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Townsville Ring Road Section 4

Monitoring Plan

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Monitoring Plan

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Quality Information

Document Townsville Ring Road Section 4

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Reviewed by Cameron Miller

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Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	10-Jun-2014	Draft for Review		
A	11-Jul-2014	Final Issue	Rouven Lau Associate Director - Environment	Original previously signed
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C	05-Aug-2014	2nd Revised Final Issue	Rouven Lau Associate Director - Environment	Original previously signed
D	10-Jun-2016	3rd Revised Final Issue	Rouven Lau Associate Director - Environment	

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1.0 Introduction

1.1 Purpose of the Monitoring Plan

The Townsville Ring Road Section 4 (TRR4) is a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EBPC Act). The controlled action decision on the original EPBC referral for the project was made by the Commonwealth Minister for the Environment approved the TRR4 project on 2 May 2014, subject to approval conditions which must be meet and or adhered to (Appendix A lists the full approval requirements).

This monitoring plan has been designed to address these approval requirements and to document TMR's obligations and commitments made in response to state regulations regarding threatened species and habitat for the project. The monitoring plan will be regularly reviewed to ensure monitoring strategies remain current and effective.

Throughout the EPBC related documentation for the TRR4 project, various mitigation, management and offset obligations have been made to minimise potential impacts of road construction and operation on the matters of national environmental significance (MNES) and matters of state biodiversity interest. These commitments have been made in the original EPBC referral and in the Preliminary Documentation (PD) inclusive of the EMP (P). Appendix B summarises each of the proposed mitigation and management measures and provides cross referencing to the various documents.

This plan addresses the monitoring requirements needed to test the effectiveness of these measures in controlling impacts on MNES particular for Black-throated Finch, Squatter Pigeon and Bare-rumped Sheathtail Bat.

1.2 EPBC Approval Requirements in Relation to the Monitoring Plan

TRR4 was granted approval by the Department of Environment on 2 May 2014, with a variation to conditions attached to this original approval granted on 31 October 2014.

Condition 1 of the approval requires:

"To ensure the protection of the matters of national environmental significance (MNES) the approval holder must construct the road in accordance with Section 3.0 'Current Design for TRR4', and Appendix A Environmental Management Plan (EMP) of the Preliminary Documentation (PD)".

The varied condition 2 requires:

To minimise impacts to the habitat of the black-throated finch (southern) (Poephila cincta cincta) (BTF), the approval holder must not disturb, destroy or remove more than 68.24 ha of remnant vegetation, including 49.19 ha of BTF habitat (as described in the PD)."

Condition 4 of the approval requires the preparation and implementation of a monitoring plan for the project as set out below:

"To ensure the protection of MNES, the approval holder must prepare and submit a Monitoring Plan to the Minister for approval prior to the commencement of the action. The monitoring plan must include adaptive management actions to monitor the effectiveness of mitigation measures, monitoring strategies, performance criteria and corrective actions to minimise impacts on MNES. The approval holder must not commence the action until the Minister has approved the Monitoring Plan. The approved Monitoring Plan must be implemented."

Condition 12 enables the approval holder to revise the approved Monitoring Plan without submission to the Minister if the taking the action in accordance to a revised plan would not be likely to have a new or increased impact. The approval holder does need to notify the Department of the Environment in writing, implement the revised monitoring plan from the date submitted to the Department and maintain a record of the reasons the approval holder considers that taking the action in accordance with the plan would not be likely to have a new or increased impact.

Other conditions of the approval also influence the content of this Monitoring plan including the offset management plan (Condition 5), and the requirement in Condition 9 to maintain accurate records as set out below.

"*The approval holder must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the plans and strategies required by this approval, and make them available upon request to the Department….*"

All approval conditions are set out in Appendix A.

Key components of the monitoring plan which relate to protected matters are set out below:

Approval Condition Reference	Content Requirement	Section of Monitoring Plan	Page Reference
Condition 1	*To ensure the protection of the matters of national environmental significance (MNES) the approval holder must construct the road in accordance with Section 3.0 'Current Design for TRR4', and Appendix A Environmental Management Plan (EMP) of the Preliminary Documentation (PD)*	Section 4 Table 6 Item 1 Table 8 Item 16	 Page 16 Page 19
	To ensure the protection of the matters of national environmental significance (MNES) the approval holder must construct the road in accordance Appendix A Environmental Management Plan (EMP) of the Preliminary Documentation (PD)	Section 4 Table 7 & 8	Pages 17-22
Condition 2	*To minimise impacts to the habitat of the black-throated finch (southern) (Poephila cincta cincta) (BTF), the approval holder must not disturb, destroy or remove more than 68.24 ha of remnant vegetation, including 49.19 ha of BTF habitat (as described in the PD)."*	Section 4 Table 8 Item 22 & 23	Page 20
Condition 4	*To ensure the protection of MNES, the approval holder must prepare and submit a Monitoring Plan to the Minister for approval prior to the commencement of the action.*	This document	NA
	The monitoring plan must include adaptive management actions to monitor the effectiveness of mitigation measures, monitoring strategies, performance criteria and corrective actions to minimise impacts on MNES	Section 5 Tables 9 -12	Pages 25-29
	The approval holder must not commence the action until the Minister has approved the Monitoring Plan.	Section 4 Table 6 Item 3	Page 16
	The approved Monitoring Plan must be implemented.	Section 4 Table 6 Item 1 Table 8, Item 13	 Page 16 Page 18

Approval Condition Reference	Content Requirement	Section of Monitoring Plan	Page Reference
Condition 9	*The approval holder must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the plans and strategies required by this approval, and make them available upon request to the Department…."*	Section 4 Table 6 Item 1 Table 8, Item 13	 Page 16 Page 18

Note that monitoring requirements for the performance of the offset management plan (Condition 5) is provided for in offset management plan itself as a separate document (AECOM, 2014).

2.0 Adaptive Management Actions

2.1 Definition of Adaptive Management

Adaptive management involves taking a structured, iterative approach to finding the best options for action in the face of uncertainty and risk. Adaptive management includes monitoring change over time, so that the results of management choices can be assessed and changes made if needed to improve future management (COAG Standing Council on Environment and Water, 2012).

Further, the Commonwealth Government has defined adaptive management as:

"an active culture of reflection comprising effective evaluation rewards for thinking and reflection, appropriate communication for all project participants, and provision of mechanisms for incorporating learning into planning and management (Commonwealth of Australia, 2009).

More simply the adaptive management cycle can be described as '*plan, do, reflect and revise'*. There are many representations of how adaptive management cycles can be applied, however the primary elements of the management cycle is illustrated in Figure 1.

The key elements of adaptive management are to monitor and then respond to the success or failure of management actions during the project period.

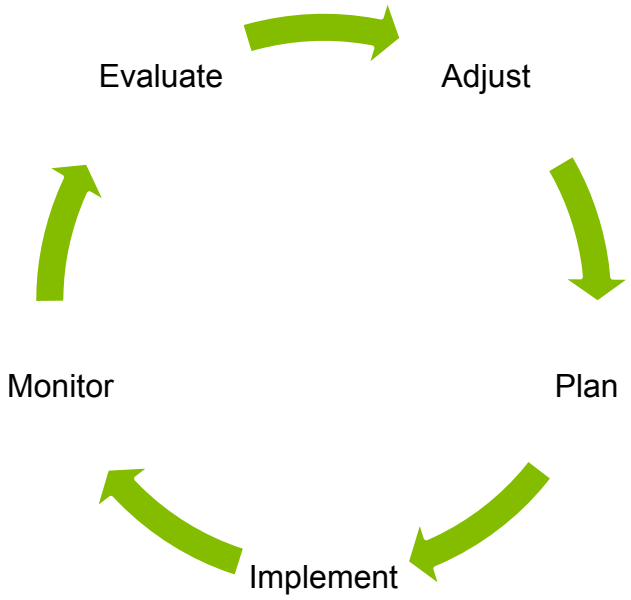

Figure 1 Representation of the adaptive management cycle

2.2 Adaptive Management Requirements for TRR4

The TRR4 monitoring requirements as set by the approval requirements can be categorised into two types of monitoring as defined below.

Compliance (or implementation) monitoring which tracks the status of commitments, approval conditions, and plan requirements to ensure that planned actions are executed. For TRR4 this would include for compliance monitoring associated with:

- Offset land acquisition and management
- Management activities reporting (e.g., proportion of area cleared or fenced, status of invasive plant removal activities)
- Road design requirements that relate to mitigation for protected matters have been met, and

- Alignment of monitoring activities and reporting requirements (e.g., what monitoring activities were implemented and resulting reports received).

In contrast e*ffectiveness* or for simplicity in this report - *environmental monitoring* evaluates the success of management commitments in meeting biological objectives (Noss & Cooperrider, 1994). Such monitoring strategies would be primarily directed at determining whether the mitigation measures have an observable change in the environment and for TRR4 the objectives relate to being able to minimise impacts on MNES. Typically environmental monitoring measures could include:

- Status and trends of resources (e.g., quantitative data on a particular species, biodiversity value, vegetative structure)
- Status and trends of known pressures or threatening processes on the environment (e.g., invasive species, contaminants, disturbance), or
- Effects of management actions on resources and known pressures (e.g., density of invasive plants measured before and then 1 to 5 years after herbicide treatment).

Performance (or action) criteria are specific values of monitored parameters (indicators) used in evaluating project performance. *Their function is to determine if the monitoring results support continued implementation of the project as designed or if adaptive actions should be undertaken* (Fischenich, C., *et al*. 2012).

In other words they are measures or attributes that describe how well the results of a monitoring program indicate that management actions are achieving their stated objectives. Criteria define a measure of progress and enable actual results achieved over time to be compared with planned results.

Ideally, performance criteria should be set after long-term studies have been completed, and natural thresholds identified and their causes well established. Unfortunately, the imperatives for management are immediate in most cases, and thresholds must be set in the absence of the information needed to do this accurately. This is also true of most other areas where land management is required. Under these circumstances, it is important to use as much available information as possible on the site, any thresholds that have been set for similar sites, and any studies undertaken where the change factors are the same. Performance criteria that are based only on change will require triggers based on an estimated margin of error of detecting change, i.e. the level at which we can be reasonably sure that change has indeed taken place (AECOM, 2009).

The EPBC approval condition requires the establishment of monitoring strategies to determine the success of the project's mitigation measures in their effectiveness of minimising impacts on MNES. To achieve this monitoring strategies have been outlined in this plan, as well as associated indicators as measures of change and performance criteria which indicate the need to undertake corrective actions. Table 1 below outlines the relationship between a monitoring strategy, its indicator and metrics and performance criteria.

Table 1 Indicators and performance criteria

Monitoring strategy		Indicator			Performance Criteria [1]		Potential Management Action
					Acceptable Range	Range that triggers corrective action	
Objective	**Measure**	**Unit of measurement**	**Method of measurement**	**Frequency**			
Minimising impact on BTF	Population size of BTF at Dam 1	# of individuals	Late wet season and breeding season waterhole counts	Biannual	50% incremental increase of desired species	25% reduction in annual number of individuals (assessed from 2 surveys)	Report and analysis trends. Review all land management strategies
Minimising impact on water quality	Effectiveness of ESCPs	Turbidity measurements in Saunders Creek	Hand held calibrated sampling meter for NTU measurements	Weekly	Downstream > 22 NTU	Downstream over 15 % of upstream value (over 4 sampling events)	Investigation into cause of exceedance. Non-conformance related to site practise triggers on site mitigation measures

1. Performance criteria are the specific values of monitored parameters used in evaluating program and project performance and are used as a management tool to determine when specific responsive management actions should be taken.

Setting of indicators and performance criteria have been applied to the effectiveness monitoring strategies proposed in Section 5 for BTF population densities, changes in habitat condition and water quality and effectiveness of weed control and fire management strategies.

3.0 Baseline Environmental Conditions

The following section outlines the current baseline environmental conditions which exist within and adjacent to the project area, prior to the planned construction start. Much of this information is summarised and derived from field investigations undertaken in 2012-13 originally for the referral and then in response to the information requirements needed to support the preliminary assessment and the detailed design phase for TRR4. The detailed field investigations can be found in these original documents (EPBC referral 2012/6562 and AECOM 2014). These documents can be viewed at:

- Referral: http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referral_detail&proposal_id=6562, and
- Preliminary documentation: http://www.tmr.qld.gov.au/Projects/Name/T/Townsville-Ring-Road-Section-4.aspx.

This section's purpose is to provide context for around the current environmental conditions on site and the factors that influence them.

3.1 Climate

The climate of the majority of the Townsville Local Government Area (LGA) is described as dry tropical. The geographical position of Townsville and the mountain ranges to the south and south-west of the coastal plain effectively create a rain shadow for the coastal floodplains for most of the year. The exception is in the northernmost area of the Townsville LGA where the Paluma Ranges are less than 10km from the coast, are more north-south aligned and they better capture the prevailing south easterly trade winds. Rainfall within the Paluma Range is more frequent and higher than the remainder of the Townsville LGA, hence its inclusion in the wet tropics classification.

There are two distinct weather patterns in Townsville and while it is much dryer than other parts of the tropics in Australia due to its geographical location, it still experiences distinct wet and dry seasons. During spring the monsoon trough begins to descend over the northern part of Australia bringing increasing temperatures, rain and humidity. Summer means increasing storm activity and subsequent rainfall. This period includes the 'wet season' which usually lasts from late December through to early April. The retreat of the monsoon trough back to the north of Australia, generally during April, brings temperate conditions with much lower rainfall and humidity (i.e. the dry season).

Rainfall typically associated with the monsoon trough is heavy and spasmodic. The wet season provides Townsville with approximately 80% of its annual rainfall in one quarter of the year (using mean annual rainfall figures).

Townsville experiences on average an annual rainfall of 1143mm (over an average 91 rain days). However, the amount of rain that falls each year is extremely variable. An example provided on the Bureau of Meteorology (BoM) public website notes that in 2000 there was 2400mm of rain (wettest on record) and the following year was the second driest with 467mm of rainfall recorded (BoM, no date).

3.2 Topography, Geology and Soils

The TRR4 site is located primarily on Quaternary age unlithified deposits of clay, silt, sand and gravel, with floodplain alluvium on higher terraces. In the north towards Deeragun, geological mapping shows a north-west to south-east trending exposure of the Permian age Julago Volcanics Formation comprising rhyolitic to andesitic lava, tuff, volcanic breccia interspersed with sedimentary deposits such as sandstone, siltstone, shale and coal seams. The flanks of the Julago Volcanics are covered by talus (scree) deposits comprising boulders and cobbles with interstitial sand and clay (AECOM, June 2012).

TRR4 is situated over a coastal plain with duplex soils around Mt Bohle and the Bohle River, and alluvial deposits along the length of Saunders Creek and Stony Creek (Lokkers, 2000; Hopley, 1970). These soils are typical of those found on Townsville coastal plains, and as a rule are particularly susceptible to sheet and gully erosion and dispersion. Both gully and sheet erosion are observed over the alignment.

There is a low probability of occurrence of acid sulfate soils in the study area, except in the stream beds (Mueller, P., *pers. com.*).

3.3 Surface Water

The Townsville Water Quality Improvement Plan (WQIP) (Gunn *et al*, 2010) breaks the Townsville LGA into two catchments (exception is in the south of the LGA where several catchments flow towards the Burdekin and are included in this WQIP). The southern catchment is known as the Ross River Basin, its namesake being its major waterway the Ross River, and the northern is called the Black River Basin also named after its main river system (Black River). The main catchments are broken down into 10 sub-basins. TRR4 falls within the Ross River Basin and the Bohle River sub-basin.

All the waterways within the TRR4 alignment are noted in the WQIP as being entirely lowland freshwater systems, and are situated on a relatively flat coastal plain. Stony Creek is noted as being highly incised in the middle (in the vicinity of TRR4) and upper reaches, contained within a localised flat, narrow catchment with vegetation present that is associated with creek lines/river systems and associated riparian vegetation on alluvial plains. Saunders Creek also has a relatively flat and narrow local catchment with vegetation present that is associated with creek lines/river systems and associated riparian vegetation on alluvial plains. Both Saunders and Stony Creeks have largely undeveloped local catchments south of the Bruce Highway. The topography and climate of the coastal plain over which TRR4 is situated means that many of the waterways are ephemeral with flows visible for a short time after rain has fallen. Many of the tributaries of Saunders and Stony Creeks and the tributaries of the Bohle River may not have defined bed and banks and may only serve as drainage features (AECOM, 2010; C & R Consulting, 2007; Gunn and Manning, 2010).

TRR4 will require works in waterways associated with Saunders Creek and Stony Creek (inclusive of their tributaries), and tributaries of the Bohle River which flow into the Great Barrier Reef Marine Park. The Great Barrier Reef World Heritage Area is 6 km downstream from the project area. All waterways crossed by the road alignment feed eventually into the Bohle River which drains into the Reef, through the state declared Bohle Fish Habitat.

3.4 Vegetation

The project area lies within the Townsville Coastal Plains Province of the Brigalow Belt Bioregion (Sattler & Williams, 1999). Most of the proposed TRR4 alignment is covered in native vegetation on alluvial plains comprised of paperbark woodlands, fringing riverine wetlands and eucalypt woodlands. The proposed TRR4 alignment crosses watercourses that are mapped as high ecosystem diversity and provide significant wildlife habitat corridors. In addition, an area adjacent to Stony Creek is listed as high value regrowth in the regional ecosystem mapping under the *Vegetation Management Act 1999* (VMA). High value regrowth watercourses are mapped within the proposed alignment of TRR4 with the riparian vegetation along these watercourses largely intact but containing some weed species (these are discussed below).

Table 2 Regional Ecosystems in and Adjacent to the TRR4 Footprint

RE Description	VMA Status	EPBC Biodiversity Status
11.3.12 *Melaleuca viridiflora* with occasional *M. argentea* +/- *M. dealbata* woodland to open-woodland. Occasional midstratum of *Grevillea pteridifolia* and *Acacia leptocarpa*. Ground layer of perennial grasses such as *Themeda triandra, Elionurus citreus, Ectrosia leporina, Eriachne rara, Eremochloa bimaculata, Thaumastochloa pubescens, Eragrostis brownii* and *Ischaemum australe*. Occurs on older alluvial plains on strongly duplex clay soils with restricted drainage. Fire Management: season: Mid-dry season. Intensity: Low to moderate.	Least concern	No concern at present
11.3.25b Riverine wetland or fringing riverine wetland. *Melaleuca leucadendra and/or M. fluviatilis, Nauclea orientalis open forest.* A range of other canopy or sub canopy tree species also occur including *Pandanus tectorius, Livistona* spp., *Eucalyptus tereticornis, Corymbia tessellaris, Millettia pinnata, Casuarina cunninghamiana, Livistona decora, Lophostemon suaveolens or L. grandiflorus,* rainforest species and, along drainage lines, *Eucalyptus camaldulensis or E. tereticornis.* A ground layer of tall grasses such as *Chionachne cyathopoda, Mnesithea rottboellioides or Heteropogon triticeus* may be present. Often occurs on coarse sand spits and levees within larger river channels. Fire management: Season: Primarily early dry season. Intensity: Low.	Least concern	Of concern

RE Description	VMA Status	EPBC Biodiversity Status
11.3.30 *Eucalyptus crebra* or *E. paedoglauca* and *Corymbia dallachiana* woodland. Forms an open-woodland to open forest in places. Has a grassy ground layer of *Heteropogon contortus, Bothriochloa bladhii, Themeda triandra, Sehima nervosum, Enneapogon* spp., with forbs such as *Indigofera* spp., *Glycine tabacina, Galactia tenuiflora* and *Tephrosia juncea* common. Occurs on older floodplain complexes on Cainozoic alluvial plains. Fire management: Season: Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains. Intensity: Primarily low to moderate, with occasional high intensity fires.	Least concern	No concern at present
11.3.35 *Eucalyptus platyphylla, Corymbia clarksoniana woodland.* This association usually occurs as woodland of *Eucalyptus platyphylla* and *Corymbia clarksoniana* with *Corymbia tessellaris* occurring in some areas. A low tree layer of species such as *Planchonia careya, Pandanus spiralis, Melaleuca viridiflora* or *M. nervosa* and *Petalostigma pubescens* is often present. The ground layer is usually grassy with common species including *Themeda triandra, Heteropogon contortus, Mnesithea rottboellioides* and *Bothriochloa decipiens,* together with herbs or forbs such as *Glycine tabacina, Galactia tenuiflora or Sida hackettiana.* Occurs on Cainozoic alluvial plains. Older floodplain complexes, major stream levees and lighter deltaic deposits. Fire management: Season: Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains. Intensity: Primarily low to moderate, with occasional high intensity fires.	Least concern	No concern at present

Seasonally flooded *Melaleuca viridflora* woodland, consistent with RE 11.3.12, covers a large portion of the area around the TRR4 alignment and also occurs within the alignment. Where this habitat was dominant the epiphytic black orchid *Cymbidium canaliculatum* was widespread. This RE was found to commonly have canopy species such as *E. crebra, C. dallachiana* and *E. platyphylla*.

Grassy woodland with *C. crebra* (often in conjunction with *C. dallachiana*) or *E. platyphylla* canopy and *M. viridiflora* midstorey, representing RE 11.3.30 and 11.3.35, were both recorded vegetation communities within the footprint. RE 11.3.30 and 11.3.35 are distributed in adjoining areas to the alignment and were sometimes not clearly defined. Common midstorey species recorded in open woodland in both RE's was *Grevillea striata*, *Petalostigma pubescens*, *Planchonia careya* and multiple *Acacia spp*. (including *A. bidwillii* and *A. simsii*). Common grasses recorded included *Heteropogon contortus* and *Themeda triandra*.

Riparian habitat, closely aligned with RE 11.3.25b, within the proposed alignment consisted primarily of canopy species including *C. clarksonia*, *C. tessellaris*, *M. leucadendra* and sub canopy species including *Acacia* spp., *Pandanus cookii*, *Leucaena leucocephala**, and *Ziziphus mauritiana**. Groundcover species often included *Mnesithea rottboellioides* and *Megathyrus maximus**.

3.5 Weeds

Vehicle and human movement, soil disturbances, soil movement and transportation of materials are activities that increase the dispersal or introduction of introduced plant species and diseases. A number of introduced plant species already occur within the TRR4 corridor as identified in Table 3 below. Without appropriate management, the construction of TRR4 has the potential to disperse these weeds into areas where weed species are currently limited, or allow the establishment of these species in newly cleared areas. In addition, new weed species could be introduced to the area through increased vehicle and soil movement, and through long term maintenance operations such as mowing of the road verges.

Weed invasion reduces the overall condition and quality of vegetation, and out-competes many native species for resources such as space, nutrients and light. Weed invasion is a disturbance factor that can change the structure and composition of native vegetation irreversibly.

Table 3 List of Weed Species Recorded within and Adjacent to the Two Lane Construction Footprint

Species name	Common name	Growth form	Family	LPA status^	PMP status#
*Aeschynomene paniculata**	Pannicle joint vetch	Shrub	Fabaceae		
*Alternanthera ficoidea**	Joy weed	Creeper	Amaranthaceae		
*Clitoria ternatea**	Butterfly pea	Vine	Fabaceae		
Cryptostegia grandiflora	Rubbervine	Vine/shrub	Apocynaceae	Class 2	High priority
*Hyparrhenia rufa**	Thatch grass	Grass	Poaceae		
*Hyptis suaveolens***	Hyptis	Shrub	Lamiaceae		
Lantana camara	Lantana	Shrub	Verbenaceae	Class 3	
*Leucaena leucocephala***	Coffee bush	Shrub/tree	Mimosaceae		High priority
*Macroptilium atropurpureum***	Siratro	Vine	Fabaceae		
*Macroptilium lathvroides**	Phasey bean	Vine	Fabaceae		
*Megathyrus maximus***	Guinea grass	Grass	Poaceae		
*Melinis repens**	Red Natal grass	Grass	Poaceae		
*Neptunia spp**	Sensitive plant	Shrub	Fabaceae		
*Passiflora foetida***	Stinking passion flower	Vine	Passifloraceae		
*Ricinus communis***	Castor oil	Shrub	Euphorbiaceae		
Sporobolus spp	Rat's tail grass	Grass	Poaceae	Class 2	High priority
*Stachytarpheta jamaicensis***	Snakeweed	Shrub	Verbenaceae		
Stylosanthes spp.	Stylo	Shrub	Fabaceae		
*Themeda quadrivalvis***	Grader grass	Grass	Poaceae		Potential weed
*Urochloa mutica***	Para grass	Grass	Poaceae		
*Xanthium strumarium***	Noogoora burr	Shrubs	Asteraceae		
Ziziphus mauritiana	Chinee apple	Tree	Rhamnaceae	Class 2	High priority

^LPA= *Land Protection (Pest and Stock Route Management) Act 2002.*

#PMP= Townsville City Council Draft Pest Management Plan (2010-2014).

*=species not listed by the State as a significant weed.

**=species listed by the State as a significant weed.

3.6 Ambient Noise Levels

Noise measurements have been conducted at six locations within the woodland area surrounding the TRR4 road reserve during 2013 (AECOM, 2013) (refer to Figure 1). The measurements were conducted in accordance with the requirements of the Department of Environment and Heritage Protection's *Noise Measurement Manual* 2000. The recorded noise levels indicate that the existing noise environment at each location was controlled by animal noise and distinct traffic noise.

Table 4 below documents noise measurement findings.

Table 4 Summary of Measured Noise Levels

Location	Maximum $L_{Aeq\ (1h)}$ dB(A)[1]			Average $L_{Aeq,\ T}$ dB(A)[2]			Average $L_{A90,\ T}$ dB(A)[2]		
	7am – 6pm	6pm – 10pm	10pm – 7am	7am – 6pm	6pm – 10pm	10pm – 7am	7am – 6pm	6pm – 10pm	10pm – 7am
1 - directly west of the end of Tompkins Road	56	57	58	43	50	48	34	43	35
2 200m west of the Dalrymple interchange area	56	54	48	44	46	37	35	36	31
3 – Dam 1	60	55	53	48	46	41	35	39	31
4 – Dam 3	61	54	49	48	48	39	36	37	27
5 - 50 m from TRR4	50	54	49	42	45	40	33	35	27
6 –western edge of state land lot	50	54	45	42	44	37	35	35	31

1. The highest of the maximum $L_{Aeq\ (1h)}$ for each time period has been reported.
2. The arithmetic average of the $L_{Aeq,\ T}$ or $L_{A90,T}$ has been reported.

Attended measurements were undertaken at each location when setting up the noise loggers in August 2013 to provide more information about the local noise environment. Attended measurements were also conducted at an additional location, approximately 100 m away from Logger 4, on the other side of the dam, in close proximity to several cockatoos. The results of the attended measurements are presented in Table 5 below.

Table 5 Summary of Attended Noise Measurement

Location	Measurement Time	Noise Measurement			Observed Noises
		L_{Aeq} dB(A)	L_{A10} dB(A)	L_{A90} dB(A)	
1	8.00 am – 8.15 am	43	44	38	Distant traffic (Shaw Road) ~ 40,41 dB(A). Distant industrial noise ~ 42, 43 dB(A)
2	12.00pm – 12.15pm	40	42	34	Distant traffic ~ 32-41 dB(A) Aircraft flyover ~ 38-52 dB(A)
3	1.00pm – 1.15pm	39	41	35	Birds ~ 33-50 dB(A) Distant traffic ~ 32-36 dB(A)
4	2.15pm – 2.30pm	44	48	38	Birds ~ 40-48 dB(A) Insect ~ 42 dB(A) Wind and rustling leaves ~ 42-47
100m from Logger 4	2:44pm – 2:59 pm	50	53	41	Birds (cockatoos) ~ 41-63 dB(A)
5	9.00am – 9.15 am	47	42	26	Distant bird noise ~ 28-54 dB(A) Distant traffic ~ 38 dB(A) Aircraft flyover ~ 26-68 dB(A)

Location	Measurement Time	Noise Measurement			Observed Noises
		L_{Aeq} dB(A)	L_{A10} dB(A)	L_{A90} dB(A)	
6	10.00am – 10.15am	37	39	29	Distant bird noise ~ 35-40 dB(A) Distant insect noise ~ 28 dB(A) Aircraft flyover ~ 30-49 dB(A)

It was observed that the local noise environment was dominated by aircraft noise from by planes taking off and landing at the nearby Townsville Airport. In the absence of aircraft noise, distant animal noise was observed at all locations, whilst distant traffic noise could be heard at Locations 1, 2, 3 and 5.

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LAST MODIFIED CFS 04-June-2013
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AECOM

Cadastre, Study Area, Water body provided by Townsville City Council 2011.
Bog Figwort - AECOM 2012
StreetPro © 2010 Pitney Bowes Software Pty Ltd
Roads, Watercourse - © 2010 PSMA Australia Pty Ltd

N

Scale: 1:50,000
(when printed at A3)

0 500 1,000 2,000 Metres

Legend

- Dam Locations
- Noise Receptor Locations
- Highways
- Main Roads
- Local Roads
- TRR4 Concept Design
- Property Boundary
- State Land

TOWNSVILLE RING ROAD SECTION 4

2013 Noise monitoring locations

Figure 2

3.7 Matters of National Environmental Significance for TRR4

3.7.1 Black-throated Finch

The two respective populations of 20 black-throated finch (BTF), centred on Dams 1 and 3 on Lot 1 SP232873 (the adjoining state land around TRR4) are considered a medium sized population for Townsville. Dam 1 was a centre for a population of approximately 20 mainly adult birds during field surveys undertaken in 2013 (NRA 2013). At various times during the observation periods, birds made up of mostly adult pairs regularly came to drink at this dam. Groups of 4 to 7 BTF were also frequently noted, the maximum group size counted was 15 BTF within a mixed-species flock (with Double-bar Finches). Nests thought to, or known to belong to BTF were encountered approximately 300m to 430m north-west of Dam 1, although it is expected there would have been more than observed.

Approximately 470m north-east of Dam 3, a separate group of 20 BTF were observed foraging and in one instance birds were seen drinking from Dam 3 (a group of seven). Nests were also discovered near the group of foraging birds. This suggests that this population of BTF have found an alternative source of water to Dam 3 and it is supposed that it is one of the water troughs. The nearest water trough (north of Dam 3) was observed to have a perch available (a stick placed in the trough) which would allow the birds access. Due to the number of BTF observed there would be more nests than those seen by the survey team.

A nest that was noted in the May 2012 survey approximately 180m from the TRR4 alignment was revisited in the December 2012 survey (west of TRR4). While the nest was in good condition, no BTF were observed in the vicinity of this nest (this was the same result as the June 2012 survey).

The populations on the state land adjoining the TRR4 road reserve are thought to be becoming increasingly isolated due to the land management practices and development pressures in the surrounding areas. Weeds are considered a major issue and in particular rat's tail grass *Sporobolus* sp. and chinee apple *Ziziphus mauritiana* need to be managed to prevent degradation of BTF habitat. In the state land, and within close proximity of TRR4, the BTF breeding habitats and dry season habitats are considered important, particularly the areas around the permanent water sources as these are a limiting factor in the presence of the BTF.

3.7.2 Key threatening processes for BTF

The National recovery plan for the Black-throated finch southern subspecies Poephila cincta cincta (Australian Government, 2007)[1] identifies seven primary threatening processes for BTF including the following:

- clearing and fragmentation of habitat
- introduced weed invasion
- degradation of habitat by domestic stock (grazing)
- inappropriate fire regime, and
- Introduced fauna (including predators).

TRR4 mitigation measures have been focused around four of these threatening processes (refer EPBC referral 2012/6562), with introduced fauna not specifically seen as a significant threat from the road construction activities themselves. The proposed mitigation measures in the EPBC referral and the EMP (P) have been primarily focused around clearing and fragmentation of habitat, although other threatening processes have been addressed. To measure the efficacy of these mitigation measures it will be necessary to monitor both compliance matters particularly in relation to the level of clearance, but also changes in both the remaining road reserve environment and that in the adjacent state land, as many of the management and mitigation proposed for the project focused on improving habitat conditions for BTF.

3.7.3 Squatter Pigeon

Squatter Pigeon distribution as found from the various surveys for the TRR4 project, is thought to be concentrated south of the proposed road alignment, with the closest sighting location some 800m to the south west. This species has been found either singly or in small groups (2-4 individuals) at the cattle stockyards, along access tracks, near Saunders Creek, and most commonly in the woodland areas around the two farm dams sited 1 km and 3 km south west of the proposed road.

[1] The national recovery plan also lists illegal trapping of birds and hybridisation with escapes of the northern subspecies. As these threats are not known to be relevant to the offset area they have not been included in the management plan.

3.7.4 Key threatening processes for Squatter Pigeon

The Australian Government species profile for Squatter Pigeon identifies the following threatening processes that affect the species:

Habitat fragmentation by:

- Clearing for development purposes
- Clearing for agriculture
- Overgrazing by sheep and cow
- Weed invasion (e.g. buffel grass *Cenchrus ciliaris*)
- Predation (avian e.g. birds of prey and terrestrial predators e.g. cats and foxes) (SPRAT, 2014).

As for BTF, proposed monitoring for this species will focus on compliance and environmental monitoring areas, with monitoring for habitat condition for BTF being a surrogate for Squatter Pigeon, given their similarity in habitat preference.

3.7.5 Bare-rumped Sheathtail Bat

Various passive acoustic monitoring occurred along the TRR4 alignment and also at Dam 1 during the field investigation period. Findings confirmed the presence of a range of non-threatened bat species listed below:

- Gould's wattled bat *Chalinolobus gouldii*
- Western broad-nosed bat *Scotorepens balstoni*
- Eastern cave bat *Vespadelus troughtoni*
- Little bent-wing bat *Miniopterus australis*
- Eastern bent-winged bat *Miniopterus orianae oceanensis*
- Northern freetail bat *Chaerephon jobensis*
- Beccari's free-tailed bat *Mormopterus beccarii*
- Eastern little free-tailed bat *Mormopterus ridei*
- Yellow-bellied sheath-tailed bat *Saccolaimus flaviventris.*

Spectrum analysis concluded that it is highly probable that the Bare-rumped Sheathtail bat *S. saccolaimus* was present at all sites in the TRR4 alignment (RPS 2013). Observations of tree hollows using burrow scope cameras within the original two lane alignment revealed only two juvenile blue winged kookaburras, an Australian owlet-nightjar and many invertebrates.

3.7.6 Key threatening processes for Bare-rumped Sheathtail bat

The National recovery plan for the Bare-rumped Sheathtail bat *Saccolaimus saccolaimus nudicluniatus* identifies the following threatening processes for this microbat:

- Loss of habitat by
  - Clearing for urban development, and
  - Agricultural clearing.
- Other likely threats
  - Vegetation change
  - Timber collection and targeted tree removal
  - Competition for hollows (feral birds, native birds and introduced insects)
  - Disease, and
  - Climate change (Schulz, M & B Thomson, 2007).

The primary argument presented in the PD in relation to the likelihood of significant impacts to be not of concern for this microbat, related to the retention of the remaining widespread woodland landscape around TRR4, and that it is most probable the bat is foraging over rather than roosting within the construction area. With this in mind, only compliance monitoring of the environmental management measures specifically stated for the bat in the EMP are proposed in this plan. Ongoing passive acoustic monitoring is not recommended as it is considered that any failure to record the bat call, could be attributed to a range of variables, rather than a clear indication the bat has moved away from this landscape.

The Species Management Program (SMP) submitted to DEHP by TMR for the project has specified the requirement to undertake dawn pre-clearance surveys 48 hours prior to felling an area that contains potential bat roosting habitat, should a spotter catcher identify potential roost trees. The SMP has also provided greater guidance to the contractor on how to undertake these surveys and on sensitive tree felling techniques. The Contractor's Site Environmental representative will report findings to the Contractor's Project Manager and discuss if the roost tree can viably be retained, before tree felling occurs.

4.0 Monitoring Requirements

As indicated in Section 2.2 monitoring requirements for the project have been broadly categorised into either compliance or environmental monitoring. Within the compliance monitoring requirements there are those that relate to whether stated mitigation measures have occurred as committed to through the various approval documents, and secondly whether during the construction period, EPBC approval requirements are being met.

The mitigation commitments/obligations (listed in Appendix B) are drawn originally from the referral itself, of which most have been embedded in some form into the EMP (P) and cross referencing between documents is provided in Appendix B. The variation requested to extend the design of TRR4 during the course of the environmental assessment under the EPBC did change some of those mitigation measures and these amendments, plus new mitigation made in response to ongoing field investigation findings were made in the preliminary documentation.

The following section documents the monitoring requirements and the responsibility for the delivery of the requirements.

4.1 Compliance Monitoring

Compliance monitoring requirements can be drawn directly from the:

- EPBC approval conditions for the project (Appendix A)
- Mitigation and management measures in the referral and the preliminary documentation (summarised in Appendix B), and
- EMP (P) conditions.

4.2 Monitoring Responsibilities

Some monitoring and associated reporting requirements fall directly to TMR as the approval holder even if components of the necessary reporting data needs to be captured and provided by the construction contractor.

4.2.1 TMR Responsibilities

Table 6 outlines the compliance monitoring and reporting requirements that rest with TMR under the EPBC approval conditions.

Table 6 Compliance reporting requirements for TMR as a result of EPBC approval requirements

Reference No.	Issue	Method of Recording	Frequency	Reporting Period
	Record Keeping			
1	Maintain accurate records substantiating all activities associated with or relevant to the conditions of approval including measures taken to implement the plans and strategies required by the approval and make them available on request to DOE.	File references	Continuous through project	Monthly collation Annually
	Plan preparation and approval			
2	Prepare and submit an Offset Management Plan to the Commonwealth Environment Minister for approval	File references	Event based	2014
3	Prepare and submit a Monitoring Plan to the Commonwealth Environment Minister for approval which must then be implemented.	File references	Event based	2014

Reference No.	Issue	Method of Recording	Frequency	Reporting Period
	Offset provision			
4	Fund and undertake a research projects on BTF	Documentation between TMR and education facility to establish research (letters, meeting notes, presentations etc.)	Progressive reporting as research topics discussed, selected and candidate found and scholarship awarded. During the course of the research, biannual meetings between research provider and TMR to document progress, research direction, progress and in time findings which can be implemented if relevant in the offset site.	Annual letter to DOE documenting progress
5	Final research topics selected via consultation with BTF Recovery Team			
6	Outcome of research undertaken be used to inform management actions at secured offset site	Review of offset management plan to incorporate changes to management actions. Minister to approve.	Event based	As required (triggered)
	Publications			
7	Publication of each of the conditions and implementation of the plans specified in the EPBC conditions on TMR web site	Compliance report summarising implementation tasks Letter to DOE providing Proof of date of publication of compliance report and web site link to compliance reporting	Annual compliance report for project	At end of every 12 months from construction start

TMR also committed to a number of education and advocacy mitigation measures and operational management for the remaining habitat in the road reserve in the EPBC referral and in regards to the indirect offsetting (research) in the PD. These are documented in the Table 7 below.

Table 7 Advocacy, Education and Land Management Measures that require Compliance Monitoring

Reference No.	Issue	Method of Recording	Frequency	Reporting Period
	Advocacy and Education			
8	TMR to provide advice to the Department of Natural Resources and Mines (DNRM) regarding the conservation of BTF found on the state land parcel and to seek revised lease conditions for the state land related to: - Vehicle and stock access and management on the state land - Stock levels, land and water management in relation to BTF habitat on state land - Pest control requirements (noxious and environmental weeds) - Fire regimes and fire breaks that could enhance the biomass of key grass species for BTF at critical times	Meeting notes with DNRM Subsequent correspondence between departments	As actioned	Annual report to DOE

Reference No.	Issue	Method of Recording	Frequency	Reporting Period
9	TMR to discuss feasibility with Recovery Team regarding including BTF populations in Saunders Creek / TRR4 alignment in the annual BTF waterhole count	Correspondence between Recovery Team members and TMR	As actioned	Annual report to DOE
10	Provide findings and learnings about threatened species in TRR4 into the broader community. To raise awareness of BTF and other species management issues on TMR web site and available to other TMR projects	Records of website material and dates posted Internal TMR file and meeting notes – lessons learnt exchanges between projects	As actioned	Annual report to DOE
	Outcomes of research from indirect offsetting			
11	TMR will facilitate informal relationships between the researchers (in relation to the indirect offset) to ensure new findings can be incorporated or trialled at the TRR4 offset site	Once research project is established, scholarship requirements will include six monthly formal contact with JCU on progress and findings of project	As actioned	Annual report to DOE
	Road reserve management – operational phase			
12	TMR will manage the remaining road reserve in accordance with their weed and fire management practises to prioritise actions to improve BTF habitat conditions in remaining TRR4 road reserve: Specific techniques likely to be applied include: - Slash perimeter fence line firebreaks during burning rotations to stimulate grass regrowth and seeding - Strategic timing of sections being burnt (cool dry season burns only) to increase grass seed yield; implement mosaic pattern of burns - Post construction burns in road reserve - Hydromulch trials in burnt sections	TMR's land management plan prepared for road reserve management	As actioned	Annual report to DOE

4.2.2 Contractor Responsibilities

It is understood that the contractor is ultimately responsible for compliance of their own work and a regular review of the monitoring program. However the contractor is also responsible for reporting on compliance for mitigation measures and for monitoring as specified by the EMP (P), MRTS51.1 and other specifications for the project to TMR, so the department can fulfil its obligations under the EPBC Act and other state legislation.

Table 8 Monitoring Requirements for Contractor

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
	Record Keeping			
13	Maintain accurate records substantiating all activities associated with or relevant to	Convert EMP into corrective action / monitoring log for	Continuous	Fortnightly summaries by contractor, with

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
	the conditions of approval including measures taken to implement the plans and strategies required by the approval and make these available to TMR.	contractor's environmental representative to apply on project site		monthly reports provided to TMR (unless requested more frequently due to construction activity)
14	Reporting on meeting EMP (P) commitments	Use EMP as a compliance and corrective action record report	Continuous	Fortnightly by contractor, with monthly summaries provided to TMR (unless requested more frequently due to construction activity)
	Design			
15	TRR4 construction as per design approved by Commonwealth.	Submission of 'As constructed' drawings	End of construction for set chainages	Yearly report as relevant
16	Apply Dense Graded Asphalt in rural section.	Submission of 'As constructed' drawings	End of construction for set chainages	Yearly report as relevant
17	Create water sources	Submission of 'As constructed' drawings or similar type of record of where water sources have been created	End of construction for set chainages	Yearly report as relevant
	State approval requirements relating to threatened species			
18	Approval of Species Management Program by DEHP	Approval letter and SMP	Provided to TMR on completion	30 days after received
	Construction Management			
	Site Induction			
19	Site induction covering matters of NES including Toolbox talks to ensure all workers are aware of location and reason for protection features across site	Schedule of inductions Attendance sheets for staff present	During site establishment phase As required thereafter as new staff are appointed	Monthly environmental reporting
	Clearance of Native Vegetation and Impact on Threatened Species			
20	Pre-clearance survey for all threatened species[2] in clear and grub areas using appropriate search method for key species (bat and birds) checking of hollow logs at key waterways, riparian areas and searching for breeding activity.	Daily log of spotter catcher activity, with date, and key observations (i.e. species observed, GPS record of location, and note if animal breeding	Two days before clear and grub activities	Weekly report during clear and grub

[2] Especially for Bare-rumped sheathtail bat, Black-throated finch, Squatter pigeon, and Short beaked echidna, but applies to any state or commonwealth threatened plant or animal species recorded.

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
		place needs to be cleared). Follow up daily log on protective measures to be applied to either remove and relocate animal or protect habitat whilst breeding activity underway consistent with EMP and project mitigation commitments, such as: Requirements to flush potential nesting areas of Squatter Pigeon before clearance Checking of nests and fledging of chicks before clearing by spotter catcher		
21	Mark out feeding, roosting, nesting sites for any threatened species that in close proximity (5 m) to works area.	Photographic record, annotated on construction drawing	Week before clear and grub activities	Weekly report during clear and grub
22	Native (remnant[3]) vegetation clearance remnant vegetation not to exceed 68.24 hectares for project.	Physical measures of length/breadth of clearance by chainage for construction area and fence line Displayed by GIS mapping in relation to GA drawings for clear and grub areas	Progressive during clear and grub period	Weekly report during clearing and grubbing operations
23	Native vegetation clearing in BTF habitat not to exceed 49.19 hectares.	Physical measures of length/breadth of clearance by chainage in construction area and for fence line Displayed by GIS mapping	Progressive during clear and grub period	Weekly report during clearing and grubbing operations

[3] That is mapped as remnant vegetation on DEHP Regional Ecosystem mapping.

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
24	Staged clearing outside of breeding seasons for BTF and Bare-rumped sheathtail bat.	Weekly log of date of clearance by chainage and method used in relation to environmental areas shown on environmental mitigation drawings	Weekly record summary of start and end of clear and grub period and date and start and finish times	Weekly report during clearing and grubbing operations
25	If trees are found to be actively used by threatened microbats during pre-clearing surveys, then clearing those trees will be attempted at night to allow the bats to relocate to an alternative roosting site.	Daily log of spotter catcher activity, with date, and key observations (i.e. species observed, GPS record of location, and note if animal breeding place needs to be cleared).	Weekly record summary of start and end of clear and grub period and date and start and finish times	Weekly report during clearing and grubbing operations
26	Licenced spotter catchers on call.	Contractor's staff / sub consultant register and appointment file records	Construction duration	At appointment
27	Inspection and marking of hollow bearing logs near watercourses.	Photographic record, annotated on construction drawings	Prior to clear and grub activities in area	Included in monthly reports
28	Hand clearing of vegetation would occur in riparian area to ensure soil stability.	Photographic record, and annotated on construction drawings	As required	Included in monthly reports
29	Perimeter fencing prior to construction.	Site inspection with TMR environment staff	Inspection Log	As required
30	Waterways to be fenced to keep stock out.	Site inspection with TMR environment staff	At end of works period	Included in final compliance report
	Weed Control			
31	Weed wash down facilities.	Photos of facilities when installed Log of vehicles into site and using wash down Record of sump disposal offsite	Daily use of facilities Weekly log of vehicles going through wash down	Included in monthly reports
32	Control of declared weeds found in TRR4 road reserve.	Inspection and mapping of declared weeds Activity log of control treatment (date, method)	Initial survey and treatment Follow up inspection of controlled area	Once each task is completed

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
			and further treatment if live weeds present after three months	
33	Environmental weeds[4] (non-declared). Elimination of weeds in areas to be worked or trafficked prior to works commencing.	Inspection and mapping of weed areas Activity log of control treatment (date and method)	Initial survey and treatment Follow up inspection of controlled area and further treatment if live weeds present after three months	Once each task is completed
34	Avoid stockpiling topsoil in weed affected areas.	Inspection for weeds at stockpile locations	Prior to stockpile being created Every month during construction while stockpile used	Monthly record
35	Elimination of weeds including invasive grasses from landscape treatments as per MRTS16E.	Site inspection	Every six weeks for period of three months post construction	At inspection
	Night Works			
36	In any area where threatened species are found nesting/roosting in the road reserve during construction, temporary lighting to be directed away from nest area.	Site inspection	During periods when temporary lighting is required	At time of inspection
37	Vegetation clearing activities in BTF and Squatter Pigeon areas will not occur at night.	Daily log of vegetation clearing activities (chainage, time period, area)	During clear and grub	Included in weekly reports
38	Limited construction works will occur at dusk or night.	Work activities recorded daily	Continuous	Included in monthly reports
	Dust			
39	Fugitive dust	Fugitive dust monitoring program see Section 5.6	Continuous	Incident based reporting

[4] Annexure MRTS51.1 Clause 11.2 identifies known species in the construction zone.

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
	Water Quality			
40	Sediment and Erosion Control Plan requirements to be implemented.	At establishment, then weekly to confirm integrity of sediment/erosion control methods, and on the day before or day of an anticipated high rainfall event	Continuous	Confirmation in monthly reports
41	Water quality monitoring	Hand held field meter – see Section 5.5 for water quality parameters to be measured	Daily while work is occurring within high banks of Saunders and Stony Creek Otherwise weekly	Confirmation in monthly reports
42	Rehabilitation of riparian areas post culvert and bridge construction will focus on restoring an appropriate mix of grass and woody vegetation. Where there is sufficient space, logs and stags with hollows reclaimed from clearing activities will be placed in these areas downstream of road infrastructure.	Fixed photo monitoring point established in riparian areas, to record and analyse native & grass succession rates into sites. Record of logs and stags placed into riparian areas (but not within the high bank)	Fixed point photo monitoring taken every three months post rehabilitation until construction period ends	Included in monthly reports as relevant
	Noise			
43	Ensure that vehicles are serviced in accordance with manufacturing handbook.	Reporting on findings of regular servicing in accordance with manufacturing handbook.	As relevant	Included as relevant in monthly reporting
44	Vehicle and machinery speeds restricted in construction areas.	Signage Enforcement checks by site manager	Monthly	In monthly reports as relevant
	BTF Population Stability			
45	Population numbers.	Late dry season survey	Once every year of construction	Post survey
46	BTF breeding activity.	Breeding Season survey (generally March –June (see Section 5.1 for method)	Once every year of construction	Post survey

Reference No.	Issue	Method of Monitoring and/or Measure	Frequency	Reporting Period
	BTF Habitat Condition			
47	Reduction in weeds in road reserve.	Weed distribution surveys (See Section 5.3 for method)	Every six months for construction period	Post survey
48	Increase in BTF grasses in road reserve particularly around perimeter fence/firebreaks.	Transects/monitoring plots (see Section 5.2 for method)	Annual	Post survey
	Other – construction generally			
49	Public access will be restricted and discouraged by appropriate signage.	Photographic record	At end of construction period	Evidence included in final compliance report

5.0 Environmental Monitoring Program

5.1 Stability of BTF and Squatter Pigeon Populations

The area between TRR4 and Dam 1 is breeding habitat for BTF and in the vicinity of where Squatter Pigeon has been observed. This area will be close to construction activities particularly those around Dalrymple / Kalynda interchanges and carries the greatest risk of being disturbed by unplanned construction activities outside the clear and grub alignment, and from indirect impacts as a result of the project. Monitoring for the ongoing presence of BTF at Dam 1 particularly, would provide an indicator of change in the use of the area by BTF. It is acknowledged that there are other risks external to construction activities that could also influence BTF use and numbers in this habitat. Such external factors include habitat degradation caused by other reasons elsewhere in the broader area which are not in TMR's or the contractor's control, adverse weather events, disease in BTF population and even fluctuations in BTF movement in the broader landscape. However monitoring BTF numbers at Dam 1 will provide sufficient information to raise concerns and associated management responses concerning deteriorating or improving conditions. Monitoring Dam 3 at the same time will allow correlation of trends to occur.

The contractor will be responsible for commissioning these surveys.

Table 9 Monitoring method for late dry and breeding season survey for presence of BTF at Dams 1 & 3

Monitoring Method	Indicators	Frequency	Performance Criteria		Potential Management Action
			Acceptable Range	Range that triggers corrective action	
BTF[5], Squatter Pigeon - late dry season (Oct-Nov, dependent on weather conditions) waterhole surveys at Dams 1 & 3, if possible in conjunction or same timing with annual BTF waterhole counts by Recovery Team. Six hours per day for two consecutive days (12 hr total) at each of the dams and include the first three hours after first light on each day. - targeted survey during the breeding season (Mar-Jun, dependent of weather conditions). Three days, 10 hours within 600 m of both Dams 1 & 3, 20 hours within 1.5 km of Dams 1 & 3. - Squatter Pigeon observations during the above surveys will be noted and mapped.	BTF and Squatter Pigeon observations (nesting, foraging)	Biannual (wet and dry season surveys)	Maintenance or increase in observed numbers at Dam 1 and 3 over two surveys for BTF	25 % reduction of BTF numbers in observed numbers at Dam 1, where trend is not replicated at Dam 3 over two surveys	TMR to discuss with contractor BTF & Squatter Pigeon survey results, particularly if there has been an significant change in construction practice TMR to discuss findings with DEHP and review merits of management actions to improve habitat condition in state land and or increase water source supply

[5] Survey methods follow the *Significant impact guidelines for the endangered black-throated finch (southern) (Poephila cincta cincta)-background paper to the EPBC Act policy statement 3.13*.

5.2 Habitat Condition Monitoring

Many of the mitigation measures in the TRR4 referral related to managing the habitat condition in the remaining component of the road reserve as well as minimising impacts on the MNES species adjacent to the road reserve. Permanent monitoring plots which record habitat composition and condition can inform management decisions about the effectiveness of weed control and fire management in the road reserve as well as changes in the abundance of BTF preferred grasses. Control plots in the adjacent state land would also assist in trend monitoring.

Table 10 Monitoring methods for changes in habitat conditions

Monitoring Method	Frequency	Reporting	Performance Criteria		Potential Management Action
			Acceptable Range	Range that triggers corrective action	
Monitoring Plots Annual monitoring of permanent sites[6] Each plot covering a 10 x 50 metre (m) plot (500 m^2) marked by star pickets. Data to be collected: - site name, location (using hand-held GPS), RE - photos (at start and end of 50 metre transect and each 1x1 m plot) - litter, rock, bare ground and cryptogram cover - observed disturbance factors (weeds, fire, drought, grazing) - vegetation condition, using the scale of Kaesehagen (1994) - vegetation structural descriptions using modified Specht (1970) descriptions cited in Neldner, Wilson. Thompson &	Report - Annual Monitoring Plots - Annual (undertaken at a time that species can be readily identified, e.g. presence of inflorescence)	Reporting should include: - detailed description of habitat composition and condition at monitoring sites - description of any changes in vegetation - detailed description management actions undertaken over the year reported on BTF observations (nesting, foraging) - Squatter Pigeon observations (nesting, foraging, dust bathing)	The performance of the management actions can be assessed through: - changes in vegetation composition and structure - presence, abundance of BTF and or Squatter Pigeon	Significant (i.e. >10%) increase (thickening) in shrub layer Significant reduction (>10%) in native grass coverage Significant (10%) increase in exotic grasses compared to native grasses	Intensify weed control efforts Revisit fire management strategy

[6] The complete data recorded at each site can be used for weed and fire management outcomes as well. That is, only one complete data set will need to be recorded at each site and extrapolated for each related mitigation measure.

Monitoring Method	Frequency	Reporting	Performance Criteria		Potential
Dillewaard (2012) - list of all vascular flora species present - strata, height and calculation of crown cover using the line intersect method for shrub and tree layers - estimation of ground cover in five, 1 x 1 m ground plots (including native grass composition) - basal area and stem counts for shrub and tree layers.					

5.3 Bog Figwort Restoration Site Monitoring

The contractor is required under the NC Act protected plant permit authority (WIPA15012214) conditions to implement the Impact Management Plan – Bog Figwort (AECOM, 2014). The impact management plan proposed the following monitoring to occur in the chosen soil translocation site:

"Suitably skilled persons will monitor the site from March-June in the trial year to document the germination and growth of Bog Figwort. Records to be retained shall include:

- GPS photographs of Bog Figwort on the plot;
- A monthly count of the number of Bog Figwort individuals germinating;
- Records of any weeds;
- Records of any predation/damage;
- Observations of water depth in depression; and
- Rainfall observations from the translocation site gauge after each rain event.

Monitoring shall consist of:

- Weekly photographs of the plot taken from the monitoring point;
- Weekly inspections for weeds. Any weeds found are to be removed by hand;
- Fortnightly counts of Bog Figwort germination; and
- Notes taken regarding reproductive state of Bog Figwort (flowering, fruiting, seeding).

*Suitably skilled persons shall have the following skills inclusively:

- Someone with botanical identification skills;
- Is familiar with Bog Figwort;
- Is familiar with capturing and maintaining botanical records; and
- Has a skill in ecological survey techniques."

5.4 Weed Persistence Monitoring

Declared and environmental damaging weeds are present in varying distributions within the TRR4 road reserve. The EMP (P) Section 6.2.2 indicated that the contractor should develop a monitoring program to ensure that weed invasion is controlled during the construction period. It is noted that TMR's efforts in weed control in the road reserve will be a collaborative approach in consideration of applied weed control effort undertaken by neighbouring landowners and Townville City Council in its pest control function, particularly adjacent to unallocated state land. Table 11 outlines the monitoring effort.

Table 11 Monitoring methods for weed management strategy

Monitoring Method	Frequency	Performance Criteria		Potential Management Action
		Acceptable Range	Range that triggers corrective action	
Weed distribution and control area map for road reserve For shrub species or those limited in distribution and abundance, the location of individual plants should be marked with GPS and or star picket. For widely distributed species (*e.g.* Rat's Tail Grass) site inspection and associated mapping to indicate distribution and abundance for weed control effort. **Monitoring plots** - list of weed species - strata, height and estimated of cover of weed species	Weed map - Initial (2014) with ongoing inspections for weeds every three months Monitoring plots – Annual Weed control Biannual plus follow up 4-6 weeks after the first treatment. If annual monitoring plots and/or weed mapping indicate an increase in weed distribution and abundance, review of weed management to be undertaken.	Progressive and measurable reduction in abundance and distribution of weeds through the review of annual weed maps and abundance data from monitoring plots **Note**: Weed control contractor to provide details of annual weed control effort. This should include the timing and duration of control, area covered, species sprayed (if chemical), chemicals used.	25 % increase in original distribution of weeds in areal extent	Increase weed control efforts
Weed hygiene declarations Vehicle log of wash-down	Continuous	No new weed species located along construction zone / perimeter fence tracks Use of wash-down facility and vehicle logs	New species found in monitored area compared to original species present	Control new weeds, review vehicle lot of wash downs
As per weed map and monitoring plots	Continuous. During weed mapping, monitoring plots, weed control, site inspections.	No new species of weed found	New species found in monitored area compared to original species present	Control new weeds

5.5 Fire Management

TMR will manage the remaining road reserve in accordance with their weed and fire management policies with the view to prioritising actions to improve habitat conditions for BTF for TRR4 section of the national highway. Land management practices proven to increase seed density include fire management and weed management. Management of fire breaks on the resumption boundary to introduce or encourage a greater variety of grasses favoured by BTF and Squatter Pigeon will occur on a **small scale trial**. As it is recognised the BTF forage 'resource bottleneck' is based on seed availability (coupled with water availability) at the onset of the wet season the fire management techniques could include:

- Slashing perimeter fence line firebreaks when undertaking any burning rotations to stimulate grass regrowth and seeding.
- Strategic timing of sections being burnt (cool dry season burns only) to increase yield over this bottleneck period during 2016-2017; and following a mosaic pattern of controlled burn sections within the road reserve to spread the seeding times of the grass species that respond to burning (refer to Figures 9, 10 &11 in the EPBC referral).
- Post construction undertake one controlled burn no more than every five years that the road reserve is being managed for BTF habitat.

Table 12 Monitoring methods for fire management strategy

Monitoring	Frequency	Performance Criteria	
		Acceptable Range	Range that triggers corrective action
Inspection of firebreaks. If implemented at end of wet season no other action should be required.	Firebreak – Annual	Increase in desirable native grasses (BTF preferred)	40 % (projected cover) invasion of grader grass and or rat's tail grass and / or environmental shrubby weeds into firebreak
Monitoring plots in controlled burn sections in road reserve - vegetation condition, using the scale of Kaesehagen (1994) - vegetation structural descriptions using modified Specht (1970) descriptions cited in Neldner, Wilson. Thompson & Dillewaard (2012) - list of all vascular flora species present - strata, height and calculation of crown cover using the line intersect method for shrub and tree layers - estimation of ground cover in five, 1 x 1 m ground plots (including native grass composition) - basal area and stem counts for shrub and tree	Monitoring plots – Annual	Increase in desirable native grasses (BTF preferred)	40 % (projected cover) invasion of grader grass and / or rat's tail grass into controlled burn sections in road reserve

5.6 Water Quality Monitoring

The EMP (P) established a framework for water quality monitoring including the requirements for formal site inspections to be conducted at the discretion of the Site Environmental Officer, TMR's Project Manager or the appointed Project Manager which involves visual assessment of waters to determine the presence of sediment and chemical plumes. The Construction Contractor shall report monitoring results, analysis and any corrective actions to TMR on a monthly basis (refer to MRTS51). Monitoring shall be undertaken in accordance with the Monitoring and Sampling Manual 2009 – Version 2 September 2010 (DERM 2010). Parameters shall comply with the Environmental Protection (Water) Policy 2009.

Complaints and water monitoring data, if collected, are to be documented and reported to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report.

MRTS51.1 Clause 10.1.2 describes the water quality monitoring requirements further than the EMP (P), requiring the Contractor to undertake all water quality monitoring in situ by hand held field meter (unless otherwise directed by the Principal) and specified that water quality monitoring locations are to be established in both Stony and Saunders Creeks 100 m upstream and 100 m downstream of the construction site. Monitoring is to be undertaken on a weekly basis except during works within the high banks of both creeks and during rainfall when monitoring is to be undertaken daily. Parameters to be monitoring are:

- Temperature
- pH
- DO
- EC, and
- Turbidity.

Should any groundwater discharge point be used, then monitoring 50 m upstream and 50 downstream of the nearest creek must be undertaken. Parameters to be monitored are:

- Temperature
- pH
- DO
- EC, and
- Turbidity.

The distance upstream and downstream for monitoring may be altered:

- To exclude suspected contamination inputs from other external sources
- To ensure that (and provided that) the monitoring points remain sufficiently distant from all works areas.

Monitoring is to be undertaken within an hour prior to discharge, during discharge and within an hour following discharge.

Table 13 Performance Criteria for Bohle River Catchments

	Primary Performance Criteria	OR	Secondary Performance Criteria (over four sampling events)	Corrective Actions
pH	Downstream 6.5–8.0	OR	Downstream within 0.7 of a pH unit of Upstream	Should the water quality at downstream locations at Stony and Saunders Creeks exceed the performance criteria above then an investigation into the cause of the exceedence must be undertaken and a report provided with the monthly environmental report. Should the cause be related to site practices then a non-conformance report must be generated that documents mitigation actions that will be taken to address the exceedence.
Dissolved Oxygen	Downstream > 85 %	OR	Downstream within 10% of Upstream	
Electrical Conductivity	Downstream < 660µS/cm	OR	Downstream < 10 % above Upstream	
Turbidity	Downstream <22 NTU	OR	Downstream within 15% of Upstream	

Any water discharged to waters (watercourses, creeks, drainage lines, etc.) other than Stony and Saunders Creeks must meet the following water quality criteria:

- pH: 6.5–8.0
- DO: 60%–90% saturation
- Turbidity: < 10% above background, and
- EC: < 10% above background at the intended time of discharge to other receiving waters.

Any water discharged to land must comply with the water quality criteria:

- pH- 6.5-8.0
- DO: >40 % saturation
- Turbidity: < 150 NTU, and
- EC: <400 µS/cm.

It is acknowledged that to achieve the required quality of discharge one or more of the following actions may be required:

- Diluting discharge water with fresh water to lower the EC (quicker than evaporation strategies)
- Lime treatment for acid neutralizing
- Flocculation using proprietary products, or
- Aeration for dissolved oxygen.

5.7 Soil Condition and Erosion and Sediment Control

The EMP (P) established strategies and control measures for impacts on soil. Monitoring of the success of these strategies is via site inspections conducted at the discretion of the Contractor's Site Environmental Officer using visual assessment of terrestrial and aquatic areas located within or adjacent to the construction site.

The contractor is required to submit an ESCP for approval with TMR, before subsequent construction of those erosion and sediment controls and ground surface disturbance can occur. The referral measure for ESCP content including the requirement for details regarding the existing topography, soil types and their location, location and type of vegetation to be retained, areas of high erosion hazard, limits of disturbance, total area to be exposed, nature and extent of earthworks including areas of cut and fill, final site contours, summary of the Contractor's Construction Program, watershed boundaries, location of permanent stormwater drainage structures, likely points of convergence between clean and dirty water during construction, location of all proposed structural control measures, discussion regarding proposed site management practises and strategies, time based schedule for the implementation of the ESCP and an inspection and maintenance schedule. All installation of erosion and sediment control devices is to be in accordance with the International Erosion Control Association standard drawings.

The ESCP shall address wet season / dry season variability and inclement weather contingency. For any given period, temporary controls shall be designed and scheduled relative to climatic averages and programmed works (soil exposure).

Monitoring requirements in the EMP for soil related matters included site inspections conducted at the discretion of the Site Environmental Officer (SEO), the Principal or Principal's Project Manager which involves visual assessment of terrestrial and aquatic areas located within or adjacent to the construction site.

Monitoring of the erosion and sediment control devices is to be undertaken weekly and immediately following a rain event that generates surface water flow. Immediate maintenance work (e.g. cleaning out), replacement and/or repair is to occur when there a report of the potential or actual failure of a device.

The Construction Contractor shall report monitoring results, analysis and any corrective actions to TMR on a monthly basis (refer to MRTS51).

5.8 Air Quality

The EMP (P) outlines air quality objectives, impacts and mitigation measures with the intention that monitoring would be incident based and conducted as the discretion of the Site Environment Officer, TMR's Project Manager in response to legitimate complaints. Reporting of monitoring results to the TMR Project Manager is to occur on a monthly basis as a component of the monthly construction report, with the immediate notification of incidents involving material or serious environmental harm.

The referral mitigation included the requirement for a fugitive dust program to be included in the construction contract to meet the following performance requirements:

- Zero loads uncovered
- Dust suppression tools will be used on stockpiles for embankment fill (if stockpiled on site), and
- Water trucks will be used to suppress dust on haul road and generally in the construction zone.

The contractor shall undertake the following activities to ensure acceptable standards of air quality are preserved:

- Implement effective dust management measures in accordance with air quality management strategies outlined in MRTS51
- Exposed surfaces and potential dust-generating areas to be regularly watered
- Site speed limits will be set to minimise dust generation
- Soil stockpiles will be stabilised with a sterile grass crop
- Clearing and other activities likely to generate dust should be restricted during strong winds
- Access roads are to be sealed where possible.

5.9 Noise Environment

The EMP (P) requires that baseline noise monitoring occur prior to the commencement of construction works. Noise and or vibration monitoring will be incident based and conducted at the discretion of the Site Environmental Officer, the Principal or Principal's Project Manager in response to legitimate complaints. Clause 10.4.2 of MRTS51.1 requires noise monitoring of a valid complaint at the sensitive receptor at an appropriate time in or der determine the cause of noise nuisance. Note that Saunders and Stony Creeks and the southern interchange area are identified as noise sensitive receptors among other residential areas and schools. Reporting is to be monthly as a component of monthly construction reporting with immediate reporting to TMR of incidents involving material or serious environmental harm.

6.0 References

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Appendix A

EPBC Approval Conditions

Appendix A EPBC Approval Conditions

EPBC Approval Requirements are available from:

http://epbcnotices.environment.gov.au/publicnoticesreferrals/

Appendix B

Mitigation Obligations

Appendix B Mitigation Obligations

The following tables outline the mitigation commitments made in the EPBC Referral and or the Preliminary Documentation (PD) for TRR4, coupled with any amendments to those mitigation measures made as a consequence of the variation and or them final preliminary documentation, and where reference to those relevant mitigation measures are found in the project EMP and or design drawings.

Reference number in monitoring report	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
Requirements from EPBC Approval Conditions (specific requirements paraphrased)									
14-17	MNES	Compliance/ record keeping	Condition 1. TRR4 must be constructed in accordance with Section 3 (of PD) Current Design for TRR4 and the EMP of the Preliminary Documentation (PD) Note the EPBC Approval requirements are available from http://epbcnotices.environment.gov.au/publicnoticesreferrals/		Relevant to all EMP (P) requirements	Relevant to all EMP (P) requirements	TMR & Contractor		
22 & 23	BTF	Compliance/ record keeping	Condition 2. Vegetation clearance limit for project no more than 68.24 ha of remnant vegetation including 49.19 ha of BTF habitat (as described in the PD)	Changed by approval conditions so early documentation is now incorrect	Section 6.2.2 Table 2 – stated generally for project clearance limit		Contractor	Note the EMP (P) does not reflect the approved vegetation clearance limits as stated in the EPBC approval as the EMP was issued Dec 2013, and EPBC approval made May 2014. However it is not considered necessary to revise and have the Minister approve a new version of the EMP (P) for this matter alone, as the approval conditions are clear.	Environmental Mitigation Drawings show clear and grub line for design (but not fence line)
13-14	MNES	Compliance/ record keeping	Condition 3. Undertake mitigation actions in accordance with Section 6.3 of PD Undertake action in accordance with the EMP		Relevant to all EMP (P) requirements	Relevant to all EMP (P) requirements	Contractor & TMR		
3	MNES	Compliance/ record keeping	Condition 4. Prepare and submit a Monitoring Plan to the Minister for Approval prior to the commencement of the action. The approved MP must be implemented.		NA	NA	TMR	Keep Letter / Email record of when monitoring plan submitted to Minister and when approved	
2	BTF	Compliance/ record keeping	Condition 5. Prepare and submit an Offset Management Plan to the Minister for Approval before the commencement of the action The approved OMP must be implemented.		NA	NA	TMR	Keep Letter / Email record of when monitoring plan submitted to Minister and when approved	
2	BTF	Compliance/ record keeping	Condition 6. Offset site at the Pinnacles must be located within Lots 10 SP228126 and 12 E124175.		NA	NA	TMR	Covered in Offset Management Plan	
4-6	BTF	Compliance/ record keeping	Condition 7. To offset residual indirect noise impacts, TMR must undertake, or fund to undertake, research projects as outlined in Section 6.4.3 of the PD. EPBC Approval Requirements are available from http://epbcnotices.environment.gov.au/publicnoticesreferrals/		NA	NA	TMR	TMR and JCU have made a contractual arrangement for two research projects addressing BTF (see Appendix C). These topics have been selected in consultation with BTF Recovery team members.	
1		Compliance/record keeping	Condition 8. Within 30 days of the commencement of TRR4, TMR must advise DOE in writing the actual date of commencement		NA	NA	TMR	TMR to Prepare letter to advisee Minister	

Reference number in monitoring report	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
1		Compliance/record keeping	Condition 9. TMR must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the plans and strategies required by the approval and make them available on request to DOE. Note that record keeping can be independently audited by DOE		Relevant to all EMP (P) requirements	Relevant to all EMP (P) requirements	TMR – and as supported by Contractor	Establish compliance file and reporting system	
7		Compliance/record keeping	Condition 10. TMR must publish on their web site a report addressing compliance with each of the conditions and implementation of plans specified in conditions (i.e. OMP, MP, and EMP). Proof of date of publication and details of non -compliance must be provided to DOE at the same time the report is published. Reporting timeframes are documented in EPBC Approval Requirements are available from http://epbcnotices.environment.gov.au/publicnoticesreferrals/		Relevant to all EMP (P) requirements		TMR		
1		Compliance/record keeping	Condition 11. If directed by DOE, TMR must engage an independent audit of compliance with the conditions of approval		Relevant to all EMP (P) requirements		TMR		
1		Compliance/record keeping	Condition14. If TRR4 construction has not commenced by 2 May 2019, TMR cannot commence the action without permission of the Minister		NA		TMR		
1 & 7		Compliance/record keeping	Condition 15. TMR must publish the approved Offset Management Plan, Monitoring Plan and EMP on their web site. Timeframes for publishing these plans are documented in the EPBC Approval Requirements which are available from http://epbcnotices.environment.gov.au/publicnoticesreferrals/		Relevant to all EMP (P)		TMR		
Mitigation Measures from Section 6.3									
13, 14, 18, 20	Squatter Pigeon	Compliance/ record keeping	Prior to clearing pre-clearance surveys for Squatter Pigeon by qualified spotter catchers, searching for core feeding, roosting or nesting sites.		Covered generally by Section 6.3.2 Table 3, but this species not specifically mentioned	Clause 9.1 states specifically for SP	Contractor	Addressed in the Species Management Program (SMP) to be submitted to DEHP	
13, 14, 18, 20	Squatter Pigeon	Compliance/ record keeping	Flush any potential areas of Squatter Pigeon prior to clearing operations if nesting sites not found.		Covered generally by Section 6.3.2 Table 3, but this species not specifically mentioned	Clause 9.1 generally applicable	Contractor	Addressed in the Species Management Program (SMP) to be submitted to DEHP	
13, 14, 18, 20	Squatter Pigeon	Compliance/ record keeping	Core feeding, roosting or nesting sites identified should be marked out as no go zones (outside of clearance areas).		Covered generally by Section 6.3.2 Table 3, but this species not specifically mentioned	Not stated	Contractor	Addressed in the Species Management Program (SMP) to be submitted to DEHP	
13, 14, 18, 20	Squatter Pigeon	Compliance/ record keeping	If nesting sites must be cleared, use permitted spotter catcher to check nest. Apply SMP requirements.		Covered generally by Section 6.3.2 Table 3, but this species not specifically mentioned	Clause 9.1 identifies need for SMP requirements if Squatter Pigeon found in areas to be cleared	Contractor	Addressed in the Species Management Program (SMP) to be submitted to DEHP	
14	Squatter Pigeon	Compliance/ record keeping	Establish and enforce speed limits for plant / vehicles on site.		Section 6.6.2 Table 6		Contractor		

Reference number in monitoring report	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
36	Squatter Pigeon	Compliance/ record keeping	Temporary lighting will not be placed in Squatter Pigeon nesting areas.		Not specified		Contractor	Covered in monitoring plan	
16	BTF	Compliance/ record keeping	Apply Dense Graded Asphalt to rural section of TRR4 alignment to reduce extent of noise impact on BTF habitat.		Not specified		Contractor	Addressed in monitoring plan	Specified in Pavement Treatment and Drainage Layout D646636 A
1	BTF / MNES	Compliance/ record keeping	Provide EMP and environmental mitigation drawings to tendering contractors in ETI process.				TMR	Undertaken during tender process	
20	BRST bat	Compliance/ record keeping	Pre-clearance survey for BRST bat. Should active roosts be found in clearing areas, attempt to fell roost tree at night to allow bats to relocate. Revisit this measure if felling at night compromises other species		Not specified, but note 6.5.2 Table 5		Contractor	Addressed in the Species Management Program (SMP) to be submitted to DEHP	
Direct Offset									
2	BTF	Compliance/ record keeping	Refer to Offset Management plan for management commitments		NA		TMR		
2	BTF	Environmental Monitoring	Note monitoring requirements at offset site are addressed in the Offset Management Plan				TMR		
1 & 2	BTF	Compliance/ record keeping Environmental Monitoring	Key management intents and monitoring requirements for the offset site are addressed in the Offset Management Plan.		NA		TMR		
Indirect Offset									
4	BTF	Compliance/ record keeping	Research project on likely mechanisms which generate fluctuations in BTF populations which build on BTF recovery plan objectives. Possibly beneficial studies could include: To what extent habitat quality and water availability may affect abundance of BTF at the local scale How road traffic noise effects BTF breeding and foraging behaviour How effective particular land management practises can be in improving habitat condition for BTF esp. fire management, weed control, and replanting, should these build on BTF recovery plan objectives		NA		TMR	Research topics have been confirmed (JCU letter to TMR dated 7 August 2014).	
5	BTF	Compliance/ record keeping	Final research topics will be chosen in consultation with the Recovery Team		NA		TMR	Research topics have been confirmed with the Recovery Team (JCU letter to TMR dated 7 August 2014).	
6	BTF	Compliance/ record keeping	Outcomes of research understanding gained by TMR where relevant will be used to improve habitat condition and utilisation of the offset site by BTF		NA		TMR		
10	BTF	Compliance/ record keeping	TMR will facilitate informal relationships between the researchers to ensure new findings can be incorporated or trialled at the TRR4 offset site		NA		TMR	Noted in minutes of meeting held between JCU and TMR 14 April 2015.	

Monitoring reference number	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
Commitments from Original Referral									
Principal Threat: Clearing and Fragmentation of foraging habitat (grasslands and grassy woodlands)									
22 & 23	BTF, Squatter Pigeon	Compliance/ record keeping	The alignment of TRR4 (two lanes) is located predominantly to the eastern side of the centreline of the road reserve as is the construction access/haul road. Consequently the wider habitat / bushland will be retained generally within the western half of the road corridor. Apart from local additional clearing at culverts and bridges to accommodate construction plant and in areas of high embankment, about 70m of the original 120m corridor width is retained as natural bushland (about 55% of the corridor). TMR will manage this remnant vegetation to improve habitat conditions for BTF. Vegetation clearance activities will only occur in accordance with the clearance plan locations (refer to Figure 8 for an indicative clearing plan). Vegetation clearance activities will not occur at night (squatter pigeons roost at night and can be easily run over and bright lights can interfere with bat behaviour). Hand clearing of vegetation would occur in riparian areas to ensure soil stability.	Variation changed to four lanes. However rest of mitigation measure stands	Section 6.3.2 Table 3		Contractor		General Arrangement Plans 646505 GA 01-14
8	BTF, Squatter Pigeon	Compliance/ record keeping	TMR will provide advice on the significance of BTF in the adjacent grazing land and make recommendations to DEHP (State Land Asset Management group) about the conservation of BTF and that conditions be attached to a revised lease arrangement for the Bohle state land surrounding the TRR4 corridor relating to: Access controls for vehicles and stock. TMR can limit access off TRR4 to preserve remaining vegetation between the cleared zone and property boundary. The recommendation would be to expand this regulation of stock and movement to the full extent of the lease land. Stock levels and land and water management in relation to BTF habitat requirements Pest control requirements including noxious and environmentally damaging pests that impact on BFT habitat Fire regimes and fire breaks that could enhance the biomass of key grass species for BTF at critical times (resource bottleneck). The purpose of this action is to influence land management practise to maintain and improve the persistency of BTF in adjoining habitats as a measure to minimise the impacts of a reduction in habitat size by fragmentation by the road corridor. Would also address threatening processes related to inappropriate grazing and fire regimes. Effectiveness. Subject to a third party endorsement and action, however has significant potential if successful in improving habitat quality.		NA		TMR		
29	BTF, Squatter Pigeon	Compliance/ record keeping	The road corridor will be perimeter fenced prior to construction (and prior to the contractor taking 'possession' of site for works) to prevent public and vehicular access into the surrounding state land and riparian areas.		Section 6.3.2 Table 3		Contractor		General Arrangement Plans 646501 GA 01-14

Monitoring reference number	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
49		Compliance/ record keeping	Public access will be restricted and discouraged by appropriate signage. Signage at targeted track closure locations has been found to be an effective deterrent.		Section 6.3.2 Table 3		Contractor		
31 47	BTF, Squatter Pigeon	Compliance/ record keeping Environmental monitoring	Weed wash down requirements shall be conditioned in the construction contract documentation for all construction plant coming into and exiting the alignment. This will be strictly implemented to avoid the introduction or spread of grader grass into and around the TRR4 alignment and other invasive grassland weeds		Section 6.2.2 Table 2	In MRTS51.1 Clause 11.1	TMR Contractor for activities		
32 – 34 47		Compliance/ record keeping Environmental monitoring	The contractor will also undertake control measures for existing declared weeds and grader grass in the project site using a combination of fire management and spot spraying measures		Section 6.2.2 Table 2	In MRTS51.1 Clause 11.1	Contractor		
12 45 - 48	BTF, Squatter Pigeon	Compliance/ record keeping Environmental Monitoring	TMR will manage the remaining road reserve in accordance with their weed and fire management policies with the view to prioritising actions to improve habitat conditions for BTF for TRR4 section of the national highway. Land management practices proven to increase seed density include fire management and weed management. Management of fire breaks on the resumption boundary to introduce or encourage a greater variety of grasses favoured by BTF and Squatter Pigeon will occur on a **small scale trial**. As it is recognised the BTF forage 'resource bottleneck' is based on seed availability (coupled with water availability) at the onset of the wet season the fire management actions will include: Slash perimeter fence line firebreaks when undertaking any burning rotations to stimulate grass regrowth and seeding. Strategic timing of sections being burnt (cool dry season burns only) to increase yield over this bottleneck period during 2013-2014; and following a mosaic pattern of controlled burn sections within the road reserve to spread the seeding times of the grass species that respond to burning (refer to Figures 9, 10 &11). Post construction undertake one controlled burn no more than every five years that the road reserve is being managed for BTF habitat. Hydro mulching (discussed below) would be trialled in some burnt sections to support the introduction of BTF grass species. Effectiveness: Could be subject to Department's priority setting and funding constraints over time, and would be more effective if fire management is to occur in conjunction with similar actions in larger contiguous habitat adjacent to the road reserve. However these are known means to manage weeds, reduce fuel loads and if used strategically, allow for manual introduction of other native grasses post burning.	In the PD, the merits of trial seeding of BTF grasses on the embankments was revisited and discarded as a viable option	Fire management on perimeter fence in Section 6.2.2 Table 2		TMR		

Monitoring reference number	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
	BTF	NA	Areas on the embankment batters and firebreaks deemed able to be hydro mulched will be used to trial the effectiveness of hydro mulching BTF preferred native grass seeds in combination with appropriate annual exotic grass species to ensure soil stability. Preferred native grass species include: *Bothriochloa decipiens* (pitted bluegrass) *Chloris* spp. (windmill grass) *Eragrostis* spp. (lovegrasses) *Panicum* spp. (panic grasses) *Sporobolus caroli* (fairy grass) *Eraichne armittii* (Wanderrie grass) *Setaria apiculata* and *S. surgens* (pigeon grasses) The exotic sabi grass (*Urochloa mosambicensis*) is also a good seed source for BTF. Effectiveness: Experimental and will occur on a small scale in the project area as a trial only. Hydro mulching can have a mixed success with seed strike. Not known if above seeds have been used successfully before in hydro mulch, and the level of seed dormancy. Native grass seeds and tube stock are commercially available although not all may be available locally.	Changed as described in the PD	NA		NA		
	BTF	NA	Other disturbed areas generally will be broadcast seeded with BTF preferred species after rain. Effectiveness: Experimental. Manual broadcast seeding offers the opportunity to spot-seed micro sites at different seed rates and seed mixes. Spot-seeding can also be a method of applying valuable seeds or "unique" species to strategic locations. The disadvantage of broadcast seeding is that seeds are not covered by soil or mulch and broadcast seeding typically leads to low establishment of seedlings. This can be compensated by more seeds been sown to cover loss. Not known how well BTF preferred seeds will work.	Changed as described in the PD	NA		NA		
30	BTF, Squatter Pigeon	Compliance/ record keeping	Stock will also be kept out from using waterways as a means of traversing under the Ring Road by stock deterrent fencing across waterways. Waterway fencing will be erected at the end of construction by the contractor as a final works measure before the road becomes operational. Effectiveness: This is a widely used measure for stock control. Expected to be effective.		Section 6.2.2 Table 2		Contractor		
21	BTF	Compliance/ record keeping	The BTF nesting area in the remaining uncleared road reserve will be protected during construction with suitable construction fencing and or barriers, toolbox talks to ensure all workers are aware of location and reason for protection. Effectiveness: This measure will be undertaken by the contractor and will be effective in protecting the BTF nest from physical disturbance during construction.	Note BTF nest discussed is actually just outside of road reserve boundary	However should a BTF nest be found in the road reserve Section 6.2.2 Table 2 would apply		Contractor		

Monitoring reference number	Species / Matter of NES	Type of Monitoring	TRR4 obligations that will require monitoring and or compliance auditing	Changes to commitments	Section of EMP if relevant	MRTS51.1 (April 2014)	Party Responsible	Comment	Drawing Reference
24		Compliance/ record keeping	Construction staging plans and methodology will recognise that there will be constraints to native vegetation clearance activities. TMR will prepare a vegetation clearing plan (indicative components of this plan is shown as Figure 8 which will be formalised during detailed design) for the contractor as a component of the construction contract documentation. This plan will clearly delineate the construction footprint from the balance of the road reserve which is to remain as green space. Effectiveness: This measure will reduce unnecessary native vegetation clearance to only that required for construction and safe operation of the road.		Section 6.3.2 Table 3		Contractor		
20	BTF	Compliance/ record keeping	Pre-clearance surveys will be undertaken in riparian areas or near water sources to ensure BTF nests have been vacated prior to vegetation clearance. Effectiveness: This measure will be effective in avoiding physical disturbance to BTF by physical impacts in the breeding season, allowing time for fledging. Coupled with the use of spotter catchers to remove other species this will reduce impacts on individual species.		Section 6.3.2 Table 3		Contractor		
24	BTF	Compliance/ record keeping	The preferred period within which clearing is desirable is between July and September to avoid both the BTF breeding season (Feb-June) and the wet season (Oct-April). There will be occasions when clearing will need to occur outside this preferred time period to allow early works to progress on sections of the site. Where possible, clearing within the construction corridor will also be progressively staged along the alignment to minimise exposed soil surface at any one time. Effectiveness: This measure will be effective in avoiding physical disturbance to BTF by physical impacts in the breeding season, allowing time for fledging. It will also reduce the possibility of sediment dispersal.		Section 6.3.2 Table 3		Contractor		
22 & 23	BTF/SP/BRST	Compliance/ record keeping	Vegetation clearance for the construction zone will be the minimum necessary to accommodate works, ancillary works such as lay down areas, haul road, site camps, storage areas and stockpiles. Effectiveness: This measure will reduce unnecessary native vegetation clearance to only that required for construction and safe operation of the road.		Section 6.3.2 Table 3		Contractor		
40 41	BTF	Compliance/ record keeping Environmental monitoring	Sediment and erosion control plans (SECPs) will be required by the construction documentation and prepared by the contractor for the various construction activities on site. These will be required for the entire alignment, and will have a stringent focus around waterway works. Effectiveness: This is standard practice for all TMR projects, and coupled with controls on clearance outside of the wet season, and sediment detention ponds as well as other measures will minimise the transport of sediments into the waterways. The SECPs will require particular focus on works in waterways for culvert and bridge installation.		Section 6.4.2 Table 4 also Section 6.1.1 Table 1		Contractor		

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17		Compliance/ record keeping	Works for the construction will require the loss of areas of riparian vegetation and ready access to water along existing lengths of streams by culvert construction, although water flow will be maintained in the broader landscape. The TRR4 design will include provision of additional water sources that can be established in association with the works. Four kinds of water enhancement features are envisaged as being included in the detailed design: Outlet controlled stormwater drainage lines to provide temporary detention of water on stormwater drains and minor watercourses. Detention features that will maximise the retention of incidental rainfall, downstream of cross drainage (culvert) sites. These features will be predominantly excavated depressions and would include a perch structure to enable BTF to reach the water line (Refer to Figures 9, 10 & 11 for preliminary location of detention features). Table drains that are required as part of the road design, will be designed as a flat bottom drain (trapezoidal) with outlet controls so that they can retain water for short periods. Effectiveness: The level to which the BTF population finds water a resource restriction in the Bohle Plains habitat is unknown. There are readily available natural water sources in the area, with the TRR4 alignment crossing 13 watercourses, two of which are in regular flow (Stony and Saunders creeks) with a maximum distance of 1.5 km between them. It is possible that the proposed water enhancement features may alleviate water shortage restrictions on a temporal and spatial basis, although will have limited effect in the dry season. In terms of the variety and functionality of water retention structures proposed, it is noted that BTF have been recorded using a wide range of water features in the landscape (pers comm. P. Buosi, 2012). The BTF recovery plan highlights the importance of a bird being able to access (reach) water at water sources. The current understanding is that many forms are available from wooden perch arrangements used in aviaries, through to rock or concrete type riffle ladders. The most robust solution, which may be a combination of options, will form part of the detailed design and be part of the construction contract.	These are not provided for in the formal design drawings for the project due to the likely scale, however TMR intend for additional water sources to be provide as the construction progresses			TMR/Contractor		
42	BTF, NCA species	Compliance / record keeping	Rehabilitation of riparian areas post culvert and bridge construction will have a focus on restoring an appropriate mix of grass and woody vegetation. Where there is sufficient space, logs and stags with hollows reclaimed from clearing activities will be placed in these areas. Effectiveness: This measure is expected to be effective if regularly followed up with water in the early stages, followed by weed control. Rehabilitation in these areas provides benefit in long term stream bank stability, fauna and fish passage and roosting opportunities as well as ensuring close proximity of grassland species to water sources for BTF.		Section 6.2.2 Table 2 & Section 6.3.2 Table 3		Contractor		

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15	BTF, NCA species and waterway condition	Compliance / record keeping	Bridge runoff catchment drainage (scuppers) and spill/sediment containment dams will be installed on the Saunders Creek Bridge to protect water quality in the operational phase of the infrastructure. Effectiveness: This is a widely used design measure to protect against accidental spills entering waterways. Expected to be effective.	TMR's bridge branch did not authorise scuppers for structural integrity reasons so these features are not currently in the formal design drawings. TMR are investigating other methods of directing and containing spills.			TMR/Contractor		
25	Bare-rumped Sheathtail Bat (BRST bat)	Compliance/ record keeping	Should the BRST bat (or Semon's leaf nosed bat) be confirmed during the proposed survey then a species management program (SMP) (inclusive of marking habitat trees for spotter catchers, avoid clearing fringing trees around the construction zone where possible, and using spotter catchers to remove bats) will be prepared. A preliminary species management program will include: Staged clearing works to allow bats to leave roosting sites No vegetation clearing to occur at night (bright lights can interfere with bat behaviour) Periodic impact noise to encourage bats to leave roosting sites – use of noise cannons is currently the preferred method Additional methods to encourage bats to leave roosting sites is the intrusive method of tapping trees with hollows before clearing Immunised spotter catcher will be on site for the entire clearing exercise to monitor clearing works and assist with clearing hollows as each tree is felled Timing for clearing works will where practicable be outside the breeding season (tropical wet season) so young are not keeping adult bats in roosting sites Stockpiles will be placed away from concentrations of potential roost trees areas in the green zone that remains. Effectiveness: SMP will require approval from the Queensland Department of Environment & Heritage Protection and will therefore benefit from state government knowledge on this species. Expected to be effective.		Partly covered in Section 6.2.2 Table 2	SMP requirements flagged in Clause 9.1	Contractor	Draft SMP prepared and will be lodged by TMR on contractor's behalf	
26	BTF/SP/ threatened micro bats	Compliance/ record keeping	Licensed spotter catchers to be active on alignment before and during vegetation clearance and on call during construction. Effectiveness: TMR have access to several experienced groupings of spotter catchers. This measure is expected to be effective.		Section 6.3.2 Table 3		Contractor		
13	BTF, threatened micro bats	Compliance / record keeping	The contractor's Construction EMP will have a strong focus and control over activities that will have an impact on movement, feeding and breeding behaviour of threatened micro bats (and BTF) during construction. Effectiveness: This measure is expected to be effective, with contractors' proposed methodologies explored through the construction tender requirements.				Contractor	Addressed in the SMP	

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25	BRST bat	Compliance/ record keeping	Clearing of roost trees will only occur in the construction zone (nominal 40m clearing width for most of the alignment except at culverts and bridge crossings); cleared logs/stags will be placed in remaining road reserve or adjoining habitat. Effectiveness: This measure is expected to be effective, will be conditioned in the construction contract documents, and implemented through the construction EMP.	Construction width changed as a consequence of Design Variation	Requirement to place logs/stags in Section 6.2.2 Table 2		Contractor		
24	BRST bat	Compliance/ record keeping	As far as practicable, clearing of roost trees will be avoided between December and April. Effectiveness: This measure is to avoid disturbing microbat breeding activities. Habitat ecology for this bat is not well known, the presumption is that it breeds in the tropical wet season (Schulz & Thomson, 2007).		Section 6.2.2 Table 2		Contractor		
43	BTST bat	Compliance/ record keeping	TMR will require that the contractor undertakes regular machinery inspections on all vehicles to ensure compliance with relevant regulations in relation to noise. In particular, exhaust systems will be checked regularly for all construction and other vehicles entering site during construction. Effectiveness: This measure is expected to reduce the potential level of noise during construction, although higher noise levels compared to ambient conditions will occur, from heavy machinery and safety reversing beeper operations. It is not known if micro bats would habituate to construction noises.		Section 6.5.2 Table 5		Contractor		
39	BRST bat	Environmental monitoring	A fugitive dust program will be included in the construction contract to meet the following performance requirements: Zero loads uncovered Dust suppression tools will be used on stockpiles for embankment fill (if stockpiled on site). Water trucks will be used to suppress dust on haul road and generally in the construction zone. Effectiveness: This measure is expected to be effective, and will be implemented through the construction EMP requirements. Dust suppression methods are regularly applied in many TMR projects.		General dust management strategies in Section 6.6.2		Contractor		
	BRST bat	NA	Lighting of the northern and southern connections for safety reasons will be required. Route lighting elsewhere is not required. This is expected to reduce nuisance to bats. Effectiveness: This measure is expected to be effective in reducing the likelihood of bats being attracted to insect gathering around light sources.	With the change to four lanes, route lighting now needed for safety reasons			NA		
36, 38	BRST bat	Compliance/ record keeping	Limited construction works will occur at dusk or at night (some pavement and surfacing work may occur at night at the connections to existing roads). Effectiveness: This measure is expected to be effective in reducing the likelihood of bats being attracted to insect gathering around light sources.				Contractor		

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20	Hollow roosting tree species generally	Compliance/ record keeping	Pre clearing surveys to ensure animals that need to be relocated are done so before clearing activities occur. Effectiveness: This measure is expected to be effective; it is a standard measure in most of TMR's environmental management plans and can only be undertaken by licensed persons under the Qld *Nature Conservation Act 1992*.		Section 6.3.2 Table 3		Contractor		
9 45, 46	BTF, Threatened micro bats including Bare-rumped Sheath tail Bat (BRST bat)	Compliance/ record keeping Environmental Monitoring	TMR will discuss the feasibility (and access arrangements) of including Saunders Creek and possibly other significant waterways or areas in the TRR4 alignment in the annual BTF waterhole count which occurs in Townsville each October through the BTF Recovery Team for 2013 and 2014. Relevant findings from the counts will be assimilated into the TRR4 construction EMP. Effectiveness: This measure is expected to build capacity and engagement in the Northern TMR office during 2013 and with the construction contractor when appointed in 2014. This would allow TRR4 personnel to monitor and respond to situations during the construction period and to inform any further projects with similar habitat values.				TMR		
10	BTF, Threatened micro bats including Bare-rumped Sheathtail Bat (BRST bat)	Compliance/ record keeping	Provide findings and learning's to relevant academic and study bodies to expand knowledge base on BTF and BRST bat and others (Semon's leaf-nosed and greater large eared horseshoe) if present from this area. Take opportunities where possible to raise awareness of BTF or other threatened species management issues and outcomes on the TMR web site, to ensure learning's available to other road projects. Effectiveness: As above this measure is expected to prove effective in disseminating knowledge.	Note that all 2012 and 2013 field investigations are on the TMR web site, and have been lodged in the Council library	NA		TMR		
10	Bare-rumped Sheathtail Bat (BRST bat)	Compliance/ record keeping	If the BRST bat is found then the results from the various ecological assessments about roost habitat conditions will be published. Effectiveness: Habitat conditions for this bat are poorly known, and learnings from this project may be valuable to others.	Note that all 2012 and 2013 field investigations are on the TMR web site, and have been lodged in the Council library	NA		TMR		
	Williams tylophora (not MNES)	NA	Pre clearance survey for Williams' tylophora will occur in riparian areas that would be cleared, preferably during the wet season. Effectiveness: This measure is expected to be effective, if occurs in the wet season when species is in leaf.	No longer an MNES matter	NA		NA		
	Bog figwort (not MNES)	Compliance/ record keeping	An offset contribution under the Queensland Biodiversity Offset Policy will be made in relation to the area of bog figwort and riparian state significant biodiversity values within the alignment.	Under the Environmental Offset Act and regulations offsetting for Near Threatened plants no longer required	Section 6.2.2 Table 2		TMR	TMR are lodging an NCA clearing permit in July 2014. Approval conditions may be set. See below.	
	Bog figwort (not MNES)	Environmental Monitoring	A suitable site within the road resumption area will be used as a trial restoration area for bog figwort with the site containing drainage characteristics similar to those found locally and where bog figwort is found or expected. Top soil containing seed bank from where the bog figwort are on the alignment will be rescued during vegetation clearance, stored temporarily and respread it in an area where		Section 6.2.2 Table 2	Clause 1 and 10	Contractor	Note this information will require updating as a result of a late May 2014 bog figwort survey undertaken following the NCA guidelines for ENVT flora survey. Field results pending, but high numbers found, GPS records taken of locations and	

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			particular drainage requirements can be mimicked by similar type of earthworks. This trial would occur just before the 2014-2015 wet season as the seeds would germinate in the early wet and occur under a NCA approved species management plan. Effectiveness: Experimental, this species is thought to have not been translocated before. As it is an annual plant and there is no knowledge on its germination characteristics, it is thought that trying to keep it in nursery conditions over three seasons would be costly for potential poor success. Translocation via seed bank is also experimental as the level of soil depression and moisture retention required to enable Successful germination is also unknown. However given that machinery that can undertake this trial will be on site for minimal cost, and there is time to examine the existing habitat before removal to either replicate physically or find a suitable site on the road reserve, the trial would have a better chance of success.					seed collected and stored.	
Species obligation matrix									
18	BTF / microbats, Squatter Pigeon, Northern Spadefoot toad, short beaked echidna	Compliance/ record keeping	Prepare a Species Management Program for the project – whole ecosystem approach (as per DEHP advice meeting of 4 March 2014.) SMP requirements inclusive of those in referral etc. for EPBC species If toad was found on site then SMP would include: Construction measures such as, stop work if toad present, spotter catcher on site, Operational measures such as: compensatory habitat areas protected, frog fences, ongoing monitoring. For echidna Signs of this species found south of Deeragun, but have a very large home range 45-50 ha so potentially everywhere. Operational controls, prevent road kill by appropriate fencing, pest control of dogs and cats. If animal breeding places are found: TMR's SMP with DERM requires activities to minimise impacts on fauna by: - Inspecting trenches, culverts and other structures prior to works being undertaken to see if trapped or injured fauna require rescue. - With the use of temporary fencing, consider fauna movement, current land uses and worker safety requirements. - Consider mechanisms to facilitate fauna movement through construction sites - Educate staff and contractors in relation to risk of fauna injury and death and how to manage fauna that are injured or displaced (inc. threatened species)			Potential need for SMP flagged in Clause 9.1	TMR on Contractor's behalf	Draft SMP prepared and will be lodged with DEHP on contractor's behalf during tender evaluation period	

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	Bog figwort (Not MNES)	Compliance/ record keeping Environmental Monitoring	Trial restoration area to be established for bog figwort. Establish site conditions and constraints (i.e. weed and fire regimes, soil conditions, and depth of inundation requirements needed to successfully establish bog figwort restoration) Find trial site, and establish suitable propagation method (s) Establish monitoring requirements	NCA authority conditions (WIPA15012214) have refined the restoration and monitoring requirements		In MRTS51.1		Seed collection undertaken was undertaken during 2014. TMR commissioned Greening Australia to undertake a germination trial. Germination under greenhouse conditions proved successful.	
	Waterway crossing (not MNES)	Compliance/ record keeping	Assess bridge and culverts against self-assessable codes to determine approval triggers and fish passage requirements			In MRTS51.1	TMR on contractor's behalf	IDAS application lodged in July 2014. State approval conditions may need to be complied with.	