2	7,600	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	$15,200	OEH	Unsecured
6.2	Survey of potential habitat	2	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	$9,500	OEH	Unsecured

7.1	Research propagation & ex-situ	2	20,000	20,000	-	-	-	-	-	-	-	-	$40,000	OEH	External
7.2	Experimental translocation	2	-	75,000	33,000	70,000	20,000	20,000	20,000	20,000	20,000	20,000	$198,000	OEH	Unsecured
Annual and total costs			20,000	20,000	-	-	-	-	-	-	-	-	$40,000		**External**
			9,500	78,800	36,800	73,800	23,800	23,800	23,800	23,800	23,800	23,800	$341,700		**Unsecured**
			15,200	5,700	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	$36,100		**In kind**
			44,700	104,500	58,700	75,700	25,700	25,700	25,700	25,700	25,700	25,700	$437,800		**TOTAL**

[1] **Priority ratings are: 1** Action critical to meeting plan objectives, **2** Action contributing to meeting plan objectives, **3** Desirable but not essential action.
[2] **#** No direct cost (either cost of action is negligible or action is an existing responsibility of the responsible party), ***** Amount to be determined by the responsible party
[3] **OEH**: Office of Environment and Heritage; **CCC**: Cessnock City Council; **HCRCMA**: Hunter-Central Rivers Catchment Management Authority; **Lands**: Department of Lands.
[4] **In kind** funds represent the salary component of permanent staff and recurrent resources. **External** funds are those that have already been provided by external sources. **Unsecured** funds will be sought from external sources. [@] $80,000 secured from Hardy Holdings Pty Ltd.