

Preliminary Documentation







Williamtown Sand Syndicate Pty Ltd

Cabbage Tree Road Sand Quarry (EPBC 2016-7852)

282B Cabbage Tree Road, Williamtown NSW 2318

19 February 2018



Preliminary Documentation

Cabbage Tree Road Sand Quarry (EPBC 2016-7852)

282B Cabbage Tree Road, Williamtown NSW 2318

Kleinfelder Document Number: NCA17R67151 File Name: 20170448_Cabbage Tree Rd_2016-7852_v2.docx Project No: 20170448 All Rights Reserved

Prepared for:

WILLIAMTOWN SAND SYNDICATE PTY LTD PO BOX 898 NEWCASTLE NSW 2300

Only Williamtown Sand Syndicate Pty Ltd, its designated representatives or relevant statutory authorities may use this document and only for the specific project for which this report was prepared. It should not be otherwise referenced without permission.

Document Control:

Version	Description	Date	Author	Technical Reviewer	Peer Reviewer
1.0	Final	25 October 2017	C. Phu	S. Schulz J. Berry	K. Peters
2.0	Final, incorporating comments from adequacy review.	19 February 2018	C. Phu	S. Schulz J. Berry	K. Peters

Kleinfelder Australia Pty Ltd 95 Mitchell Road Cardiff NSW 2282 Phone: (02) 4949 5200 Fax: 1300 881 035

ABN: 23 146 082 500



Contents

1.	INTRO		9
	1.1	CHRONOLOGY OF KEY EVENTS IN STATE APPROVAL PROCESS	9
	1.2	DOCUMENT PURPOSE	. 13
2.	DESC	RIPTION OF THE PROJECT	_17
	2.1	BACKGROUND	. 17
		2.1.1 Key Project Changes	18
	2.2	PROJECT SUMMARY	. 19
	2.3	THE NEED	. 21
		2.3.1 Demand	21
		2.3.2 Employment and Royalties	22
	2.4	THE RESOURCE	. 22
		2.4.1 Proposed Sand Products	23
		2.4.2 Extraction Rate and Project Life	25
	2.5	PROPOSED INFRASTRUCTURE	. 27
		2.5.1 Clearing and Earthworks	27
		2.5.2 Intersection and Access Road	30
		2.5.3 Office and Workshop Compound	31
		2.5.4 Fencing and Security	31
	2.6	OPERATIONS	. 32
		2.6.1 Pre-extraction Activities	33
		2.6.2 Quarrying of Resource	35
		2.6.3 Noise Bunds and Operational Limitations	37
		2.6.4 Processing and Sale	37
		2.6.5 Transport	38
		2.6.6 Hydrocarbon Management	38
	2.7	REHABILITATION AND FINAL LAND USE	. 40
		2.7.1 Final Land Use	46
	2.8	EQUIPMENT SUMMARY	. 46
	2.9	HOURS OF OPERATION AND WORKFORCE	. 48
	2.10	WATER	. 49
	2.11	PROJECT ALTERNATIVES	. 50
		2.11.1 Extraction Area	50
		2.11.2 Extraction Method	51
		2.11.3 Site Access Alternatives	51
		2.11.4 Rehabilitation Method	52



		2.11.5	Alternative of Not Proceeding	52
	2.12	COST	ING OF THE MANAGEMENT ACTIONS	53
3. ENVII	DESC RONME	RIPTIC ENTAL	ON OF THE ENVIRONMENT AND MATTERS OF NATIONAL SIGNIFICANCE	55
	3.1	DESC	RIPTION OF THE ENVIRONMENT	55
		3.1.1	Context of the Subject Land	55
		3.1.2	Current Land Use	55
		3.1.3	Hydrology	58
		3.1.4	Soil and Vegetation Characteristics	61
		3.1.5	Remnant Vegetation	62
	3.2	MATT	ERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE	66
		3.2.1	Camfield's Stringybark (Eucalyptus camfieldii)	66
		3.2.2	Earp's Gum (Eucalyptus parramattensis subsp. decadens)	75
		3.2.3	Koala (Phascolarctos cinereus)	83
		3.2.4	Grey-headed Flying-fox (Pteropus poliocephalus)	93
4.	RELE	VANT I	MPACTS	97
	4.1	HABI	TAT IMPACTS ON THREATENED SPECIES	97
		4.1.1	Camfield's Stringybark (Eucalyptus camfieldii)	97
		4.1.2	Earp's Gum (Eucalyptus parramattensis subsp. decadens)	99
		4.1.3	Koala (Phascolarctos cinereus)	102
		4.1.4	Grey-headed Flying-fox (Pteropus poliocephalus)	109
	4.2	GROL	JNDWATER AND SURFACE WATER IMPACTS	111
		4.2.1	Impacts from Depth of Mining	113
		4.2.2	Impacts on Water Quality	115
		4.2.3	Impacts due to Erosion and Soil Movement	116
5.	PROP	OSED	AVOIDANCE AND MITIGATION MEASURES	117
	5.1	INTRO	DDUCTION	117
		5.1.1	Operating Limits, Times and Criteria	118
		5.1.2	Management and Offset Measures	119
	5.2 MEAS	SPEC SURES	IFIC GROUNDWATER AND SURFACE WATER MITIGATION	138
	5.3	GENE	RAL MITIGATION MEASURES	138
	5.4	REHA	BILITATION AND ECOLOGY	150
		5.4.1	Objectives	150
		5.4.2	Rehabilitation Plan	151
		5.4.3	Rehabilitation Methodology	152
		5.4.4	Monitoring Methodology	158



		5.4.5 l	Performance Criteria	160
		5.4.6	Completion Criteria	162
	5.5	KOALA	SPECIFIC MITIGATION MEASURES	163
		5.5.1	Vehicle Mortality	163
		5.5.2	Vegetation Clearing	163
		5.5.3 l	Monitoring of Mitigation Measures	165
6.	RESI	DUAL IM	PACTS / PROPOSED OFFSETS	166
	6.1	RESID	UAL IMPACTS ON RELEVANT MNES	166
	6.2	OFFSE	T STRATEGY	166
		6.2.1 I	Introduction	166
		6.2.2 I	Description of the Offset Site	167
		6.2.3 I	Biodiversity Credit Assessment	167
		6.2.4	Security of the Offset	170
		6.2.5	Management of the Offset	170
		6.2.6	EPBC Act Offset Assessment Guide	173
7.	ОТНЕ	R APPR	OVALS AND CONDITIONS	181
8.	SOCI	AL AND		182
	8.1	DETAIL	S OF PUBLIC CONSULTATION ACTIVITIES	182
		8.1.1	Goals of the Consultation Program	182
- 6		8.1.2	Community Consultation Program	184
		8.1.3	Consultation Outcomes to Date	186
		8.1.4	Documentation of Consultation	187
		8.1.5	Ongoing Consultation	188
	8.2	PROJE	CTED COSTS AND BENEFITS	189
		8.2.1 I	Employment and Royalties	189
		8.2.2 I	Demand	189
	8.3	ESTIM/	ATED VALUE OF THE PROJECT	190
9. ACT		RONMEN	ITAL RECORD OF PERSON PROPOSING TO TAKE THE	191
40				
10.				192
7	10.1 10.2			192
	10.2	SUIVIIVI	ANT OF INFACTS AND COMPENSATION	197
11.	REFE	RENCES	8	199



Tables

Table 1.	Summary of request for information and where requirements are addressed in preliminary documentation	13
Table 2:	Planned extraction rate	27
Table 3:	Estimated costs relevant to MNES	53
Table 4:	Number of NPWS Atlas records per Bell and Driscoll (2006) Vegetation Communities within the RAAF Williamtown West sub-population and the area of each vegetation community	78
Table 5:	Number of <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> recorded within each plot sampled within the RAAF Williamtown West sub-population	80
Table 6:	Eucalyptus parramattensis subsp. decadens local population estimate	83
Table 7:	Survey effort within the Subject Land	85
Table 8:	Results of Koala SAT Surveys	86
Table 9:	Classification of Koala Habitat as per CKPoM	88
Table 10:	Estimated preferred and supplementary Koala habitat and potential Koala habitat within the Tomago Sandbeds KMU	91
Table 11:	Assessment of habitat critical to the survival of the Koala1	03
Table 12:	Operating limits, times and criteria1	18
Table 13:	Proposed management and offset measures1	19
Table 14:	Environmental outcomes1	40
Table 15:	Mitigation measures to address each MNES1	45
Table 16:	Typical species present within target vegetation communities, noting this is not exhaustive or prescriptive (i.e. all species shown should not be present within all areas)	54
Table 17:	Tree species important for Koalas proposed for rehabilitation1	58
Table 18:	Details of data collected at each survey1	58
Table 19:	Performance criteria for rehabilitation1	61
Table 20:	Completion criteria for rehabilitation1	62
Table 21:	Biodiversity credit ledger1	68
Table 22:	Standard management actions for biobank sites1	71
Table 23:	Additional management actions required for the biobank site	71
Table 24:	Planting strategy to achieve overstorey cover target1	73
Table 25:	Assessment of Koala habitat against EPBC Act Referral Guidelines assessment tool	75
Table 26:	Community information sessions1	85
Table 27:	Summary of issues raised during consultation1	86
Table 28:	Summary of impacts1	97



Figures

Figure 1:	Project Location Plan	10
Figure 2:	Aerial of the Subject Land and Project Area	11
Figure 3:	Resource Areas Considered During the Development of the Project	24
Figure 4:	Quarry Operations Plan	26
Figure 5:	Revised Intersection, Office and Workshop Area	28
Figure 6:	North-south Section through Quarry and Cabbage Tree Road	29
Figure 7:	Proposed resource recovery process (note electric conveyor feed bin shown, may be substituted for a simple feed bin).	36
Figure 8:	Quarry Progress Plan Year 1	41
Figure 9:	Quarry Progress Plan Year 3	42
Figure 10:	Quarry Progress Plan Year 5	43
Figure 11:	Quarry Progress Plan Year 7	44
Figure 12:	Quarry Progress Plan Year 9	45
Figure 13:	Final Landform and Rehabilitation	47
Figure 14:	Context of the Subject Land	56
Figure 15:	Elevation and drainage of the project area and subject land in relation to surrounding lands	59
Figure 16:	Indicative section illustrating surface water flow direction from the extraction area	60
Figure 17:	Vegetation Communities within the Subject Land	63
Figure 18:	Eucalyptus camfieldii Survey Effort	71
Figure 19:	Eucalyptus camfieldii Locations	74
Figure 20:	Eucalyptus parramattensis subsp. decadens RAAF Williamtown West Subpopulation	76
Figure 21:	Revised Koala Habitat Mapping	90
Figure 22:	Koala Habitat Mapping Tomago Sandbeds KMU	92

Plates

Plate 1:	Examples of <i>Eucalyptus camfieldii</i> characteristics used for identification; leaf length to breadth ratio (top left and right), blunt leaf apex with mucro (top left and right), and sessile angular buds (bottom left)	69
Plate 2:	<i>Eucalyptus camfieldii</i> within the Project area (rehabilitation) (left), and within the offset area (right).	73



Appendices

- Appendix 1. Preliminary Documentation Requirements
- Appendix 2. Environmental Management Plan
- Appendix 3. Ecological Summary Report
- Appendix 4. EPBC Referral Report
- Appendix 5. Royal Botanic Gardens Sydney, Species Determinations
- Appendix 6. Groundwater, Surface Water and PFAS
- Appendix 7. Biodiversity Offset Strategy
- Appendix 8. OEH Review of the Response to Submissions Documents



1. INTRODUCTION

Kleinfelder Australia Pty Ltd referred the Cabbage Tree Road Sand Quarry (EPBC 2016/7852) to the Department of the Environment and Energy in December 2016 on behalf of the Williamtown Sand Syndicate Pty Ltd (WSS). On 29 May 2017 the Project was declared a controlled action and it was determined that the Project would be assessed by preliminary documentation.

The Cabbage Tree Road Sand Quarry is a proposed sand quarry located on Cabbage Tree Road, Williamtown, within in the Port Stephens Council local government area of New South Wales (see **Figure 1)**. The quarry is proposed to operate for 8-15 years and will extract approximately 3.25 million tonnes per annum (Mtpa) at up to 530,000 tonnes per annum (tpa) from a Project Area of 42.3 hectares. An aerial photograph of the Subject Land and Project Area is further illustrated in **Figure 2**.

1.1 CHRONOLOGY OF KEY EVENTS IN STATE APPROVAL PROCESS

The Project is currently undergoing assessment under the NSW *Environmental Planning and Assessment Act 1979.* An Environmental Impact Statement (EIS) has been subject to public exhibition and has received submissions, which have been reviewed and responded to under the state assessment process.

As a result of the submission process, the Project was reviewed and the following changes were made:

- Additional survey for threatened flora species to further assess potential impacts on threatened species;
- Additional survey for the development of a Biodiversity Offset Strategy;
- The reconfiguration and resequencing of the quarry and extraction methods;
- Reduction in spatial extent of the quarry to minimise impacts on ecology and neighbouring properties;
- Re-assessment of ecological impacts of the project based on revised quarry extents and additional survey;



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig01_LocationPlan.mxd



KLEINFELDER Bright People. Right Solutions.

www.kleinfelder.com

Williamtown Sand Syndicate EPBC Preliminary Documentation Proposed Sand Quarry Cabbage Tree Road, Williamtown

DATA SOURCE: NSW Land and Property Information - 2016 Port Stephens Council - 2000 nearmap - 2017



- Local Road
- - Track

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig02_SubjectLand.mxd



- Re-assessment of air quality impacts associated with the altered configuration and sequencing of the quarry and based on comment from the Department of Planning and Environment (DPE);
- Assessment of risks of the quarry to human health associated with the extraction of silica;
- Re-assessment of noise impacts of the project based on the amendments to the project;
- Survey of radiation risks and a Phase 1 environmental investigation for contamination;
- Analysis of groundwater for per- and polyfluoroalkyl substances (PFAS) contamination;
- Revised intersection design; and
- Additional community consultation following the EIS in the form of community meetings, one on one meetings, newspaper notices and newsletters. This consultation is all in addition to that which is required under legislation.

These changes were described and discussed in a Response to Submissions document, which was lodged with the DPE in November 2016. Following the lodgement of the Response to Submissions the following additional information was provided in response to further requests for information:

- On 18 November 2016 a request for the survey and assessment of the recently discovered Uperoleia mahonyi (Mahony's Toadlet). The toadlet has only been recently listed as a threatened species under state legislation but is not listed under the Environment Protection and Biodiversity Conservation Act 1999. On lodgement of the report with DPE on 16 December 2016, no further comment on this matter has been received;
- Additional detail on the noise impact assessment was provided in December 2016;
- Additional groundwater modelling information and a peer review of the groundwater modelling and assessment was provided in January 2017;
- Clarification with Aboriginal Stakeholders and lodgement of a revised Aboriginal Cultural Heritage Impact Assessment was provided in February 2017; and
- Consideration of the need for monitoring of PFAS within dust to ensure the quarry would not contribute to additional PFAS in the local area. In looking to adequately respond to this, WSS undertook the following investigations:
 - Review of monitoring techniques for PFAS in air, to find that there is currently no accredited method for undertaking such monitoring;
 - Preparation of a response on per- and polyfluoroalkyl substances (PFAS) risks associated with airborne dust from the quarry based on known exposure pathways and existing advice on possibilities of the development of a monitoring system, lodged in 2 February 2017; and
- To further address the risks of the quarry in contributing to PFAS concentrations in the local community, testing of the soil was undertaken across the site. The analysis



determined that there were no measurable concentrations of PFAS within the samples analysed and as such the quarry is highly unlikely to contribute to PFAS concentrations to onsite workers or to neighbouring residents. A report detailing the analysis undertaken and results of analysis was lodged with the DPE on 21 February 2017.

- Additional groundwater and surface water sampling was undertaken in May 2017 along the southern extent of the proposed quarry and analysed for PFAS, no measurable concentration was detected.
- Although no measurable concentrations of PFAS were detected in onsite soil, surface water or groundwater a Contingency Management Plan for potential PFAS disturbance during construction activities was prepared. The management plan included commitments to avoid interaction with groundwater during construction wherever feasible (e.g. limiting depth of footings, installation of power or water utilities, and during road subbase construction).

1.2 DOCUMENT PURPOSE

This report represents a consolidation of the state documentation and has been prepared to the specifications in the requirements for preliminary documentation, which was issued to WSS on 29 June 2017 and for which a copy is attached at **Appendix 1**. In preparing this report, Kleinfelder has drawn upon the information from the EIS, the additional studies undertaken in response to submissions, the referral document, and provided supplementary information as required.

Table 1 summarises the information required for the preliminary documentation and indicateswhere each requirement has been addressed in this report.

	Request Item	Where addressed in this document
Description of the Action	The PD must provide background to the action and describe in detail all components of the action for example (but not limited to) the land and vegetation clearance, quarry operations and decommissioning and rehabilitation works. This must include the precise location of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or relocated and elements of the action that may have impacts on relevant MNES. The description of the action must include details on how the works are to be undertaken (including stages	Section 2

Table 1.Summary of request for information and where requirements are addressed in
preliminary documentation



	Request Item	Where addressed in this document
	of development and their timing) and design parameters for elements of the action that may have relevant impacts.	
Description of the Environment and Matters of National Environmental Significance	 The PD must provide a general description of the environment affected by and surrounding the proposed action area, in both the short and long term. This section must specifically include: a) A description of the MNES (listed threatened species and communities) that may be affected by the proposal, in particular: i. Camfield's Stringybark (<i>Eucalyptus camfieldii</i>) (vulnerable) ii. Earp's Gum (<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>) (vulnerable) iii. Koala (<i>Phascolarctos cinereus</i>) (vulnerable) iv. Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) (vulnerable) b) A description of the current land use, land topography, surface and underground waterways and water bodies and vegetation coverage (habitat types as they relate to the above listed threatened species) on the proposed action site and adjoining areas. c) Information about the resources used to identify and assess the environmental values on the proposed action site and surrounding areas, including survey data and historical records. Survey data must be provided for the above listed threatened species. d) Information detailing known/recorded populations and known or potential habitat, including habitat in the area surrounding the proposed action site (including whether habitat is critical to the survival of the species). Information must include maps indicating the distribution of the above listed threatened species and associated habitat. e) An assessment of the adequacy of any surveys undertaken (including survey effort and timing). In particular the extent to which these surveys were appropriate and undertaken in accordance with the Department's relevant survey guidelines for: i. Australia's threatened bats http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-bats-guidelines/detecting-bats-listed-threatened 	Section 3
Relevant Impacts	 The PD must include an assessment of the potential impacts on the listed threatened species identified in section 3 (including direct, indirect, consequential and cumulative impacts) that may occur as a result of all elements and phases of the proposed action. As part of the potential impacts addressed in the PD, the Department requires specific information to be included on the following: Habitat impacts on listed threatened species Groundwater and surface water impacts Disturbance to Koala and Grey-headed Flving-fox populations 	Section 4
Proposed Avoidance and	The PD must provide information on proposed avoidance and mitigation measures to prevent or minimise impacts on the listed threatened species identified in section 3 likely to be impacted by the proposed	Section 5



	Request Item	Where addressed in this document
Mitigation Measures	 action. A consolidated list of proposed avoidance and mitigation measures must be provided, based on best available practices and must include, but not be limited to, the following elements: Specific groundwater and surface water mitigation measures General mitigation measures 	
Residual Impacts / Proposed Offsets	In the event that there are significant impacts that cannot be avoided or mitigated, a description of any offsets to compensate for residual impacts on threatened species must be provided for each protected matter. The Department considers that an offset package is required to compensate for residual impacts to Camfield's Stringybark and Earp's Gum local populations and Koala and Grey-headed Flying-fox habitat to be removed by the proposed action. The PD should provide details of an offset package to compensate for residual impacts on these species. The Department understands that an offset package is being developed to address the residual impacts of the proposed action in accordance with the endorsed NSW Biodiversity Offsets Policy for Major Projects, published by the Office of Environment and Heritage (OEH) for the NSW Government in September 2014.	Section 6
Other Approvals and Conditions	 The PD must include information on any other requirements for approval or conditions that apply, or that you reasonably believe are likely to apply, to the proposed action. This must include: A description of any approval obtained or required to be obtained from a local, State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including its current status and any conditions that apply to the proposed action; A statement identifying any additional approval that is required; and A description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action. 	Section 7
Social and Economic	 The PD must address the economic and social impacts (both positive and negative) of the proposed action at a local, regional and national level. This may include: Details of any public consultation activities undertaken, and their outcomes Projected costs and benefits of the proposed action, e.g. employment opportunities expected to be generated by the project (including construction and operational phases). This must include specific dollar amounts or relevant numeric values The estimated value of the project in \$. 	Section 8
Environmental Record of Person Proposing to take the Action	 The PD must include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: The person proposing to take the action For an action for which a person has applied for a permit, the person making the application. If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework should be described. 	Section 9



	Request Item	Where addressed in this document
Conclusion	The PD must provide an overall conclusion as to the environmental acceptability of the proposal, including discussion on compliance with the principles of Ecologically Sustainable Development (ESD) and the objects and requirements of the EPBC Act.	Section 10
	To assist you, the National Strategy for Ecologically Sustainable Development (1992) is available on the following web site: <u>https://www.environment.gov.au/about-us/esd/publications/national-esd-strategy</u> .	
	Reasons justifying undertaking the proposal in the manner proposed and measures proposed or required by way of offset for any unavoidable impacts on MNES, along with the relative degree of compensation, should be restated here.	



2. DESCRIPTION OF THE PROJECT

2.1 BACKGROUND

Port Stephens Council (PSC) purchased four allotments on Cabbage Tree Road from Rutile and Zircon Mines (Newcastle) Limited (RZM). The four allotments are Lot 1012 DP 814078, Lot 11 DP 629503, Lot 121 DP 556403, and Lot 1 DP 224587, and are collectively referred to as the Subject Land.

During the thirty-year ownership by RZM, the land was used for a variety of uses including extensive heavy mineral sand mining, silica sand extraction, deposition of sand tailings, burial of monazite, equipment storage and sand filling.

Following acquisition from RZM, PSC were made aware of the potential presence of a sand resource. PSC undertook an assessment of the potential resource characteristics and environmental constraints before seeking tenders in 2012 for interested parties to extract sand from the Subject Land. At this stage the resource was characterised as containing 4.6 million tonnes (Mt) over an area of 69.85 hectares (ha).

Castle Quarry Products was the successful tenderer and entered into a 15-year lease with PSC. Key elements of the winning tender included:

- \$5/ tonne royalty based on sand leaving the quarry;
- Ground rent of \$100,000 per annum;
- Minimum extraction rate of 250,000 tonne (t) per year for Year 1 and 300,000 t each year after; and
- Amounting to approximately \$16,250,000 in royalties plus \$800,000 to \$1,500,000 depending on the duration of the quarry (i.e. 8-15 years).

The lease was subsequently transferred to Williamtown Sand Syndicate Pty Ltd (WSS) with the approval of PSC, including an extension to various lease milestones on account of several delays in the development of the Project. A \$250,000 security deposit was provided to PSC to demonstrate the financial capability of WSS to operate the quarry. The deposit is returnable to WSS on conclusion of the lease if completed to required standards.



In September 2013, a request for Director General's Requirements (DGRs) was made to NSW Department of Planning for a sand quarry that would have an annual extraction rate in excess of 500,000 t from a resource of 4.6 Mt. Given the extraction of more than 500,000 tonnes per annum (tpa) the quarry was considered a State Significant Development (SSD) pursuant to the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

An EIS for the Project was subsequently prepared and publicly exhibited for nine weeks from 4 December 2015 to 15 February 2016. The EIS was based on the extraction of up to 600,000 tpa from a resource of 3.32 Mt over an area of 53.4 ha.

2.1.1 Key Project Changes

Based on the responses to the public exhibition and government authority review of the EIS documentation, changes were made to the Project to reduce its potential impact on the environment and community. The changes include:

- Reduction of the maximum extraction rate from 600,000 tpa to 530,000 tpa, or the equivalent of a reduction in over 2,100 trucks on the road per annum when at maximum extraction;
- Change of the predominant extraction method to portable electric conveyors fed by front end loaders. The existing method of dozer push, loader, and articulated trucks would remain but used only when conveyors are under maintenance. This will reduce noise sources, dust generation and diesel consumption;
- Change to electric processing (conveyors, stackers, screens and air separator) that will be predominantly powered by mains power. Note: in the event of unforeseen outages or mains connection issues a diesel generator may be used as a backup;
- Removal of a tub grinder from operations;
- The inclusion of an emergency avoidance lane on the eastbound lane of Cabbage Tree Road at the intersection to the site to improve emergency avoidance of static right turning private vehicles;
- Reduction in the resource footprint of 22.5% based on a range of additional avoidance and optimisation measures; and
- Extraction and rehabilitation sequencing that will limit the area exposed during operations to active quarrying sectors. Rehabilitation will commence in each extraction sector once quarrying is completed in each sector. This will result in a progressive rehabilitation plan for the life of the Project.



The descriptions provided in the following sections detail these changes.

2.2 PROJECT SUMMARY

The revised Project involves the following key elements:

- Extraction and processing of a 3.25 Mt sand resource at up to 530,000 tpa over a Project life of up to 15 years including:
 - o Quarrying using a combination of excavator, loaders, dozers, trucks and conveyors;
 - o Processing the sand using a screen and air separation system; and
 - o Sale and transport of sand products from the site;
- No use of groundwater from the site and maintenance of a 0.7 m buffer above the maximum predicted groundwater level during extraction, with a 1.0 m buffer reinstated for the final landform on conclusion of extraction.
- Infrastructure including:
 - An upgraded intersection on Cabbage Tree Road consisting of left-turn-in deceleration lane and left-turn-out acceleration lane;
 - o A sealed access road to an office and workshop compound and extraction areas;
 - An office and workshop compound comprising offices, toilets (with waste pump out), workshop, weighbridge, fully bunded plant storage and refuelling area, and staff/visitor car park; and
 - o The compound area will be connected to the water and electrical mains networks;
- Progressive rehabilitation of the extraction area to a native ecosystem, equivalent to or better than existing; and
- Provision of a comprehensive offset strategy.

The quarry will extract approximately 3.25 Mt of sand over approximately eight years (at expected market demand) or up to 15 years allowing for a variable market demand. Sand will be quarried at up to 530,000 tpa from a total disturbance area of 42.3 ha. The variable quoted tonnages account for changing thoughts on the sand density.

The resource is effectively divided into a southern and northern resource area. Resource extraction will commence in the southern area with the establishment of an intersection on Cabbage Tree Road and a 200 metre (m) bitumen sealed access road through to the office and workshop area. Extraction and the construction of a sealed access continues north through the centre of the southern resource area to the northern area. The northern resource area is extracted south to north along the western side then the eastern side before returning to the



southern area and the completion of quarrying. The final landform will remain at a minimum of 1 m above the highest predicted groundwater levels with 1 in 4 batters (1 m vertical to 4 m horizontal) around the perimeter of the resource area. Typically, the batters will be less than 1 m in height, with exception to the south-western and western boundaries of the resource where batters will reach up to 12 m high (i.e. batters up to 48 m wide).

Sand is extracted using front-end loader from the base of a batter face and loaded into a series of electric conveyors that convey the sand to the semi-mobile processing plant (i.e. it will move to seven locations during the Project). The processing plant includes an electric screen and air separator that provides a dry method for processing the sand. The sand is then stockpiled for loading into bulka bags or directly into trucks. The trucks then transport the sand from the site via a weighbridge to the consumer.

Extraction occurs through a series of 1-2 ha sectors that provide for the direct transfer of topsoil and cleared vegetation to quarried areas to promote progressive rehabilitation. The core aim and objective of the rehabilitation is to reinstate native species consistent with the existing vegetation communities (in terms of composition and structure) in the area. Methods will include a combination of natural regeneration, brush matting, direct seeding and propagated tube stock methods. It is proposed to retain the intersection and access road through to the office and workshop area along with a suitable asset protection zone for a future land use consistent with the land zoning.

Residual biodiversity impacts are proposed to be offset through the establishment of a biobanking site over the remainder of the Subject Land area, in conjunction with retiring species credits offsite as required under the biobanking framework. Rehabilitated lands are also proposed to be secured under a long-term conservation agreement, once they reach a suitable standard.

Quarrying operations will be managed under an Environmental Management Plan that provides protocols for the management and monitoring of clearing, topsoil, weeds, rehabilitation, air quality, noise, traffic and water. Annual reporting will be required to satisfy Project Approval requirements stating progress activities undertaken through the year and adherence to Project Approval Conditions. In addition, annual reporting will be required against the conditions of an Environmental Protection Licence that will likely focus on air, noise and water monitoring.



2.3 THE NEED

2.3.1 Demand

A 2008 review of Stockton Bight sand products by Don Reed and Associates Pty Ltd (DRA 2008), found that approximately 1.5 Mt of sand was being produced annually from Stockton Bight quarries, with 66-85% being sold for construction purposes and the residual sold for industrial purposes. It is understood that with subsequent quarry approvals at Fullerton Cove and Salt Ash that production levels are now likely to exceed 2.5 Mt per annum. A review of local sand quarries details the rates of production for state significant approvals in the Port Stephens Local Government Area (LGA). It is also understood that these quarries are regularly operating at levels approaching their extraction limits:

- ATB Morton's Redisand can extract up to 0.201 Mtpa;
- Mackas Sand can extract up to 2 Mtpa;
- Boral Sand at Fullerton Cove can extract up to 0.5 Mtpa; and
- An application for a sand quarry extracting up to 0.75 Mtpa at Bobs Farm appears to be on hold since the application was lodged in 2013.

In 2008 approximately 0.8 Mtpa of the construction sand was sold to regional markets, with the balance being sold to Sydney markets. With the 1 Mt increase in sand supply since 2008, the increase in demand is likely the result of changes in both regional and Sydney markets, with the proportion of the Sydney market likely to increase with the closure of existing Sydney based quarries. DRA (2008) estimated that by 2015:

- The Hunter Region will be looking for 0.8 million to 1.0 million tpa fine construction sand;
- The Sydney Metropolitan area markets will be looking for more than 2.0 million tpa replacement fine construction sand for the 8 Mtpa demand; and
- Industrial sand markets will be facing a crucial shortage of suitable quality sands for use in foundries and in the manufacture of glass, fibre glass, grouts, adhesives and coatings.

Based on DRA's 2008 estimates and the demonstrated increase in supply since 2008 (of about 1 Mt), there is a demonstrated demand for sand from the area. Maintaining adequate supply levels is essential to ensuring stable sand prices, especially as it forms a large component of new home and road construction. The minimum price for sand will be governed by the costs of production, of which existing and larger operations are likely to have a strategic advantage with lower costs of production. The opportunity to provide an additional source of sand into the market is at the commercial risk of the proponent and is unlikely to significantly affect existing providers.



2.3.2 Employment and Royalties

The proposed Project will result in the capital expenditure of approximately \$4.7 million, in addition to employment of approximately six individuals during the three-month construction period.

The Project will then provide employment for six individuals for the duration of the Project (8 to 15 years). It is anticipated that approximately 20 contractor or customer truck drivers will also be involved in the haulage of sand from the quarry for its duration. It is likely the quarry employees will reside in the local area, while truck drivers are potentially living more remote from the quarry. This employment will provide economic stimulus to the local businesses and will also contribute taxes to the Federal government.

The lease arrangement for the Project as detailed above will result in the provision of over \$17 million to PSC. These funds will be available for Council to utilise in the provision of services to the ratepayers within the LGA.

On this basis the Project provides a valuable source of revenue for the local and regional economies.

2.4 THE RESOURCE

Resource estimates provided during the tender process with PSC estimated that the sand resource on the property above the 4 m contour was 5.17 Mt. With the incorporation of a wildlife corridor separating the northern and southern deposits, the resource was reduced to 4.61 Mt over 72.7 ha (69.9 ha without an access road).

The resource boundary presented within the EIS took into consideration the initial constraints and adopted additional constraints that resulted in an estimated resource of 3.32 Mt over an area of 54.6 ha (53.4 ha without access road). These constraints included:

- Avoidance of endangered ecological communities;
- Maintaining a 0.7 m buffer above the highest predicted groundwater level in the extraction area with a finished floor a minimum of 1 m above that level; and
- Maintaining a 20 m buffer to adjoining properties.



Taking into account the issues raised by the submissions to, and in the review of the EIS, a revised resource of 3.25 Mt over 42.3 ha was developed. This resource incorporated the following constraints:

- Avoidance of high density habitat areas based on additional field data collection;
- Review of the minimum recovery depth necessary to justify vegetation removal, rehabilitation and offsets; and
- Increase in buffers to some adjoining properties while increasing habitat corridor widths.

It should be noted that the estimated resource is based on a bulk density of 1.65 tonnes per cubic metre. Where the sand has a higher bulk density due to compaction or moisture levels the total tonnage may increase accordingly (typically density increases with depth). For example, with a bulk density of 1.5 or 1.8 tonnes per cubic metre there is about a 10% change in the estimated tonnage. On this basis, any approval given is requested to be conditioned on an annual tonnage limit and not a total resource tonnage.

The revised resource boundary reduces the amount of sand to be removed from the property; resulting in a slight reduction in the total Project value, the royalties to PSC, and potentially the Project life (less than 6 months). However, these changes will further reduce potential impacts by increasing habitat retention on the site, creation of additional habitat corridors and the area of Project disturbance. In short, a 22.5% reduction in Project disturbance has been achieved with a 2% reduction in the resource volume.

The sequence of resource area modification is illustrated by **Figure 3**.

2.4.1 **Proposed Sand Products**

Particle size distribution tests on samples taken from across the resource area were similar in composition and indicated 95-100% will pass through a 0.06–2.0 mm sieve. This suggests the sands at the site are likely to be fine-medium grained or medium grained sands.

All of the sands available for extraction within the proposed resource area are at a minimum suitable for sale as construction sand.



- EIS Extraction Area Boundary (53.9 ha)
- Proposed Sand Extraction Area from Port Stephens Council (69.9 ha)



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig03_ResourceAreas.mxd



Based on current knowledge of the resource, it is anticipated that the following products will be generated for sale by the quarry:

- Raw fill sand sand excavated directly from the face with no processing (i.e. screening or air separation);
- Screened sand sand that has been passed through the screen to remove larger organic matter;
- Sandy loam suitable for landscaping, is a combination of the screened and air-separated organic matter with other sands;
- Concrete sand also called dry-washed sands, for use in concrete that has been screened and processed with all organic matter removed; and
- Glass sand also called industrial sand. It is anticipated up to 300,000 t of the resource (where A2 horizons are heavily leached) are potentially industrial grade sand that can be used for glass manufacture and other industrial sand applications. This sand is extracted mechanically (i.e. by dozer and loader) and stockpiled separately. Depending on the customer, the sand may be sold as processed or unprocessed product.

Considering the range of products available from the quarry, the resource is a valuable and unique resource that is able to satisfy several market areas.

2.4.2 Extraction Rate and Project Life

Figure 4 illustrates the order of sequencing for the extraction of the resource and the location of the processing plant and access road. The processing plant will move nine times over the project.

The expected extraction rate, based on predicted demand, is shown in **Table 2**. Extraction rates are planned to be maintained generally above 300,000 tpa and may increase to as high as 530,000 tpa.

To account for a variable market demand, approval for a Project life of 15 years is sought. As demonstrated in **Table 2**, assuming demand and sales are as expected, the life of the Project may be reduced to less than 10 years.



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig04_QuarryOperationsPlan.mxd



Project Year	Extraction Rate	Cumulative Extraction				
	Construction					
1	250,000	250,000				
2	300,000	550,000				
3	336,000	886,000				
4	376,320	1,262,320				
5	421,478	1,683,798				
6	472,056	2,155,854				
7	528,703	2,684,557				
8	363,007	3,047,564				
Expected 8 to 15 years	From 250,000 to 530,000 tonnes per annum	3.05 Mt to 3.75 Mt depending on density.				

Table 2:Planned extraction rate

2.5 PROPOSED INFRASTRUCTURE

The area of construction for the Project is limited to the intersection with Cabbage Tree Road, the bitumen access road to the site office complex, and the site office. All construction activities on the site will be managed under a Construction Environmental Management Plan (CEMP) and Traffic Management Plan. The key elements of infrastructure are described below and are illustrated in **Figure 5**. **Figure 6** provides a section of the Project's interface with Cabbage Tree Road.

2.5.1 Clearing and Earthworks

Clearing and topsoil stripping required to facilitate construction will be undertaken progressively following established protocols. Stripped topsoil will be stockpiled for use in landscaping and stabilisation of batters. A portion of the surface in this area has been previously disturbed by the existing gravel access road.

The access road, workshop and office area will require earthworks to establish the estimated base of the quarry, thereby avoiding the need to relocate the buildings and weighbridges during the Project. Up to 65,000 tonnes may need to be extracted during the construction phase.



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig05_IntersectionAndOffice_V5.mxd





Legend Road - sealed Office & Workshop Subject L and Roundary	Metres 0 5 10 15 20 25	PROJECT REFERENCE: 20170448 DATE DRAWN: 24/10/2017 17:20 Version 1 DRAWN BY: gjoyce	North-south Section Through Quarry and Cabbage Tree Road	FIGURE:
Project Land Boundary Project Area Boundary Arterial Road Contours (1m)	RIGHT People. Right Solutions. www.kleinfelder.com	DATA SOURCE: LPI - 2016 Nearmap - 2017	Williamtown Sand Syndicate EPBC Preliminary Documentation Proposed Sand Quarry Cabbage Tree Road, Williamtown	O

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig06_CrossSection.mxd



Retention and stockpiling of all material during construction creates potential logistical complications for stockpiling and management as the processing area and intersection at the site entrance will not be established. Where feasible, sand from this area will be removed from the site as overburden in the course of construction activities.

Temporary batters will be established within future resource areas during construction. These batters represent a relatively narrow band (approximately 20 m width) located between existing vegetation and rehabilitated areas. It is proposed to provide temporary stabilisation of the batters using tube stock, mulching, geotextile or similar. The temporary stabilisation efforts will reduce wind exposure and limit dust generation.

Clearing in this area may utilise a tub grinder located near the site office, with resultant woodchip utilised in landscaping and revegetation of the access road batters. The tub grinder has been removed from operational activities in preference for placement of whole timber over the rehabilitation areas to minimise noise sources, maximise any retained seed bank, provide habitat and minimise sand erosion during vegetation establishment.

2.5.2 Intersection and Access Road

To address concerns raised during exhibition of the EIS, an emergency avoidance lane will be provided in the area of the intersection to allow passing to occur around private vehicles turning right into residential properties opposite the intersection.

While haulage will occur prior to sunrise and after sunset (during winter), the low traffic volumes on Cabbage Tree Road during this period and that proposed from the quarry should not necessitate intersection lighting. Should lighting be imposed, it will be installed consistent with specifications provided by the road authority and relevant Australian Standards. This will ensure lighting is appropriately shielded from neighbouring residences.

The access road will be constructed at the final quarry floor level with a bitumen seal to the southern side of the northern resource area. Access beyond that point will be via an all-weather gravel road. Speed limits will be restricted to 40 km/h between Cabbage Tree Road and the incoming weighbridge and 20 km/h from the weighbridge to the processing plant.



2.5.3 Office and Workshop Compound

The Office and Workshop Compound will be located outside of the Hunter Water special area catchment that is regulated under the *Hunter Water Regulation 2015*. The compound will include the following:

- Demountable office building measuring approximately 20 m x 5 m that will include lunch room, offices, and ablutions;
- Workshop and refuelling area on concrete contained within a shed measuring approximately 16 m x 16 m with a concrete floor and high roof line to accommodate large equipment;
- Double skinned 5,000 10,000 L "transtank" or similar located adjacent to the workshop allowing refilling of equipment within a bunded area inside the building;
- Light vehicle parking area;
- Hardstand area for heavy vehicle parking overnight (where not possible to park within workshop);
- Weighbridges (in and out);
- Perimeter security fence around the compound area;
- CCTV and back to base alarm system; and
- Low level security lighting directed downwards and installed in accordance with AS 4282

 Control of Obtrusive Effects of Outdoor Lighting.

The office area will be connected to the electrical mains network and the Hunter Water Corporation (HWC) water main located on Cabbage Tree Road via a shared below ground trench adjacent to the access road. Overhead electrical supply may be used in preference to trenching where the electrical design determines it more appropriate. No sewer network exists in the local area, as such the ablutions block will be connected to a pump-out system to be collected on a routine basis by a licenced contractor. The pump out system will require approval by PSC prior to and following installation.

2.5.4 Fencing and Security

In addition to fencing the Office and Workshop Compound, a Koala exclusion fence will be erected from the south-western corner to south eastern corner of Lot 1 DP 224587 along Cabbage Tree Road and either side of the access road through to the Office and Workshop area. The intent of the fence is to prevent unauthorised access into the quarry and to limit the potential for koala or other fauna injury on Cabbage Tree Road and the access road into the



weighbridge. The fence will include fauna access structures (one-way valves) to allow fauna to come into the site from the road reserve.

A gate will be integrated with the fence adjacent to Cabbage Tree Road. The gate will be locked overnight to prevent site access out of operational hours.

2.6 **OPERATIONS**

On completion of the infrastructure construction, the key sequence of the revised quarrying operation are as follows:

- 1. Pre-extraction activities will vary subtly through the Project, being subject to refinement during the Project, but is expected to include the following:
 - a) Initial sectors will be cleared and vegetation stockpiled, then topsoil stockpiled within an area adjacent to the processing plant. The initial area of cleared vegetation and topsoil will be used to supplement other extraction areas over the life of the Project that are deficient in organic matter. The topsoil from this area may be processed to reduce the footprint size and concentrate the organic matter and seed bank for reuse;
 - b) Construct the central haul road and turning bays and prepare the processing plant pad;
 - c) Establish the processing plant; and
 - d) For subsequent sectors; clear and stockpile vegetation then strip topsoil from the next resource sector, placing topsoil and then cleared vegetation over the completed sector for rehabilitation;
- 2. Quarrying of resource:
 - a) Establish through regular survey and two-yearly review of groundwater modelling the permitted base of extraction (0.7 m above highest predicted groundwater level).
 - b) To establish the next processing pad and extend the haul road, sand will be extracted down to the quarry floor level and trucked or conveyed to the last processing plant location;
 - c) Progressive quarrying of resource from the base of sand face (created by excavation of haul road and processing pad), working behind the face when advancing toward residences; and
 - d) Transfer sand to the processing plant by a series of conveyors fed by front end loader;
- 3. Processing and sale of resource:
 - a) Using an electric screen and air separation system, split the feed sand into products and stockpile using radial stackers;



- Electric conveyors, screens, and air separator powered by mains power (overhead or underground) with the ability to alternate to diesel powered generator should electrical connection be interrupted;
- c) Load road registered trucks from the processed and stockpiled sand;
- d) Direct loading of unprocessed sand to road registered trucks; and
- e) Transport of sand from the site to customers via a weighbridge located at the site office;
- 4. Rehabilitation:
 - a) Establish through regular survey and two-yearly review of groundwater modelling the minimum elevation for the rehabilitated landform (1.0 m above maximum predicted groundwater).
 - b) Maximise existing topsoil seed bank and retained seed in re-laid vegetation;
 - c) Monitor success of natural regeneration through high frequency monitoring during early stages, reducing as rehabilitation ages;
 - Assess success (diversity and cover) of natural regeneration against site specific completion criteria proposed;
 - e) Supplement rehabilitation where necessary with direct seeding or locally propagated tubestock; and
 - f) Adapt rehabilitation process as required to achieve completion criteria.

Using this method, the disturbance footprint is minimised to the active quarrying operations and progressive rehabilitation can commence immediately following resource extraction. Each sector is approximately 1 - 2 ha in size.

2.6.1 **Pre-extraction Activities**

Pre-extraction involves the clearing of vegetation, stripping of topsoil, establishing the spine road and turning bay and relocating the processing plant.

Integral to pre-extraction, quarrying of the resource and rehabilitation will be the regular survey of extraction levels to ensure extraction is limited to 0.7 m above the maximum predicted ground water level and the final rehabilitated landform is at 1.0 m above that groundwater level.

Vegetation clearing will follow established protocols that account for potential habitat hollows and aim to reduce the incidence of fauna injury; a trained ecologist will supervise all clearing activities to identify, manage, and relocate fauna. Cleared vegetation will be pushed and



moved aside to stockpiles. These stockpiles will be respread over the quarried floor after topsoil is respread.

A 50 m buffer has been applied between the extraction area and the Tilligerry State Conservation Area. No buffer zone around the disturbance footprint is proposed between the extraction area and proposed onsite offsets for the following key reasons:

- The resource will be delineated prior to clearing by a qualified ecologist that will mark the boundary.
- Where threatened plants or habitat trees are contained within 3 m of the proposed extraction boundary (as presented in **Figure 4**) the tree drip line will be delineated and avoided during extraction.
- Active extraction areas typically have a limited temporal and spatially interface with surrounding vegetation.
- Extraction of the resource can be undertaken mechanically without the need for blasting.
- The edge of the resource following extraction will be battered to surrounding lands and revegetated.
- Weed incursion will be managed through two separate management regimes (site rehabilitation plan and offset management plans established under the NSW Stewardship Agreement).
- A koala exclusion fence is proposed along the access road between the weighbridge and Cabbage Tree Road where vehicles need to accelerate to merge with traffic. An additional koala exclusion fence is proposed along the Subject Land frontage to Cabbage Tree Road.

Topsoil stripping will vary across the site, but is generally expected to be the upper 100 mm that is likely to contain the majority of the seed bank and organic matter, extending to 300 mm as needed. Following the stripping of the organic topsoil component, the underlying resource will be windrowed in shallow layers to determine the presence of industrial sands. Where present, these sands will be processed separately as described below.

The central spine road will be constructed and bitumen sealed from the entrance on Cabbage Tree Road through to the southern edge of the northern resource area. The road beyond this point will have an all-weather gravel surface. Turning areas will be constructed with gravel to limit damage from turning trucks. Gravel from each turning area will be recovered and reused in the next turning area, allowing the previous turning area to be rehabilitated.


2.6.2 Quarrying of Resource

An important change from that proposed within the EIS is the adoption of a series of portable electric conveyors to recover the resource, replacing trucks and excavators. The EIS was based on the following sequence after pre-extraction activities:

- 1. Bulldozer used to push stockpiles of sand (the use of a bulldozer was restricted in the southern area of the resource due to noise considerations);
- 2. Front-end loader or excavator used to load stockpiles onto articulated off-road trucks for transport to the processing plant; and
- 3. Front-end loader used to transfer dumped sand from trucks to the processing plant. For areas close to the processing plant, trucks were not required.

After further consideration of potential methods, the following sequence is proposed as the preferred method for the recovery of the resource (also refer to **Figure 7** below):

- 1. An electric conveyor loader will provide for direct loading of the processing plant. The conveyor loader can be fed by front-end loader or dump truck;
- 2. Where present, industrial sands will be windrowed using a bulldozer or grader and loaded on the electric conveyor with the front end loader;
- 3. Extraction will progress away from the processing plant using up to eight 30 m or six 40 m long portable electric conveyors, with the conveyor loader at the end;
- 4. A front-end loader will source material directly from the base of the resource face and feed the conveyor loader. Within resource sector 2/3 and 7/8 where the processing plant moves between the northern and southern resource areas and within Resource Area 7c. There will be a need to utilise dump trucks to feed the conveyor bin or processing plant;
- 5. Where the conveyors require servicing, the use of front-end loaders and excavators and trucks may be required to maintain feed rates; and
- 6. Power for the electric conveyor bin and electric conveyors will be sourced from a central power supply located on the processing plant, which will be sourced from the mains supply, or diesel generator as a contingency.





Figure 7: Proposed resource recovery process (note electric conveyor feed bin shown, may be substituted for a simple feed bin).

While WSS have confidence in the effective use of the conveyors, in order to minimise potential operational delays, the original EIS resource recovery method may be used if the conveyors are not feasible. In this regard the noise and dust assessments have considered the worst case assessment consistent with the EIS. Further, it should be noted that consistent with any business there is a need to drive efficiency and reduce costs. Where efficiencies can be gained through the adoption of alternative quarrying techniques or equipment while adhering to noise and air quality goals and sequential rehabilitation these will be investigated.

Importantly, from a safety perspective, the resource extraction occurs during the day and batters within the quarry will be left at the sand's angle of repose (around 45 degrees) at the conclusion of each day. As the resource recovery is progressive, with extraction occurring from the sides of the resource, no pits (that may trap fauna) will be created.

Integral to pre-extraction, quarrying of the resource and rehabilitation will be the regular survey of extraction levels to ensure extraction is limited to 0.7 m above the maximum predicted ground water level and the final rehabilitated landform is at 1.0 m above that groundwater level.

Key benefits of the revised method include:

- Reduced diesel consumption;
- Reduced noise generation;
- Greater efficiencies (time and labour) in transfer of sand; and
- Reduced presence of diesel and mobile diesel equipment within the Hunter Water catchment area. If a generator is used, it will be contained within a bunded area.



2.6.3 Noise Bunds and Operational Limitations

The EIS included the construction of 2 m and 5 m high (19-43 m wide) noise bunds along the south-eastern and south-western boundaries of the southern resource area. These bunds were proposed so to provide a noise barrier during the extraction of the adjoining resource areas. With consideration to noise and costs associated with their construction, the resource extent has been adjusted to allow equipment to work behind a sand face for the majority of the extraction process. There is now no requirement for the bunds as a result of the change in resource boundary, adoption of electric conveyors and reduction in dozer push.

2.6.4 **Processing and Sale**

Sand extracted from the resource area is to be conveyed to the processing plant that will be located within one of eight locations (two will share a similar footprint) distributed across the resource. The location of the processing plant takes into account the length of conveyors, the physical resource extent, access from the central spine road and access for road registered trucks. The initial locations in the southern area are also positioned to maximise acoustic screening of adjoining dunes.

The processing plant consists of the following key components:

- Electric screen. The screen will separate course organic matter and rocks (unlikely), generating the screened sand product and reject material. The screened sand will be sold as product or transferred to the air separator. While unlikely given past processing, if potential Aboriginal artefacts are found during screening, these will be set aside and managed under the site's Aboriginal Heritage management measures. Other organic matter will be blended with the topsoil for rehabilitation;
- Air separator. Screened sand will be fed into the electric air separator. The electric air separator uses centrifugal forces and air flow within a closed system to separate the silts, clays, and fine organic matter from the sands. A fine organic matter is also produced from the separator. The air separator requires no water;
- **Two radial stackers and yard conveyor**. The radial stackers will provide improved stockpiling for the various products produced at the quarry, with the yard conveyor used to relocate and move stockpiles and product more efficiently; and
- **Bagging plant (hopper and bag holder)**. One tonne bulka bags will be filled and available for sale and transport (i.e. typically multiple bags per truck). The hopper will be filled using a front-end loader, bulka bags filled then loaded on to trucks.

KLEINFELDER Bright People. Right Solutions.

2.6.5 Transport

Product transport from the site is expected to be primarily by 32 tonne truck and dog, road registered trucks. The one tonne bulka bags will also be available for transport from the site.

Estimates of traffic generation from the site are as follows:

- Annual average daily truck movement of 63 laden trucks per day (126 movements), equating to average hourly truck movements of 5 laden trucks per hour (10 trips per hour);
- Peak rate of 6 laden trucks per hour (12 trips per hour) during the hours of 5 am to 7 am;
- Peak rate of 10 laden trucks per hour (20 trips per hour) during hours of 7 am to 6 pm; and
- Six vehicles of employees would be expected to arrive from 4:45 am to 7 am and leave between 5 pm and 7:00 pm.

Incoming trucks will be weighed on entry to the site via a weighbridge at the site office complex and again on leaving site where product weight and tickets will be generated and recorded for each load.

To provide confidence in the ticketing and sales from the quarry and trucking times and rates, the ticketing system will be connected with a boom gate on the exit weighbridge. The boom gate will be configured to operate only within the quarry operating hours and linked to the peak traffic generation rates shown above. Video surveillance will also be erected at the weighbridge for security and ticket cross checks.

The distribution of traffic from the site is weighted on the basis of proximity to expected customers; given other major sand supplies on the Stockton Bight are located north of, and further from, the customer. On this basis, traffic from the operation is expected as follows:

- Sydney and Central Coast 40%;
- Maitland 36%;
- Newcastle and Lake Macquarie 24%; and
- Limited distribution to the north into Port Stephens given the proximity of other sand supplies in the area.

2.6.6 Hydrocarbon Management

As a large portion of the site is contained within the Tomago Sands Drinking Water Catchment Area regulated under the *Hunter Water Regulation 2015*, specific controls and management practices have been developed for the site operations in consultation with the HWC (refer to correspondence with Hunter Water Corporation contained in **Appendix 6** and **Section 5**).



Hydrocarbon use and storage onsite will be consistent with AS 1940 *The storage and handling of flammable and combustible liquids*, and will include the following:

- Workshop and refuelling area located at the Office and Workshop Compound outside the catchment area, comprising:
 - A concrete bunded area for refuelling of machinery onsite and tank refuelling within the workshop (i.e. under cover) to avoid surface water runoff;
 - A 5 to 10,000 L above ground double skinned Transtank (or similar) for diesel storage located adjacent to the workshop;
 - o Spill control kits maintained throughout the area;
 - Monthly refill from offsite, based on potential annual consumption for onsite plant and equipment of approximately 100,000 L; and
 - Approximately 200 L of engine oil and 200 L of hydraulic oil stored within self-bunded pallets located within the workshop;
- Mobile equipment will:
 - Be refuelled at a lined and bunded refuelling area;
 - o Include spill control kits;
 - o Be operated by personnel trained in the use and maintenance of spill control kits; and
 - Be returned at the end of each day to the Office and Workshop Compound (excluding the bull dozer) in accordance with the HWC letter of advice (refer **Appendix 6**);
- Processing plant area (moved around the site based on resource area) that will include:
 - o A bunded parking area for the overnight parking of the bull dozer;
 - Diesel generators (if power via electrical mains supply is unavailable). If used, diesel generators will:
 - Be located within a bunded area;
 - Include an internal double skinned and self-bunded diesel storage tank;
 - Be topped up as required within the bunded refill area; and
 - Be returned to the Office and Workshop Compound on conclusion of operations each Saturday. This is proposed in the context of reducing the risk of vandalism over the weekend, and limiting risks (e.g. electrical and diesel) associated with the daily transport of the generator to and from the processing plant area;
 - o Electric screen and air separator will include:
 - Bunding under the electric screen and air separator plant to capture hydraulic leaks; and
- Any hydrocarbon spills will include the following response:
 - o Immediate deployment of spill control kits;
 - Notification of relevant stakeholders (e.g. EPA and HWC) consistent with the Emergency Response Plan for any spills estimated to be greater than 30 L; and



o Recovery of all contaminated sands or gravels regardless of size for collection and offsite disposal at a licenced waste facility.

2.7 REHABILITATION AND FINAL LAND USE

The overarching objectives for the rehabilitation of the quarry are as follows:

- Provide a safe and stable landform;
- Establish a sustainable native ecosystem with species and structure generally consistent with pre-existing or surrounding native vegetation communities relative to elevation. However, it is noted that the species composition of a large portion of the site to be quarried is a modified community (from previous mining);
- Provide opportunity for reuse of infrastructure where agreed with the land owner; and
- Level of final landform to be a minimum of 1 m above the highest predicted groundwater level.

Figure 8, **Figure 9**, **Figure 10**, **Figure 11**, and **Figure 12** show the proposed sequencing of extraction and rehabilitation over the life of the quarry. Rehabilitation will include the following key steps:

- Annual seed collection in advance of pre-clearing surveys to establish local seed source for direct seeding and propagation;
- Pre-clearing surveys;
- Vegetation clearing and stockpiling;
- Topsoil stripping and direct placement on completed area;
- Placement of stockpiled vegetation on topsoil;
- Monitoring of rehabilitated areas; and
- Weed control and supplementary seeding and planting as required.

A description of each step is detailed within the Rehabilitation chapter of the Environmental Management Plan in **Appendix 2** of this report.



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig08_QuarryProgressPlan_Yr1.mxd



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig09_QuarryProgressPlan_Yr3.mxd



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig10_QuarryProgressPlan_Yr5.mxd



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig11_QuarryProgressPlan_Yr7.mxd



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig12_QuarryProgressPlan_Yr9.mxd



2.7.1 Final Land Use

The proposed final land use of the Subject Land on completion of the Project is broken into three key areas (see **Figure 13**):

- 1. Access road and the Workshop and Office Compound. On completion of the Project all fuel infrastructure, weighbridges, site office and the workshop structure would be removed from the site. Given the significant road access infrastructure, cleared and established compound area that is connected to water and electrical mains, the utilisation of this existing infrastructure for a use consistent with the zoning under Port Stephens Local Environmental Plan 2013 is considered appropriate and consistent with the objects of the EP&A Act 1979. A 40 m bushfire asset protection zone will remain established around the former Office and Workshop compound area;
- 2. Quarry resource area. As noted above it is proposed to rehabilitate the area of quarrying to a stable natural land form that is revegetated with native species consistent with surrounding communities. This vegetation, once established, is likely to be considered a valuable native ecosystem (considering past rehabilitation) with potential for long-term conservation under mechanisms like the Biodiversity Banking and Offsets Scheme; and
- 3. Residual Subject Land. The residual lands located outside the quarry disturbance area form a substantial component of the proposed offset strategy for the Project. This land has been assessed consistent with the Biodiversity Banking and Offsets Scheme and is proposed to be conserved under that mechanism. This mechanism provides the land owner (Port Stephens Council) with the funding for the long-term conservation of this land. While increasing the conservation of biodiversity in the local area, the offset also reduces funding required from Council's revenue for the management of the Subject Land.

2.8 EQUIPMENT SUMMARY

The following equipment (or equivalent) will be utilised within the quarry:

- Bulldozer (D9 or lower) used in clearing and stripping of topsoil and selective sand layers;
- Two front-end loaders, one located at the processing plant loading trucks and managing stockpiles, one feeding the conveyor loader from the face;
- 30 t Excavator (with grab and big bucket) used primarily in clearing activities;
- Two x 6-wheeler or equivalent 28 t off-road haul trucks, only used in Resource Sector 7C or where conveyors are under maintenance;
- Graders and rollers (associated with the road and pad construction);
- Water cart;

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranites, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

Rehabilitated Area (Final Landform Surface >1m above Highest Groundwater)

- Smooth-barked Apple Blackbutt Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- Indicative transition zone with adjoining vegetation communities
- Managed Asset Protection Zone

Existing Plant Community Type

- HU917 Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast
- HU860 Smooth-barked Apple Blackbutt -Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- HU851 Scribbly gum Wallum Banksia -Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands
- HU865 Parramatta red gum Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula
- HU938: Broad-leaved Paperbark Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast
- HU938: Broad-leaved Paperbark Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast
- HU938: Broad-leaved Paperbark Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast
- HU948 Wallum Bottlebrush leptocarpus tenax - Baloskion pallens Wallum Sedge heath of the lower North Coast
- Excluded



Legend	Metres	PROJECT REFERENCE: 20170448		FIGURE:
Subject Land Highest Predicted Groundwater Level (metres AHD)	0 50 100 200 300 400 500	DATE DRAWN: 24/10/2017 17:25 Version 1	Final Landform and Rehabilitation	
Project Area		DRAWN BY: gjoyce		12
Track		DATA SOURCE: LPI - 2016	Williamtown Sand Syndicate	13
Local Road	Bright People. Right Solutions.	Nearmap - 2017	Proposed Sand Quarry Cabbage Tree Road Williamtown	
			Cabbage Tree Road, Williamowin	

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig13_FinalLandform.mxd



- Electric yard conveyor;
- Two electric radial stackers;
- Electric air separator;
- Electric screen;
- Six 40 m or eight 30 m portable electric conveyors;
- Feed bin or electric conveyor loader to load conveyors;
- Diesel generator (as a contingency where mains power unavailable); and
- Transport of sand will be through contractor haulage and customer trucks not engaged by WSS. It is expected that this may involve various sized trucks, typically 32 t truck and dogtrailer configurations.

Within the Office and Workshop Compound there will be:

- A 5 to 10,000 L double skinned Transtank (or similar) located within a bunded and covered refuelling area;
- Incoming and outgoing weighbridge system;
- Site offices, ablutions and lunch room;
- Car parking area; and
- Fenced compound for mobile equipment after hours.

A tub grinder may be used during construction for landscaping.

2.9 HOURS OF OPERATION AND WORKFORCE

The Project will employ up to six staff for the duration of the construction activities and quarry operations.

Construction activities are expected to be 12 weeks in duration and will be undertaken during the standard construction hours of:

- 7 am to 6 pm Monday to Friday;
- 8 am to 1 pm Saturdays; and
- No work on Sundays or public holidays.

Quarry operations will occur during the following hours:

- All quarry activities:
 - o 7 am to 5 pm Monday to Friday; and
 - o 7 am to 4 pm on Saturdays;
- Transportation and loading of sand only:



- o 5 am to 6 pm Monday to Friday; and
- o 7 am to 4 pm on Saturdays; and
- No work on Sundays or public holidays with an exception for repair and maintenance of plant and equipment that may occur during these times.

Employees (in light vehicles) will arrive at the quarry approximately 15 minutes before opening (i.e. 4:45 am) to open quarry gates, by 5 am, and will leave approximately 30 minutes after quarry close (i.e. to 6:30 pm).

2.10 WATER

The key elements of water management on the site are as follows:

• Dust Suppression:

- Adoption of a bitumen sealed access and haulage road from Cabbage Tree Road to the southern boundary of the northern resource area;
- O Dust suppression by water cart of the gravel road section and any other un-vegetated areas as required to reduce visible windblown dust. The rate of application is expected to be a maximum of 12 mm per day (maximum daily evaporation of 10 mm multiplied by 120% to account for wind generated by truck movements, Umwelt 2015c). Noting the rate and frequency are relative to the material type and frequency of haulage, and application rates and frequencies of less than half of that figure have achieved control efficiencies above 95% in the Hunter Valley. Over the maximum extent of gravel road (approximately 6,600 m² during Year 4/5) this equates to about 80 kL per day (over 10 hours), on days where rainfall is not sufficient to supress dust. During Years 1, 2, 7 and 8 negligible water will be required for dust suppression on the main haulage road;
- Static sprays will be installed on the stockpiles. It is estimated that in order to maintain stockpile surface moisture levels at peak production up to 45 KL per day of water may be required; and
- Daily water consumption based on revised project design of up to 125 KL. This compares to 144 KL within EIS, excluding stockpile sprays, accounting for longer road lengths;
- Surface Water:
 - Surface water will be contained onsite through incorporation of bunds around the perimeter of the resource area. Most of the bunds will be created through the resource extraction process being lower than the adjoining surface. The bund will also be



incorporated into the access road (at both the southern boundary of both the southern and northern resource areas) through a 600 mm high 10 m wide trafficable mound that ensures all surface water within the resource area must percolate vertically into the groundwater;

- Rainwater will be captured from the workshop and office roofed area and reused for dust suppression; and
- o All impervious areas will be shaped such that water sheds to infiltration areas;
- **Groundwater** in the area will be protected through:
 - o Adoption of electrical equipment where feasible;
 - o Comprehensive spill containment procedures;
 - o Location of the office and workshop area outside the Hunter Water special area;
 - Security measures on plant and equipment to avoid damage and spills through vandalism;
 - Extraction activities down to 0.7 m above the highest predicted groundwater level, with a final landform established at 1 m above the highest predicted groundwater. This results in a buffer of more than 2 m from the final land form to the average groundwater level; and
 - o Monitoring of groundwater levels and quality on a quarterly basis around the perimeter of the quarry; and
- Site Facilities require potable water to supply the onsite office and ablution facilities. This is expected to be less than 1.5 kL/day, (based on 150 L per person for 10 people) and will also be drawn from rainwater collection, supplemented by HWC's reticulated water supply.

2.11 PROJECT ALTERNATIVES

Numerous alternatives have been evaluated in the development of the original and revised Project. The key alternatives for the Project are detailed below.

2.11.1 Extraction Area

The area of extraction for the quarry (as documented earlier in this section) has been adjusted based on a broad range of constraints and opportunities and is open to a broad range of alternatives, these include:

- PSC definition of area, depth to groundwater and the vegetation and habitat corridor area that separates the northern and southern extraction areas;
- Avoidance of high value habitat areas;



- An increase in the vegetation and habitat corridor widths on the south-east and north-east of the resource areas; and
- Evaluation of minimum depths of extraction to meet project costs.

2.11.2 Extraction Method

Several alternatives to the extraction of the sand resource have been examined, these include:

- Dozer push, loader and truck as proposed within the EIS;
- Mobile electric conveyors fed by loader as proposed as the preferred alternative;
- As the project progresses the optimum methods and equipment for extraction will be relative to efficiency and costs while maintaining noise and air quality goals at the surrounding residential dwellings; and
- The location of the processing plant during the Project and sequencing resource extraction
 has been reviewed. The EIS proposed a sequence of extraction that involved removal of
 effectively half of the southern resource area before moving to the northern area. The
 adopted sequence is aimed at establishing the office and workshop and an access road
 through to the northern resource area. The majority of the southern resource area will now
 be extracted at the end of the Project, after five years of air and noise monitoring and
 refinement of the project.

2.11.3 Site Access Alternatives

Alternate locations for access roads into the quarry were considered during the project design, primarily the access on the eastern side of the Subject Land. This access was discounted due to the deceleration and acceleration lanes being located directly in front of residential properties, the alignment of the road restricting visibility of merging traffic. The haulage road location is also less efficient given the majority of the resource is located on the western side of the property and the haulage road length is considerably longer than that required by the proposed access location. Access of the site from the western boundary through to Masonite Road was not adopted as it was precluded within the quarry lease with PSC and would also have a greater haulage length and would require haulage over sensitive lands associated with Hunter Water Special Area and the Tilligerry State Conservation Area (SCA).

Alternate intersection designs were considered during the Project design. Options evaluated included seagull type intersections that would provide a protected right turn for trucks leaving the quarry, along with a signalised intersection. Both of these intersections were not adopted



given increased costs associated with construction for minimal operational benefit. Given potentially multiple trucks could cue at the lights and would accelerating from a standing start the associated noise from the intersection is likely to be higher than that proposed.

2.11.4 Rehabilitation Method

Various options for rehabilitation have been considered within both the EIS and the response to submissions. The alternatives have considered the following key aspects:

- The avoidance of stockpiling of topsoil, such that the seed bank may be sterilised, and material must be double handled. The adopted method avoids stockpiling where possible through the direct transfer of topsoil between extraction sectors;
- Mulching of vegetation as proposed within the EIS will now be avoided, with a woody debris and brush matting approach using whole trees and branches that will promote a more variable organic material input to the soil providing greater habitat and seed source for rehabilitation; and
- With sequential topsoil and vegetation placement, progressive rehabilitation of the quarry is driven through operation practice, where new resource areas cannot be accessed without transfer of topsoil and vegetation. In contrast, topsoil and mulch stockpiling can result in lags in rehabilitation.

2.11.5 Alternative of Not Proceeding

This Project is formed on a tender issued by PSC for a property purchased by Council as an asset. The realisation of the project and the tender will see up to \$18.5 million dollars contributed back to Council in the form of rents and royalties from the project. This royalty represents a substantial input to Council revenue for use within the LGA. In addition to the rents and royalties, Council will be provided annual funding to undertake management of the Subject Land in perpetuity, thereby reducing potential burden on the Council. Failure of not proceeding with the project would result in a substantial loss in revenue to PSC and without revenue replacement (such as rate variations), a related reduction in the ability to maintain and supply infrastructure and services for the benefit of the residents of the LGA.

Failure to proceed with the Project would also result in lost employment opportunities for up to six individuals of the local community as a result of the jobs that would be created by the quarry.



If the Project does not proceed, a regionally and state significant sand resource will remain undeveloped, resulting in the need to identify, assess and approve additional sand resources from other sites. Given the increasing scale of the sand market driven by the construction industry and the decreasing major sand suppliers in the Sydney market, demand will increase. Increased demand, coupled with a shortage of supply may lead to increased prices passed through to home owners placing further market pressure on the housing market within the Newcastle and Sydney area, this in turn can potentially result in a reduction in construction activity.

2.12 COSTING OF THE MANAGEMENT ACTIONS

Project has a total value of approximately \$50 million (i.e. 3.25 Mt at an approximate value of \$15.30/t), where \$5 per tonne is paid in a levy to Port Stephens Council. The value of sand is anticipated to increase over the term of the quarry life. Feasibility planning has determined the cost of environmental related controls and monitoring is likely to be in the order of \$2.5 - 3.6 million (\$1.0 - 1.5 excluding offsets) over the life of the quarry. The expenditure will vary year to year largely depending on the depth of the resource (i.e. shallow resources require more rehabilitation for the same extent).

In the refinement of the project since its inception, the resource has been reduced from an initial size of 4.61 Mt to the current estimate of 3.25 Mt. This has resulted in the avoidance of 1.36 Mt at gross cost to the project \$20.4 million. This avoidance conserved habitat for protected fauna and numerous protected flora species.

The estimated costs of management controls directly relevant to Matters of National Environmental Significance for the project are documented in **Table 3**.

Table 3:	Estimated co	osts relevant f	to MNES
	Lotimated et	Jord Loc Valle	

Action	Calculation Method	Value over quarry life (8-15 years)
Seed collection – collection of seed from threatened Eucalypts and associated species for rehabilitation.	1 week per year over 8 years for a botanist and bush regenerator (40 hours @ \$132+ 40 hours @ \$55).	\$59,840 - \$112,200
Spotter catcher and pre-clearing surveys.	5 days per year (40 hours) at \$132/hr. 5 weeks per year at 40 hours/week at \$90/hr.	\$186,240 - \$349,200



Action	Calculation Method	Value over quarry life (8-15 years)
Propagation of tubestock and planting of threatened Eucalypts.	40 hectare rehabilitation area at a rate of 400 tubetock per hectare at \$3.30 supply and plant with guards and native fertiliser. Likely to get some regeneration from topsoil and brush matting and planting of other canopy species that will reduce cost of this item.	\$52,800
Koala exclusion fence cost	1200 m at \$120/m installed. \$500 / year in inspection and maintenance.	\$148,000 – 153,500
Feral pest management Annual deployment of cameras for detection of feral pests and trapping for feral or wandering domestic animals.	40 hours at \$132/ hour for field and reporting plus costs for traps vehicle, cameras.	\$64,000 – 120,000
Monitoring and reporting on rehabilitation.	Up to 3 weeks per year for two people.	\$128,000 - 240,000
Estimated Offset Costs	Assuming offsite offsets purchased at market rates and onsite costs subject to Stewardship Agreement costs. Actual costs likely to be reduced if secured independently as one site may fulfil more than one credit depending on the site.	\$2,135,000
	Total	\$2,773,880 - 3,162,700

Other controls that are applicable to a broader range of environmental protection measures that will indirectly apply are taken to be covered by the remaining balance of the estimated budget. These controls would include:

- Erosion and sediment controls and maintenance.
- Weed management, noting that the annual offset weed management is built into the cost of the offsets.

Other controls such as installation and maintenance of bunding on hydrocarbon storage, maintenance of plant, maintenance of effluent pump out system, capital costs of electric over diesel plant and application of topsoil and vegetation to the rehabilitated surface are taken to be operational costs and would be in addition to that identified above.



3. DESCRIPTION OF THE ENVIRONMENT AND MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

3.1 DESCRIPTION OF THE ENVIRONMENT

3.1.1 Context of the Subject Land

The four allotments comprising the Subject Land has a total land area of approximately 176.1 ha. The Subject Land is located on the north side of Cabbage Tree Road, Williamtown. Tilligerry SCA and HWC lands are situated on the northern and western boundaries of the Subject Land. Rural residential land holdings are located immediately to the south, east and west of the Subject Land.

In the wider locality of the Subject Land, Fullerton Cove and the surrounding Hunter Wetlands National Park are located to the south of Cabbage Tree Road, and the RAAF Base is located to the east at Newcastle Airport. The northern portion of the Subject Land is within the Hunter Water Special Area as it is underlain by the Tomago Sandbeds.

Refer to **Figure 14** for the context of the Subject Land.

3.1.2 Current Land Use

The Subject Land is freehold, under ownership by PSC. WSS will be operating the Quarry under a lease arrangement with PSC. PSC have also given their approval for the use of remaining area of the Subject Land as an offset area. PSC will establish a biobank site, and sell the credits to WSS for retirement.

The existing use of the Project area is limited; the Council tender process for the potential use of land for sand extraction commenced in 2012 and as such has not authorised the land for any purpose. It is noted that nearby residents use the land on occasion for recreation uses. Prior to the commencement of the tender process for a potential quarry, the land was leased to a neighbouring landowner for livestock agistment.



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig14_DevelopmentSite_BiobankSite_Location.mxd



The majority of the Subject Land contains remnant native vegetated. Previous sand extraction and associated disturbances have occurred within the Subject Land. As a result, there are areas of naturally regenerating native vegetation and native rehabilitation. Previous disturbances include:

- Heavy mineral sand mining;
- Silica extraction;
- Settling ponds;
- Sand tailings areas;
- Potential monazite trenches;
- Ilmenite stockpile;
- Scrap yard area;
- Infrastructure areas; and
- Isolated areas of illegal dumping.

Approximately 65% of the 42.25 ha extraction area has been cleared or mined for heavy mineral sand mining since 1954. More recently, a bushfire occurred across the site in November 2013.

The extraction area (42.25 ha) is located in the western and central parts of the Subject Land, within the areas of higher elevation. The extraction area is predominately vegetated with dry sclerophyll forest (40.38 ha), approximately half of which is either rehabilitation or regenerating forest (21.85 ha). A small portion of the Project area consists of un-vegetated areas, two previous sand extraction areas and access tracks (1.88 ha). The northern section of the Project area was previously subject to heavy mineral sand mining (now consisting of rehabilitation).

Weed infestations within the Subject Land are restricted to areas of previous disturbance. The Regenerating areas of the Coastal Sand Apple – Blackbutt Forest only contain a scattered canopy layer and have a higher dominance of weeds in the understorey than the remnant forest, with *Eragrostis curvula* (African Lovegrass) and *Lantana camara* (Lantana) occurring. Weeds also occur along access tracks throughout the site, particularly *Eragrostis curvula* (African Lovegrass).

Six introduced fauna species were identified during field surveys: Red Fox, Wild Dog, House Mouse, Black Rat, European Rabbit and Domestic Horse. Evidence of impacts from European Rabbits (diggings) are visually evident within the extraction and offset areas.



3.1.3 Hydrology

The site is located on highly permeable Pleistocene aged sand dunes. On the Subject Land, these dunes reach up to approximately 24 m AHD. The high permeability results in little or no defined surface runoff from the site with no natural creeks on the site. The Pleistocene sands are located on the edge of Holocene aged freshwater and alluvial and estuarine swamps (about 2-3 m AHD) that drain from the site both to the east and to the south, to either the Ring Drain or Dawsons Drain before meeting Fullerton Cove. Surface drainage where present, is via a series of constructed drains, now partially blocked or ineffective (local landowner pers. comm 2016). **Figure 15** and **Figure 16** illustrate the topography of the subject land in relation to surrounding areas, and the identified contamination from the Williamtown RAAF base.

With the Project area being located on the permeable sands, there is a significantly reduced potential for runoff and consequential erosion to occur. The topography of the Project area and proposed extraction means any runoff from within the Project area is directed internally (i.e. keeping it onsite).

The dominant surface drainage pathway for most of the site is to the east where the landform drops from the edge of the resource around 5 m AHD to the swamp or flats over a relatively short distance with the gradient reaching up to 16%. The swamp areas have a gradient of approximately 0.1% with the elevation falling 1.5 m over the 1100 m to the eastern boundary of the Subject Land. From the eastern boundary of the site, drainage is directed via constructed channels through to Dawsons Drain and the northern extent of Fullerton Cove where the elevation drops 1 m over 1900 m (with an average gradient of 0.05%).

For the south eastern portion of the Project area, a portion of the resource area has the potential to drain south east across the Subject Land to a constructed drain beneath Cabbage Tree Road. In this area the landform drops at about 14% to the swamp or flats that then appears to have a very slight gradient to the south eastern corner of the site (i.e. less than 0.5 m over at least 140 m). From this point the area drains via series of constructed channels through to the Ring Drain, a large constructed channel around the northern extent of Fullerton Cove over a distance of 590 m with an average gradient of less than 0.4%.

The Project area and extent of extraction has been designed such that sand extraction remains a minimum of 0.7 m above the highest predicted groundwater level, with the final landform to be established at no less than 1 m above the highest predicted groundwater level (about 2 m above the average level).



DATA SOURCE:

Aecom - 2016 Bright People. Right Solutions. www.kleinfelder.com Williamtown Sand Syndicate EPBC Preliminary Documentation Proposed Sand Quarry Cabbage Tree Road, Williamtown

L\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig15_ElevationAndDrainage_ExistingLandform.mxd



1 m

Airport

363

	PROJECT REFERENCE: 20170448		FIGURE:
	DATE DRAWN: 24/10/2017 17:28 Version 1	Elevation Section	
	DRAWN BY: gjoyce		46
KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com	DATA SOURCE:	Williamtown Sand Syndicate EPBC Preliminary Documentation Proposed Sand Quarry Cabbage Tree Road, Williamtown	10

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig16_ElevationSection.mxd



Outside the Project area, the Subject Land is regularly inundated for extended periods after heavy rain (especially in those areas below 2.0 m AHD). The inundation is largely owed to a slight groundwater gradient that flows to the south-south-east across the Subject Land and Project area.

The northern portion of the Subject Land is located within the Hunter Water Special Area, owing to the presence of the Tomago Sandbeds and their use for a portion of the lower Hunter's drinking water supplies.

3.1.4 Soil and Vegetation Characteristics

The following soil landscapes are mapped within the Subject Land (Matthei 1995):

- The majority of the Subject Land is mapped as Aeolian Landscapes (Tea Gardens and Shoal Bay), with an area in the south mapped as an Estuarine Landscape (Bobs Farm):
 - Tea Gardens: occurs across the majority of the Subject Land, including the northern portion of the extraction area. The geology of this landscape is Pleistocene beach ridges and sandsheets consisting of marine and Aeolian quartz sands. Aeolian reworking of the sand plan by wind action produced an irregular low sandy rises and broad deflation basins and swales within the variant of the landscape mapped within the Subject Land;
 - Shoal Bay: this soil landscape is mapped as occurring in the south-western corner of the Subject Land, and covers the majority of the southern extraction area, and the southern portion of the northern extraction area. The geology of the landscape is Pleistocene Aeolian sandsheets and low dunes composed of quartz sands; and
 - Bobs Farm: this soil landscape occur in the south/ south-east of the Subject Land, covering only a small portion of the southern extraction area. The geology is Holocene estuarine mud deposits consisting of silt and clay.

The vegetation within the Subject Land is classified into four vegetation formations:

- Dry Sclerophyll Forests (shrubby sub-formation);
- Heathlands;
- Forested Wetlands; and
- Freshwater Wetlands.

The Dry Sclerophyll Forest types typically contain a moderately dense canopy layer with a dense midstorey or shrub layer. These vegetation types occur over the areas of higher



elevation in the Subject Land, and lower lying areas in the north that are above the water table (i.e. not frequently inundated).

The Heathland occurs in the north of the Subject Land (outside the extraction area); this vegetation contains a dense midstorey and shrub layer, and a limited or absent canopy layer (<5% cover).

The Forested Wetlands occur in the low lying areas of the Subject Land (outside the extraction area) where the water table is at, or close to, ground level. These vegetation communities contain a moderately dense canopy layer over graminoids and scattered shrubs.

The Freshwater Wetland within the Subject Land also occurs where the groundwater is at the surface level. This vegetation community is a dense heathy wetland dominated by sedges and shrubs.

3.1.5 Remnant Vegetation

A description of the vegetation communities within the Subject Land is provided in the following sections. Full vegetation descriptions are provided in the Ecological Assessment Summary Report (**Appendix 3**) and the vegetation community mapping within the Subject Land is shown in **Figure 17**.



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig17_VegCommunities.mxd



3.1.5.1 Coastal Sand Wallum Woodland - Heath

Canopy	This canopy of this community is dominated by <i>Eucalyptus signata</i> (Scribbly Gum). <i>Eucalyptus piperita</i> (Sydney Peppermint), along with the smaller tree <i>Eucalyptus camfieldii</i> (Camfield's Stringybark) co-dominate in the west of the community's distribution. <i>Eucalyptus globoidea</i> (Shite Stringybark) dominates a patch of the community in the northeast corner. <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Angophora costata</i> (Smoothbarked Apple) also occur at lower densities.
Midstorey	The midstorey is characterised by a dense layer of <i>Melaleuca nodosa</i> (Prickly-leaved Paperbark), <i>Leptospermum trinervium</i> (Flaky-barked Tea-tree) and <i>Banksia aemula</i> (Wallum Banksia).
Shrubs	Common shrubs include <i>Dillwynia retorta, Lambertia formosa</i> (Mountain Devils), <i>Isopogon anemonifolius</i> (Broad-leaf Drumsticks), <i>Leucopogon ericoides</i> (Pink Bear-heath), <i>Ricinocarpos pinifolius</i> (Wedding Bush), <i>Bossiaea heterophylla</i> (Variable Bossiaea), <i>Eriostemon australis</i> (Pink Wax Flower) and <i>Pimelea linifolia</i> subsp. <i>linifolia</i> (Slender Riceflower).
Ground	The ground layer is typically dominated by <i>Lomandra glauca</i> (Pale Mat-rush), <i>Amperea xiphoclada var. xiphoclada, Euryomyrtus ramosissima</i> (Rosy Baeckea), <i>Haemodorum planifolium, Schoenus ericetorum</i> (Heath Bog-rush), <i>Astroloma pinifolium</i> (Pine Heath), <i>Hibbertia fasciculata</i> and <i>Platysace ericoides</i> .
Condition	This community is generally free of exotic species.
Distribution within the Subject Land	This community occurs in the north of the Subject Land, typically on lower lying areas. This community is replaced by the Coastal Sand Apple – Blackbutt Forest at higher elevations and intergrades with the Tomago Sand Swamp Heath, Tomago Sand Swamp Woodland and Swamp Mahogany – Paperbark Swamp Forest in lower/wetter areas of the Subject Land. A very small portion of this community (0.04 ha) occurs within the extraction area.

3.1.5.2 Swamp Mahogany – Paperbark Swamp Forest

Canopy	The canopy is dominated by <i>Eucalyptus robusta</i> (Swamp Mahogany) and <i>Melaleuca quinquenervia</i> (Broad-leaved Paperbark).
Midstorey and Shrubs	The midstorey and shrub layers are dominated by <i>Acacia longifolia</i> subsp. <i>longifolia</i> (Sydney Golden Wattle) and <i>Leptospermum juniperinum</i> (Prickly Tea-tree).
Ground	The ground layer is dominated by <i>Blechnum indicum</i> (Swamp Water Fern), <i>Blechnum cartilagineum</i> (Gristle Fern), <i>Baumea articulata</i> (Jointed Twig-rush), <i>Baumea rubiginosa, Schoenus brevifolius</i> (Zig-zag Bog-rush), <i>Baloskion tetraphyllum</i> subsp. <i>meiostachyum, Gahnia sieberiana</i> (Red-fruit Saw-sedge) and <i>Gahnia clarkei</i> (Tall Saw Sedge).
Distribution within the Subject Land	This community occurs in the lower lying areas of the Subject Land. Patches of this community occur in the south-west, central portion and east of the Subject Land. A very small portion (0.13 ha) of this vegetation community occurs within the extraction area.



3.1.5.3 Coastal Wet Sand Cyperoid Heath

Canopy	A scattered canopy of <i>Eucalyptus robusta</i> (Swamp Mahogany) and <i>Melaleuca quinquenervia</i> (Broad-leaved Paperbark) occurs, generally at the periphery of the community where it intergrades with the Swamp Mahogany – Paperbark Swamp Forest.
Midstorey and Shrubs	The midstorey and shrub layers are dominated by <i>Callistemon citrinus</i> (Crimson Bottlebrush) and <i>Leptospermum juniperinum</i> (Prickly Tea-tree).
Ground	The understorey is dominated by <i>Gahnia clarkei</i> (Tall Saw Sedge), <i>Baumea articulata</i> (Jointed Twig-rush), <i>Baumea rubiginosa, Blechnum indicum</i> (Swamp Water Fern), <i>Schoenus brevifolius</i> (Zig-zag Bog-rush), <i>Empodisma minus</i> (Spreading Rope- rush), <i>Gleichenia dicarpa</i> (Pouched Coral Fern) and <i>Cassytha glabella</i> . Scattered grasses also occur including <i>Hemarthria uncinata</i> var. <i>uncinata</i> (Mat Grass) and <i>Entolasia stricta</i> (Wiry Panic).
Distribution within the Subject Land	Two areas of this community occur in the southern-central and eastern portions of the Subject Land. The community occurs on the periphery of the Swamp Mahogany – Paperbark Swamp Forest. This community only occurs within the offset area.

3.1.5.4 Tomago Sand Swamp Heath

Canopy	A scattered occurrence of <i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Eucalyptus camfieldii</i> (Camfield's Stringybark) and <i>Corymbia gummifera</i> (Red Bloodwood) occur.
Midstorey	The dense midstorey is characterised by <i>Banksia aemula</i> (Wallum Banksia), <i>Melaleuca nodosa</i> (Prickly-leaved Paperbark) and <i>Leptospermum trinervium</i> (Flaky-barked Tea-tree), with <i>Persoonia lanceolata</i> (Broad-leaved Geebung) also occurring.
Shrubs	Common shrubs include <i>Leptospermum polygalifolium</i> subsp. <i>cismontanum, Leucopogon ericoides</i> (Pink Beard-heath), <i>Monotoca scoparia, Micromyrtus ciliata</i> (Heath-myrtle), <i>Bossiaea heterophylla</i> (Variable Bossiaea), <i>Banksia oblongifolia, Isopogon anemonifolius</i> (Broad-leaf Drumsticks) and <i>Ricinocarpos pinifolius</i> (Wedding Bush).
Ground	The ground layer is typically dominated by <i>Euryomyrtus ramosissima</i> (Rosy Baeckea), <i>Amperea xiphoclada</i> var. <i>xiphoclada, Hypolaena fastigiata, Schoenus ericetorum</i> (Heath Bog-rush), <i>Astroloma pinifolium</i> (Pine Heath), <i>Hibbertia fasciculata, Platysace ericoides</i> and <i>Lomandra glauca</i> (Pale Mat-rush).
Condition	This community is generally free of exotic species.
Distribution within the Subject Land	This community occurs in the north of the Subject Land, on lower lying areas adjacent to the Coastal Sand Wallum Woodland-Heath. This community only occurs within the offset area.



3.1.5.5 Tomago Sand Swamp Woodland

Canopy	The canopy of this community is dominated by <i>Eucalyptus parramattensis</i> subsp. <i>decadens,</i> with <i>Eucalyptus signata</i> (Scribbly Gum) and <i>Eucalyptus piperita</i> (Sydney Peppermint) also occurring.
Shrub	The shrub layer is dominated by <i>Leptospermum polygalifolium</i> subsp. <i>cismontanum</i> (Tantoon), <i>Melaleuca thymifolia</i> (Thyme Honey-myrtle), <i>Banksia oblongifolia, Leucopogon juniperinus</i> (Prickly Beard-heath), <i>Leptospermum arachnoides, Mirbelia rubiifolia</i> (Heathy Mirbelia), <i>Hakea sericea</i> (Needlebush) and <i>Pultenaea retusa</i> (Notched Bush-pea).
Ground	The ground cover is dominated by Schoenus brevifolius (Zig-zag Bog-rush), Ptilothrix deusta, Leptocarpus tenax, Lepyrodia scariosa, Dampiera stricta, Haemodorum planifolium and Trachymene incisa. Scattered grasses include Hemarthria uncinata var. uncinata (Mat Grass), Entolasia marginata (Bordered Panic), Entolasia stricta (Wiry Panic) and Eragrostis brownii (Brown's Lovegrass).
Condition	The community is largely free from weeds. However, some <i>Andropogon virginicus</i> (Whisky Grass) is present along an access track which occurs along part of the southern boundary of the community.
Distribution within the Subject Land	A patch of this community occurs in the north of the Subject Land in an area likely to be subject to periodic inundation. This community intergrades with the Coastal Sand Wallum Woodland-Heath in higher areas and the Swamp Mahogany - Paperbark Swamp Forest in lower lying wetter areas.

3.2 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Matters of National Environmental Significance that are described in the following sections are those that may be affected by the proposed action. Other MNES that have been considered and are unlikely to be affected by the proposed action are discussed in the Referral of the Proposed Action, which is included at **Appendix 4** of this report.

The consolidated information presented in the following sections are derived from studies undertaken for the earlier constraints and opportunities due diligence (RPS 2011), the previous Environmental Assessment Report for the EIS (Umwelt 2015) and the Ecology Summary Report prepared for the Response to Submissions (**Appendix 3**).

3.2.1 Camfield's Stringybark (*Eucalyptus camfieldii*)

3.2.1.1 Background

Eucalyptus camfieldii is a tree or mallee growing to 10 m high with orbiculate, cordate, glossy green and hispid juvenile leaves. Adult leaves are broad-lanceolate, 7 - 10 cm long, 2 - 3 cm



wide, green and glossy. Buds are sessile, broadly ovoid and angular. The species occurs in coastal shrub heath on sandy soils on sandstone, often of restricted drainage (Hill 2002).

The core distribution of the species is the Hawkesbury Sandstone geology of the Sydney Basin, with all occurrences in small, localised populations in low forest or scrub (Hill 2003; Bell and Driscoll 2006). The identification of the species during the 1990's at Norah Head, Charmhaven, Forresters Beach, Dudley and Tomago, was an extension of the species range (Hill 2003). Hill (2003) discusses that the northern populations differ from the core *E. camfieldii* population, "in the reduction or absence of the cordate orbiculate juvenile leaves, the longer buds and the sometimes longer leaves". The populations inspected by Hill (2003) in the Wyong area were described as hybrids, with putative parent species of *E. camfieldii* and *E. capitellata* or *E. oblonga*. Ecological segregation was also observed by Hill (2003); one example is that plants at Lake Haven exhibited more *E. capitellata* characteristics in the drier eucalypt dominated sites, and plants in the wetter *Melaleuca* dominated sites showed more characteristics of *E. camfieldii*.

Hill (2003) also outlined that for identification purposes, "plants with a majority of morphological features of any one species can be identified as that species...as morphology reflects the predominance of the genes of that species".

The extent of the population on the Tomago Sandbeds is poorly understood. There are only four Atlas records of the species on the Tomago Sandbeds; two within the Subject Land and two at the south of the RAAF live firing range. It is likely that two of these records are duplicates (one at each location), and that the Atlas database only contains records of the species at two locations, as two of the records are sourced from Royal Botanic Gardens Herbarium Specimen Register (likely to be the samples sent to the herbarium for identification). Bell and Driscoll (2006) recorded a small number of individuals or groups at five locations on the Tomago Sandbeds. Three of these locations occur within 3 km of the Subject Land (one likely to be the Atlas Records within the Subject Land).

3.2.1.2 Background within the Subject Land

During surveys in 2008, RPS identified one individual *Eucalyptus camfieldii* within the proposed disturbance area; this species was confirmed by the Royal Botanic Gardens Sydney (RBGS) (RPS 2011). A population count of the species within the study area was not conducted as part of the RPS assessment. Umwelt conducted targeted surveys for the species and sent a number of samples to the RBGS for identification (number not specified).



All samples were positively identified as *Eucalyptus capitellata* (Brown Stringybark) (letter from the RBGS was not provided in the Umwelt (2015) report).

During vegetation surveys in 2016 Kleinfelder identified potential *E. camfieldii* plants within the Subject Land. A total of eight specimens were sent to the RBGS for identification (letters from the RBGS are provided in **Appendix 5**):

- Two specimens collected on 11 August from the Tomago Sand Swamp Heath (offset area) were both confirmed to be *E. camfieldii* (Enquiry No: 19772);
- Four specimens collected on 29 and 30 August; one sample of a Stringybark from within the rehabilitation within the disturbance area, and three from within the rehabilitation area adjoining the Subject Land to the west, were also confirmed to be *E. camfieldii* (Enquiry No: 19782); and
- Two specimens from the disturbance area, collected 8 September were sent for identification. One was confirmed as *E. camfieldii* and the second was given an identification as probable *E. camfieldii* (Enquiry No: 19796).

3.2.1.3 Survey Methods

Identification

As discussed above, the species is similar to *E. capitellata* and differentiation between these two species can be difficult. To assist with identification in the field, Kleinfelder discussed with the RBGS the key characteristics used to identify the specimens sent to the herbarium. The following characteristics were used:

- The primary identification tool was the leaf length to breadth ratio, being less than 3:1 in *E. camfieldii* and greater than 3:1 in *E. capitellata* (**Plate 1**);
- Leaves are thick and leathery;
- Blunt leaf apex with a mucro (*E. capitellata* typically has a more graduating leaf tip) (**Plate 1**); and
- Sessile buds that are angled (separates the species from *E. globoidea* which has pedicellate buds that are not angular) (**Plate 1**).





Plate 1: Examples of *Eucalyptus camfieldii* characteristics used for identification; leaf length to breadth ratio (top left and right), blunt leaf apex with mucro (top left and right), and sessile angular buds (bottom left).

Field surveys were conducted when the species was in-bud. As such, the distinction between *E. camfieldii* and *E. globoidea* was based on bud characteristics (as these two species both have a leaf length to breadth ratio of less than 3:1). When distinguishing the species from *E. capitellata*, the leaf length to breath ratio was the primary determination tool used.

The specimen that was identified by the RBGS as 'probable *E. camfieldii*' was assumed to be the threatened species; only two individuals exhibiting the characteristics of this sample were identified within the Subject Land.

Eucalyptus camfieldii is a mallee tree and can sucker. As such where groups of stems occur, they were defined as one individual. Typically the separation distance between stems of



separate individuals was defined as >1 m; however, where it was obvious that stems were connected (i.e. visible roots or lignotubers), stems >1 m apart were counted as an individual.

Subject Land

Surveys were conducted by walking systematic parallel transects 5 - 20 m apart through areas of suitable habitat within the Project Area as well as the proposed on-site offset area (**Figure 18**). Where individuals were identified, their location was recorded with a hand-held GPS.

Habitat for the species was defined as the Coastal Sand Wallum Woodland-Heath, Tomago Sand Swamp Heath, low lying areas of Coastal Sand Apple Blackbutt Forest and the Coastal Sand Apple Blackbutt Forest (Rehabilitation) vegetation types.

Off-Site

In addition to surveys within the Subject Land, surveys for the species were conducted in surrounding areas to determine the extent of the local population on 29, 30 August and 7, 8, 9, 13, 15 September 2016 (**Figure 18**).

Surveys were conducted within the Tilligerry SCA and on HWC land to the north, north-west and north-east of the Subject Land. Areas mapped by Bell and Driscoll (2006) as Disturbed (Rehabilitation Mining Lands) and Peppermint-Apple-Bloodwood Forest (particularly where this community intergrades with Clay Wallum Scrub) were targeted.

Additionally, the approximate location of where the species was identified within close proximity to the Subject Land by Bell and Driscoll (2006) were targeted. Surveys were conducted by walking systematic parallel transects 20 - 40 m apart. Where individuals were identified, their location was recorded with a hand-held GPS.

Adequacy of Survey

Counts of the species within the Subject Land and in proximate adjacent areas were conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). There are no Commonwealth general survey guidelines that address survey of threatened plants.


L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrus\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig18_Camfieldii_SurveyEffort.mxd



The parallel field-traverse method is considered a suitable and appropriate survey technique because it systematically covers the entire area of potential habitat within a site and can be applied to a range of species and habitat types. The surveys for *E. camfieldii* is therefore considered to be adequate.

3.2.1.4 Results

Occurrence on Subject Land

A total of 1,868 *E. camfieldii* individuals were identified within the Subject Land: 227 within the Project area; and 1,641 within the offset area (**Plate 2** and **Figure 19**). The majority of the individuals occur within the Coastal Sand Wallum Woodland-Heath vegetation type. The species also occurs within the Coastal Sand Apple – Blackbutt Forest (Rehabilitation), Tomago Sand Swamp Heath and low lying areas of the Coastal Sand Apple – Blackbutt Forest, which are co-dominated by *Eucalyptus piperita* (Sydney Peppermint), and also typically where *Melaleuca nodosa* (Prickly-leaved Paperbark) occurs.

The 229 individuals that occur within the Coastal Sand Apple – Blackbutt Forest (Rehabilitation) are likely to have been planted/seeded into the area post mining in the 1970's, and it is highly unlikely that the species would have been present prior to rehabilitation.

The majority of the naturally occurring population within the Subject Land was identified at lower elevations, typically below 6 m elevation, within the Coastal Sand Wallum Woodland-Heath and Tomago Sand Swamp Heath. Only a few individuals were identified within the Coastal Sand Apple - Blackbutt Forest. These individuals occur at elevations below 9 m in areas which are co-dominated by *Eucalyptus piperita* (Sydney Peppermint) and with *Melaleuca nodosa* (Prickly-leaved Paperbark) in the understorey.

Occurrence Off-site

A total of 395 individuals were identified during surveys outside the Subject Land (**Figure 19**). The majority of these (334 individuals) were identified within Disturbed areas (Rehabilitation Mining Lands) to the north and west of the Subject Land. A further 61 individuals were identified within an area to the north of the Subject Land mapped as Peppermint – Apple – Bloodwood Forest by Bell and Driscoll (2006).



Local Population

The total local population of *E. camfieldii* identified during the surveys was 2,263 individuals. All patches of *E. camfieldii* identified off-site during the field surveys occur within 3 km of the individuals within the Subject Land and are within vegetation that is contiguous with the Subject Land. As such all individuals identified during field surveys will be assessed as occurring within the local population for the purposes of this impact assessment. It is likely that they are crosspollinating with individuals within the Subject Land, as highly mobile species (such as birds, bats and insects) are pollinators for eucalypts (House 1997). As such there is the potential for genetic material to be spread large distances (Potts 1997).

Not all areas of available habitat, or areas of rehabilitation, in the area to the north and west of the Subject Land were surveyed. As such the local population may be larger than determined.



Plate 2: *Eucalyptus camfieldii* within the Project area (rehabilitation) (left), and within the offset area (right).



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig19_Camfieldii_Locations.mxd



3.2.2 Earp's Gum (*Eucalyptus parramattensis* subsp. *decadens*)

3.2.2.1 Background

A study conducted by Bell (2006) on the distribution and habitat of *E. parramattensis* subsp. *decadens* for the NSW Department of Environment and Conservation is the primary source of population information for this subspecies. The information in the following subsections is summarised from this document.

Regional Population Information

Eucalyptus parramattensis subsp. *decadens* occurs within two distinct meta-populations within the Hunter-Central Rivers catchment management area, one on the Tomago Sandbeds and the other in the Cessnock-Kurri region (Bell 2006). As of August 2015, a total of 3,047 records of the species exist in the NPWS Atlas Database; 1,224 of these belong to the Tomago Sandbeds population.

Bell (2006) estimated that the Tomago Sandbeds meta-population was between 2,500 and >8,000 individuals. This assessment was based on the number of NPWS Atlas records (820 records in the meta-population in 2006) and that each record may represent between 3 and 10 individuals. Based on this approach, an updated population assessment based on the number of records as of August 2016 would be between 3,500 and >12,000 individuals.

Bell (2006) defined nine sub-populations within the Tomago Sandbeds meta-population. Each population was based on a separation distance of greater than 1 km between successive records. As such the individuals within the Subject Land occur within the RAAF Williamtown West sub-population (shown on **Figure 20**). Using Bell's 2006 population estimate methodology, this sub-population would be between 1,900 and 6,500 individuals (based on 654 records within this sub-population; all records that occur on developed or cleared land were excluded).

As this population estimate methodology used by Bell (2006) was based solely on the number of NPWS Atlas records, a more detailed estimate of the sub-population was conducted to inform the impact assessment. The methodology is outlined below.



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig20_parramattensis.mxd



Local Population

In determining the local population of the individuals within the Subject Land, the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007), were taken into consideration. DECC (2007) defines 'the local population of a threatened plant species as comprising those individuals occurring in the study area or the cluster of individuals that extend into the habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area' (where study area is taken to be the Subject Land in this assessment). As such, the definition of the local population as the RAAF Williamtown West sub-population is considered to be appropriate for the impact assessment (**Figure 20**), since:

- The Subject Land is contiguous with the whole sub-population through vegetated areas;
- Successive records within the sub-population are separated by less than 1 km (Bell 2006); and,
- The species is likely to be pollinated by foraging birds, bats and insects (as with most eucalypts) and hence material has the potential to be spread kilometres (OEH 2011a).

3.2.2.2 Survey Methods

Targeted Searches within the Subject Land

Targeted searches for *E. parramattensis* subsp. *decadens* within the Subject Land was undertaken by RPS in 2008 and 2011 (RPS 2011) and by Umwelt in 2013, 2014 and 2015 (Umwelt 2015).

Targeted searches were undertaken along meandering transects that were positioned systematically to cross the diversity of landform elements and vegetation communities that are present. Where the species was detected, the location was recorded using a handheld GPS.

Surveys Outside the Subject Land

To inform the impact assessment, additional surveys for *E. parramattensis* subsp. *decadens* were conducted by Kleinfelder within the land adjoining the Subject Land. These surveys were conducted to estimate the size of a 'local population' of *E. parramattensis* subsp. *decadens*, to which the individuals within the Subject Land belong.



Density Estimates

To estimate the population size of *E. parramattensis* subsp. *decadens* within the RAAF Williamtown West sub-population, density estimates of the species within key vegetation types was conducted by Kleinfelder.

Within the sub-population area, the number of NPWS Atlas records within each vegetation community mapped by Bell and Driscoll (2006) was assessed to determine the vegetation communities that support the highest number of *E. parramattensis* subsp. *decadens* records. This assessment identified Clay Wallum Scrub (Unit 3ai) and Earp's Gum Sedge Woodland (Unit 4d), which contained 152 and 118 records respectively (**Table 4**).

The results of this analysis are supported by the vegetation descriptions within the Bell and Driscoll (2006) report, which identifies *E. parramattensis* subsp. *decadens* as the dominant tree species within three vegetation communities: Clay Wallum Scrub (Unit 3ai), Earp's Gum – Peppermint Scrubby Forest (4cii, 4ciii, 3aii), and Earp's Gum Sedge Woodland (Unit 4d).

As such, areas of Clay Wallum Scrub and Earp's Gum Sedge Woodland were targeted during surveys.

Vegetation Community (Bell and Driscoll 2006)	Number of NPWS Atlas Records	Area (ha) within Sub- population Extent
Clay Wallum Scrub (3ai)	152	230.14
Earp's Gum Sedge Woodland (4d)	118	162.98
Disturbed - rehabilitated mining lands (R)	17	527.03
Scribbly Gum-Apple-Bloodwood Forest (1b)	13	428.92
Paperbark-Apple-Mahogany Dry Swamp Forest (1i)	4	59.49
Tomago Blackbutt-Apple-Bloodwood Forest (1ai, 1aii, 1c)	3	108.68
Peppermint-Apple-Bloodwood Forest (1aii)	3	82.22
Fringing Baloskion Sedge Woodland (3e)	3	56.86
Callistemon-Hakea Shrub Swamp (2e)	3	10.16
Lepidosperma Sedgeland (2i)	2	31.47
Swamp Mahogany Forest (1ii)	2	29.54

Table 4:Number of NPWS Atlas records per Bell and Driscoll (2006) VegetationCommunities within the RAAF Williamtown West sub-population and the area of
each vegetation community

Density estimates were not conducted within the other vegetation communities, due to the low number of records within other vegetation community types, and as Bell and Driscoll (2006) do not describe *E. parramattensis* subsp. *decadens* as occurring within them. The occurrence



of a low number of individuals within other vegetation communities is likely to be due to localised favourable conditions that cannot be accurately predicted, e.g. ecotones between preferred habitat and dry forest communities.

There are also a number of records of the species within rehabilitation areas, and it is documented that the species was used in rehabilitation works following heavy mineral mining by RZM Pty Ltd on the sandbeds (i.e. the western portion of the population within the study area). However, areas of rehabilitation have not been used as part of the density estimates as the occurrence of the *E. parramattensis* subsp. *decadens* within rehabilitation areas is not natural and the distribution of the species within these areas is potentially not predicable.

The density of *E. parramattensis* subsp. *decadens* was estimated by conducting counts of the species within 20 m x 20 m plots (representing 0.04 ha per plot) across areas of preferred habitat (i.e. Clay Wallum Scrub and Earp's Gum Sedge Woodland). Prior to conducting the field surveys, plot locations were selected to ensure an even distribution across the sub-population. Plot locations were selected to sample as many patches of preferred habitat as possible, and plots were located to sample areas that contain historical records and those without records (plot locations shown on **Figure 20**).

The location of each plot was loaded on to a hand held TrimbleTM GPS unit to allow for navigation to the location in the field. During field surveys meandering transects were conducted through the areas of the targeted vegetation communities to assess the general density of *E. parramattensis* subsp. *decadens* within a patch. When the plot location was reached, if the density was not representative of that patch, the location was moved to ensure a representative sample was taken (a total of seven of the 19 plot locations were moved). Additionally, the boundary of the target vegetation communities within surrounding vegetation types was confirmed.

Targeted Searches outside of the Subject Land

Within the land directly adjoining the Subject Land to the west and north (adjacent to locations where *E. parramattensis* subsp. *decadens* has been recorded within the Subject Land), targeted surveys for the species were conducted by Kleinfelder.

Targeted surveys were undertaken by walking systematic parallel transects approximately 5 to 20 m apart. The location of each individual was recorded on a handheld GPS unit.



Additionally, Kleinfelder were provided access to land owned by PSC located approximately 750 m to the east of the Subject Land (Lot 1310 DP 1197158). Counts of individuals within this lot were also conducted. The location of area searches conducted is provided on **Figure 20**.

Adequacy of Survey

Counts of the species within the Subject Lands were conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). There are no Commonwealth general survey guidelines that address survey of threatened plants. The parallel field-traverse method is considered a suitable and appropriate survey technique because it systematically covers the entire area of potential habitat within a site and can be applied to a range of species and habitat types. The surveys for *E. parramattensis* subsp. *decadens* is therefore considered to be adequate.

Density estimates by plot sampling is considered appropriate to cover large areas of the subpopulation outside of the Subject Land. As key vegetation types were identified systematically using a combination of field and desktop data to identify preferred habitat, and as preferred habitat were sampled representatively with due consideration of the spread and placement of plots, the survey to estimate densities of *E. parramattensis* subsp. *decadens* is therefore considered to be adequate.

3.2.2.3 Results

Targeted Searches within the Subject Land

The combined total number of trees mapped within the Subject Land by RPS (2011) and Umwelt (2015) is 864 individual trees (based on spatial data supplied to Kleinfelder).

Surveys Outside the Subject Land

Density Estimates

An average of 8.21 *E. parramattensis* subsp. *decadens* were recorded in the plots (Table 5).

	• •	• •	
Plot	Mapped Community Type (Bell and Driscoll 20016)	KLF Community Determination (at Plot Location)	Count
1	Clay Wallum Scrub	Clay Wallum Scrub	9
2	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	12
3	Clay Wallum Scrub	Clay Wallum Scrub	3

Table 5:Number of *Eucalyptus parramattensis* subsp. *decadens* recorded within each
plot sampled within the RAAF Williamtown West sub-population



Plot	Mapped Community Type (Bell and Driscoll 20016)	KLF Community Determination (at Plot Location)	Count
4	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	5
5	Clay Wallum Scrub	Earp's Gum Sedge Woodland	16
6	Clay Wallum Scrub	Earp's Gum Sedge Woodland	6
7	Clay Wallum Scrub	Clay Wallum Scrub	0
8	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	0
9	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	0
10	Clay Wallum Scrub	Clay Wallum Scrub	2
11	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	1
12	Clay Wallum Scrub	Clay Wallum Scrub	9
13	Clay Wallum Scrub	Clay Wallum Scrub	9
14	Clay Wallum Scrub	Earp's Gum Sedge Woodland	6
15	Earp's Gum Sedge Woodland	Clay Wallum Scrub	8
16	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	29
17	Clay Wallum Scrub	Clay Wallum Scrub	16
18	Earp's Gum Sedge Woodland	Earp's Gum Sedge Woodland	12
19	Clay Wallum Scrub	Clay Wallum Scrub	13
		Average Number per Plot	8.21
		Average Density per hectare	205.26

During the field surveys it was noted that the boundaries of the targeted vegetation communities and surrounding vegetation types (typically dry sclerophyll forest types or swamp sclerophyll forests) were largely correct. The differentiation between the target vegetation types and other vegetation types was easily distinguishable via aerial photograph interpretation (API), and where boundaries were not visited they were checked using this method. No changes to the vegetation boundaries were made.

It was noted during the field survey that areas of Clay Wallum Scrub and Earp's Gum Sedge Woodland were at times incorrectly identified as each other (**Table 5**). This is likely due to the high similarities in floristics and landscape position between areas of these two vegetation types. Due to time restrictions, the polygons of the two target vegetation communities were not attributed during field surveys. Additionally, differentiation between the two communities via API was difficult. As such the total area of these two communities within the sub-population was used to estimate the local population. This methodology was deemed to be appropriate as the extent of the two communities was confirmed as correct (i.e. total area used for density estimate), and the two vegetation communities support similar densities of *E. parramattensis* subsp. *decadens*.



Targeted Searches outside of the Subject Land

A total of 354 individuals were identified during area searches conducted by Kleinfelder, comprising 324 individuals outside of the Subject Land, and 30 individuals within Lot 1310 DP 1197158.

Estimated Size of the Local Population

Within the RAAF Williamtown West sub-population there is a total of 230.14 ha of Clay Wallum Scrub and 162.98 ha of Earp's Gum Sedge Woodland mapped by Bell and Driscoll (2006). As outlined above, the total area of the two target communities were used in the population density estimate due to difficultly in differentiating the two communities. As such, this equates to a total of 393.13 ha of potential habitat for *E. parramattensis* subsp. *decadens* within the sub-population area.

During the area searches, a patch of Clay Wallum Scrub to the north of the Subject Land was surveyed, with no individuals identified. As such, the area of this polygon (13.17 ha; shown on **Figure 20**) was subtracted from the area of potential habitat used to calculate the density estimates, giving a total area of 379.96 ha of potential habitat within the sub-population.

The initial density estimate calculated a total of 77,992 individuals occurring within 379.96 ha of potential habitat within the sub-population area and is based on a density of 205.26 individuals per ha (as outlined in **Table 5**).

A number of variables were accounted for in the population estimates, including:

- Pre-determined plot locations that were distributed throughout areas of potential habitat;
- Assessments of the heterogeneity of *E. parramattensis* subsp. *decadens* within targeted vegetation community polygons; and
- Validation of vegetation mapping (extent of the two communities).

Notwithstanding, the population density estimate was reduced by a factor of 50% for the final local population estimate. This factor was applied to account for the relatively small area of the population sampled during the density estimates: a total of 19×0.04 ha plots equates to 0.76 ha (0.2% of the total area of potential habitat). The application of the 50% revision factor gives a density of 102.63 individuals per hectare (note: the density of individuals within the Tomago Sand Swamp Woodland within the Subject Land (equivalent to the Earp's Gum Sedge Woodland) is 122.13 plants/ ha).



The estimate of the RAAF Williamtown West Sub-population is 40,214 individuals: 38,996 individuals from the density estimate surveys; and 1,218 from targeted area searches (864 within the Subject Land, 324 on land adjacent to the Subject Land and 30 individuals on Lot 1310 DP 1197158) (**Table 6**).

It should be noted that the total local population is potentially significantly larger, as areas of mine rehabilitation were not assessed during this population estimate. It was noted that the species occurs within mine rehabilitation areas to the north of the Subject Land, during surveys for *Eucalyptus camfieldii*.

Within the Subject Land, the revised extraction area will impact on a total of 230 of 864 individuals counted, with a total of 634 being retained within the on-site offset area (**Figure 20**).

Method	Average Density/ ha	Area (ha) of Potential Habitat	Population Estimate/ Count
Population Density (50% adjusted)	102.63	379.96	38,996
Count – Subject Land	-	-	864
Count – Land Adjacent to Subject Land	-	-	324
Count – Council Land	-	-	30
	Total Local	Population Estimate	40,214

 Table 6:
 Eucalyptus parramattensis subsp. decadens local population estimate

3.2.3 Koala (*Phascolarctos cinereus*)

3.2.3.1 Background

The Koala occurs from north-eastern Queensland, south along the coast and ranges to southwestern South Australia, including areas west of the Great Dividing Range (DECC 2008).

The species inhabits eucalypt woodlands and forests and feeds on the foliage of Eucalypt and non-Eucalypt species. Across their range, the species has been recorded as foraging or sitting in 69 different Eucalypt species and almost 30 non-Eucalypt species, however, most studies of Koala foraging habits noted that the species predominantly feeds on one or a few Eucalypt species at any site (Moore and Foley 2000). Within the Port Stephens area, *Eucalyptus robusta*, *E. parramattensis* and *E. tereticornis* were identified as preferred feed trees by Lunney *et al.* (1998). Additionally, vegetation associations containing *Eucalyptus signata* were also identified as important in this study.



The species is generally solitary (OEH 2015), but they have a complex social hierarchy, living in breeding aggregations comprising of the territory of a dominant male overlapping a small number of mature females, also juveniles of various ages occur (DECC 2008; OEH 2015). Across their range, adult Koalas generally exhibit long-term fidelity to their individual home range. Within the Port Stephens area studies have established home ranges of 0.2 ha to 500 ha, with an average of 80 – 90 ha (DECC 2008).

3.2.3.2 Port Stephens Population

There is evidence that the population within the Port Stephens area is in decline. The mortality rate in 1995 was estimated to be 5 - 10% of the population. Since 1995 this rate has declined linearly to less than half that level. As trends in road mortality rates of animals can provide a good surrogate for animal abundance, this may indicate a substantial decline in the population at Port Stephens (TSSC 2012). Modelling of the impacts of fire and dogs on the Port Stephens population conducted by Lunney *et al.* (2007) also identified that these two pressures are impacting on the local population. The research estimated the population to be between 350 and 800 individuals, and modelled that under basic assumptions (impacts from dogs and fire), the population was unlikely to survive 50 years (Lunney *et al.* 2007).

The Subject Land falls within a key Koala population (Tomago Sandbeds Koala Management Unit (KMU); PSC 2002) in the Port Stephens LGA. There is a high number of records of the species within 1 km of the site. There are a total of nine Atlas records within the Subject Land; one from 2011 (accuracy of 10 m), one from 2008 (accuracy of 1,000 m) and the remaining seven in 1992 or prior (all accuracy of 1,000 m). Additionally, there are 37 records within 1 km of the Subject Land, of which five are within the last 10 years. This suggests that the area is potentially of high importance to the Koala in the area, particularly due to the occurrence of areas of preferred habitat.

3.2.3.3 Occurrence within the Subject Land

The occurrence of the Koala within the Subject Land was investigated by RPS (2011) and Umwelt (2015) as part of the constraints and opportunity assessment of the land and for the EIS. The survey methods and results are presented and discussed in the following sections.



Survey Methods

Field surveys were undertaken by RPS in 2011 and by Umwelt between 2013 and 2015 (**Table 7**).

Survey Method	Survey Requirement (DEC 2004)	Survey Effort Employed for Ecology Assessment	Habitat Stratification Units Surveyed
Spotlighting surveys	2 x one hour and 1 km of spotlighting up to 200 hectares of stratification unit, walking at approximately 1 km per hour on 2 separate nights	Two nights of spotlighting transects, each of 2 person- hours was undertaken throughout the Subject Land (10 and 26 February 2015). Eight person hours of spotlighting surveys was undertaken over two nights across the Subject Land (24 and 26 May 2011).	Woodland/Forest Swamp Forest Heath
Opportunistic observations	-	Opportunistic observations were made throughout all surveys (23 May 2011 to 3 June 2011, 28-29 August 2013, 25-26 August 2014, and 10, 12 and 26 February 2015).	Throughout the Subject Land
Koala SAT Surveys	-	10 SAT surveys sampled across the Subject Land (28 September 2015)	Throughout the Subject Land

Table 7: Survey effort within the Subject Land

A total of 10 Koala Spot Assessment Technique (SAT) surveys were undertaken in the Subject Land in September 2015 by Umwelt. Searches were undertaken on and around the base of 30 trees at each site. Searches included looking for signs of Koala activity including scats at the bases of trees or characteristic scratches on the trunk. The SAT surveys were completed across the Subject Land in five of the mapped vegetation communities, which contained Koala feed trees (refer to **Table 8** in results section below).

Survey Results

One Koala was identified in the south of the Subject Land by RPS in 2011 within the Swamp Mahogany – Paperbark Swamp Forest. No signs of Koala activity were recorded at any of the 10 SAT survey locations and therefore, activity levels within the Subject Land in 2015 when the SAT surveys were undertaken can be considered to be zero.



The usage of the Subject Land by Koalas and the ability to detect use is likely to have been affected by intense bushfires in October 2013. The trees occurring across the Subject Land were still recovering from this fire event at the time of the 2015 surveys.

SAT Survey Number	Vegetation Community	Koala Activity
SAT 1	Coastal Sand Apple – Blackbutt Forest	0%
SAT 2	Coastal Sand Apple – Blackbutt Forest	0%
SAT 3	Swamp Mahogany – Paperbark Swamp Forest	0%
SAT 4	Tomago Sand Swamp Woodland	0%
SAT 5	Coastal Sand Apple - Blackbutt Forest (Rehabilitation)	0%
SAT 6	Tomago Sand Swamp Heath	0%
SAT 7	Coastal Sand Apple - Blackbutt Forest (Rehabilitation)	0%
SAT 8	Swamp Mahogany – Paperbark Swamp Forest	0%
SAT 9	Swamp Mahogany – Paperbark Swamp Forest	0%
SAT 10	Coastal Sand Apple – Blackbutt Forest	0%

Table 8: Results of Koala SAT Surveys

Discussion

Influence of 2013 Bushfire on Koala usage of the Subject Land

Matthews *et al.* (2007) identified that burnt trees could be utilised by Koalas from as little as three months after fire, as the epicormics growth provides sufficient nutrients. Un-burnt areas are important during wildlife events, to maintain the population and service as source of colonising individuals into area of burnt bush (Matthews *et al.* 2007).

It is likely that Koala re-colonisation of the habitat burnt in 2013 fire, including the Subject Land, is still occurring. This is supported by the lack of activity detected by Umwelt in 2015 (two years post fire), and the lack of Atlas records within burnt areas in close proximity to the Subject Land. Post 2013 fire event, there are seven records of the species within 5 km of the Subject Land (within the KMU). These occur along Medowie Road approximately 3 to 4 km to the east/ north-east (4 records from 2014) and approximately 4 km north along Richardson Road (two record from 2014 and one record from 2015). The four records along Medowie road all occur within areas that were not burnt during the fire and the three records along Richardson Road occur within 1 km of the mapped fire extent.

Value of Subject Land as Koala Habitat

It is considered that the SAT results do not accurately portray the potential usage of the Subject Land by Koalas. Although the SAT surveys conducted by Umwelt in 2015 did not identify any



Koala activity, the following points are noted: RPS (2011) did identify one Koala within the Subject Land; and the Subject Land contains habitat suitable for utilisation by the species, with preferred feed trees present (*Eucalyptus robusta, Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus signata*).

Phillips and Callaghan (2011) acknowledge that this is a limitation of the SAT methodology and state that:

"Low activity levels recorded in what might otherwise be med-high carrying capacity *P. cinereus* habitat may be a result of contemporary population dynamics, landscape configuration and/ or historical disturbances including logging, mining, fire, agricultural activities and/ or urban development. Such considerations should not necessarily detract from the potential importance of such habitat for longer-term conservation, particularly if preferred koala food trees are present and populations of *P. cinereus* are known to occur in the general area".

Since preferred feed trees are present, and considering the number of historic records in the locality (46 Atlas records within 1 km of the Subject Land; nine of which occur within the Subject Land), as well as the connectivity to vegetation to the north and the importance of the Port Stephens Koala population, the Subject Land is considered to be an area of medium to high quality habitat for Koalas.

The precautionary principle was applied and the preferred habitat within the Subject Land is assumed to have the potential to support a medium (normal) usage category. The local population of Koalas which potentially occupy the Subject Land do not occur at the extent of the range of the species. However, the local population has been assessed as 'important' as the population of the species in the Port Stephens LGA is likely to be important for maintaining genetic diversity and/or breeding and dispersal.

The Koala habitat mapping for the Subject Land has been updated, based on additional vegetation mapping surveys conducted by Kleinfelder, see **Section 3.2.3.4**.

3.2.3.4 Koala Habitat Mapping within the Subject Land

Kleinfelder re-examined vegetation mapping from the EIS (Umwelt 2015) with the objective of reviewing the Koala habitat mapping for the Subject Land. As part of this review, Kleinfelder undertook additional vegetation mapping surveys and updated the Koala habitat mapping with



reference to the Port Stephens Council Comprehensive Koala Plan of Management (CKPoM), which applies to all development applications on land within the Port Stephens LGA and which provides regionally specific guidance on Koala habitat.

Methods

The extent and quality of Koala habitat within the Subject Land was categorised and mapped in accordance with the definitions of Preferred and Supplementary habitat in the CKPoM. The CKPoM definitions of Preferred and Supplementary habitat is based on vegetation associations described in Lunney *et al.* (1998). There are five vegetation associations identified in Lunney *et al.* (1998) to be Koala habitat (Category A – E); these vegetation associations were applied to the revised vegetation mapping of the Subject Land and each vegetation unit was subsequently identified as Preferred, Supplementary or Other Koala habitat.

Results

Table 9 lists the vegetation types mapped within the Subject Land and identifies each

 vegetation type as a category of Koala habitat. The justification is provided in the final column.

Within the Subject Land, a total of 40.38 ha of Koala habitat was mapped within the Project area and 104.78 ha within the offset area. A revised Koala habitat map is provided in **Figure 21**.

Vegetation Type	Habitat Category	Justification
	Supplementary	This vegetation most closely aligned to the Tall Open Blackbutt Sydney Red Gum Forest in Table 1 of Lunney <i>et al.</i> (1998), which is a Category C Vegetation Association.
Coastal Sand Apple – Blackbutt Forest	Preferred	An area of this vegetation community (represented by Plot 17 on Figure 17) is co-dominated by <i>Eucalyptus signata</i> , as such it is considered to most closely align to the Open Blackbutt and Sydney Red Gum Forest with Scribbly Gum in Table 1 of Lunney <i>et al.</i> (1998), which is a Category B Vegetation Association.
Coastal Sand Apple – Blackbutt Forest (Regenerating)	Supplementary	As above for Coastal Sand Apple – Blackbutt Forest classified as Supplementary
Coastal Sand Apple – Blackbutt Forest (Rehabilitation)	Preferred	The canopy of this vegetation community is co-dominated by both <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> and <i>Eucalyptus signata,</i> as such this area has been classified as preferred habitat.

Table 9:	Classification of Koala Habitat as per CKPoM
----------	--



Vegetation Type	Habitat Category	Justification
Coastal Sand Wallum Woodland – Heath	Preferred	This vegetation is most closely aligned to Sydney Red Gum, Red Bloodwood, Brown Stringybark, White Stringybark Forest with Scribbly Gum in Table 1 of Lunney <i>et al.</i> (1998), which is a Category A Vegetation Association.
Coastal Wet Sand Cyperoid Heath	Other	Classified as an Excluded Vegetation Association (Moist Heathland/ Sedgeland), as per Table 1 of Lunney <i>et al.</i> (1998).
Swamp Mahogany – Paperbark Swamp Forest		This vegetation is most closely aligned to Open Swamp
Swamp Mahogany – Paperbark Swamp Forest (Regenerating)	Preferred	Dominating in Table 1 of Lunney <i>et al.</i> (1998), which is a Category B Vegetation Association.
Tomago Sand Swamp Heath	Other	Classified as an Excluded Vegetation Association (Closed Heathland), as per Table 1 of Lunney <i>et al.</i> (1998).
Tomago Sand Swamp Woodland	Preferred	The canopy of this vegetation community is dominated by <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> and <i>Eucalyptus signata</i> also occurs, as such this area has been classified as preferred habitat.
Exotic Vegetation	Cleared Land	Non-native vegetation with limited canopy
Excluded (Cleared Land)	Cleared Land	Cleared of vegetation (e.g. tracks)



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig21_Koala.mxd



3.2.3.5 Koala Habitat Assessment within the Tomago Sandbeds KMU

The Tomago Sandbeds KMU is a koala management unit identified within the PSC CKPoM and has been treated as the extent of habitat for the local population of the species. An analysis of the preferred and supplementary Koala habitat within the Tomago Sandbeds KMU was undertaken to inform the impact assessment, and also to determine if there was an appropriate amount of land within the KMU for offsetting purposes (discussed further in the Offset Strategy; see **Section 6.2**).

Methods

The analysis involved examining available vegetation mapping for the Tomago Sandbeds KMU and assigning each vegetation community type as preferred, supplementary or other Koala habitat based on comparison of the floristic descriptions of the vegetation mapping studies with the descriptions of preferred and supplementary habitat by Lunney *et al.* (1998) and PSC (2002). The desktop analysis was primarily based on the *Vegetation of the Tomago and Anna Bay Sandbeds* (Bell and Driscoll 2006), which covers most of the Tomago Sandbeds KMU and is the most accurate and recent vegetation mapping available. For areas not covered by the Bell and Driscoll (2006) mapping within the Tomago Sandbeds KMU, the *Lower Hunter and Central Coast Regional Environment Management Strategy* (LHCCREMS; NPWS, 2000) vegetation mapping was used. Additionally, the vegetation mapping within the Subject Land was added to the totals.

Results

The assessment identified an estimated 1,900 ha of preferred and 2,716 ha of supplementary habitat within the Tomago Sandbeds KMU (**Table 10**). A map of the habitat within the KMU is presented on **Figure 22**.

Koala habitat	Equivalent vegetation map units (MU)		Total area (ha) of Koala habitat
category	Bell and Driscoll (2006)	LHCCREMS (2000)	(including Subject Land)
Preferred	5, 7, 9, 17-19, 21, 24 & 43	36 & 37	1,900 ha
Supplementary	1-3, 11, 22 and 41	33	2,716 ha
Marginal, other and excluded	20, 23, 25-29, 31-38 & 42	9, 12, 15, 17, 30, 34, 36a, 40, 44, 46 and 47	N/A
		Total	4,616 ha

Table 10:Estimated preferred and supplementary Koala habitat and potential Koala
habitat within the Tomago Sandbeds KMU



Subject Land (176.1 ha) Tomago Sandbeds KMU Preferred Koala Habitat

Supplementary Koala Habitat



L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_EPBCPD_Fig22_KoalaHabitat_TomagoSandbeds.mxd



3.2.3.6 Adequacy of Surveys

The survey methods shown in **Table 7** targeted mammals and includes survey for Koala. These survey methods were designed with due consideration of the *Threatened Biodiversity Survey and Assessment: Guidelines of Developments and Activities (working draft)* (DEC 2004). When evaluated against the survey guidelines in the Koala EPBC referral guidelines (DoE 2014) and the national *Survey Guidelines for Australia's Threatened Mammals* (DSEWPC 2011), the survey undertaken is considered to be appropriate and adequate and meets the requirement for desktop, direct and indirect survey methods and survey effort.

3.2.4 Grey-headed Flying-fox (*Pteropus poliocephalus*)

3.2.4.1 Ecology and Distribution

The Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs along the eastern seaboard of Australia roosting in communal colony sites, which are used permanently, annually, or occasionally depending on food availability (Tidemann, 1995).

Roosting and breeding colonies are referred to as camps and can vary considerably in size from hundreds to many thousands of individuals, and fluctuate according to food resources (Parry-Jones & Augee 1991; Tidemann, 1995). Camp sites are often situated near water and provide adequate shade and protection, usually in tall closed forest near streams, rivers or estuaries (DEWHA 2010). Large colonies are very vocal even during the day, and can significantly damage roost trees by their sheer weight of numbers. Nationally important camps are those that have contained \geq 10,000 individuals in more than one year in the last 10 years, or have been occupied by more than 2,500 individuals permanently or seasonally every year for the last 10 years (DoE 2015b).

Fruits and flowers from numerous rainforest trees and other myrtaceous species form a large component of the Grey-headed Flying-fox diet, and consequently mass nomadic movements occur throughout their range in response to fruit and flower availability. Grey-headed Flying-fox utilises subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths swamps and mangroves, as well as urban gardens and fruit crops for foraging (Churchill 1998; Eby *et al.* 1999).

"The Grey-headed flying fox must be acknowledged as being highly significant to the health and maintenance of many ecosystems in eastern Australia. The species performs



the ecosystem services of pollination and seed dispersal for a wide range of native trees, including commercially important hardwood and rainforest species. It thus contributes directly to reproduction, regeneration and the evolutionary processes of forest ecosystems. Flying-foxes are unique in the large distances they disperse pollen and seeds. The population of Grey-headed flying fox must be of sufficient size for this to continue. If numbers were reduced to small or localised groups, then rainforest seed dispersal and hardwood pollination processes would be severely curtailed" (Eby, 2000).

As myrtaceous plants are a large part of the species' diet, most vegetation types are considered suitable foraging habitat for the species. However, foraging habitat that is considered critical to the survival of the species has at least one or more of the following attributes (DECCW 2009):

- Productive during winter and spring, when food bottlenecks have been identified;
- Known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult);
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May);
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions); or
- Known to support a continuously occupied camp.

The updated recovery plan for the Grey-headed Flying-fox (DoEE 2017) states that all foraging habitat has the potential to be productive during general food shortages and therefore provide a critical resource. Habitat and associated seasonal resources critical to the survival of the Grey-headed Flying-fox have been mapped, but have yet to be ground-truthed (Eby and Law 2008).

3.2.4.2 Regional Occurrence

Data from the National Flying-fox Monitoring Programme (DoE 2015a) indicates that there are no Grey-headed Flying-fox camps within or adjacent to the Subject Land. The two nearest Nationally Important Flying-fox roost/camp sites of the Grey-headed Flying-fox to the Subject Land are at Carrington Mangroves (approximately 12 km to the south-west of the Subject Land) and Raymond Terrace, approximately 9 km to the north-west of the Subject Land. The most recent population estimates for both camps (February 2017) are between 2,500 and 9,999 individuals.



Other roosting sites at Medowie (approximately 10 km north-east of the Subject Land) and Bob's Farm (approximately 22 km east of the Subject Land) were last occupied in February and May 2015 respectively; the population estimates at that time for these camps were between 1 and 500 individuals. The population estimate of Blackall Park (approximately 30 km south-east of the Subject Land) in February 2017 was between 500 and 2499 individuals.

Former roosting sites at Fullerton Cove, Anna Bay, Stockrington, Belmont and Glenrock are inactive (DoE 2015a), with no evidence of use since the national monitoring programme began in 2012.

The Atlas database indicates that there are approximately 14 records within five km of the Subject Land; of these only one record was from the last five years. This record is from 2014 and is located off Nelson Bay Road to the east of the airport in the Tilligerry SCA.

3.2.4.3 Occurrence in the Subject Land

Survey Methods

RPS (2011) undertook eight person hours of spotlighting surveys over two nights across the Subject Land (24 and 26 May 2011).

Umwelt (2015) undertook walking nocturnal spotlighting surveys, each of one person-hour repeated over two nights (10 and 26 February 2015). Spotlighting was conducted on foot along transects of the Subject Land using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 8.00 pm and 12.00 midnight, commencing one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving vehicle while travelling between fauna survey sites at night.

Results

The species was detected foraging on site within the Swamp Mahogany—Paperbark Forest in the south-eastern section of the site during nocturnal spotlighting surveys by RPS (2011). Umwelt (2015) reported two records that are additional to the record reported by RPS (2011); however, details around the date, location and habitat of the sightings is not available.

Notwithstanding the above, all vegetation within the Subject Land is expected to provide potential foraging habitat for this species as they all represent suitable habitat types (i.e. forest, swamp forest, heath and woodland) and all provide flowering resources from eucalypt species.



The foraging habitat within the Subject Land is connected to native vegetation offsite, and is part of a much larger patch of vegetation comprising HWC land, the Tilligerry SCA, and private landholdings. Large areas of foraging habitat in the wider locality include the Hunter Wetlands National Park and Worimi National Park.

No roosting camps were identified within the Subject Land or immediately adjacent to the Subject Land. Although the Subject Land is not located within 50 kilometres of a population of Grey-headed Flying-fox that supports more than 30,000 individuals, the foraging habitat within the Subject Land is located within 50 km of two Nationally Important Flying-fox camps and is expected to provide food resources for the species during winter and spring. It is highly likely that the species would forage in the native vegetation within the Subject Land on occasion or in low numbers as part of a larger foraging range.

Adequacy of Survey

The national survey guidelines for threatened bats (DEWHA 2010) acknowledges that surveys for Grey-headed Flying-fox based on animal sightings are likely to be unreliable and that database assessments in conjunction with habitat assessment to identify foraging habitat are more effective. The assessment of Grey-headed Flying-fox considers database information on the location of known camps as well as data on foraging habitat collected from vegetation survey; for this reason, the surveys are considered to be adequate and appropriate.



4. RELEVANT IMPACTS

A discussion and assessment of each of the relevant threatened species MNES (*Eucalyptus camfieldii, Eucalyptus parramattensis* subsp. *decadens*, Koala and Grey-headed Flying-fox) are provided in the following sections. Detailed assessment in line with significant impact criteria were completed as part of the Referral application for the Project; these assessments are provided at the end of the Referral document, which is included at **Appendix 4** of this report.

4.1 HABITAT IMPACTS ON THREATENED SPECIES

4.1.1 Camfield's Stringybark (*Eucalyptus camfieldii*)

4.1.1.1 Direct Impacts

The local population of *Eucalyptus camfieldii* was estimated to be 2,263 individuals distributed as seven clusters that occur within 3 km of each other. Of this, a total of 1,868 *E. camfieldii* individuals were identified within the Subject Land.

The Project will remove 227 individuals, the majority (201 individuals) of which have been seeded/planted into the rehabilitation area and are not naturally occurring. The removal of 227 individuals represents approximately 10% of the local population.

The residual areas of the Subject Land (i.e. land not within the Project area) supports 1,641 individuals, which represents approximately 73% of the local population. As PSC proposes to use the remaining area of the Subject Land as an offset area and will establish it as a biobank site, 73% of the local population will be protected under the BioBanking mechanism. Furthermore, the species will be used within the rehabilitation of the Project area, which will re-instate the removed individuals and maintain the local population size in the long-term. This mitigation measure has been proven to be successful for the species, which is evident through its current presence within the existing rehabilitation area.

The population of *E. camfieldii* within the Subject Land was assessed as important as it occurs near the limit of the species range. However, it is noted that the majority of the area occupied by the species was historically rehabilitated and these areas are considered marginal habitat



in this regard, as the species was actively introduced to these areas. Preferred habitat for the species within the Subject Land is represented by natural habitat that occurs in low lying areas which adjoin the Coastal Sand Wallum Woodland-Heath.

There is no national recovery plan for the species and no official areas of critical habitat have been defined. Notwithstanding, the Project is unlikely to significantly impact on habitat that is critically important to the survival of the species. OEH has developed a targeted strategy for this species under the Saving Our Species program. This species has been assigned to the 'site-managed species' management stream as this species is considered to require 'site-based management in order to secure it from extinction in NSW for 100 years'. Four management sites have been established at Mangrove Creek Dam, Kur-ring-gai Chase National Park, North Head Sydney Harbour, and Royal National Park. The Project does not impact on any of these management areas (all located over 50 km south of the Subject Land).

Considering the above, the Project is unlikely to significantly decrease the size or area of occupancy of the local population such that it is likely to lead to a long-term decline of the local population.

4.1.1.2 Indirect Impacts

The Project is unlikely to significantly fragment the local population. All individuals within the local population will still be connected via areas of remnant native vegetation post extraction, and the distance between clusters will not be increased (i.e. no additional distance for pollination vectors). Additionally, the Project area will not represent a hostile barrier as it will be progressively cleared and rehabilitated, including the use of *E. camfieldii* within the rehabilitation.

There is the potential for indirect impacts on 197 individuals occurring within 50 m of the extraction area. These individuals occur adjacent to the disturbance area and as such, there is the potential for indirect impacts through habitat modification. However, these impacts are unlikely to significantly impact on the reproductive potential or health of the retained individuals, as the disturbance will not be permanent, with progressive rehabilitation occurring within the Project area.

There is the potential for the proposal to introduce weed species into the retained habitat within the offset area. A weed control program will be implanted as part of the Project and is detailed in the Environmental Management Plan (**Appendix 2**), with regular inspections of the



disturbance area interface being conducted. As there will be regular inspections and follow-up weed control for the life of the Project (until rehabilitation is signed off), it is unlikely that a harmful species will become established within the species habitat.

Potential harmful diseases which *E. camfieldii* is susceptible to include Myrtle Rust and *Phytophthora cinnamomi*. Myrtle Rust is a disease caused by the exotic fungus *Puccinia psidii*. It infects species of the Myrtaceae family and causes leaf deformation, defoliation, reduce fertility, dieback, stunted growth, and plant death. *Phytophthora cinnamomi* is a pathogen which infects the plant roots and causes disease and plant death. Infection of susceptible ecological communities can result in modification of the community, reduction in functionality and habitat loss or degradation for dependant flora and fauna species. The pathogen is spread in water, soil or plant material that contains the pathogen. *Phytophthora cinnamomi* occurs in all Australian states and territories (except NT), and is well established in many of the higher rainfall areas of the country.

Evidence of these two diseases was not identified within the Subject Land, however, they are known to occur in the region. It is not expected that the Project will introduce or exacerbate any of these diseases that may cause the species to decline. To limit the potential of spread, all machinery conducting clearing within the extraction area will be clean and free of any soil or vegetative material when it enters the site.

4.1.2 Earp's Gum (*Eucalyptus parramattensis* subsp. *decadens*)

4.1.2.1 Direct Impacts

The local population of *Eucalyptus parramattensis* subsp. *decadens* is conservatively classified as the RAAF Williamtown West sub-population (as defined by Bell 2006). This is considered to be appropriate for the assessment as: the Subject Land is contiguous with the whole sub-population through vegetated areas; successive records within the sub-population are separated by less than 1 km (Bell 2006); and the species is likely to be pollinated by foraging birds, bats and insects, as with most eucalypts, hence material has the potential to be spread kilometres (OEH 2011a). The size of the local population was estimated as part of this assessment to be 40,214 individuals.

A total of 864 *E. parramattensis* subsp. *decadens* individuals were recorded on the Subject Land. Of these individuals, 283 occur within the Coastal Sand Apple – Blackbutt Forest



(Rehabilitation) and 581 occur naturally in the north of the Subject Land predominantly within the Tomago Sand Swamp Woodland. The individuals within the Subject Land that occur within the Coastal Sand Apple – Blackbutt Forest (Rehabilitation) are not considered to be naturally occurring. It is highly unlikely that the species would have been present in this area prior to heavy mineral sand mining in the 1970's as it does not represent potential habitat for the species, due to the elevation of this area. The naturally occurring population of the species on site occurs in lower lying areas subject to periodic inundation. As such, it is likely that all individuals have been planted or seeded into this area during rehabilitation works.

The Project would result in the removal of 230 *E. parramattensis* subsp. *decadens* individuals within the Coastal Sand Apple – Blackbutt Forest (Rehabilitation) on the Subject Land. This removal represents a total of 27% of the population within the Subject Land. In relation to the total estimated local population, the impact equates to a total removal of 0.57% of the local population.

The Project will retain 634 individuals within the Subject Land; this represents approximately 73% of the onsite population and 1.58% of the local population. As PSC proposes to use the remaining area of the Subject Land as an offset area and will establish it as a biobank site, 73% of the onsite population will be protected under the BioBanking mechanism.

The RAAF Williamtown West sub-population (of which the individuals within the Subject Land form part of) is part of the Tomago Sandbeds Meta-population. As this is only one of two meta-populations of the species, the individuals within the Subject Land have been classified as forming part of an important population as the local population is key for breeding and dispersal, and maintaining genetic diversity. A Draft National Recovery Plan (OEH 2011a) has been prepared for this species. The plan outlines that the species occupies more than 2,500 hectares, and that it all contributes to the long-term conservation of the species.

Notwithstanding this, the habitat to be impacted was not assessed as suitable for the species (due to its elevation and that it is not subject to periodic inundation) and as such it is unlikely to be critical to the species survival. The Project will only remove a small proportion of the local population (0.57%) and the Project will only remove individuals that have been seeded/ planted following rehabilitation.

The Project will not interfere with any of the four specific recovery objectives that are identified in the Draft National Recovery Plan (OEH 2011a):

• Distribute information that assists in conserving and managing Earp's Gum;



- Ensure appropriate use of Earp's Gum in rehabilitation projects;
- Raise awareness of Earp's Gum and facilitate community involvement in the recovery plan; and,
- Ensure appropriate protection of the Fern Bay form.

Considering the above, the Project is unlikely to significantly decrease the size or area of occupancy of the local population, or interfere with the recovery of the species such that it is likely to lead to a long-term decline of the local population.

4.1.2.2 Indirect Impacts

The Project is unlikely to significantly fragment the local population. The Subject Land occurs on the edge of a large patch of vegetation that extends along the sandbeds to the west and east. Habitat for the species occurs to the north of the Subject Land, throughout the subpopulation area and totals 393.13 ha. The Project will remove a total of 19.01 ha of occupied vegetation from the south of the local population, including 230 individuals. However, this removal will not cause fragmentation into two or more populations. All individuals within the local population will still be connected via areas of remnant native vegetation post extraction, and the distance between individuals will not be increased (i.e. no additional distance for pollination vectors). Additionally, the disturbance area will not represent a hostile barrier as it will be progressively cleared and rehabilitated.

There is the potential for indirect impacts on 54 individuals occurring within the rehabilitation area that occur within 50 m of the extraction area. These individuals occur within close proximity to the disturbance area and as such, there is the potential for habitat modification. There is limited potential for indirect impacts on naturally occurring individuals within the Subject Land, as at its closest point the disturbance area occurs approximately 180 m from the naturally occurring population within the Subject Land.

The Project is unlikely to result in an invasive species becoming established in habitat for *E. parramattensis* subsp. *decadens* as areas of suitable habitat for the species occur approximately 180 m from the Project area. Furthermore, to limit the potential spread of weeds from the disturbance area into the offset area, a weed control program will be implanted as part of the Project. This will involve regular inspections of the disturbance area interface being conducted and follow-up weed control for the life of the Project until rehabilitation is signed off (**Appendix 2**).



Potential harmful diseases which *E. parramattensis* subsp. *decadens* is susceptible to include Myrtle Rust and *Phytophthora cinnamomi*. Myrtle Rust is a disease caused by the exotic fungus *Puccinia psidii*. It infects species of the Myrtaceae family and causes leaf deformation, defoliation, reduce fertility, dieback, stunted growth, and plant death. *Phytophthora cinnamomi* is a pathogen which infects the plant roots and causes disease and plant death. Infection of susceptible ecological communities can result in modification of the community, reduction in functionality and habitat loss or degradation for dependant flora and fauna species. The pathogen is spread in water, soil or plant material that contains the pathogen. *Phytophthora cinnamomi* occurs in all Australian states and territories (except NT), and is well established in many of the higher rainfall areas of the country.

Evidence of these two diseases were not identified within the Subject Land, however, they are known to occur in the region. It is not expected that the proposal will introduce or exacerbate any of these diseases that may cause the species to decline. To limit the potential of spread, all machinery conducting clearing within the extraction area will be clean and free of any soil or vegetative material when it enters the site.

4.1.3 Koala (*Phascolarctos cinereus*)

The Subject Land falls within a key Koala population (Tomago Sandbeds Koala Management Unit (KMU); PSC 2002) in the Port Stephens LGA. The species was identified in the south of the Subject Land during surveys conducted by RPS (2011) but no individuals were recorded in 2015 surveys (Umwelt 2015). Notwithstanding, Atlas database records indicate that the species is reliably present in the vicinity, and the Subject Land is potentially of high importance to the Koala in the area, particularly as suitable Koala habitat is present within the Subject Land.

Although the local Koala population that potentially occupies the Subject Land does not occur at the extent of the range of the species, it has been assessed as 'important' as the population of the species in the Port Stephens LGA is likely to be important for maintaining genetic diversity and/or breeding and dispersal.

4.1.3.1 Direct Impacts

The decline of the Koala population in the Port Stephens LGA has historically been attributed to habitat loss. Direct loss of habitat is cited as the primary threat to the Koala (DECC 2008)



and habitat identified as critical to the survival of the species is an important consideration when assessing impacts of a development.

Identifying Habitat Critical to Koala Survival

The EPBC Act Referral Guidelines for the Vulnerable Koala Combined populations of Queensland, New South Wales and the Australian Capital Territory (DoE 2014) outline a Koala habitat assessment tool to determine if a site contains critical Koala habitat. The habitat within the extraction area has been assessed against the criteria, and is detailed in **Table 11** (the site occurs within a coastal area, as such these criteria have been used).

Attribute	Score	Discussion	
Koala Occurrence	+1	 EPBC PMST report identified the species or species habitat known to occur in area. The species was identified within the southern portion of the Subject Land (outside the extraction area) during surveys in 2011. No evidence of the species was identified within the extraction area (or the Subject Land) during surveys in 2015, however this is likely due to impacts from the 2013 bushfire. Post-2013 bushfire, there are seven records of the species within 5 km of the Subject Land (within the KMU). 	
Vegetation Composition	+2	The vegetation associations in the extraction area have been mapped as either preferred or supplementary habitat (as defined by the CKPoM; PSC 2002). The rehabilitation area was defined as preferred habitat due to the occurrence of <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> and <i>Eucalyptus signata</i> , while the remnant forest is classified as supplementary habitat.	
Habitat Connectivity	+2	The extraction area is connected to a large expanse of vegetation (>500 ha) to the north of the Subject Land.	
Key Existing Threats	+1	Vehicle strikes and dog attacks have been identified as a key threat to the Port Stephens population. The exact level of vehicle strike and dog attacks in the area is not known. However, evidence of dogs (tracks) was observed within the Subject Land along the access track that runs through the extraction area.	
Recovery Value	+1	 Uncertain whether the habitat is important for achieving the interim recovery objectives, as it is not known if the habitat is: Of sufficient size to be genetically robust/operate as a viable sub-population, or Free of disease or have low incidence of disease, or Breeding. 	
Total Score	7	As such the impact area is classified as habitat critical to the survival of the species.	

 Table 11:
 Assessment of habitat critical to the survival of the Koala



The above assessment is relevant to all areas of the extraction area, as such the extraction area contains a total of 40.38 ha of habitat critical to the survival of the species. Within the offset area, the Swamp Mahogany – Paperbark Swamp Forest, Coastal Sand Wallum Woodland-Heath and Tomago Sand Swamp Woodland are also classified as habitat critical to the survival of the Koala. The Coastal Wet Cyperoid Heath and the Tomago Sand Swamp Heath do not represent Koala habitat. As such, a total of 104.78 ha of habitat critical to the survival of the Koala will be retained within the offset area.

As habitat critical to the survival of the Koala has been identified within the Project area, the impacts of the Project were further assessed against the factors detailed in Figure 2 (Assessing adverse effects on habitat critical to the survival of the Koala) of the *EPBC Act Referral Guidelines* (detailed in the following sections).

Assessing Impacts on Critical Habitat

Amount of Habitat Removal and Impacts on Area of Occupancy

The Project will remove 40.38 ha and retain 104.78 ha of suitable Koala habitat within the Subject Land. Additionally, the proposed disturbance area will be progressively rehabilitated with suitable habitat for the species (**Appendix 2**). As such there is the potential for the species to re-occupy this area once the rehabilitation reaches a suitable age.

Within the wider Tomago Sandbeds KMU, there is approximately 4,616 ha of suitable habitat mapped; the area of suitable Koala habitat that will be impacted by the Project represents 0.87% of the total habitat available in the Tomago Sandbeds KMU. Given the large distribution of the species, this removal is not assessed as reducing the area of occupancy of an important population. Approximately 2.27% of the total available habitat in the Tomago Sandbeds KMU will be retained and protected in the remainder of the Subject Land.

Method of Clearing

The proposed extraction area will be progressively cleared, and rehabilitated with native vegetation that will constitute Koala habitat. Soft-felling clearing procedures will also be implemented to ensure that no individuals are negatively impacted during clearing. This will involve both nocturnal and diurnal surveys prior to clearing, and any Koalas identified within the clearing area will be captured, given a veterinary check and tracked (remote tracker) for a three month period.

Details of mitigation measures to be implemented during clearing are outlined in Section 5.5.2.



Koalas Density / Abundance and Impacts on Longer-term Viability

No Koala activity was detected within the Subject Land during surveys in 2015. These surveys occurred two years post fire, and suggest that the area is still being recolonised. While the abundance of the species in the area is not known, the habitat has the potential to support a medium (normal) usage category.

During clearing there is the potential for displacement of an individual if the extraction area forms part of its home-range. The removal of an area of an individual's home range may force it to move, potentially impeding on the home range of another individual. This could result in conflicts in the local area due to the high fidelity the species exhibit to their home range. Based on the assessment of an average home range in the Port Stephens area of 80 – 90 ha (DECC 2008), the Project has the potential to impact on the home range of approximately one to two adult Koalas. While there is the potential to displace one to two individuals, this impact is unlikely to be significant due to the large area of available habitat within the Tomago Sandbeds KMU. Lunney *et al.* (2007) modelled the carrying capacity of the Port Stephens area to be a maximum of 2,500 individuals. However, the population within the same area was estimated to be only 350 – 800 individuals (Lunney *et al.* 2007).

Based on this assessment, habitat availability is not the limiting factor for the Koala population in Port Stephens area and it is likely that there is a large amount of available habitat within the locality that is either un-occupied, or could potentially support a higher density of Koalas. It is therefore unlikely that the Project would lead to the long-term decline of an important population.

Level of Fragmentation and Impacts on Movement

The Subject Land occurs on the edge of a large patch of vegetation that extends along the sandbeds to the west and east, with Koala habitat occurring along this corridor. The Project will temporarily remove a total of 40.38 ha of native vegetation from the edge of this corridor. As such, the Project will not fragment any areas of habitat for the Koala extending off the site.

Within the Subject Land the Project will cause some minor fragmentation of two areas of habitat in the west/south-west of the Subject Land. The proposed extraction area has been revised to ensure no areas of Koala habitat will be isolated. As such, movement corridors within the Subject Land will be maintained. All areas of vegetation retained within the Subject Land will be linked to other areas of vegetation both within and adjacent to the site. Along the western boundary, areas of habitat will be linked through a retained strip of vegetation that is either



20 m or 50 m wide (depending on the point along the boundary). A corridor of vegetation between the northern and southern extraction areas will also be retained. As such, the proposal will not fragment an important population.

Conclusion

In consideration of the above, it is concluded that while the extraction area is identified as critical habitat, the impacts of the Project are unlikely to adversely affect habitat critical to the survival of the species. Large areas of suitable habitat (with similar characteristics to that within the Subject Land) occur in the locality and will not be fragmented or isolated by the Project.

4.1.3.2 Indirect Impacts

Impacts that may Substantially Interfere with Species Recovery

The Project was assessed against the impacts detailed in Section 8 of the *EPBC Act Referral Guidelines* to determine if it is likely that the action will substantially interfere with the recovery of the species (detailed in the following sections). The assessment concluded that it is unlikely that the action will substantially interfere with the recovery of the Koala.

Impacts from Dog Attacks

Dogs are a significant threat to the species. The Project is unlikely to lead to the increase in dog attacks in the locality as it does not involve the construction of residential dwellings and associated pet ownership. Additionally, the Project will implement a vertebrate pest control program within the Subject Land, with wild dogs as one of the target species, see the Environmental Management Plan (**Appendix 2**).

Vehicle Strike

The decline of the Koala population in the Port Stephens LGA has historically been attributed to habitat loss, however, impacts from fires, dogs (Lunney *et al.* 2007) and motor vehicles (Phillips *et al.* 1996) have been identified as significant threats to the species.

The Project has the potential for increased impact to the species from vehicle strikes as there will be an increase in traffic. However, traffic assessments concluded that the proposal will only cause a minor increase in traffic volume. At absolute maximum extraction rates, the proposal will increase traffic along Cabbage Tree Road by less than 3% in a 24 hour period. However,


it is expected under average operational conditions that traffic increases along Cabbage Tree Road will be less than 1%.

The proposed action will implement a recognised mitigation measure with a high effectiveness, through the installation of Koala proof fencing along Cabbage Tree Road and along internal roads with speed limits above 40 km/hour. It is recognised that this control is only applicable to the Subject Land.

Disease Impacts

Impacts from Chlamydia can be expressed in individuals when they undergo stress, such as habitat loss, interactions with predators, nutritional stress or overcrowding (DECC 2008). The Project will result in habitat loss. However, as discussed above, habitat availability is unlikely to be the limiting factor of the Koala population in the Port Stephens area, and there is likely a large amount of available habitat to the north of the Subject Land that is either un-occupied, or could support a higher density of individuals. Additionally, in order to access this habitat, Koalas would not be forced to cross any roads, which has the potential to cause further stress. As such, the potential for the proposed action to spread the Chlamydia disease such that it is likely to significantly reduce the reproductive output of the species is unlikely.

Myrtle Rust is a disease caused by the exotic fungus *Puccinia psidii*. It infects species of the Myrtaceae family and causes leaf deformation, defoliation, reduce fertility, dieback, stunted growth, and plant death. *Phytophthora cinnamomi* is a pathogen which infects the plant roots and causes disease and plant death. Infection of susceptible ecological communities can result in modification of the community, reduction in functionality and habitat loss or degradation for dependant flora and fauna species. The pathogen is spread in water, soil or plant material that contains the pathogen. *Phytophthora cinnamomi* occurs in all Australian states and territories (except NT), and is well established in many of the higher rainfall areas of the country. Evidence of these two diseases were not identified within the Subject Land, however, they are known to occur in the region. It is not expected that the Project will introduce or exacerbate either of these diseases that may impact on Koala habitat. To limit the potential of spread, all machinery conducting clearing within the extraction area will be clean and free of any soil or vegetative material when it enters the site.

Barriers to Movement

As discussed in earlier sections, no areas of habitat for the species will be completely isolated. There will be some fragmentation of habitat in the south-west of the Subject Land, however,



all areas of habitat will be connected to habitat within and to the north of the Subject Land. As such, it is unlikely that the proposed action will lead to the long-term reduction in genetic fitness or access to habitat critical to the survival of the Koala.

Changing Hydrology

As discussed in **Section 4.2**, the final landform of the extraction area will be 1 m above the maximum predicted groundwater level. Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained. Additionally, no extraction of groundwater is proposed as part of the Project. As such, the proposal is unlikely to substantially modify the hydrological regime in the area.

Light, Noise and Dust Impacts

Light, noise and dust factors have not been identified as key threats to the Koala by the approved recovery plan (DECC 2008) or the *EPBC Act Referral Guidelines*. Notwithstanding, these impacts will be managed during the operation of the Project to minimise impacts on the Koala.

Sand extraction activities will be undertaken between 7 am and 6 pm. The revised noise impact assessment undertaken by Spectrum Acoustics (2016) indicates that the Project is not likely to have a significant noise impact on neighbouring receivers. The area that is likely to experience the highest noise impacts will be immediately around the extraction areas and the processing plant. It is noted that there is approximately 104.78 ha of habitat within the Subject Land outside of the development footprint for animals to retreat to in order to avoid noise. The Koala is unlikely to be impacted by noise due to the Project.

All lighting required for the Project will be installed with regard to maintaining sufficient light for the task while avoiding light spill to other areas. It is noted that for the majority of the year, lighting will only be required for two to three hours per day, with only security lighting around the office and workshop compound required outside working hours. Localised lighting zones will largely be located within processing plant and infrastructure areas and away from foraging areas within native vegetation. There is approximately 104.78 ha of habitat within the Subject Land outside of the Project area, which will allow for animals to retreat an adequate distance away from lighted areas during the night. The Koala is unlikely to be impacted by light due to the Project.



Dust suppression by water cart will be implemented as part of the water management of the site as required to reduce visible windblown dust. This will also minimise the amount of dust settling on leaves of trees within adjacent habitat in the Subject Land. Dust build up on the foliage of browse trees, such that it may cause crown dieback, is unlikely. Other potential dust impacts (such as respiratory disease, teeth wear or other health impacts due to ingestion of high quantities of dust on leaves) are also considered to be unlikely.

4.1.4 Grey-headed Flying-fox (*Pteropus poliocephalus*)

4.1.4.1 Direct Impacts

The Subject Land does not support a Grey-headed Flying-fox camp and does not provide critical roosting habitat for Grey-headed Flying-fox. Notwithstanding, the species was recorded foraging within the Subject Land during field surveys and all areas of native vegetation within the Subject Land are potential foraging habitat for the species.

The Grey-headed Flying-fox is highly dependent on adequate foraging resources and the availability of suitable foraging habitat influences the location of camps and dispersal/movement patterns. Loss of foraging habitat is identified as the primary threat to Grey-headed Flying-fox (DoEE 2017) and clearing of winter foraging resources has a particularly high impact on the species. As the Subject Land is located within 50 km of known Nationally Important Flying-fox camps, the foraging habitat provided by the native (and rehabilitated) vegetation within the Subject Land is assessed as critical habitat (although the Subject Land is not located within 50 kilometres of a population of Grey-headed Flying-fox that supports more than 30,000 individuals).

The foraging habitat within the Subject Land is connected to native vegetation offsite, and is part of a much larger patch of vegetation comprising HWC land, the Tilligerry SCA, and private landholdings. Large areas of foraging habitat in the wider locality include the Hunter Wetlands National Park and Worimi National Park.

The Project would remove 40.38 ha of foraging habitat for the species (approximately 24% of the available foraging habitat within the Subject Land). Within the Subject Land, approximately 130 ha (approximately 76%) of native vegetation will be retained within the offset area and will continue to provide foraging habitat and connectivity to adjacent foraging habitat. In addition, the Project area will be progressively rehabilitated and it is expected that these areas will continue to provide foraging habitat after the Project is completed.



Due to the high availability of foraging habitat to be retained within the offset area and protected within the Tilligerry SCA, it is unlikely that the Project will adversely affect critical foraging habitat, or lead to the long term decline of the population. As no camps were identified within the Subject Land, the Project is unlikely to reduce the occupancy of the species or disrupt the breeding cycle of an important population.

4.1.4.2 Indirect Impacts

Fragmentation

The Project is unlikely to fragment an existing important population. The Subject Land occurs on the edge of a large patch of vegetation that extends along the sandbeds to the west and east. The Project will temporarily remove a total of 40.38 ha of native vegetation from the edge of this corridor. As such, the Project will not fragment any areas of habitat extending off the site. Within the Subject Land the Project will cause some minor fragmentation of two areas of habitat in the west/south-west of the Subject Land, however, no barriers to movement will be created. Due to the highly mobile nature of this species, the Project will not cause the fragmentation of a population of the species.

Invasive Species

No introduced invasive species are identified as threatening the species. Competition with the Black Flying-fox is identified as a threat to the species (DECCW 2009). The proposed action in unlikely to increase the abundance or activity of the Black Flying-fox in the locality.

Disease

Australian bat lyssavirus can cause disease and mortality in Grey-headed Flying-foxes when Flying-foxes undergo significant ecological stress (DECCW 2009). The proposed action is unlikely to cause significant ecological stresses for the species, as such it is unlikely to lead to the species decline due to the relatively small area of temporary habitat removal.

Light, Noise and Dust Impacts

The Project is unlikely to have significant light, noise and dust impacts on Grey-headed Flyingfox. The Project is approximately 6.8 km away from the nearest occupied camp in Raymond Terrace; as such, light, noise and dust from the Project area is unlikely to affect roosting bats.



Sand extraction activities will be undertaken between 7 am and 6 pm and so operational noise is unlikely to affect bats that may be foraging at night in habitat within the Subject Land. The revised noise impact assessment undertaken by Spectrum Acoustics (2016) indicates that the Project is not likely to have a significant noise impact on neighbouring receivers.

All lighting required for the Project will be installed with regard to maintaining sufficient light for the task while avoiding light spill to other areas. It is noted that for the majority of the year, lighting will only be required for two to three hours per day, with only security lighting around the office and workshop compound required outside working hours. Localised lighting zones will largely be located within processing plant and infrastructure areas and away from foraging areas within native vegetation.

Dust suppression by water cart will be implemented as part of the water management of the site as required to reduce visible windblown dust.

4.2 GROUNDWATER AND SURFACE WATER IMPACTS

The following studies relating to surface water, groundwater and contamination have been conducted in relation to the project, these studies are available on the NSW Major Projects website and where noted have been included within **Appendix 6** of this document:

- Within the Environmental Impact Statement (EIS):
 - O Umwelt, November 2015. Section 4.10 of the Environmental Impact Statement main text provided an assessment of water use, and the expected surface water and groundwater impacts. The assessments concluded that given the high permeability of the soils on the site there would be minimal runoff with no change or impact to the drainage channels constructed on surrounding lands.
 - RCA, October 2015. Geotechnical and Groundwater Investigation. The investigation included the installation of twelve groundwater bores and the sampling of groundwater for a range of parameters and collection of groundwater level data.
 - Umwelt, November 2015. Groundwater Impact Assessment. The study provided an analysis of groundwater levels and presented the maximum predicted groundwater level. The report concluded that as there is little change between pre-and post extraction groundwater levels there would be a negligible impact on groundwater users or groundwater dependant ecosystems (included in **Appendix 6**).
- Within the Response to Submissions (RTS):



- RCA, June 2016. This study included the collection of groundwater samples from several bores on the north-eastern side of the subject land for analysis of PFAS. No PFAS was recorded within the samples taken on the site (included in **Appendix 6**).
- Umwelt, October 2016. Potential for Sand Extraction to Increase Flooding Impacts in Surrounding Area. This report was prepared in response to questions raised during the exhibition of the EIS about the potential for the quarry to result in an increase in groundwater levels as a result of reduced tree cover that would result in increased flooding of surrounding lands. The study concluded that the sand extraction would result in a negligible change to groundwater levels and the rate of groundwater movement, or an increase in surface water runoff and consequentially would have no impact on flooding or water logging in low lying areas adjoining the quarry (included in Appendix 6).
- o Kleinfelder, October 2016. Phase 1 Environmental Site Assessment. This Phase 1 environmental site assessment included a review of past land uses onsite and considered the potential for the quarry to be affected by past land use and site contamination. The report concluded that it the quarry is unlikely to disturb areas of past known contamination (e.g. scrap yard and monzonite trenches).
- Following the Response to Submissions additional requests for information were made and information provided as follows:
 - o Umwelt, November 2016. Response to Hydro Simulation Peer Review 1. Hydro Simulations was engaged to undertake a peer review of the Umwelt groundwater model. This letter was provided in response to that review. A peer reviewed groundwater model was a condition requested by HWC associated with the providing approvals to undertake sand extraction within a regulated special area. (Hydro Simulations undertook detailed groundwater modelling for the nearby Williamtown RAAF PFAS investigations) (included in **Appendix 6**).
 - Umwelt, January 2017. Response to Hydro Simulation Peer Review 2. This letter was in response to further peer review of additional information provided following the initial Hydro Simulations peer review (included in **Appendix 6**).
 - Kleinfelder, February 2017. This study included the collection of soil samples from across the resource area for laboratory analysis of PFAS. No PFAS was detected in any soil sample (included in **Appendix 6**).
 - Pacific Environment Limited, February 2017. Exposure to PFAS and Potential Health Impacts. This letter provided an assessment of the potential for increased exposure for residents to PFAS due to dust generated by the proposed quarry. The letter concluded that the risks are negligible given the dust control measures proposed. No accepted monitoring procedures for PFAS in dust where available at that time,



however some research level monitoring analysis could be conducted if concerns remained on the potential for PFAS exposure from dust generation on the site.

- Kleinfelder, June 2017. This study included the collection of surface water and groundwater samples from the southern portion of the study area for analysis of PFAS.
 No PFAS was found within samples taken on the site (included in **Appendix 6**).
- o Kleinfelder, June 2017. Contingency Management Plan for Potential PFAS Disturbance during Construction Activities. Despite the above testing demonstrating that PFAS was unlikely to be contained in soils, surface water or groundwater on the site, this document provided management response measures in the event PFAS was encountered during construction activities where intersection of the groundwater table could not be avoided (included in **Appendix 6**).

Based on these studies the following advice relevant to surface and groundwater has been provided by regulatory authorities (further regulatory authority advice is available on the NSW Major Projects Website):

- NSW Chief Scientist, March 2016. This correspondence was provided based on the Williamtown Contamination Water Working Group comments on the EIS. The correspondence concluded that provided operations remain above the water table the sand quarry presents a low risk with regard to PFAS exposure or contribution to the spread of PFAS (included in **Appendix 6**).
- Correspondence to and from HWC, October 2014 to June 2016. This correspondence with the HWC is in relation to water servicing advice for the development and the development of suitable conditions for operations within the Hunter Water regulated special area (included in **Appendix 6**).
- NSW Chief Scientist, June 2017. This correspondence was provided in response to a request for comment from NSW Department of Planning and Environment to comment on the potential PFAS pathways from the quarry via airborne dust. The correspondence concluded that the previous conclusion remains appropriate, i.e. that provided operations remain above the water table the sand quarry presents a low risk with regard to PFAS exposure or contribution to the spread of PFAS (included in **Appendix 6**).

4.2.1 Impacts from Depth of Mining

The depth of the quarry extraction is based the addition of a 0.7 m buffer to the maximum predicted groundwater level. The maximum predicted groundwater level was developed through modelling of the groundwater system utilising long term monitoring records from



surrounding HWC monitoring bores and onsite monitoring bores. The final landform of the extraction area will be 1 m above the maximum predicted groundwater level (i.e. the 0.7 m extraction level plus topsoil). Extraction levels will be monitored throughout the project through regular surveys, and recalibration of the groundwater model based on the most recent data that will potential adjust the floor height. Detailed control measures are outlined in **Section 5.2**. Additionally, the quarry will utilise potable water from the mains network with no extraction of groundwater is proposed as part of the action. Therefore, the Project is unlikely to impact on the hydrology of the Subject Land, such that it will impact on habitat for *Eucalyptus camfieldii*, *E. parramattensis* subsp. *decadens*, Koala and Grey-headed Flying-fox. The extraction area is located within the catchment of the Tomago Sand beds a large freshwater aquifer, with groundwater levels at 2-5 m AHD (well above estuarine seawater in Fullerton Cove). The resource for extraction is highly leached and large areas of previously processed sands, as such the risk of changes in salinity from the quarry within the subject land and surrounding lands is highly unlikely.

The Project has potential to result in a slight increase of surface water runoff from access roads and associated impervious areas; however, as the sand dunes have a high infiltration capacity, the predicted increase in surface runoff from the extraction area is negligible. Runoff will be managed via diversion drains and bunding to infiltration areas adjacent to roads and on the northern side of Cabbage Tree Road. The quarry will establish bunds a minimum of 600 mm high around the perimeter of the resource extraction area, primarily along the southern boundaries of the northern and southern resource areas (i.e. down gradient). This will include a 600 mm high and 10 m wide trafficable bund incorporated into the main access road. Combined with roadside infiltration areas and rainwater collection tanks from the office and workshop, rainfall will be contained within the disturbance area and will not flow offsite.

The Project is unlikely to increase flood levels as flooding from the Hunter River system is the key driver of flood levels in the Subject Land, investigations have determined that the changes in hydrology (e.g. removal of evapotranspiration) on the site will have negligible effects on flooding and water logging of adjoining lands. Thus, the Project is unlikely to impact on surface flows such that it will impact on habitat for *Eucalyptus camfieldii, E. parramattensis* subsp. *decadens*, Koala and Grey-headed Flying-fox.



4.2.2 Impacts on Water Quality

The Project is unlikely to significantly impact on the quality of groundwater and surface water. As discussed above, interactions with the groundwater will be negligible as the extraction area will remain above the maximum predicted groundwater level.

Review of the EIS was undertaken by the New South Wales Chief Scientist and Engineer and the Williamtown Contamination Water Working Group (**Appendix 6**). The review determined that providing the quarry does not intersect the groundwater table during quarrying, and implements suitable management of construction activities (e.g. trenching that may intersect the groundwater), there is a low risk that the project will increase PFAS exposure or contribute to the spread of PFAS. Notwithstanding, subsequent PFAS soil and water assessments indicate that there are no detectable traces of PFAS in the soil, surface water and groundwater within the Subject Land.

The RZM mining operation operated a dredge below the groundwater table to extract the heavy mineral sands. This caused an oxidation of various natural compounds that resulted in an increase in primarily iron, but also arsenic in some locations within the water table. As the proposed quarrying activity will not intersect the groundwater table, the risk of remobilising these contaminants into the groundwater is highly unlikely.

A Phase 1 Environmental Site Assessment (Kleinfelder 2016) provides a review of the potential for contamination on the Subject Land and the risks of the proposed sand quarry providing an exposure pathway to onsite workers and neighbouring properties. Based on a review of historical aerial photography, discussion with former RZM employees and radiation surveys over the site, several possible buried monazite (a radioactive heavy mineral sand) trenches are identified on the site, along with other areas of sand fill, tailings and historical machinery storage. The proposed quarry extent will not intersect these areas, and as such there is no risk of exposure to contaminants from these areas. It is noted that as the RZM activity was a dredge based activity, the majority of the sand dunes in the resource area have been processed and re-emplaced. Therefore, the potential for buried materials (such as steel, plastic pipe and potentially asbestos sheeting or pipe) cannot be discounted. A procedure will be enforced during excavation to ensure that any foreign materials encountered during quarrying will signal an immediate stop work in the proximate area until the nature of the object/s can be determined. In the case of uncovered potential asbestos sheeting or pipe laboratory testing may be required to determine if asbestos fibres are present in the surrounding sand.



There is not considered to be any risk of transport of contaminated sand from the quarry or risk of exposure to the broader public, given the activity will not disturb the groundwater table; and procedures will be in place for activities that may intersect the water table (e.g. trenches for pipes) and for foreign material encountered during quarrying.

4.2.3 Impacts due to Erosion and Soil Movement

The Subject Land is topographically flat and erosion and soil movement is not considered to be a high risk. Notwithstanding, the Project area will be fully bunded to prevent movement of soil and surface flows off-site and into adjacent areas, including offset areas within the Subject Land. Bunding will be maintained at the downslope side of each of the extraction areas to contain any sediment and runoff that may be generated from disturbed areas on site. A low level bund around the silty loam stockpile will also be maintained to limit potential for offsite transport and spread.

Erosion and sediment controls will be installed on site as part of a Construction Environmental Management Plan for all construction activities proposed. Vegetation and soil excavated during the initial block construction will be stockpiled (vegetation and then topsoil) within an area adjacent to the processing plant. The initial area of cleared vegetation and topsoil will be used to supplement other extraction areas over the life of the project that are deficient in organic matter. During excavation of each new extraction zone, vegetation and topsoil cleared will be laid over the previous extracted zone to encourage regrowth and rehabilitation.

The Project is not likely to have a significant impact on threatened species habitat due to soil erosion and soil particle movement.



5. PROPOSED AVOIDANCE AND MITIGATION MEASURES

5.1 INTRODUCTION

WSS intend to construct and operate the Williamtown Sand Quarry in an environmentally responsible manner. The Project, and subsequent revisions to the Project in response to submissions from agencies and stakeholders (described in **Section 2**), incorporate measures to avoid mining impacts, as well as mitigation measures to lessen the impact of the Project on the community and environment.

The management measures proposed have been developed with due consideration of the following:

- Compliance with the *Protection of the Environment Operations Act 1997* (protection of the environment through erosion and sediment controls, soil and water management, and hydrocarbon controls).
- Compliance with controls imposed in accordance with an approval given under the *Hunter Water Act 2011* and the *Hunter Water Regulation 2015*.
- Compliance with biodiversity legislation and associated offsetting policies, to address foundational principles of "no net loss" and "improve and maintain".
- Relevant conservation advices for listed threatened species and communities established by both State and Commonwealth governments.

The proposed mitigation measures are not inconsistent with the various relevant conservation advices and recovery plans, and in many cases are supportive of the objectives and actions within the plans. A summary of these measures is provided below:

- Predation: Predation by foxes, cats and dogs is a common theme through most advices and plans. Planned pest control through targeted monitoring and deployment of baiting or trapping programs that will be developed with regard to Commonwealth guidance (e.g. in relation to the Spotted Quoll and limiting bait uptake).
- Survey and monitoring: Increased survey and monitoring undertaken during the project and its rehabilitation has the potential to increase the scientific knowledge of relevant species.
- Vehicle strike: The project incorporates Koala exclusion fencing along the boundary of the Subject Lands, this fencing has the potential to also deter other native species from entering the road corridor.



- Weed and disease management: Weed and disease management are incorporated into both the mitigation measures for the operations and within the proposed offset measures. These are logical responses to identified threats and common actions within the conservation advices and recovery plans.
- Corridors: The project includes avoidance of areas to preserve greater corridor widths through the site, operational practices will enable progressive rehabilitation of quarried areas, the operation is not 24 hours per day and has reduced vehicle transport from 5 am to 7 am that reduces the effects of transport on existing use of the site as a corridor.
- Rehabilitation: The proposed rehabilitation includes propagation of threatened Eucalypt species for replanting within the quarried area, actions that are proposed iin conservation advice.
- Long term management: The offsets proposed by the Project will provide for the long term protection of threatened biodiversity and includes measures to improve values through removing weeds and other threats to the species and biodiversity values.

To ensure that the Project operates with environmental safeguards in place during its life cycle, WSS is committed to:

- The revised operating limits, times and criteria summarised in **Table 12**;
- The revised statement of commitments detailed in Table 13;
- The implementation of a comprehensive Environmental Management Plan (Appendix 2), which includes measures to achieve the environmental outcomes outlined in Table 14 and Table 15.

5.1.1 Operating Limits, Times and Criteria

Table 12:Operating limits, times and criteria.

Aspect	Key Aspects of the Project	
Project Life	Approval is sought to operate the quarry for a period of up to 15 years.	
Production rate	Up to 530,000 tonnes per annum.	
Operating Hours	 Construction: 7 am to 6 pm Monday to Friday. 8 am to 1 pm Saturday. No construction on Sunday or public holidays. Operations: Sand extraction and processing: 7 am to 5 pm Monday to Friday. 7 am to 4 pm Saturday. Loading and haulage: 5 am to 6 pm Monday to Friday. 7 am to 4 pm Saturday. 	



Aspect	Key Aspects of the Project
	No operations on Sunday or public holidays.
Traffic	 Up to 6 laden trucks per hour (12 trips per hour) during the hours of 5 am to 7 am. Up to a maximum of 10 laden trucks per hour (20 trips per hour) during hours of 7 am to 6 pm on weekdays and 7am to 4pm Saturday (i.e. all haulage hours excluding the morning peak). Up to 6 vehicles of employees would be expected to arrive from 5 am to 7 am and leave between 5 pm and 7 pm.
Noise and Air Quality Criteria	As per Project Approval.

5.1.2 Management and Offset Measures

Table 13 provides a summary of the identified mitigation and management measures proposed to be implemented to minimise the impacts of the Project on the receiving community and environment. These measures shall apply, unless superseded or made redundant by an approved management plan or the Conditions of Approval.

ltem	Action	Trigger/ Timing			
1. Ge	1. General Management Measures				
a)	Williamtown Sand Syndicate Pty Ltd will prepare an Annual Environmental Management Report (AEMR) stating the environmental performance of the project to be distributed to stakeholders.	Annually			
b)	 Staff, contractor and visitor inductions will include where relevant an overview of management measures and responsibilities and will include: EMP requirements. Environmental sensitivities. Hazard and risk management. Designated site access. Waste management. Spill response and management. Heritage management and heritage finds protocol. Weed and pathogen control. Bushfire prevention. Emergency response. Incident reporting (environmental and safety). Driver code of conduct. 	Ongoing			
c)	The effectiveness of the induction and training program will be monitored and improvements implemented where identified.	Ongoing			
2. Community Relations					
a)	Establishment of a community consultative committee (CCC) to facilitate meetings with representatives of the local community.	Ongoing			
b)	Document CCC meeting agendas, issues raised, action items and close-out.	Ongoing			

Table 13:	Proposed	management	and	offset	measures



ltem	Action	Trigger/ Timing
c)	A dedicated information contact phone number will be established prior to the commencement of construction and maintained throughout the life of the project.	Ongoing
d)	Feedback, enquiries and complaints received will be recorded in a consultation register that will be established prior to the commencement of construction and maintained throughout the life of the project.	Ongoing
e)	Complaints recorded in the consultation register will include details of complainant, WSS response and commitments to follow-up by whom and when will be detailed.	Ongoing
f)	Consultation with immediate neighbours via an annual site open day.	Annually
g)	 Community information newsletters providing awareness of: Project progress. Operating hours, contact information and details of how to provide feedback. Ways in which further information can be sought. Details of breaches of any development approval and licence conditions and WSS response and corrective actions. 	Six-monthly
h)	 Website to include: Contact numbers. Copies of community newsletters. Details of annual open days. Copies of minutes from Community Consultative Committee. Copies of approvals. Copies of licences. 	Ongoing
3. Ac	cess, Fencing, Gates and Signage	
a)	Redundant access tracks to be removed when no longer required for bushfire control, rehabilitation maintenance, resource access or haulage.	As required
b)	The main access gate adjacent to Cabbage Tree Road, and any other installed gates that provide access to surrounding lands will be locked when the quarry is not operating. A key will be provided to PSC, Hunter Water, NPWS, and the RFS.	Daily
c)	 Construct a Koala exclusion fence on the Subject Land boundary adjoining Cabbage Tree Road for Lot 1 DP 224587 to limit movement of Koalas from the site onto Cabbage Tree Road. Construct a Koala exclusion fence from the site entry to the weighbridge. The exclusion fence is to be installed with regard to the design specifications outlined in the <i>Koala Sensitive Design Guideline</i> (DEHP 2012). One-way fauna gate installed along the fence for circumstances where fauna is trapped on the road side of the fence. Total of four gates; two along Cabbage Tree Road (one on either side of the site entrance) and two along the internal access road (one on either side of the road). 	During construction
d)	A ticketing system will be connected between the boom gate and exit weigh bridge. The boom gate will be configured to only operate within the quarry operating hours and will be linked to peak permissible quarry traffic generation rates. Video surveillance will also be erected at the weighbridge for security and ticket cross checks.	Ongoing
e)	Construct a security fence around the office and workshop compound, including security measures to manage and limit unlawful activity.	During construction



Item	Action	Trigger/ Timing
f)	Progressively delineate the perimeter of the active resource area that will prevent incidental access into Offset Lands and not impede the movement of, or be a danger to, native fauna (e.g., rope barricade, or equivalent).	During construction
g)	Remove or repair old internal fences.	Year 2
h)	 Install signage at main entrance on Cabbage Tree Road to advise of the following: Development name and description. Contact number for general and emergency enquiries. Site safety requirements (e.g., PPE, evacuation routes and muster points). 	At commencement of construction
i)	Install fauna signage at main entrance and either side of corridor reminding drivers of the presence of wildlife and to adhere to site speed limits.	
j)	Install signage on perimeter of Project Area on adjoining access roads advising the presence of the offset area.	At commencement of
k)	Install signage on perimeter of site adjoining access roads advising the presence of the operational quarry.	Construction
I)	Install speed limit signage on quarry access roads.	
4. Tra	affic	
a)	Traffic control plans prepared by an accredited person are to be approved by the RMS prior to implementation by an accredited person for the construction of the quarry intersection.	Prior to construction
b)	 The quarry intersection and associated acceleration and deceleration lanes will have the following signage installed (subject to approval by RMS). "No Stopping zones". Digital signage stating if quarry is opened or closed to avoid truck entry and idling at entry if gate is closed. Quarry approach and need to limit air breaking. Speed limit signage for 40 km/h entering site before intersection. Sign-on gate: in the event of arriving prior to gate being open turn off vehicle immediately. 	Installed during construction and updated as necessary
c)	 Speed limit signage within the site as follows: Incoming traffic at 40 km/h between Cabbage Tree Road and the incoming weighbridge. 20km/h from the weighbridge to the processing plant / stockpiles. 	Installed on completion of construction
d)	 WSS will implement a Driver Code of Conduct signed by all drivers during their site induction and will allow WSS to strictly enforce the access requirements and penalise non complying drivers, the Driver Code of Conduct will include but is no limited to the following: Quarry operating times. Proposed digital signs prior to deceleration lane stating status of quarry being open or close subject to RMS approval. This will mitigate early arrivals to the quarry. No stopping signage for extent of site for deceleration lane to deter early arrivals. Pre booking of high demand slots between 0500 and 0700 which are anticipated to be limited, these slots are likely to be pre-booked. Any unexpected truck turning up on site will have to wait on-site prior to exiting the site in the allocated slots. Quarry approach and need to limit air breaking. Respect our neighbours internal signage on exit of quarry. 	Ongoing



ltem	Action	Trigger/ Timing
	 Sign-on gate: in the event of arriving prior to gate being open turn off vehicle immediately. UHF radio contact to quarry manager for enquiries prior approach to the quarry. 	
e)	 Peak traffic generation limits from the site are as follows: 6 laden trucks per hour (12 trips per hour) during the hours of 5 am to 7 am. 10 laden trucks per hour (20 trips per hour) during hours of 7 am to 6 pm. No haulage on Sundays or Public Holidays. 	Ongoing
f)	Incoming trucks will be weighed on entry to the site via a weigh bridge at the site office complex and again on leaving the site where product weight and tickets will be generated and recorded for each load.	Ongoing
g)	Boom gate on outgoing weigh bridge linked to peak haulage rates. CCTV system to be installed on outgoing weigh bridge to provide compliance assessment of haulage numbers.	Ongoing
5. We	eed Control	
a)	 Vehicles and access tracks All machinery used on the site will be cleaned of all soil and organic matter prior to entering the Project Area. Road registered haulage vehicles will be required to remain on the formed access roads. Vehicle access to the rehabilitation will be restricted to authorised personnel. Once access tracks are no longer required they will be revegetated to minimise their potential as weed vectors. 	Ongoing
b)	 Weed-infested topsoil handling Pre-clearing surveys: Pre-clearance survey to record approximate cover and abundance of environmental weeds within each area to be cleared. Where infestations of environmental weeds occur they will be mapped and pegged as a "weed area" prior to clearing to allow for separate stockpiling and re-spreading. For practicality purposes during clearing and topsoil stripping, weed infestations greater than 100 m² (i.e. 10 m x 10 m) will be delineated and pegged. 	Prior to clearing of each sector
	 Topsoil containing environmental weeds (as delineated in pre-clearance) will stockpiled separately and will not be blended or stockpiled with "clean" (weed-free) topsoil. Topsoil stockpiles containing environmental weeds will be respread within a mapped "weed area" similar to its pre-disturbance location to avoid weed spread across the site. Weed containing topsoil will not be transported between the Southern and Northern Resource areas. The extent of respread topsoil with environmental weeds will be delineated and recorded. 	When clearing, stockpiling and respreading topsoil.
c)	Inspections During monitoring of the rehabilitation, annual monitoring will be conducted to identify any weeds, including non-local native species within the site. Inspections will include the outer perimeter of the current disturbance (i.e. interface with conservation areas) and the verges of internal access roads.	During monitoring of each sector



ltem	Action	Trigger/ Timing
d)	Weed controlWeed management will be conducted by a suitably qualified contractor with a focus on the recommendations made as a result of rehabilitation monitoring and inspections.Control of weeds will predominantly be through manual removal to limit the use of chemicals. Chemical controls will only be utilised where there are significant outbreaks.	When required, as identified during monitoring events
6. Ve	rtebrate Pest Control	
a)	All putrescible waste bins to be securely covered and removed from the site on a weekly basis to remove potential food source for vermin.	Ongoing
b)	 Undertake monitoring for presence of pests through one of the following methods: Conducting searches and spotlighting, and mapping evidence of pest species across Project Area (e.g. rabbit warrens, pig scratching, evidence of wild dogs). Installing remote motion sensing camera traps at a minimum of five locations across the Project Area for a two-week period. The presence of domestic or wild cats and dogs within the central wildlife corridor (consistent with PSC lease conditions) should be included within the program. 	Annually
c)	Recording of incidental observations for evidence of pests and where suspected to be domestic and (if considered safe to do so) are to be captured and reported to PSC and returned to the owner if known or animal shelter if unknown.	Opportunistically
d)	 Where detected during monitoring, implement a pest control program to reduce vertebrate pest numbers where there is potential for impacts on native wildlife and rehabilitation. The program is to have regard for the presence of domestic animals and return these to the owners where captured. The vertebrate pest control program is to be conducted: In consultation with the LLS and adjoining landholders. In accordance with the 'EPBC Act Policy Statement 3.4 – Significant Impact Guidelines for the Endangered Spotted-tailed Quoll <i>Dasyurus maculatus maculatus</i> (Southeastern Mainland Population) and the use of 1080' and the 'Administrative Guidelines on Significance: Supplement for the Tiger Quoll (Southeastern Mainland Population) and the use of 1080'. In accordance with the Pest Smart Code of Practice's (COPs) and Standard Operating Procedures (SOPs) (accessed: http://www.pestsmart.org.au/animal-welfare/humane-codes/). By suitably qualified and experienced personnel. Other control methods such as shooting or trapping can also be used if deemed necessary or appropriate with advice from OEH or the LLS. Given the proximity of residential properties baiting programs may not be appropriate. 	Within three months of an observation with potential for impacts.
7. Er	osion, Sediment Control and Soil Management	
a)	A construction environmental management plan (CEMP) including erosion and sedimentation controls will be prepared and implemented for all construction activities proposed.	Prior to commencement of Project construction
b)	Erosion and sediment control plans (ESCP) to be prepared and implemented with all internal road construction activities.	Prior to internal road construction
c)	Vegetation and soil excavated during the initial block construction will be stockpiled (vegetation and then topsoil) within an area adjacent to the	During construction/Ongoing



ltem	Action	Trigger/ Timing
	processing plant. The initial area of cleared vegetation and topsoil will be used to supplement other extraction areas over the life of the project that are deficient in organic matter.	
d)	During excavation of each new extraction zone, vegetation and topsoil cleared will be laid over the previous extracted zone to encourage regrowth and rehabilitation.	Ongoing
e)	Install erosion and sediment controls on-site as required in accordance with the Code of Practice for Managing Urban Stormwater – Soils and Construction (Landcom, 2004).	At commencement of project
f)	Maintain erosion and sediment controls as required and consistent with the Code of Practice for Managing Urban Stormwater – Soils and Construction (Landcom, 2004).	Monthly / post major rainfall inspections.
g)	Maintain a bund at the downslope side of each of the extraction areas to contain any sediment and runoff that may be generated from disturbed areas on site.	During extraction of block.
h)	Maintain a low level bund around the silty loam stockpile to limit potential for offsite transport and spread.	During establishment of processing areas
i)	Final landform batters with edge of Project Boundary not to exceed 4H (horizontal) to 1V (vertical), 4H:1V.	During rehabilitation
j)	Disturbance of potentially contaminated soils or potential hazardous building materials or pipe (e.g. fibre cement containing asbestos) must be reported to the quarry manager immediately and no further disturbance of area to continue. Quarry manager to determine need for formal classification.	As required
k)	Erosion and sediment controls will be monitored to ensure performance is maintained.	Monthly and after significant rainfall
I)	The post extraction landform must be surveyed on completion of the primary site rehabilitation works and the results presented in the form of plans to demonstrate compliance with the extraction limit of 1 m above highest predicted groundwater level.	Ongoing
8. Wa	ater Management	
a)	Water management controls will be revised and updated on determination of the project to ensure management measures proposed adequately reflect the requirements of the Conditions of Consent. The revised controls will be prepared in consultation with the NSW EPA, NSW Water and Hunter Water for approval by NSW DPE.	Prior to commencement of operations
b)	Water for potable use and dust suppression will be drawn from Hunter Water's reticulated water supply at Cabbage Tree Road. No groundwater will be extracted or utilised.	Ongoing
c)	Surface water will be contained onsite through incorporation of bunds around the perimeter of the resource area. Most of the bunds will be created as a result of the extraction process being topographically lower than the adjacent surfaces. The bund will also be incorporated into the access road through a trafficable mound that ensures all surface water within the resource area must percolate vertically into the groundwater.	Ongoing
d)	Rainwater will be captured from the workshop and office roofed area and reused for dust suppression.	Ongoing
e)	All impervious areas will be shaped such that water sheds to infiltration areas constructed in areas adjoining rehabilitated areas.	Ongoing



ltem	Action	Trigger/ Timing
f)	Offices, workshops and weighbridges to support the operation, where all structural footings / excavation limits for those facilities are limited to 1.0m above the predicted maximum groundwater level.	During construction
g)	Connection of water and electrical utilities to the office and workshop. Utilities will be conveyed above ground where feasible, or kept below ground but above the highest predicted groundwater level where possible (e.g. outside the immediate connection with the existing utility).	During construction
h)	Extraction of sand down to a level no lower than 0.7m above the highest predicted groundwater level, with a final landform of 1.0m above that level.	Ongoing
i)	WSS will consult with DPI Water with regards to the locations of and construction of proposed groundwater monitoring points, installation of loggers and selection of sampling points.	Prior to construction
j)	WSS will install groundwater monitoring wells, so that monitoring can be performed immediately up and down gradient of the main extraction areas after destruction of existing bores.	As required if monitoring bore removed
k)	Data loggers will be installed in monitoring wells to continuously monitor and provide additional data for input to the groundwater model.	Prior to construction
I)	Trigger levels for monitoring will be developed in consultation with DPI Water to ensure the groundwater table is not intersected.	Prior to construction
m)	Implementation of the "Contingency Management Plan for Potential PFAS Disturbance during Construction Activities" dated June 2017 or as amended for any potential incursion into groundwater during construction.	During construction
n)	WSS will update the groundwater model every two years from commencement of quarry activities to determine maximum predicted groundwater level along with updated topography showing the progress of the quarry.	Every 2 years
o)	The quarry floor height will be reviewed every two against the revised groundwater model (refer to Rehabilitation section for establishing the adopted level), unless trigger levels determine a review is required.	Every 2 years
p)	No equipment maintenance will occur within Tomago Sandbeds Special Area.	Ongoing
9. Hy	drocarbon Controls	
a)	If obvious signs of contamination such as discoloured or odorous soils are encountered during site set-up and extraction, work will stop in the vicinity of the area and, if safe to do so, samples will be taken for analysis	Ongoing
b)	A fully bunded and undercover hardstand for fuel, hydrocarbon and chemical storage will be constructed outside of the Tomago Sandbeds Special Area.	Ongoing
c)	Personnel to be trained in spill containment and response procedures.	Ongoing
d)	Hazardous material stored onsite will be kept to the minimum practicable amount.	Ongoing
e)	Spill response kits will be kept and maintained onsite.	Ongoing
f)	 Processing plant area (moved around the site based on resource area) installed on site will include: A bunded parking area for the overnight parking of the bull dozer. If power via electrical mains supply is unavailable, diesel generators will be required. If used, diesel generators will: Be located within a bunded area. Include an internal double skinned and self bunded diesel storage tank. 	Ongoing



ltem	Action	Trigger/ Timing
	 Be refuelled as required within the bunded refill area. Be returned to the Office and Workshop Compound on conclusion of operations each Saturday. This is proposed in the context of reducing the risk of vandalism over the weekend, and limiting risks (e.g. electrical and diesel) associated with the daily transport of the generator to and from processing plant area. 	
g)	 Mobile equipment installed on site will: Be refuelled at a lined and bunded refuelling area. Include spill control kits. Operators trained in the use and maintenance of spill control kits. Return of all mobile equipment at end of each day to Office and Workshop Compound (excluding the bull dozer). 	Ongoing
h)	Electric screen and air separator installed on site will include bunding under the electric screen and air separator plant to capture hydraulic leaks.	Ongoing
i)	Refuelling of equipment will be undertaken over a bunded concrete pad by a registered contractor. No fuel or diesel will be stored on site contained in plant and equipment. Oils and grease will be stored in a bunded area.	Ongoing
j)	 Mobile plant used in the extraction process will be refuelled outside of the Tomago Sandbeds Special Area, including: Pneumatic tyred loaders (2x full time) Dump Trucks (campaign usage as required for extraction area 7C). Sales truck (Daily). Trailer mounted diesel generator to power processing plant interim or back up in the event electricity is not available. 	Ongoing
k)	 All diesel powered pneumatic tyred mobile plant will be removed from the Tomago Sandbeds Special Area at the end of each day's operation, including: Loaders x 2 (daily) Dump trucks (campaign usage as required for extraction area 7C). Sales trucks (daily) Trailer mounted diesel generator (where used) This plant will be stored within fenced area with CCTV and back to base security at the Office and Worksop area located outside the Special Area. 	Ongoing
I)	When plant and equipment is not operating, pressure will be removed from hydraulic lines and hydraulic fluid returned to the tank. The tank will be bunded to 110% of capacity.	Ongoing
m)	 The tracked plant will be refuelled on a fully bunded and lined hardstand. The following plant that are permitted to be refuelled on the fully bunded and lined hardstand area within the Tomago Sandbeds Special area include: 1 x Dozer (Maximum of 3 campaigns of 2 weeks each, 42 days per year). 1x Excavator (Maximum of 3 campaigns of 2 weeks each, 42 days per year). 	Ongoing
n)	 Any hydrocarbon spills on site will include the following response: Immediate deployment of spill control kits. Notifications of relevant stakeholders (e.g. EPA and HWC) consistent with the Pollution Incident Response Management Plan (PIRMP) for any spills estimated to be greater than 30 L. Recovery of all contaminated sands or gravels regardless of size for collection and offsite disposal at a licenced waste facility. 	Following Spill



Item	Action	Trigger/ Timing
o)	Appropriate maintenance schedules for plant and equipment must be followed to detect and repair leaks.	Ongoing
10. Gr	eenhouse Gas and Energy	-
a)	Record diesel and electricity by the operations.Review of opportunities to improve energy efficiency.	Ongoing
b)	 On site diesel efficiency will continue to improve based upon the following measures: Scheduling activities so that equipment and vehicle operation is optimised. The quarry fleet will continue to be replaced by more efficient equipment over the life of the project, where replaced. Fuel use efficiency will be an important factor in selecting quarry fleet. Resource recovery will be optimised within the constraints of the Project. Machines will be working to their upper design performance. Optimising machine performance is key performance indicator for operators. Fleet will be serviced and maintained to OEM specifications. 	Ongoing
11. Wa	aste	
a)	Application to Port Stephens Council for installation of effluent management system.	During construction (prior to construction of ablutions and effluent management system).
b)	All wastes generated by Cabbage Tree Road Quarry will be managed by the way of Council collection services or via appropriately licensed waste contractors.	Ongoing
c)	The on-site pumping system must be located and constructed in accordance with Port Stephens Councils <i>Development Assessment Framework</i> for on-site sewerage.	During Construction
d)	No onsite disposal of waste will occur.	Ongoing
e)	Scrap metal will be deposited into a dedicated receptacle for periodic collection and recycling.	Ongoing
f)	Diesel fuel will be stored within self-bunded above ground tank and all refuelling will be undertaken on a bunded and covered hardstand area.	Ongoing
g)	During excavation any foreign materials encountered will signal an immediate stop work in the proximate area until the nature of the object/s can be determined. In the case of uncovered potential asbestos sheeting or pipe laboratory testing may be required to determine if asbestos fibres are present in the surrounding sand.	Ongoing
h)	Where excavation is to occur below the quarry floor, an excavation specific spoil and water management procedure is to be developed to manage PFAS contaminated soil and groundwater and/or acid sulphate soils.	As required
i)	All waste oil will be collected and stored in containers within a covered and bunded area, and will be removed from the site by an appropriately licensed contractor with all relevant waste tracking documentation completed.	Ongoing
j)	All oil filters will be separately stored in containers with a covered bunded area, and will be removed from the site by an appropriately licensed contractor with all relevant waste tracking documentation completed.	Ongoing
k)	Silt will be periodically removed from the various silt control structures and used in progressive rehabilitation of the site	Ongoing



ltem	Action	Trigger/ Timing
I)	All office paper and general waste originating from the office, amenities building and packaging from routine equipment and vehicle maintenance consumables will be placed in appropriate containers for collection by council or a licensed contractor for disposal/ recycling at an appropriate waste management facility.	Ongoing
m)	Wastewater from the amenities, workshop and laboratory will be collected in a pump-out system and transported off-site by a licensed contractor.	Ongoing
n)	All waste tyres will be removed by the supplier of replacement tyres.	Ongoing
12. Aiı	r Quality	
a)	Air Quality controls and management measures will be revised and updated on determination of the project to ensure management measures proposed adequately reflect the requirements of the Conditions of Consent. The revised controls will be prepared in consultation with the NSW EPA for approval by NSW DPE.	Prior to commencement of operations
b)	Bitumen seal access road through to the boundary for the southern boundary of the northern resource area.	During Construction
c)	Utilise water carts or a sprinkler system for dust suppression of exposed areas and haul roads.	Ongoing
d)	Water sprays will be incorporated into transfer points where higher levels of moisture are acceptable, such as conveyer transfers to product and reject stockpiles.	Ongoing
e)	Install a suitable continuous air quality monitoring network.	Ongoing
f)	WSS will install a meteorological station to allow quarry personnel to access instantaneous wind speed and direction data and also generate site specific meteorological data records.	Ongoing
g)	Quarry operations will be subject to a staged shutdown of equipment based on rolling 24 hour average PM_{10} concentrations, PM_{10} concentration spikes and adverse background air quality and meteorological conditions. Indicative completion criteria are set out below, it important to note that these triggers will be adapted and refined as the project progresses based on actual monitoring data. The proposed draft triggers include:	
	 Where the wind is directed toward surrounding residences, that is the weather station indicates winds are blowing from the quadrants west (270 degrees), through North (0 degrees) to East (90 degrees) the quarry should review dust controls (e.g. stockpile sprays and need for dust suppression on trafficked areas). In addition, based on the real-time air quality monitoring network, the following controls should be implemented: 1. No topsoil stripping or dozer push to occur where: 	Continuous
	 a) Wind is directed toward surrounding residences; AND b) Rolling PM₁₀ 24-hour average exceeds 35 µg/m³ OR c) Rolling PM₁₀ 1-hour average exceeds 50 µg/m³. 2. If levels continue to increase after two hours, suspend sand extraction and processing (loading trucks only) where: a) Wind is directed toward surrounding residences; AND b) Rolling PM₁₀ 24 hour average exceeds 42.5 µg/m3 OR c) Rolling PM₁₀ 1-hour average exceeds 50 µg/m3. 	
	(no machinery operating) where:	



ltem	Action	Trigger/ Timing
	a) Wind is directed toward surrounding residences; AND	
	b) Rolling PM ₁₀ 24 hour average exceeds 45 µg/m3. OR	
	c) Rolling PM ₁₀ 1-hour average exceeds 50 μ g/m3.	
h)	 In the event the Trigger Response Framework fails to maintain levels below criteria, monitoring results are to be assessed for compliance using the following protocol: Results above 24 hour average PM₁₀ criteria of 50 µg/m³. Is wind direction in the preceding three hours toward receptors and the monitoring location? If <u>No</u>, unlikely to be due to project, suspend extraction activities until levels drop below 48 µg/m³. Sales can continue. If <u>Yes</u> continue to Step 3. Are regional levels also elevated as per the OEH monitoring network? Does the quarry monitoring network show upstream and downstream air quality levels are above criteria? If <u>Yes</u>, unlikely to be due to project, suspend extraction activities until levels drop below 48 µg/m³. If <u>No</u> continue to Step 5. Exceedance directly related to activities onsite. Non-compliance has occurred. Review activities onsite and develop actions to mitigate future non-compliance. 	When exceedance of air quality criteria measured. DPE notified within 24 hours where non- compliance identified.
i)	If noncompliance is demonstrated, additional monitoring will be undertaken within one week following implementation of additional mitigation controls.	Following non- compliance.
13. No	ise	
	Noise controls will be revised and undated on determination of the project to	
a)	ensure management measures proposed adequately reflect the requirements of the Conditions of Consent. The revised controls will be prepared in consultation with the NSW EPA for approval by NSW DPE.	Prior to commencement of operations
b)	 The following noise management measures will be employed during construction activities: The proponent will inform potentially noise affected residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. All feasible and reasonable work practices will be implemented where possible to meet the noise affected level. Construction personnel will be made aware of the requirement to minimise noise, and to implement best practice operating techniques to minimise noise. Consideration should be given to operating low noise emission plant where possible. 	During Construction
c)	 Operational noise mitigation measures will include: Areas 8, 9 and 10 will be extracted last to retain the natural sound attenuation of the sand dunes for as long as possible. Extraction orientation will, where feasible, maintain the sand face between the operating plant and the nearest dwelling. Use of a dozer for operational material push up will be restricted to areas within the northern resource area and only used in the southern resource area where monitoring determines noise criteria will not be exceeded at dwellings. All dozers operating within the southern resource area will be restricted to areas to first gear in reverse to minimise associated track noise. 	Ongoing



ltem	Action	Trigger/ Timing
	 All equipment frequently used onsite will be fitted with a BBS-Tek "backalarm" broadband reversing alarms or similar. All plant is to be positioned on each pad with regard to minimising the potential for offsite noise at the surrounding dwellings. Diesel generators used for backup power will be positioned such that the exhaust is generally directed to the north. 	
d)	 The following noise monitoring is recommended for the construction phase of the project: Attended noise monitoring at the potentially most affected residences at commencement, or during the highest noise emitting period, of each construction activity. If noncompliance is demonstrated, additional monitoring will be undertaken within one week following implementation of additional mitigation controls. Vibration monitoring at the potentially most affected residences at commencement, or during the highest vibration emitting period, of Cabbage Tree Road intersection construction activity. 	During estimated 12 week construction phase.
e)	Detailed dilapidation reporting will also be undertaken at all properties within a 300 m radius of quarrying activities and/or intersection works where access is provided to undertake the reporting prior to the commencement of any works. Each property owner will be provided a copy of the dilapidation report for their property.	Prior to commencement of any work within a 300 m radius of private dwelling
f)	 The following monitoring is recommended for the operational phase of the Project: Attended noise monitoring at the potentially most affected residences at commencement, or during the highest noise emitting period, of each phase of the Project. These phases should include: Clearing and stripping in Areas 1, 3, 7, 8, 9, 10. Extraction and processing works in Areas 1, 8, 9, 10. Periodic attended monitoring with a frequency of one day per quarter unless targeted monitoring is already scheduled in that quarter. 	Quarterly, unless targeted monitoring scheduled.
g)	 Attended monitoring results are to be assessed for compliance using the following protocol: Results above intrusiveness criteria. Do standard weather conditions apply (as per INP)? If non-standard weather conditions apply, undertake follow-up monitoring. Are the results considered to be directly related to activities onsite or are they from an unrelated source? If related to activities onsite and standard weather conditions apply a non-compliance has occurred. 	When exceedance of noise criteria identified.
h)	If noncompliance is demonstrated, additional monitoring will be undertaken within one week following implementation of additional mitigation controls.	Following non- compliance.
i)	 Where noise monitoring or complaints suggest the project is unable to achieve these noise goals the proponent will undertake the following sequence of investigations and controls: Review the details of the noise level exceedances, the weather, operational activities at the time and the nature of the noise exceedance. If due to failure or equipment or to follow operational procedures, undertake corrective actions to prevent recurrence. If exceedance not as a result of failure, review and refine procedures. 	Complaints and non- compliance.



ltem	Action	Trigger/ Timing
	 If operational practices cannot be improved, consult with the residents of impacted dwellings to discuss potential mitigation measures, this may include: 	
	o Double glazing of windows or similar improvements to dwellings.	
	o Erection of a noise barrier (on resident's property or near source).	
	 Provide compensation to allow receptor to seek relief from noise emissions. 	
j)	Attended noise monitoring at representative dwellings will be carried out during normal operations and the results compared with the predicted model results. The model may be recalibrated to allow noise levels for the remaining scenarios to be more accurately predicted.	Prior to commencement of Sector 8.
14. Ab	original Heritage	
a)	 An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed in consultation with the relevant Aboriginal stakeholders and OEH prior to the commencement of the Project. The ACHMP will address the following matters: A protocol for managing any archaeological material exposed during the course of operations. Recommendations for the ongoing management of the study area. 	Prior to commencement of project
b)	All staff and contractors will undergo site induction incorporating Aboriginal cultural awareness and be made aware of statutory legislation protecting sites and places of significance.	Ongoing
c)	Management of any artefacts will be undertaken in consultation with Aboriginal stakeholder groups in accordance with the ACHMP.	Ongoing
15. His	storical Heritage	
a)	Footings associated with the former World War II radar station will be subject to photographic archival recording of footings and survey of its location prior to disturbance by a qualified archaeologist.	Prior to disturbance of footings – expected within Sector 1A or 2.
b)	Should unexpected heritage items be discovered during the Project and are likely to be disturbed by the Project, all works in the immediate area will cease and a qualified archaeologist or heritage consultant will provide an assessment and, if necessary, the Heritage Branch, Department of Planning will be notified.	On disturbance of unexpected heritage item.
16. Vis	sual Amenity	
a)	All structures with the potential to be visible from off site will be finished in non- reflective natural tones which blend with natural vegetation.	During construction
b)	Any required lighting will be directed downwards in accordance with relevant Australian Standards (AS 4282- Control of Obtrusive Effects of Outdoor Lighting).	During construction
c)	Maintain a 20 m vegetated buffer along the southern boundary of the operation between the resource area and Cabbage Tree Road.	During removal of Sector 9
d)	Exclude resource extraction, thus maintaining a vegetated screen, for the first 75m of the access road from Cabbage Tree Road, as shown by Response to Submissions Figure 3.	During construction
e)	Areas of disturbance are kept to the minimum practicable at any one point.	Ongoing
f)	Undertake rehabilitation of disturbed areas as soon as practicable.	Ongoing
17. Bu	Ishfire and Hazard	
a)	Consultation with the Rural Fire Service on fire management controls.	Prior to construction



ltem	Action	Trigger/ Timing
b)	Review bushfire danger ratings and when total fire bans are in place prior to undertaking clearing activities or other hot works onsite. Postpone activity where feasible or increase preparedness through having a fire tanker on standby.	Prior to undertaking clearing activities.
c)	All mobile machinery and fixed plant to include on-board fire extinguishers.	At all times.
d)	Maintain a 40 m asset protection zone (APZ) around the office and workshop area.	At all times.
e)	Maintain access roads and mapping of tracks consistent with their required purpose.	At all times.
f)	All dangerous goods will be stored in accordance with dangerous goods storage requirements and relevant Australian Standards.	Ongoing
g)	Procedures for refuelling and servicing of all plant and equipment will be undertaken in a manner to prevent spills and protect drinking water catchment from potential contamination. These procedures will be detailed in the EMS to be prepared for the site operations.	Ongoing
18. Ec	ology and Rehabilitation Management	
a)	 Seed Collection Seed will be collected by appropriately qualified contractor in advance of clearing activities for species determined likely to require direct seeding or propagation, and determined to be required for direct seeding and propagation based on monitoring results. 	Annually, during appropriate season for target species
b)	Seed will be stored under appropriate conditions.	At all times
c)	 Pre-clearing surveys Confirmation of resource boundaries and extent of clearing. Habitat trees (containing hollows or nests) within the clearing area will be clearly marked using flagging tape or spray paint. Habitat trees are to be felled using the procedure outlined in Rehabilitation Plan. Habitat trees (containing hollows or nests) within 3 m of the resource boundary will be marked for avoidance, including the delineation of the tree drip line to limit compaction and excavation that may affect the tree. Areas of noxious weeds or environmental weeds will be marked to avoid mixing of weed containing soil with weed-free topsoil (refer to Weed Control section). The following surveys will be conducted within the area proposed for removal within a one day period: Nocturnal surveys will be conducted the night before clearing, and diurnal surveys will be conducted the morning of clearing, prior to commencement; and The procedure for when a Koala is identified within the clearing area is outlined below. All clearing will be supervised by a suitable qualified ecologist. 	Prior to clearing each sector
d)	 <u>Koala Management Protocol</u> The following procedure will be used if a Koala is identified as occupying a tree within the proposed clearing area. The aim of this capture and relocation procedure is to ensure that no Koalas are harmed during the vegetation clearing activities within the extraction area: The individual will be captured prior to the commencement of clearing. 	During clearing, if a Koala is identified



ltem	Action	Trigger/ Timing
	 The individual will be given a veterinary check for any disease or illness and a monitoring device will be attached (remote tracker). Any Koalas captured will be relocated into an area of retained vegetation adjacent to where it was originally located. All individuals will be monitored for a three-month period post relocation. Where any Koalas are identified and captured for re-location, the following will be reported on: Location identified within the disturbance area, and location of relocation; Movement of the Koala will be mapped for the three-month period; Any instances where the Koala enters areas proposed for future clearing will be identified, and the need for further monitoring/action determined. If there is the potential for the individual to occur within areas of future vegetation clearing, a plan to ensure the individual is not impacted will be developed; and The health of the individual will be checked at the end of the three-month period and any impacts (i.e. dog attacks, vehicle strikes, bushfire impacts, or disease) will be identified. 	
e)	 Vegetation Clearing A fully qualified, experienced and licenced ecologist will supervise clearing and encourage movement of any displaced animals into adjoining vegetation. 	During clearing
f)	 Clearing will be undertaken predominantly by bulldozer and may be conducted in conjunction with topsoil removal. Vegetation should be cleared in a way that maintains habitat linkages and allows fauna living in or near the clearing site to move safely from the site to adjacent areas: Clearing should occur towards connecting vegetation. The direction of clearing should also ensure that fauna are directed away from Cabbage Tree Road and the quarry spine road. Sequential clearing should not create an 'island' of habitat that is isolated from adjoining habitat by roads or cleared and disturbed areas. Habitat trees will be left to stand for a period of two nights (also refer to Koala Protocol). Habitat trees will be left to stand for a period of two nights (also refer to Koala Protocol and Habitat Tree Removal) and "soft-felled" under supervision of a suitably experienced fauna ecologist. No clearing should occur during the early evening or at night (when fauna species are most likely to be on the move and are more vulnerable to injury). Plants that are suitable for brush matting (and may be vulnerable to dropping seed during clearing) will be cut ahead of the quarry face and stockpiled on weed-matting or similar to ensure seed is not "lost" during clearing and can then be spread over topsoiled areas. Large organic debris, and where possible, other vegetation cleared from the operational area will be stockpiled and spread on rehabilitated areas immediately after re-distribution of topsoil. Vegetation stockpiling should maintain a minimum 10 m cleared asset protection zone around the stockpile to minimise fire risk in adjoining vegetation. 	During clearing



ltem	Action	Trigger/ Timing
	 Displacement of fauna may occur as part of the clearing process. All clearing will be supervised by a suitable qualified, experienced and licenced ecologist, the following protocol should be followed in case of an injured animal: If possible any fauna fleeing the clearing area should be captured and relocated or directed to a safe area outside the extraction zone during the tree removal process. All fauna are to be handled in such a way as to prevent injury to the animal or the handler. Once the animal is safely handled it should be relocated or caged in a hessian bag or box and released at an appropriate time of day. Any microbats or other nocturnal species captured during the tree removal process should be held in cotton or hessian bags and released at dusk on the same day as capture if possible. If any animal is injured during the construction process, a veterinarian should be contacted immediately for professional advice on the best course of action. If any native animal is injured during other operational/ construction processes while an ecologist, environmental representative or animal handler is not present, they must be contacted immediately. 	
h)	 Habitat Tree Removal Habitat trees will be removed according to the following protocol: Hollow bearing trees will be left standing for two nights after the surrounding vegetation has been cleared to encourage any native fauna species utilising the habitat hollows to self-relocate. The actual felling of any habitat trees will be attended by a suitably experienced fauna ecologist in order to ensure the safety of any fauna found to be in the hollows. On all occasions, trees having potential habitat hollows will be 'soft felled' by an experienced machine operator. The recommended soft felling procedure is as follows: The hollow-bearing tree is given several moderate nudges with an excavator to give a warning to any occupying native fauna. The hollow-bearing tree is soft felled with the rate of the tree's fall controlled by the machinery operator to minimise impact. All hollows will be inspected for fauna and if any are found, the animal should be relocated at an appropriate time of day (i.e. dusk for nocturnal species). If the animal is injured, it will be taken to a local veterinarian. Suitable medium and large hollows should be cut from the tree at least one metre beyond the deepest point of the hollow and then stored in a dry safe place in size related categories for replacement in rehabilitated areas. 	During clearing of habitat trees
i)	Topsoil Stripping and Placement Areas of 'weed contaminated' topsoil: • Refer to Weed Control section above.	Before and during topsoil removal and respreading of topsoil.
j)	 Areas of 'clean' topsoil: Topsoil is to be transferred and respread directly over the previously quarried area as soon as it is extracted and no longer required for access (exhausted area). 	During topsoil removal and respreading



ltem	Action	Trigger/ Timing	
	 Once an area is exhausted and becomes available for rehabilitation the floor of the quarried area will be ripped, if it is hard and impenetrable, prior to redistribution of topsoil. Direct topsoil transfer from an area ahead of the mining face, to the recently exhausted area, will be utilised to facilitate the natural regeneration of plant species and limit the degradation of soil microbes. 		
k)	• Strip topsoil to 100 mm minimum depth (having regard to final landform floor levels of the quarried area needing to meet the required 1 m above groundwater).		
I)	• Where topsoil is stripped at more than 150 mm thickness, topsoil to be stripped in two paths and re-laid in correct order.	During topsoil removal and redistribution	
m)	 Avoiding stockpiling topsoil enabling direct transfer to rehabilitation areas where feasible. 		
n)	 Minimising stripping depths to avoid seed burial, and taking two strips where possible ensuring respreading is sequential. 		
o)	• If a hard or indurated layer is present on the floor of the quarried area, the floor will be ripped prior to topsoil respreading.	Prior to topsoil placement	
p)	• Respread topsoil to a minimum thickness of 100 mm, noting the need to achieve a final land form of 1 m above groundwater).	During topsoil placement	
q)	 Operational Levels and Final Landform Quarry floor levels to be established on weekly basis. 	Weekly	
r)	• Quarry floor levels to be reviewed on completion of quarrying to confirm required topsoil strip depth.	On completion of sector	
s)	Independent registered surveyor to undertake audit	3 months	
t)	• Operational floor of quarry to be no less than 0.7 m above highest predicted groundwater level. Level relative to thickness of topsoil removal, i.e. if topsoil stripping is less than 0.3 m than the operational floor level must be increased accordingly such that replacement of topsoil achieves final landform requirement of 1 m above highest predicted groundwater level.	At all times	
u)	• Final landform, including topsoil to be not less than 1 m above highest predicted groundwater level.	Upon completion of final landform shaping	
V)	 Nest Box Installations Hollows will be replaced with nest boxes at a ratio of 1:1 within the rehabilitation area. Nest box design will be selected to replace the natural size of removed hollows. The number and type of next boxes to be installed will be determined for surveys of hollow-bearing trees felled during clearing. Nest boxes will be installed on wooden poles at an approximate height of 3 m within the rehabilitation area. 	As required	
w)	 Placement of woody debris and brush matting Where possible individual plant species (especially <i>Leptospermum</i>, <i>Melaleuca</i> and <i>Eucalyptus</i> species) will be harvested when they are bearing mature seed rather than immediately prior to clearing. Bradysporous (seed retaining) species are best harvested and spread in autumn whereas geosporous (seed shedding) species are best harvested immediately prior to annual seed release in late spring. Experienced and qualified contractors to coordinate seed collection. 	Annually in autumn and late spring.	



ltem	Action	Trigger/ Timing
x)	 Distribution of all stockpiled vegetation will occur following the respreading of topsoil up to a maximum of 20% ground cover by woody debris (greater than 10 cm diameter). The re-laid vegetation will comprise branches and timber of all sizes including leaves and stems of shrubs and grasses. The placement of large timber should have regard to its orientation for the purpose of the capture of wind-blown sand and delay of runoff. Generally, this means an orientation along the north-east to south-west vectors, perpendicular to dominant onshore and off-shore winds. 	During placement of woody debris and brush matting.
у)	 Direct Seeding Common pioneer species (i.e. Acacia species and Actinotus helianthi) and others will usually regenerate from topsoil or brush matting and direct seeding is not required. Where monitoring shows a deficiency in a particular species they will be introduced through direct seeding. 	Where monitoring shows failure of species to regenerate by topsoil or brush matting.
z)	• Locally sourced seed will be used, and will be sown in the soil rather than broadcast. Harvesting of mature seed and direct sowing into re-topsoiled areas at the most appropriate time of year (usually autumn or spring) will be undertaken for species that typically do not readily regenerate from the soil seedbank, such as <i>Eucalyptus</i> , <i>Angophora</i> , <i>Banksia</i> and <i>Xanthorrhoea</i> .	Annually in autumn and late spring as required.
aa)	 Propagation and Replanting The focus of propagation is to: Introduce to the rehabilitation the dominant structural species that have difficulty establishing from topsoil, brush matting, or direct seeding or recalcitrant species. Provide advanced species that are desired for establishment in strategic locations or densities to achieve the revegetation objectives. Propagation will be undertaken by a local wholesale nursery. 	Where monitoring shows failure of species to regenerate by direct seeding or other means.
bb)	• Where targeted species do not regenerate through the topsoil seedbank or direct seeding, tubestock will be planted within the rehabilitation. Planted tubestock will be watered to ensure for initial establishment.	In autumn (for optimum success), as required
cc)	 Transplanting Transplanting of will be used as a method of revegetation for certain species. The plants will be excavated with a front-end loader (or similar) retaining as much soil around the roots as possible The plant will then be moved to a prepared hole, water in where possible. For mature <i>Xanthorrhoea</i> species (Grass Trees), these will be burnt (where weather and conditions permit). Burning the shirt of dead leaves and some of the lower green leaves is important to stimulate new growth and flowering. 	As required, during rehabilitation
dd)	 Species Composition and Structure Rehabilitation will aim to achieve the species composition and structure of the following communities: 	When undertaking rehabilitation



Item	Action	Trigger/ Timing
ee)	• Landscaping Areas will include species composition and structure that will aim to establish native ground cover and shrub species that are consistent with requirements for fuel loads within Asset Protection Zones (e.g. maintained, minimal wood debris, discontinuous patches of the shrub layer, no canopy species within 10 m of building and where present do not have connected canopy with adjoining vegetation).	For landscaped areas
ff)	 <u>Rehabilitation Monitoring</u> Six monthly (bi-annual) monitoring of rehabilitation for the first three years and monitoring at years four, five and eight post-rehabilitation will be assessed against the performance criteria. The Eight year (or final) monitoring event will also be compared against the completion criteria, and where met will not require further monitoring. 	As specified.
19. De	commissioning and Closure	
a)	Prepare a final quarry closure plan to establish a safe, stable and non-polluting final landform.	3 years prior to closure of quarry
b)	Satisfy land owner lease conditions for relinquishment of bond.	During decommission and rehabilitation.
c)	 Decommissioning will include: Removal of all plant and equipment (e.g. all fuel infrastructure, weigh bridges, site office and the workshop structure). Consultation with land owner to agree on residual infrastructure to be left onsite. Expected residual infrastructure / works includes: Intersection and bitumen access road. Building pads. Electrical line work from Cabbage Tree Road to Office and Workshop area. Water mains pipe work though to Office and Workshop area. A 40 m wide asset protection zone (with inner and outer protection areas) around office and workshop compound. 	During decommissioning
d)	Meet rehabilitation completion criteria, or at a minimum establish that the rehabilitated lands are on trajectory to meet the completion criteria without additional input.	During decommissioning
20. Of	fsets	
a)	Sufficient biodiversity offsets will be secured to satisfaction of OEH and DPE prior to the commencement of construction.	Prior to commencement



5.2 SPECIFIC GROUNDWATER AND SURFACE WATER MITIGATION MEASURES

The specific groundwater and surface water mitigation measures are detailed in the following sections:

- Section 5.1.2 (above) under **7.** Erosion, Sediment Control and Soil Management, and Section 5.7 of the EMP (Appendix 2);
- Section 5.1.2 (above) under **8. Water Management**, and Section 5.8 of the EMP (Appendix 2);
- Section 5.1.2 (above) under 9. Hydrocarbon Controls, and Section 5.9 of the EMP (Appendix 2); and
- Section 5.1.2 (above) under 18. Ecology and Rehabilitation Management Rehabilitation / Operational Levels and Final Landform, and Section 5.18.3.8 of the EMP (Appendix 2).

The EMP included within **Appendix 2** is intended to provide a draft outline of the management measures proposed and will be subject to further refinement and approval following Project Approval. Monitoring measures for surface water and groundwater for all phases of the Project will be further defined post approval in consultation with NSW Water and Hunter Water, and approved by the NSW Depart of Planning and Environment.

Identification of the potential impacts, a risk assessment for each impact and the management and control measures which have been implemented to minimise the impacts on MNES, are outlined in **Table 15**.

5.3 GENERAL MITIGATION MEASURES

Table 14 details the environmental outcomes that will be achieved for all MNES that were identified as occurring within the Subject Land (or assumed present in the case of New Holland Mouse), or that have the potential to be indirectly impacted on due to the proposed action.

Identification of the potential impacts, a risk assessment for each impact and the management and control measures which have been implemented to minimise the impacts on MNES, are outlined in **Table 15**. Details on the management and control measures are outlined in the relevant sections of the Environmental Management Plan (EMP), which is attached to this report in **Appendix 2**. The risk of the impacts were evaluated using the methodology (matrix)



detailed in Section 4 of the Department of the Environment Environmental Management Plan Guidelines (2014). The impacts of the proposed action have been fully described and assessed as part of the Referral documentation for the proposed action.

The mitigation measures form part of the Environmental Management Plan for the proposed action, which is required under the State Legislation approval. As such, the proponent is fully committed to undertaking these mitigation measures and they will form part of the proposed action through adherence to the plan throughout the life of the action. Monitoring and reporting is also required under the EMP, these details are set-out within that document.



Table 14:Environmental outcomes

Proposed Outcomes	How Outcome will be Achieved	Measuring and Monitoring Success of Outcome	Confidence in Achieving the Proposed Outcome			
Wetlands of Internation	Wetlands of International Importance					
No impact on Hunter Estuary National Park (Ramsar Wetland) through modification of the groundwater due to the proposed action	 No groundwater extraction. Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained. Area has a very low hydraulic gradient with limited or no connected drainage from the Subject Land to Fullerton Cove. Protocols for the use of hydrocarbons on the project enforced by the HWC due to location of Tomago Sand Beds. 	 Groundwater monitoring will be conducted throughout the life of the project. The groundwater model will be updated every two years. Erosion and sediment controls to retain all runoff from the project within the subject land. 	Confidence of achieving the outcome is high. Constant monitoring and update of the groundwater model and the floor level of the extraction area will ensure the extraction level is adapted thoughout the life of the project.			
Listed Threatened Spec	ies and Communities	Ι				
Removal of 40.38 ha of vegetation that represents: • 40.38 ha of Koala habitat • 40.24 ha of New Holland Mouse Habitat • 40.38 ha of Grey- headed Flying-fox habitat	The proposed extraction area will be cleared progressively. Prior to clearing the extraction area will delineated.	The extraction area boundary will be surveyed and delineated prior to clearing to ensure no accidental incursions.	Confidence of the clearing to be restricted to 40.38 ha is high as an accurate survey of the project boundary will be conducted prior to the commencement of clearing.			
Retention of movement corridors within and through Subject Land	The proposed disturbance area has been reduced so that no areas of vegetation within the Subject Land area isolated, and movement and dispersal corridors are retained.	The extraction area boundary will be surveyed and delineated prior to clearing.	Confidence of achieving the outcome is high as the modified footprint is the only footprint be considered for approval. Additionally, the retained area of the Subject Land that			



Proposed Outcomes	How Outcome will be Achieved	Measuring and Monitoring Success of Outcome	Confidence in Achieving the Proposed Outcome
			facilitate the movement corridors will be protected in perpetuity under a biobanking agreement.
Rehabilitation of native vegetation within the extraction area.	Rehabilitation will be conducted through combination of topsoil re-distribution and planting and seeding of locally endemic species, see the Environmental Management Plan (Response to Submissions Part 17 (Major Projects Website)).	Rehabilitation will be monitored for a period of eight years pot completion. This will ensure suitable species mix is achieved.	Confidence of achieving the outcome is high. Previous rehabilitation following sand mining has been shown to be successful (e.g. Sibelco). The rehabilitation plan for the site has been prepared, and forms part of the site's Environmental Management Plan. Adherence to this plan will be required under State Legislation approval.
Protection and enhancement of threatened species and their habitat within offset areas.	 A total of 130.14 ha of native vegetation will be protected and enhanced on-site through the establishment of a biobank site. The biobank will include: 104.78 ha of Koala habitat 74.90 ha of New Holland Mouse Habitat 130.14 ha of Grey-headed Flying-fox foraging habitat 1,641 <i>Eucalyptus camfieldii individuals</i> 634 <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> individuals 102 <i>Grevillea parviflora</i> subsp. <i>parviflora</i> individuals A further 75 - 100 ha will be secured off-site (to satisfy the additional 580 - 690 ecosystem credits and 306 Koala credits required to satisfy State Approval requirements). This site will also be protected through the establishment of a biobank site. Habitat will be enhanced through management actions implemented as part of the biobank agreements. 	Monitoring and reporting as part of the biobanking agreement will be conducted to ensure targets are achieved.	Confidence level of achieving the outcome is high as land will be secured under a biobanking agreement.



Proposed Outcomes	How Outcome will be Achieved	Measuring and Monitoring Success of Outcome	Confidence in Achieving the Proposed Outcome
Reduced impacts on native fauna species through implementation of a vertebrate pest control program	The program will be implemented, as detailed in the Environmental Management Plan (Response to Submissions Part 17 (Major Projects Website)). This will involve monitoring and implementation of shooting, trapping and/ or baiting programs, as required.	Monitoring will be conducted as part of the control program.	
Koala			
No net loss of Koala habitat due to the proposed action	Progressive rehabilitation of the disturbance area with preferred and supplementary Koala habitat.	Rehabilitation will be monitored for a period of eight years post completion. This will ensure suitable species mix is achieved.	Confidence of achieving the outcome is high. Previous rehabilitation following sand mining has been shown to be successful (e.g. Sibelco). The rehabilitation plan for the site been prepared, and forms part of the site's Environmental Management Plan. Adherence to this plan will be required under State Legislation approval.
	Gain in Koala habitat due to planting of a preferred feed tree species, <i>Eucalyptus robusta,</i> within disturbed areas of offset.	Area of supplementary planting within the offset (on- site biobank) will be monitored as part of the biobanking agreement to ensure targets are achieved.	Confidence of achieving the outcome is high as the action will be a requirement of the biobanking agreement for the site. As such, funding for the work will be secured and external audits on the action will be conducted.
Limit potential vehicle strikes along Cabbage Tree Road and within the Subject Land.	A Koala exclusion fence will be installed along the properties frontage with Cabbage Tree Road. The fence will continue along internal access roads with a speed limit is 40 km/hr.	The fence will be monitored using remote cameras and inspected to identify maintenance requirements.	High confidence as the fencing will be installed in accordance with the <i>Koala</i> <i>Sensitive Design Guideline</i> (DEHP 2012).
Camfield's Stringybark and Earp's Gum			
Removal of 230 individuals of <i>E.</i> <i>parramattensis</i> subsp. <i>decadens</i> individuals	The surveys across the extraction area (and its immediate surrounds) were conducted by a series of parallel transects which covered the entire extraction area. The surveys were conducted by individuals who were confident in identification of the two species, and the	The extraction area boundary will be surveyed and delineated prior to clearing to ensure no accidental incursions.	 The confidence of achieving the removal of only 230 <i>E. parramattensis</i> subsp. <i>decadens</i> and 227 <i>E. camfieldii</i> individuals is moderate to high. It is believed that the surveys conducted across the extraction area were sufficient


Proposed Outcomes	How Outcome will be Achieved	Measuring and Monitoring Success of Outcome	Confidence in Achieving the Proposed Outcome			
	location of each individual was recorded using a hand- held GPS (accurate to 2 – 5 m).		and conducted by individuals with sufficient knowledge. There is some inherent inaccuracy in the method of collecting the location of each individual (i.e. GPS error of $2 - 5$ m).			
No net loss of <i>Eucalyptus camfieldii</i> due to the proposed action.	<i>Eucalyptus camfieldii</i> will be used within seed mix for the rehabilitation of the disturbance area and monitoring will indicate the rate at which the species is establishing.	Monitoring will be used to estimate the density of the species across the rehabilitation and ensure all individuals removed are replaced post activity.	 Confidence of achieving the outcome is high. The species has been included in the rehabilitation plan for the site. This plan forms part of the site's Environmental Management Plan and adherence to this plan will be required under State Legislation approval. Additionally, the individuals within the proposed extraction area occur within an area of rehabilitated vegetation. As such there is confidence in the successful rehabilitation of the species as part of the proposed action. 			
Migratory Species	Migratory Species					
Eastern Osprey and Ru	fous Fantail	Γ				
Removal of 40.38 ha of vegetation that represents:	The proposed extraction area will be cleared progressively. Prior to clearing the extraction area will delineated.	The extraction area boundary will be surveyed and delineated prior to clearing to ensure no accidental incursions.	Confidence of the clearing to be restricted to 40.38 ha is high as an accurate survey of the project boundary will be conducted prior to the commencement of clearing.			
Protection and enhancement of migratory species	 A total of 130.14 ha of native vegetation will be protected and enhanced on-site through the establishment of a biobank site. The biobank will include: 0 101.02 ha of Eastern Osprey habitat 	Monitoring and reporting as part of the biobanking agreement will be conducted	Confidence level of achieving the outcome is high as land will be secured under a biobanking agreement.			



Proposed Outcomes	How Outcome will be Achieved	Measuring and Monitoring Success of Outcome	Confidence in Achieving the Proposed Outcome
habitat within offset areas.	 40.13 ha of Rufous Fantail Habitat Habitat will be enhanced through management actions implemented as part of the biobank agreements. 	to ensure targets are achieved.	
Migratory Species with	Habitat in Fullerton Cove		
No impact on migratory species habitat through modification of the groundwater due to the proposed action	 No groundwater extraction. Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained. Area has a very low hydraulic gradient with limited or no connected drainage from the Subject Land to Fullerton Cove. Protocols for the use of hydrocarbons on the project enforced by the HWC due to location of Tomago Sand Beds. 	 Groundwater monitoring will be conducted throughout the life of the project. The groundwater model will be updated every two years. Erosion and sediment controls retain all runoff from the project within the subject land. 	Confidence of achieving the outcome is high. Constant monitoring and update of the groundwater model and the floor level of the extraction area will ensure the extraction level is adapted thought the life of the project.



Threats to MNES	Potential Impacts	Management and Control Measures	Risk Assessment (after controls are implemented)
Wetlands of International I	mportance		
Impact area occurs approximately 590 m upstream of the Hunter Estuary Wetlands.	No direct impacts, potential for downstream impacts if any modification of groundwater hydrology due to proposed action.	• Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	Low (Likelihood: Unlikely/ Consequence: Minor).
	Reduced water quality, habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	 Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2. 	Low (Likelihood: Unlikely/ Consequence: Minor).
Listed Threatened Species	and Ecological Communities		
Threatened Birds:Regent HoneyeaterSwift Parrot	Clearing of suitable foraging habitat.	Retention of corridors.Rehabilitation of extraction area.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
	Increase risk of Psittacine Beak and Feather Disease (PBFD) through release of rehabilitated parrot species.	 Clearing procedures, including pre-clearing surveys and habitat tree felling procedures will be followed to limit impacts on local fauna species. 	Low (Likelihood: Unlikely/ Consequence: Moderate).
	Introduction of Myrtle Rust of <i>Phytophthora cinnamomi</i> which could impact on habitat	• All machinery will be free of soil and organic matter prior to entering the extraction area.	Low (Likelihood: Unlikely/ Consequence: Moderate).
	Dieback of feed trees as a result of sedimentation and/or pollution due to unmitigated surface runoff.	 Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2. 	Low (Likelihood: Unlikely/ Consequence: Minor).
Australasian Bittern	Indirect impacts on habitat through modification of groundwater hydrology.	• Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored	Low (Likelihood: Unlikely/ Consequence: Minor).

Table 15: Mitigation measures to address each MNES



	Threats to MNES	Potential Impacts	Management and Control Measures		Risk Assessment (after controls are implemented)
•	Wading Birds with habitat in Fullerton Cove	No direct impacts, potential for downstream impacts if any modification of groundwater hydrology due to proposed action.		throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	
		Habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	•	Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2 .	Low (Likelihood: Unlikely/ Consequence: Minor).
Thre • •	eatened Mammals: Spotted-tail Quoll Koala	Clearing of suitable habitat will impact on any potentially occurring threatened mammal species during	•	Koala protocol, if any individuals are identified during clearing.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
•	 Long-nosed Potoroo New Holland Mouse Grey-headed Flying- fox 		• •	Retention of corridors. Rehabilitation of extraction area. Clearing procedures, including pre-clearing surveys and habitat tree felling procedures will be followed to limit impacts on local fauna species.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
		Removal of habitat trees (relevant to Spotted-tail Quoll).	•	Habitat tree felling procedures and installation of nesting boxes.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
		Indirect impacts on habitat through modification of the groundwater hydrology	•	Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	Low (Likelihood: Unlikely/ Consequence: Minor).
		Ingestion of 1080 poison, which will be used as part of vertebrate pest control program.	•	Any use of 1080 poison as part of the proposed action will be used in accordance with Commonwealth guidelines.	Low (Likelihood: Unlikely/ Consequence: Moderate).
		Impacts from Chlamydia, induced from stress (relevant to Koala).	•	Clearing procedures, including pre-clearing surveys and habitat tree felling procedures will be followed to limit impacts on local fauna species.	Low (Likelihood: Unlikely/ Consequence: Moderate).



Threats to MNES	Potential Impacts	Management and Control Measures	Risk Assessment (after controls are implemented)
	Modification of habitat from impacts from Myrtle Rust and <i>Phytophthora cinnamomi</i>	• All machinery will be free of soil and organic matter prior to entering the extraction area (see Section 5.5 of the EMP).	Low (Likelihood: Unlikely/ Consequence: Moderate).
	Increased vehicle activity along Cabbage Tree Road	• The proposed action will implement a recognised mitigation measure with a high effectiveness, through the installation of Koala proof fencing along Cabbage Tree Road and along internal roads with speed limits above 40 km/ hour.	Low (Likelihood: Unlikely/ Consequence: Moderate).
	Habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	 Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2. 	Low (Likelihood: Unlikely/ Consequence: Minor).
 Threatened Flora: Commersonia prostrata Eucalyptus camfieldii Eucalyptus parramattensis subsp. decadens Grevillea parviflora subsp. parviflora Persicaria elatior 	Clearing of individuals (<i>E. camfieldii</i> and <i>E. parramattensis</i> subsp. <i>decadens</i>) and suitable habitat	 Retention of corridors. Clear delineation of clearing boundary. Rehabilitation of extraction area (with <i>Eucalyptus camfieldii</i>). 	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
	Indirect impacts on habitat and retained individuals through modification of the groundwater hydrology	• Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	Low (Likelihood: Unlikely/ Consequence: Minor).
	Impacts on retained individuals from Myrtle Rust and <i>Phytophthora cinnamomi</i>	• All machinery will be free of soil and organic matter prior to entering the extraction area.	Low (Likelihood: Unlikely/ Consequence: Moderate).
	Habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2 .	Low (Likelihood: Unlikely/ Consequence: Minor).
Listed Migratory Species			



Threats to MNES	Potential Impacts	Management and Control Measures	Risk Assessment (after controls are implemented)
Eastern OspreyRufous Fantail	Clearing of suitable habitat	Retention of corridors.Rehabilitation of extraction area.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
	Indirect impacts on habitat through modification of groundwater hydrology	• Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re-distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
	Habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	 Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2. 	Low (Likelihood: Unlikely/ Consequence: Minor).
Snipe Species	Indirect impacts on habitat through modification of groundwater hydrology	• Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re- distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	Moderate (Likelihood: Highly Likely/ Consequence: Minor).
	Habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	 Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2. 	Low (Likelihood: Unlikely/ Consequence: Minor).
Migratory species with Habitat in Fullerton Cove	No direct impacts, potential for downstream impacts if any modification of groundwater hydrology due to proposed action.	• Extraction will occur to 70 cm above the maximum predicted groundwater level, and then 30 cm of topsoil will be re- distributed. The final landform will be monitored throughout the life of the quarry, to ensure that the level above the maximum predicted groundwater level is maintained.	Low (Likelihood: Unlikely/ Consequence: Minor).
	Habitat degradation as a result of sedimentation and/or pollution due to unmitigated surface runoff.	 Water management / hydrocarbon/ erosion and sediment controls as per Section 5.2. 	Low (Likelihood: Unlikely/ Consequence: Minor).





5.4 REHABILITATION AND ECOLOGY

5.4.1 Objectives

The objectives of the following management controls are to:

- Limit the impacts of the works on locally occurring fauna species within the extraction area during clearing;
- Progressively re-establish native vegetation after sand extraction and completion of landform rehabilitation;
- Ensure there is no net loss of Koala habitat due to the proposal; and
- Ensure there is no net loss of *Eucalyptus camfieldii* individuals due to the proposal.

The rehabilitation sets out to achieve a standard of tree and shrub growth, and recovery in species richness and abundance, as close as possible to that of the original vegetation, within the limits of current best practice techniques, final landform and a reasonable period of post-extraction monitoring. To achieve the rehabilitation aim, the management controls will aim at re-establishing:

- Stable and sustainable native vegetation cover, free of significant erosion;
- The original vegetation community type, or similar, due to the lowered post-extraction landform;
- The structural components and dominant species of vegetation, comparable with preextraction vegetation at similar elevations; and
- Similar species composition to pre-extraction at similar elevations.

Efforts will also be made to re-establish all other structural components of the vegetation including canopy, sub-canopy, understorey, groundcover, hollows and logs, though not necessarily in the same proportions as pre-extraction vegetation at similar elevations, and within the above limits.



5.4.2 Rehabilitation Plan

The successful rehabilitation methods adopted by Sibelco for the rehabilitation on the Tanilba Northern Dune have been adapted where practical to suit the rehabilitation of this sand mine. The methodologies used by Sibelco have proved effective in the rehabilitation of similar communities on the same substrate.

5.4.2.1 Stages of Rehabilitation

The quarrying within the extraction area would utilise progressive rehabilitation methods. This would involve direct topsoil transfer onto exhausted areas to aid in revegetation from the topsoil seedbank and stabilise disturbed areas (outlined in Table 35 of the EMP, see **Appendix 2**). Progressive rehabilitation plans are shown in **Figure 8** to **Figure 12**.

5.4.2.2 Final Landform and Vegetation

The rehabilitation area will be suitable for HU860: Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast (Smooth-barked Apple – Blackbutt Forest) and HU851: Scribbly Gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands (Coastal Sand Wallum Woodland-Heath). Canopy species of the adjoining HU938: Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast (Swamp Mahogany – Paperbark Swamp Forest) will supplement rehabilitation in areas where this community adjoins the rehabilitation area.

The Smooth-barked Apple – Blackbutt Forest community occurs across the majority of the extraction area. Remnant areas occur in the south, and with revegetated areas of the previously mined lands associated with mineral sand mining of the late 1970s and early 1980s, in the north. Only a very small area of the Coastal Sand Wallum Woodland-Heath community occurs within the quarry footprint. However, based on the elevation of the final landform, areas of the rehabilitation may be more suitable for this community.

Landscaping Areas will include species composition and structure that will aim to establish native ground cover and shrub species that are consistent with requirements for fuel loads within Asset Protection Zones (e.g. maintained, minimal wood debris, discontinuous patches of the shrub layer, no canopy species within 10 m of building and where present do not have connected canopy with adjoining vegetation).



Temporary batters will be established within future resource areas during construction. These batters represent a relatively narrow band (approximately 20 m width) located between existing vegetation and rehabilitated areas. It is proposed to provide temporary stabilisation of the batters using tube stock, mulching, geotextile or similar. The temporary stabilisation efforts will reduce wind exposure and limit dust generation.

The final landform plan and indicative vegetation community distribution is provided in **Figure 13**.

5.4.3 Rehabilitation Methodology

To aid in the re-establishment of native vegetation over the extraction area a combination of methods will be utilised. Initially topsoil will be distributed over the exhausted areas; a significant number of species will naturally regenerate from the topsoil seedbank. Where certain species are lacking (i.e. major structural species), or are known to not readily regenerate from the topsoil a number of methods will be utilised to re-introduce these species. The revegetation strategy will consist of a schedule that defines species and target plant densities for respective vegetation types in accordance with baseline survey data and recommendations from monitoring events.

Given that vegetation rehabilitation is vulnerable to climatic and other ecological factors (including human intervention), and regeneration of native species follows a pattern of succession over time, rehabilitation areas will be monitored (refer to **Section 5.4.4**) and supplemented where necessary for up to 8-years after initial planting.

5.4.3.1 Next Box Installation

Based on current surveys the project will result in the removal of approximately 77 hollow bearing trees (99 hollows) across the project area. These hollows will be offset at a ratio of 1 nest box for each hollow lost, in addition to lands proposed within the Offset Strategy. However, surveys during clearing will provide the final number of hollows to be replaced as it is likely to change from this initial assessment, as; initial surveys were conducted from the ground, and have an inherent level of inaccuracy; and, a number of hollow-bearing trees have the potential to be avoided as they occur near the edge of the resource (over 30% of the hollows are within 10 m of the resource boundary).



Hollows will be replaced with nest boxes at a ratio of 1:1 within the rehabilitation area. Nest box design will be selected to replace the natural size of removed hollows. Nest boxes will be installed on wooden poles at an approximate height of 3 m within the rehabilitation area. Installation will occur post topsoil spreading and prior to any additional seeding/ planting. Where feasible, hollows harvested from the clearing area will be utilised in place of constructed nest boxes.

5.4.3.2 Redistribution of Vegetation and Timber

Cleared vegetation is proposed to be placed back onto the rehabilitated landform, this provides both a seed source through any retained seed, and habitat. The placement of timber will need to be cognisant of avoiding saturation of the soil surface with timber. In this regard the timber can be positioned partially below ground, and where branching permits protrude above the ground. This variation in placement will provide additional structural diversity and habitat while providing increased soil moisture retention and erosion control. Where timber is considered to be at a density that is likely to prohibit the achievement of required native cover, the timber should be stockpiled for use in later rehabilitation. Any hollows salvaged from the disturbance area, that cannot feasibly be installed to replace hollows removed, will be distributed to provide ground level habitat (these hollows will not contribute to the 1:1 replacement ratio, outlined above).

5.4.3.3 Species Selection and Revegetation Methodology

A large portion of the Project Area has been subject to past disturbance and has been rehabilitated with a broad range of species characteristic of vegetation in the adjoining Subject Land and the broader Tomago Sand Beds. Past rehabilitation in addition to respreading of 300 mm of the topsoil included a combination of methods from direct seeding (with a composite seed mix from the local area), to more targeted planting of tube stock species that were likely to exist pre-mining. This methodology is in part the likely reason for the presence of *Eucalyptus signata, Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus camfieldii*, within communities that would be more commonly dominated by *Angophora costata*.

A list of indicative species that regularly occur across these Coastal Sand Apple – Blackbutt Forest and Coastal Sand Wallum Woodland-Heath vegetation communities is provided in **Table 16**. This listed is based on quadrat data collected by Kleinfelder (full species list in the Ecological Summary Report (Kleinfelder 2016)). This list is not exhaustive and is not intended to be a prescriptive list (i.e. where all species must be present). Overstorey species of the Swamp Mahogany-Broad-leaved Paperbark community are also included, as an opportunity



exists to broaden the existing ecotone from the interface with these communities. This ecotone is typically well defined where topography increases rapidly, however with the removal of the dunes an opportunity exists to broaden the ecotone of this important community, that is considered preferred koala habitat.

Table 16:Typical species present within target vegetation communities, noting this is not
exhaustive or prescriptive (i.e. all species shown should not be present within
all areas).

Stratum	Scientific Name	Common Name	Re-establishment Mode
Ground	#Actinotus helianthi	Flannel Flower	R
Ground	Dianella caerulea	Blue Flax-lily	T, R
Ground	Entolasia stricta	Wiry Panic	R
Ground	Gonocarpus teucrioides	Raspwort	R
Ground	Hardenbergia violacea	Purple Coral Pea	R, O, P
Ground	Imperata cylindrica	Blady Grass	R
Ground	Leptocarpus tenax	Slender Twine rush	R, T
Ground	#Lomandra glauca	Pale Mat-rush	T, R
Ground	#Lomandra longifolia	Spiny-headed Mat-rush	T, R
Ground	Pandorea pandorana subsp. pandorana	Wonga Wonga Vine	R, D, P
Ground	Pomax umbellata	-	R
Shrub	Pteridium esculentum	Common Bracken	R
Ground	Ptilothrix deusta	-	R
Ground	Schoenus ericetorum	Heath Bog-rush	R
Shrub	[#] Acacia longifolia subsp. longifolia	Sydney Golden Wattle	R, O
Shrub	Acacia suaveolens	Sweet Wattle	R, O
Shrub	Acacia terminalis	Sunshine Wattle	R, O
Shrub	#Acacia ulicifolia	Prickly Moses	R, O
Shrub	Actinotus helianthi	Flannel Flower	R
Shrub	Amperea xiphoclada var. xiphoclada	Broom Spurge	R
Shrub	Aotus ericoides	Golden Pea	R, B
Shrub	Astroloma pinifolium	Pine Heath	R, P
Shrub	Banksia oblongifolia	-	B, D, P
Shrub	#Bossiaea heterophylla Variable Bossiaea		R
Shrub	Comesperma ericinum Pyramid Flower		R
Shrub	Conospermum taxifolium	Variable Smoke-bush	R
Shrub	*Dillwynia retorta	Small leaf Parrot pea	R, O
Shrub	#Eriostemon australasius Pink Wax Flower		R, T
Shrub	Gompholobium latifolium	Golden Glory Pea	R, O



Stratum	Scientific Name	Common Name	Re-establishment Mode
Shrub	Haemodorum planifolium	-	R
Shrub	Hibbertia fasciculata	-	R
Shrub	#Hibbertia linearis	Guinea Flower	R
Shrub	Isopogon anemonifolius	Broad- leaf Drumsticks	R
Shrub	Lambertia formosa	Mountain Devils	R, P
Shrub	#Leucopogon ericoides	Pink Beard-heath	R
Shrub	Leucopogon esquamatus		R
Shrub	Leucopogon juniperinus	Prickly Beard-heath	R
Shrub	Leucopogon lanceolatus var. lanceolatus	-	R
Shrub	Macrozamia communis	Burrawang	T, P, D
Shrub	Marsdenia suaveolens	Scented Marsdenia	R
Shrub	Micromyrtus ciliata	Heath- myrtle	R, P
Shrub	Monotoca scoparia	Prickly Broom heath	R
Shrub	Pimelea linifolia subsp. linifolia	Slender Rice-flower	R
Shrub	Platysace ericoides	-	R
Shrub	*Ricinocarpos pinifolius	Wedding Bush	R
Shrub	Tetratheca thymifolia	Thyme Pink-bells	R
Shrub	Woollsia pungens	Woollsia	R
Shrub	Xanthorrhoea glauca	Austral Grass Tree	T, P, D
Mid-Storey	[#] Banksia aemula	Wallum Banksia	P, D
Mid-Storey	[#] Banksia serrata	Old Man Banksia	P, D
Mid-Storey	Leptospermum polygalifolium subsp. cismontanum	Tantoon	B, P
Mid-Storey	#Leptospermum trinervium	Flaky-barked Tea-tree	B, P
Mid-Storey	Melaleuca nodosa	Prickly- leaved Paperbark	R, B, D, P
Mid-Storey	Monotoca elliptica	Tree Broom-heath	B, R, P
Mid-Storey	Persoonia lanceolata	Lance Leaf Geebung	R
Mid-Storey	Persoonia levis	Broad-leaved Geebung	R
Over-storey	#Angophora costata	Smooth-barked Apple	B, D, P
Over-storey	#Corymbia gummifera	Red Bloodwood	B, D, P
Over-storey	#Eucalyptus piperita	Sydney Peppermint	B, D, P
Over-storey	#Eucalyptus signata	Scribbly Gum	B, D, P
Over-storey	#Eucalyptus camfieldii	Camfield's Stringybark	B, D, P
Over-storey	Eucalyptus robusta	Swamp Mahogany	B, D, P
Over-storey	Melaleuca quinquenervia	Broad-leaved Paperbark	B, D, P,

= Key target species for rehabilitation



A number of key species for rehabilitation have been highlighted in **Table 16**. These 'key species' are indicative species of the targeted vegetation communities for the rehabilitation, and their presence will be specifically monitored (**Section 5.4.4**) to ensure the rehabilitation is achieving its performance indicators (**Section 5.4.5**) and completion criteria (**Section 5.4.6**).

The recommended choice of rehabilitation methods for particular plant species is summarised in **Table 16** (re-establishment mode provided in order or preference). This table will be used as a guide to vegetation rehabilitation. Actual methods of rehabilitation may be modified or varied in response to the results of monitoring surveys as detailed in **Section 5.4.4**.

The rehabilitation method proposed through direct respreading of topsoil and transfer of cleared vegetation over the topsoil should improve the success of both the species that store seed in woody fruits/capsules on the branches or canopy of the parent plant (bradysporous species) and for the species that build up a seed bank within the topsoil (geosporous).

Methods of re-establishment are listed below and are abbreviated as follows:

- R Regenerates from topsoil
- **B** Brush matting
- **D** Direct Seeding
- M Mature Specimens retained in quarry path
- **P** Propagation
- **O** Organic Screenings (from processing)
- T Transplanted specimens

Direct Seeding

Locally sourced seed will be used, and will be sown in the soil rather than broadcast. Harvesting of mature seed and direct sowing into re-topsoiled areas at the most appropriate time of year (usually autumn or spring) will be undertaken for species that typically do not readily regenerate from the soil seedbank, such as *Eucalyptus*, *Angophora*, *Banksia* and *Xanthorrhoea*.

Common pioneer (i.e. *Acacia* species and *Actinotus helianthi*) will usually regenerate in abundance and direct seeding is not required. If for any reason they don't germinate within areas of the rehabilitation; they can be introduced in this way.



Brush Matting

Rehabilitation will be facilitated by spreading brush matting composed of plant material cut ahead of the mining face and spread in a thick layer over the rehabilitation areas. Large branches and whole plants are preferred for matting because they will not move in the wind. Brush matting facilitates direct seeding, provides a protected microclimate for developing seedlings, and adds nutrients to the soil.

Where possible individual plant species (especially *Leptospermum*, *Melaleuca* and *Eucalyptus* species) will be harvested when they are bearing mature seed rather than immediately prior to clearing. Bradysporous (seed retaining) species are best harvested and spread in autumn whereas geosporous (seed shedding) species are best harvested immediately prior to annual seed release in late spring.

Propagation and Replanting

The focus of propagation is twofold:

- Dominant structural species that have difficulty establishing naturally or recalcitrant species, and
- Species that are desired for establishment in strategic locations or densities to achieve the revegetation objective.

Seed will be collected locally and supplied to a wholesale nursery for propagation, or alternatively, will be propagated at a local nursery. Planting programs will occur in autumn for optimum seedling establishment success.

Transplanting

Transplanting will be a valuable method of revegetation for certain species (outlined in **Table 16**). The transplanting efforts will focus on mature *Xanthorrhoea* and *Macrozamia* species as they do not readily germinate from the topsoil seedbank. The methodology for transplanting the species is outlined in Table 35 of the EMP (**Appendix 2**).

5.4.3.4 Koala Feed Trees

All canopy species identified within the extension area are potentially important to Koalas in the Port Stephens LGA; these have been identified from multiple sources (**Table 17**). A focus on the revegetation of species that are preferred Koala feed trees will occur where appropriate habitat for these species occurs in the final landform, with the whole rehabilitation area being



returned to supplementary or preferred Koala habitat. This will aim to encourage Koalas into the post extraction landscape.

Scientific Name	Common Name	Source	
Angophora costata	Smooth-barked Apple	Potentially important in LGA (CKPoM)	
Corymbia gummifera	Red Bloodwood	Potentially important in LGA (CKPoM)	
Eucalyptus piperita Sydney Peppermint		Potentially important in LGA (CKPoM)	
		Preferred feed tree in LGA (CKPoM)	
Eucalyptus robusta	Swamp Mahogany	Primary feed tree on North Coast (Recovery Plan)	
		Feed tree (SEPP 44)	
Eucalyptus signata	Scribbly Gum	Feed tree (SEPP 44)	
Melaleuca quinquenervia	Broad-leaved Paperbark	Potentially important in LGA (CKPoM)	

 Table 17:
 Tree species important for Koalas proposed for rehabilitation

5.4.4 Monitoring Methodology

5.4.4.1 Bi-annual Monitoring

The following monitoring methodology will be conducted every six months (bi-annually) across each sector post rehabilitation for a period of three years.

Plot monitoring

Each sector will have points overlaid in a grid fashion at approximately 15 m intervals using a GIS program; these points represent a single sample plot, each $2 \times 2 \text{ m} (4 \text{ m}^2)$. The plot points will be confirmed in the field during the first monitoring event, to ensure each point occurs within the extraction area. These confirmed points will be retained and used for following monitoring events until completion after 3 years.

The pre-confirmed 2 x 2 m quadrat locations will be uploaded on to hand held GPS unit and a qualified ecologist will visits each of these quadrat locations using the GPS. Once the point is located, four 2 m poles will be laid on the ground around the point to define the sample area and the data outlined in **Table 18** will be collected at each point.

Parameter	Details	Description
Species	The total number of different species of plant present.	A measure of biodiversity/ species composition
Plants	The total number of each species present.	A measure of plant/ species density.

Table 18:	Details of	data	collected	at	each survey
	Details of	uata	concelled	aı	cach Survey



Parameter	Details	Description
	The total number of <i>Eucalyptus</i> camfieldii individuals	A measure of the number of individuals per sector
Height	The average height of all plants in the plot.	An indicator of overall growth.
Cover	An estimate of the total plot area having plant cover-percentage of area.	A measure of the total green cover for the rehabilitation area.

Inspection

During all monitoring events an inspection of each sector for weeds, signs of feral pests, erosion, die-off, and site access issues will occur. Any significant problems will be mapped.

Photo Monitoring

A minimum of four photo monitoring points will be established within each sector. Photographs will be taken at the same location and bearing at each monitoring event. A panoramic photograph will be taken at each survey to allow a visual assessment of the rehabilitation progression in future monitoring events.

Reporting

Data will be collected bi-annually and reported on annually. These data will be compared to any previous surveys events to assess the progression of the rehabilitation. Additionally, the rehabilitation will be assessed against the performance indicators outlined in **Table 19**. If the rehabilitation sectors are not meeting these performance indicators, specific management measures (i.e. revegetation measures, weed and pest control and/ or measures for erosion control) will be outlined in the AEMR.

5.4.4.2 Post 3-year Monitoring

The following monitoring methodology will be conducted annually at years four, five and eight post-rehabilitation.

Quadrat Monitoring

One permanent 20 m x 20 m quadrat will be established per hectare of rehabilitation. This quadrat will be used to give a broad scale indication of the rehabilitation structure and diversity. The quadrat location will be in an area that is representative of rehabilitation within the sector. The data collected from each quadrat will include:

• Total species richness.



- Average height.
- Percent foliage cover of each species: recorded from 1 5% and then to the nearest 5%.
- Abundance rating of each species, using the following intervals (numbers above 20 are estimates only): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1,000 or specify a number greater than 1,000 if required.
- Reproductive status and any evidence of second generation plants (succession) will be recorded for each species; and
- General comments; including notes on litter deposition and structural formation.

Photo Monitoring

The photo monitoring points established during bi-annual monitoring will be continued during the post-3 year monitoring. Additionally, a permanent photographic monitoring point will be established in one corner of each quadrat. A panoramic photograph will be taken at each survey to allow a visual assessment of the rehabilitation progression in future monitoring events.

Inspection

During all monitoring events an inspection of each sector for weeds, signs of feral pests, erosion, die-off, and site access issues will occur. Any significant problems will be mapped.

Reporting

The survey data from the post 3-year monitoring will be compared against previous survey events and the performance indicators to assess the progression of the rehabilitation. Any recommendations for revegetation, weed and pest control and any mitigation measures for erosion issues will be outlined in the AEMR. In addition, the eight year survey data will be assessed against the completion criteria (outlined in **Table 20**) to determine whether the rehabilitation sector can be released from further rehabilitation and monitoring.

5.4.5 **Performance Criteria**

At each stage of monitoring the rehabilitation will be compared to the performance indicators outlined in **Table 19**. If the rehabilitation areas are not meeting these performance indicators specific management measures will be developed to remedy the deficiencies.



Year	Aims for Each Strategic Ecosystem Development Stage	Performance Indicators
1		 Early pioneer stage appearing: Small seedlings (< 5 cm) regenerating from topsoil, < 5% surface cover. Brush-matting evident. Woody debris (>10 cm diameter) does not exceed 20% of the ground surface cover. Local seed has been collected and is stored appropriately for direct seeding or propagation.
2	 Monitoring will be on a bi-annual basis until achieving the early pioneer stage, with the following features: Topsoil stabilized by primary colonizers (e.g. acacias & pea species). Key species present, including tree species important for Koalas and <i>Eucalyptus camfieldii.</i> No significant erosion problems. Weed control program in place. 	 Natural regeneration of pioneer species occurring. Seedlings developing under brush-matting. Cover of 10 - 20% of ground surface. Plant height and density in each strata increasing Trees and shrubs not present, but expected are planted (based on deficiencies identified in Year 1 monitoring), including tree species important for Koalas and <i>Eucalyptus camfieldii</i>. No significant erosion problems. Weed control program in place.
3		 Mid and over-storey species are present. Shrub layer and ground cover strata evident. Natural regeneration covering 30 - 50% of surface. Key species present across sector, including tree species important for Koalas and <i>Eucalyptus camfieldii</i>. No significant erosion problems. Weed control programme in place and weeds successfully controlled.
4	 Single annual monitoring event to determine development of mature pioneer stage characterised by: Gradual dieback of some primary colonizers. Appearance of mature vegetation. Key species present. 	 Key .species present across each sector, including tree species important for Koalas. Number of <i>Eucalyptus camfieldii</i> individuals approaching the numbers removed from the extraction area Mature pioneer stage evident; cover 50 – 70% No significant erosion problems. Weed control programme in place and weeds successfully controlled.
5	 Beginning of differentiation of structural layers (canopy, sub-canopy, shrub layer). No significant erosion problems. Weed control program in place. 	 Decline in pioneer community, coinciding with emergence in canopy species. Canopy layer emerging above shrub layer. No significant erosion problems. Weed control programme in place and weeds successfully controlled.

Table 19: Performance criteria for rehabilitation



Year	Aims for Each Strategic Ecosystem Development Stage	Performance Indicators
8	 Single monitoring event to determine development of early stages of mature vegetation assemblage characterised by: Key species present. Species composition similar to premining. 	 Overstorey and midstorey species increasing in height and percentage cover. Overstorey and midstorey species density stable. Key species present across each sector. Overstorey layer evident above shrub layer. Number of <i>Eucalyptus camfieldii</i> individuals present at, or above, numbers removed from extraction area.

Completion Criteria 5.4.6

At the end of the project life the rehabilitation will be assessed against the completion criteria set out in Table 20. Each rehabilitation sector will be assessed against these completion criteria to determine eligibility of operational areas for release from further rehabilitation or monitoring, and if the rehabilitation bond can be released.

The Completion Criteria will be independently audited to assess whether the adopted criteria are reasonable performance indicators for the rehabilitation, relative to its age. Monitoring of the rehabilitation post mining should be conducted until such time that these completion criteria are met or there is a high degree of confidence that based on monitoring undertaken the rehabilitation is on the correct trajectory to meeting those levels.

Table 20: Completion criteria for rehabilitation			
Completion Indicator	Completion Criteria		
Topsoil coverage across the rehabilitation area.	100% topsoil cover.		
Similar species composition to pre- extraction at similar topographic levels.	Species composition of the rehabilitation similar to Coastal Sand Apple – Blackbutt Forest and/ or Coastal Sand Wallum Woodland- Heath.		
Canopy average height.	Canopy >1.5 m tall (average at 8 years).		
Midstorey average height.	Midstorey >1 m tall (average at 8 years).		
Shrub layer average height.	Shrubs 90 cm tall (average at 8 years).		
Vegetation cover	Vegetation cover present across 90% of each sector (assessed via inspection), with no bare areas >25 m ² (i.e. 5 m x 5 m). Bare area defined as no foliage cover.		
	Key species present across the rehabilitation sector.		
Key species	Tree species important for Koalas present across the rehabilitation sector.		
	Eucalyptus camfieldii present at, or above, numbers removed from		

Table 20:	Completion	criteria fo	r rehabilitation

Litter development.

Early litter development evident.

sector.



Completion Indicator	Completion Criteria
Woody debris	Woody debris (>10 cm diameter) does not exceed 20% of the ground surface cover.

5.5 KOALA SPECIFIC MITIGATION MEASURES

The EMP (**Appendix 2**) details the specific mitigation measures that will be implemented throughout the operational phase of the quarry. Mitigation measures that relate to the Koala, including specific measures for the species are outlined in the following section.

5.5.1 Vehicle Mortality

A specific Koala exclusion fence will be installed along the frontage to Cabbage Tree Road to limit the potential of vehicle strikes. This fence will be installed in accordance with the design specification outlined in the *Koala-sensitive Design Guideline* (DEHP 2012); either a floppy top fence, or a fence with a smooth metal or perspex top will be installed. One-way fauna valves will be installed along the fence, for circumstances where Koalas (or other fauna) are trapped on the road side of the fence. This fence line will be extended into the Subject Land, along the access road to the weighbridge. This initial section of internal road was assessed as having the greatest potential for impact due to low visibility around the corner entering the site. For this section of road, speed limits will be 40 km/hr. For all other sections of road that will not be fenced, speed limits will be 20 km/hr. The visibility of Koalas along internal roads will be increased through the management of roadside vegetation and trimming of over-hanging vegetation.

5.5.2 Vegetation Clearing

The following standard mitigation measures will be implemented to limit impacts on locally occurring fauna, including the Koala:

- Pre-clearing surveys within the area proposed for clearing each day:
 - Nocturnal surveys will be conducted the night before clearing, and diurnal surveys will be conducted the morning of clearing, prior to commencement; and
 - o The procedure for when a Koala is identified within the clearing area is outlined below.
- All clearing will be supervised by a suitable qualified ecologist; and
- Clearing will not create vegetation islands: clearing will occur from disturbed areas towards vegetated areas.



The following procedure will be used if a Koala is identified as occupying a tree within the proposed clearing area. The aim of this capture and relocation procedure is to ensure that no Koalas are harmed during the vegetation clearing activities within the extraction area:

- The individual will be captured prior to the commencement of clearing;
- The individual will be given a veterinary check for any disease or illness and a monitoring device will be attached (remote tracker);
- Any Koalas captured will be relocated into an area of retained vegetation adjacent to where it was originally located;
- All individuals will be monitored for a three-month period post relocation; and
- Where any Koalas are identified and captured for re-location, the following will be reported on:
 - o Location identified within the disturbance area, and location of relocation;
 - o Movement of the Koala will be mapped for the three-month period;
 - Any instances where the Koala enters areas proposed for future clearing will be identified, and the need for further monitoring/action determined. If there is the potential for the individual to occur within areas of future vegetation clearing, a plan to ensure the individual is not impacted will be developed; and
 - o The health of the individual will be checked at the end of the three-month period and any impacts (i.e. dog attacks, vehicle strikes, bushfire impacts, or disease) will be identified.

This relocation method for Koalas is deemed to be an appropriate mitigation measure for any identified Koalas within the impact area. Assessment of the potential impact on the species (see **Section 4.1.3**) indicates that if the removal of vegetation from the extraction area impacts on the home range of an individual, it is unlikely to significantly impact on the local population due to the large area of available habitat within the Tomago Sandbeds KMU. Lunney *et al.* (2007) modelled the carrying capacity of the Port Stephens area to be a maximum of 2,500 individuals. However, the population within the same area was estimated to be only 350 – 800 individuals (Lunney *et al.* 2007). Based on this assessment, there is a large amount of available habitat within the locality that is either un-occupied, or could potentially support a higher density of Koalas. As such, it is likely that any potentially displaced individuals from within the disturbance area would be able to self-relocate to areas of suitable habitat within and adjacent to the Subject Land. The potential for impacts on Koala welfare, from anthropogenic sources would not be increased using the self-relocation methodology. The vegetation within the disturbance area is connected to the north and individuals would not need to intersect any hostile barriers (i.e. roads) to access this habitat.



Long distance translocations are usually only required when all available habitat on a site is being cleared, and there is no suitable habitat adjacent to the site. In these situations it is unethical to allow displaced Koalas to move through areas where there is the potential for injury or death (i.e. residential properties and/ or roads). As such, translocation of any Koalas occurring within the extraction area, to areas of suitable habitat away from the site, is considered unlikely to be warranted as the preference is to allow Koalas to self-relocate to adjacent existing habitat. If at any point during the operational phase of the project, translocation is deemed to be necessary, a translocation plan will be prepared in consultation with the relevant authorities (i.e. OEH and Port Stephens Council).

5.5.3 Monitoring of Mitigation Measures

Infra-red cameras will be used to monitor the Koala exclusion fence and the one-way fauna valves during the breeding season (September to February) when Koalas are most active, for two years post construction. This will help inform future design of similar structures and demonstrate if the structures are effective, both for Koalas and other locally occurring fauna species.



6. RESIDUAL IMPACTS / PROPOSED OFFSETS

6.1 RESIDUAL IMPACTS ON RELEVANT MNES

The residual impacts of the proposal include the clearing of 40.38 ha of native vegetation which includes:

- 40.38 ha of Koala habitat;
- 40.38 ha of Grey-headed Flying-fox habitat;
- 227 individuals of *Eucalyptus camfieldii*; and
- 230 individuals of *Eucalyptus parramattensis* subsp. decadens.

These residual impacts have been offset as part of the offset package proposed to satisfy the State Legislation requirements. The details of the offset package have been outlined below. Additionally, the offsets have been assessed against the EPBC Act offset assessment guide.

6.2 OFFSET STRATEGY

6.2.1 Introduction

A biodiversity offset strategy for the Cabbage Tree Road Sand Quarry was prepared by Kleinfelder (2016) (see **Appendix 7**). To determine the offset requirements of the proposal, the assessment was conducted in accordance with the Biobanking Assessment Methodology (BBAM) 2014 and the *NSW OEH Interim Policy on Assessing and Offsetting Biodiversity Impacts of Part 3A, State Significant Development (SSD) and Stage Significant Infrastructure (SSI) Projects* (OEH 2011b).

The Biodiversity Offset Strategy proposes that the land not subject to development be secured as a biobank site via a biobanking agreement under the TSC Act to ensure its in-perpetuity protection. The proposed biobank site is 131.12 ha and occupies the majority of the remaining areas of the Subject Land. The Biodiversity Offset Strategy also proposes the purchase of offsite lands, also to be secured as a biobank site via a biobanking agreement under the TSC Act.



State Approval

OEH has reviewed the Biodiversity Offset Strategy and has provided written endorsement (**Appendix 8**). The details regarding the appropriate location of offsite offsets are still being discussed with OEH and PSC, and written approval of the Biodiversity Offset Strategy is likely to be granted once the exact offset sites have been identified and obtained.

6.2.2 Description of the Offset Site

The total area of the Subject Land is 176.1 ha. The development site (42.3 ha) is located in the western and central parts of the Subject Land, within the areas of higher elevation. This impact area is inclusive of all extraction and operational areas that would be impacted by the proposal. The majority of the development site is within Lot 1 in DP224587, with a small area extending through the central portions of Lot 121 in DP 556403 and Lot 11 in DP 629503. It is proposed that the majority of the land not subject to development be secured as a biobank site.

The proposed biobank is 131.12 ha and occupies the majority of the remaining areas of the Subject Land (130.14 ha of native vegetation and 0.99 ha cleared tracks). There is a small area of exotic vegetation (1.26 ha) in the south east corner of the Subject Land and a small strip of land along the south-western boundary (1.46 ha), both of which have been excluded from the proposed biobank, see Figure 2 in the Offset Strategy (**Appendix 7**).

6.2.3 Biodiversity Credit Assessment

An assessment of the development site and biobank site was undertaken in accordance with BBAM 2014. The assessment and results are fully detailed in the Biodiversity Offset Strategy, which is attached to this report in **Appendix 7**. The assessment determined that the impact at the development site requires a total of 2,207 ecosystems credits for impact on HU860 and 17,479 *Eucalyptus camfieldii*, 3,220 *Eucalyptus parramattensis* subsp. *decadens*, 525 Eastern Osprey, 1,050 Koala and 9 Wallum Froglet species credits. As Grey-headed Flying-fox is an ecosystem credit species, it is addressed as part of the ecosystem credits for impact on HU860.

The assessment determined that the biobank site would generate a total of 1,189 ecosystem credits, and 11,651 *Eucalyptus camfieldii*, 4,501 *Eucalyptus parramattensis* subsp. *decadens*,



724 *Grevillea parviflora* subsp. *parviflora*, 717 Eastern Osprey, 744 Koala and 606 Wallum Froglet species credits.

Table 21 summarises the credits generated at the impact site and the credits that will be retired at the biobank to fulfil, or partially fulfil these credit requirements.

Credit Type	Credits Requirements (Impact Site)	Credits at the Biobank: To be Retired (% of credit requirement meet)	
	2,207	HU860	273
		HU851	311
		HU917	80
HU860 Ecosystem Credits		HU965	22
		HU938	388
		HU948	115
		Total	1,189 (54% of credits required)
	17,479	Eucalyptus camfieldii	11,651
		Eucalyptus parramattensis subsp. decadens	1,281
Eucalyptus camfieldii		Grevillea parviflora subsp. parviflora	724
		Total	13,656 (78% of credits required)
Eucalyptus parramattensis subsp. decadens	3,220	3,220 (100% of credits required)	
Koala	1,050	744 (71% of credits required)	

 Table 21:
 Biodiversity credit ledger

It is proposed to retire all ecosystem credits created at the biobank site (total 1,189 ecosystem credits), as per variation criterion (f) for mitigated net loss (tier 3) under the Interim Policy, to partially fulfil the ecosystem credit requirements at the development site, this would fulfil 54% of the ecosystem credit requirements. This variation criterion allows for conversion of ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar. The proposed biobank is of high conservation value due to its location, as it occurs adjacent to Tilligerry SCA, proposed Hunter Water biobank sites and mapped fauna habitat and corridors; quality of vegetation, as it supports moderate to good vegetation that is predominantly old-growth; and the presence of threatened species and ecological communities within the site.



Williamtown Sand Syndicate are committed to retiring between 80% - 85% of the required ecosystem credits for the development, utilising the ecosystem credits generated at the onsite biobank and additional credits available at a potential off-site biobank located to the east of Williamtown Airport. The retirement of this proportion of ecosystem credits is considered adequate for the proposed development, given that the impact area predominantly contains rehabilitated or regenerating vegetation (54% of the impact area), and the majority of the vegetation within the on-site and potential off-site biobank sites is old-growth forest. Additionally, both the on-site and potential offsite biobanks contain a threatened ecological community (Swamp Sclerophyll Forest) and multiple threatened species (based on historical records).

The biobank site fulfils the species credit requirements for impacts on *Eucalyptus parramattensis* subsp. *decadens* (and other state threatened species, including Eastern Osprey and Wallum Froglet). The biobank site does not generate enough species credits for *Eucalyptus camfieldii*, with a shortfall of 5,828 species credits, and the Koala, with a shortfall of 306 species credits.

The biobank fulfils 67% of the species credits required for Eucalyptus camfieldii at the development site. As such it is proposed to apply Variation Criteria (B) - Convert one type of species credit to another type of species credit with the same or more endangered conservation status, under Tier 3: Negotiation a "Mitigated Net Loss Outcome" of the OEH Interim Policy (OEH 2011b). There are residual species credits generated at the Biobank site for E. parramattensis subsp. decadens (1,281) and G. parviflora subsp. parviflora (724). As such the total number of species credits available at the biobank to offset impacts on E. camfieldii at the development site is 13,656 (78% of the required 17,479 credits). The fulfilment of 78% of the required E. camfieldii species credits is considered adequate. As the majority of the E. camfieldii within the development site is part of a planted (rehabilitated) population, it is highly unlikely that the species would have been present in this area prior to rehabilitation. Additionally, the species will be replanted within the rehabilitation area, as it will represent potential habitat for the species due to the lower elevation of the final landform. Furthermore, there are additional species credits generated at the biobank for both the Eastern Osprey and Wallum Froglet. While these fauna species credits may not directly transfer to offset impacts against E. camfieldii, WSS propose to retire these credits as part of the offset package for the development.

Williamtown Sand Syndicate are committed to retiring the remaining 306 Koala species credits at an off-site offset within the Tomago Sandbeds KMU. Williamtown Sand Syndicate are



currently investigating potential freehold land to the east of Williamtown Airport to establish a biobank. Based on a desktop assessment, the land contains preferred and supplementary Koala habitat and could potentially fulfil the remaining Koala credit requirements, within the Tomago Sandbeds KMU.

6.2.4 Security of the Offset

The biobank site will be secured on title under the provisions of the BioBanking Scheme or under the provisions of the *Biodiversity Conservation Act 2016* (BC Act) for stewardship sites. Any off-site offsets that supply credits for the Project will also be secured on title under the provisions of the BioBanking Scheme or under the provisions of BC Act for stewardship sites.

6.2.5 Management of the Offset

The biobank site will be managed in accordance with the BBAM 2014, which makes provisions for standard management actions to be implemented in perpetuity under a management plan established as part of the BioBanking Agreement (or Biodiversity Stewardship Agreement under the BC Act).

Specific management actions proposed for the biobank site to address each of the standard and relevant additional management actions listed under BBAM 2014 have also been outlined below to enable retirement of ecosystem and species credits. Key management actions include weed control, vertebrate pest control, installation and maintenance of fencing and signage, preparation and implementation of a fire management plan, and erosion and sediment control.

6.2.5.1 Management Actions

Retirement of biodiversity credits requires certain management actions to be implemented that underpin the predicted improvements to biodiversity values on the biobank site. These management actions are divided into two categories: standard management actions required for all biobank sites and additional management actions required for certain vegetation types and species.

The specific actions proposed for each standard and additional management action category for the biobank site are set out in **Table 22** and **Table 23** respectively. The additional actions



are also listed in the biobanking credit report for the biobank site (appended to the Biodiversity Offset Strategy (**Appendix 7**).

Specific details on the management actions to be undertaken at the biobank site would be provided as part of the biobanking agreement and will be detailed in the Management Actions Template.

Standard management action category	Proposed actions		
Management of grazing for conservation	 Installation and/or maintenance of stock exclusion fencing (wildlife friendly) along external property boundaries. 		
Weed control	Preparation and implementation of a weed control action plan.		
Management of fire for conservation	Preparation and implementation of a fire management plan.		
Management of human disturbance	 Installation and/or maintenance of fencing along boundaries to discourage encroachment of adjoining landholders and restrict recreational activities (e.g. trail bike riding, horse riding and hunting). Restriction of vehicular access to the site by road. Installation of signage at appropriate locations. Liaison with adjoining landholders (where appropriate). 		
 Installation and/or maintenance of fencing along certain boun Permitted clearing provisions of the NSW Native Vegetation extinguished. Firewood collection and timber harvesting are not permitted. 			
Replanting or supplementary planting where natural regeneration will not be sufficient	 Implementation of the planting actions. 		
 Installation and/or maintenance of fencing or markers boundaries. Restriction of vehicular access to the site by road. Installation of signage at appropriate locations. 			
Erosion control	Repair existing tracks displaying active erosion.Implementation of the erosion control actions.		
Retention of rocks	 Installation and/or maintenance of fencing along land boundaries. Restriction of vehicular access to the site by road. Installation of signage at appropriate locations. 		
Note: These management actions are required to be considered under the BBAM; however, it is noted that not all			

Table 22:	Standard management actions for biobank sites.
-----------	--

	Additional management actions nominal family a kick and aits
i able 23:	Additional management actions required for the biobank site.

Additional management action category	PCTs and species credit species to be targeted	Proposed actions
Control exotic pest fish species (within dams)	Wallum Froglet	No dams were identified within Wallum Froglet habitat: HU851, HU865, HU917, HU948, HU938.

are applicable to the site.



Additional management action category	PCTs and species credit species to be targeted	Proposed actions
Control of feral pigs	HU917, HU948	The implementation of the vertebrate pest management plan.
Exclude commercial apiaries	HU851, HU860, HU865, HU938	No establishment of commercial apiaries within the site.
Exclude miscellaneous feral species	HU851, HU860, HU865, HU938 Koala	The implementation of the vertebrate pest management plan.
Feral and/or overabundant native herbivore control	HU851, HU860, HU865, HU917, HU938, HU948 <i>E. parramattensis</i> subsp. <i>decadens</i>	No evidence of overabundant native herbivores (e.g. heavily grazed vegetation or large areas of bare ground) was observed during the assessment.
Fox control	HU851, HU860, HU865, HU917, HU938, HU948	The implementation of the vertebrate pest management plan.
Maintain or re-introduce natural flow regimes	Eastern Osprey, Wallum Froglet	No natural drainage lines identified within the site. A water management plan will be implemented to ensure run-off from the development site is managed.
Slashing	HU851, HU860, HU865, HU917, HU938, HU948 <i>E. parramattensis</i> subsp. <i>decadens,</i> Koala, Wallum Froglet	The exclusion of slashing would be achieved through installation and maintenance of boundary fencing.

6.2.5.2 Management Actions for Site Attribute Increase

Within Management Zone 8 of the biobank, the site attribute score for overstorey cover was increased by 1.5 rather than by 1 in accordance with Appendix 7 of the BBAM 2014. The current score for this site attribute within Zone 8 is 1, therefore the future site score of this attribute will be 2.5 rather than 2, if no additional management actions were undertaken.

To increase the overstorey cover attribute score from 1 to 2.5, it must be documented how additional management actions will achieve >50% - <75% or >100 - <125% of the percent native overstorey cover benchmark for the nominated PCT.

The overstorey benchmark for Zone 8 (HU938) is 15% - 70%. Currently the overstorey cover within the zone is an average of 4%. To allow for the increase in the site attribute, it is proposed to increase overstorey cover of the zone to approximately 53% (75% of the upper benchmark), which would represent an increase of 49% through additional planting within the zone. To achieve this target it is proposed to plant 1,347 overstorey species within Zone 8 (**Table 24**). Only tree species characteristic of this PCT will be used in the planting, these will include *Eucalyptus robusta* and *Melaleuca quinquenervia*.



If the Zone is 11,570 m², then an additional 54,115 m² of overstorey foliage cover will be needed to achieve the target (increase by 49%). The calculation for the number of overstorey trees required to achieve the target is based on one mature overstorey species within a Swamp Forest having a foliage cover of 50 m², resulting in 1,122 plants required. An additional 20% was added to this planting number as a contingency.

Target Cover	53%
Existing Cover Across Zone (Average Cover)	4%
Additional Cover Required to Achieve Target	49%
Area of Zone 8	11,570 m ²
Area of Overstorey Foliage Cover to Achieve Target	56,115 m ²
Cover of One Mature Canopy Tree in Swamp Forest	50 m ²
Number of Plants Required to Achieve Target	1,122
Number of Plants Required to Achieve Target + 20% Contingency	1,347

Table 24: Planting strategy to achieve overstorey cover target

6.2.6 EPBC Act Offset Assessment Guide

An assessment of the suitability of the offset package proposed to fulfil the State Legislation requirements has been assessed in the following sections against the EPBC Act offset assessment guide. This has been conducted for species that were identified (or assumed present) within the Subject Land and have the potential to be impacted on by the proposed action.

6.2.6.1 *Eucalyptus camfieldii* and *Eucalyptus parramattensis* subsp. *decadens*

Impact Calculator

The proposed action will impact on a total of 227 *Eucalyptus camfieldii* individuals and 230 *Eucalyptus parramattensis* subsp. *decadens* individuals.

Offset Calculator

Start Value

The proposed offset area includes a total of 1,641 *Eucalyptus camfieldii* individuals and 634 *Eucalyptus parramattensis* subsp. *decadens* individuals.



Time Until Ecological Benefit (Time Horizon)

The majority of the offset area contains remnant vegetation with few management issues, as such the time until ecological benefit is only the time taken to establish and implement the biobanking agreement. As all offsets will be secured prior to the commencement of the activity within the offset assessment guide, a timeframe of 1 year has been input for both species.

Future Value Without Offset

The land proposed for the offset is currently zoned RU2 – Rural Landscape, and as such has the potential to be subdivided into a maximum of four allotments and subject to separate ownership and management. Due to ecological constraints within the offset area (low lying land, threatened species and ecological communities) it is unlikely that the whole offset area would be lost. However, the site constraints would not limit the installation of rural fencing and infrastructure, and access tracks. Additionally, the environmental compliance record of the individual owners cannot be assured. As such, the risk of loss without the offset was assessed as a potential 50% population reduction. A future value without offset of 821 individuals for *Eucalyptus camfieldii* and 317 individuals for *Eucalyptus parramattensis* subsp. *decadens* was input into the calculator.

Future Value with Offset

The future value with offset has been input as 1,641 for *Eucalyptus camfieldii* and 634 for *Eucalyptus parramattensis* subsp. *decadens*. No increase in the population has been assumed (over the 20-year period), due to the slow growing nature of these species (tree species).

Confidence in Result

A confidence level of 95% was given to level of certainty about the success of the proposed offset. All management actions required to be implemented as part of the offset will be incorporated into the biobanking agreement. The targets of the biobanking agreement will be monitored and reported to the State Government (OEH), and audits by the State Government are conducted as part of the biobank agreement.

Net Present Value

The net present value output from the offset assessment guide for *E. camfieldii* was 778.39, which offsets 342.90% of the impacts on the species. The net present value output from the offset assessment guide for *E. parramattensis* subsp. *decadens* is 300.55 individuals, which



offsets 130.67% of the impacts on the species. As such the minimum 90% direct offsets requirement is met for both these species.

6.2.6.2 Koala

Impact Calculator

The proposed action will impact on a total of 40.38 ha of Koala habitat. The site has been assessed as containing habitat with a value of 7, based on the Koala habitat assessment tool detailed in the *EPBC Act Referral Guidelines for the Vulnerable Koala Combined populations of Queensland, New South Wales and the Australian Capital Territory.*

The output from the calculator determined that the total quantum of impact (adjusted hectares) is 28.26 ha.

Offset Calculator

Start Area and Quality of Habitat

The proposed offset area is 130.14 ha, of which 104.78 ha represents suitable Koala habitat, including; Swamp Mahogany – Paperbark Swamp Forest (remnant and regenerating), Tomago Sand Swamp Woodland, Coastal Sand Apple – Blackbutt Forest (Remnant, Regenerating and Rehabilitation) and Coastal Sand Wallum Woodland-Heath.

An assessment of the Koala habitat within the proposed on-site offset against the Koala habitat assessment tool within the *EPBC Act Referral Guidelines for the Vulnerable Koala Combined populations of Queensland, New South Wales and the Australian Capital Territory* is provided in the table below.

Attribute	Score	Discussion
Koala Occurrence	+1	 EPBC PMST report identified the species or species habitat known to occur in area. The species was identified within the southern portion of the Subject Land (outside the extraction area) during surveys in 2011. No evidence of the species was identified within the extraction area (or the Subject Land) during surveys in 2015, however this is likely due to impacts from the 2013 bushfire.

Table 25: Assessment of Koala habitat against EPBC Act Referral Guidelines assessment tool



Attribute	Score	Discussion
		• Post-2013 bushfire, there are seven records of the species within 5 km of the Subject Land (within the KMU).
Vegetation Composition	+2	• The vegetation associations in the extraction area have been mapped as either preferred or supplementary habitat (as defined by the CKPoM; PSC 2002). The rehabilitation area was defined as preferred habitat due to the occurrence of <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> and <i>Eucalyptus signata</i> , while the remnant forest is classified as supplementary habitat.
Habitat Connectivity	+2	• The extraction area is connected to a large expanse of vegetation (>500 ha) to the north of the Subject Land.
Key Existing Threats	+1	• Vehicle strikes and dog attacks have been identified as a key threat to the Port Stephens population. The exact level of vehicle strikes and dog attacks in the area is not known. However, evidence of dogs (tracks) was observed within the Subject Land along the access track that runs through the extraction area.
Recovery Value	+1	 Uncertain whether the habitat is important for achieving the interim recovery objectives, as it is not known if the habitat is: Of sufficient size to be genetically robust/operate as a viable sub-population, or Free of disease or have low incidence of disease, or Breeding.
Total Score	7	

The offset site was assessed as containing habitat with a value of 7. As the areas of Swamp Mahogany – Paperbark Swamp Forest (Regenerating) and Coastal Sand Apple – Blackbutt Forest (Regenerating) currently only contain scattered canopy trees (total of 17.28 ha of the offset area – 16%), the habitat quality of the offset area was revised to 6 for the offset assessment guide.

The future quality of the habitat without the offset was assessed as declining slightly to a score of 5. Any future development that may occur within or surrounding the land has the potential to degrade that habitat on site. The future quality of the habitat within the offset is likely to increase due to management actions to a score of 8. This will be achieved through planting of preferred feed trees, weed control, pest control and maintaining connectivity.

Time Over Which Loss is Averted

As the proposed offset will be secured under a biobanking agreement (in-perpetuity measure), the maximum timeframe of 20 years was used.



Time Until Ecological Benefit

The majority of the offset area contains remnant vegetation with few management issues, as such the time until ecological benefit is only the time taken to establish and implement the biobanking agreement. As all offsets will be secured prior to the commencement of the activity, for the majority of the site the ecological benefit will be immediate. For the 17.28 ha of regenerating vegetation (16% of the offset site), rehabilitation works (tree planting) and natural regeneration of the canopy are required to achieve ecological benefits. These works could take up to 20 years for benefits to be realised. As such, within the offset assessment guide, a timeframe of 10 years has been input.

Risk of Loss

The land proposed for the offset is currently zoned RU2 – Rural Landscape, and as such has the potential to be subdivided into a maximum of four allotments and subject to separate ownership and management. Due to ecological constraints within the offset area (low lying land, threatened species and ecological communities) it is unlikely that the whole offset area would be lost. However, the site constraints would not limit the installation of rural fencing and infrastructure, and access tracks. Additionally, the environmental compliance record of the individual owners cannot be assured. As such the risk of loss without the offset was assessed as 50%.

The risk of loss with the offset is very low due to the mechanism that will be implemented to secure the land (biobank agreement). However, the risk of loss cannot be 100% guaranteed, due to potential for boundary encroachment, policy/ legislation changes, as such the risk of loss within the offset is assessed as 5%.

Confidence in Result

A confidence level of 95% was given to both the change in habitat quality and averted loss components.

All management actions required to be implemented as part of the offset will be incorporated into the biobanking agreement. The targets of the biobanking agreement will be monitored and reported to the State Government (OEH), and audits by the State Government are conducted as part of the biobank agreement.

The confidence in the averted loss is also due to the implementation of a biobank agreement over the site, which is the State Government's preferred offsetting mechanism. The potential



for loss of the land once the biobank agreement is enacted is low due to the legislative protection the mechanism provides.

Net Present Value

The net present value output from the offset assessment guide was 49.07 ha, which offsets 173.59% of the impacts. As such the minimum 90% direct offsets requirement is met for the species.

6.2.6.3 Grey-headed Flying-fox

Impact Calculator

The proposed action will impact on a total of 40.38 ha of Grey-headed Flying-fox habitat. The habitat quality within the impact area was assessed as 8. While there is a large area of available foraging habitat, the impact area lacks winter flowering Eucalypt species (e.g. *Eucalyptus robusta*) and fruit resources. The output from the calculator determined that the total quantum of impact (adjusted hectares) is 32.30 ha.

Offset Calculator

Start Area and Quality of Habitat

The proposed offset area is 130.14 ha, all of which represents suitable foraging habitat for the species. The offset site was assessed as containing habitat with a value of 9. The offset area contains a range of Eucalypt species, including the winter flowering *E. robusta*, but lacks any fruit resources.

The future quality of the habitat both with and without the offset was assessed as 9. While the area of habitat may change without offsetting (due to potential development), it is unlikely that the quality of habitat for the species would change. While the proposed management actions would increase the quality of the vegetation in general, they are unlikely to impact on the quality of the habitat for the Grey-headed Flying-fox as resources are unlikely to be affected by the proposed management (slight increase in tree number due to planting, but not assessed as large enough to increase score).

Time Over Which Loss is Averted

As the proposed offset will be secured under a biobanking agreement (in-perpetuity measure), the maximum timeframe of 20 years was used.


Time Until Ecological Benefit

The majority of the offset area contains remnant vegetation with few management issues, as such the time until ecological benefit is only the time taken to establish and implement the biobanking agreement. As all offsets will be secured prior to the commencement of the activity, for the Grey-headed Flying-fox within the site the ecological benefit will be immediate. As such, within the offset assessment guide, a timeframe of 1 year has been input.

Risk of Loss

The land proposed for the offset is currently zoned RU2 – Rural Landscape, and as such has the potential to be subdivided into a maximum of four allotments and subject to separate ownership and management. Due to ecological constraints within the offset area (low lying land, threatened species and ecological communities) it is unlikely that the whole offset area would be lost. However, the site constraints would not limit the installation of rural fencing and infrastructure, and access tracks. Additionally, the environmental compliance record of the individual owners cannot be assured. As such the risk of loss without the offset was assessed as 50%.

The risk of loss with the offset is very low due to the mechanism that will be implemented to secure the land (biobank agreement). However, the risk of loss cannot be 100% guaranteed, due to potential for boundary encroachment, policy/ legislation changes, as such the risk of loss with the offset is assessed as 5%.

Confidence in Result

A confidence level of 95% was given to both the change in habitat quality and averted loss components.

All management actions required to be implemented as part of the offset will be incorporated into the biobanking agreement. The targets of the biobanking agreement will be monitored and reported to the State Government (OEH), and audits by the State Government are conducted as part of the biobank agreement.

The confidence in the averted loss is also due to the implementation of a biobank agreement over the site, which is the State Government's preferred offsetting mechanism. The potential for loss of the land once the biobank agreement is enacted is low due to the legislative protection the mechanism provides.



Net Present Value

The net present value output from the offset assessment guide was 48.11 ha, which offsets 148.93% of the impacts. As such the minimum 90% direct offsets requirement is met for the species.



7. OTHER APPROVALS AND CONDITIONS

The proposed sand quarry will be required to operate in accordance with the following approvals, licences and conditions (if granted):

- Terms of the lease for the subject land with Port Stephens Council;
- Conditions of a NSW Project Approval;
- Terms of approval granted by the Hunter Water Corporation (HWC) to enable works to occur within a special area pursuant to the *Hunter Water Corporation Limited (Special Areas) Regulation 1997.* Expected to be consistent with correspondence with HWC;
- Works Authorisation Deed (WAD) for the construction of the intersection onto Cabbage Tree Road granted by the NSW Roads and Maritime Service (RMS);
- Environmental Protection Licence (EPL) under the NSW Protection of Environment Operations Act 1997; and
- Conditions of a Commonwealth EPBC Act approval.



8. SOCIAL AND ECONOMIC

8.1 DETAILS OF PUBLIC CONSULTATION ACTIVITIES

This Section describes WSS' engagement and consultation program with the local community since the EIS was exhibited and includes a description of:

- The goals and context of the consultation program.
- The communication and consultation methods that WSS has used.
- Outcomes of the consultation program.
- WSS' ongoing consultation program for the project.

8.1.1 Goals of the Consultation Program

WSS is committed to open and constructive consultation with the local community. The primary objectives of the consultation program during the post-EIS exhibition phase to date have been to describe the changes made to the Project in response to the issues raised in the EIS submissions and to achieve broad understanding of how these project changes aim to reduce the project's potential impact on the environment and the community.

Good industry practice (or leading practice) consultation guidelines include those from the International Finance Corporation's Performance Standards on Environmental and Social Sustainability (Performance Standards) (IFC, 2012). While WSS will not be seeking project investment funding from international finance institutions who require their clients to apply the Performance Standards in the assessment and management of project environmental and social risks, the principles of the Performance Standards in relation to engagement and consultation have been used as a framework to plan and conduct community consultation.

The IFC's Performance Standard 1: Assessment and Management of Social and Environmental and Social Risks and Impacts, paragraph 30, states (IFC, 2012):

When Affected Communities are subject to identified risks and adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them. The extent and degree of engagement required by the consultation process should be commensurate with the project's risks and adverse impacts and with the concerns raised by the Affected Communities. Effective consultation is a two-way process that should: (i) begin early in the process of identification of environmental and social risks and impacts and continue on an ongoing basis as risks and impacts arise; (ii) be based on the prior disclosure and dissemination of relevant, transparent, objective,



meaningful and easily accessible information which is in a culturally appropriate local language(s) and format and is understandable to Affected Communities; (iii) focus inclusive engagement on those directly affected as opposed to those not directly affected; (iv) be free of external manipulation, interference, coercion, or intimidation; (v) enable meaningful participation, where applicable; and (vi) be documented. The client will tailor its consultation process to the language preferences of the Affected Communities, their decisionmaking process, and the needs of disadvantaged or vulnerable groups. If clients have already engaged in such a process, they will provide adequate documented evidence of such engagement.

The IFC describes community engagement as an important element in managing social and environmental impacts, which normally involves the disclosure of information, consultation with affected communities and the establishment of a grievance mechanism. Paragraph 25 states

(IFC, 2012):

Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an ongoing process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development.

Consistent with the principles described above, the consultation program has facilitated:

- The ongoing identification of potentially affected members of the community and other relevant stakeholders for inclusion in engagement activities.
- Informing the community of the nature and status of the project by presenting information in a number of formats and venues, to further the community's understanding of the project.
- Developing engagement mechanisms that were effective and commensurate with the project's potential impacts and the concerns raised by the community.
- Recording all consultation initiatives, issues raised and WSS' responses to these issues.
- Identifying issues of concern to the community for consideration in the project planning and design.
- Developing a mechanism for reporting the outputs from consultation activities back to the community, as appropriate.
- Minimising the potential for stakeholder disaffection that might result from a misunderstanding of the project and, particularly for local communities, either a real or perceived exclusion from the consultation process.



8.1.2 Community Consultation Program

8.1.2.1 Stakeholder Identification

During the post-EIS exhibition phase, community consultation has necessarily focussed on those members of the community who took the opportunity and invested their time in making submissions to the EIS. This approach ensured information dissemination and opportunities to provide feedback and consider WSS' responses to the feedback received via a range of mechanisms prioritised these members of the community.

While local submission-makers were the focus of this phase of consultation, members of the wider community were similarly given the opportunity to participate in further consultation as described in the following sections.

8.1.2.2 Community Consultation Activities

Community consultation activities completed during the post-EIS exhibition phase to date are discussed below and have included:

- Community newsletters.
- Community information sessions.
- Public notices in print media.
- One-on-one meetings.
- A dedicated telephone number.
- A contact email address.

Community Newsletters

Three newsletters have been prepared to coincide with the findings of further assessments as they have been completed, changes to the project configuration and updates on consultation. The newsletters have been distributed by mailbox drop to residents along Cabbage Tree Road (from Nelson Bay Road to Masonite Road) and Barrie Close and made available to members of the community who indicated they would like to receive regular updates:

 Newsletter 1 (July 2016) – this newsletter describes the work WSS had completed to optimise the project in order to reduce impacts; provide an update on the approvals process and current status; detail some of the issues raised in the EIS submissions and provide preliminary responses; and, outline the planned consultation activities including details and an invitation to the first community information session in August 2016.



- Newsletter 2 (August 2016) this newsletter summarises the community information session held during August and collates the issues raised at the session and the interim responses able to be provided by WSS at the time.
- **Newsletter 3 (October 2016)** this newsletter provides detailed responses on the issues raised at the community information session held during August following further assessment and an invitation to a second community information session in October 2016.

Community Information Sessions

Community information sessions were held at Heatherbrae (approximately 10 km from the project site) in August and October 2016, the details of which are provided in **Table 26**.

Date	Number of Attendees	Content	
1 August 2016	28	 Provide the forum for community to meet WSS representatives. Present the updated project description in response to EIS submissions. Provide members of the community an opportunity to present their individual and collective concerns. Provide WSS an opportunity to respond or commit to responding (through further assessment where appropriate) to the concerns raised. Provide members of the community an opportunity to remain informed throughout the approvals, construction and operational phases of the project Outline WSS' plans for continuing consultation. 	
10 October 2016	5	 Provide WSS an opportunity to present the latest assessmen response to specific issues raised through the consultation prog Provide members of the community an opportunity to present individual and collective concerns. Provide members of the community an opportunity to rer informed throughout the approvals, construction and operati phases of the project. 	

 Table 26:
 Community information sessions

Print Media

Media advertisements were placed in the Newcastle Herald and Port Stephens Examiner inviting the community to the planned community information session on 1 August 2016 and in the Newcastle Herald inviting the community to the planned community information session on 10 October 2016.

One-on-one Meetings

Five one-on-one meetings with seven members of the community have been held to date. These meetings provided residents along Cabbage Tree Road the opportunity to meet with



WSS representatives to discuss their concerns directly, while providing a mechanism for WSS to understand specific issues and outline how the issues have been assessed in light of the changes made to the project.

Dedicated Telephone Number

A telephone number was established for members of the community wishing to seek information or provide feedback on the project. This telephone number provides direct access to a project spokesperson.

Contact Email Address

Direct access to a project spokesperson was provided via a contact email address. Contact details have been provided through each of the newsletters and the media advertisements published to date and have provided a means for members of the community to seek information, request further consultation and provide their feedback.

8.1.3 **Consultation Outcomes to Date**

Issues raised by members of the community during the post-EIS exhibition phase and the consultation program have, resulted in a number of additional or further assessment of potential environmental and social impacts (e.g., ecology, surface hydrology, groundwater, radiation, health and amenity) and changes in the project description.

Issues raised during the community consultation activities are summarised in Table 27.

Table 27:Summary of issues raised during consultation

Amenity (noise, air quality and health)				
•	Noise from arriving and departing trucks (deceleration and acceleration).			
•	Change operating hours to 'business hours' or avoid peak hour traffic.			
•	Noise from truck cleaning onsite.			
•	Noise from trucks traversing proposed rumble/grid shakers.			
•	Remove sectors 9A/9B from project that are closer to residences.			
•	Proportion of silica sand as quarry product.			
•	Air quality modelling to ensure the silica sand measures are fully addressed in terms of how the sand should			
	be managed and monitored.			
•	Baseline health monitoring of nearby residents.			
•	Williamtown/Joint Strike Fighter noise impacts due to topography change from project.			
•	Fugitive sand on public roads.			
Consultation				
•	Provide feedback from information session to attendees.			
0				

\frown
KLEINFELDER
Bright People. Right Solutions.

-					
•	Transport of contaminated groundwater via surface water infiltration.				
Cumulative Impacts					
•	Scale-up of operation after approval.				
Ec	Economic and Community Benefit				
•	Employment for 20 truck drivers disputed. Community beyond royalties paid to Council. Bonds for more than just the rehabilitation.				
На	bitat and Ecology				
•	Haul road threat to koala in wildlife corridor within project footprint. Poor vegetation species diversity within previously rehabilitated areas on site.				
Proponent					
•	WSS ownership. WSS trust.				
Tra	affic				
• • • • • •	Number of additional trucks. Time of arrival. Independence of truck operators. EIS data only 2 days (including Saturday). Rogue truck drivers, fatigue, speeding. Existing road condition; rutting; uneven surface (drain beneath Cabbage Tree Road). Change operating hours to 'business hours' or avoid peak hour traffic. Shoulder and intersection treatment removes corridor for cyclists. Existing safety of Cabbage Tree Road, dangerous for left in and right turn into driveways. Approval for increase in haulage rates at nearby quarry only now being realised by the community, and they are not sure that the peak has been met.				
	poding				

The issues listed above have been taken into account and considered as part of further assessments and optimisation of the project design. Other consultation outcomes may see the development of further mitigation strategies to be implemented where appropriate, as part of the specific strategies to mitigate potential impacts on the community surrounding the project site.

8.1.4 Documentation of Consultation

All community consultation activities related to the EIS and responses to submissions have been recorded and analysed as follows:

- Consultation recorded in consultation log (including where, when, who and the matters raised).
- Actions from each activity recorded and responsibility for actioning and a timeframe for action assigned, such as providing results of additional impact assessment outcomes.



- Consultation events and significant outcomes reported to wider WSS team.
- Issues of concern considered in the project planning and design process and in the responses to submissions, as appropriate.

The feedback mechanism arising from the recording and analysis of community consultation activities will close the loop on follow-up actions required by recording project responses to issues raised and how these were communicated back to the community. Both the consultation log and feedback mechanism allow for the:

- Identification of trends in stakeholder issues.
- Monitoring the effectiveness of resolution actions taken.
- Reporting the breadth and depth of community consultation internally and to external parties (e.g., government agencies).
- Reporting will allow WSS to demonstrate that the consultation process has been thorough and that the critical project stakeholders have had the opportunity to shape the outcomes.

8.1.5 Ongoing Consultation

The consultation and communication program to address ongoing consultation during construction and the operation of the project will continue with the same goals and principles as outlined in this section. Mechanisms such as the newsletters, access to project spokespersons and one-on-one meetings, will be utilised to ensure that the community and the wider public are informed of project developments. WSS will continue to build on the relationships that it has fostered during this phase of community consultation and will continue to liaise regularly with directly affected stakeholders.

Community consultation activities will incorporate the engagement needs of the project as it develops and will be inclusive of all stakeholders to the project as well as prioritising those members of the community who are directly affected. The objectives of WSS' ongoing community consultation program will comprise:

- Building understanding for the project and its potential outcomes.
- Achieving informed support for the project's activities.
- Minimising the risks of poor stakeholder relations.
- Achieving compliance.
- Building capacity for the WSS project team to implement effective stakeholder engagement over the life of the project.



8.2 PROJECTED COSTS AND BENEFITS

8.2.1 Employment and Royalties

The proposed Project will result in the capital expenditure of approximately \$4.7 million, in addition to employment of approximately six individuals during the three-month construction period.

The Project will then provide employment for six individuals for the duration of the Project (8 to 15 years). It is anticipated that approximately 20 contractor or customer truck drivers will also be involved in the haulage of sand from the quarry for its duration. It is likely the quarry employees will reside in the local area, while truck drivers are potentially living more remote from the quarry. This employment will provide economic stimulus to the local businesses and will also contribute taxes to the Federal government.

The royalty arrangement for the Project with PSC will result in the provision of over \$17 million to PSC, this is made up of the following elements:

- \$5/ tonne royalty based on sand leaving the quarry;
- Ground rent of \$100,000 per annum;
- Minimum extraction rate of 250,000 tonne (t) per year for Year 1 and 300,000 t each year after; and
- Amounting to approximately \$16,250,000 in royalties plus \$800,000 to \$1,500,000 depending on the duration of the quarry (i.e. 8-15 years).

These funds will be available for Council to utilise in the provision of services to the ratepayers within the LGA. On this basis the Project provides a valuable source of revenue for the local and regional economies.

8.2.2 Demand

In addition to the above economic benefits, the project will also go toward satisfying an established need for the product that will be produced by the quarry as detailed below.

A 2008 review of Stockton Bight sand products by Don Reed and Associates Pty Ltd (DRA 2008), found that approximately 1.5 Mt of sand was being produced annually from Stockton Bight quarries, with 66-85% being sold for construction purposes and the residual sold for



industrial purposes. It is understood that with subsequent quarry approvals at Fullerton Cove and Salt Ash that production levels are now likely to exceed 2.5 Mt per annum. A review of local sand quarries details the rates of production for state significant approvals in the Port Stephens Local Government Area (LGA). It is also understood that these quarries are regularly operating at levels approaching their extraction limits:

- ATB Morton's Redisand can extract up to 0.201 Mtpa;
- Mackas Sand can extract up to 2 Mtpa;
- Boral Sand at Fullerton Cove can extract up to 0.5 Mtpa; and
- An application for a sand quarry extracting up to 0.75 Mtpa at Bobs Farm appears to be on hold since the application was lodged in 2013.

In 2008 approximately 0.8 Mtpa of the construction sand was sold to regional markets, with the balance being sold to Sydney markets. With the 1 Mt increase in sand supply since 2008, the increase in demand is likely the result of changes in both regional and Sydney markets, with the proportion of the Sydney market likely to increase with the closure of existing Sydney based quarries. DRA (2008) estimated that by 2015:

- The Hunter Region will be looking for 0.8 million to 1.0 million tpa fine construction sand;
- The Sydney Metropolitan area markets will be looking for more than 2.0 million tpa replacement fine construction sand for the 8 Mtpa demand; and
- Industrial sand markets will be facing a crucial shortage of suitable quality sands for use in foundries and in the manufacture of glass, fibre glass, grouts, adhesives and coatings.

Based on DRA's 2008 estimates and the demonstrated increase in supply since 2008 (of about 1 Mt), there is a demonstrated demand for sand from the area. Maintaining adequate supply levels is essential to ensuring stable sand prices, especially as it forms a large component of new home and road construction. The minimum price for sand will be governed by the costs of production, of which existing and larger operations are likely to have a strategic advantage with lower costs of production. The opportunity to provide an additional source of sand into the market is at the commercial risk of the proponent and is unlikely to significantly affect existing providers.

8.3 ESTIMATED VALUE OF THE PROJECT

Total value of the project has been estimated at approximately \$50 million dollars.



9. ENVIRONMENTAL RECORD OF PERSON PROPOSING TO TAKE THE ACTION

- Does the party taking the action have a satisfactory record of responsible environmental management?
- Provide details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:
 - a) The person proposing to take the action, or
 - b) If a permit has been applied for in relation to the action - the person making the application.
- If the person taking the action is a corporation, please provide details of the corporation's environmental policy and planning framework and if and how the framework applies to the action.
- 4. Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

Yes.

There are no proceedings under Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the Company taking the action.

The Company taking the action is a newly formed company. An Environmental Management Plan has been prepared for the proposed action, which includes an environmental policy.

No.



10. CONCLUSIONS

10.1 ESD CONSIDERATIONS

A review of the project against the principles of ecologically sustainable development has been undertaken with regard to the National Strategy for Ecologically Sustainable Development (1992) is available on the following web site: https://www.environment.gov.au/aboutus/esd/publications/national-esd-strategy. The assessment has included consideration against the core objectives, guiding principles and the Sectorial objectives relating to mining. On this basis it is reasonably demonstrated that the project is consistent with the national strategy for ecologically sustainable development.

The Core Objectives of the National Strategy for ESD are:

"to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;

to provide for equity within and between generations; and

to protect biological diversity and maintain essential ecological processes and lifesupport systems"

The proposed quarry design and mitigation measures will minimise noise and air quality impacts on the surrounding land owners, protect groundwater supplies and provide a rehabilitated landform and biodiversity offsets that result in a net benefit to biodiversity outcomes. While the project will deplete a natural resource from the local area, this is offset through the delivery of a product for construction of infrastructure and over \$17 million dollars to the local council for the delivery of services and capital works within the local government area for the benefit of current and future generations.

A review of the Project against the guiding principles of ESD is provided below:

"Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations;"



<u>Response</u>: The project has been the subject of extensive assessment processes under the New South Wales planning system and in this application will be the subject of the Commonwealth assessment process.

Social equity involves value concepts of justice and fairness so that basic needs of all sectors of society are met and there is a fairer distribution of costs and benefits to improve the wellbeing and welfare of the community, population, or society. Social equity also includes concerns for intergenerational equity which requires that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The proposed project and the mitigation and rehabilitation measures described in Section 5 will minimise impacts upon not only the current generation, but also upon future generations. Whilst the extraction of the sand resource will remove an opportunity for future generations, the economic benefits generated by the quarry will benefit current and future generations. The construction and operation of the quarry will deliver significant economic benefits to the local community during the life of the project whilst appropriately managing environmental impacts and making appropriate provision for rehabilitation and landscape restoration.

Sand is an essential component in the domestic construction industry, this quarry will assist in satisfying an existing demand and will ensure construction costs for the delivery of housing and infrastructure is maintained at acceptable levels.

Biological diversity refers to the variety of life forms on earth and is reflected at three levels by genetic diversity, species diversity and ecosystem diversity.

The quarry has been designed to be consistent with the conservation of biological diversity and ecological integrity. The project has received a thorough examination consistent with statutory authority guidelines, with special attention on threatened and endangered species that may potentially be impacted. Significance assessments have determined that the quarry will not have a significant adverse impact on any species.

Environmental and rehabilitation procedures will ensure the project does not adversely impact the local environment in the long term.



"Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;"

Response: This is essentially the precautionary principle means that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (NSW *Protection of the Environment Administration Act 1991*).

Application of the precautionary principle to the project needs to ensure that there has been:

- Careful evaluation of the proposal to avoid serious or irreversible damage;
- Predictable and transparent decision making for the proposal; and
- An assessment of consequences of various options undertaken.

The environmental consequences of the proposal have been documented in *Section 4*, the EIS and the associated Response to Submissions. Scientific and engineering analysis of the environment and likely impacts of the project has been thorough, and has involved field surveys, computer modelling, impact identification and measures to avoid, minimise and ameliorate impacts.

At all stages of project development there has been an open and transparent decision making process. Consultation has occurred with the various stakeholders and resulted in the project being modified to minimise the potential for serious and/or irreversible damage to the environment. These modifications include:

- Reduction of the maximum extraction rate from 600,000 tpa to 530,000 tpa;
- Change of the predominant extraction method to portable electric conveyors fed by front end loaders to reduce noise sources, dust generation and diesel consumption;
- Change to electric processing (conveyors, stackers, screens and air separator) that will be predominantly powered by mains power;
- Reduction in the resource footprint of 22.5% based on a range of additional avoidance and optimisation measures; and
- Extraction and rehabilitation sequencing that will limit the area exposed during operations to active quarrying sectors. Rehabilitation will commence in each extraction sector once quarrying is completed in each sector. This will result in a progressive rehabilitation plan for the life of the Project.



"The global dimension of environmental impacts of actions and policies should be recognised and considered;"

Response: In this regard the project has considered the potential for impacts on migratory birds protected under various international agreements. The assessments have concluded the project will not adversely impact on migratory birds.

"The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised;"

<u>Response</u>: The project through the implementation of the proposed offset and mitigation measures will result in the long term preservation and management of offset lands that improve environmental protections, whilst diversifying the economy through providing land management opportunities.

"The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised; "

<u>Response</u>: No direct relevance to the project, aside from maintaining the cost of resources and the ultimate cost of infrastructure delivery and the competiveness of Australian industry.

"Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms; " and

<u>Response</u>: This principle requires that environmental factors should be included in the valuation of assets and services, such as:

- Polluter pays those who generate pollution and waste should bear the cost of containment, avoidance or abatement.
- The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.
- Environmental goals having been established, they should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.



The process of identifying project impacts (positive and negative) on the environment and formulating actions or works to mitigate negative impacts recognises the value of both the resource and environment. The impact assessments have examined the environmental consequences of the quarry and recommended mitigation measures and safeguards be implemented if the project proceeds. The costs of mitigation and associated management measures proposed have therefore been included in the costs of the proposal to ensure that the local environment is protected from pollution. The proponent considers and acknowledges that the environment is a valuable resource for the local and broader communities and also for future generations.

"Decisions and actions should provide for broad community involvement on issues which affect them."

Response: Consultation undertaken during the project is summarised within Section 8. Surrounding landowners have been provided opportunity to discuss the project with WSS representatives. The NSW EP&A Act 1979 provides through the public exhibition of the EIS report further opportunity for public involvement and participation in the environment planning and assessment process for the project. The exhibition of this Referral and associated preliminary documentation provides a further opportunity for public comment.

In addition, a review of the project against the Objectives for Under Part 2 – Sectorial Issues (Mining) is provided below:

Objective 5.1 "to ensure mine sites are rehabilitated to sound environmental and safety standards, and to a level at least consistent with the condition of surrounding land"

Response: This document has detailed the proposed rehabilitation of the disturbance area that is aimed at restoring the land to a condition that is the same, or better than, the existing condition of native communities in the surrounding lands. A large portion of the subject land has been the subject of past mineral sand mining, and while deficiencies have been observed, the rehabilitation demonstrates the capacity to achieve a suitable level of rehabilitation.

Objective 5.2 "to provide appropriate community returns for using mineral resources and achieve better environmental protection and management in the mining sector"

Response: The proposed economic returns to the community by this project are considerable. This is due to the lease holder being the local council. As such over \$17 million is expected to



be returned directly to the local council for use in providing services to the local community. In addition, taxes paid by employees and those on profits will ultimately return to the community.

Objective 5.3 "to improve community consultation and information, improve performance in occupational health and safety and achieve social equity objectives"

Response: The development and assessment of the project to date has been the subject of extensive consultation with the community and government agencies as detailed within Section 8. In addition, the proponent is committed to the establishment of a community liaison group that will operate for the duration of the project. Results of monitoring and reporting will also be made transparent and available to interested members through placement on a project website.

10.2 SUMMARY OF IMPACTS AND COMPENSATION

The predicted impacts of the Project on Camfield's Stringybark, Earp's Gum, Koala and Greyheaded Flying-fox are assessed as unlikely to lead to the long-term decline of the local populations of these species. The Project is expected to remove a small proportion of the local occurrence of suitable habitat for each species and to retain and protect habitat onsite as shown within **Table 28**.

Species	Proportion to be removed from Subject Land	Proportion to be retained in Subject Land
Camfield's Stringybark	10% of local population	73% of local population
Earp's Gum	0.57% of local population	1.58% of local population
Koala	0.87% of suitable habitat in KMU	2.27% of suitable habitat in KMU
Grey-headed Flying-fox	24% of suitable habitat in Subject Land	76% of suitable habitat in Subject Land

 Table 28:
 Summary of impacts

Furthermore, the majority of the habitat that is to be removed also represents previously cleared habitat that has been subsequently rehabilitated. For Camfield's Stringybark and Earp's Gum, the rehabilitated habitat where they currently occur is not considered to be preferred habitat. The removal of such habitat is unlikely to fragment or isolate the local population, or to reduce its current local occupancy in the long term. The expectation is that post-quarrying rehabilitation can successfully re-establish both tree species, as well as reintroduce suitable foraging habitat for the Koala and Grey-headed Flying-fox.



The Project, through the state public exhibition and submission process, has been reviewed and revised with the objective of further reducing the predicted impacts on individuals and their habitats. As part of this process, detailed mitigation measures have been proposed under the EMP to mitigate impacts during the construction and operational phases of the Project. The mitigation measures have taken into consideration the relevant conservation advices and are not inconsistent with relevant recovery plans. The measures include a detailed rehabilitation plan and completion standards to achieve the following objectives:

- Limit the impacts of the works on locally occurring fauna species within the extraction area during clearing;
- Progressively re-establish native vegetation after sand extraction and completion of landform rehabilitation;
- Ensure there is no net loss of Koala habitat due to the proposal; and
- Ensure there is no net loss of *Eucalyptus camfieldii* individuals due to the proposal.

In addition to this, the EMP includes water and soil erosion measures to ensure that standards for groundwater and surface water flows are maintained and do not indirectly impact on surrounding threatened species habitat that will be retained throughout the construction and operation of the Project.

A biodiversity offset strategy has also been proposed to address the residual impacts of the Project on Camfield's Stringybark, Earp's Gum, Koala and Grey-headed Flying-fox and to provide security over the residual areas of habitat that are proposed to be retained in the Subject Land.

The Biodiversity Offset Strategy proposes to establish the remaining areas of the Subject Land as a biobank site under the NSW BioBanking Offsetting Scheme. The threatened species and habitat within the offset areas of the Subject Land will be protected under the mechanisms of the BioBanking Offsetting Scheme and be managed in accordance with a BioBanking Agreement to be established over the land. Any credit requirements not met by the offset areas of the Subject Land will be achieved via acquisition of credits offsite, as per discussion in **Section 6.2.3**. When the offset strategy is assessed using the EPBC Act offset assessment guide, the requirement of minimum 90% direct offset for all species can be shown to be exceeded.



11. REFERENCES

Bell S.A.J. (2006). Eucalyptus parramattensis *subsp.* decadens: *status, distribution and habitat.* Unpublished report prepared for the Department of Environment and Conservation, Newcastle. Eastcoast Flora Survey. June 2006.

Bell, S.A.J. & Driscoll, C. (2006). Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens, New South Wales: Management of Groundwater Dependent Ecosystems. Part 1 – Vegetation Classification. Unpublished Report to Hunter Water. Eastcoast Flora Survey. September 2006.

Churchill, S. (1998). Australian Bats. Reed New Holland, Frenches Forest.

DEC (2004). *Threatened Biodiversity Survey and Assessment: Guidelines of Developments and Activities (working draft),* New South Wales Department of Environment and Conservation (DEC), Hurstville, NSW.

DECC (2007). *Threatened Species Assessment Guidelines: The Assessment of Significance,* Department of Environment and Climate Change NSW (DECC), Sydney.

DECC (2008). *Recovery Plan for the Koala* (Phascolarctos cinereus), Department of Environment and Climate Change NSW (DECC), Sydney.

DECCW (2009). *Draft National Recovery Plan for the Grey-headed Flying-fox* Pteropus poliocephalus. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney.

DEHP (2012). Koala-sensitive Design Guideline: A Guide to Koala-sensitive design for planning and development activities. Prepared by the Koala Conservation Unit, Department of Environment and Heritage Protection QLD (DEHP).

DEWHA (2010). *Survey Guidelines for Australia's Threatened Bats.* Department of the Environment, Water, Heritage and the Arts, Canberra.

DoE (2014). *EPBC Act Referral Guidelines for the Vulnerable Koala*. Department of the Environment, Canberra.



DoE(2015a).NationalFlying-foxmonitoringviewer.Fromhttp://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf.AccessedOctober 2017

DoE (2015b). *Referral Guideline for Management actions in Grey-headed and Spectacled Flying-fox camps.* Department of the Environment, Canberra.

DoEE (2017). *Draft Recovery Plan for the Grey-headed Flying-fox* Pteropus poliocephalus. Department of the Environment and Energy, Canberra.

DSEWPC (2011). *Survey Guidelines for Australia's Threatened Mammals*. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Eby, P, Richard, G, Collins L and Parry-Jones, K (1999). 'The distribution, abundance and vulnerability to population reduction of a nomadic nectarivore, the Grey-headed Flying-fox *Pteropus poliocephalus* in New South Wales, during a period of resource concentration.' *Australian Zoologist* 31: 240-253.

Eby, P. (2000). Background biology, ecology and public health issues. **In:** Richards, G., ed. *Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox in New South Wales*. Unpublished report to the NSW Threatened Species Scientific Committee.

Eby, P. (2016). Using restoration and revegetation plantings to aid conservation of threatened nomadic pollinators and long-distance pollination services in NSW. A report to the NSW Office of Environment and Heritage.

Hill, K.D. (2002). 'Eucalyptus', IN: G.J. Harden (ed), *Flora of New South Wales Volume 2*. NSW University Press, Sydney.

Hill, K.D. (2003). Eucalyptus camfieldii *in the Gosford-Wyong District*. Unpublished Report to Wyong Shire Council.

House, S.M. (1997). 'Reproductive Biology of Eucalypts', IN: J.E Willimas and J.C.Z Woniarski (ed), *Eucalypt Ecology: Individuals to Ecosystems*. Cambridge University Press, United Kingdom.



IFC (2012). Performance Standards on Environmental and Social Sustainability. International Finance Corporation – World Bank Group. Washington D.C., U.S.A.

Kleinfelder (2016). *Phase 1 Environmental Site Assessment. Proposed Sand Quarry North of Cabbage Tree Road Williamtown, NSW.* Prepared for Williamtown Sand Syndicate Pty Ltd.

Landcom (2004). Soils and Construction – Managing Urban Stormwater. Landcom, Parramatta

Lunney, D., Gresser, S., O'Neill, L.E., Mathews, A. and Rhodes, J. (2007). 'The Impact of Fire and Dogs on Koalas at Port Stephens, New South Wales, Using Population Viability Analaysis'. *Pacific Conservation Biology*, 13: 189 – 201.

Lunney, D., Phillips, S., Callaghan, J. and Coburn, D. (1998). 'Determining the distribution of koala habitat across a shire as a basis for conservation: a case study from Port Stephens, New South Wales'. *Pacific Conservation Biology*, 4: 186-196.

Matthei, L.E. (1995) *Soil Landscapes of the Newcastle 1:100 000 Sheet Map.* Department of Land and Water Conservation, Sydney.

Matthews, A., Lunney, D., Gresser, S. and Maitz, W. (2007). 'Tree Use by Koalas (Phascolarctos cinereus) after Fire in Remnant Coastal Forest'. *Wildlife Research*, 34: 84 – 93.

Moore, B.D. and Foley, W.J. (2000). 'A Review of Feeding and Diet Selection in Koalas (Phascolarctos cinereus). *Australian Journal of Zoology*, Vol 48, 317 – 333.

National Parks and Wildlife Services (NPWS) (2000). Vegetation Survey Classification and Mapping Lower Hunter and Central Coast Region: A project undertaken for the Lower Hunter and Central Coast Regional Environment Management Strategy, Version 1.1.

OEH (2011a). *Draft National Recovery Plan: Earp's Dirty Gum* Eucalyptus parramattensis *subsp.* decadens, Office of Environment and Heritage NSW (OEH), Sydney.

OEH (2011b). NSW OEH interim policy on assessing and offsetting biodiversity impacts of *Part3A, State significant development (SSD) and State significant infrastructure (SSI) projects.* Chief Executive Officer. 25 June 2011.



OEH (2014). BioBanking Assessment Methodology 2014. Office of Environment and Heritage NSW (OEH), Sydney.

OEH (2015). *Koala – Profile*, Office of Environment and Heritage NSW (OEH) Website, Available: <u>http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10616</u>

OEH (2016). *NSW Guide to Surveying Threatened Plants*. Office of Environment and Heritage NSW (OEH), Sydney.

Parry-Jones K.A. & Augee M. (1991). 'Food selection in Grey-headed flying foxes (*Pteropus poliocephalus*) occupying a summer colony site near Gosford, NSW'. *Wildlife Research* 18: 111-124.

Phillips, S., and Callaghan, J. (2011). 'The Spot Assessment Technique: a tool for determining localised levels of habitat use by koalas *Phascolarctos cinereus*'. *Australian Zoologist* 35: 774–780.

Phillips, S., Callaghan, J. and Thompson, V. (1996). *The Koala Habitat Atlas Project No 6: Port Stephens Local Government Area*. Report prepared for Port Stephens Council.

Port Stephens Council (PSC) (2002). *Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2002*. Prepared by Port Stephens Council with the Australian Koala Foundation.

Potts, B.M. and Wiltshire, R.J.E. (1997). 'Eucalypt Genetic and Genocology', IN: J.E Willimas and J.C.Z Woniarski (ed), *Eucalypt Ecology: Individuals to Ecosystems*. Cambridge University Press, United Kingdom.

RPS (2011). Ecological Constraints and Opportunities Report. 398 Cabbage Tree Road, Williamtown, NSW. Prepared for Port Stephens Council.

 Threatened Species Scientific Committee (TSSC) (2012). Listing advice for Phascolarctos

 cinereus
 (Koala).

 http://www.environment.gov.au/biodiversity/threatened/species/pubs/197-listing-advice.pdf.

 effect under the EPBC Act from 02-May-2012.



Tidemann C.R. (1995). 'Grey-headed flying fox, *Pteropus poliocephalus* (Temminck, 1825)'. IN: *The Mammals of Australia*. Ronald Strahan (ed) Reed New Holland.

Umwelt (2015). *Ecological Assessment, Proposed Sand Quarry, Cabbage Tree Road, Williamtown.* Prepared for Williamtown Sand Syndicate Pty Ltd.