Appendix G

Threatened Plant Management Plan

Threatened Plants Management Plan

Mt Emerald Wind Farm

Report prepared for RPS Australia Asia Pacific (Cairns) for MEWFPL

September 2016

Threatened Plants Management Plan

Mt Emerald Wind Farm

Final Report

Simon Gleed

7th September 2016

Report Prepared for RPS Australia Asia Pacific (Cairns) for MEWFPL

Disclaimer

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Simon Gleed undertook the fieldwork and preparation of this document in accordance with specific instructions from RPS Australia Asia Pacific (Cairns), to whom this document is addressed. This report has been prepared using information and data supplied by RPS Australia Asia Pacific (Cairns) and other information sourced by the author.

The conclusions and recommendations contained in this document reflect the professional opinion of the author based on the data and information supplied and available at the time of the work. The author has used reasonable care and professional judgment in the interpretation and analysis of the data. The conclusions and recommendations must be considered within the agreed scope of work, and the methodology used to perform the work, both of which are outlined in this report.

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Simon Gleed	1 (electronic)	S. Gleed

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1.0 SUMMARY

The Mt Emerald Wind Farm site provides important habitat and refuge areas for threatened plants. These plants are endemic to the region and in many instances, are only found or have significant populations in the vicinity of Mt Emerald Wind Farm project site on the Herberton Range.

Six threatened plant species are confirmed to be present within the project footprint and could be impacted during construction, maintenance and decommissioning of the wind farm. These plants are listed under either the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the Queensland *Nature Conservation Act 1992* (NC Act). Some species are listed under both legislation.

Major threats to the survival of the conservation significant species include altered fire regimes, weed invasion, and physical clearing and modification of critical habitats.

This Threatened Plants Management Plan details the distribution, habitat, ecology, conservation status, threats and management actions relating to the following threatened plant species:

Acacia purpureopetala (Purple-flowering Wattle) - Critically Endangered/Endangered (EPBC Act / NC Act);

Grevillea glossadenia (no common name) - Vulnerable / Vulnerable (EPBC Act / NC Act);

Homoranthus porteri (no common name) - Vulnerable / Vulnerable (EPBC Act / NC Act);

Melaleuca uxorum (no common name) - Endangered (NC Act);

Plectranthus amoenus (Plectranthus) - Vulnerable (NC Act); and

Prostanthera clotteniana (Mint Bush) - Critically Endangered/Endangered (EPBC Act / NC Act).

To provide an indication of "rarity" of each of the threatened plant species in terms of the numbers of individuals or area of representation of populations on the Mt Emerald Wind Farm site, the threatened species are ordered as follows (rarest first):

1) *Acacia purpureopetala* - exceptionally rare, with only 18 plants seen in a very small area.

2) *Melaleuca uxorum* - exceptionally rare and found in the proposed road network as one thicket of a small population measuring 7 x 5 metres.

3) *Prostanthera clotteniana* - exceptionally rare and found at only one location with approximately 30 plants seen on a proposed access road.

4) *Plectranthus amoenus* - scattered individuals over rock pavement habitat and mostly restricted to north of the 275 kV powerline.

5) *Homoranthus porteri* - several individuals which form dense thickets. The main population area is south of the 275 kV powerline.

6) *Grevillea glossadenia* - the most widespread threatened plant on the wind farm site, but primarily restricted to south of the 275 kV powerline.

The listing above **DOES NOT** infer importance, and all threatened plants should be managed in accordance with this plan.

2.0 INTRODUCTION

2.1 Project Description

Mount Emerald Wind Farm Pty Ltd (MEWFPL) proposes to construct and operate a wind farm located approximately 20 km SSW of Mareeba on the Atherton Tablelands in north Queensland.

Given the nature of the project to efficiently and effectively harness wind energy, the wind turbine generators (WTG's) are located on high points through the project site. The northern half of the site has broad, rolling hills, with dissected areas found in ravines and gorges; whereas the land to the south of the existing 275 kV powerline is markedly rugged and steeply dissected, rendering the highest points a series of narrow ridges and rocky knolls with steep drop-offs on adjacent slope faces.

2.2 Project Components

The wind farm will consist of a maximum of 63 hollow tower WTG's, which will be approximately 80 m high with 55 m diameter rotor blades.

The wind farm will provide energy to feed into the main electricity grid infrastructure currently provided by the 275 kV Chalumbin to Woree powerline. The WTG's will be connected and linked by a series of access tracks and underground cabling.

Other infrastructure and facilities to be constructed within the wind farm project site include a contractors site compound, a laydown area, a substation and an associated substation operation and management building. The location of the works and layout of the wind farm infrastructure are shown in **Figure 1**.

2.3 Duration and Intent of the Threatened Plants Management Plan

This Threatened Plant Management Plan is effective for the construction, operation and decommissioning stages of the Mt Emerald Wind Farm. The management strategies in this Plan are intended to be adapted where specific circumstances require modified or different approaches. Situations where adaptive management approaches may be required include for example:

- weather events that might otherwise prevent normal management strategies to be performed;
- limited knowledge or absence of data and information specific to a certain issue. For example, limited knowledge of the ecology of a plant species;
- significant changes to the project layout, operation or decommissioning.

The Plan is intended to be "flexible" and will require an on-going review process, with specific amendments or recommendations made to the Plan (if required) annually. In the event that a significant management issue arises and requires attention before the annual review, then adaptive management will need to be implemented in a timely manner to ensure an efficient response.

The Plan's overarching intent is to provide guidance to avoid or minimise adverse impacts to threatened plant species and their respective habitats listed under the Queensland NC Act and the Commonwealth EPBC Act.

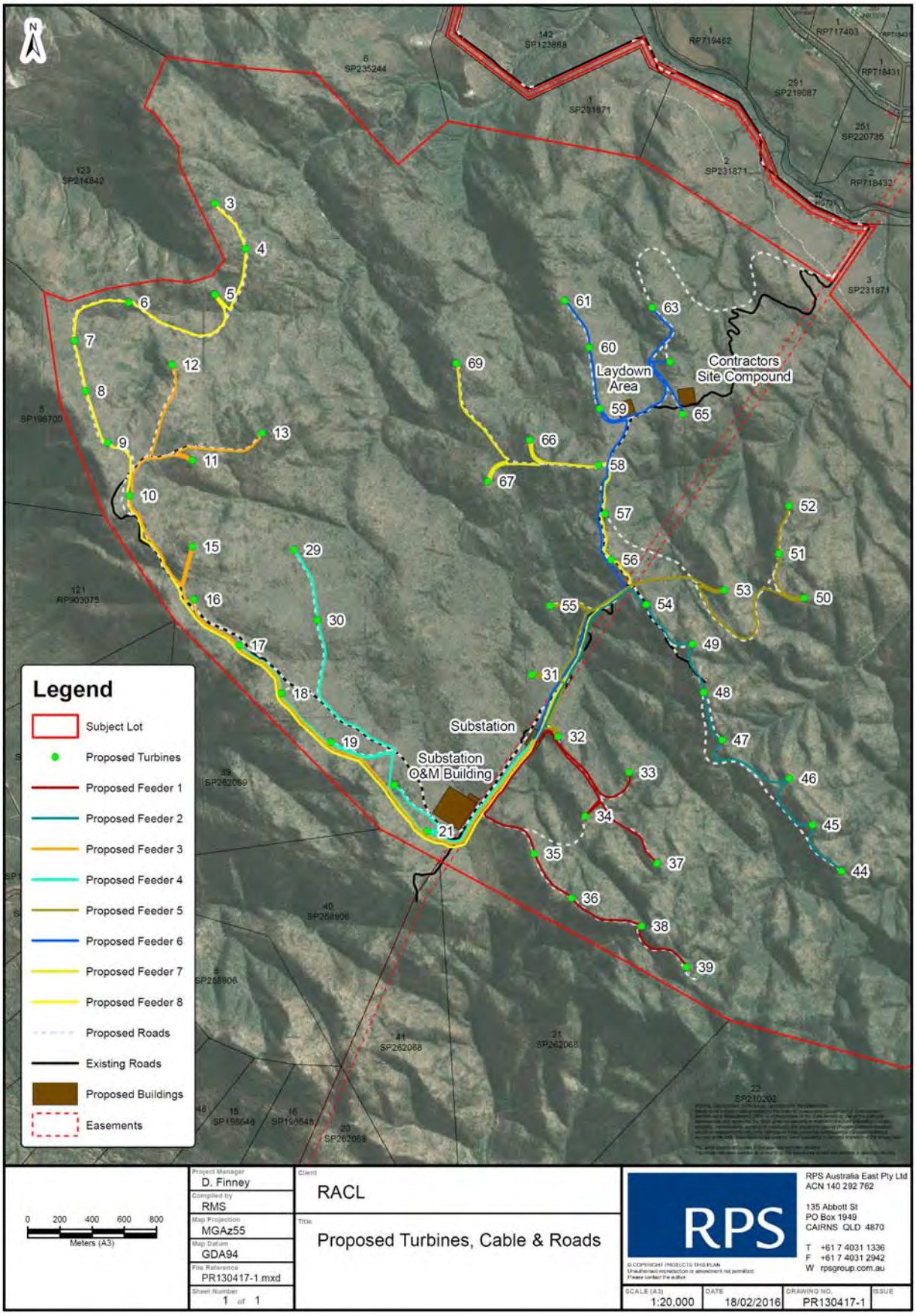


Figure 1. Layout of the Mt Emerald Wind Farm

2.4 Project Stages

The main stages of the wind farm project are:

Planning & Approvals: Environmental field surveys and investigations; Environmental Impact Statement; conditional approval under the EPBC Act.

Construction: Includes pre-clearance surveys and micro-siting of WTG's; clearing and construction of tracks, WTG's; road infrastructure and other facilities. Rehabilitation commences. Weed and threatened plants management commences. Baseline environmental monitoring commences.

Operation: Construction of WTG's and associated infrastructure completed. Environmental safeguards in place and functional. Continued and progressive rehabilitation and environmental monitoring. Weed and threatened plants management continues. Periodic review of management plans and management strategies and actions.

Decommissioning: Re-widening of track and road network to allow for heavy machinery access and removal or replacement of WTG's. Weed and threatened plants management continues. Rehabilitation of disturbed areas commences.

2.5 Project Timing

Preliminary investigations of the site including environmental and planning have been undertaken since 2010. The project is presently approved under the EPBC Act with conditions. Construction works are expected to commence in the latter half of 2016. Completion and operation of the wind farm is expected in 2018.

2.6 Legislative Context

The plants described in this Threatened Plants Management Plan are listed under Commonwealth or Queensland legislation. Some species are listed under both. The two pieces of legislation that are relevant are:

- *Environment Protection and Biodiversity Act 1999* (Commonwealth) - referred to in this document as the EPBC Act.
- *Nature Conservation Act 1992* (Queensland) - referred to in this document as the NC Act.

The plant species listed under the legislation with their respective status which are confirmed to occur in the wind farm project footprint are summarised in **Table 1**.

Table 1. Conservation significant plant species found in the Mt Emerald Wind Farm project footprint.

Species	Common Name	Form	EPBC Act[1]	NC Act[1]
Acacia purpureopetala	Purple-flowering Wattle	Shrub	CE	V
Grevillea glossadenia	No common name	Shrub	V	V
Homoranthus porteri	No common name	Shrub	V	V
Melaleuca uxorum	No common name	Shrub	-	E
Plectranthus amoenus	No common name	Semi-succulent shrub	-	V
Prostanthera clotteniana	Mint Bush	Shrub	CE	E

[1] Conservation status: CE - Critically Endangered; E - Endangered; V - Vulnerable. Hyphen indicates the species is not listed.

2.6.1 Conditions of EIS approval

The EIS (Environmental Impact Statement) compiled in compliance with the EPBC Act was approved with conditions in November 2015. Several aspects of this plan address key components of the conditions in respect of avoiding and minimising impacts to EPBC Act listed threatened species.

In relation to this Threatened Plants Management Plan, the following conditions of the approval are relevant.

General Conditions (listed in the EPBC Act approval)

1. The action is limited to the construction of a maximum of 63 wind turbines and associated infrastructure on the wind farm site.

2. To minimise impacts to EPBC Act listed threatened species, the approval holder must not disturb more than 58 ha of habitat for EPBC Act listed threatened species on the wind farm site.

3. Prior to commencement of the action, the approval holder must submit a Turbine Location and Development Footprint Plan identifying the final position of all turbines, access roads and associated operational and maintenance infrastructure, for the written approval by the Minister.

   Note: The approval holder may undertake micro-siting of turbines.

4 The Turbine Location and Development Footprint Plan must demonstrate how the approval holder has avoided and minimised disturbance to denning habitat for the Northern Quoll (*Dasyurus hallucatus*) and to *Grevillea glossadenia* and *Homoranthus porteri.*

3.0 DESCRIPTION OF EXISITING ENVIRONMENT

The Mt Emerald Wind Farm site is located at the northern limit of the Herberton Range and immediately north of Mt Emerald. The landscape is characterised by steeply dissected hills, rocky terrain and areas of precipitous ravines and narrow ridges. The broad geology of the site is mapped as the Walsh Bluff Volcanics, which comprises fine-grained rhyolite.

3.1 Vegetation

The predominant vegetation cover over the project site is a mosaic of sclerophyll woodlands, shrublands and heathlands.

Common trees of the woodlands include Lemon-scented Gum (*Corymbia citriodora*), Yellow Stringybark (*Eucalyptus mediocris* - this species was referred to its former name in the EIS as *E. portuensis*), Range Bloodwood (*C. abergiana*), Ironbark (*E. crebra*), Dead Finish (*E. cloeziana*), Cypress Pine (*Callitris intratropica*), Silver-leaf Ironbark (*E. shirleyi*), Orange Jacket (*C. leichhardtii*), White Stringybark (*E. reducta*), and *E. lockyeri.* The dominant grasses are usually Kangaroo Grass (*Themeda triandra*) and *Arundinella setosa*. Woodlands are most frequent over broad slopes, flats and rolling hills with less dissected surfaces.

Shrublands is characterised by many species, but typically include Sheoak (*Allocasuarina littoralis*), (*Xanthorrhoea johnsonii*), *Eucalyptus lockyeri*, Wattle (*Acacia aulacocarpa*), *Homoranthus porteri*, *Grevillea glossadenia*, and stunted forms of Range Bloodwood (*Corymbia abergiana*). Shrublands are generally found in relation to the ridge environment where thin rocky soils prevail. The endangered shrub *Melaleuca uxorum* is found on the boundary of this vegetation type with taller woodlands. It is found elsewhere in association with the montane heathland and rock pavements described below.

Heathlands have a special and diverse group of plants which include species such as Broom (*Jacksonia thesioides*), Grass Tree (*Xanthorrhoea johnsonii*), *Gompholobium nitidum*, the wattles *Acacia calyculata* and *A. whitei*, the grass *Cleistochloa subjuncea*, emergent stunted forms of *Eucalyptus lockyeri*, shrubs such as *Grevillea glossadenia* and *Homoranthus porteri*; and compact shrublets such as *Cryptandra debilis*, *Mirbelia speciosa* subsp. *ringrosei*, *Pseudanthus ligulatus*, *Zieria whitei*, *Boronia occidentalis* and others. The critically endangered *Acacia purpureopetala* and *Prostanthera clotteniana* grow in this vegetation type. It is referred to in the EIS as montane heathland, because of its reliance on high elevation aspects and very thin soils.

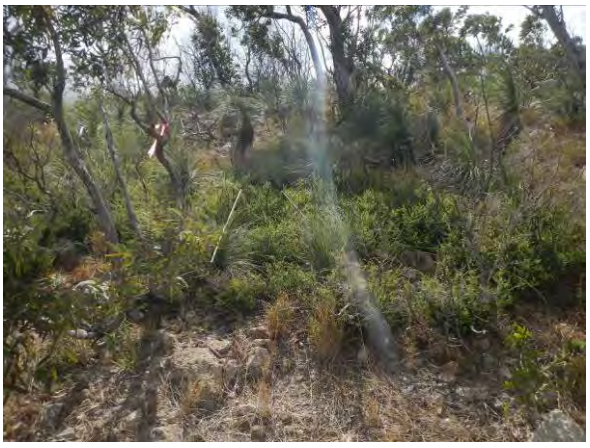
A feature of the montane heathland and shrublands at high elevation is the presence of rock pavements and areas of poorly vegetated rock outcrops. This particular habitat supports few large plant species because of the near-absence of soil or growth medium on their surfaces. The soil that does develop is trapped in rock hollows, scoops and crevices between rock plates and boulders, and is developed from small plants such as lichens, mosses and the remains of rock ferns (*Cheilanthes* spp.). This plant matter integrates with weathered rock material to form a soil that has the texture of peat, where in wetter times the absorbent nature of the medium is able to store water for longer periods. Plants on rock pavements include the Resurrection Plant (*Borya septentrionalis*), *Pseudanthus ligulatus*, scattered shrubs of *Grevillea glossadenia*, *Plectranthus* species (including the threatened *P. amoenus*) and occasionally, sentinel specimens of Cypress Pine (*Callitris intratropica*). Grasses are sparsely represented and can include Five Minute Grass (*Tripogon loliiformis*) and *Eriachne humilis*. *Eriachne mucronata* is often found around the edges of rock pavements. Some rock pavements are entirely covered by Firegrass (*Schizachyrium pachyarthron*).

3.2 Significance of the Ridge Environment and Key Plant Habitats

The high altitude ridges in the wet tropics bioregion section of the site (south of the 275 kV powerline) are sensitive environments that serve as important habitats for plants and the poorly represented montane heathland and shrubland mosaic found around 900 m ASL. Here the cloud base is a determinant of the moisture regime in relation to plants and their exposure to extreme conditions.

The land south of the 275 kV powerline holds the highest levels of species diversity and endemism, where many species are restricted to and have adapted to the harsh environment of exposed high elevation points on ridges, rock pavements and areas of skeletal soil. This montane habitat supports six species of plants which are listed as critically endangered, endangered and vulnerable under Queensland and Commonwealth legislation. Many other species, not listed under legislation, are restricted to the montane heathland along and on the edges of narrow ridges and rock pavement areas.

The rugged nature of the land with steep rocky slopes, bare rock pavements, outcrops and cliffs provides a unique environment for plants, and it is these characteristics which act as a refuge and reduces the effects of the severity and intensity of bush fires due to the low levels of flammable material such as grasses. Consequently, the conservation significant plants are found almost exclusively in fireproof habitats and niches. The protection from fire is a critical attribute, which renders most of the ridge tops and rock pavements as significant habitats where many threatened plants are able to persist.



Habitat of *Melaleuca uxorum* on edge of low woodland and shrubland. Outside of the tree and taller plant layer, montane heathland is present.

Matrix of low shrubland and montane heathland with *Homoranthus porteri* and *Acacia aulacocarpa*. This the specific habitat of *Acacia purpureopetala* on the wind farm site.

The rocky area in centre of photo is fire-protected habitat for *Prostanthera clotteniana*.

Montane heathland over large area of rock, here dominated by *Borya septentrionalis* and *Pseudanthus ligulatus*.

4.0 DESCRIPTIONS OF THREATENED PLANT SPECIES

The following descriptions are of threatened plants found on the Mt Emerald Wind Farm project site. To facilitate identification, the descriptions use characteristics of the plants as they are seen in the field within the project area. Detailed species distribution mapping is provided at the end of this document.

4.1 *Acacia purpureopetala*

Purple-flowering Wattle Family: Mimosaceae

Conservation Status: EPBC Act 1999: Critically Endangered; NC Act 1992: Vulnerable

Description

Habit: The Purple-flowering Wattle *Acacia purpureopetala* is a prostrate shrub with a spreading habitat growing to approximately 50 cm high. Most plants are lower and usually attain a height of 20-35 cm. Older plants have a distinctive "rosette" pattern to the branches, where they tend to radiate outwards in a circular fashion and arch downwards. Mature plants may spread to a diameter of one metre or more.

Branches are distinctly dull red, angular in cross-section, slightly hairy and often with blunt prickles formed by the bases of old phyllodes (leaves). **Leaves** (phyllodes) are grey green, small (25 mm long and 10 mm wide) and can be covered with fine pale hairs. The leaf apex is terminated by a short bristly point.

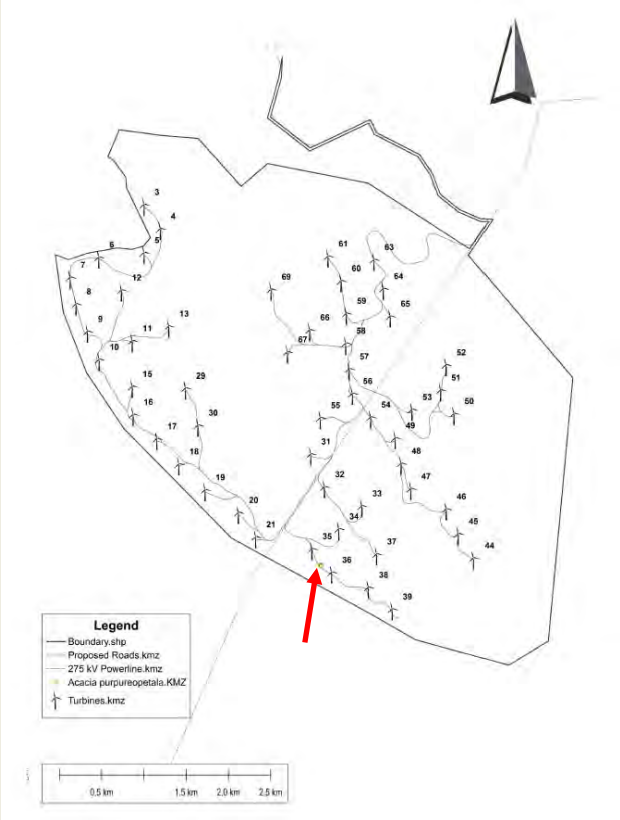
Flowers are a characteristic feature which can draw attention to the plant's presence. They are ball-shaped about 10 mm diameter or less and are pink to pale purple. Flowering occurs between December through to about July, but sporadic flowering can occur during other months. **Fruit** is a flattened pod with swellings where the seeds are held inside, up to 30 mm long and 8 mm wide. The pod when fresh is often a similar colour to the leaves and can be quite obscure. When dry it turns brown, splits open lengthways and contains about 1 to 5 hard, black seeds.

Seedlings in the early stages of development have a characteristic "bipinnate" leaf appearance, but later this feature falls off the seedling and the leaves are similar to those found on adult plants. Seedlings are mostly single-stemmed, green and erect and are often covered in fine pale hairs.

Distinguishing characteristics are the low-growing habit, reddish stems that radiate in a circular fashion from the main stem, small grey-green phyllodes, and pink-purple ball flowers. *Acacia purpureopetala* is the only wattle in Australia with pink or purple flowers. All other species of wattle in the region have white, cream or yellow flowers (in rods or balls).

Distribution: *Acacia purpureopetala* is endemic to northern Queensland and has a restricted distribution with populations between Herberton and Irvinebank, Stannary Hills, and Silver Valley. The Mt Emerald Wind Farm site populations represent the most north-eastern distribution of the species, where it is found at only a single location between WTG's 35 and 36.

The location of known populations of *A. purpureopetala* on or near the Mt Emerald Wind Farm site is shown in **Figure 2**.



Location of *Acacia purpureopetala* - Mt Emerald Wind Farm.

Acacia purpureopetala foliage and flowers. Photo SG

Acacia purpureopetala growth habit. Photo TDR

Acacia purpureopetala fruit pod. Photo SG

Acacia purpureopetala seedling. Photo SG

Figure 2: *Acacia purpureopetala* (Purple-flowering Wattle)

4.2 *Grevillea glossadenia*

(No common name - a Grevillea) Family: Proteaceae

Conservation Status: EPBC Act 1999: Vulnerable; NC Act 1992: Vulnerable

Description

Habit: *Grevillea glossadenia* (no common name) is a well-branched and often rounded shrub which grows to approximately 2 metres tall. On the Mt Emerald Wind Farm site, this species rarely gets much taller than 1.6 m. The **leaves** of *G. glossadenia* are elliptic with entire margins and about 12 cm long. They are not divided or lobed like many other Grevillea species in Australia. The upper surface of the leaf is typically light green, and the lower surface is characteristically silvery, with a slight metallic sheen, where the veins can be easily seen.

Flowers are mixture of yellow, orange and red and quite attractive and large enough to be easily see from a short distance.

Fruits are a follicle, which superficially resembles a pea pod. They are green when fresh and ripen to almost black, at which time they split open lengthways and contain one or two flattened and slightly papery seeds.

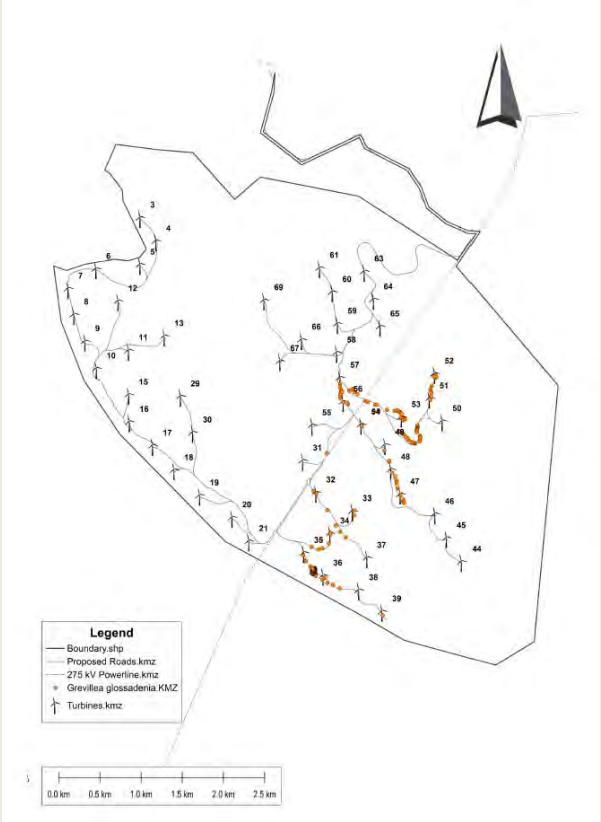
Seedlings have leaves similar in shape to the adult plants but are smaller.

Distinguishing characteristics of *G. glossadenia* are the silvery sheen on the lower leaf surface and the conspicuous red-yellow-orange flowers. In some areas and especially a few months after a bushfire, the seedlings can be seen growing densely around burnt and dead adult plants.

Habitat: *Grevillea glossadenia* grows in rocky soils or on ridges in exposed conditions or on the edges of woodlands. It rarely grows under woodland cover. Associated plants can include: *Eucalyptus lockyeri*, *E. mediocris*, *Corymbia abergiana*, *C. citriodora*, *Xanthorrhoea johnsonii* and the grasses *Themeda triandra* and *Cleistochloa subjuncea*.

Distribution: *Grevillea glossadenia* is endemic to northern Queensland and has a restricted distribution, with the main populations around Mt Emerald, Irvinebank and Silver Valley. The population on the Mt Emerald Wind Farm site is large when compared to other more dispersed populations in the region.

The location of known populations of *G. glossadenia* on or near the Mt Emerald Wind Farm site is shown in **Figure 3**. On the wind farm site it is found mainly close to and south of the 275 kV powerline and is widely distributed in this area. It is often encountered on the edges of existing tracks.



Location of *Grevillea glossadenia* - Mt Emerald Wind Farm.

Grevillea glossadenia foliage and flowers. Photo SG

Grevillea glossadenia growth habit. Photo SG

Grevillea glossadenia fruit pod. Photo SG

Grevillea glossadenia seedlings. Photo SG

Figure 3: *Grevillea glossadenia* (no common name - a Grevillea)

4.3 *Homoranthus porteri*

(No common name) Family: Myrtaceae

Conservation Status: EPBC Act 1999: Vulnerable; NC Act 1992: Vulnerable

Description

Habit: *Homoranthus porteri* (no common name) is an upright and spreading shrub which grows to approximately 2 metres tall and forms dense, woody thickets. On the Mt Emerald Wind Farm site this species rarely gets much taller than 1.7 m.

Leaves of *H. porteri* are narrow and linear, approximately 10 mm long and 1.5 mm wide, with entire margins and a pointed apex. Leaves are arranged oppositely and tend to be crowded towards the ends of the branches. The leaf veins are very difficult to see.

Flowers are pink to red and occasionally with white. They grow in "pairs" on the branches and are quite attractive. When in full flower, the flowers can be seen from some distance.

Fruits are difficult to come across and see and are a light brown dry, semi-woody capsule.

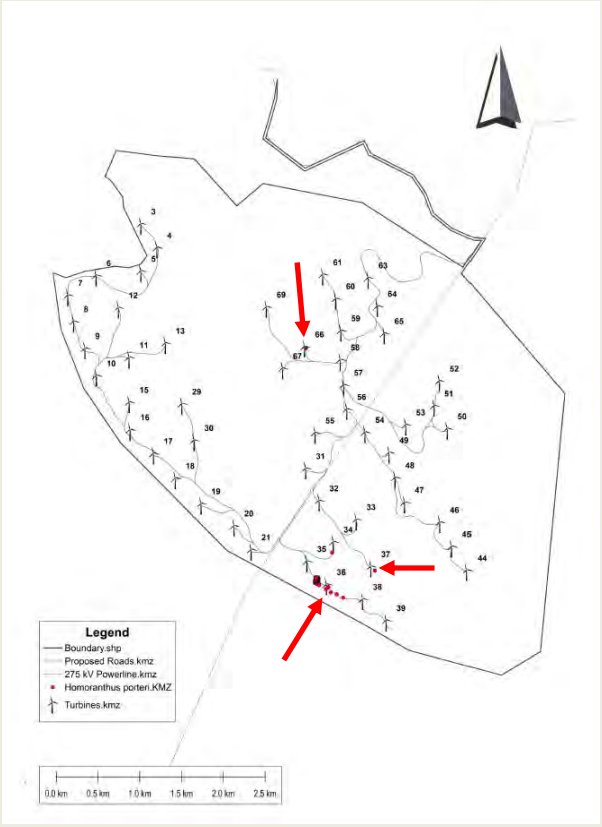
Seedlings have leaves similar in shape to the adult plants but are slightly smaller.

Distinguishing characteristics of *H. porteri* are its bright green foliage, narrow leaves and bright pink to red flowers that grow in pairs. Another feature is its preference for growing on or around the edges of rock pavements or large areas of bare rock.

Habitat: *Homoranthus porteri* grows on and around rock pavements and amongst wide areas of bare or poorly vegetated rocks and mostly on ridges or above very steep rocky slopes. It is seldom found under trees of woodlands. Associated species include *Acacia aulacocarpa*, *Leptospermum amboinense*, *Pseudanthus ligulatus*, *Grevillea glossadenia* and *Eucalyptus lockyeri*. Grasses include *Cleistochloa subjuncea*, *Cymbopogon obtectus*, *C. bombycinus* and *Aristida* spp. Stunted trees of *Corymbia abergiana* are sometimes found around the edges of rock pavements.

Distribution: *Homoranthus porteri* is endemic to northern Queensland and has a restricted distribution, with the main populations around Mt Mulligan, Mt Emerald, Watsonville, and south to near Ravenshoe. A disjunct occurrence of the species is found north-west of Townsville. The populations on the Mt Emerald Wind Farm site are large and significant in a regional context.

The location of known populations of *H. porteri* on or near the Mt Emerald Wind Farm site is shown in **Figure 4**. On the wind farm site the largest populations are found south of the 275 kV powerline along the ridge between WTG's 38 and 35. Another reasonably large population is found around the edge of the rock pavement at WTG 66.



Location of *Homoranthus porteri* - Mt Emerald Wind Farm.

Homoranthus porteri foliage and flowers. Photo SG

Homoranthus porteri growth habit. Photo SG

Homoranthus porteri habit on rock pavement. Photo SG

Homoranthus porteri typical habitat. Photo SG

Figure 4: *Homoranthus porteri* (no common name)

4.4 *Melaleuca uxorum*

(No common name) Family: Myrtaceae

Conservation Status: NC Act 1992: Endangered

Description

Habit: *Melaleuca uxorum* (no common name) is a low-growing, dense and stiff shrub, which grows to approximately 1 metre tall and forms very closely spaced, woody thickets.

Leaves of *M. uxorum* are light to mid-green and are arranged oppositely on the branches in a distinct pattern, where the pairs of leaves are at right-angles to each other (decussate). Leaves are small, scale-like and rounded with the tips curving backwards. They have a distinctive pointed apex giving the shrub a prickly texture.

Flowers are white and similar to a small bottlebrush flower with many stamens.

Fruits are a compact, rounded woody capsule and are grouped together and held tightly to the branches.

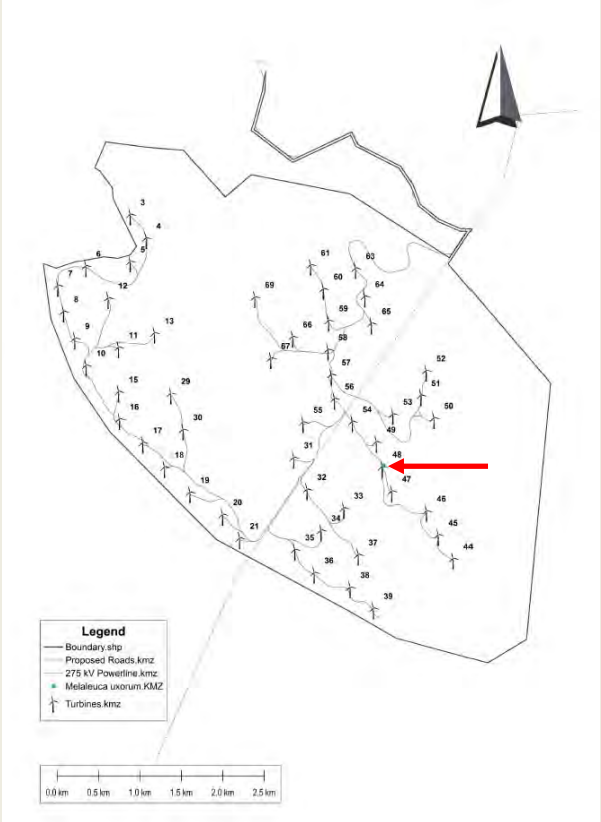
Seedlings have not be observed, but the juvenile foliage of *M. uxorum*, which is typically seen when plants regenerate after fire, is similar to the adult leaves and lighter green.

Distinguishing characteristics of *M. uxorum* are its low, dense thicket habitat and the small decussate, prickly scale-like leaves. Shrubs are prickly to touch, which is caused by the sharp, pointed apex of the leaf.

Habitat: *Melaleuca uxorum* grows on very rocky slopes and rock pavements and generally in exposed, wind-swept areas of ridges. Associated species include *Acacia aulacocarpa*, *A. calyculata*, *Pseudanthus ligulatus*, *Grevillea glossadenia*, *Eucalyptus lockyeri*, *E. mediocris*, and *Corymbia abergiana*. Grasses include *Cleistochloa subjuncea* and *Themeda triandra*. Grass trees (*Xanthorrhoea johnsonii*) are often present.

Distribution: *Melaleuca uxorum* is endemic to northern Queensland and has a very restricted distribution, where the species is represented by only 6 or 7 small populations on Mt Emerald and the wind farm site. The populations on the Mt Emerald Wind Farm site are therefore of very high significance in a regional context.

The location of the population of *M. uxorum* on the Mt Emerald Wind Farm site is shown in **Figure 5**. It is found on the eastern edge of the broad ridge between WTG's 48 and 49 just below the wind monitoring tower.



Location of *Melaleuca uxorum* - Mt Emerald Wind Farm.

Melaleuca uxorum foliage. Photo SG

Melaleuca uxorum regeneration after fire. Photo SG

Melaleuca uxorum fruit capsules. Photo SG

Melaleuca uxorum habitat below monitoring tower. Photo SG

Figure 5: *Melaleuca uxorum* (no common name)

4.5 *Plectranthus amoenus*

(Plectranthus) Family: Lamiaceae

Conservation Status: NC Act 1992: Vulnerable

Description

Habit: *Plectranthus amoenus* (Plectranthus) is a sparse open growing semi-succulent shrub with grey stout, ascending stems. The species grows to approximately 60-70 cm tall. The stems radiate outwards at the base from a central growth point.

Leaves of *P. amoenus* are thick and fleshy and covered with dense, pale hairs. Leaves have a felt-like texture. They are broad and have prominent raised veins. Leaves are aromatic when crushed. The veins are readily visible on both sides of the leaf and strongly raised on the lower surface.

Flowers are quite small (about 10 mm long), blue to purple and arise from a terminal stalk held above the main stems. The flowers are unscented.

Fruits are a small, dry papery capsule.

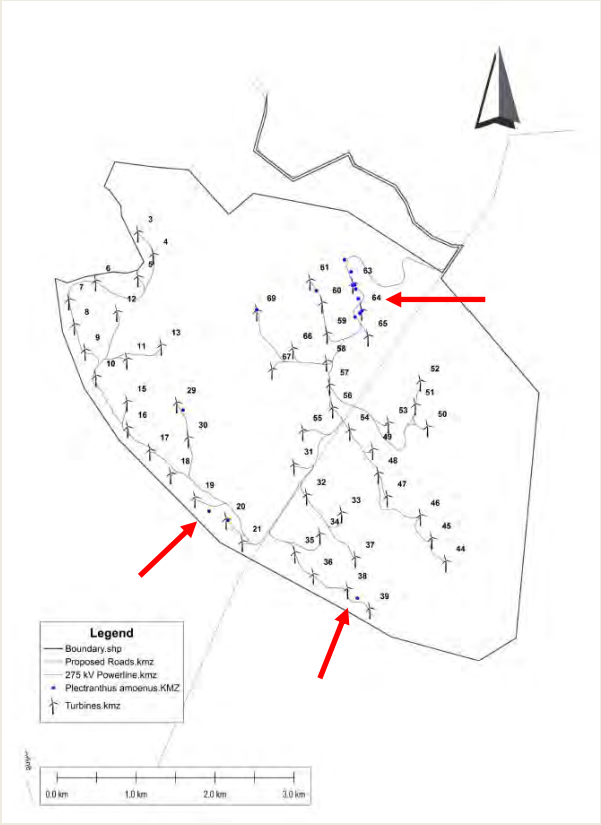
Seedlings have not be observed, but the juvenile foliage of *P. amoenus* is similar, but smaller than the adult leaves and the leaves are soft and felt-like to touch.

Distinguishing characteristics of *P. amoenus* are its sparse open growth habitat with only a few ascending grey and fleshy stems. The thick, soft and felt-like leaves are a feature of the species. Its preference for bare rock pavements is also the characteristic habitat.

Habitat: *Plectranthus amoenus* grows almost exclusively on rock pavements and large areas of bare rock in accumulated soil pockets and in crevices. The species has a strong association with the tree *Callitris intratropica* on the wind farm site. Associated species include the grass *Eragrostis schultzii* and the Cypress Pine *Callitris intratropica*.

Distribution: *Plectranthus amoenus* is endemic to northern Queensland and is primarily confined to the Herberton Range.

The location of the population of *Plectranthus amoenus* on the Mt Emerald Wind Farm site is shown in **Figure 6**. The largest populations are found north of the 275 kV powerline around WTG's 61, 63, 64 and 65. Isolated occurrences occur further south in the project area.



Location of *Plectranthus amoenus* - Mt Emerald Wind Farm.

Plectranthus amoenus foliage and flowers. Photo SG

Plectranthus amoenus underside of leaf. Photo SG

Plectranthus amoenus habit. Photo SG

Plectranthus amoenus typical habitat. Photo SG

Figure 6: *Plectranthus amoenus* (Plectranthus)

4.6 *Prostanthera clotteniana*

(Mint Bush) Family: Lamiaceae

Conservation Status: EPBC Act: Critically Endangered; NC Act 1992: Endangered

Description

Habit: *Prostanthera clotteniana* (Mint Bush) is a small erect, openly branched shrub which grows to about 1 metre tall. The Mt Emerald Wind Farm specimens grow to approximately 60 cm tall. Plants grow separately from each other and do not form thickets or dense shrubby areas.

Leaves of *P. clotteniana* are light green, opposite or in whorls of three. They are broader towards the apex and up to 35 mm long and 9 mm wide. On close inspection, both surfaces of the leaf are covered with fine, pale silky hairs which lay flat. The same hairs are found on the younger branches. The leaf veins are difficult to see. The apex of the leaf is drawn into a short point.

Flowers are pink to white (the wind farm population flowers are predominantly white) and about 10 mm, with attractive, lobed petals. The throat of the flower is streaked with pink to purple fine lines.

Fruits of *P. clotteniana* have not been observed, but is expected to be an inconspicuous dry capsule.

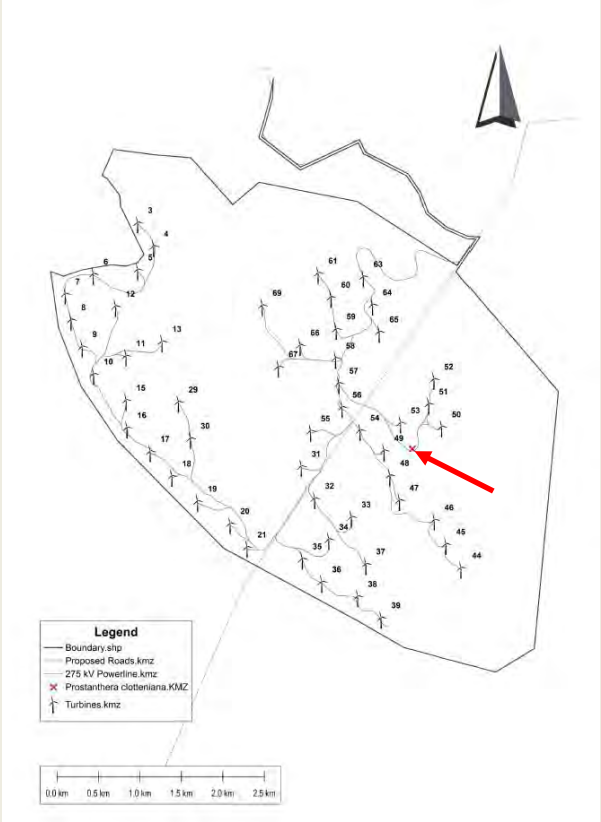
Seedlings have a similar erect growth habit of the adult plants but the features are much smaller (i.e. smaller leaves and less degree of branching).

Distinguishing characteristics of *Prostanthera clotteniana* are its low, open-branched erect growth habitat and attractive flowers. The grey branches with fine pale silky hairs is characteristic. When not in flower, this species is difficult to identify quickly and looks superficially similar to the widespread shrub *Platysace valida*.

Habitat: *Prostanthera clotteniana* grows in exposed rocky areas that are protected from hot fires. The species prefers the tops of steep rocky drop-offs and with a southeast aspect. Associated species include *Pseudanthus ligulatus*, *Grevillea glossadenia*, *Eucalyptus lockyeri* and *Xanthorrhoea johnsonii*. There can be woodland of *Eucalyptus reducta* in gullies and on slopes in adjacent areas. Grasses include *Cleistochloa subjuncea*, *Cymbopogon obtectus* and *Themeda triandra*.

Distribution: *Prostanthera clotteniana* is endemic to northern Queensland and is highly restricted. Populations are found near Ravenshoe, the Dinden State Forest to the north-east, and the single population of the Mt Emerald Wind Farm site. It has also been recorded from the Baal Gammon mine area near Watsonville, and at lower elevation around Oaky Creek. All populations are small.

The location of the population of *P. clotteniana* on the Mt Emerald Wind Farm site is shown in **Figure 7**. It is found on the eastern edge of the broad ridge south of WTG 53.



Location of *Prostanthera clotteniana* - Mt Emerald Wind Farm.

Prostanthera clotteniana foliage and flowers. Photo SG

Prostanthera clotteniana growth habit. Photo SG

Prostanthera clotteniana flower and branches. Photo SG

Prostanthera clotteniana habitat. Photo SG

Figure 7: *Prostanthera clotteniana* (Mint Bush)

5.0 IMPACTS TO THREATENED PLANTS AND HABITATS

Impacts are expected to occur during the construction and operational phases of the project. A range of new impacts will occur at the decommissioning stage; for example, tracks will require re-widening to allow for heavy machinery access.

The primary impacts are those associated with vegetation clearing at WTG construction pads and the linear clearing between WTG's. It is expected that the most severe effect of impacts will occur in the dissected land south of the 275 kV powerline, which coincides with the greatest representation of poorly represented and specialised habitats for threatened plants. Much of this habitat is found from 850 m ASL and above.

The removal of habitat in this altitudinal zone will have implications in regard to the total area of similar habitat for these plants found in the region. For example, clearing ridges around and above the 900 m contour will remove the key habitat for *Homoranthus porteri* and *Acacia purpureopetala*. These species are restricted to this type of particular habitat on the site.

5.1 Types of Impact

5.1.1 Vegetation and habitat clearing

Linear clearing causes edge effects, pathways for weeds, and potential for pathogens and diseases. Clearing also creates barrier effects with the potential to limit seed movement and genetic material across landscapes.

On a smaller scale, surface hydrology can be altered and redirected, which affects micro-habitat function in sensitive environments reliant on limited resources such as mosses, lichens and ferns which contribute to pockets of soil and the scarce growing medium required by threatened plants restricted to ridges and rock pavements. This is more applicable to narrow ridges where the actual habitat representation for threatened plants may only be in the order of 5-10 m wide in places.

Slow vegetation succession is also expected on ridges where soil development is minimal and of very low fertility. Plant species which occur along ridges are specialists and rely on special habitat and soil characteristics that may not be able to be replaced or rehabilitated to their original status.

Some plants of ridges are termed obligate seeders, where their regeneration capacity is only through production and germination of seed. This regenerative strategy differs from other plants of ridges and woodlands that may recover from resprouting from root or stem stock. Scalping of ridge top soils will remove the soil seed bank, and if excavated to a depth below the root zone, could seriously affect the species composition of regenerating vegetation.

5.1.2 Invasive weeds

Invasive weeds are introduced grasses and broadleaf plants (i.e. non-native species). Weeds displace native plants and habitats. They contribute to changed fire regimes, which negatively affect the structure, flora composition and habitat values of native vegetation. On the Mt Emerald Wind Farm site, invasive grasses and other weeds pose a significant threat to the natural values of the project area. Invasive weeds place adverse and unnatural pressure on the integrity and function of the vegetation of all aspects of the wind farm site, and notably the function of threatened plant habitats. Hence, it is crucial that weed management and control is actively and diligently practiced throughout all stages of the project.

Weed invasion results in loss of vegetation and landscape integrity. The impacts of weeds affects vegetation function, alters floristic composition, retards or stops natural plant regeneration and has a profound effect on the local fire ecology and dynamics. Species of weeds that have a high potential to enter the site through construction will be those found primarily along the access road edges; those which are already present at higher elevation; and a range of other deleterious species generally found in drier landscapes. Invasive weeds move into a site through human activity, on machinery and vehicles and by expansion of nearby weed populations (for example, along Kippen Drive).

5.1.3 Altered fire dynamics

Altered fire dynamics may occur as a result of increased fuel loads developing adjacent to newly cleared tracks. Changed fire ecology could result in the elimination of certain plant species or the promotion of different plant functional groups, and consequently, change the habitat micro-environment.

Obligate seeder species are killed by fire and regenerate through germination of seed stored in the soil seed bank; whereas, resprouters recuperate after fire by reshooting from stems or rootstock. Fire ecology (intensity, timing, duration etc) is critical for the successful regeneration of plant communities. As many rock areas are considered refuges, inappropriate fire regimes that breach the natural level of protection afforded by rock pavements and outcrops are likely to have a negative effect at least in the short-term, but possibly in the longer-term if the fire event is unnaturally severe.

The introduction of dense swards of grass (weeds or even native species) that are not typical of a particular vegetation type or habitat has the capacity to tilt fuel loads and could introduce unnatural fire events in formerly protected rock environments.

5.1.4 Erosion and sedimentation

Following track and WTG pad construction, an increased potential for soil erosion will be present. Different sections of the site have different soil textures and structures, and therefore, the potential for erosion will vary according to site-specific situations. Slope and rainfall intensity will also affect the rate and severity of soil erosion.

Sediment movement from construction and excavation areas in niche habitats for threatened plants has the potential to adversely alter the soil fertility and drainage status - both of which are crucial factors that if changed could displace threatened species from a particular habitat, and allow opportunistic weeds to quickly colonise more fertile soil environments.

5.2 Information Gaps Regarding Impacts

It is not fully understood what practices are best suited to rehabilitating the disturbed land and plant habitats of ridges dominated by rock cover. Natural plant regeneration is expected to be slow. The loss of fruticose and crustose lichens, mosses and ferns from cleared rock areas will affect the rate and status of soil generation on otherwise soilless landforms. This will have implications for the eventual plant species composition and success rates of rehabilitation.

On more dissected ridges, where a majority of threatened plants grow, it is expected that the original floristic composition and structure will not be able to be accurately reproduced through conventional rehabilitation treatment. This has implications for the rehabilitation and maintenance of specific habitat types for threatened plants.

6.0 THREATENED PLANTS MANAGEMENT STRATEGIES

This section outlines the environmental management strategies required for mitigating the impacts (section 5.0) on threatened plants and their habitats described in section 3.0. The strategies provide guidance on the overall management plan intent and its purpose to avoid or limit the impact to threatened plants and key habitats. The strategies also identify the desired management outcomes and standards.

The following management strategies are intended to target the impacts from pre-construction to post-construction of the wind farm, which includes the stage of decommissioning. Prior to the decommissioning stage and periodically throughout the operational stage, the management strategies are to be reviewed and amended to allow for unpredicted circumstances or events that require an adaptive management approach.

Management Strategy 1: Avoid direct impacts on threatened plant species and their habitats during construction, operation and decommissioning of the wind farm.

Management Strategy 2: Where direct impacts to threatened plants are unavoidable, reduce the level of impacts on threatened plant species and their habitats during construction, operation and decommissioning.

Management Strategy 3: Avoid indirect impacts on threatened plant species during construction, operation and decommissioning.

Management Strategy 4: Maintain and enhance the populations of threatened plant species and their habitats following completion of the wind farm construction.

6.1 Threatened Plants Management Actions

The broader management strategies described above form the basis for individual management actions. Specifically, management actions include the key components of management measures, monitoring, success indicators and corrective actions. These are detailed in **Table 2** to **Table 5** on the following pages.

Table 2. Threatened Plants Management Strategy 1.

MANAGEMENT STRATEGY 1	Avoid direct impacts on threatened plant species and their habitats	
Threatened Plants Management Actions	**Responsibility**	**Timing**
- Complete pre-clearance surveys in conjunction with surveyors, engineers and civil contractors prior to final decision on road alignment and position of WTG's.	Botanist/Environmental Officer/Senior Contractors	Pre-construction
- Align roads and cabling network, and micro-site WTG base pads in order to avoid physical disturbance to these species and the supporting habitat (see buffer below).	Environmental Officer	Pre-construction
- Identify and clearly mark all populations in vicinity of potential impact. Establish a minimum **30 metre** quarantine zone buffer around each population of ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***. No machinery or contractor work (except environmental) to be allowed in quarantine zone.	Botanist	Pre-construction
- Provide permanent signage: "Sensitive Environmental Area" in clear view of buffer edge of each population of ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***.	Environmental Officer	Pre-construction
- All contractors to be provided with identification guides/species profile sheets for each threatened plant species. - Contractors to be given site-specific threatened plant induction and familiarisation training. New contractors to be inducted prior to construction - when required.	Environmental Officer/Botanist/Contractors	Pre-construction and/or at stage when new contractor enters site.
- Constrain clearing and modification of narrow ridges to the absolute minimum to achieve useable road width.	Environmental Officer/Contractors	Construction
- DO NOT construct or direct turn-out drains in the vicinity of populations of ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***. - Maintain a minimum distance of 30 metres from sensitive population areas during construction of WTG pads.	Environmental Officer/Contractors	Construction
- Rehabilitate road edges in accordance with **Rehabilitation Plan** and increase areas of specific threatened plant habitat where possible. - ONLY native plant seed sourced from a local provenance is to be used. NO exotic grasses and pasture legumes will be used.	Environmental Officer/Botanist	Post-construction
- Take opportunities to selectively harvest seed from the wind farm site populations of all threatened plant species. Store, label and record data appropriately.	Botanist	All stages
- Report any new or suspected populations of ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana*** immediately and mark location in field. - Alert machinery operators and contractors in vicinity to avoid work at new or suspected new population until clearance has been given.	Environmental Officer/Contractors/Botanist	All stages

Threatened Plants Management Strategy 1 (continued).

MANAGEMENT STRATEGY 1	Avoid direct impacts on threatened plant species and their habitats	
Monitoring	**Responsibility**	**Timing**
- Develop a **Monitoring Program** for management actions in relation to measuring effectiveness of impact mitigation for all threatened plants.	Environmental Officer/Botanist	Pre-construction
- Map all locations of threatened plants: record coordinates, location in relation to WTG's.	Botanist	Pre-construction
- Define population boundaries of ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana*** and undertake population counts. Including any new population discoveries.	Botanist	All stages
- Establish photographic monitoring protocol and intervals.	Environmental Officer	All stages
- Record baseline data and on-going population health observations: flowering, fruiting, dieback, seedling emergence and survival, mortality.	Environmental Officer/Botanist	All stages
- Record "natural" damage, modification or significant decline in population size and health.	Environmental Officer/Botanist	All stages
- Record all fire events: date, source (if known), severity and impact on populations. - Record extreme weather events: frost, heavy rain (and erosion if present), drought, cyclone.	Environmental Officer	All stages
- Record and report all incidences of human damage or modification to populations and the significant habitat area.	Environmental Officer	All stages
- Review monitoring program.	Environmental Officer	Twice yearly
Success Indicators	**Responsibility**	**Timing**
- No impact to significant habitat or decline in population sizes of ***Acacia purpureopetala***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***. There is likely to be a reduction in the number and size of *Homoranthus porteri* and *Grevillea glossadenia* populations near WTG36, but avoidance is recommended where feasible.	Environmental Officer	All stages
- Increase in population size and number of individuals of ***Acacia purpureopetala***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***.	Environmental Officer	All stages
Corrective Actions	**Responsibility**	**Timing**
- Increase quarantine zone buffers if found to be inadequate.	Environmental Officer	When required
- Improve quality of significant habitat by eliminating weeds if present.	Environmental Officer	When required
- Increase area of rehabilitation for habitat enhancement.	Environmental Officer	When required
- Review rehabilitation species selection if incorrect or poor establishment success.	Environmental Officer	When required

Table 3. Threatened Plants Management Strategy 2.

MANAGEMENT STRATEGY 2	Where direct impacts to threatened plants are unavoidable, reduce the level of impacts on threatened plant species and their habitats	
Threatened Plants Management Actions	**Responsibility**	**Timing**
- Complete pre-clearance surveys in conjunction with surveyors, engineers and civil contractors prior to final decision on road alignment and position of WTG's.	Botanist/Environmental Officer/Senior Contractors	Pre-construction
- Align roads and cabling network, and micro-site WTG base pads in order to avoid physical disturbance to these species and the supporting habitat.	Environmental Officer	Pre-construction
- Reduce the width and area of clearing to an absolute minimum necessary to achieve useable road width and construction pad.	Environmental Officer/Contractors	Construction
- Avoid inadvertent and unnecessary clearing by observing quarantine areas and significant habitat zones. - Clearly mark all locations of threatened plants. - Only clear what is necessary. - Provide threatened plant profile sheets to contractors and retain in machinery (see below).	Environmental Officer/Contractors	Construction
- All contractors to be provided with identification guides/species profile sheets for each threatened plant species. - Contractors to be given site-specific threatened plant induction and familiarisation training. New contractors to be inducted prior to construction - when required.	Environmental Officer/Botanist/Contractors	Pre-construction and/or at stage when new contractor enters site.
- Select road routes that follow straighter contours and avoid tight bends and zig-zagging.	Environmental Officer/Contractors	Pre-construction and construction
- Reduce size of disturbance footprint for turn-out drains and construction pads. - Avoid over-widening bends to accommodate truck and heavy machinery turning limits.	Environmental Officer/Contractors	Construction
- Avoid clearing and damaging large trees (>30 cm diameter at breast height). - Retain tree buffers around montane heathland vegetation where possible.	Environmental Officer/Contractors	Construction
- Identify and approve location of major soil and rock stockpiles prior to earthmoving. - Do not stockpile soil and rock spoil indiscriminately or on areas of montane heathland vegetation.	Environmental Officer/Contractors	Construction
- Rehabilitate road edges and turbine pads in accordance with **Rehabilitation Plan** and increase areas of threatened plant habitat where possible. - ONLY native plant seed sourced from a local provenance is to be used. NO exotic grasses and pasture legumes will be used.	Environmental Officer/Botanist	Post-construction

Threatened Plants Management Strategy 2 (continued).

MANAGEMENT STRATEGY 2	Where direct impacts to threatened plants are unavoidable, reduce the level of impacts on threatened plant species and their habitats	
Threatened Plants Management Actions	**Responsibility**	**Timing**
- DO NOT burn windrowed cleared vegetation. - Pre-harvest seed from selected plants species if available prior to clearing. - Store heath vegetation separately from large tree branches and stems, and use shrub branches in rehabilitation sites.	Environmental Officer/Botanist	All stages
- Take opportunities to selectively harvest seed from the wind farm site populations of all threatened plant species. Store, label and record data appropriately.		
- Identify threatened plants (tag and mark) that are candidates for translocation. - Translocate to recipient site as soon as possible after removal from site and manage in accordance with **Threatened Plant Translocation Plan**.	Botanist/Environmental Officer	Pre-construction and construction
- Report any new or suspected populations of ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana*** immediately and mark location in field. - Alert machinery operators and contractors in vicinity to avoid work at new or suspected new population until clearance has been given.	Environmental Officer/Contractors/Botanist	All stages
Monitoring	**Responsibility**	**Timing**
- Develop a **Monitoring Program** for management actions in relation to measuring effectiveness of impact mitigation for all threatened plants.	Environmental Officer/Botanist	Pre-construction
- Map all locations of threatened plants: record coordinates, location in relation to WTG's.	Botanist	Pre-construction
- Establish photographic monitoring protocol and intervals.	Environmental Officer	All stages
- Define population boundaries of all threatened plants, particularly ***Acacia purpureopetala***, ***Homoranthus porteri***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana*** and undertake population counts. Including any new population discoveries.	Botanist	All stages
- Record area and number of cleared plants. - Record species names, number and location of translocated plants. - Map all records and enter into monitoring database.	Environmental Officer	Construction and post-construction
- Record baseline data and on-going population health observations: flowering, fruiting, dieback, seedling emergence and survival, mortality.	Environmental Officer/Botanist	All stages
Success Indicators	**Responsibility**	**Timing**
- No loss or decline in population sizes of ***Acacia purpureopetala***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***. There is likely to be a reduction in the number and size of *Homoranthus porteri* populations near WTG36, but avoidance is recommended. *Grevillea glossadenia* and *Plectranthus amoenus* will also be affected.	Environmental Officer	All stages

Threatened Plants Management Strategy 2 (continued).

MANAGEMENT STRATEGY 2	Where direct impacts to threatened plants are unavoidable, reduce the level of impacts on threatened plant species and their habitats	
Success Indicators	**Responsibility**	**Timing**
- Increase in population size and number of individuals of ***Acacia purpureopetala***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***.	Environmental Officer	All stages
- Active regeneration of *Grevillea glossadenia* around disturbance sites where it formerly existed. - Successful establishment of *Plectranthus amoenus* on adjacent/recipient rock pavements and in suitable habitat. - Successful translocation for all threatened plants managed in this way.	Environmental Officer	All stages
Corrective Actions	**Responsibility**	**Timing**
- Increase quarantine zone buffers if found to be inadequate.	Environmental Officer	When required
- Improve quality of significant habitat by eliminating weeds if present.	Environmental Officer	When required
- Increase area of rehabilitation for habitat enhancement.	Environmental Officer	When required
- Review rehabilitation species selection if incorrect or poor establishment success.	Environmental Officer	When required
- Review translocation program if low success rates.	Environmental Officer	When required

Table 4. Threatened Plant Management Strategy 3.

MANAGEMENT STRATEGY 3	Avoid indirect impacts on threatened plant species during construction, operation and decommissioning.	
Threatened Plants Management Actions	**Responsibility**	**Timing**
- Develop a **Weed Management Plan** prior to construction.	Botanist	Pre-construction
- Map all occurrences and categories of weeds prior to construction.	Botanist	Pre-construction
- Reduce potential for erosion to affect significant habitats by reducing road widths and the disturbance footprint.	Environmental Officer/Contractors	Construction
- Avoid constructing turn-out drains near significant habitats.	Environmental Officer/Contractors	Construction
- DO NOT burn windrowed cleared vegetation. - DO NOT start *ad hoc* bush fires.	Environmental Officer/Contractors	Construction
- Control all weeds in Significant plant habitat areas according to the **Weed Management Plan**.	Environmental Officer/Contractors	Construction
- Maintain and proceed with an effective program of progressive rehabilitation in accordance with the **Rehabilitation Plan**. - Rehabilitate all disturbed sites after disturbance and impact.	Environmental Officer/Contractors	All stages
Monitoring	**Responsibility**	**Timing**
- Develop a **Monitoring Program** for management actions in relation to measuring effectiveness of impact mitigation for all threatened plants.	Environmental Officer/Botanist	Pre-construction
- Establish photographic monitoring protocol and intervals.	Environmental Officer	All stages
- Undertake floristic composition surveys of natural areas and compare with baseline data.	Botanist	All stages
- Monitor all weed outbreaks: species, density, importance.	Environmental Officer/Botanist	All stages
- Record dieback or health decline events in **any** vegetation or plant species - regardless of conservation status.	Environmental Officer	All stages
Success Indicators	**Responsibility**	**Timing**
- No loss or decline in population sizes of the balance of threatened plant species remaining after construction or decommissioning.	Environmental Officer	All stages
- Significant plant habitats remain (structurally and floristically) in near-pristine condition and hold high levels of natural integrity.	Environmental Officer	All stages
- No change in floristic composition of natural habitats when compared to baseline data.	Environmental Officer	All stages
- Increase in population size and number of individuals of ***Acacia purpureopetala***, ***Melaleuca uxorum*** and ***Prostanthera clotteniana***.	Environmental Officer	All stages
- Active regeneration of *Grevillea glossadenia* around disturbance sites where it formerly existed. - Successful establishment of *Plectranthus amoenus* on adjacent/recipient rock pavements and in suitable habitat. - Translocation success for all threatened plants managed in this way.	Environmental Officer	All stages

Threatened Plant Management Strategy 3 (continued).

MANAGEMENT STRATEGY 3	Avoid indirect impacts on threatened plant species during construction, operation and decommissioning.	
Corrective Actions	**Responsibility**	**Timing**
- Review weed management if appropriate.	Environmental Officer	When required
- Increase vigilance for weed outbreaks and control.	Environmental Officer	When required
- Increase area of rehabilitation for habitat enhancement.	Environmental Officer	When required
- Review rehabilitation species selection if incorrect or poor establishment success.	Environmental Officer	When required
- Seek expert advice in regard to pathogen that could cause dieback (e.g. Phytophora).	Environmental Officer	When required

Table 5. Threatened Plant Management Strategy 4.

MANAGEMENT STRATEGY 4	Maintain and enhance the populations of threatened plant species and their habitats following completion of the wind farm construction	
Threatened Plants Management Actions	**Responsibility**	**Timing**
- Control, manage and eliminate where practicable all weeds within the project footprint above the main access road into the site.	Environmental Officer/Contractors	Post-construction
- Continue with progressive rehabilitation and habitat enhancement. Implement corrective actions where rehabilitation areas require intervention.	Environmental Officer/Contractors	Post-construction
- Establish research rehabilitation plots for montane heathland at appropriate locations. Develop appropriate level of data collection and monitoring protocols.	Botanist/Environmental Officer	Construction/post-construction
- Maintain healthy populations of all plants regardless of conservation status within the montane heathland environment surrounding and between WTG's.	Environmental Officer/Contractors	Post-construction
- Continue with propagation and use of threatened species in targeted rehabilitation areas.	Botanist/Environmental Officer/Nursery	Post-construction
- Engage in active research and applying new approaches to rehabilitation and plant translocation.	Botanist/ Environmental Officer/third party researchers and institutions	Post-construction
Monitoring	**Responsibility**	**Timing**
- Monitor contraction or expansion of montane heathland areas including rehabilitation sites.	Environmental Officer/Botanist	Pre-construction
- Record recruits for flora species, structural changes to montane heathland, reproduction and productivity.	Botanist/Environmental Officer	Post-construction
Success Indicators	**Responsibility**	**Timing**
- No loss or decline in population sizes of the balance of threatened plant species remaining after construction or decommissioning.	Environmental Officer	Post-construction
- Significant plant habitats remain (structurally and floristically) in near-pristine condition and hold high levels of natural integrity.	Environmental Officer	Post-construction
- Zero net increase in weed population areas and numbers; and no new weed species detected in project footprint (WTG's and road and cabling network).	Environmental Officer	Post-construction
- No change in floristic composition of natural habitats when compared to baseline data.	Environmental Officer	Post-construction
- Increase in area of montane heath.	Environmental Officer	Post-construction
- No significant increase in area of dominant wattle regrowth around and between WTG's.	Environmental Officer	Post-construction
- Populations of threatened plants are stable and reproducing (flowering and fruiting).	Environmental Officer	Post-construction

Threatened Plants Management Strategy 4 (continued).

MANAGEMENT STRATEGY 4	Maintain and enhance the populations of threatened plant species and their habitats following completion of the wind farm construction	
Corrective Actions	**Responsibility**	**Timing**
- Review weed management if appropriate.	Environmental Officer	When required
- Increase vigilance for weed outbreaks and control.	Environmental Officer	When required
- Increase area of rehabilitation for habitat enhancement.	Environmental Officer	When required
- Review rehabilitation species selection if incorrect or poor establishment success, or increasing dominance of wattles.	Botanist/Environmental Officer	When required

7.0 TRAINING

The uniqueness of the site, mainly south of the 275 kV powerline, necessitates a good understanding and appreciation of the local environment and how it supports special plants. Staff and contractors of the Mt Emerald Wind Farm must be aware of the importance and significance of the project area in terms of the special habitat qualities that host threatened plants particularly those listed at the highest levels under Queensland and Commonwealth legislation (e.g. *Acacia purpureopetala*, *Melaleuca uxorum* and *Prostanthera clotteniana*).

Site-specific training and environmental awareness must be undertaken and delivered to all contractors prior to construction. New contractors who enter the project at later stages of the construction and operation of the wind farm will need to receive the same level of environmental awareness training. Training should be delivered by an appropriately qualified person who is familiar with the threatened plants and ecology of the wind farm site.

Generic approaches to environmental awareness training are not recommended unless the training has merit and is valid to the site's landscape context. Training must be delivered as part of site induction and toolbox meetings, which should include the following key aspects:

- An outline of why the Mt Emerald Wind Farm project site is important in a regional context; and what specific environmental values the site holds. For example, the site south of the 275 kV powerline is unique in respect to its high elevation, montane environment and the group of specialist plants that are dependent on and restricted to this environment.
- A series of Threatened Plant Profile sheets should be available to all contractors working in sensitive threatened plant habitats (e.g. the montane heathland). These profile sheets should be readily available in the field (i.e. kept in vehicles or machinery).
- The identification and understanding of special habitats and threatened plant species should be reinforced by actual field visits to appropriate sites at the time of induction for those areas that are readily accessed using the existing road network. For example, the tall wind monitoring tower is a suitable location to highlight and explain the habitat qualities for *Grevillea glossadenia*. The population of the endangered *Melaleuca uxorum* is also within easy viewing distance of the monitoring tower.
- Why weeds pose a significant threat to habitat quality and the maintenance of high quality habitats into the future and throughout the operation of the wind farm. A series of Weed Profile sheets or a field guide should be available to all contractors.
- Reporting procedures for informing the Environmental Officer of threatened plant sightings, uncertain identifications, weed sightings and events that could be causing impacts to sensitive threatened plant habitats. A database of these records should be kept and regularly updated by the Environmental Officer.

8.0 TRANSLOCATION AND PROPAGATION

A management action for threatened plants includes taking opportunities to remove a living plant from its natural habitat and planting it into a suitable recipient site, where there is a reasonable probability of it surviving and forming a healthy and functional population in the future. This process is called translocation and is an accepted impact mitigation technique used for threatened plants listed under the EPBC Act and the NC Act.

The translocation of living threatened plants requires a detailed and site-specific *Translocation Plan* to be developed in order that a number of matters including the selection of suitable recipient sites; the technique of translocation; and a monitoring component are clearly defined. This Threatened Plants Management Plan is not a dedicated translocation plan; however, a brief summary of the predicted likelihood of successfully translocating the threatened plant species recorded from the Mt Emerald Wind Farm site is shown in **Table 6**.

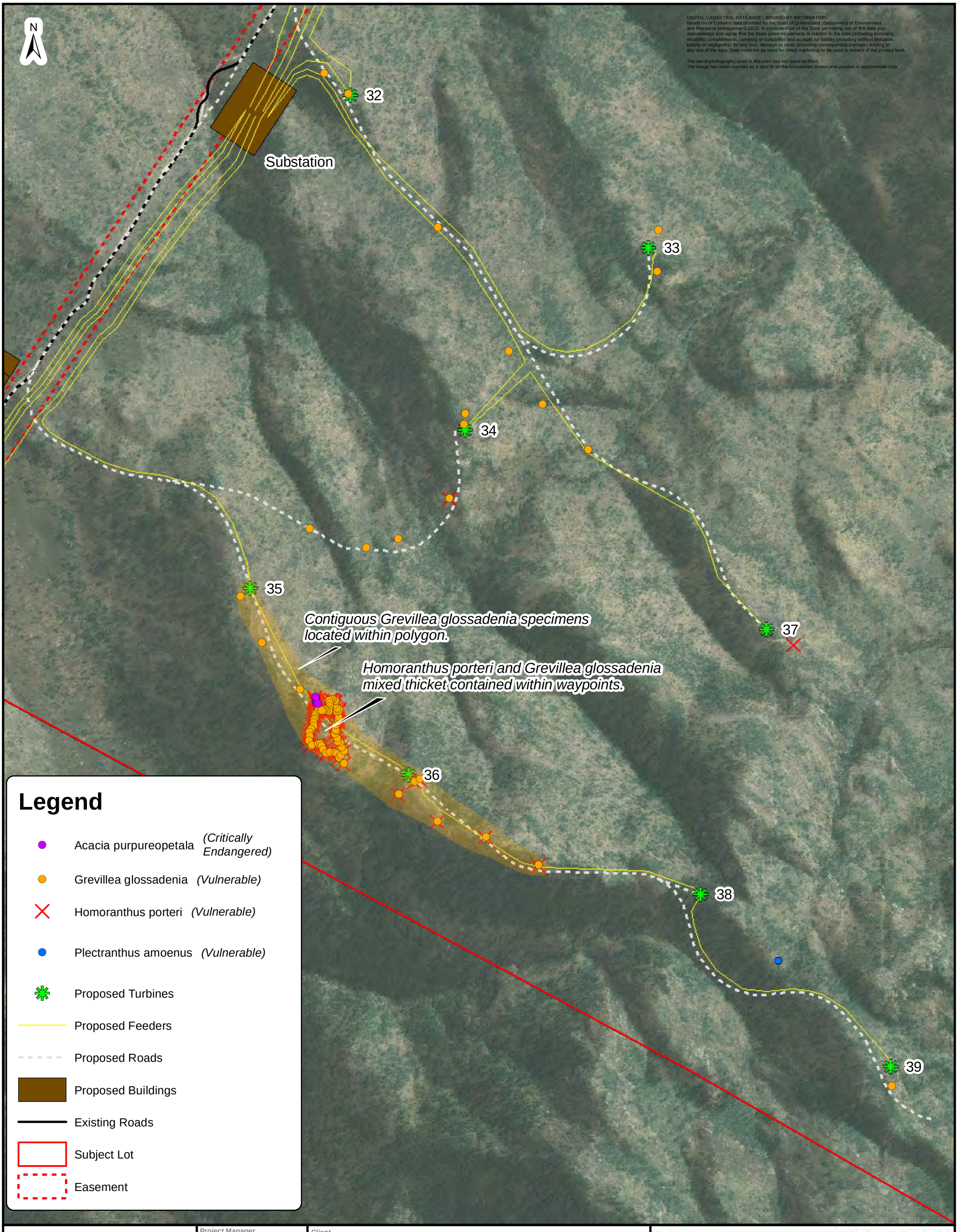
Table 6. Predicted success rates for translocating threatened plant species.

Species	Transplant/translocation	Stem/leaf cuttings	Seed propagation
Acacia purpureopetala (Purple-flowered Wattle)	Low. Adult plants could have underground perennating stems or other plant parts. Possible higher success rate transplanting seedlings. Plants (on Mt Emerald) have peculiar and very specific habitat requirements.	Low.	Low-moderate. Seeds germinate okay, but new seedlings are prone to fungal disease and difficult to grow on to more mature stages.
Grevillea glossadenia (no common name)	Adult plants - low. Seedlings - would need to select relatively fresh seedling material (post-fire germination event). Plants are likely to require mycorrhyzal inoculation from parent soil to improve success rates.	Low.	Moderate to high.
Homoranthus porteri (no common name)	Low. Insufficient knowledge of propagation. Plants have very specific habitat requirements.	Low - insufficient knowledge of propagation through cuttings, although other species of *Homoranthus* have been propagated using this method.	Insufficient knowledge to determine validity of this method.
Melaleuca uxorum (no common name)	Low. Natural regeneration appears to be from resprouting stems from adult plants. Seedlings not observed in wild - insufficient knowledge.	Low to moderate, although insufficient knowledge of propagation through cuttings.	Moderate to high. Fresh seed material would need to be collected.
Plectranthus amoenus (Plectranthus)	Moderate to high. Would need to have recipient site and dedicated process to increase success rates.	High. Plectranthus plants are likely to be successfully propagated through leaf or stem cuttings.	Insufficient knowledge, although other methods of propagation or transplanting are likely to prove successful and are a more valid means of horticultural reproduction.
Prostanthera clotteniana (Mint Bush)	Low for adult plants. Juvenile material may have higher rates of transplanting success. Insufficient knowledge to determine validity of this method.	Moderate, but would require specialised nursery set-up.	Insufficient knowledge to determine validity of this method.

APPENDIX A

EVNT PLANT SPECIES DISTRIBUTION

Mt Emerald Wind Farm Site



Project Manager	M. Jess
Compiled by	RMS
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR130417-3.mxd
Sheet Number	1 of 1

Client: RACL

Title: Rare and Threatened Plant Species Turbines 32-39

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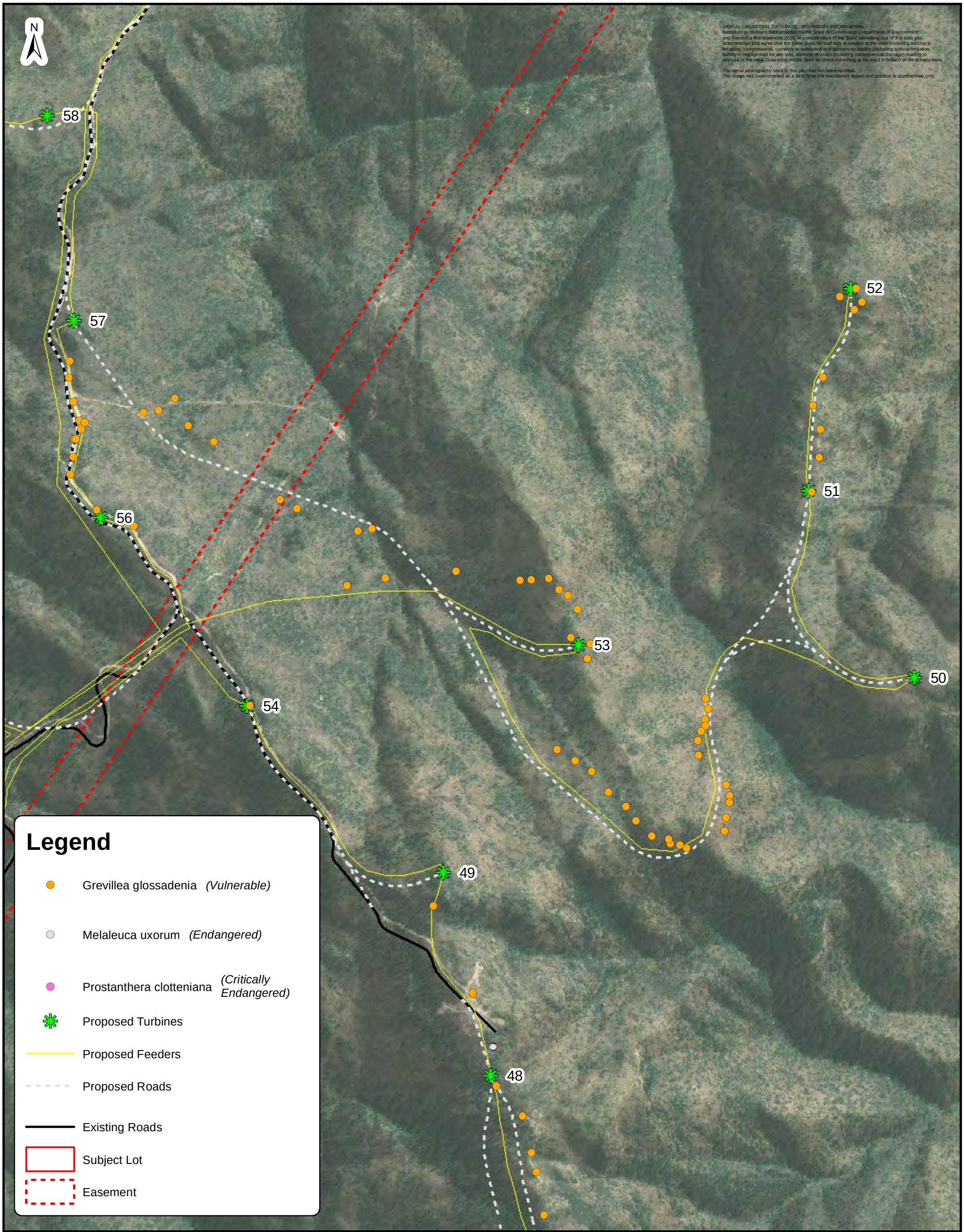
SCALE (A3)	DATE	DRAWING NO.	ISSUE
1:5,000	29/07/2016	PR130417-3	



Project Manager	M. Jess
Compiled by	RMS
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR130417-4.mxd
Sheet Number	1 of 1

Client: RACL

Title: Rare and Threatened Plant Species Turbines 48-58

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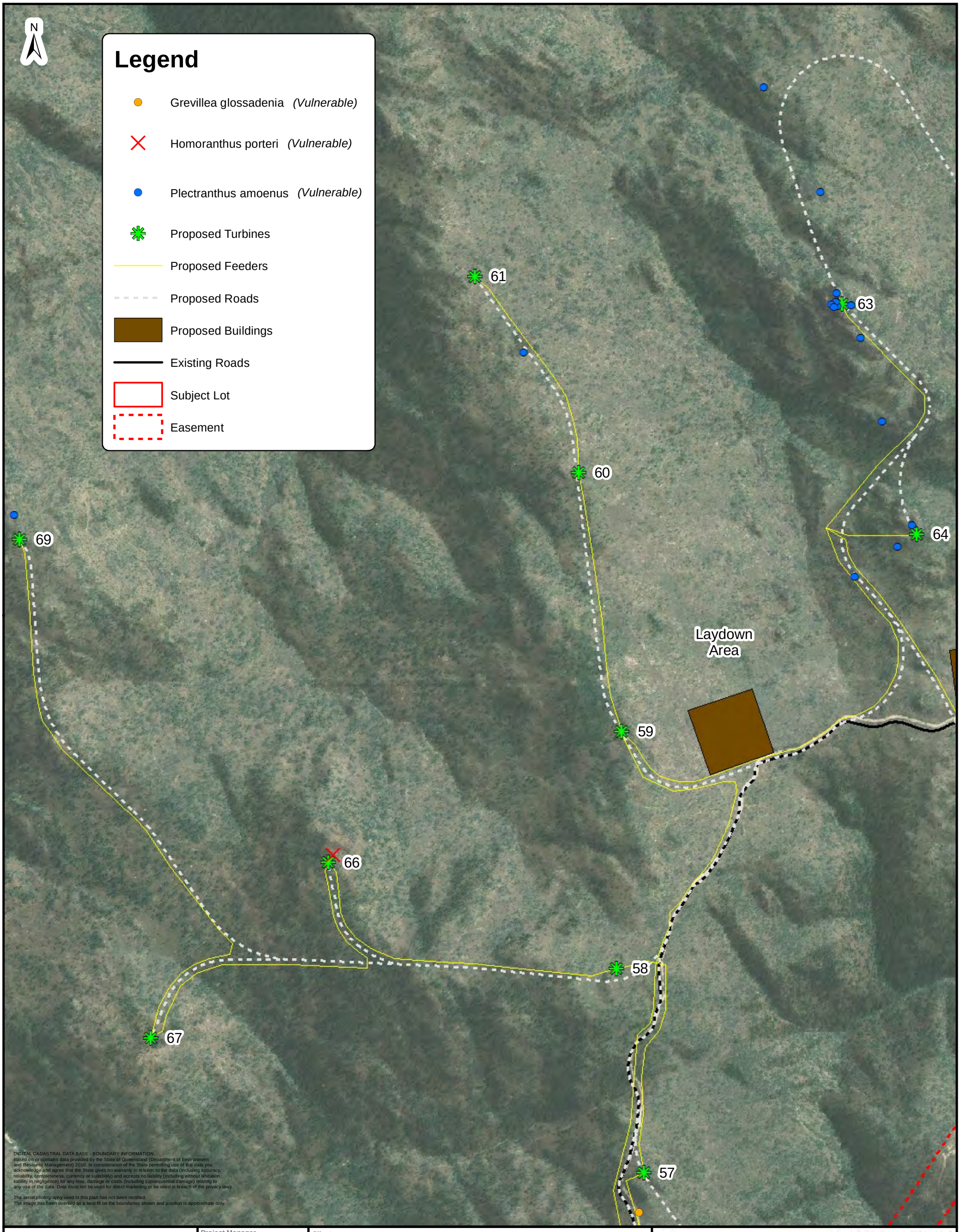

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Meters (A3)

Project Manager	M. Jess
Compiled by	RMS
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR130417-5.mxd
Sheet Number	1 of 1

Client: RACL

Title: Rare and Threatened Plant Species
Turbines 57-61, 63, 64, 66, 67, 69

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