Draft NSW Recovery Plan

Recovery Plan for the Mongarlowe Mallee (*Eucalyptus recurva*)

Draft for Public Comment

April 2003

Natural Heritage Trust

Helping Communities Helping Australia

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Cover photographs: Flowering and fruiting branchlets of the Mongarlowe Mallee, and one of the Mongarlowe Mallee plants from near Mongarlowe.
Photographer: J. D. Briggs

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Recovery Plan for the Mongarlowe Mallee (*Eucalyptus recurva)*

Executive Summary

This document constitutes the formal Commonwealth and New South Wales State Recovery Plan for the Mongarlowe Mallee (*Eucalyptus recurva*). It considers the conservation requirements of the species across its known range, identifies future actions to be taken to ensure the long-term viability of the Mongarlowe Mallee in nature and the parties who will carry these out.

The Mongarlowe Mallee is listed as Endangered on the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*, and as Endangered (Schedule 1, Part 1) on the NSW *Threatened Species Conservation Act 1995*. It is a mallee which grows to 4.2 m tall and which has distinctive small, opposite, outwardly curved leaves. The flowers occur in clusters of three. This species occurs only in NSW, where it is known from four sites on the Southern Tablelands of NSW, three near Mongarlowe and one near Windellama. Three of these sites each support only single plants and the other site has two individuals. The sites are all privately owned.

The future Recovery Actions detailed in this Recovery Plan include; (i) Restoration and protection of the site near Windellama., (ii) Appropriate future management of the site near Windellama, (iii) All sites are afforded long-term protection, (iv) Completion of Aerial Survey, (v) Increase genetic diversity of current seed collections and investigate vegetative propagation techniques, (vi) Establish ex-situ populations, (vii) Determine the genetic diversity amongst the wild individuals and investigate the contribution of other eucalypt species to the genetic make-up of the progeny resulting from various natural and manipulated pollination events, and (viii) Maintenance of an effective Recovery Team.

It is intended that this Recovery Plan will be implemented over a five year period. Much of the Plan will be carried out using the existing resources of the NSW National Parks and Wildlife Service and Commonwealth Natural Heritage Trust funding already provided for this purpose. At least an additional $5,000 will be required to implement some of the currently unfunded actions. Some proposed actions are currently uncosted.

Brian Gilligan
Director-General

BOB DEBUS
Minister for the Environment

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Tina Dodson (Mulwaree Shire Council)
Kylie Coe (Tallaganda Shire Council)
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Michael and David Wood from Tarrawood Native Nursery are thanked for their work in trialling propagation of the Mongarlowe Mallee using specialist grafting techniques.

The successful implementation of Recovery Actions for this species will be largely dependent on the ongoing cooperation of those landholders with individuals of the Mongarlowe Mallee growing on their land. The cooperation of these landowners to date has greatly assisted in progressing the Recovery Program.

Environment Australia has provided funding for the preparation of the Recovery Plan and the implementation of some interim actions.

1 Introduction

The Mongarlowe Mallee (*Eucalyptus recurva* Crisp) occurs only in New South Wales, and is currently only known from four sites, three of which have only a single plant present, the other site has two individuals. It is a short multi-stemmed plant (mallee) upto 42 m high which flowers in early January. The species was discovered in 1985 by a local landholder and formally described in 1988 (Crisp, 1988).

This document constitutes the formal draft National and New South Wales State Recovery Plan for the Mongarlowe Mallee, 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 Mongarlowe Mallee 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. It may also be necessary to amend this Plan in the event of new information or following recommended changes to the Recovery Program by the Recovery Team. The information in this Recovery Plan is accurate to April, 2003.

This draft will be placed on public exhibition for a period of six weeks. Readers are invited to comment on its contents. Further information regarding the submission process and a submission form can be found at the rear of this Plan.

2 Legislative Context

2.1 Legal Status

The Mongarlowe Mallee is listed as Endangered on the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Endangered (Schedule 1, Part 1) on the NSW *Threatened Species Conservation Act 1995* (TSC Act). It is also listed as nationally Endangered (Code 2E) in *Rare or Threatened Australian Plants* (Briggs & Leigh, 1996).

Among the consequences of listing a threatened species on the TSC Act are:

- a Recovery Plan must be prepared;
- consideration be given to the species in assessing the impacts of developments and activities with the aim of minimising adverse impacts; and
- other actions that are likely to result in the harming or picking of that species or damage its habitat are licensed.

2.2 Recovery Plan Preparation

The TSC Act provides a legislative framework to protect and encourage the recovery of threatened species, endangered populations and endangered ecological communities in NSW. Under this legislation the Director-General of National Parks and Wildlife (NPW) has a responsibility to prepare Recovery Plans for all species, populations and ecological communities listed as endangered or vulnerable on the TSC Act schedules. Similarly, the EPBC Act requires the Commonwealth Minister for the Environment ensures the preparation of a Recovery Plan for nationally listed species and communities or adopt plans prepared by others, including those developed by State agencies. Both Acts include specific requirements for the matters to be addressed by Recovery Plans and the administrative process for preparing Recovery Plans.

This Recovery Plan has been prepared to satisfy both the requirements of the TSC Act and the EPBC Act and therefore will be the only Recovery Plan for the species. It is the intention of the Director-General of NPW to forward the final version of this Recovery Plan to the Commonwealth Minister of the Environment for adoption, once it has been approved by the NSW Minister for the Environment.

2.3 Recovery Plan Implementation

The TSC Act requires that a public authority must take any appropriate measures available to implement actions included in a Recovery Plan for which it has agreed to be responsible. Public authorities and councils identified as responsible for the implementation of Recovery Plan actions are required by the TSC Act to report on measures taken to implementation those actions. In addition, the Act specifies that public authorities must not make decisions that are inconsistent with the provisions of a Recovery Plan. The Government agencies relevant to this Plan are the New South Wales National Parks and Wildlife Service (NPWS), the Department of Land and Water Conservation (DLWC), the Tallaganda Shire Council (TSC) and the Mulwaree Shire Council (MSC). Consequently, the actions outlined for each of these agencies must be implemented as described in the Plan.

The EPBC Act specifies that a Commonwealth agency must not take any action that contravenes an approved Recovery Plan.

2.4 Relationship to other legislation

The lands on which the Mongarlowe Mallee occur are freehold. Relevant NSW and Commonwealth legislation includes:

- NSW *National Parks and Wildlife Act 1974*
- NSW *Environmental Planning and Assessment Act 1979*
- NSW *Local Government Act 1993*
- NSW *Rural Fires Act 1997*
- NSW *Native Vegetation Conservation Act 1997*
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The interaction of these Acts with the TSC legislation is varied. The most significant implications are described below and in Section 2.5.

The clearing of native vegetation in NSW is subject to consent from the DLWC in accordance with the NSW *Native Vegetation Conservation Act 1997* (NVC Act). The NVC Act is integrated with the *Environmental Planning and Assessment Act 1979* (EP&A Act), and requires that threatened species are taken into account when considering clearing applications under Part 4 of the EP&A Act. There are however a series of exemptions and the NVC Act does not apply to certain types of land including land zoned as 'residential', 'township', 'village', 'industrial', or 'business'. The three sites near Mongarlowe are all zoned Rural 1 (a) on the Tallaganda Local Environmental Plan (LEP) 1991. One of these sites is identified as occurring on 'Environmentally sensitive land' listed on Part 3 special provisions of the LEP. The site near Windellama is zoned General Rural 1 (a) on the Mulwaree LEP 1995; thus the NVC Act applies to all Mongarlowe Mallee sites.

The Rural Fires Act 1997 requires that all parties involved in fire suppression and prevention must have regard to the principles of Ecologically Sustainable Development (ESD) when exercising their functions and when preparing Draft Operational Plans and Draft Bush Fire Risk Management Plans. Consideration of the principles of ESD must include the conservation of biological diversity and ecological integrity. Within this, consideration must be given to the impact on threatened species and their habitats.

2.5 Environmental Assessment

New South Wales

The New South Wales *Environmental Planning and Assessment Act 1979* (EP&A Act) requires that consent and determining authorities, and the Director-General of National Parks and Wildlife, as a concurrence authority, consider relevant Recovery Plans when exercising a decision-making function under Parts 4 and 5 of the EP&A Act. Decision-makers must consider known and potential habitat, biological and ecological factors and the regional significance of individual populations.

The following public authorities currently have a decision making function in relation to the Mongarlowe Mallee*:*

- MSC as a consent authority;
- TSC as a consent authority;
- the DLWC in relation to Crown land, subject to the provisions of the *Crown Lands Act 1989*, and in relation to private land under the requirements of the NVC Act; and
- the NPWS where a concurrence role under the EP&A Act is required, or where a Section 91 Licence (under the TSC Act) or a Section 132 Licence (under the NPW Act) is required.

Additional authorities may have responsibilities if the species is located in other areas in the future.

Any other activity not requiring development consent under the EP&A Act, and which is likely to have a significant impact on the Mongarlowe Mallee, requires a Section 91 licence from NPWS under the provisions of the TSC Act. Such a licence can be issued with or without conditions, or can be refused. Routine agricultural activities however, are exempt from the provisions of the TSC Act. This means, for example, that the population of Mongarlowe Mallee or its habitat can, in some circumstances, be legally subject to grazing by domestic stock under the provisions of the TSC Act.

Any owner or occupier of private land is required to obtain a Section 132 licence from the Director-General of NPW if they wish to grow a TSC Act-listed threatened native plant species for the purposes of sale.

Commonwealth of Australia

The EPBC Act regulates actions that may result in a significant impact on nationally listed threatened species and ecological communities. It is an offence to undertake any such actions in areas under State or Territory jurisdiction, as well as on Commonwealth-owned areas, without obtaining prior approval from the Commonwealth Environment Minister. As the Mongarlowe Mallee is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on this species should refer the action to the Commonwealth Minister for the Environment for consideration. The Minister will then decide whether the action requires EPBC Act approval.

Administrative guidelines are available from Environment Australia to assist proponents in

determining whether their action is likely to have a significant impact. In cases where the action does not require EPBC Act approval, but will result in the death or injury of a member of the Mongarlowe Mallee and the member is in, or on a Commonwealth area, a permit issued by the Commonwealth Minister under the EPBC Act, will be required.

The Environment Minister can also delegate the role of assessment and approval to other Commonwealth Ministers under a Ministerial Declaration and to the States and Territories under bilateral agreements. The development of a bilateral agreement between NSW and the Commonwealth is not yet complete, but when in place will avoid the need for duplication of environmental assessment.

2.6 Critical Habitat

New South Wales

The TSC Act makes provision for the identification and declaration of Critical Habitat. Under the TSC Act, Critical Habitat may be identified for any endangered species, population or ecological community occurring on NSW lands. Once declared, it becomes an offence to damage Critical Habitat (unless the action is exempted under the provisions of the TSC Act) and a Species Impact Statement is mandatory for all developments and activities proposed within declared Critical Habitat.

To date, Critical Habitat has not been declared for this species under the TSC Act. However, declaration of Critical Habitat for the Mongarlowe Mallee will be considered within the life of this Plan.

Commonwealth of Australia

Under the EPBC Act, Critical Habitat may be registered for any nationally listed threatened species or ecological community. When adopting a Recovery Plan the Federal Minister for the Environment must consider whether to list habitat identified in the Recovery Plan as being critical to the survival of the species or ecological community. It is an offence under the EPBC Act for a person to knowingly take an action that will significantly damage Critical Habitat (unless the EPBC Act specifically exempts the action). This offence only applies to Commonwealth areas. However an action which is likely to have a significant impact on a listed species is still subject to referral and approval under the EPBC Act.

This Plan does not specifically identify habitat that is critical to the survival of the Mongarlowe Mallee. However, NPWS considers that the areas critical to the survival of this species must include as a minimum all habitat currently occupied by it. The distribution, habitat and ecological information included in this Plan (sections 3.2 – 3.6) would assist the Federal Minister for the Environment in identifying habitat that is critical to the survival of this species. NPWS does not consider it appropriate that this Recovery Plan identifies or maps the occurrences of this species in the detail that would be required to define the Critical Habitat.

3 Species Information

3.1 Description and Taxonomy

The Mongarlowe Mallee is a few- to many - stemmed mallee eucalypt, with individuals varying from 1.5 m to 4.2 m in height. The stems have a smooth, orange-brown to grey bark and arise from a substantial (up to 7.5 m x 12 m in diameter) lignotuberous rootsystem. Seedling leaves are opposite, with each pair arranged at right angles to the next, stalkless and held ± at right angles to the stem, broad elliptic to obovate, 1.3 –3.0 cm long and 0.7-1.6 cm wide, the leaf tip blunt. Seedling leaves after 10-20 pairs becoming elliptic, 1.8-2 cm long and about 0.8 cm wide, with a pointed, distinctly recurved tip, the leaves held at a sharper angle to the stem as the seedlings develop beyond the 10-20 leaf pair stage. Adult leaves are opposite, with each pair arranged at right angles to the next, narrow-elliptic, tapered to both ends and the tips conspicuously recurved, to 2.8 cm long and 0.7 cm broad, with abundant oil glands. The flowers are white, arranged in clusters of three on a common stalk to 5.5 mm long. Each flower cluster is borne singly in the axil of leaf, with flower clusters grouped in 3 or 4 adjoining leaf pairs near the branchlet tips. Buds are broad-ovoid, up to 6 mm long and 5 mm broad and stalkless or almost so. Fruit an almost stalkless, depressed-hemispherical woody capsule 2.5 – 3.5 x 4.5 – 6 mm. There are 3 or 4 valves just below the capsule summit. Flowering occurs for a period of about 2 weeks, normally commencing at the beginning of January (see front cover of this Recovery Plan for photograph of the leaves, flowers and habit of the Mongarlowe Mallee).

The size of the five known plants varies considerably. The largest individual (located near Windellama) has 78 stems that are over 2 cm diameter at ground level and these stems range from 1.5 to 2.8 m in height. The stems arise from an extensive lignotuber occupying an oblong area of 12 m x 7.5 m. The smallest plant (also near Windellama) has only seven stems and is currently 1.9 m in height. The sizes of the three plants located near Mongarlowe are; (a) 20 stems to 2 m high and a lignotuber spread of 5 x 3 m; (b) 50 stems (prior to 1995) to 4.2 m high and a lignotuber spread of 2.8 m x 1.8 m, and (c) 6 stems to 1.5 m high from a lignotuber 1 m across.

It is not currently known whether the two plants near Windellama (located 40 m apart) are genetically different, or whether they may have originated in the distant past from a common lignotuber.

3.2 Distribution

The Mongarlowe Mallee is known from four locations on the Southern Tablelands of NSW, three near Mongarlowe and one near Windellama (Figure 1). Three of these sites support what are believed to be only single plants, whilst the other has two individuals present. Thus the total known population of this species is only five individuals. All occurrences are within largely uncleared country that has been unsuitable for agricultural purposes. It therefore appears that the species is naturally rare, rather than having been reduced in numbers through human activities.

The first botanical specimen of this species was collected from one of the Mongarlowe plants by a local landholder in August 1985. The species was subsequently described in 1988 by M.D. Crisp.

A second plant in the Mongarlowe area was discovered in 1990 by a botanical consultant undertaking a vegetation survey in relation to the then proposed Welcome Reef Dam. It was not until 1994 that the larger of the Windellama plants was found. This find was made during a flora and fauna study being undertaken prior to a mining company submitting a Development Application for an extension to a clay mining operation. The second smaller plant near Windellama was not noticed until 2001. The third plant near Mongarlowe was detected during a targeted aerial survey conducted by NPWS in January 2001, using a helicopter.

3.3 Land Tenure

Three of the known sites are on privately owned land and the fourth site is on freehold land owned by a company.

3.4 Habitat

The species is found in low heathland and in some cases at the margins of the heathland and adjacent low woodland. The woodlands are dominated by Brittle Gum (*Eucalyptus mannifera*) and Snow Gum (*E. pauciflora*), but scattered Candlebark (*E. rubida*) and Broad-leaved Peppermint (*E. dives*) trees are also nearby at some sites. In the Mongarlowe area the heathland is dominated by Stunted Sheoak (*Allocasuarina nana*) with emergent shrubs of Finger Hakea (*Hakea dactyloides*), a Tea-tree (*Leptospermum* sp.) and Hairpin Banksia (*Banksia spinulosa*). Other associated species include Trigger Plant (*Stylidium graminifolium*), *Boronia rhomboidea, Isopogon prostatus, Lepidosperma laterale, Mirbelia oxylobioides*, Purple Flag (*Pattersonia longifolia*), *Petrophile pulchella*, and a Speargrass (*Austrostipa* sp.).

At Windellama the heathland is more diverse and dominated by a sedge (*Restio* sp.) and a prostrate Kunzea (*Kunzea* sp. nov.). Other associated species include *Oxylobium* sp., Common Fringe Myrtle (*Calytrix tetragona*), *Allocasuarina* sp., Bracken Fern (*Pteridium esculentum*), A Geebung (*Persoonia* sp.), *Lepidosperma laterale*, *Gahnia* sp., Two-spiked Rush (*Lomandra longifolia*), Purple Flag (*Pattersonia sericea*), Trigger Plant (*Stylidium graminifolium*), *Juncus* sp., *Sowerbaea juncea* and several grasses, including *Eragrostis brownii*, *Aristida ramosa*, Tussock Grass (*Poa sieberiana)* and a Wallaby Grass (*Notodanthonia* sp.).

All sites are on gentle slopes, with the site aspects ranging from easterly to northerly to westerly. The Mongarlowe plants occur from mid to upper slope, whilst the Windellama plants are on the lower part of a gentle slope.

At all sites the soil is a shallow, pale-grey sandy loam overlying white or grey clay.

3.5 Ecology

Life Cycle

No seedling establishment has been observed at any of the known sites and survival of the species in the wild currently appears dependent on the survival of the existing adults, most of which appear to be already of a great age.

The extent of flowering among the five known individuals is highly variable. The first known Mongarlowe plant has flowered prolifically every year since its discovery. The second plant found near Mongarlowe also flowered prolifically until it suffered major die-back of most of its stems sometime between 1995 and 2000. The most recently discovered plant (the third near Mongarlowe) flowered prolifically in 2001, 2002 and 2003, and is budded for flowering in January 2004. The larger of the Windellama plants had not been observed to flower from the time of its discovery in 1994 until 2001. That plant then flowered in 2001 and 2002 and had buds present for another flowering in 2003. However, most of the latest bud crop had aborted by November 2002, possibility due to the prevailing drought conditions. Flowering and budding has, however, only occurred within two small sections of this large mallee clump, and the reasons for this patchy flowering pattern are not currently evident. The smaller plant at Windellama has not budded or flowered since its discovery.

The Mongarlowe Mallee is almost certainly insect pollinated, as are most species of eucalypts. Prolific visitation of the flowers by several species of beetles, moths, flies, hover flies and native bees has been observed during the flowering period (Briggs, pers. comm.).

Rates of natural seed set are, however, extremely low. Only a small number of fruit capsules have been found on the various plants at the time of their discoveries. The most recently discovered plant near Mongarlowe had relatively more capsules per branchlet than the other plants. These naturally pollinated capsules contained an average of only 0.6 viable seeds per capsule (Briggs, pers. comm.).

Reproductive ability

Germination rates of naturally produced seed have been about 80%, but the vigour of the resulting seedlings has been highly variable and the progeny has shown marked morphological segregation (Briggs, unpublished data), indicating extensive hybridisation is occurring. In 1992, 47 seedlings were successfully raised by the CSIRO Centre for Plant Biodiversity Research (CPBR) to a size of 10 cm or more in height from naturally produced seed collected from the two plants known at that time. The first-discovered plant produced 10 seedlings that morphologically resembled the adult Mongarlowe Mallee plants out of a total of 25 seedlings grown, and the other plant produced only three seedlings that morphologically resembled the adult Mongarlowe Mallee out of a total of 22 seedlings grown (Briggs, unpublished data). In 1993, 32 of these progeny were planted into an arboretum at the CSIRO Division of Plant Industry Research Station at Gininderra, Canberra. All eight plants with leaf morphology closely resembling the parent Mongarlowe Mallee plants died within a year of planting. The other plants flourished and by 1999 many were more than 4 m in height. At that time many of these plants had begun producing flower buds. Notably, most were producing both three and seven-flowered umbels, indicating that the other parent was almost certainly a species with seven-flowered umbels. Given the shape of the juvenile and intermediate foliage on the hybrid progeny, the other parent was probably Black Swamp Gum (*Eucalyptus aggregata)* (Briggs, pers. comm.). Previously Candlebark had been thought to be the other parent because of the rounded seedling leaves on most of the hybrid progeny (Crisp, 1988). Seedlings raised in 2002 from naturally produced seed on the large Windellama plant and the newly discovered plant near Mongarlowe have also shown considerable morphological variation and variation in vigour, with few plants closely resembling the leaf morphology of the adult Mongarlowe Mallee plants. Of a batch of seven surviving seedlings from each of these parents, the foliage of only one plant from each parent shows a close resemblance to that of the adults. This is again strong evidence of natural hybridisation occurring with these plants, and the seedlings of poor vigour are probably the result of self-pollinated flowers. The very low level of seed production by all individuals is likely to be a major reason why recruitment in the wild, even of hybrid progeny, is not occurring.

The reasons for such a lack of seed set could be simply due to the individual plants being physically too far apart for transfer of pollen by natural pollinators (all plants are at least 2 km from any other), or the reasons could be more complex. Previous natural loss of genetic diversity and/or inbreeding could have lead to inherent infertility of individuals or pollination incompatibility between the surviving plants due to them being too closely related.

Pollination trials

Hand pollination trials conducted by NPWS in 2001 and 2002 (see Previous Recovery Actions for more details) have resulted in a substantial (several hundred percent) increase in the rate of fruit set on two of the Mongarlowe Mallee plants. Progeny grown from these crosses has produced an approximately equal number of plants that appear to be hybrids and plants believed to be 'pure' Mongarlowe Mallee (Briggs, unpublished data). Because of previous experience of an adverse reaction to the temporary covering of branchlets of the Mongarlowe Mallee, the flowers were not bagged to exclude foreign pollen during the 2001/2002 pollination trials. An unwanted consequence of not being able to readily exclude foreign pollen is that a mixture of apparently 'pure' and hybrid seed has been produced. Indeed, the presence of unrelated Mongarlowe Mallee pollen has greatly increased the receptivity of the Mongarlowe Mallee flowers to fertilization by pollen from other eucalypt species that were flowering at the same time. This is evidenced by the significant increase in the quantity of hybrid seed being produced compared to that occurring in naturally pollinated plants where there is no input of pollen from unrelated Mongarlowe Mallee plants. This is a phenomenon known as pollen mentoring (A. Young, pers. comm.). The pollen from other species has presumably been transferred by some of the numerous insect vectors observed visiting the Mongarlowe Mallee flowers. The apparently 'pure' Mongarlowe Mallee plants raised from the seed produced by the hand pollinations have so far shown moderate vigour (Briggs, pers. com.). This positive result suggests that for some of the Mongarlowe Mallee plants, physical separation and lack of pollen from unrelated individuals of this species may be the major cause of low natural seed production. However, the almost total failure of another plant to set fruit as a result of pollination from a either of the other two plants that were themselves

successfully pollinated using pollen from it suggests the situation is, nevertheless complex.

Population Structure

Only five mature individuals are known. The size of these is variable, as detailed under Section 3.1. Four of these plants are known to have flowered in at least some years, although the fifth has not yet been observed to flower or bear fruit capsules. No seedlings have been observed in the wild.

There are a number of factors that suggest the surviving individuals of the Mongarlowe Mallee are very long-lived. The extensive spread of the lignotubers of the two largest plants (one 7.5m x 12 m, the other 5 m x 3 m) indicates that these two plants in particular are of a great age. Assuming the largest plant started from the centre point of the current lignotuber, and that the rate of horizontal spread of the lignotuber is unlikely to be more than 2 mm per year, then it would have taken 3,000 (6,000/2) years to achieve such a spread. This calculation presumes that each mallee patch is a single genotype, a presumption based on genetic studies by Moran (unpublished data) that indicated that the first discovered mallee clump is all the same genotype. The growth rate is an estimate that is based on the slow growth rate of branchlets and the low fertility and shallow soils of the site. There is also a possibility that the two plants near Windellama, located 40 m apart, are identical genotypes that originated from a common rootstock that separated and spread in different directions. If this were demonstrated to be the case then the above calculation applied to a minimum migration distance of 26 m would give this plant an age of 13,000 years.

The species occurs in habitat that has remained largely unaltered since European settlement. The current rarity of the Mongarlowe Mallee, with about a 2 km separation between each of the three individuals at Mongarlowe and 30 km to the plants near Windellama therefore appears to have been the result of natural causes. The decline in the species has possibly been caused by changes in the environment that were unfavourable to this species. Such a decline is therefore likely to have been over many hundreds or thousands of years and the result of a general failure of the species to adapt to the changing conditions. Perhaps the last survivors of this species are those that possessed the advantage of a particularly strong persistent lignotuberous rootsystem that has enabled them to repeatedly regenerate vegetatively in the absence of sexual reproduction. Loss of reproductive ability appears in part, at least, to have resulted from physical separation from other individuals. It is not possible to know how long ago sexual reproduction ceased, but it was presumably a gradual process with successfully pollination events becoming more infrequent as the distance between surviving individuals increased.

Disturbance Regimes

The three largest individuals have a substantial lignotuberous rootstock and these plants currently have young shoots sprouting from their lignotubers. Notably, the vigour of resprouts from the lignotubers is greatest on parts of the lignotuber closest to where stems have recently died. This is a strong indication that, like other mallee eucalypts, the Mongarlowe Mallee would have a strong capacity to resprout from the lignotuber following a fire. Indeed, given the apparent great age of the plants and lack of seedling recruitment, the surviving plants have without doubt survived many fire events in the past. The major dieback of most stems of the tallest of the Mongarlowe Mallee plants over recent years is possibly a reflection of a long absence of fire. In the absence of fire, the stems may have reached a height that the plant could no longer support. This plant is now resprouting vigorously from the lignotuber, and also from low down on some partially dead stems. Similar dieback has been observed (Briggs, pers. comm.) in other mallee species that have grown tall in cultivation.

3.6 Ability of Species to Recover

Given the low number of individuals of this species, the small genetic base, and the lack of recruitment due to low levels of seed production and poor seedling vigour, the prospect of the population of this species increasing naturally is remote. Given that this species appears to be in a slow natural decline, the appropriate aim of this Recovery Plan should primarily be to protect the existing individuals, since they all may continue to live several hundreds of years in the absence of threats resulting from human activity. It is not considered appropriate to interfere with natural processes by attempting to establish new genotypes at known sites in order to initiate reproductive success and increase the number of individuals at existing sites.

The success of the hand-pollination work in 2001 and 2002 in producing apparently pure Mongarlowe Mallee seedlings has greatly increased the prospect that ex-situ collections could be established in appropriate sites away from known occurrences, and that the species may also be successfully introduced into cultivation.

4 Management Issues

4.1 Current Threats

A major threat to the plant that was first found near Mongarlowe is visitation from those wishing to see the plant and collect specimens from this botanical curiosity. The impact of visitation pressures includes

the collection of plant material, soil compaction, and other associated habitat damage. Vehicle damage is also a threat to this plant, since a track occasionally used by fishermen passes adjacent to the plant and vehicles have previously damaged shoots sprouting from the lignotuber. Such visitation and vehicular traffic poses the risk of introduction of soil-borne fungal pathogens such as *Phytopthera cinnamomi*.

At the Windellama site, the main threat to the two plants has been habitat loss and degradation associated with clay mining and associated activities that have operated since 1995. Major concerns include altered drainage, siltation around the base of the plants, dust deposition and glare, all arising mainly from an extensive area of exposed white clay that extends to within 6 m of both the Mongarlowe Mallee plants at this site. The exposed clay is the result of the construction of a site access road and a low, wide clay wall (berm) that was built along the edge of the mine pit between 1995 and 1999, under an approval granted by Mulwaree Shire Council under the EP&A Act. This earthwork is 40-50 m wide and 110 m long and slopes towards the Mongarlowe Mallee plants. The earthwork involved the placement of clay fill (up to 1-2 m deep) onto a previously flat, seasonally wet area adjacent to the Mongarlowe Mallee plants that previously supported a low dense heath vegetation with no trees present (Briggs, pers. comm.).

At one stage there were also concerns about possible nutrient and other chemical enrichment of the habitat from leachate washing from a compost containing waste paper pulp and fowl manure that was spread over the berm area adjacent to the Mongarlowe Mallee plants. This material has since been removed by the mining company.

4.2 Potential threats

Although the exact locations of most of the Mongarlowe Mallee plants are currently not widely known, threats associated with increased visitation pressures are likely to occur if visitation is not controlled. Whilst the owners of the properties on which this species occurs are generally supportive of protecting the species, potential future subdivisions of the properties near Mongarlowe could increase the level of threat to the species. In particular, inappropriate placement of property boundaries/fences or buildings, or changes in current land use could threaten the individuals.

Because the population is reduced to just a few individuals, the species is extremely vulnerable to extinction through disturbances such as severe drought, and other unforeseen stochastic events. Fortunately the current 2002/03 drought does not appear to have caused major stress on most of the plants so far. However, a lack of vigorous new growth and an absence of flower bud production on the larger plant near Windellama seems likely to be the result of recent moisture stress.

5 Previous Recovery Actions

(Listed in chronological order)

- In 1992 approximately 30 seedlings each from naturally produced seed collected from the two plants then known from the Mongarlowe area were raised by the CPBR, Canberra. The majority of these seedlings proved to be hybrid progeny. Most of these seedlings were then planted into an arboretum at the CSIRO Division of Plant Industry Research Station at Gininderra, where only the hybrid progeny survived beyond the first year (Briggs, pers. comm.) (see Section 3.5 for more details).
- In 1992 and 1993 the CSIRO Centre for Biodiversity Research undertook some trial cross-pollination between the two individuals known near Mongarlowe at that time. This trial was unsuccessful, apparently largely due to the high sensitivity of this species to a standard technique successfully used on other eucalypt species. In the case of the Mongarlowe Mallee, following the hand-pollination work, which included the temporary placement of gauze bags over selected flowering branchlets to exclude foreign pollen, the leaves and developing fruit on these bagged branchlets rapidly yellowed and were shed.
- Also in 1992, the then CSIRO Division of Forestry attempted two vegetative propagation techniques on the Mongarlowe Mallee. One of the methods involved culturing small segments of young shoots (these had been surface sterilised) of the Mongarlowe Mallee in tubes of sterilized agar gel that had been enriched with nutrients and growth hormones. This technique proved unsuccessful due to infection of the growth media from fungi that emerged from within the internal tissues of the shoots (J. Svensson, pers. comm.; CSIRO Div. For.). Interestingly, it has also been observed (M. Wood, pers. comm.) that whilst preparing cutting material sourced from the first-discovered plant from near Mongarlowe that most of the shoots exhibited a form of internal stem rot. The second method involved grafting young stems of the Mongarlowe Mallee onto young plants of hybrid progeny that had been grown from the naturally set seed collected from the two plants known at that time from near Mongarlowe. Although many of the grafts remained alive for several months, eventually all died (V. Hartney, pers. comm.; CSIRO Div. For.).
- As one of the Conditions of Consent for a proposed Landfill operation at the site near Windellama, MSC

in 1999 required the preparation of an Environmental Monitoring Manual that must include appropriate management and protection of the Mongarlowe Mallee plants. The manual is to be prepared to the satisfaction of an Environmental Monitoring Panel, whose membership includes NPWS, various other government agencies, MSC and representatives from the local community. Various drafts of this Manual have been prepared, however a final version is yet to be approved by the Environmental Monitoring Panel.

- In January 2001, six hours of helicopter survey of potential habitat was undertaken to locate other possible individuals of the species. One new plant was found near Mongarlowe.
- In January 2001, hand pollination work was undertaken on four of the five individuals of the Mongarlowe Mallee. This work resulted in the production of significant quantities of fruit on two of the Mongarlowe Mallee plants (one near Windellama and one near Mongarlowe).
- A Recovery Team was established by NPWS in August 2001.
- Seedlings from naturally set seed collected from the larger of the two plants at Windellama and the third plant from near Mongarlowe (approximately 15 seedlings from each) were grown by NPWS in 2002 (see Section 3.5 for more details).
- In January 2002 further hand pollinations were undertaken on the three individuals that flowered that year. Again, a significant quantity of fruit was set on two of the Mongarlowe Mallee plants (one near Windellama and one near Mongarlowe).
- In early 2002 NPWS engaged a native plant nursery with expertise in grafting of eucalypt species to attempt to graft shoots of the Mongarlowe Mallee onto rootstock of a selection of four other eucalypt species. Both branchlet tips and shoots from the lignotubers were tried. A total of 40 grafts (ten shoots each from three of the Mongarlowe Mallee plants) were made onto seedlings of Small-leaved Gum *(Eucalyptus parvula*), Black Gum *(E. aggregata)*, Narrow-leaved Sally *(E. moorei*) and Blue Mountains Mallee Ash *(E. stricta*). Only two grafts were successful. These were both from the first discovered plant near Mongarlowe and were both grafts onto Small-leaved Gum. Experience with grafting eucalypt species has shown that grafting onto species in different subgenera is unlikely to be successful (D. Wood, pers. comm.). One of the reasons why the Mongarlowe Mallee grafting had only limited success is therefore considered (D. Wood, pers. comm.) to be related to the fact that two of the unsuccessful rootstock species used - Narrow-leaved Sally & Blue Mountains Mallee Ash - belong to the Subgenus Eucalyptus, whereas the Mongarlowe Mallee (and the other two rootstocks used) belong to the Subgenus Symphyomyrtus (Section Maidenaria).
- In 2002 NPWS grew the first batch of seedlings from the seed produced from the 2001 hand pollinations. This seed was harvested from the larger of the two plants at Windellama and the most recently discovered plant near Mongarlowe. Both of these plants were mainly pollinated from pollen sourced from the first discovered plant located near Mongarlowe. Approximately 50 seedlings from each of the two parent plants were raised (see Section 3.5 for more details). These seedlings will be sampled as part of the proposed genetic studies. The seedlings will then be used for the proposed ex-situ plantings and some will be distributed to appropriate botanic gardens, providing the purity of the seedlings is confirmed by the proposed genetic studies.
- In March 2002 NPWS engaged a contractor to commence seed collection and propagation of associated native plant species in connection with rehabilitation works at the Windellama site.
- In late 2002 NPWS commenced discussions with the SCA regarding selection and use of sites for the establishment of an ex-situ population within suitable habitat. Field survey has already identified some options and additional investigation is planned for May/June 2003.

6 Proposed Recovery Objectives, Actions and Performance Indicators for 2002/3-2007/8

The overall objective of this Recovery Plan is to ensure that the current natural population of the Mongarlowe Mallee is maintained. Given that only five individuals across four sites are known, together with the absence of natural reproduction, it is difficult to envisage that a positive change in the conservation status will be achievable.

Actions under Objectives 1 and 2 have also been recommended in a draft Environmental Monitoring Manual that is being developed specifically to manage a variety of environmental issues associated with a proposed landfill operation near Windellama that has the potential to further affect two Mongarlowe Mallee plants. The preparation of this Manual is part of the Conditions of Consent required by MSC for the activity. The Manual includes specific recommendations regarding the protection, management and monitoring of the two Mongarlowe Mallee individuals at this site.

Specific Objective 1: Restoration and protection of the site near Windellama.

Action 1.1. Revegetation to protect the two Mongarlowe Mallee individuals and their habitat near Windellama.

Clay mining and associated activities since 1995 have created a 30-40 m wide and 110 m long bare clay area between a clay-pit access road and the Mongarlowe Mallee individuals at the site near Windellama. This area should be vegetated with local native shrub, grass and sedge species in order to prevent further washing of eroded clay material from this area onto the adjacent Mongarlowe Mallee plants and their habitat, and to reduce dust and glare affecting the plants. This bare area slopes towards the two Mongarlowe Mallee plants and silt from this area has been washing onto the base of the plants and into the surrounding habitat. A specialist contractor will need to be engaged to collect propagating material (mainly seed) of other native species growing in the Mongarlowe Mallee habitat, raise plants to an appropriate stage and undertake the plantings. Approximately 24,000 plants will be needed to complete this task satisfactorily.

Performance Indicator 1.1

Within 1 year of the approval of this Plan the revegetation will have commenced.

Action 1.2. Fencing of Mongarlowe Mallee habitat near Windellama

A standard stock-proof fence should be erected by the mining company in consultation with the Recovery Team around the entire block of native vegetation containing the two Mongarlowe Mallee individuals. This will provide physical protection, including preventing domestic stock from accessing the area, to both the remaining intact habitat and the proposed regeneration area adjacent to the plants. It will also place an additional barrier around the Mongarlowe Mallee plants to prevent any accidental vehicle or machinery damage.

Performance Indicator 1.2

Within 1 year of the approval of this Plan the block of native vegetation containing the two Mongarlowe Mallee individuals has been fenced.

Action 1.3. Prevention of leachate from proposed landfill near Windellama impacting on Mongarlowe Mallee habitat.

Part of the proposed landfill operation is to produce compost derived from a mixture of fowl manure, paper pulp waste and sand. This compost will be mixed and stored in designated 'cells' in the clay pit.

The planned 'pulp-maturing' cells located closest to the Mongarlowe Mallee plants in the proposed landfill area need to be constructed with an appropriate liner to minimise the risk of leachate movement towards the Mongarlowe Mallee habitat.

Performance Indicator 1.3

All cells within the proposed landfill site near Windellama are appropriately lined to prevent seepage of leachate and no escape of leachate is detectable near the Mongarlowe Mallee plants.

Specific Objective 2: Appropriate future management of the site near Windellama.

Action 2.1. Visitation to the Windellama site of the Mongarlowe Mallee to be regulated and monitored.

Visitation of the Mongarlowe Mallee plants near Windellama needs to be controlled and monitored by the mining company in consultation with NPWS and the Mongarlowe Mallee Recovery Team. This constraint is to prevent over visitation to the site and potential habitat damage caused by trampling. In addition, no seed or plant material is to be removed by visitors (or others) from the Mongarlowe Mallee plants without the prior consent of NPWS. Under the provisions of the TSC Act, any approval will also require the submission of an application for an appropriate licence from NPWS.

Performance Indicator 2.1

Visitation to the Mongarlowe Mallee plants near Windellama is restricted and monitored such that no damage to the habitat or individuals is evident.

Action 2.2: Monitoring of environmental impacts on the Mongarlowe Mallee site near Windellama.

NPWS in consultation with the Recovery Team and the Environmental Monitoring Panel should develop a methodology for the monitoring of the health of the Mongarlowe Mallee plants and their habitat near Windellama. NPWS should undertake this monitoring on at least an annual basis and investigate the likely cause of any detected decline in the health of the Mongarlowe Mallee plants or the surrounding habitat.

An ongoing weed control program for the rehabilitated area and any area of native vegetation adjacent to the Mongarlowe Mallee individuals that becomes affected by weeds should be prepared and implemented by NPWS, the Recovery Team and the company.

A water quality stand-pipe is to be placed between the closest 'pulp-maturing' cell in the adjacent clay extraction/landfill area and the Mongarlowe Mallee plants to detect any movement of contaminated groundwater towards those individuals. In addition, groundwater levels in the vicinity of the plants near Windellama should also be monitored to detect any significant change that might arise as a result of the surrounding mining operations.

Performance Indicator 2.2

Within one year of the approval of this Plan a monitoring program has been established and implemented to ensure; (1) any decline in the health of the Mongarlowe Mallee plants and their habitat is detected, (2) the likely cause of any detected decline in the health of the Mongarlowe Mallee plants and their habitat is identified, (3) that weeds are detected and controlled in Mongarlowe Mallee habitat, and (4) that movement of contaminated water can be detected in accordance with the protocols in the draft Environmental Monitoring Manual and any adverse changes in the hydrology of the sites supporting the Mongarlowe Mallee are detected and remediated.

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Action 2.3: Investigate any existing potentially adverse changes to the hydrology of the area in the vicinity of the Mongarlowe Mallee plants near Windellama, and remediate if necessary.

In Section 5.1 of the 1998 Environmental Impact Statement (EIS) for a proposed landfill operation near Windellama it was stated (Gunninah Consultants) that one of the measures to be implemented in the management of the Mongarlowe Mallee is the restoration of the natural hydrology of the area surrounding the Mongarlowe Mallee plants. An existing drainage problem was noted in the EIS. The Recovery Team considers that an expert hydrologist should be engaged to provide advice on any likely adverse impacts that may result from past excavation/drainage works and to advise on any remediation works required to restore near natural hydrological conditions. Any necessary remediation works should then be implemented.

Performance Indicator 2.3

Within two years of the approval of this Plan the hydrological impacts of past mining operations at the site near Windellama are investigated and any necessary remediation works are undertaken.

Specific Objective 3: All sites are afforded long-term protection.

Action 3.1. Undertake liaison with private landholders

The NPWS will consult with the four private landholders with the Mongarlowe Mallee on their properties and develop site-specific management actions and the timescale for implementation. In the longer term, formal protection of the sites on private land will be sought through the promotion of Voluntary Conservation Agreements or other mechanisms.

Performance Indicator 3.1

Within two years, each landholder with the Mongarlowe Mallee on their properties is consulted, and agreement is reached on cooperative management actions and timeframe for their implementation to protect each site.

Action 3.2: Tallaganda and Mulwaree Shire Councils are encouraged to include an advisory note recording the presence of this species on Section 149 Certificates for the relevant properties.

Although the current landowners are aware of, and are supportive of the protection of this species on their land, it is important that future potential purchasers of the properties are made aware of the presence of these species at an early stage. Council staff also change over time and it is also important that TSC is automatically alerted to the presence of this species should any Development Applications be submitted which might affect any of the plants. The recording by TSC and MSC of the presence of this species on Section 149 Certificates under the provisions of the *Local Government Act* will assist in achieving this.

Performance Indicator 3.2

Within two years TSC and MSC have recorded the presence of this species on s.149 Certificates for the relevant properties.

Action 3.3: Identification and nomination of Critical Habitat

The NPWS will consider the benefits of nominating Critical Habitat and, if appropriate, make a recommendation to the Minister regarding what areas should be listed.

Performance Indicator 3.3

Within five years, the NPWS will have made a recommendation to the Minister regarding what areas, if any, should be declared Critical Habitat.

Specific Objective 4: Completion of Aerial Survey

Action 4: Undertake further aerial survey for the Mongarlowe Mallee

The NPWS will conduct further helicopter surveys for the Mongarlowe Mallee to locate possible new populations of the species, particularly south of the current known southern limit of the species.

Performance Indicator 4

Within three years, an aerial survey has been completed and any new populations have been documented.

Specific Objective 5: Increase genetic diversity of current seed collections and investigate vegetative propagation techniques.

Action 5.1: Undertake additional combinations of hand pollination between the four flowering individuals.

Hand pollination efforts have successfully produced significant quantities of seed on two Mongarlowe Mallee individuals in 2001 and 2002. At this stage most of the seed was produced with pollen sourced from a third Mongarlowe Mallee individual, and a small quantity of seed has resulted from a cross between the two main seed-producing plants. In order to increase the genetic diversity of the current seed collection it is desirable that further cross-pollinations be undertaken in an attempt to include the genetic diversity from the fourth flowering plant in the seed material. It is also desirable to increase the proportion of seed resulting from crosses between the two main seed-producing plants.

The success and timing of the proposed additional cross-pollinations will be largely dependent on the extent of flowering of the various individuals over the next few years. The extent of flowering on two of the plants has been highly variable over the last seven years.

Performance Indicator 5.1

Within the next five years the additional hand pollinations outlined above have been undertaken and the resulting seed collected, providing flowering events permit.

Action 5.2: Investigate various vegetative propagation techniques.

Over recent years unsuccessful attempts have been made to propagate the species through grafting and tissue culture. Recent advances in vegetative propagation techniques for eucalypts justify further attempts at propagating the Mongarlowe Mallee using new grafting and tissue culture technologies. If possible, vegetative propagation of individuals from all five individuals will be undertaken.

Performance Indicator 5.2

Within three years selected propagation techniques have been trailed and, if possible, plants established in cultivation which represent the genetic diversity of the individuals in the wild.

Specific Objective 6: Establish ex-situ populations.

Action 6.1: Investigate suitable sites within potential natural habitat of the Mongarlowe Mallee for the establishment of a genetically diverse ex-situ population.

The establishment of a genetically diverse ex-situ population within suitable natural habitat is considered desirable in order to have a healthy seed-producing population (seed orchard) from which future propagating material would be available, particularly for introducing the species into the nursery trade. Any such ex-situ population should be sufficient distance from the naturally occurring plants that there will be little chance of pollen from the plantings being transferred to the natural plants. If this were to happen then this could potentially affect natural processes (a 2 km separation has proven a sufficient distance to prevent pollen exchange between the existing individuals).

Suitable sites on land owned by the Sydney Catchment Authority will be investigated as a priority, with sites on private land being a second option. Replication of sites for the ex-situ planting is seen as desirable to improve the chances of the mico-environment of selected sites being favourable to the growth and survival of at least some of the plantings and to reduce the risk of disturbances such as wildfire damaging the entire ex-situ planting.

Performance Indicator 6.1

Within two years suitable sites for the establishment of an ex-situ planting have been selected and the use of these sites negotiated with the landowner/s. Within five years at least 30 Mongarlowe Mallee plants raised from seed produced as a result of the hand pollination work have been established at the selected site/s.

Action 6.2: Distribute a range of Mongarlowe Mallee genotypes to Botanic Gardens that have suitable climatic conditions.

The Mongarlowe Mallee is not currently represented in any Botanic Gardens. Now that relatively vigorous, apparently 'pure' Mongarlowe Mallee plants are likely to be available from the successful hand pollination work it should be possible to distribute a selection of these to appropriate Botanic Gardens. The Australian National Botanic Gardens and Mount Annan are suggested as two Botanic Gardens with suitable climate for the maintenance of the Mongarlowe Mallee. Before any seedlings are distributed the 'purity' of selected progeny resulting from the hand pollination work will need to be confirmed by the genetic studies proposed in Action 7.1

Performance Indicator 6.2

Within three years plants will have been distributed to at least two Botanic Gardens, providing the genetic studies demonstrate the 'purity' of the selected progeny.

Specific Objective 7: Determine the genetic diversity amongst the wild individuals and investigate the contribution of other eucalypt species to the genetic make-up of the progeny resulting from various natural and manipulated pollination events.

Action 7.1: Undertake studies using appropriate genetic research techniques such as the use of DNA sequencing to confirm, or otherwise, the presumed clonal structure of each of the wild plants (mallee clumps).

Each of the known clumps of the Mongarlowe Mallee look uniform in their vegetative growth characteristics. Currently it is presumed that each of the five known mallee clumps of this species consist of single genotypes (clones). This, however, has yet to be verified through appropriate detailed genetic marker studies that could establish beyond doubt whether each clump represents a single individual. There are likely to be some specific benefits from such genetic studies. For example, if the two plants near Windellama (located about 40 m apart) were to be shown to be identical, and therefore to have originated from a common rootstock, this would greatly increase the estimated age of these individuals. It is also notable that the larger Mongarlowe Mallee clump near Windellama consistently only flowers within specific parts of the clump. There is no obvious reason for this, and genetic sampling of the clump may provide some clues.

Performance Indicator 7.1

Within three years a genetic study investigating the above is completed, funding permitting.

Action 7.2: Undertake studies using appropriate genetic research techniques such as the use of DNA sequencing to determine the contribution of other eucalypt species to the genetic make-up of the progeny resulting from various natural and manipulated pollination events

It is believed that about 50% of the seedlings raised from the seed produced by the hand pollinations undertaken in 2001 and 2002 are 'pure' Mongarlowe Mallee, i.e. that both parents are Mongarlowe Mallee individuals. Since no 'pure' out-crossed Mongarlowe Mallee seedlings have ever been observed or described prior to the recent propagation work, it is important that appropriate genetic investigations are undertaken to demonstrate that these seedlings are indeed 'pure' Mongarlowe Mallee.

Many seedlings of obvious hybrid origin have been grown, both from seed that originated from naturally pollinated flowers and from hand pollinated flowers. The morphology of these hybrid seedlings varies considerably and there appears to be more than one other eucalypt species involved in producing these hybrid progeny. It is of scientific interest that those other eucalypt species that are hybridizing with the Mongarlowe Mallee be determined with certainty.

Performance Indicator 7.2

Within three years a genetic study investigating the above is completed, funding permitting.

Specific Objective 8: Maintenance of an effective Recovery Team.

Action 8: NPWS convene Recovery Team meetings at least annually.

Recovery Team meetings will be required on a regular basis (at least annually) to review progress of the recovery program and ensure all interested parties are fully informed.

Performance Indicator 8

A Recovery Team meeting is convened by NPWS at least annually for the life of this Plan.

7 Implementation

Table 1 allocates responsibility for the implementation of Recovery Actions specified in this Plan to relevant government agencies and/or parties for a period of five years and identifies costs associated with each Recovery Action. The total estimated cost for the implementation of these actions is $78,950. The majority of the funds will be provided from existing resources within the NPWS. $16,100 of remaining NHT funding previously received from Environment Australia (EA) will also assist with the implementation of this Plan.

At least an additional $5,000 of unsecured funds is required to implement some of the actions. These additional funds will be sought from various sources, including corporate sponsorship and other external funding sources. Some of the proposed actions are currently uncosted.

8 Social and Economic Consequences

The owners of two of the sites near Mongarlowe are highly supportive about the protection of the habitat of the Mongarlowe mallee on their properties and the continued protection of these sites would cause no social or economic costs. The site near Windellama is owned by a mining company that is using the adjacent land for commercial activities. The protection of the two individuals at this site will impose some operational costs on the company, but these costs have already been imposed through the MSC Conditions of Consent attached to the landfill approval.

The main social benefit of conserving the habitat in which the Mongarlowe Mallee survives, is in meeting the desire of many in the community that further loss of species, as well as the ecological communities in which they occur, is prevented.

9 Roles and Interests of Indigenous People

The Batemans Bay and Pejar Local Aboriginal Land Councils represent the indigenous people in the areas where the Mongarlowe Mallee occurs and have been sent a copy of the draft Recovery Plan. Their comments on the draft have been sought and will be considered in finalising the Plan. It is also the intention of the Recovery Team to consider the roles and interests of these indigenous communities in the implementation of the recovery actions identified in this Plan.

10 Biodiversity Benefits

The conservation of this species will also benefit parts of the localised community in which it occurs.

11 Preparation Details

This Plan was prepared by John Briggs and Genevieve Wright of NPWS and in consultation with the landowners of the sites supporting the Mongarlowe Mallee. The Plan was edited by Michael Saxon of NPWS.

12 Review Date

In relation to its status as the State-endorsed Recovery Plan for the Mongarlowe Mallee, any major changes to this Recovery Plan will require the revised Plan to be placed on public exhibition in NSW and re-approval by the NSW Minister for the Environment. The NPWS or Environment Australia should be contacted if it is believed any change to the Recovery Plan or to the Recovery Program should be considered. This Recovery Plan is to be formally reviewed by the NPWS and the landowner and lessee within five years from the date of its publication.

13 References

Briggs, J.D. & Leigh J.H. (1990). *Delineation of Important Habitats of Threatened Plant Species in South-eastern New South Wales*, 312 pp. Research Report to the Australian Heritage Commission. (CSIRO: Canberra).

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Gunninah Environmental Consultants (1998). Flora & Fauna Assessment – proposed landfill and concrete recycling plant * near Windellama. In Environmental Impact Statement Vol. 2, Supplementary Reports for property * via Windellama, Mulwaree LGA. (Hirst Consulting Services Pty Ltd; Lane Cove).

* Property name withheld for site security reasons.

14 Acronyms Used in this Document

DLWC – Department of Land and Water Conservation

EP&A Act – NSW *Environmental Planning and Assessment Act 1979*

ESD – Ecologically Sustainable Development

EPBC Act – Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*

NPW Act – NSW *National Parks and Wildlife Act 1974*

NPWS – NSW National Parks and Wildlife Service

NVC Act – NSW *Native Vegetation Conservation Act 1997*

TSC Act – NSW *Threatened Species Conservation Act 1995*

Table 1: Estimated costs, funding source and responsible parties for implementing the actions identified in the Mongarlowe Mallee Recovery Plan.

Action No.	Action Description	*Priority	^Feasibility	Responsible Party	Fund source	Cost Estimate ($'s/year)					Total Cost ($'s)
						02-03	03-04	04-05	05-06	06-07	
1.1	Revegetation to protect the two Mongarlowe Mallee individuals and their habitat near Windellama	1	80 %	NPWS	'NHT'[1]	1,400	10,000	0	0	0	**10,400**
					'cash'	5,000	0	0	0	0	**5,000**
					'in kind'	0	1,400	1,400	700	700	**4,200**
				Landfill company	'in kind'	350	700	350	0	0	**1,400**
1.2	Fencing of Mongarlowe Mallee habitat near Windellama	1	100%	Landfill company	'in kind'	0	5,000	0	0	0	**5,000**
1.3	Prevention of leachate from proposed landfill near Windellama impacting on Mongarlowe Mallee habitat	2	80%	Landfill company	'in kind'	0	Uncosted	Uncosted	Uncosted	Uncosted	**Uncosted**
2.1	Visitation to the Windellama site of the Mongarlowe Mallee to be regulated and monitored	2	90%	NPWS/Recovery Team	'in kind'	700	700	700	700	700	**3,500**
				Landfill company	in kind'	350	350	350	350	350	**1,750**
2.2	Monitoring of environmental impacts on the Mongarlowe Mallee site at Windellama	2	80%	NPWS/Recovery Team	'in kind'	0	1,400	700	700	700	**3,500**
				Landfill company	'in kind'	0	Uncosted	Uncosted	Uncosted	Uncosted	**Uncosted**
2.3	Investigate any existing potentially adverse changes to the hydrology of the area in the vicinity of the Mongarlowe Mallee plants near Windellama, and remediate if necessary	2	50%	Mining company	'cash'	Uncosted	Uncosted				**Uncosted**
3.1	Undertake liaison with private landholders	1	100%	NPWS	'NHT'[1]	700	0	0	0	0	**700**
					'in kind'	0	700	700	0	0	**1,400**
3.2	TSC & MSC to include an advisory note recording the presence of these species on s. 149 Certificates for the relevant properties.	2	100%	TSC & MSC	'in kind'	0	350	0	0	0	**350**
3.3	Identification and nomination of Critical Habitat	2	100%	NPWS	'in kind'	0	1,400	1,400	0	0	**2,800**
				Recovery Team	'in kind'	0	700	700	0	0	**1,400**
4	Undertake further aerial survey for the Mongarlowe Mallee	2	80%	NPWS	'in kind'	0	1,050	0	0	0	**1,050**
					'NHT'	0	4,000	0	0	0	**4,000**
5.1	Undertake additional combinations of hand pollination between the four flowering	2	50%	NPWS	'in kind'	1,050	1,750	1,750	1,750	1,750	**8,050**

	individuals										
5.2	Investigate various vegetative propagation techniques	2	80%	Consultant	'cash'	0	Uncosted	Uncosted	Uncosted	0	**Uncosted**
6.1	Investigate suitable sites within potential natural habitat of the Mongarlowe Mallee for the establishment of a genetically diverse ex-situ population	2	80%	NPWS	'in kind'	1,750	1,750	1,750	700	700	**6,650**

Action No.	Action Description	*Priority	^Feasibility	Responsible Party	Fund source	Cost Estimate ($'s/year) 02-03	03-04	04-05	05-06	06-07	Total Cost ($'s)
6.2	Distribute a range of Mongarlowe Mallee genotypes to Botanic Gardens that have suitable climatic conditions	2	100%	NPWS	'in kind'	0	700	0	700	0	**1,400**
7.1	Undertake studies using appropriate genetic research techniques such as the use of DNA sequencing to confirm, or otherwise, the presumed clonal structure of each of the wild plants (mallee clumps)	2	80%	Research Institution	Uncosted	Uncosted	Uncosted	Uncosted	Uncosted	Uncosted	Uncosted
7.2	Undertake studies using appropriate genetic research techniques such as the use of DNA sequencing to determine the contribution of other eucalypt species to the genetic make-up of the progeny resulting from various natural and manipulated pollination events	2	80%	Research Institution	Uncosted	Uncosted	Uncosted	Uncosted	Uncosted	Uncosted	Uncosted
8	Maintain of an effective Recovery Team	2	100%	NPWS	'in kind'	1,400	1,400	700	700	700	4,900
				Recovery Team	'in kind'	3,000	3,000	1,500	1,500	1,500	10,500
Total					**'NHT'** [1]	2,100	14,000	0	0	0	**16,100**
Total					**'cash'**	5,000	0	0	0	0	**5,000**
Total					**'in kind'**	8,600	22,350	12,000	7,800	7,100	**57,850**
Total					**'cash' + 'in kind' +'NHT'** [1]	**15,700**	**36,350**	**12,000**	**7,800**	**7,100**	**78,950**

15 Costing Explanations

Costing is based on 2003 dollar rates.

Where *fund source* is listed as 'cash', funding will be sought from sources such as NHT, industry sponsors, the State Biodiversity Program and internal NPWS threatened species budget.

Salary for 'in-kind' contributions is calculated at $350/day, which includes officer salary, provision of office space, vehicles, admin support and management.

* Priority ratings as defined by Commonwealth Recovery Plan Guidelines: 1 - action critical to prevent extinction, 2 - action prevents negative impact short of extinction,

^Feasibility assessment reflects estimated chance of success of the action on a scale of 0-100%.

[1] Funding obtained by DLWC from NSW State Biodiversity Program

[2] Funding already allocated from the Commonwealth's Natural Heritage Trust Endangered Species Program

Making a submission regarding this Draft Recovery Plan

You are invited to make a written submission to the NPWS regarding this draft Recovery Plan. To make your submission as effective as possible, please:

- refer to the section or action of the plan you wish to address;
- briefly explain the reasons for your comments,
- providing source information or examples where possible; and
- provide your name and address to enable receipt of your submission to be acknowledged.

The NPWS will consider all written submissions received during the period of public exhibition and must provide a summary report of those submissions to the Minister for the Environment prior to final approval of this Recovery Plan.

Please note, that for the purposes of the NSW *Privacy and Personal Information Protection Act* 1998 any comments on this draft Recovery Plan, including your personal details, will be a matter of public record and will be stored in the NPWS records system. Following approval of the plan by the Minister, copies of all submissions, unless marked 'confidential', will be available, by arrangement, for inspection at the NPWS office responsible for the preparation of the Recovery Plan.

Should you not wish to have your personal details disclosed to members of the public once the Recovery Plan has been adopted, please indicate below whether you wish your personal details to remain confidential to NPWS and not available for public access. Further information on the *Privacy and Personal Information Protection Act* 1998 may be obtained from any office of the NPWS or from the website: www.npws.nsw.gov.au.

Submissions should be received no later than the advertised date. Submissions should be addressed to:

The Director-General
c/o NPWS, Threatened Species Unit
Southern Directorate
PO Box 2115
Queanbeyan NSW 2620
Ph: (02) 6298 9700

Submission regarding the Draft Recovery Plan for the Mongarlowe Mallee

Please ensure that you provide the information in the box below if you do not use the following form to make your submission.

Name Individual/ Organisation: .....

.....

Postal Address .....

.....

.....

Postcode: ..... Contact Number(s): .....

Date: .....

❒ Yes, please keep my personal details confidential to the NPWS

Submission:

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

43 Bridge Street
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