MUDGEE STONE COMPANY PTY LTD

ABN: 89 100 974 365

Oberon White Granite Quarry

Flora Assessment

Prepared by

Gingra Ecological Surveys

ABN 79 612 700 628

Specialist Consultant Studies Compendium

Part 2

August 2010

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Flora Assessment

Prepared for: R.W. Corkery & Co. Pty. Limited
Level 1, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Tel: (02) 9985 8511
Fax: (02) 9985 8208
Email: brooklyn@rwcorkery.com

On behalf of: Mudgee Stone Company Pty Ltd
PO Box 342
MUDGEE NSW 2850

Tel: (02) 6373 3939
Fax: (02) 6373 3766
Email: mdl@hwy.com.au

Prepared by: Gingra Ecological Surveys
PO Box 1
CANTERBURY NSW 2193

Tel: (02) 9787 9710
Fax: (02) 9787 9710
Mob: (0427) 779 925
Email: gingra@ozemail.com.au

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FOREWORD

The information presented in this report is based upon field studies previously completed by Central West Environmental Services (CWES) during 2003 (published) and 2007 (unpublished) and supplementary field work completed by Gingra Ecological Services in 2009. Due to the unavailability of CWES, Gingra Ecological Services has been commissioned to prepare a flora assessment based upon review of the published and unpublished data from the previous field studies, supplementary field work and an updated database search for matters related to the NSW *Threatened Species Conservation Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

It is the opinion of the author that this assessment meets the requirements of the Director General's Requirements issued for the Project and has been completed in accordance with the *Draft Guidelines for Threatened Species Assessment* and other relevant guidelines.

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EXECUTIVE SUMMARY

Mudgee Stone Company Pty Ltd ("the Proponent") plans to extend operations of the Oberon White Granite Quarry ("the Project"), located at Ferndale Road, Oberon, about 6km east-southeast of the township of Oberon. R. W. Corkery & Co. Pty. Limited has commissioned Gingra Ecological Services on behalf of the Proponent to prepare a Flora Assessment for the Project.

Flora and fauna surveys of the site have previously been conducted by Central West Environmental Services (CWES) in 2003 and 2007. Gingra Ecological Surveys have conducted new data searches for threatened flora, prepared a site specific vegetation map and prepared assessments in relation to the likely impact on threatened flora under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Four vegetation map units are described for the Project Site each of which occur in association with soils of the Duckmaloi soil landscape. None of these vegetation map units correspond to a listed endangered ecological community.

A search of the Atlas of NSW Wildlife and the EPBC Protected Matters Database found four threatened flora species are known to occur in or around the Duckmaloi area.

The development footprint would cover a total area of about 11ha resulting in the disturbance of an additional 7.1ha of native vegetation incorporating 4.9ha of Narrow-leaved Peppermint-Mountain Gum-Ribbon Gum Grassy Woodland, 0.2ha of Ribbon Gum Woodland, 2.0ha of Snow Gum-Mountain Gum Grassy Woodland. Approximately 2.5ha of Grassland/Improved Pasture would also be disturbed.

The Project would not result in a significant impact on any threatened flora species listed under either the TSC Act or the EPBC Act and there is no need for a referral under the EPBC Act.

A number of measures which would mitigate the impact of the Project form part of the proposed activity.

Offset areas have also been proposed and would be implemented through establishment of necessary covenants in consultation with DECCW prior to commencement of any additional vegetation clearing.

The impact on native vegetation is assessed as relatively minor, given the disturbed nature of flora habitat present on the Project Site and the history of agricultural use prior to the commencement of quarrying. There are no significant constraints to the proposed development with respect to flora ecology.

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1 INTRODUCTION

Mudgee Stone Company Pty Ltd ("the Proponent") plans to extend operations of the Oberon White Granite Quarry ("the Project"), located at Ferndale Road, Oberon, about 6km east-southeast of the township of Oberon (see **Figure 1**). R. W. Corkery & Co. Pty. Limited has commissioned Gingra Ecological Services on behalf of the Proponent to prepare a Flora Assessment for the Project.

Flora and fauna surveys of the site have previously been conducted by Central West Environmental Services (CWES) in 2003 and 2007. These surveys were conducted in a manner consistent with the draft flora and fauna survey guidelines published by the then Department of Environment and Climate Change (DECC 2004)

This report draws information from the flora component of the surveys undertaken by CWES in 2003 and 2007, supplemented with a field survey undertaken by Gingra Ecological Surveys in November 2009 and additional data searches and review.

The purpose of the current flora report is to:

- undertake new data searches for threatened flora;
- compare and contrast vegetation patterns on the Project Site with those identified in Department of Environment, Climate Change & Water (DECCW) vegetation mapping;
- prepare a site specific vegetation map; and
- provide an assessment in relation to the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *NSW Threatened Species Conservation Act 1995* (TSC Act), Director General's Requirements issued for the Project (refer to **Appendix 1**) and relevant guidelines.

This report should be read in conjunction with the fauna assessment conducted by Biodiversity Monitoring Services (2010) – see Part 3 of the *Specialist Consultant Studies Compendium*.

2 PROJECT OVERVIEW

The Oberon White Granite Quarry is located wholly within Lot 2, DP 1089826 ("the Project Site") which covers an area of approximately 40ha and includes:

- a proposed 6ha extraction area;
- a 20m wide area for construction of a safety bund and channel around the northern and eastern boundary of the proposed extraction area;
- a site access road, internal access road, internal haul road and access track;
- soil and water management structures; and
- an office, amenities and stockpiling area (see **Figure 2**).

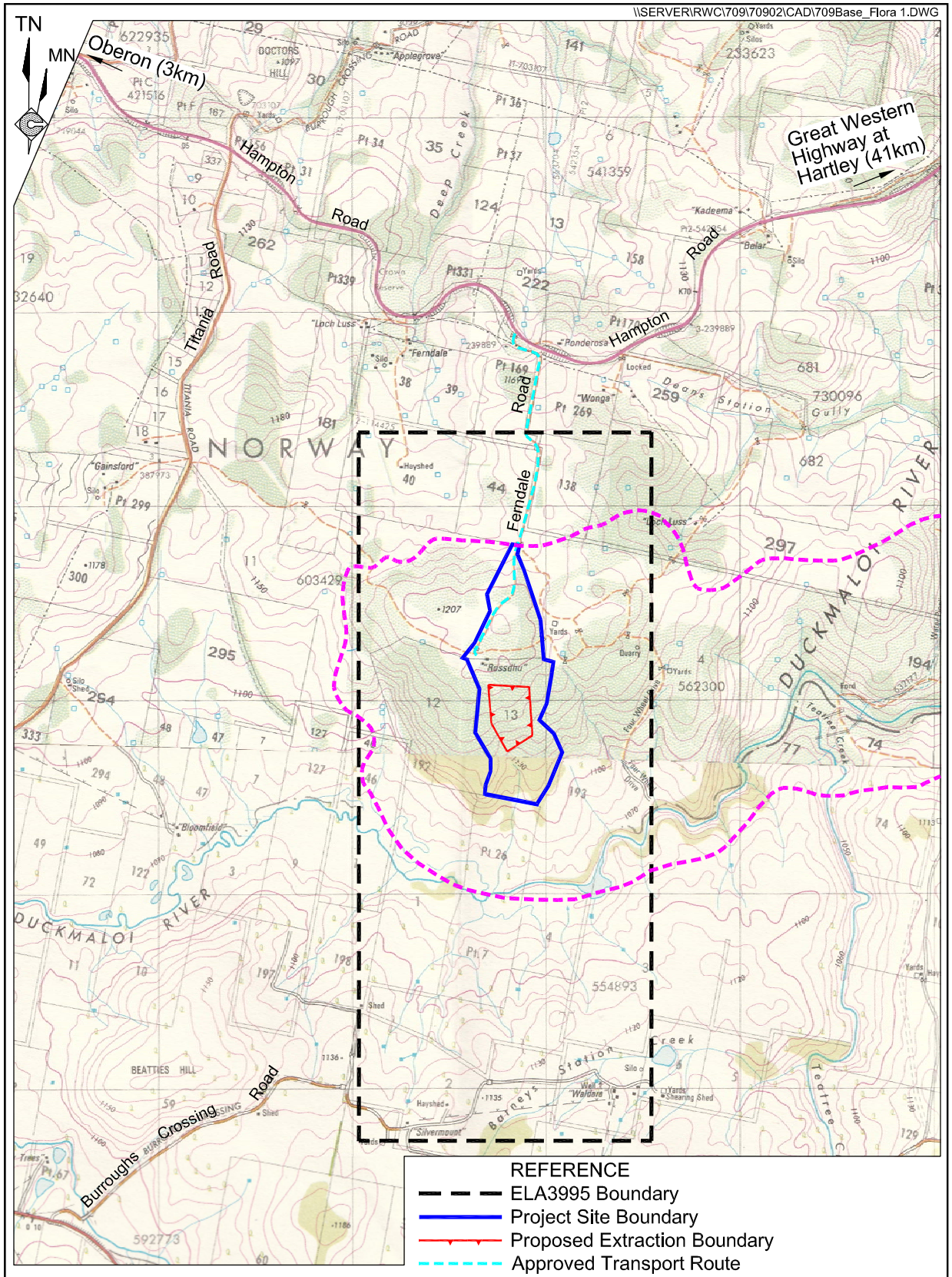

Figure 1
LOCALITY PLAN

Note: A Colour Version of this figure is available on the project CD

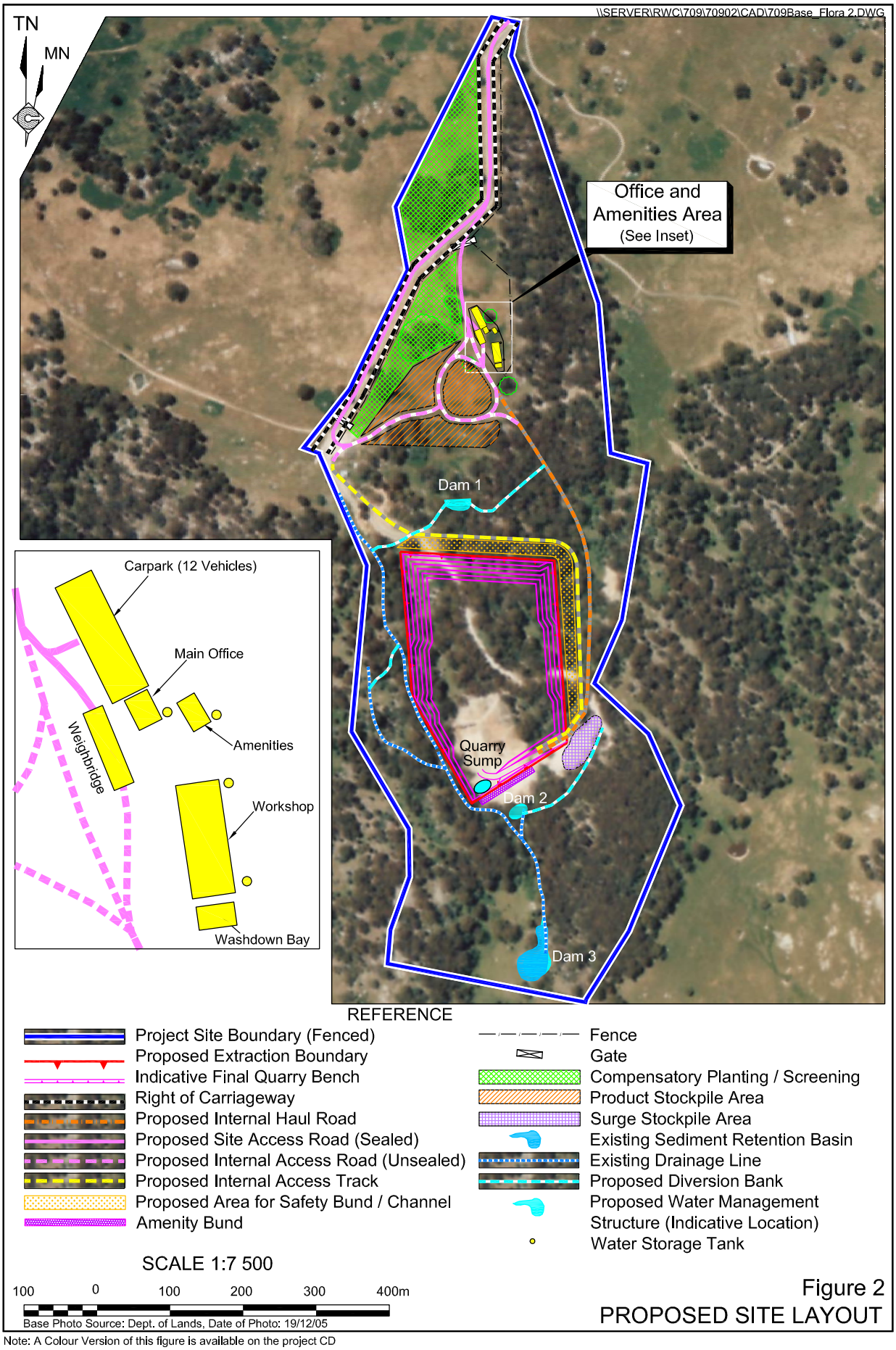

Figure 2
PROPOSED SITE LAYOUT

Note: A Colour Version of this figure is available on the project CD

The Proponent proposes to extend their existing extraction and processing operations and increase production. The current approved area of disturbance for the quarry is approximately 1.4ha with a maximum production level of 25 000t per year. The proposed extension of the quarry would progressively extend the existing approved extraction area to approximately 6ha and result in a total of approximately 11ha of disturbance (including the existing quarry). Extraction would progressively increase to a maximum of 250 000t per year with an average of approximately 200 000t extracted per year over approximately 30 years.

Weathered granite would continue to be removed using an excavator with more competent granite removed using drill and blast methods. Extracted material would continue to be processed using a crushing and screening plant located within the extraction area.

The proposed extension would also involve the construction of an additional section of site access road, internal access road, haul road and access track together with the installation of an office, amenities, weighbridge and stockpiling area. Crushed granite products would be transported using road-registered trucks and loaded out either directly from the extraction area or from the stockpiling area. Product trucks would exit the Project Site via Ferndale Road and turn either east or west onto Hampton Road.

The Proponent would adopt a progressive approach to rehabilitation to ensure that, wherever possible, disturbed areas are either temporarily or permanently stabilised to limit erosion and adverse visual impacts. An important component of the rehabilitation of the Project Site would be the progressive revegetation of finalised quarry benches utilising native vegetation. Drilling of final quarry benches would be undertaken to provide a slight infall towards the face to aid in the retention of soil and water. Subsoil and topsoil would then be placed to a depth of approximately 0.5m and 0.15m respectively and approximately 5m wide prior to the final blast reducing the final bench to approximately 5m width.

In the long-term the Proponent's objective would be to retain a safe and stable landform commensurate with surrounding native vegetation conservation and agricultural uses.

3 PREVIOUS SURVEYS

Central West Environmental Services (CWES) had previously completed two flora and fauna surveys of the Project Site. The first was conducted over four days from 18th to 21st October 2003 and the second took place over three days from 6th to 8th March 2007.

The flora component of the October 2003 survey involved an assessment of 3 x 10m^2 quadrats based on a random stratification within the proposed area of disturbance together with opportunistic recording across the remainder of the Project Site. The flora component of the March 2007 survey involved traverses of the northern part of the Project Site and was aimed at characterising the vegetation present in the area likely to be affected by the long-term access road, the new office, amenities and stockpiling areas.

It is considered that these two surveys were conducted in a manner consistent with the Threatened Biodiversity Survey and Assessment Guidelines issued by the Department of Environment and Climate Change (DECC 2004). A summary of the flora survey techniques employed are provided in **Appendix 2**.

CWES recorded 65 plant species occurring on the Project Site, comprising 45 native plant species, including one species of club moss, and 20 exotic species. None of the species detected by CWES are listed as threatened species under the TSC Act or EPBC Act. A full species list from the CWES surveys is included as **Appendix 3**.

4 CURRENT SURVEY

4.1 Methodology and Limitations

The Project Site was visited on 11th November 2010. During the inspection notes were made on the distribution of canopy species and their relationship to environmental characteristics including aspect, elevation, topographic position and soils; the floristics within different vegetation types, the presence of weeds species and the presence of any threatened or significant flora species. The site visit involved traversing all areas of native vegetation within and adjacent to the proposed development footprint, as well as areas of native vegetation on the Project Site which may be retained.

The timing of the survey in late spring would have allowed the detection of cryptic species such as lilies and orchids, as it corresponded to the flowering time of such species but was not ideal for detection of some summer flowering grasses and early spring flowering species.

The November 2009 survey was intended to verify and supplement information on flora of the site obtained during the CWES surveys.

4.2 Vegetation Map Units

Four vegetation map units are described for the Project Site each of which occur in association with soils of the Duckmaloi soil landscape (Kovac, Murphy and Lawrie 1990). A vegetation map of the Project Site and adjoining land has been prepared (see **Figure 3**) whilst a description of each unit is provided as follows.

1. Narrow-leaved Peppermint-Mountain Gum-Ribbon Gum Grassy Woodland

Sheltered south-facing slopes on granite-derived shallow, loamy sand soils support a grassy woodland dominated by Narrow-leaved Peppermint (*E. radiata*), Mountain Gum (*E. dalrympleana*) and Ribbon Gum (*E. viminalis*). Associated tree species include Blackwood (*Acacia melanoxylon*).

There is a shrub layer of very low cover and a ground layer of medium cover.

Common shrub species include *Hibbertia obtusifolia*, *Lomatia myricoides*,

Common ground layer species include Snow Grass (*Poa sieberiana* ssp. *sieberiana*), Prickly Starwort (*Stellaria pungens*), Creamy Candles (*Stackhousia monogyna*), Spiny Mat-rush (*Lomandra longifolia*), *Cynoglossum suaveolens*, *Caladenia alba*, *Veronica calycina*, *Viola betonicifolia Euchiton involucratum* and *Senecio prenanthoides*.

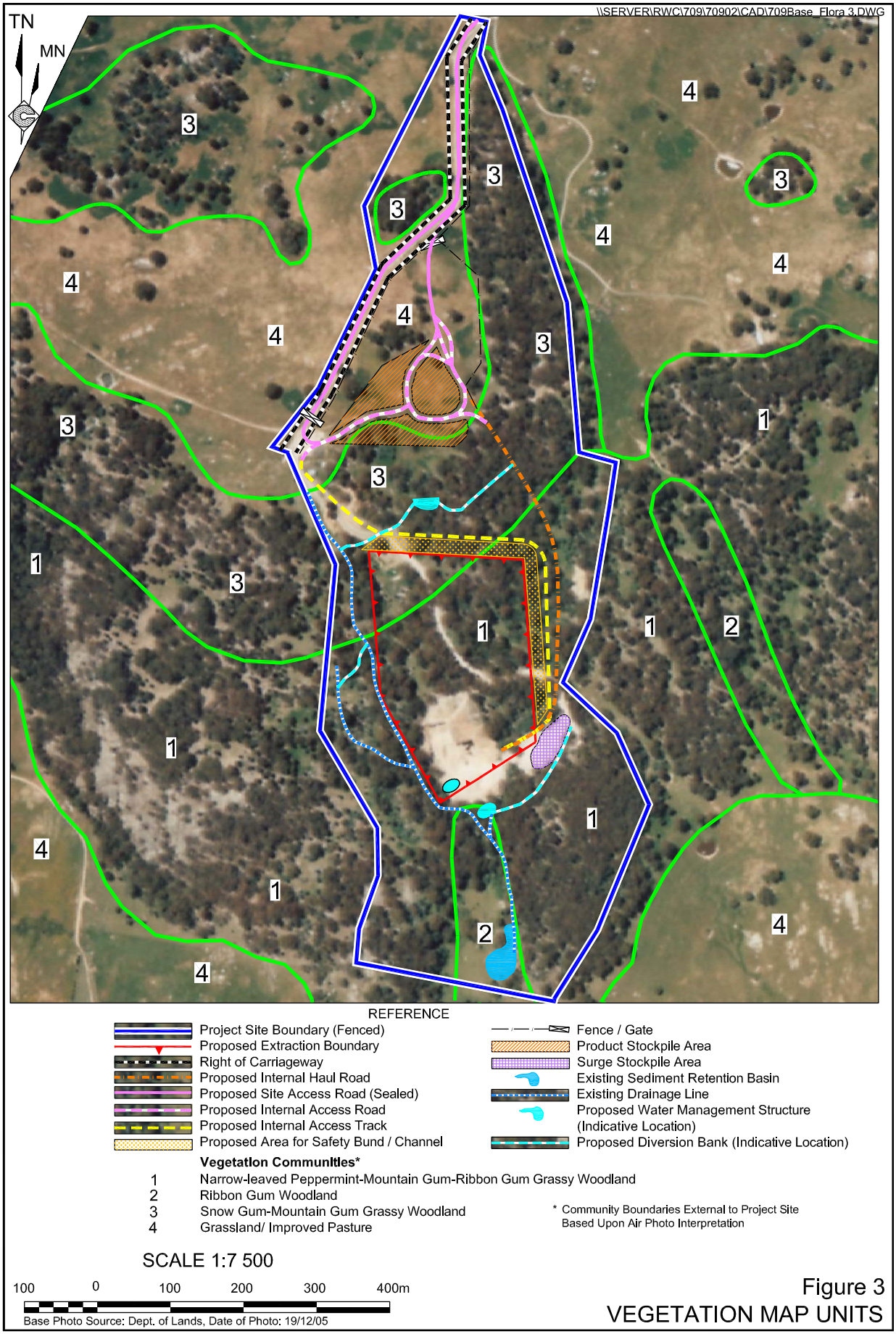

Figure 3
VEGETATION MAP UNITS

Grazing and other impacts of human disturbance means that there is a range of exotic species within this vegetation map unit. These include Sheep Sorrel (*Acetosella vulgaris*), Yorkshire Fog (*Holcus lanatus*), Catsear (*Hypochaeris radicata*), Silvery Hairgrass (*Aira cupaniana*), Sweet Vernal Grass (*Anthoxanthum odoratum*) and Blackberry (*Rubus ulmifolius*).

2. Ribbon Gum Woodland

Steep gullies either side of the currently approved extraction area support woodland dominated by Ribbon Gum (*E. viminalis*). Associated tree species include Mountain Gum (*E. dalrympleana*) and Narrow-leaved Peppermint (*E. radiata*).

This vegetation map unit has a greater degree of shrub cover than Map Unit 1 and includes more mesic ground layer species. This reflects higher water availability and greater accumulation of colluvial material.

Shrub species present include Mountain Baeckea (*Baeckea utilis*) and *Lomatia myricoides*.

Ground layer plants include Weeping Meadow Grass (*Microlaena stipoides*), *Luzula flaccida*, Prickly Starwort (*Stellaria pungens*), Stinging Nettle (*Urtica incisa*) and *Helichrysum scorpioides*.

This vegetation map unit has been affected by past land use with a relatively higher level of weed invasion than that for Map Unit 1. Exotic species present include Blackberry (*Rubus ulmifolius*), Spear Thistle (*Cirsium vulgare*), White Clover (*Trifolium repens*), Fleabane (*Conyza* sp.) and Sheep Sorrel (*Acetosella vulgaris*).

3. Snow Gum-Mountain Gum Grassy Woodland

Crests and exposed slightly to moderately inclined slopes above 1140m elevation on loamy sands associated with the Duckmaloi soil landscape support a grassy woodland dominated by Snow Gum (*E. pauciflora*) and Mountain Gum (*E. dalrympleana*). Associated tree species include Blackwood (*Acacia melanoxylon*) and Narrow-leaved Peppermint (*E. radiata*).

The ground layer includes a mix of native and exotic species. Common native ground layer plants include Blue-leaved Snow Grass (*Poa sieberiana* ssp. *cyanophylla*), Bracken Fern (*Pteridium esculentum*), *Viola betonicifolia*, Prickly Starwort (*Stellaria pungens*), *Galium ciliare*, *Plantago debilis*, Bear's Ear (*Cymbonotus lawsonianus*) and Native Bugle (*Ajuga australis*).

Common exotic species include Suckling Clover (*Trifolium dubium*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Sheep Sorrel (*Acetosella vulgaris*), Spear Thistle (*Cirsium vulgare*) and Yorkshire Fog (*Holcus lanatus*). Where narrow, fragmented patches of this vegetation map unit remain pasture species such as Cocksfoot (*Dactylis glomerata*), Perennial Ryegrass (*Lolium perenne*), White Clover (*Trifolium repens*) and Subterranean Clover (*Trifolium subterraneum*) are present.

4. Grassland/Improved Pasture

Cleared areas on upper slopes and crests support improved pasture dominated by exotic pasture species and weeds. In terms of fauna habitat these areas are described as grassland.

CWES found in their 2007 survey that this vegetation type mainly consists of grasses and clovers, flatweed and areas of bracken fern and rocky outcrops. It was found to support introduced species like the small sedge *Juncus articulatus* and Capeweed (*Arctotheca calendula*) along with pasture improvement species Paspalum (*Paspalum dilatatum*) and Subterranean Clover (*Trifolium subterraneum*). Although formal survey was not completed over this area during the supplementary survey, based on informal survey, Gingra Ecological Services concurs with these findings.

A total of 10 additional native species and 7 additional exotic species were recorded during the current survey. None of the species recorded are listed as threatened species under the TSC or EPBC Act. A complete list of flora species recorded during the November 2009 survey is provided in **Appendix 4**.

4.3 Relationship of Vegetation Map Units to Regional Mapping

Vegetation Map Units 1 and 2 correspond most closely to the Tablelands Granite Grassy Woodland vegetation map unit described in Tozer et al (2006). This vegetation, in turn, forms part of the Southern Tablelands Grassy Woodlands vegetation class described by Keith (2004). Keith reports that only a small proportion of the original extent of this vegetation class now remains, the majority persisting as small fragments. Remnants are often subject to grazing with a reduced diversity of native ground layer species and a relatively high proportion of exotic grasses and forbs.

Vegetation Map Unit 3 forms part of the Subalpine Woodlands vegetation class described by Keith (2004). These Subalpine Woodlands have been modified due to clearing and grazing (Keith 2004). Extensive areas of subalpine woodland vegetation are protected within the existing reserve system. Locally these woodlands are present within Kanangra Boyd and Blue Mountains National Parks and Winburndale Nature Reserve.

All the vegetation map units present are disturbed remnants of the original vegetation which would have occurred on the site before agricultural use caused modification.

4.4 Records of Threatened Flora in the Area

A search of the online Atlas of NSW Wildlife was undertaken on 24th March 2010. The search parameters extended between the latitudes of 33^{o}30'S and 33 ^{o}50'S and the longitudes of 149 ^{o} 45'E and 150 ^{o} 00'E (ie. within approximately 10km of the Project Site).

Three threatened flora species listed under the TSC Act have been recorded within the search area. These are listed in **Table 1**.

A search of the EPBC Protected Matters Database was also undertaken on 24th March 2010. EPBC Threatened flora occurring within a 10km radius, based on this search, are also listed in **Table 1**.

Table 1
Threatened Flora Species Recorded in the Duckmaloi Area

Family	Scientific Name	Common Name	Risk Status TSC	Risk Status EPBC
Asteraceae	*Calotis glandulosa*	-	V[1]	V[2]
Myrtaceae	*Eucalyptus aggregata*	Black Box	V[1]	-
Myrtaceae	*Eucalyptus pulverulenta*	Silver-leaved Mountain Gum	V[1]	V[2]
Santalaceae	*Thesium australe*	Austral Toadflax	V[1]	V[1]

[1] Vulnerable [2] Recorded through NSW Wildlife Atlas but not listed in EPBC search 24/03/10.

Species profile information and an assessment of the likelihood of each species occurring on the Project Site is provided as follows.

Calotis glandulosa

Calotis glandulosa is an erect or ascending branched herb to about 35cm in height (Harden 1992). It has white and blue flowers from December to February. Its preferred habitat is grassland and open-forest, generally at higher altitudes. The range of *Calotis glandulosa* extends from Eden to the Dubbo area. The DECCW species profile for this species, accessed on 14th April 2010, indicates that "*There are old and possibly dubious records from near Oberon, the Dubbo area and Mt Imlay.*"

Calotis glandulosa is capable of occupying disturbed roadsides, but does not persist under heavy grazing. The species has been not detected at the Project Site at any time over the last seven years. It is considered that the species is unlikely to occur due to the fact that the native vegetation remnants show evidence of previous high levels of grazing pressure. Combined with the likelihood that previous records from the Oberon area are not reliable, there is no need for a formal assessment in relation to this species.

Black Box (*E. aggregata*)

Black Box is a small to medium sized woodland tree which grows to a height of about 20m. It occurs close to drainage lines on alluvial soils or poorly drained flats. This habitat type is not present at the Project Site and the species has not been detected at the Project Site. There is no need for formal assessment in relation to this species.

Silver-leaved Mountain Gum (*E. pulverulenta*)

Silver-leaved Mountain Gum is a mallee or small tree which grows to a height of about 10m. The tree holds it's blue-grey opposite juvenile leaves, with few broad-lanceolate adult leaves present on older specimens. The distribution of Silver-leaved Mountain Gum is disjunct with populations in the eastern Monaro and Lithgow-Bathurst areas. Near Oberon it is typically found on rocky hillsides on aplite, shale and rhyolite (Benson & McDougall 1998).

The nature of geology and soils and the vegetation community types present at the Project Site are not consistent with the preferred habitat of Silver-leaved Mountain Gum. The species has not been detected at the Project Site. There is no need for formal assessment in relation to this species.

Austral Toadflax (*Thesium australe*)

Austral Toadflax is a small herb which may grow to a height 40cm. It has pale green linear leaves and very small white axillary flowers which appear in spring. Austral Toadflax has a wide distribution across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland (DECCW profile 14/04/2010).

It is highly susceptible to the impact of grazing, being usually found in native grasslands in relatively good condition and often in association with Kangaroo Grass (*Themeda australis*).

The disturbed nature of the grassy understorey and evidence of previous high grazing pressure within forests and woodlands at the Project Site means that preferred habitat is not present. The species has not been detected at the Project Site.

It is considered that there is no need for formal assessment in relation to this species.

4.5 Endangered Ecological and Groundwater Dependent Communities

DECCW have advised that consideration needs to be given as to whether any vegetation at the site corresponds to the Tablelands Basalt Forest endangered ecological community listed under the TSC Act.

It is considered that the vegetation types present at the Project Site do not correspond to the Tablelands Basalt Forest endangered ecological community. The following factors have been taken into account in arriving at this conclusion.

1. The Project Site coincides with an area mapped as the Duckmaloi soil landscape (Kovac and Lawrie 1990). This soil landscape consists of siliceous sands of low fertility deficient in the key nutrients Nitrogen and Phosphorus (Kovac and Lawrie 1990). These soils are highly permeable with a low water-holding capacity.

   Soils observed on site in November 2009 were pale grey and yellow loamy sands, not the red or brown clayey soils normally associated with the Tablelands Basalt Forest endangered ecological community.

   The Scientific Committee's final determination in relation to Tablelands Basalt Forest (Clause 1) states that the community is: "*found on plateaus and tablelands with loam or clay soils derived primarily from basalt, but may also be derived from mudstones, granites, alluvium and other substrates*." It further (Clause 5) states "*Tableland Basalt Forest typically occurs on loam or clay soils associated with basalt or, less commonly, alluvium, fine-grained sedimentary rocks, granites and similar substrates that produce relatively fertile soils*".

   It is considered that the soils present at the Project Site do not have the full range of characteristics expressed in the final determination.

2. The altitudinal range given for Tablelands Basalt Forest (Clause 5) extends between 600 and 900m. This excludes Vegetation Map Unit 3 Snow Gum-Mountain Gum Grassy Woodland which occurs above 1000m elevation.

3. The list of characteristic species given in the final determination is problematic as it includes species which are widespread and present within a broad range of vegetation types associated with a wide variety of geology, soil types, altitudinal ranges and aspects across the northern, central and southern tablelands.

   Such species include the tree species *Acacia melanoxylon*, *Eucalyptus dalrympleana* ssp. *dalrympleana*, *Eucalyptus pauciflora*, *Eucalyptus radiata* ssp. *radiata*, *Eucalyptus viminalis* and the understorey species, *Acaena novae-zelandiae*, *Asperula conferta*, *Austrodanthonia racemosa* var. *racemosa*, *Austrostipa rudis*, *Carex inversa*, *Cymbonotus lawsonianus*, *Desmodium varians*, *Dichelachne inaequiglumis*, *Echinopogon ovatus*, *Einadia nutans*, *Elymus scaber* var. *scaber*, *Geranium solanderi* var. *solanderi*, *Glycine microphylla*, *Hydrocotyle laxiflora*, *Lomandra filiformis* var. *coriacea*, *Microlaena stipoides*, *Oxalis perennans*, *Poa sieberiana* ssp. *sieberiana*, *Poa labillardierei* var. *labillardierei*, *Pteridium esculentum*, *Rubus parvifolius*, *Rumex brownii*, *Stellaria pungens*, *Themeda australis*, *Veronica plebeia*, *Viola betonicifolia* and *Wahlenbergia stricta* ssp. *stricta*.

In the absence of other environmental characteristics identified in the final determination the presence of any or all of these species in combination does not indicate that a vegetation type corresponds to Tablelands Basalt Forest.

No other Endangered Ecological Communities were identified or are considered likely to occur within the Project Site. Additionally, none of the vegetation within the Project Site is considered to constitute a Groundwater Dependent Ecosystem in accordance with the meaning under *The NSW State Groundwater Dependence Ecosystem Policy* (DLWC 2002).

5 MITIGATION MEASURES

5.1 Introduction

The following mitigation measures have been developed in conjunction with the Proponent, and R.W. Corkery & Co Pty Limited and are also outlined within the Fauna Assessment (Part 3 of the Specialist Consultant Studies Compendium [Biodiversity Monitoring Services 2010]) and summarised within the *Environmental Assessment*.

5.2 General Measures

The Project involves a number of key features designed to minimise impacts on remnant vegetation, namely:

- minimise the development footprint as far as practicable;
- provide for environmental mitigation measures during establishment, construction and operation of the quarry; and
- progressive and prompt rehabilitation of disturbed sections of the Project site once they are no longer required for ongoing operations.

The following specific measures would also be implemented to minimise and mitigate impacts on native vegetation within the Project Site.

- Vegetation to be retained would be clearly defined and marked prior to the commencement of site establishment to ensure that native vegetation clearing is confined only to those areas required for Project operations.
- Noxious weeds would be controlled on the Project Site.
- Before being brought to site, machinery which has been working within foreign soil material would be cleaned down to minimise the risk of introducing weeds and plant pathogens.
- Domestic grazing animals would be excluded from the Project Site other than for controlled management of fuel loads for fire management control.
- Annual reporting of the progress and performance of rehabilitation and effectiveness of management measures.

5.3 Biodiversity Offsets

The removal of native vegetation is required to enable the Project to proceed. Accordingly, the use of biodiversity offsets and compensatory planting would be utilised to minimise the total impact of the Project. Based on previous experience, an offset ratio of at least 2:1 for the native vegetation identified on site is considered to be appropriate.

The total area of disturbance is approximately 11.0ha, however, the proposed extension would only result in the removal of approximately an additional 7.1ha of woodland communities (Vegetation Map Units 1 [4.9ha], 2 [0.2ha] and 3 [2.0ha]) and 2.5ha of grassland/improved pasture. Therefore, as the grassland/pasture is dominated by exotic species and is considered to have minimal conservation significance it is considered that an appropriate offset area for the Project would be 14.2ha of like for like vegetation.

The area surrounding the extraction area and to the south of the extraction area contains the highest quality vegetation within Project Site and represents a suitable offset. . The remnant woodland adjacent the northeastern boundary would also provide suitable offset area with these two areas totalling approximately 17.2ha and providing an offset ratio of approximately 2.5:1. The offset areas would be protected through a covenant or similar arrangement and improved through careful planting of selected species, including Ribbon Gum, and ongoing control of weed species, particularly in the drainage lines.

Additionally, two compensatory planting areas, totalling approximately 2.5ha, would be established adjacent to the site access road in areas which would have originally supported Vegetation Map Unit 3 Snow Gum-Mountain Gum Grassy Woodland. These areas currently contain patches of established trees, however, planting of a range of canopy and mid storey species together with the control of weeds would be undertaken. These areas would also be effectively excluded from disturbing activities associated with operation of the Project.

In light of the fact that the vegetation communities to be disturbed are not Endangered Ecological Communities and no Threatened flora species have been identified, the proposed 17.2ha offset and 2.5ha compensatory planting is considered to be more than adequate to compensate for the removal of 7.1ha of native vegetation that would be disturbed as a result of the Project. Additionally, it is considered that this would meet the DECCW's improve and maintain principles and increase the security of the remnant vegetation in this locality.

5.4 Site Rehabilitation and Soil Management

A soil management and erosion control plan and rehabilitation plan would be developed to minimise potential soil and erosion issues and to guide rehabilitation works. Further details regarding surface water and erosion controls are outlined in within the Surface Water Assessment - Part 1 of the Specialist Consultant Studies Compendium (GSSE 2010).

Soil management and erosion control measures which would act to mitigate indirect impacts on native flora / fauna habitat and facilitate future rehabilitation include the following.

- Selective separation and stockpiling of topsoil from overburden to the extent practicable given the thin, rocky soils present at the site.
- Minimisation of surface disturbed areas to only that which is required for active operations. For example, vegetation clearing and soil removal would only be undertaken to provide an operational area for the subsequent 5 years.
- The design of soil stockpiles to be stable and not pose an erosion risk. Gentle slopes would ensure that water runoff velocities are not excessive.
- The seeding of soil stockpiles, if required, with rapidly colonising grass or cereal species.
- The design and implementation of an effective stormwater control system.

The rehabilitation plan is expected to incorporate the following features.

- Direct transfer during clearing and stripping campaigns, whenever possible, of subsoil and topsoil onto finalised quarry benches in order to preserve the native seed bank and as much organic material as possible.
- Where possible, placement of sufficient subsoil / overburden material to provide a sufficient base for rooting for larger tree species.
- Direct seeding of spread topsoil with native tree and shrub species and, if necessary, supplementary planting of tube stock.
- Removal from site of all product stockpiles and infrastructure not required for future land uses following the completion of operations.

6 ASSESSMENT OF RESIDUAL IMPACTS

6.1 General Considerations

The Project would involve the clearing of approximately an additional 7.1ha of native vegetation, primarily affecting two native vegetation map units; Narrow-leaved Peppermint-Mountain Gum-Ribbon Gum Grassy Woodland and Snow Gum-Mountain Gum Grassy Woodland. Approximately 2.5ha of grassland/improved pasture would also be disturbed. The remnants of these vegetation types within the area to be affected have a moderate to high degree of disturbance relating to past use of the land for agriculture, including grazing. The understorey of each vegetation type likely to be affected has a moderate to high level of weed invasion including improved pasture species and species such as Sweet Vernal Grass (*Anthoxanthum odoratum*) and Sheep Sorrel (*Acetosella vulgaris*), normally associated with unmanaged pasture.

The Narrow-leaved Peppermint-Mountain Gum-Ribbon Gum Grassy Woodland falls within the Southern Tablelands Grassy Woodlands vegetation class of Keith (2004). Only a small proportion of the original extent of this vegetation class now remains, the majority of remnants persisting as small fragments.

The conservation significance of this vegetation type has been recognised through mitigation measures which would be applied. These measures include limitation of the amount of vegetation clearing, effective soil management and erosion control measures, rehabilitation of disturbed areas involving use of local plant species and establishment of offset areas where remnant native vegetation would be managed and exotic species controlled.

As discussed in Section 5.3, with the implementation of these measures, including the establishment of the offset area and compensatory planting, it is considered that the Project would meet the 'maintain or improve' principle for biodiversity.

6.2 Assessment of Impact on Threatened Flora Species and Endangered Ecological Communities

A search of the Atlas of NSW Wildlife and the EPBC Protected Matters Database found four threatened flora species are known to occur in or around the Duckmaloi area.

An assessment of the habitat requirements for each of the four threatened flora species indicates that the habitat present within the Project Site is either unsuitable for the species, or no longer suitable due to the extent of past disturbance, including grazing at moderate to high intensities. None of the species were detected during three flora surveys conducted in 2003, 2007 and 2009. There is a very low likelihood that any of the species would have been overlooked.

Key thresholds listed in the *Draft Threatened Species Assessment Guidelines* were reviewed for the above species. As these species are considered unlikely to occur within the Project Site it is considered that the Project would not affect the lifecycle, viability of a population, accelerate the extinction of or adversely affect critical habitat for any of these species. No further consideration in relation to the four threatened flora species is considered necessary.

In relation to Endangered Ecological Communities, consideration was given as to whether the Tablelands Basalt Forest Endangered Ecological Community, is present within the Project Site. In combination the geological, soil and altitudinal features of the site do not correspond to the environmental features listed by the Scientific Committee as supporting this Endangered Ecological Community. Tablelands Basalt Forest is not present on site and therefore, there is no need for detailed assessment in relation to the Project's impact on Tablelands Basalt Forest.

No TSC Act or EPBC Act listed endangered ecological communities occur on the Project Site.

Accordingly there is no need for further consideration of the Project in relation to flora and the provisions of the TSC Act or EPBC Act.

7 CONCLUSIONS

Flora surveys of the Project Site for the proposed extension of operations of the Oberon White Granite Quarry have been undertaken by CWES in 2003 and 2007 and Gingra Ecological Surveys in 2009.

Four vegetation map units have been found within the Project Site, namely:

- Narrow-leaved Peppermint-Mountain Gum-Ribbon Gum Grassy Woodland;
- Ribbon Gum Woodland;
- Snow Gum-Mountain Gum Grassy Woodland; and
- Grassland/Improved Pasture.

The development footprint would cover a total area of about 11ha resulting in the disturbance of an additional 7.1ha of native vegetation incorporating 4.9ha of Narrow-leaved Peppermint-Mountain Gum-Ribbon Gum Grassy Woodland, 0.2ha of Ribbon Gum Woodland, 2.0ha of Snow Gum-Mountain Gum Grassy Woodland. Approximately 2.5ha of Grassland/Improved Pasture would also be disturbed.

Data searches indicated that four species of threatened flora species may occur in the Duckmaloi area around the Project Site. Assessment of habitat conditions at the Project Site, the preferred habitat for the four species and field survey results show that none of the species are likely to occur at the Project Site.

An assessment has also been made as to whether the Tablelands Basalt Forest Endangered Ecological Community is present at the Project Site. The geology and soils present at the Project Site are not conducive to the development of vegetation which corresponds to the Tablelands Basalt Endangered Ecological Community. This and any other Endangered Ecological Community is assessed as not being present within the Project Site.

The Project would not result in a significant impact on any threatened flora species listed under either the TSC Act or the EPBC Act and there is no need for a referral under the EPBC Act.

A number of measures which would mitigate the impact of the Project form part of the proposed activity. These include soil management, rehabilitation and control of development activities, including restriction of the development footprint.

Offset areas have also been proposed and would be implemented through establishment of necessary covenants, etc. in consultation with DECCW prior to commencement of any additional vegetation clearing.

The impact on native vegetation is assessed as relatively minor, given the disturbed nature of flora habitat present on the Project Site and the history of agricultural use prior to the commencement of quarrying. There are no significant constraints to the proposed development with respect to flora ecology.

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Appendix 1

Coverage of Environmental Assessment Requirements

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Table A1-1
Coverage of Environmental Assessment Requirements and Environmental Issues in the Flora Assessment

ENVIRONMENTAL REQUIREMENTS RAISED BY THE DIRECTOR-GENERAL RELATING TO FLORA (18.09.09)		
		Relevant Section(s)
Key Assessment Requirements, namely: • **Flora and Fauna** – including impacts on threatened species, populations or endangered ecological communities or their habitats; and details of vegetation offsets to ensure that there is no net loss to the flora and fauna values of the area;.		Section 5.3 & 6
ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING TO FLORA		
Government Agency	**Paraphrased Requirement**	**Relevant Section(s)**
Department of Environment and Climate Change (7/9/07)	Assess the potential impacts on Threatened species, flora, fauna and endangered ecological communities and their habitats and the need to consider vegetation offsets to compensate for the clearing of up to 8ha of remnant native vegetation.	Section 5.3 & 6
	Follow the 'Draft Guidelines for Threatened Species Assessment'.	Foreword
	Conduct and document a field survey in accordance with the guidelines.	Sections 3 & 4, Appendix 2
	Assess, evaluate and report on likely impacts on threatened species and their habitat. Specifically report on the considerations listed in Step 3 of the draft guidelines.	Sections 6.1 & 6.2
	Describe the actions that will be taken to avoid impacts, or to mitigate unavoidable impacts of the project on threatened species and their habitat.	Section 5
	Consider offset strategies where measures to avoid or mitigate are not possible.	Section 5.3
	State whether the Project meets each of the key thresholds set out in Step 5 of the draft guidelines.	Section 6.2
Department of Primary Industries – Fisheries (6/9/07)	Assess the ecological sustainability of the proposal.	Section 6 & 7
	Outline the habitat requirements of threatened species likely to occur in the study area.	Section 4.4 & 4.5
	Indicate the location, nature and extent of habitat removal or modification which may result from the proposed action.	Section 4.2. 5.3 & Figure 3
	Discuss the potential impact of the modification or removal of habitat.	Section 6
NSW Department of Primary Industries – Agriculture (6/9/07)	Consider the adoption of a weed management and monitoring program.	Section 5.2

Table A1-1 (Cont)
Coverage of Environmental Assessment Requirements and Environmental Issues in the Flora Assessment

ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING TO FLORA		
Government Agency	**Paraphrased Requirement**	**Relevant Section(s)**
Department of Water and Energy (7/9/07)	Provide the following.	
	• Details of any clearing of vegetation including mapping overlaid on an aerial photograph and/or a vegetation/ habitat map.	Figure 3
	• Details of clearing methods.	EA Section 2.4.3
	• Identify species and/or elements of the vegetation structure to be cleared.	Section 4
	• Details of ameliorating measures including on-going management, protection of vegetation and habitat retained for conservation purposes.	Section 5
	• Identification of any Asset Protection Zone.	Not Applicable
	• A Vegetation Management Plan that details the conservation/ rehabilitation of riparian buffer zones on site including the removal of exotic species, revegetation with native species and the stabilisation of erosion hazards.	Section 5

Appendix 2

CWES Flora Survey Techniques

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Table A2-1
Application of Recommended Flora and Fauna Field Survey Techniques

(Adapted from Section 5 of the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, DECC 2004).

Field Survey Techniques Applied	Suggested Minimum Effort	Applied (✓)	Effort Achieved & Commentary
Transects (or Traverse)	1 x 100m traverse per stratification unit <2 ha		
	2 x 100m traverses per 2-50 ha of stratification unit	✓	
	3 x 100m traverses per 51-250 ha of stratification unit		
	5x100m traverses per 251-500 ha of stratification unit		
	10x100m traverses per 501-1000 ha of stratification unit, plus one additional 100m traverse for each extra 100 ha thereof		
Random Meander	30 minutes for each quadrat sampled within the same stratification unit as the quadrat.	✓	
Plot-based (Quadrat) Survey	At least 1 quadrat per stratification unit <2 ha		
	2 quadrats per 2-50 ha of stratification unit	✓	4 quadrats
	3 quadrats per 51-250 ha of stratification unit		
	10 quadrats per 501-1000 ha of stratification unit, plus one additional quadrat for each extra 100 ha thereof		
Voucher Specimens Collected		nil	
Voucher Specimens sent to Herbarium		nil	

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Appendix 3

CWES Flora Species List

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Table A3-1
CWES Survey – Flora Species List

Family **Common name**	**Scientific Name**	**Native or Introduced**
Lycopodiaceae		
Club moss	*Lycopodium sp.*	N
Sinopteridaceae		
Rock fern	*Cheilanthes austrotenuifolia*	N
Dennstaedtiaceae		
Bracken fern	*Pteridium esculentum*	N
Aspleniaceae		
Necklace fern	*Asplenium flabellifolium*	N
Ranunculaceae		
Common Buttercup	*Ranunculus lappaceus*	N
Caryophyllaceae		
Four-leaf allseed	*Polycarpon tetraphyllum*	I
Prickly Starwort	*Stellaria pungens*	N
Mouse-eared Chickweed	*Cerastum fontanum subsp. Trivale*	I
Chickweed	*Cerastium glomeratum*	I
Polygonaceae		
Sheep sorrel	*Acetosella vulgaris*	I
Dilleniaceae		
Hoary Guinea Flower	*Hibbertia obtusifolia*	N
Urticaceae		
Stinging Nettle	*Urtica dioica*	I
Violaceae		
Native violet	*Viola betonicifolia*	N
Brassicaceae		
	Cardamine paucijuga	N
	Cardamine lilacina	N
	?Cardamine sp A	N
Rosaceae		
Sheep's burr	*Acaena agnipila*	N
Native Raspberry	*Rubus parvifolius*	N
Sweet briar	*Rosa rubiginosa*	I
Amygdalaceae		
	Prunus sp.	I
Proteaceae		
River Lomatia	*Lomatia myricoides*	N
Myrtaceae		
Narrow leaf Peppermint	*Eucalyptus radiata*	N
Ribbon Gum	*Eucalyptus viminalis*	N
Snow Gum	*Eucalyptus pauciflora*	N
Mountain Gum	*Eucalyptus dalrympleana*	N
Mountain Baeckea	*Baeckea utilis*	N

Table A3-1
CWES Survey – Flora Species List

Family **Common name**	**Scientific Name**	**Native or Introduced**
Fabaceae		
Blackwood	*Acacia melanoxylon*	N
Silver wattle	*Acacia dealbata*	N
Oxalidaceae		
Grassland Wood Sorrel	*Oxalis perennans*	N
Geraniaceae		
Native Geranium	*Geranium solanderi*	N
Stackhousiaceae		
Creamy Candles	*Stackhousia monogyna*	N
Rubiaceae		
Woodruff	*Asperula conferta*	N
Rough bedstraw	*Galium gaudichaudii*	N
Fabaceae		
Twining Glycine	*Glycine clandestina*	N
Silver wattle	*Acacia dealbata*	N
Black wood	*Acacia melanoxylon*	N
Subteranean Clover	*Trifolium subterraneum*	I
Apiaceae		
Stinking Pennywort	*Hydrocotyle laxiflora*	N
Asteraceae		
Spear Thistle	*Cirsium vulgare*	I
Winged Slender Thistle	*Carduus tenuiflorus*	I
Bears ear	*Cymbonotus lawsonianus*	N
Flatweed	*Hypochoeris radicata*	I
Creeping Cudweed	*Gnaphalium gymnocephalum*	I
Capeweed	*Arctotheca calendula*	I
Common Cudweed	*Euchiton involucratus*	I
Common Everlasting	*?Chrysocephalum apicalatum*	N
Dandelion	*Taraxacum officinale*	I
Convolvulaceae		
Kidney Weed	*Dichondra repens*	N
Boraginaceae		
Paterson's Curse	*Echium plantagineum*	I
Plantaginaceae		
Variable plantain	*Plantago varia*	N
Lamiaceae		
Australian Bugle	*Ajuga australis*	N
Lomandraceae		
Spiny mat rush	*Lomandra longifolia*	N
Pale Mat-rush	*Lomandra glauca*	N
Little Lomandra	*Lomandra filiformis*	N

Table A3-1
CWES Survey – Flora Species List

Family **Common name**	**Scientific Name**	**Native or Introduced**
Asphodelaceae		
Bulbine Lily	*Bulbine bulbosa*	N
Orchidaceae		
Tiger Orchid	*Diuris sulphurea?*	N
Antelope Greenhood	*Pterostylis laxa*	N~
Juncaceae		
	Juncus articulatus	I
Cyperaceae		
	Carex sp.	N
Poaceae		
Creeping bent	*?Agrostis stolonifera*	I
Spear grass	*Stipa nodosa*	N
Snow grass	*Poa sieberiana*	N
Winter grass	*Poa annua*	N
Kangaroo grass	*Themeda triandra*	N
Weeping grass	*Microlaena stipoides*	N
Kikuyu grass	*?Pennisetum clandestinum*	I
Paspalum	*Paspalum dilatatum*	I

Families arranged according to modified Dahlgren system as in the Flora of New South Wales.
Reference: Harden G. Ed, Flora of New South Wales Vol 1-4 1990 New South Wales University Press, Sydney.
? Indicates species identification uncertain. ~ The only additional species found in the second survey

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Appendix 4

Gingra Ecological Services Flora Species List

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Table A4-1
Gingra 2009 Survey – Flora Species List

Family **Common name**	**Scientific Name**	**Native or Introduced**
Dennstaedtiaceae		
Bracken fern	*Pteridium esculentum*	N
Apiaceae		
Forest Pennywort	*Hydrocotyle laxiflora*	N
Asteraceae		
	Brachyscome spathulata	N
Spear Thistle	*Cirsium vulgare*	I
Fleabane	*Conyza* sp.	I
Bears Ear	*Cymbonotus lawsonianus*	N
	Euchiton involucratus	N
	Helichrysum scorpioides	N
Catsear	*Hypochaeris radicata*	I
	Senecio diaschides	N
	Senecio linearifolius	N
	Senecio prenanthoides	N
	Senecio quadridentatus	N
Boraginaceae		
	Cynoglossum suaveolens	N
Caryophyllaceae		
Prickly Starwort	*Stellaria pungens*	N
Mouse-eared Chickweed	*Cerastium glomeratum*	I
Convolvulaceae		
Kidney Weed	*Dichondra repens*	N
Dilleniaceae		
Hoary Guinea Flower	*Hibbertia obtusifolia*	N
Euphorbiaceae		
	Poranthera microphylla	N
Fabaceae		
Silver Wattle	*Acacia dealbata*	N
Blackwood	*Acacia melanoxylon*	N
Suckling Clover	*Trifolium dubium*	I
White Clover	*Trifolium repens*	I

Table A4-1
Gingra 2009 Survey – Flora Species List

Family **Common name**	***Scientific Name***	**Native or Introduced**
Geraniceae		
	Geranium solanderi	N
Lamiaceae		
Native Bugle	*Ajuga australis*	N
Myrtaceae		
Mountain Baeckea	*Baeckea utilis*	N
Mountain Gum	*Eucalyptus dalrympleana*	N
Snow Gum	*Eucalyptus pauciflora*	N
Narrow-leaved Peppermint	*Eucalyptus radiata*	N
Ribbon Gum	*Eucalyptus viminalis*	N
Oxalidaceae		
	Oxalis ?exilis	N
Plantaginaceae		
	Plantago debilis	N
Polygonaceae		
Sheep Sorrel	*Acetosella vulgaris*	I
Proteaceae		
River Lomatia	*Lomatia myricoides*	N
Rosaceae		
Sheep's Burr	*Acaena ovina*	N
Blackberry	*Rubus ulmifolius*	I
Rubiaceae		
	Galium ciliare	N
Scrophulariaceae		
	Veronica calycina	N
Stackhousiaceae		
	Stackhousia monogyna	N
Urticaceae		
Stinging Nettle	*Urtica incisa*	N
Violaceae		
	Viola betonicifolia	N
Cyperaceae		
	Carex appressa	N

Table A4-1
Gingra 2009 Survey – Flora Species List

Family **Common name**	***Scientific Name***	**Native or Introduced**
Juncaceae		
	Luzula flaccida	N
Lomandraceae		
Spiny Mat-rush	*Lomandra longifolia*	N
Orchidaceae		
	Caladenia alba	N
	Caladenia sp.	N
Poaceae		
Feather Grass	*Aira cupaniana*	I
Sweet Vernal Grass	*Anthoxanthum odoratum*	I
Yorkshire Fog	*Holcus lanatus*	I
Perennial Ryegrass	*Lolium perenne*	I
Weeping Meadow Grass	*Microlaena stipoides*	N
Blue-leaved Snow Grass	*Poa sieberiana* subsp. *cyanophylla*	N
Snow Grass	*Poa sieberiana* subsp. *siberiana*	N
Kangaroo Grass	*Themeda australis*	N

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