TETRATHECA JUNCEA TRANSLOCATION MANAGEMENT PLAN FOR THE KARUAH EAST QUARRY SITE (PROJECT APPROVAL 09-0175)

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Site Details:	*Tetratheca juncea* Translocation Management Plan
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ABBREVIATIONS

DA	*Development Application*
EPA Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GPS	*Global Positioning System*
OEH	*NSW Office of Environment and Heritage*
PA	*Project Approval*
PPR	*Preferred Project Plan*
RMS	*NSW Roads and Maritime Service*
TJMP	*Tetratheca juncea Management Plan*

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1 INTRODUCTION

Firebird ecoSultants has been engaged by Karuah East Pty Ltd to prepare a *Tetratheca juncea* Translocation Management Program (TJMP) to satisfy the requirements of the Project Approval (PA 09_0175) granted on 17 June 2014 for the Karuah East Quarry Project (Karuah East).

The TJMP has been prepared with reference to the following documents:

- Environmental Assessment Report – Proposed Karuah East Hard Rock Quarry prepared by ADW Johnson Pty Ltd dated 31 January 2013 (hereafter referred to as the EA);
- Preferred Project Report – Proposed Karuah East Quarry prepared by ADW Johnson Pty Ltd dated 30 July 2013 (hereafter referred to as the PPR);
- EPBC Act Assessment Report prepared for Karuah East Quarry by Eco Logical dated October 2014;
- Project Approval **Application Number:** 09_0175;
- Approval under Section 130 (1) & 133 of the Environmental Protection and Biodiversity Act 1999; and
- RPS (June 2013) Terrestrial Ecology Survey and Assessment Report Karuah East Quarry, Karuah, NSW.

2 STATUTORY REQUIREMENTS

2.1 Project Approval Requirements

Requirements of the TJMP are provided in Schedule 3, Condition 27 of the PA. These are reproduced in **2-1** together with the relevant section(s) of the TJMP where the requirements have been addressed.

Table 2-1 Project Approval (PA 09_0175) Requirements

Condition 27	**Requirement The Proponent shall develop and implement a translocation program for *Tetratheca juncea* to the satisfaction of the Secretary.**	**Relevant Section**
Schedule 3 – Environmental Performance Conditions		
	be prepared in consultation with OEH, by a suitably qualified and experienced ecologist whose appointment has been approved by the Secretary;	Sarah Jones of Firebird ecosultants has consulted OEH and a discussion has occurred with Steve Lewer (Regional Biodiversity Conservation Officer at OEH). Steve Lewer informed that OEH does not normally recommend translocation, but will review the TJMP and sign off on the report. Sarah Jones has been approved by the Secretary of NSW Planning and Environment to prepare the translocation program. Refer to Appendix A for letter from DPE.
	be submitted to the Secretary for approval prior to the commencement of construction activities that involve clearing of or potential harm to *Tetratheca juncea;*	TJMP to be summited to the Secretary for approval prior to clearing works
	include measures for the translocation of all *Tetratheca juncea* stems in the area of disturbance to nearby areas with similar physical and biological habitat features;	Section 6 and 7.
	include a monitoring program to study the *Tetratheca juncea* stems before and after translocation;	Section 9 of TJMP
	include short and long-term goals and performance criteria to measure the effectiveness of the program	Section 8 of the TJMP
	provide for the transfer of information obtained as a result of implementing the program to OEH and P&I	Section 9 of the TJMP
Schedule 5 – Environmental Management, Reporting and Auditing		
Management Plan Requirements		
3	The Proponent shall ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:	Whole of document
3(a)	Detailed baseline data	Section 3.2
3(b)	A description of: • The relevant statutory requirements (including any relevant approval, licence or lease conditions); • Any relevant limits or performance measures/criteria; and • The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any	Section 2

	management measures;	
3(c)	A description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	N/A
3(d)	A program to monitor and report on the: • Impacts and environmental performance of the project; and • Effectiveness of any management measures (see (c) above);	Section 9
3(e)	A contingency plan to manage any unpredicted impacts and their consequences;	General Management under the EMS
3(f)	A program to investigate and implement ways to improve the environmental performance of the project over time;	General Management under the EMS
3(g)	A protocol for managing and reporting any: • Incidents; • Complaints; • Non-compliances with statutory requirements; and • Exceedances of the impact assessment criteria and/or performance criteria; and	General Management under the EMS
3(h)	A protocol for periodic review of the plan.	Section 9

2.2 Statement of Commitments

Statement of commitments Section 4.1 (Appendix 6 of the Project Approval) includes the following:

1. A salvage program for *tetratheca juncea* will be implemented. The salvage program will comprise the excavation of clumps (along with rhizomes and surrounding root balls) proposed for removal and their reintroduction into prepared 'beds' within suitable habitats nearby.

2. Application for a Section 91 licence from OEH for the salvage program will be made and will be subject to a detailed Salvage plan to be prepared by the proponent (and endorsed by OEH and the Department of Planning) prior to the commencement of works.

Item 1 is addressed within Sections 6 and 7 of this document and Item 2 is addressed in Section 2.3 of this document.

2.3 Section 91 Licence

A section 91 licence is not applicable as Projects approved under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) do not require subsequent approvals or separate licensing to extract a threatened plant species for the purpose of propagation or translocation in relation to that project. This is covered by the Consent Conditions issued for DA.

The translocation program does not require a Section 91 license from the NSW Office of Environment and Heritage (OEH), as the translocation will be undertaken as part of a current approval for the Karuah East Quarry and involves a biodiversity offset adjacent to the site, the translocation to the offset site is considered to form part of the approval and as such no translocation license is specifically required for this program.

2.4 Federal Approval

There are no conditions that specifically relate to the *Tetrathecea juncea* translocation program within the EPBC Act Approval. The Eco Logical Report dated October 2014 and titled EPBC Act Assessment Report reference the *Tetrathecea juncea* translocation program which has been addressed in Section 7 of this report.

3 PROJECT DESCRIPTION

3.1 Overview

Hunter Quarries currently extract hard black andesite material from its existing quarry operation on adjoining lands. Approval was granted for this designated development on the adjoining land (Lot 21 DP 1024341, Lot 11 DP 1024564 & Lot 12 DP 1024564) by the Minister as State Significant Development on 3rd June 2005 (DA265/10/2004).

The existing Karuah Quarry currently operates under development approval DA 265/2004 and is approved to extract up to 500,000 tonnes per annum (tpa) of 'andesite' basalt material suitable for use as road base, construction aggregate and concrete batching, among various other applications.

Following exploratory works adjacent to the existing approved quarry, additional resource has been identified to the east on land owned by the Proponent (Project site). On 17 June 2014 the approval was granted by the Minister for Planning and Environment (PA 09_0175) for the extraction of this additional resource through the development of Karuah East, a stand-alone operation to the existing quarry.

3.2 Project Site

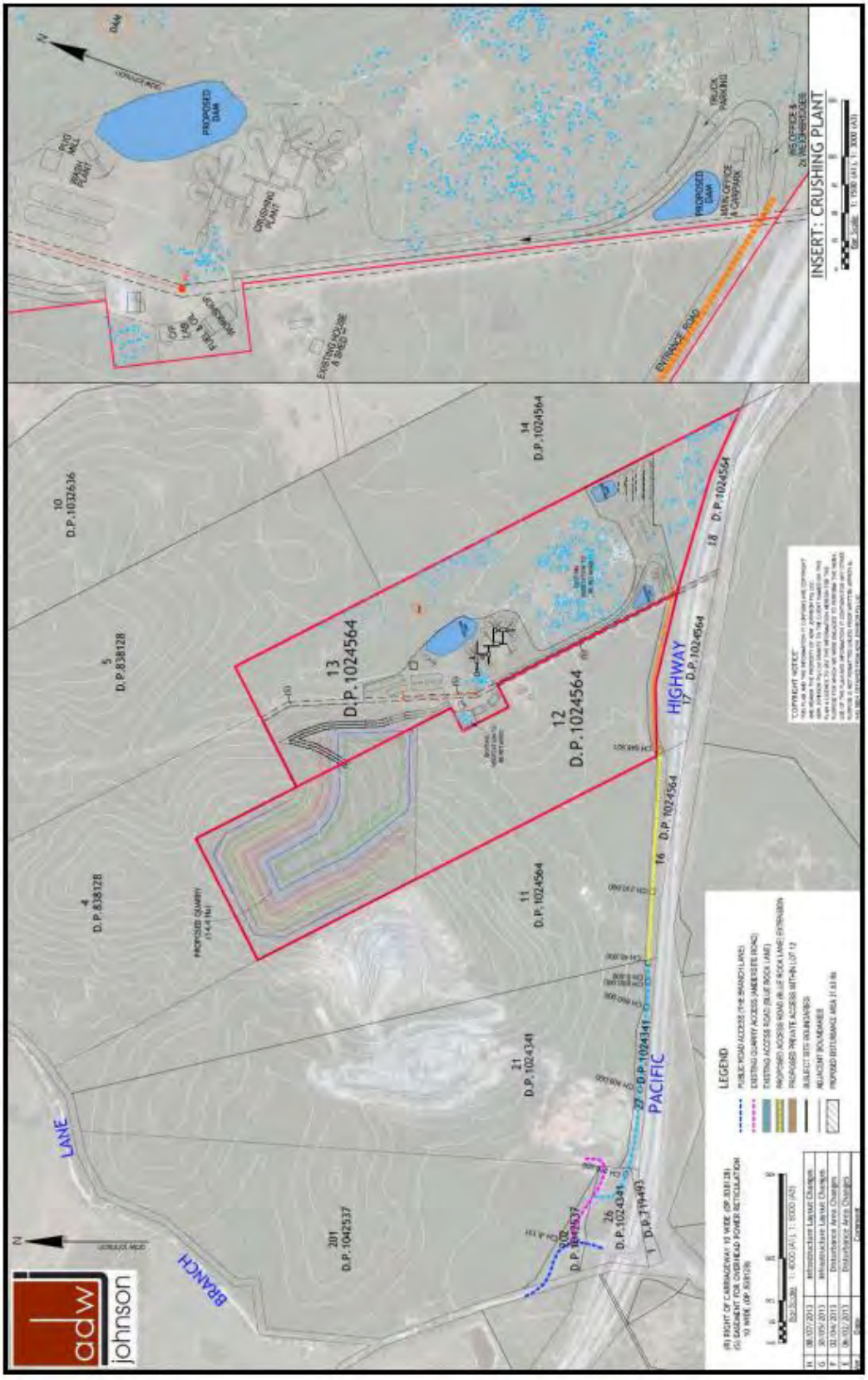
Karuah East is located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah NSW.

The approved development includes the following key elements:

- Staged extraction of approximately 29 million tonnes of "andesite" over a 20 year timeframe;
- Extraction of up to 1.5 million tonnes of andesite material per year;
- Removal and stockpiling of an estimated 380,000 m^3 of overburden (approximately 750,000 tonnes) from the quarry extraction area in accordance with the Rehabilitation Plan prepared for the project. Removal of overburden is not included in the proposed extraction rate of 1.5 million tonnes of andesite annually;

- Haulage of up to 1.5 million tonnes of andesite per year from the site to market by 25 to 30 tonne haul trucks via the Pacific Highway;
- Up to 216 truck loads per day (at maximum production);
- Implementation of water management and erosion and sediment control works to ensure no loss of sediment, dust minimisation and to control discharges from the site to ensure that all discharges are within acceptable volumetric and water quality criteria;
- Roadworks to secure access to the site including upgrade & extension of Blue Rock Lane, realignment of Andesite Road & Blue Rock Lane intersection and adjust road markings at Branch Lane & Andesite Road intersection;
- Employment of 28 on-site staff;
- Construction of new haul road and access through adjoining RMS land;
- Staged clearing;
- Drilling and blasting activities;
- Loading and hauling of extracted material;
- Crushing and screening of extracted material;
- Stockpiling of material on-site; and
- Location of plant on Lot 13 comprised of office buildings, workshops, parking areas, crushing plant, wash plant, weigh bridge and product storage areas.

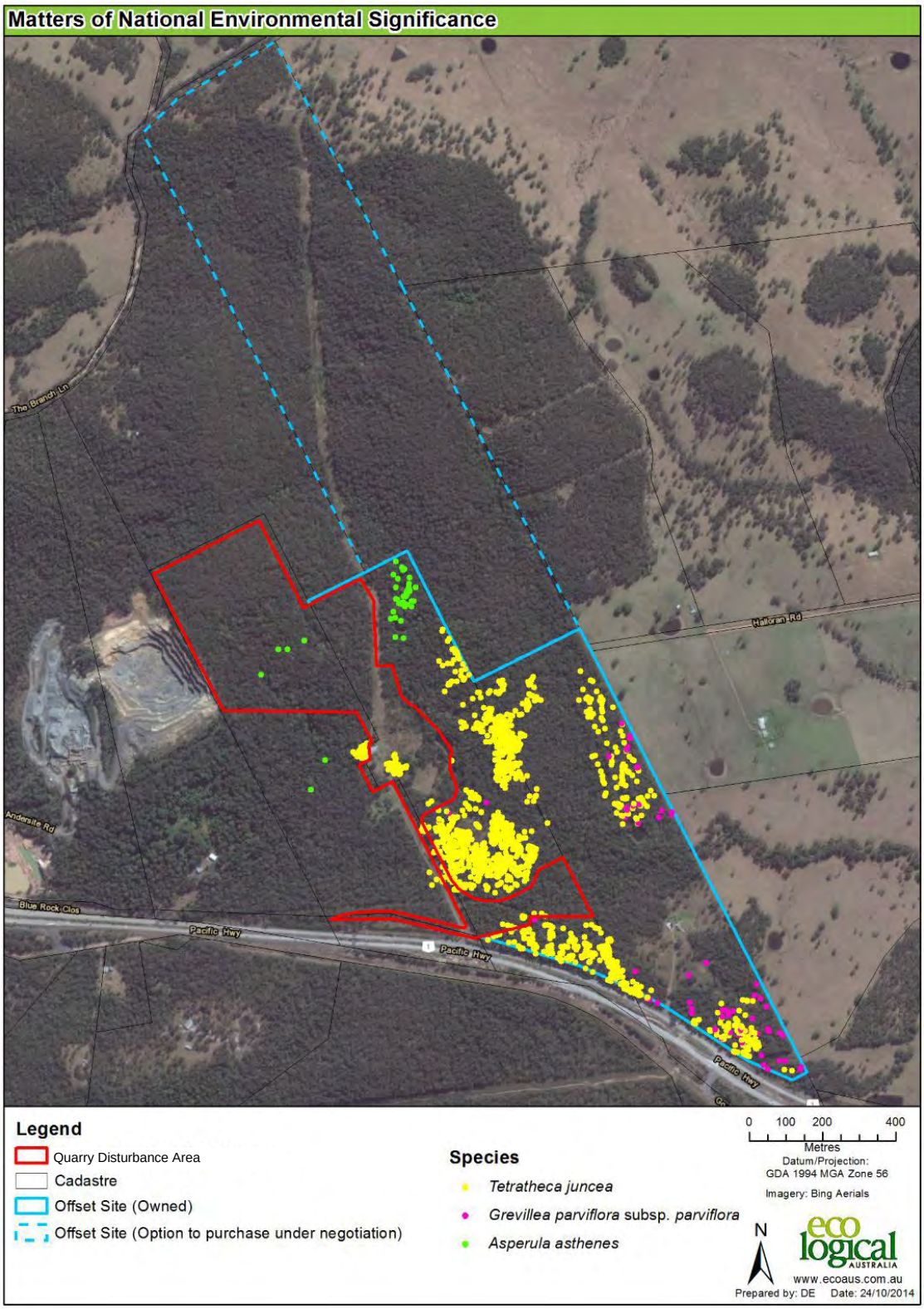
Figure 3-1 Presents the Karuah East site plan and layout.

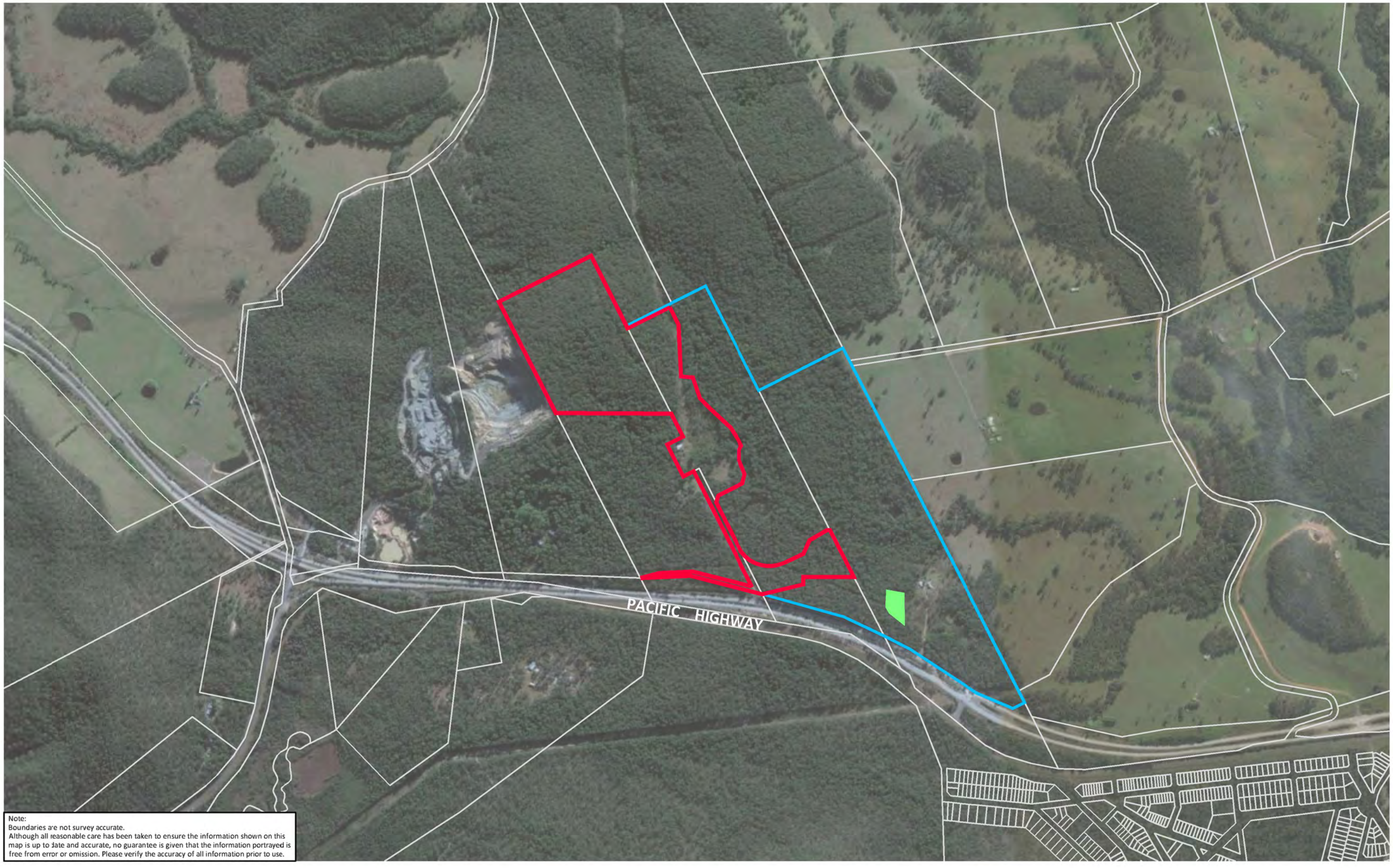


The expansion of the Karuah East quarry site requires a translocation program to be implemented for threatened species *Tetratheca juncea*. The approved quarry expansion includes a biodiversity offset conservation area adjacent to the existing quarry. This area has been investigated during the approval process and found 6324 clumps of *Tetratheca juncea*. The approved impact area was found to have 243 clumps of *Tetratheca juncea. Refer to Figure 3-1 for Locations of Tetrathecea juncea.* It is acknowledged that translocation is not a mitigation measure and is considered as a supplementary action due to low certainty of success. However, in this instance, translocation is being proposed as an additional measure to gain a better biodiversity outcome. Translocation of the individuals to be impacted from within the impact area to the offset site will assist in protecting the genetic diversity of the population. Translocation has been successfully undertaken for *Tetratheca juncea* previously at other sites with a moderate survival rate of 27% after 5 years (Lake Macquarie City Council, 2013).

The translocation program will comprise the careful excavation of the *Tetratheca juncea* individuals from the impact site and translocation into pre-prepared areas within the proposed offset site now referred to as the Translocation Site within this report. An area of 2,500m^2 to 3,000m^2 has been identified in Lot 14 as the Translocation Site. Refer to Figure 3-3 showing location of Translocation Site. The Translocation Site has been selected to ensure that an appropriate vegetation community and aspect would be provided. The *Tetratheca juncea* removed from the impact area (being 243 clumps) will be placed within this identified Translocation Site to ensure that translocation success is as high as possible, and replicates the source environment as much as practicable. Translocated plants will be carefully moved to ensure minimal disturbance as detailed in this report.

Figure 3-2 Location of *Tetratheca juncea*





Note:
Boundaries are not survey accurate.
Although all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

FIGURE 3-3: TRANSLOCATION AREA

CLIENT Karuah East Pty Ltd
SITE DETAILS Pacific Highway Karuah
DATE 19 July 2015

Legend
- Karuah East Hard Rock Quarry Disturbance Area
- Offset Site (Owned)
- Translocation Area

NORTH
0 200 400 600
SCALE 12 000 @ A3

PIXELDRAFTING

Ref No 1557

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4 ECOLOGY OF TETRATHECA JUNCEA

4.1 Description

Tetratheca juncea is a low growing, usually leafless shrub with clumps of stems to one metre or more in length that bear deep lilac-pink or rarely white flowers. When present the narrow leaves are about 2cm long and lack a stalk (Thompson 1976, Harden 1992, Payne 2000). Plants are usually sprawling and are difficult to detect amongst other vegetation when not flowering. It may be readily distinguishable from other *Tetratheca* species with which it grows by its distinct winged stem and reduced leaves (NSW Department of Environment and Conservation 2005: para. 1). The below description is provided from PlantNET (Botanic Gardens Trust 2007).

Family:
Elaeocarpaceae

Common Name:
Black-eyed Susan

Description:
Prostrate shrub with stems to 1 m long; stems with 2 or 3 wings, glabrous with minute tubercles. Leaves alternate, usually reduced to narrow-triangular scales, 3 mm long, otherwise +/- narrow elliptic, to 20 mm long and c. 5 mm wide, glabrous, margins flat or recurved; sessile. Flowers solitary or paired; peduncles 5-10 mm long, glabrous. Sepals 1-1.5 mm long, pink. Petals 7-11mm long, deep lilac-pink. Ovary glabrous; ovules 4. Fruit obovate, 6-8 mm long, often beaked, +/- stalked; seeds c. 4 mm long.

A photo of the species as typically occurs across the Site is provided in **Photo 1**

Photo 1 Example of *Tetratheca juncea*

4.2 Pollination ecology and mycorrhizal associations of Tetratheca juncea

Pollination is fundamental to the existence and persistence of plant species and their associated communities with the vast majority of flowering plants relying on animal pollination (Williams & Winfree, 2013). Habitat loss and fragmentation has been shown to effect on the pollination success, visitation to flowering plants by pollinators and pollinator community composition (Williams & Winfree, 2013).

The body size of pollinators has been demonstrated to be directly correlated to their potential foraging distance, with larger bees foraging further than smaller bee species (Greenleaf et al, 2007). The data presented by Greenleaf et al (2007) indicates that the maximum foraging distance for the majority of bee species was around 1km, with some species substantially less.

The floral structure of *Tetratheca juncea* requires the flowers to be pollinated by species of native bee which are capable of "buzz-pollinating" to vibrate the pollen out of the anthers (Gross et al, 2003). Self- fertilisation within Tetratheca juncea is low for this reason accounting for only 2% of seed set under laboratory conditions. *Tetratheca juncea* is known to be buzz-pollinated by small species of native bee approx. 6mm in size (Driscoll, 2003), approximately ½ the size of the European Honeybee (Apis mellifera). Based on studies by Greenleaf et al (2007) it would be expected that given the small size of the Bee species known to pollinate *Tetratheca juncea*, that they would have a relatively small home range, as small pollinators are known to travel a maximum of several hundred metres (Williams & Winfree, 2013). It is suggested by Driscoll (2003) that pollinators for *Tetratheca juncea* would likely travel a maximum of 500m between populations of the species.

The number of Bees observed to be pollinating *Tetratheca juncea* were very low across two studies each comprising more than 100 hours of observation (Gross et al, 2003, Driscoll, 2003). Documentation of pollinators is poor across the whole Tetratheca genus and is considered poorly understood (Gross et al, 2003). Gross et al (2003) suggests that as *Tetratheca juncea* produces nectar-less flowers, that the species requires a diversity of other flowering plants within the local area to increase the chances that it is visited by suitable pollinators. Gross et al (2003), consider that *Tetratheca juncea* is for this reason susceptible to disruption of pollination services as a result of land clearance and habitat fragmentation.

Tetratheca juncea like a large number of Australian flora species is thought to be dependent on a mycorrhizal association to thrive, due to the poor viability of plants grown under laboratory conditions Bartier et al, 2001. The specific mycorrhizal association is currently unknown.

5 PRE TRANSLOCATION

5.1 Site assessment Impact Site

The impact area for *Tetratheca juncea* has been inspected by Firebird ecologist, Nicholas Alexander in June 2015 and found that the site has a semi-continuous canopy, mature trees and less saplings than the Translocation Site. Trees in this area included Tallowwood (*Eucalyptus microcorys*), Blackbutt (*Eucalyptus pilularis*), Blue-leaved Stringybark (*Eucalyptus agglomerate)*, Red Bloodwood (*Corymbia gummifera*), Forest Oak (*Allocasuarina torulosa*) and Hickory Wattle (*Acacia implexa*).

This site had a dense mid story, dominated by Gymea Lilies (*Doryanthes excelsa*). Other shrubs included Cheese Tree (*Glochidion ferdinandi*), Forest Oak (*Allocasuarina torulosa*), *Pultenaea* sp., and *Acacia* sp. There was dense grassy undergrowth with Bracken Fern (*Pteridium esculentum*), Spiny-headed Mat-rush (*Lomandra longifolia*), Rough Guinea Flower (*Hibbertia aspera*) and *Gahnia* sp. Vines such as Lawyer Vine (*Smilax australis*), Hairy Apple Berry (*Billardiera scandens*), Scrambling Lily (*Geitonoplesium cymosum*) and Molucca Bramble (*Rubus moluccanus*) were also present. Refer to Photos 3 and 4 showing vegetation.

This site had a steeper slope (approximately 5-7 degrees) than the Translocation Site, and this slope was also in a south eastern direction.

Photo 2 Impact Site

Photo 3 Impact Site

5.2 Survey Counts

The species has been recorded extensively within Lots 13 & 14 during surveys undertaken by RPS and subsequently by ELA (2014). The species is also present on Lots 12 and Lot 5 (ELA, 2014). These surveys found that 6,324 clumps (clump = mass of suckering stems) occur within the project offset areas, whilst 243 clumps occur within the project impact area that will require translocation and is part of this TJMP. Refer to Figure 3-2 for Location of *Tetrathecea juncea.*

5.3 Mapping and Population Extent

Tetratheca juncea is well known within the local area with numerous records in the vicinity of Swan Bay, Wallaroo Nature Reserve, Karuah Nature Reserve, Tahlee and Girvan. The sub-populations in the north (Karuah to Bulahdelah), of which this population forms a component, are considered disjunct to the core population in the Lake Macquarie area. The project site (offset and project area) have been surveyed by RPS and subsequently by ELA (2014) and were found to have 6567 clumps of *Tetratheca juncea* including 243 clumps within the project area that are part of this TJMP. See Figure 3-2 Location of *Tetratheca juncea*

5.4 Site Assessment Translocation Site

Nicholas Alexander Ecologist at Firebird ecosultants has undertaken a site survey within the Translocation Site in June 2015 for the recommended translocation area

identified by Ecological (2014) to ensure that this area has the right micro-climate and conditions to give the best survival rate of the translocation program. Refer to Figure 3-3 for Translocation Site.

The site was found to accommodate a small number of sporadic mature eucalypts in the specified area, and a moderate amount of regenerating eucalypt saplings. Trees in this area included Spotted Gum (*Corymbia maculata*), Red Bloodwood (*Corymbia gummifera*), Red Mahogany (*Eucalyptus resinifera*), Broad-leaved White Mahogany (*Eucalyptus umbra*), White Stringybark (*Eucalyptus globoidea*) and Black She-oak (*Allocasuarina littoralis*). This community would best be described as a Spotted Gum Complex.

The translocation site also possessed a sporadic shrub layer consisting of individuals of *Persoonia*, *Pultanaea* and *Acacia* genus's. A relatively dense grassy understory also existed within the translocation site, with species observed including Kangaroo Grass (*Themeda australis*), Browns Lovegrass (*Eragrostis brownii*), Blady Grass (*Imperata cylindrica*), Blue flax-lily (*Dianella cerulea*), Spiny-headed Mat-rush (*Lomandra longifolia*) and Variable Sword-sedge (*Lepidosperma laterale*). The exotic South African Pigeon Grass (*Setaria sphacelata*) was also found in this location. This species will be part of the weed control within the translocation area. Refer to Photos 4-6 for Site Photos of the Translocation Site.

The slope of the translocation site was found to be very gentle (approximately 2 degrees) in a south eastern direction. The site was very open and exposed due to a low incidence of canopy trees.

Whilst the recipient site is quite open and exposed, and slope is quite gentle, the site is easily accessible and plenty of space exists for the translocation sections. Therefore, the site preparation and a detailed management strategy of this area as detailed in Section 9 and 10 of this TJMP will be undertaken to ensure long term or higher success / survival rate.

Photo 4 Translocation Site

Photo 5 Translocation Site

Photo 6 Translocation Site

6 TRANSLOCATION PREPARATION

6.1 Marking Plants

The development site exhibits 243 clumps of *Tetratheca juncea* that will require translocation as part of the development approval.

Removal of the plants will be undertaken in patches that will include numerous clumps. Each of these patches will be referred to as a translocation section.

A GPS will be used to locate the clumps of *Tetratheca juncea* by a Firebird Ecologist. The ecologist will then use pink marking spray to mark each translocation section. This action is important to enable excavating teams to recognise translocation sections.

Each translocation section will be inspected by an ecologist prior to translocation and the following noted.

- Number of clumps
- Health of stems
- Flower numbers
- A species list of all plants within the translocation section
- Each translocation section will be individually numbered to assist in monitoring.

Ecologists will be present during the removal of the translocation sections from the impact site, and will assist in the relocation to the translocation site. Refer Table 7-1 for proposed actions

6.2 Translocation Site Preparation

As the translocation will occur immediately after collection, the Translocation Site will need to be prepared prior to translocation. The collection methods entail digging within the Translocation Site before collecting a translocation section form the impact area and placing the section into the hole within the Translocation Site.

Site preparation includes the removal of threatening processes that may impact upon the success of plant survival. These include weed control, protection from herbivory and management of fire risks. An irrigation system may be required to ensure moisture levels remain adequate for plant survival.

It is recommended that weather conditions are monitored prior to translocation. A moist site is preferable for translation. Refer Table 7-1 for proposed actions

7 TRANSLOCATION OF SECTIONS

7.1 Timing

The disturbance area associated with the quarry is expected to take place in September. The success rate of the translocation program for *Tetratheca juncea* is not reliant on if the species is in flower or not and therefore can be undertaken anytime. However, it is considered that spring is an ideal translocation time as the *Tetratheca juncea* will be flowering. This will ensure that *Tetratheca juncea* plants can be confidently identified before translocation occurs.

7.2 Translocation Process

The translocation of each of the sections will be undertaken by an experienced ecologist and excavator driver. The entire root body and associated soil should be moved as a whole. Small individual plants can be removed by manual labour. Larger clumps of plants will require mechanical removal to limit disturbance and plant stress. Mechanical removal will be undertaken by the excavator.

It is recommended that translocation takes place in the morning to ensure that moisture and heat stress is minimised, and that the root balls do not dry out during translocation.

The following methods are proposed for the translocation program:

- Driver to take a large scoop, using the pink spray and the ecologist guidance as an indicator for size. The translocated sections will have large root balls which will include soil from the source area. This will assist in ensuring that any mycorrhizal fungi present within the soil and to harvest a maximum quantity of vegetative and growing media material and in doing so optimising the chances of success post transfer is also transported to the Translocation Site.
- Translocated sections will be carefully moved to ensure minimal disturbance and will be cleaned of any weed species.
- Driver to carefully place the sections on a truck and then transported to Translocation Site.
- Driver to carefully place the translocation section in the pre prepared hole under supervision of the ecologist.
- The area should be watered immediately by water tanker. The translocation sections will receive follow up watering to ensure establishment (subject to local weather conditions and requirements).

Follow the above steps until all translocation sections have been transferred. Refer Table 7-1 for proposed actions

7.3 After planting care

In order to maximise plant survival a maintenance program is required. Mulch can be used to reduce moisture loss and provide a barrier for weed establishment. Mulch is a good source of organic matter and can provide protection from frosts. Mulch needs to be sterile and free from weed seeds. Watering can occur via an irrigation or dripper system if required. The site under the advice of the ecologist will manage the irrigation schedule. Maintaining moisture levels ensures the individuals are not experiencing unnecessary stress during the establishment period. Once established the watering regime can be adjusted to allow the plants to adapt to drier conditions. Soil wetting agents can be used to increase the moisture holding capacity of the soil, or hydro-crystals can be used to store moisture that is available for uptake by the plants.

Protection of transplant sites through fencing or tree guards will exclude herbivores from impacting on plant survival. Ongoing weed control will be necessary to ensure competition is minimal. Monitoring of plant health for insect attack, pathogens and fungus are important to allow the effective treatment of plants to prevent avoidable attrition. Other preventative measures such as spraying replanted areas with Phosphonate can improve plant vigour and prevent the infection of *Phytophora cinnamomi*. Refer Table 7-1 for proposed actions.

7.4 General Inspections

Firebird Ecologists will undertake general inspections of the translocated sections withinthe first two weeks after translocation occurs. General health, flower numbers, stems and soil moisture will be monitored during these inspections.

Monitoring of plant health for insect attack, pathogens and fungus are important to allow the effective treatment of plants to prevent avoidable attrition. Other preventative measures such as spraying replanted areas with Phosphonate can improve plant vigour and prevent the infection of *Phytophora cinnamomi*.

Reports should be provided annually on the success of translocation methods and recommendations made to assist in future translocation efforts. All works are to be recorded via a photographic record, the results of which are to be included in the ensuing project reports.

Table 7-1 Proposed Actions

Site	Action	Timing	Person Responsible	Equipment
Impact Site	Mark out translocation sections with pink spray	Preferable during flowering period September - January	Firebird Ecologist	Pink Spray
Impact Site	Number each translocation site	Preferable during flowering period September - January	Firebird Ecologist	Marking Tape, Permanent Marker
Impact Site	Photograph each translocation section	Preferable during flowering period September - January	Firebird Ecologist	Camera
Impact Site	Plant species list for each translocation section	Before removal of the Tetrathecea juncea	Firebird Ecologist	
Translocation Site	Digging hole for translocation section	Preferable during flowering period September - January	Firebird Ecologist and excavator driver	Excavator
Impact Site	Taking a scoop from delineated translocation section	Preferable during flowering period September - January	Firebird Ecologist and excavator driver	Excavator
Translocation site and impact site	Trucks and excavator area to continue from the impact site to the translocation site removing and re planting translocation sections until all sections are transferred.	Preferable during flowering period September - January September	Firebird Ecologist and excavator driver	Excavator
Translocation Site	Protection of transplant sites through fencing or tree guards will exclude herbivores from impacting on plant survival	Preferable during flowering period September - January September	Firebird Ecologist with the contractor	Fencing or tree guards
Translocation	Watering of translocated sections or otherwise drip	Every afternoon for	Site Supervisor	Water Tanker or

Site	Action	Timing	Person Responsible	Equipment
Site	irrigation	the first week and twice weekly for next fortnight.	with input from Firebird ecologist	irrigation or dripper system.
Translocation Site	GPS Translocation section locations. Install permanent marker (star picket) and number	After *Tetrathecea juncea* has been translocated	Firebird Ecologist	Star pickets, GPS
Translocation Site	Ongoing weed control will be necessary to ensure competition is minimal and Monitoring of plant health for insect attack, pathogens and fungus are important to allow the effective treatment of plants to prevent avoidable attrition.	Ongoing weed control and monitoring of plant health every two months for the first year and proving affective treatment measures	Firebird Ecologist	
Translocation Site	Monitoring. Recording flower numbers, fruits plant health, soil moisture levels, plant species and taking photos. A Monitoring report will be produced detailins these findings and correction actions.	During the peak flowering period which is normally October / December 2015. October & December 2016, 2017, 2018, 2019, 2020.	Firebird Ecologist	Camera

8 OBJECTIVES OF THE TRANSLOCATION PROGRAM

The objectives of the translocation program is to successfully translocate the clumps of *Tetratheca juncea* that occur within the project impact area to the Translocation Site, and to enhance the survival of this species by weed control and monitoring of plant health for insect attack, pathogens and fungus are important to allow the effective treatment of plants to prevent avoidable attrition and to determine the best actions to help the survival and success rate of the translocated clumps. The overall objective is to ensure that the *Tetrathecea juncea* within the Translocation Site is able to survive on its own accord.

8.1 Short Term Goals

Ongoing weed control and monitoring of the health of the species to ensure high survival and success rate of the translocated clumps.

8.2 Long Term Goals

Measure the success of translocation methods and make recommendations to assist in future translocation efforts.

9 MONITORING PROGRAM

Follow up monitoring on the success of the translocation will be undertaken for the first two weeks of the translocation and then 1 month after translocation (ELA, 2014). Further monitoring will be undertaken when the species fruits in December. Further monitoring will be undertaken annually during the peak flowering period of the species for a period of 5 years.

A qualified ecologist will conduct monitoring for each translocation section, which will include the following actions detailed in Table 9-1;

Table 9-1 Monitoring Elements

Timing	Monitoring Action
October 2015	• Count Flowers • Observe general plant health • Identify all plants within section • Photo point • Weed monitoring and management
December 2015	• Count Flowers • Count fruits • Observe general plant health • Identify all plants within section • Photo point
October 2016 October 2017 October 2018 October 2019 October 2020	• Count Flowers • Observe general plant health • Identify all plants within section • Photo point

The above information will be used to report and measure the general health and success of translocated *Tetratheca juncea* sections. Reports should be provided annually on the success of translocation methods and recommendations made to assist in future translocation efforts. All works are to be recorded via a photographic record, the results of which are to be included in the ensuing project reports

10 BIBLIOGRAPHY

Driscoll, C. (2010) Centennial Coal, Cooranbong-Awaba Haul Road, Threatened Flora Translocation Report. Report by Hunter Eco for Centennial Coal.

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Driscoll, C. (2003). Pollination ecology of *Tetratheca juncea* (Tremandraceae): finding the pollinators. *Cunninghamia*. 8(1):133-140.

Driscoll, C. (2009). *A review of the ecology and biology of* Tetratheca juncea *Sm. (Elaeocarpaceae). Draft report to Lake Macquarie City Council*.

Eco Logical Australia (2014). K*aruah East Quarry EPBC 2014/7282 – EPBC Act Assessment report'* Prepared for Karuah East Quarry Pty Ltd.

Lake Macquarie City Council, 2013, *Draft Lake Macquarie Tetratheca juncea Planning and management guidelines*, Prepared by: Lake Macquarie City Council.

RPS (June 2013) Terrestrial Ecology Survey and Assessment Report
Karuah East Quarry, Karuah, NSW

APPENDIX A EXPERT APPROVAL FOR PROJECT

NSW GOVERNMENT Planning & Environment

Planning Services
Resource Assessments

Contact: Swati Sharma
Phone: 9228 6221
Email: swati.sharma@planning.nsw.gov.au

Our Ref: MP 09_0175

Mr Blake Almond
GM Business Development
Karuah East Quarry Pty Ltd
PO Box 3081
Thornton NSW 2322

Dear Mr Almond

Karuah East Quarry Project (MP 09_0175)
Expert Approval

I refer to your letter dated 23 June 2015 requesting the Secretary's approval of suitably qualified persons to prepare specific management plans stipulated under conditions 7, 12, 16, 21, 26, 27, 32, 33 and 36 of Schedule 3 of the quarry's project approval.

The Department has reviewed the CVs provided with your letter and is satisfied that the nominated persons are suitably qualified. Consequently, I can advise that the Secretary endorses the following persons

Expert	Company	Management Plan	Condition in Schedule 3
Nathan Archer	SLR Consulting	Noise Management Plan	7
Nathan Archer	SLR Consulting	Blast Management Plan	12
Martin Doyle	SLR Consulting	Air Quality Management Plan	16
Duncan Barnes	SLR Consulting	Water Management Plan	21
Craig Nethery and Andy Davis	Streetwise Road Safety and Traffic Services	Transport Management Plan	26
Sarah Jones, Alex Picton and Nicholas Alexander	Firebird EcoSultants	*Tetratheca juncea* Translocation Program	27
Chris Jones and Aaron Mulcahy	SLR Consulting / Kleinfelder	Landscape and Rehabilitation Management Plan	32
Aaron Mulcahy and Luke Forster	Kleinfelder	Biodiversity Offset Area Management Plan	33
Jeremy Hill and Darrell Rigby	RPS	Heritage Management Plan	36

If you require any more information, please call Swati Sharma on 9228 6221.

Yours sincerely

Howard Reed 22.7.15
Howard Reed
Director
Resource Assessments
As nominee of the Secretary