

Townsville Ring Road Section 4

Environmental Management Plan (Planning)



Townsville Ring Road Section 4

Environmental Management Plan (Planning)

Client: Transport and Main Roads

Co No.: 39 407 690 291

Prepared by

AECOM Australia Pty Ltd
21 Stokes Street, PO Box 5423, Townsville QLD 4810, Australia
T +61 7 4729 5500 F +61 7 4729 5599 www.aecom.com
ABN 20 093 846 925

20-Dec-2013

Job No.: 60264706

AECOM in Australia and New Zealand is certified to the latest version of ISO9001, ISO14001, AS/NZS4801 and OHSAS18001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document Townsville Ring Road Section 4
 Ref 60264706
 Date 20-Dec-2013
 Prepared by Hannah Jacques
 Reviewed by Marjorie Cutting

Revision History

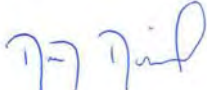
Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	12-Oct-2012	For Client Review	David Derrick Associate Director - Transport	Original previously signed
A	21-Nov-2012	Final Copy	David Derrick Associate Director - Transport	Original previously signed
B	27-Nov-2012	Revised Final Copy	David Derrick Associate Director - Transport	Original previously signed
C	04-Dec-2013	2nd Revised Final Copy	David Derrick Associate Director - Transport	Original previously signed
D	20-Dec-2013	3rd Revised Final Copy	David Derrick Associate Director - Transport	

Table of Contents

1.0	Introduction	0
1.1	Background	0
	1.1.1 Project Overview	0
	1.1.2 Construction Methodology	2
	1.2 Purpose	3
	1.3 Structure of the EMP	3
	1.4 TMR Environment and Heritage Policy 2008-2013	4
	1.5 Timing	4
2.0	Statutory Requirements	5
2.1	Relevant Legislation	5
3.0	Existing Environment and Impact Assessment	6
3.1	Site Description	6
3.2	Climate	6
3.3	Topography	6
3.4	Geology	6
3.5	Soils	6
3.6	Investigations into Flora and Fauna Values	7
	3.6.1 Flora	7
	3.6.2 Fauna	7
3.7	Water Quality	14
3.8	Noise	14
3.9	Air Quality	14
3.10	Cultural Heritage	15
4.0	Implementation and Operation	16
4.1	Environmental Responsibility	16
5.0	Design Mitigation Measures and Strategies	18
5.1	Soils	18
5.2	Flora and Fauna	18
5.3	Noise	20
5.4	Water Quality	20
6.0	Construction Mitigation Measures and Strategies	21
6.1	Soils	21
	6.1.1 Objectives	21
	6.1.2 Environmental Impact and Control Measures	21
	6.1.3 Monitoring	23
	6.1.4 Reporting	23
6.2	Flora	23
	6.2.1 Objectives	23
	6.2.2 Environmental Impact and Control Measures	24
	6.2.3 Monitoring	27
	6.2.4 Reporting	27
6.3	Fauna	28
	6.3.1 Objectives	28
	6.3.2 Environmental Impact and Control Measures	28
	6.3.3 Monitoring	30
	6.3.4 Reporting	30
6.4	Water Quality	30
	6.4.1 Objectives	30
	6.4.2 Environmental Impact and Control Measures	30
	6.4.3 Monitoring	32
	6.4.4 Reporting	32
6.5	Noise	32
	6.5.1 Objectives	32
	6.5.2 Environmental Impact and Control Measures	32
	6.5.3 Monitoring	34

	6.5.4	Reporting	34
6.6		Air Quality	34
	6.6.1	Objectives	34
	6.6.2	Environmental Impact and Control Measures	35
	6.6.3	Monitoring	36
	6.6.1	Reporting	36
6.7		Cultural Heritage	36
	6.7.1	Objectives	36
	6.7.2	Environmental Impact and Control Measures	37
	6.7.3	Monitoring	38
	6.7.4	Reporting	38
6.8		Waste Management	38
	6.8.1	Objectives	38
	6.8.2	Environmental Impact and Control Measures	38
	6.8.3	Monitoring	39
	6.8.4	Reporting	39
7.0		References	40
Appendix A			
		Mitigation Figures	A
Appendix B			
		Approvals, Licences and Permits Required for TRR4	B
Appendix C			
		Location of Weeds	C

1.0 Introduction

1.1 Background

1.1.1 Project Overview

AECOM has been engaged by the Queensland Department of Transport and Main Roads (TMR), to prepare an Environmental Management Plan (Planning) (EMP(P)) for the proposed Townsville Ring Road Stage 4 (TRR4), in Townsville, North Queensland.

The TRR4 will complete the overall Townsville Ring Road, a 20km route connecting the National Network from Townsville's northern approaches to the south and east of the city (see Figure 1). TRR4 is a new section of a four-lane road approximately 8.7km in length, running from chainage 18557.575 to 27724.703. TRR4 is defined by a start point near Shaw Road and terminates at the Bruce Highway in the vicinity of Mount Low Parkway in the northern suburbs of Townsville (refer to Figure 1).

TRR4 will become the National Network route, replacing:

- The existing National Network route – the Bruce Highway (Shaw Road – Mt Low Parkway); and
- The interim National Network – Shaw Road (Dalrymple Road – Bruce Highway).

The TRR4 project outcomes include:

- To provide a National Network route that meets contemporary safety and design standards and that addresses transport issues arising from Townsville's continuing strong economic and population growth over the next 20 years and beyond;
- To deliver a whole link solution to optimise the operation of the Townsville Ring Road sections 1-4;
- To deliver a whole of network solution, which takes account of the function of key arterial and local roads in the surrounding strategic network and which attempts to influence those functions, where appropriate to ensure they complement and support the Townsville Ring Road's agreed appropriate functions; and
- Improved freight efficiency for though and Port freight and to maximise the economic life of the overall Townsville Ring Road link.



PROJECT ID 60285754
 LAST MODIFIED CFS 14-Aug-2013
 FILE NAME 60285754_ENV_014v2

AECOM

Cadastre - © 2010 The State of Queensland
 StreetPro © 2010 Pitney Bowes Software Pty Ltd
 Roads, Rivers - © 2010 PSMA Australia Pty Ltd
 Queensland Museum Records of Burrowing Frogs - Queensland Museum 2013
 Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

1 Scale: 1:200,000
 (when printed at A3)

0 2.5 5 Kilometers

Legend

— Highways — TRR4 Project

TOWNSVILLE RING ROAD SECTION 4

**Location of the Proposed
 Townsville Ring Road 4 (TRR4)**

Figure 1

1.1.2 Construction Methodology

The construction of the TRR4 will involve the construction of bridges and culverts and the placement of fill to convey the roadway through the Bohle Plains and Deeragun suburbs of Townsville.

The following activities will be required for construction of the road component of the project:

- Survey to establish construction controls such as clearing limits, temporary bench marks and offset pegs;
- Site establishment, including a site compound (probably near a public road, so visitors can go through environment and safety site inductions before entering the work site), laydown area(s) and a haul road adjacent to the road embankment within the cleared area (which is most likely to be entirely within the construction footprint, if not actually the road formation itself). The exact location of the haul road will be confirmed with the successful construction contractor;
- Establishment of environmental controls around work sites;
- Clearing, grubbing and earthworks along the proposed road alignment to formation widths with a 3 m construction buffer on either side. Additional width will be required at intersections and overpasses to accommodate the higher embankments, as they have a broader construction footprint;
- Stripping of topsoil to a depth of 75 mm, which will be stored in stockpiles located strategically through the work site within the road corridor and reused throughout the site on completion;
- Construction of embankments generally up to 2 m in height, with heights to 8m at overpasses, with embankment material to be imported from established off-site sources. The specific source to be used will be determined as part of the construction tendering process. It is proposed to deliver the material direct to the work area from off site, therefore, no stockpiling will be required;
- Relocation or protection of existing public services, where applicable;
- Disposal of unsuitable soil material will be located adjacent to embankments or used in levees, noise wall embankments and the like (if appropriate for use in these applications);
- Erosion protection and sediment control works;
- Revegetation and environmental management;
- At-grade intersections at the Bruce Highway (northern connection), Shaw Road/Dalrymple Road and Shaw Rd/Kalynda Parade intersections (southern connections) will be signalised;
- Excavation of unsuitable soil material under embankments in drainage swales and preparation of sub-grade;
- Installation of culverts and drainage infrastructure; including inlet and outlet protection works. Drainage culverts to provide for a minimum of Q50 immunity and/or to satisfy afflux controls and fish passage where required;
- Placement and compaction of sub-base layer;
- Placement and compaction of base-course layer;
- Asphalt surfacing to all road pavements at intersections and adjacent to residential areas;
- Topsoil replacement and final reinstatement;
- Street lighting for urban parts of the project and at all intersections and merge areas;
- Erection of barriers, guardrails and signs;
- Noise attenuation works and landscaping adjacent to residential areas;
- Traffic control devices and roadside furniture;
- Perimeter fencing of road reserve (construction and permanent);
- Management of the environmental impacts during construction; and
- Reinstatement of all disturbed areas.

The following activities will be required for construction of the bridge component of the project:

- Bridges over Stoney and Saunders Creeks (Q50 immunity) and bridge overpasses at Geaney Lane and Kalynda Chase;
- Bridge runoff catchment drainage (scuppers) and spill/sediment containment dams;
- Site establishment (lay-down areas for the bridge construction equipment and temporary site office with toilets and crib room) at each bridge location;
- Construction and maintenance of temporary environmental protection works, erosion and sediment controls, fencing, access gates, wheel washing facilities and noise and dust abatement facilities;
- Bridge piling;
- Construction of footings and columns for each bridge;
- Construction of hardstand areas for the assembly of the bridge components;
- Erection and assembly of the bridge components;
- Installation of bridges on the permanent bearings;
- Completion of the reinforced concrete in-situ deck if required;
- Installation of guard rails and other safety structures;
- Installation of any services required;
- Completion of finishes including abutment batter protection; and
- Installation of bridge drainage system.

1.2 Purpose

The purpose of this EMP(P) is to assist in the formulation of practical mitigation strategies to address potential environmental issues that were identified during the Review of Environmental Factors (REF) (AECOM, October 2012) and site surveys (see section 3.6 Investigations into Flora and Fauna Values). The EMP(P) presents the key environmental issues associated with the project and outlines actions required to minimise harm during design, construction and maintenance of the project. The EMP(P) also highlights the likely statutory approvals, licences and/or permits required, and how they relate to each project phase.

The EMP(P) provides for the management of eight key environmental elements as specified by the Main Roads Road Project Environmental Processes Manual (2004, 2nd edition):

- Soils, Erosion and Sediment Control;
- Flora and Rehabilitation;
- Fauna;
- Water Quality;
- Noise;
- Air Quality;
- Cultural Heritage Management; and
- Waste Management.

1.3 Structure of the EMP

This EMP(P) provides:

- An outline of statutory obligations;
- The reporting and administrative protocols to ensure the management strategies and monitoring programs are implemented;
- Sustainability planning;
- Environmental management strategies to minimise potential environmental impacts;

- An outline of a recommended environmental monitoring activity; and
- Details of the corrective and non-conformance procedures to be employed.

1.4 TMR Environment and Heritage Policy 2008-2013

The Department of Transport and Main Roads (TMR) will manage road impacts on natural, human and cultural environments by:

- Meeting statutory obligations of all relevant environmental and heritage legislation as a minimum standard.
- Considering the effects on stakeholders and long-term relationships when carrying out statutory obligations, and seeking feedback on our performance.
- Acting as a good government agency and adopting a proactive approach to environmental and heritage management.
- Improving awareness of environmental and heritage management processes, standards and responsibilities among Main Roads' employees and contractors.
- Ensuring Main Roads approach to the management of environmental and heritage impacts embrace the hierarchy of "avoid, minimise and mitigate" in a financially feasible manner.

1.5 Timing

AECOM is currently commissioned for the detailed design phase with construction scheduled to commence in June 2014.

2.0 Statutory Requirements

2.1 Relevant Legislation

A general environmental duty not to carry out an activity in a manner that causes or is likely to cause environmental harm is established under section 319 of the Queensland *Environmental Protection Act 1994* (EP Act). In accordance with this duty, all works for the TRR4 should be undertaken in a manner that avoids or minimises environmental harm.

The main pieces of environmental legislation protecting the identified environmental values in the project area are:

Federal

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC); and.
- *Native Title Act 1993*

State

- *Environmental Protection Act 1994* (EP Act);
- *Nature Conservation Act 1992* (NCA);
- *Vegetation Management Act 1999* (VMA);
- *Fisheries Act 1994*;
- *Sustainable Planning Act 2009* (SPA) and *Sustainable Planning Regulation 2009* (SPR);
- *Aboriginal Cultural Heritage Act 2003*;
- *Water Act 2000* (Water Act); and
- *Land Protection (Pest and Stock Route Management) Act 2002*.

The approvals, licences and permits that may be required before construction can commence are listed in Appendix B. The approval register in Appendix B will be updated when the design nears completion in early 2014. As of June 2013 only an EPBC referral has been lodged (Referral reference EPBC 2012/6562).

3.0 Existing Environment and Impact Assessment

3.1 Site Description

The proposed alignment is in a largely undeveloped state, the majority having been utilised for grazing purposes for over half a century (the former DERM land being Lot 1 SP232873). The northern portion of the proposed alignment between Geaney Lane and the Bruce Highway is located within an urban area and several of the lots resumed for the gazetted future road appear to have previously been utilised for urban related land use activities. The rural land to the south of Geaney Lane has been subject to illegal dumping, with car bodies and rubbish evident throughout the area. Apart from some recreational vehicular use (motorbikes in particular), farm/easement access tracks, and areas of weed invasion the remainder of the alignment provides good habitat for native flora and fauna species. There are some reasonably intact stands of native vegetation (particularly *Eucalyptus platyphylla*) with signs of fauna inhabitation within the alignment and the neighbouring Lot 100 SP250582.

3.2 Climate

Townsville is situated in an area known as the dry tropics, meaning that while the city does have a tropical climate its geographical position does not expose it to the same level of rainfall as tropical areas to the north.

Summer in Townsville is however considered the 'wet season' as this is when the marked rainfall events occur. The wet season usually commences in October or November with humid, hot conditions causing thunderstorm activity. The monsoon trough then descends over northern Queensland in late December bringing heavy rain through to around April, when it retreats northward again. The average rainfall for the Townsville area is 1143mm, most of which falls in the wet season (November to April).

Also due to its geographical position, Townsville in winter experiences south-easterly trade winds that characterise the warm days, cool nights and low rainfall (Australian Bureau of Meteorology (BOM), 2012).

3.3 Topography

The topography of the proposed alignment is gently undulating ranging from below 10 m AHD to 20 m AHD. The proposed alignment includes waterways associated with Saunders Creek and Stoney Creek (inclusive of their tributaries), and tributaries of the Bohle River.

3.4 Geology

The geological map of the area shows that the TRR4 will be located primarily on Quaternary age un lithified 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).

3.5 Soils

The proposed alignment 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 Stoney 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. During a fauna and flora survey undertaken by AECOM staff between 14th and 25th May 2012, both gully and sheet erosion was observed over the alignment.

There is a low probability of occurrence of acid sulphate soils in the study area except in stream beds. Good quality agricultural land (GQAL) is mapped in the Townsville City Council *City Plan 2005* as occurring around Saunders Creek, but GQAL is not recorded in the *City of Thuringowa Planning Scheme* (2003) over the same area. The *Rural Resources Study* (Buckley Vann Town Planning, 2011) undertaken on behalf of Townsville City Council notes that the land within the Bohle Plains is suitable for grazing purposes but is limited for agricultural purposes due to lack of water and GQAL. There are no strategic cropping land trigger areas within the alignment.

3.6 Investigations into Flora and Fauna Values

Several flora and fauna surveys have been undertaken to understand the nature of the flora and fauna values associated in and around the alignment. A five day flora and fauna survey (14th to 25th of May 2012) was undertaken to determine the actual or potential presence of threatened flora and fauna species as listed under the NCA and the EPBC Act within the alignment of the proposed TRR4 (AECOM, September 2012).

Targeted black-throated finch (BTF) surveys were undertaken between 5th and 8th June 2012, 10th to 14th December 2012 and 8th to 12th April 2013. Individuals and nests were located both within and adjacent to the proposed alignment. The scope of the targeted surveys included record sightings of other Federal or State protected species. The June and December 2012 surveys were undertaken in relatively dry conditions, the April 2013 survey occurred within the BTF's breeding period (juveniles were present) following the wet season. Although the 2012/2013 wet season has been poor in terms of typical tropical rainfall, BTF were more widely dispersed than in the 2012 surveys in response to the greater availability of water (e.g. at ephemeral creeks). The findings of the surveys are discussed further in section 3.6.2.2.

Surveys for the potential tree roosts suitable for microbats including the bare-rumped sheath tailed bat were undertaken to determine the potential for habitat within or adjacent to the proposed alignment. A survey for potential roost trees and evidence of the presence of bats was undertaken over the 14th - 15th, and 20th - 21st of August 2012. Further observation of the potential roost trees with a burrow scope (camera) was carried out over 5 days during December 2012. Echolocation recordings to provide confirmation of the bare-rumped sheath tailed bat within the TRR4 alignment were carried out in both September 2012 and December 2012 (see 3.6.2 below for further information).

3.6.1 Flora

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 Stoney Creek is listed as high value regrowth in the regional ecosystem mapping.

High value regrowth watercourses are mapped within the proposed alignment of TRR4 with the May 2012 survey finding that the riparian vegetation along the watercourses is largely intact but do contain weed species.

Further, the May 2012 flora and fauna survey confirmed:

- Bog figwort *Ramphicarpa australiensis* (Near Threatened, NCA) within and adjacent to the alignment (refer to Appendix A for locations of bog figwort in or near the proposed road infrastructure).

3.6.2 Fauna

In May 2012 an initial site survey confirmed recorded 66 birds, two reptile and 18 mammal species. Of the 66 birds, two were Endangered, Vulnerable or Near Threatened (EVNT) species and 15 birds listed as either Migratory or Marine under the EPBC Act. One EVNT bat (mammal) species (the bare-rumped sheath tailed bat) was considered highly likely to occur within the study area. Additional protected fauna species were considered likely to occur as well, based on habitat assessment and distributional data.

As recommended from the findings of the May 2012 site survey, subsequent targeted species surveys have been undertaken to assess potential impacts from the TRR4 project (these are discussed further in the sections below).

3.6.2.1 Fauna Habitat

The development of the TRR4 will directly remove essential and/or breeding habitat for grassland fauna and potentially segregate areas of presently connected fauna habitat. Grassland habitats are common and widespread in the area, although they continue to undergo regional incremental loss. Retention of grassland areas will provide habitat for bird species such as golden-headed cisticola, red-backed fairy-wren, black kite, squatter pigeon and BTF. All efforts should be made to conserve existing grassland by restricting clearing and controlling introduced grasses during the construction phase.

The bulk of the site is identified as being suitable for BTF habitat in the Federal government's BTF Recovery Plan prepared in 2007 under the provisions of the EPBC Act (DEHWA, 2009). The BTF preferred habitats are essentially open grassy woodlands or forests, often dominated by eucalypts, melaleucas or acacias, where there is access to seeding grasses and water. Nesting requirements are trees and shrubs where nests are often constructed in the outer branches. BTF preferred habitats are found in extensive undeveloped areas around

Townsville. In terms of regional connectivity, the habitat areas form a swathe from the Hervey Ranges extending north through Woodstock and the Bohle Plains.

The Recovery Plan has been prepared to ensure that actions are taken to provide support of the endangered species' ongoing viability. Proposed action within identified habitat which is likely to have a significant impact is subject to controlled action determination by the Federal Minister administering the EPBC Act.

Within the project area there are a number of permanent and ephemeral freshwater creeks, pools and dams that provide seasonal or temporary habitat and resources for a number of fauna species, including several listed as threatened, migratory, and/or marine under the EPBC Act. Such water sources could be impacted indirectly by run-off from construction sites or by machinery and construction works.

Riparian habitat plays an important role within the broader eucalypt and paperbark woodland. Riparian habitat tends to have greater biodiversity, in comparison to surrounding landscapes, and hence have a high conservation value (Woinarski *et al.*, 2000). Riparian habitat provides potential wildlife habitat corridors and may provide a refuge for species during the extended dry season. Therefore, the greatest impact on riparian habitat from TRR4 is likely to be waterway crossings that fragment existing riparian vegetation, potentially impacting on wildlife movement.

Clearing activities within the alignment will remove potential roosting and nesting sites for protected species. The bare-rumped sheath-tail bat is supposed to, at a minimum, forage in the area, therefore removal of trees would reduce the habitat for this species.

Removal of logs and termite mounds will reduce fauna habitat. Species such as the striated pardalotes *Pardalotus striatus* and rainbow bee-eaters *Merops ornatus* are known to nest in river and creek banks and may be impacted by construction work. Habitat assessment conducted during the site survey identified the presence of mammalian species (e.g. Northern brown bandicoot *Isodon macrourus* and short-beaked echidna *Tachyglossus aculeatus*) and the presence of large fallen logs provide habitat for these species.

Northern spadefoot toad (*Notaden melanoscaphus*) habitat could occur within the proposed TRR4 road reserve or in adjacent habitat, although verification of specific location(s) in the road reserve is not available. Survey for northern spadefoot toad has been attempted but could not determine its presence, due to the lack of flooding rain during 2013 wet season. A habitat characterisation, using GIS analysis of the most likely habitat features that have been described in the literature for this species indicates that habitat could be present within the road reserve and more extensively on adjacent land. It is also possible that there are other unknown determinants for what creates a suitable habitat (AECOM, 2013a).

Construction activities may have indirect detrimental effects such as increasing weed and feral animal abundance and increasing the likelihood of uncontrolled fire.

3.6.2.2 Threatened Fauna Species

As mentioned in section 3.6 above, BTF surveys have been undertaken to determine the importance of the habitat within and adjacent to the alignment. A summary of the respective survey results are provided below.

The June 2012 survey found three locations where BTF were present in or adjacent to the proposed alignment including a potential nesting pair and a nest. The December 2012 survey noted two general locations where birds were present adjacent to the alignment. The last of the surveys in April 2013 (undertaken during the breeding season) located BTF at four separate individual sites as noted in the bullet points below. The April 2013 survey also found that rat's tail grass (*Sporobolus*. sp.) present along and near the alignment was presumably resulting in the loss/degradation of BTF habitat.

- Approximately one kilometre from the alignment groups of up to 13 birds were observed at a dam, nests were located in the vicinity (BTF were recorded here in the previous two surveys in 2012);
- Adjacent to the alignment (west by ~250m) within a creekline four individuals consisting of two adults and two juveniles were observed also with nests in the vicinity (no BTF were observed in this location in 2012 by the surveyor);
- Approximately 3km from the alignment, at a dam, groups of up to four birds were counted, juveniles and nests were observed as well at this location (BTF seen in December 2012 in this area but no survey was undertaken here in June 2012); and
- Groups of up to 4 birds (not recorded previously in the 2012 surveys) were seen along an access track approximately 2km from the alignment (NRA 2012; NRA 2013).

Figures 2 and 3 indicate the BTF habitat values in and adjacent to the TRR4 alignment.

The squatter pigeon (V, NC Act, V, EPBC Act) was found in two separate areas outside but in close proximity to the proposed alignment, on both occasions the species was recorded in vicinity of an existing access track (AECOM, September 2012). In addition, during the BTF targeted surveys (December 2012 and April 2013) there were 21 sightings of squatter pigeon within the proposed alignment and adjacent State land. In total, 23 squatter pigeon records exist for the TRR4 project.

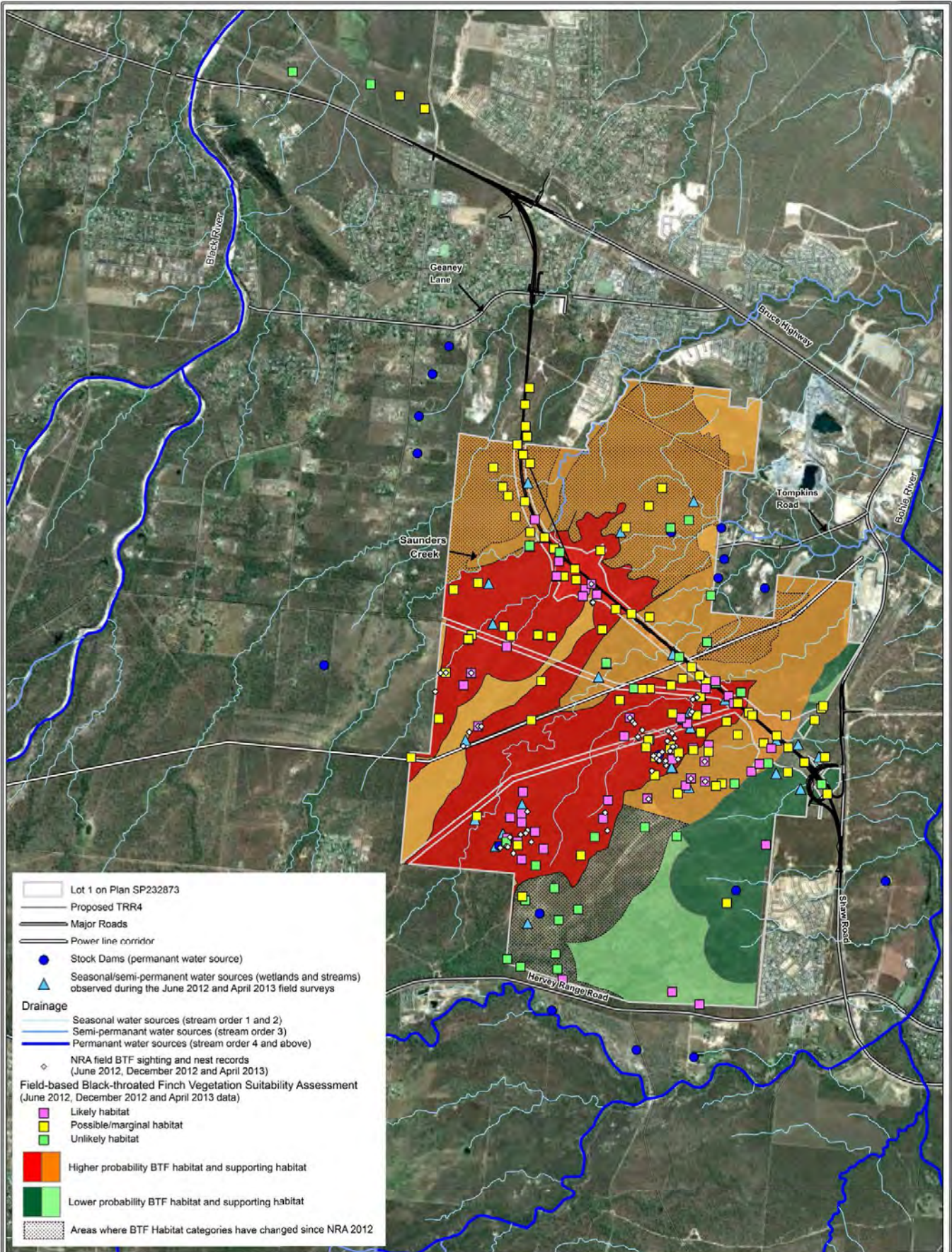
Figure 4 below provides an illustration of the locations of where the squatter pigeon has been observed in the vicinity of TRR4. If construction vehicles are likely to use these tracks for access, there is a possibility of direct impact from collision. Disturbance from construction work may also influence breeding and foraging behaviour. Indirect impacts of weed incursion and an increase of predatory feral species, such as cats, may also have a negative influence.

As noted above, it is highly probable that the bare-rumped sheathtail bat (Critically Endangered, EPBC Act and E, NC Act) is foraging within and across the alignment in the broader area of woodland. The May 2012 site survey revealed that the Critically Endangered bare-rumped sheathtail bat was possibly present within and adjacent to the alignment, with subsequent surveys noting that:

- Potential roost trees were present throughout the alignment (although no evidence of bats was observed during this survey) (AECOM, September, 2012c);
- Through expert analysis it was highly probable that the bare-rumped sheathtail bat was present, although no calls recorded could be "...definitively attributed..." to the bat. It is supposed that the bats forage in the woodland areas, use the riparian vegetation for movement and use permanent and semi-permanent pools of water for drinking (RPS, 2012);
- Investigations of roosts (burrows) using a camera failed to find roosting bats (RPS, 2013);
- LiDAR coupled with GIS analysis of vegetation found that there were a small percentage of suitable roost trees for the bare-rumped sheathtail bat likely to be present in the surrounding landscape (AECOM, September, 2012c; RPS, 2013) as interpreted in Figure 5.

This species is highly dependent on large hollow bearing trees for roosting and breeding that may be impacted through direct clearing. Additionally, noise and dust pollution and potential night time lighting may interfere with breeding and foraging behaviour. Potential impacts to the bare-rumped sheathtail bat will be similar for other microbats in the study site.

Refer to the mitigation figures in Appendix A for the location of threatened species near the alignment.



□ Lot 1 on Plan SP232873
 — Proposed TRR4
 — Major Roads
 — Power line corridor
 ● Stock Dams (permanent water source)
 ▲ Seasonal/semi-permanent water sources (wetlands and streams) observed during the June 2012 and April 2013 field surveys
Drainage
 — Seasonal water sources (stream order 1 and 2)
 — Semi-permanent water sources (stream order 3)
 — Permanent water sources (stream order 4 and above)
 ◆ NRA field BTF sighting and nest records (June 2012, December 2012 and April 2013)
Field-based Black-throated Finch Vegetation Suitability Assessment (June 2012, December 2012 and April 2013 data)
 ■ Likely habitat
 ■ Possible/marginal habitat
 ■ Unlikely habitat
 ■ Higher probability BTF habitat and supporting habitat
 ■ Lower probability BTF habitat and supporting habitat
 ■ Areas where BTF Habitat categories have changed since NRA 2012



PROJECT: Townsville Ring Road Section 4 Project Black-throated Finch Supplementary Assessment
 TITLE: Potential distribution of BTF habitat during the breeding season

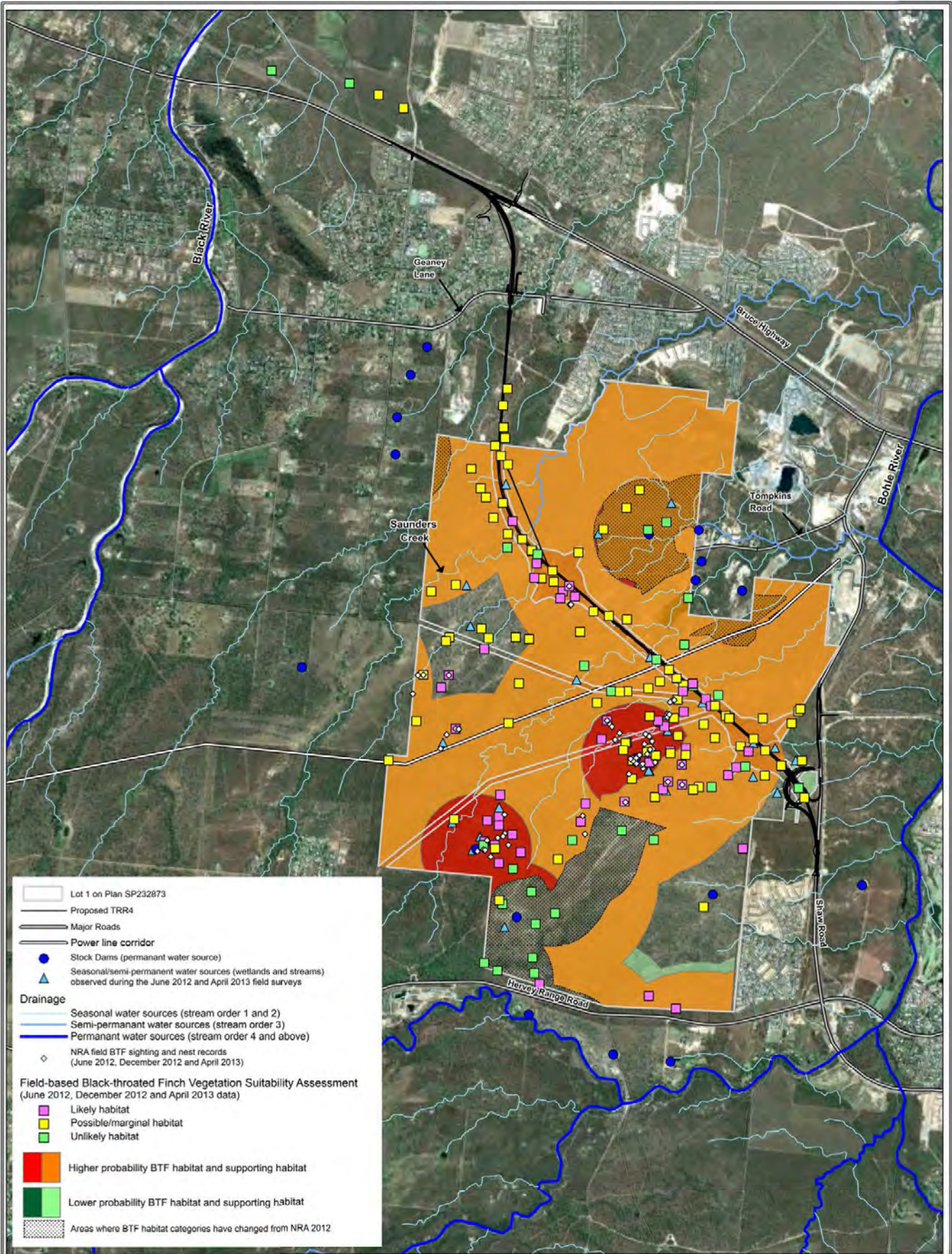
JOB NO: 248068
 DATE: June 2013



SOURCE:
 © State of Queensland (Department of Natural Resources and Mines) 2010.
 © State of Queensland (Department of Environment and Resource Management) 2010.
 © State of Queensland (Department of Natural Resources and Water) 2009.
 Google Earth
 Data File: T:\2013\06\02\248068\001_natural_res_broadb_130627.mxd



Figure 4



PROJECT: Townsville Ring Road Section 4 Project Black-throated Finch Supplementary Assessment
 TITLE: Potential distribution of BTF habitat during the dry season

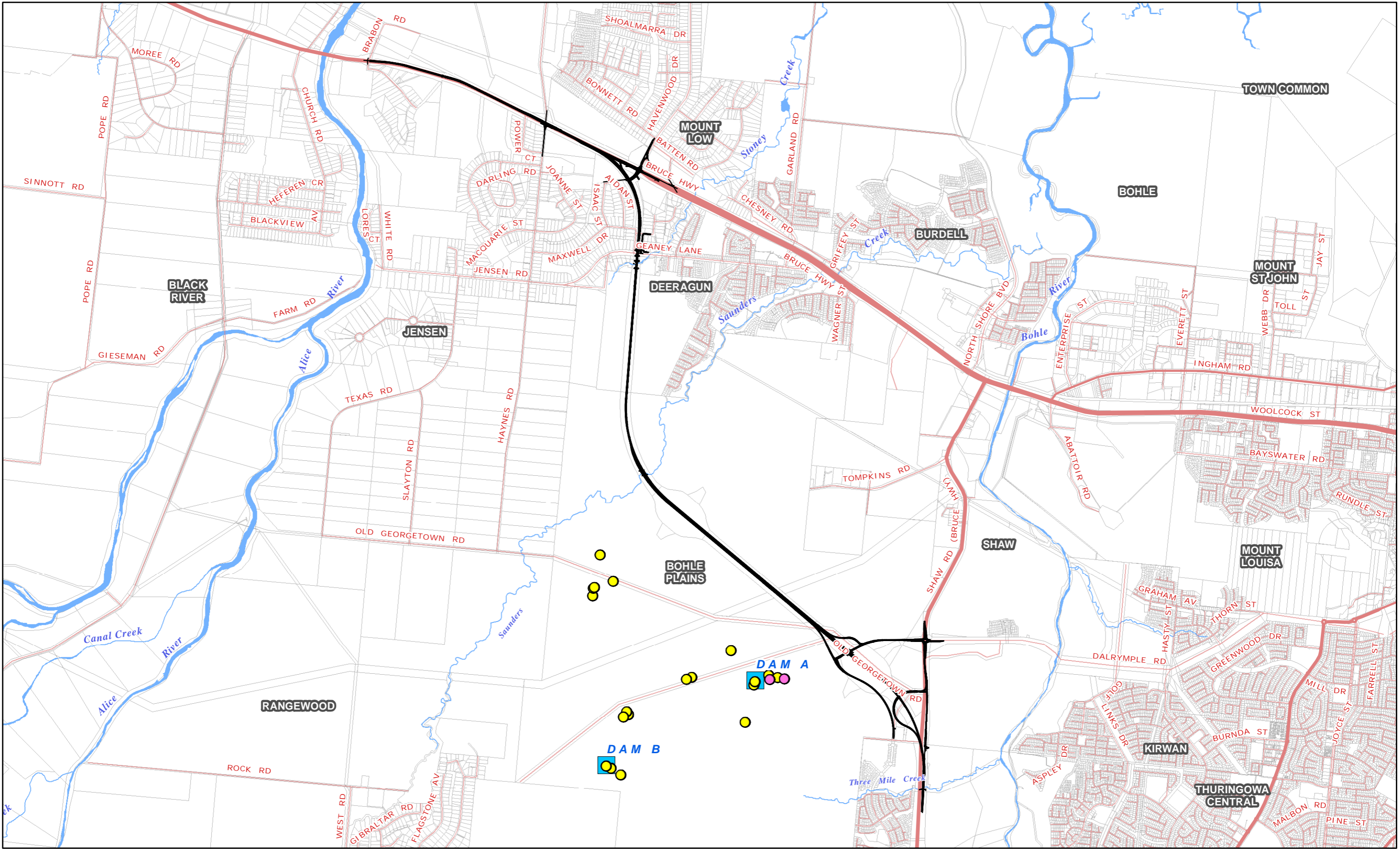
JOB NO: 248068
 DATE: June 2013



SOURCE:
 © State of Queensland (Department of Natural Resources and Mines) 2013.
 © State of Queensland (Department of Environment and Resource Management) 2010
 in State of Queensland (Department of Natural Resources and Water) 2009
 (Project #292) (License 2009/234001) (Version 1.0) (06/12/10)



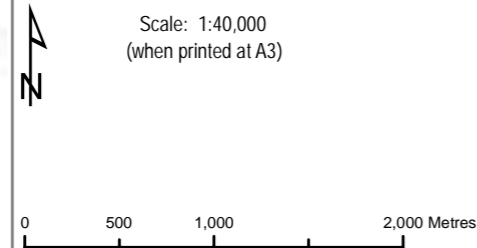
Figure 5



PROJECT ID 60264706
 LAST MODIFIED CFS 25-Nov-2013
 FILE NAME 60264706_ENV_57v3

AECOM

Cadastre, Study Area, Water body provided by Townsville City Council 2011.
 Squatter Pigeon - AECOM 2012 and NRA 2013
 StreetPro © 2010 Pitney Bowes Software Pty Ltd
 Roads, Watercourse - © 2010 PSMA Australia Pty Ltd

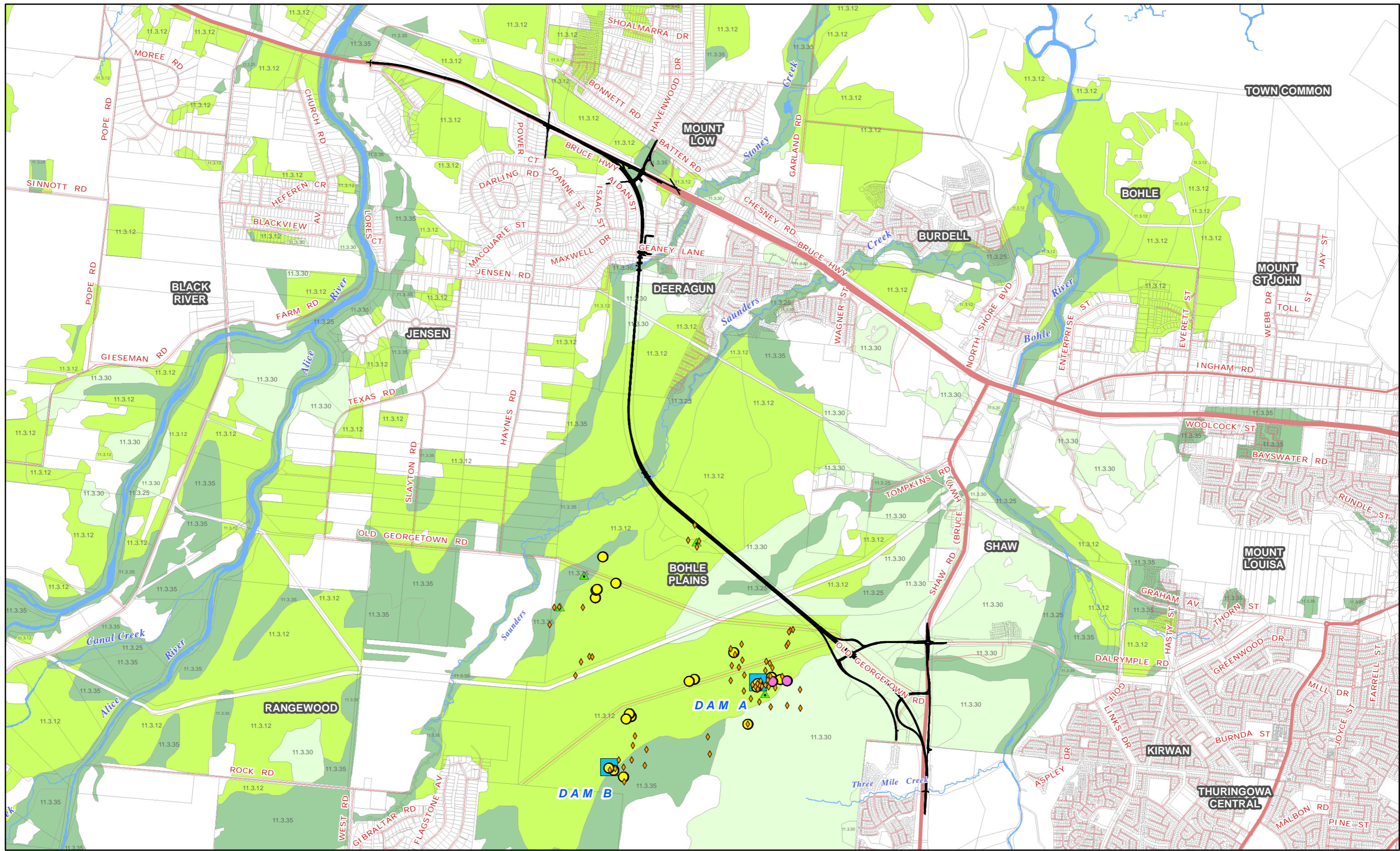


Legend			
●	Squatter Pigeon AECOM Survey	— Highways	
●	Squatter Pigeon NRA Survey	— Main Roads	
■	Dam Locations	— Local Roads	
— (thick black)	TRR4 Project	□ (grey)	Property Boundary

TOWNSVILLE RING ROAD SECTION 4

Location of Squatter Pigeon in Relation to TRR4 Proposed Road Alignment

Figure 4



PROJECT ID 60264706
 LAST MODIFIED CFS 25-Nov-2013
 FILE NAME 60264706_ENV_61

AECOM

Cadastre, Study Area, Water body provided by Townsville City Council 2011.
 Squatter Pigeon - AECOM 2012 and NRA 2013
 BFT Sightings - AECOM 2012 and NRA 2013
 StreetPro © 2010 Pitney Bowes Software Pty Ltd
 Roads, Watercourse - © 2010 PSM Australia Pty Ltd

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Scale: 1:40,000
 (when printed at A3)

0 500 1,000 Metres

Legend

◆ NRA Field BTF Sighting and Nest Records (December 2012, April 2013 data)	▲ BTF Sightings (AECOM Survey)	— Main Roads	■ Bare-rumped Sheathtail Bat
● Squatter Pigeon AECOM Survey	■ Dam Locations	— Local Roads	■ Roosting (optimal)/foraging
● Squatter Pigeon NRA Survey	— Highways	— TRR4 Project	■ Roosting (marginal)/foraging
		□ Property Boundary	■ Roosting (very marginal)/foraging

TOWNSVILLE RING ROAD SECTION 4

Location of Threatened Fauna Species

Figure 5

3.7 Water Quality

The proposed alignment of the TRR4 crosses 15 watercourses mapped on DEHP vegetation mapping; including Saunders Creek and Stoney Creek and tributaries of the Bohle River. The alignment is contained within the Bohle River sub-basin which forms part of the greater Ross Basin system. The Bohle River sub-basin waterways typically drain from their headwaters in the south/south-west towards the coastline in the north/north-east. The direction of flow of the waterways crossing the alignment is generally consistent with that of the waterways within the sub-basin, tending from the south-west to the north-east towards their respective confluence points at the Bohle River.

The waterways within the TRR4 alignment are noted in the *Black Ross Water Quality Improvement Plan (WQIP)* (Gunn and Manning, 2010) as being entirely lowland freshwater systems, and are situated on a relatively flat coastal plain. Stoney 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 Stoney Creeks have largely undeveloped local catchments south of the Bruce Highway. Due to the topography and climate of the coastal plain over which TRR4 is situated, many of the waterways are ephemeral with flows visible for a short time after rain has fallen. Many of the tributaries of Saunders and Stoney 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).

These watercourses have intact riparian vegetation and are likely to be considered to contain significant values from a biodiversity, fisheries and cultural heritage perspective. Further habitat values of note particularly from a water quality perspective, is the Bohle River Declared Fish Habitat downstream.

3.8 Noise

It is a requirement of the TMR *Road Traffic Noise Management: Code of Practice 2008* (CoP 2008) that an assessment of road traffic noise be conducted. Noise sensitive places to where the operational traffic noise impact is assessed comprise dwellings, educational, community and health buildings, outdoor educational and passive recreational areas (including parks).

Residential properties are located adjacent or within close proximity to the TRR4 alignment at both its southern and northern extents (Deeragun, Jensen and Kalynda Chase). The Woodlands Holiday Village Caravan Park and St Anthony's Catholic College are also contained in the suburb of Deeragun within close proximity to the TRR4 alignment.

An investigation of the existing environment and modelling of proposed impacts has been for the northern section of TRR4, in the vicinity of Deeragun. There is a requirement to undertake the same pre-construction monitoring at the southern extent (i.e. near Kalynda Chase) and the results for this monitoring are forthcoming.

3.9 Air Quality

The residential suburbs of Deeragun, Mount Low, Beach Holm, Kalynda Chase, Jensen and the industrial/commercial suburb of Shaw are abutting or adjacent to an aspect of the proposed TRR4 alignment. The alignment particularly impacts on properties in Deeragun and Jensen as it runs immediately adjacent to residential properties at the northern end prior to connection with the Bruce Highway. The developing estates of Brendale, Summerville Gardens and Willowbank mean that residential properties will continue to be built close to the proposed State controlled road. With the exception of Kalynda Chase (adjacent to the southern end of TRR4) and Shaw (to the north-east and east) the suburbs mentioned above are located at the northern extent of TRR4. There is an existing quarry and several industrial estates within the Shaw suburb and Jensen to the west of the TRR4 alignment contains a municipal rubbish disposal facility.

There is evidence of dispersive soils within the proposed alignment and as such dust may become an issue when these soils are disturbed, particularly during the construction period.

The Department of Environment and Heritage Protection (EHP) collect various types of data from regional air quality monitoring stations in Townsville, located at Pimlico, Stuart, Townsville Port (at the Coast Guard station) and North Ward. The closest monitoring station to the project area is located at the TAFE in Pimlico

approximately 10km from the southern extent of the TTR4 alignment. Pollutant levels at the project area are expected to be slightly lower than those at Pimlico due to the TRR4's locality on the periphery of the Townsville urban area.

3.10 Cultural Heritage

Watercourses were natural features regularly utilised by indigenous Australians, and due to the lack of development in close proximity remain largely undeveloped areas. As such, items and/or places of significance are usually found in relationship to a watercourse. The various watercourses and tributaries within the proposed TRR4 alignment may contain items or places of significance to the local Traditional Owners. Indeed, as the vast majority of the proposed alignment is largely untouched by built development there may be significant items or places elsewhere within the alignment, having been utilised for grazing purposes over at least the last 60 years and several more recent easements (including electricity).

A Cultural Heritage Management Agreement has been signed by the representative parties, Bindal and Wulgurukaba people and TMR for the TRR4 project. A cultural heritage study of the area in accordance with the Section 28 Duty of Care Guidelines under the Act, including a site inspection by the local aboriginal groups was undertaken on 18 and 19 of September 2012. The site inspection did not reveal any significant Aboriginal cultural sites or materials. In addition, the Bindal and Wulgurukaba people present during the cultural heritage study were not forthcoming with oral history or information on non-tangible values or places in the TRR4 alignment. However, a hindrance to the cultural heritage site survey was the ground-cover of vegetation from recent rains which obscured the ground surface (Bird, M., 2012). Due to the ground cover vegetation present during the cultural heritage survey, it is recommended that cultural monitoring be conducted at the time of clearing and grubbing operations by Aboriginal Party representatives to ensure there is an opportunity for any undetected Aboriginal (or non-indigenous) cultural sites, finds or values to be identified, documented and appropriately managed by the Aboriginal Parties, in conjunction with TMR.

Non-indigenous cultural heritage in the area may include World War Two relics. The Queensland government publication *WWII – NQ; A cultural heritage overview of significant places in the defence of north Queensland during World War II* (Pearce, 2009) notes that Townsville during World War Two was the main supply centre for the war effort in the 'South West Pacific Area' and also housed the largest military air base in the southern hemisphere at Garbutt to the east of the proposed TRR4 alignment (now the Royal Australian Air Force base). Besides Garbutt, the largest United States military hospital in Queensland was located at Black River to the west and an airfield on Shaw Road (to the east of the proposed alignment) was used by United States military aircraft (now the Townsville drag strip).

A European heritage assessment is currently underway for the project and heritage and UXO protocols will be required in the contractor's construction EMP.

4.0 Implementation and Operation

4.1 Environmental Responsibility

The following role descriptions outline the environmental responsibilities for each party.

All Parties

Under the *Environmental Protection Act 1994* every person is subject to a general environmental duty not to cause environmental harm unless the person has taken all reasonable and practicable measures to prevent or minimise harm. In addition, when there is an incident that may cause or threatens to cause serious environmental harm or material environmental harm notification and appropriate action is to be taken to minimise the extent of the environmental harm. Notifications of incidents are to be undertaken in compliance with the TMR specifications, in particular MRS51 and MRTS51.

Principal's Project Manager

The Principal's Project Manager is responsible for:

- Overseeing all stages of the Project;
- Implementation of provisions for each stage; and
- Confirming that Construction Contractor has obtained all project specific approvals (e.g. permits to carry out environmentally relevant activities (ERAs)).

Project Manager (Planning, Design and Construction)

The Project Manager (Planning) is responsible for implementation of the provisions of the EMP(P) during the planning phase. Similarly, the Project Manager (Design) and Project Manager (Construction) will be responsible for implementation of the EMP(P) and subsequent EMP (Construction) (EMP(C)) that relates to each matter throughout the project.

Construction Contractor

The Construction Contractor is responsible for:

- Obtaining and holding approvals required for the conduct of their day to day work activities (e.g. extractive activities) and payment of associated fees;
- Ensuring suppliers of goods and services are appropriately licenced and qualified to undertake the work for which they have been commissioned (e.g. suppliers of materials);
- Adherence to project approval conditions;
- Preparation of EMP(C) that complies with MRS51 and MRTS51, EMP(P) and relevant legislation;
- Provision of an environmental representative and support staff;
- Ensuring that all staff receive an environmental site induction (developed in accordance with MRS51);
- Monitoring and reporting as specified;
- Investigating and reporting incidents, responding to complaints and taking corrective actions to ensure compliance with legislation and any project specific guidelines or performance indicators; and
- A monitoring and reporting program will be developed by the contractor as part of the EMP(C) that dictates (among other things):
 - the purpose and/or frequency of investigations/audits,
 - the process for managing and maintaining project records for complaints, and
 - the reporting requirements from investigation/audit findings.

The contractor will differentiate between reporting of incidents and regular audits.

Construction Contractor's Site Supervisor

The site supervisor is responsible for:

- Ensuring implementation of the EMP(C) on site;
- Undertaking and/or overseeing inspections, monitoring and reporting as dictated in the EMP(C) or as directed by the Principal.

Construction Contractor's Environmental Officer

The Contractor's Environmental Officer is responsible for monitoring compliance with the EMP(C), TMR Specifications and Technical Standards and legislation throughout the project.

Contractor's Work Crew

Employees and sub-contractors of the Construction Contractor are responsible for adhering to all aspects of the Site Induction and to directions from the Site Supervisor.

5.0 Design Mitigation Measures and Strategies

Figures showing the key areas requirement environmental management and mitigation to be applied on the TRR4 project are in Appendix A.

5.1 Soils

Potential Impact	Measure Cross Reference	Design Consideration	MRS Specification
Erosion and sedimentation due to inadequate erosion and sediment control devices.	See measures in section 6.0, particularly Table 1 and Table 4.	Erosion control (preventing initial dislodgement of particles) should be the focus of Erosion and Sediment Control Plans.	MRTS51 CI 10.2 MRTS51 CI 10.2 <i>Soil Erosion and Sediment Control Engineering Guidelines.</i> The Queensland Division of the Institution of Engineers Australia.
Sedimentation and erosion of waterways from construction and operation of infrastructure associated with TRR4 (especially Saunders Creek and Stoney Creek).		Minimise the impact from bridge design on Saunders Creek and Stoney Creek through current recommended practice, vegetation retention and having an Erosion and Sediment Control Plan (ESCP) in place prior to construction.	MRTS51 CI 10.2
		All works to be undertaken in accordance with the QDMR <i>Road Drainage Design Manual</i> (Manual) (Chapter 5).	MRTS51 CI 10.2

5.2 Flora and Fauna

Potential Impact	Measure Cross Reference	Design Consideration	MRS Specification
Removal of nesting and/or roosting shrubs and trees.	See measures in section 6.0, particularly Table 2 and Table 3.	Prepare contractor's vegetation clearing plan during final design phase and confirm boundaries.	MRS51
Degradation of habitat (e.g. damage by vehicles and heavy machinery).		As above.	MRS51
Increased habitat fragmentation.		As above.	MRS51
Pollution or damage to critical water sources.		Scuppers and stormwater quality pond to be incorporated into final design for Saunders Creek.	MRS51
Increased weed infestation.		Addressed in construction measures see Table 2.	MRS51

Potential Impact	Measure Cross Reference	Design Consideration	MRS Specification
Increased feral animal abundance (e.g. potentially resulting in increased predation by cats, destruction of waterholes by pigs).		Addressed in construction measures see Table 3.	MRS51
Uncontrolled fires.		Addressed in construction measures see Table 2.	MRS51
Road mortality during and post construction.		Addressed in construction measures see Table 3.	MRS51
Disruption of breeding and/or behaviour by noise pollution and human/vehicular disturbance.		Addressed in construction measures see Table 3 and Table 5, section 6.0.	MRS51
Net loss or degradation of water sources (either permanent or seasonal in the locality).		<p>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. However, with regards to BTF, it is not expected that there will be a net loss of dry season water sources given the current design and the provision of suitable environmental management practices.</p> <p>The climate, soils and geology of the immediate and adjacent area is such that the geomorphological features can shift on the coastal floodplains from wet season to wet season. Protection of water quality is the main driver for design in this regard. Design consideration has been given for erosion control around structures for both water quality and structural reasons. Extensive hydrological modelling has been undertaken to ensure that the structures associated with TRR4 have negligible impact on the hydraulic capacity and velocity within the applicable waterways and across the Bohle Plains floodplain.</p>	No specific MRS

5.3 Noise

Potential Impact	Measure Cross Reference	Design Consideration	MRS Specification
Noise complaints from construction activities and operation.	See measures in section 6.0, particularly Table 5.	Incorporate noise mitigation measures - screens, timing of works for prevailing winds and set appropriate separation distances, and timing of works.	MRS 11.15
		Conform to the QDMR Traffic Noise Management Code of Practice.	QDMR Road Traffic Noise Management Code of Practice

5.4 Water Quality

Potential Impact	Measure Cross Reference	Design Consideration	MRS Specification
Increase in surface water and contaminants in runoff as a result of operation of the TRR4 Project.	See measures in section 6.0, particularly Table 1 and Table 4.	<ul style="list-style-type: none"> - Grade control structures (rock/sandbag check dams); - Gross pollutant traps and storm filters; and - Spill control devices. 	N/A
Net loss or degradation of water sources (either permanent or seasonal in the locality).		Design consideration has been given for erosion control around structures for both water quality and structural reasons. Extensive hydrological modelling has been undertaken to ensure that the structures associated with TRR4 have negligible impact on the hydraulic capacity and velocity within the applicable waterways and across the Bohle Plains floodplain.	N/A
Generation of contaminated stormwater from stockpiles, exposed soil and bunded storage areas.		Stockpiled materials are to be placed out of drainage lines, away from exclusion areas and vegetated areas that are to remain uncleared to avoid disturbance of roosting fauna.	N/A
		Design of erosion and sediment controls to allow for control of a 2 year ARI event.	N/A
Scour and erosion of adjacent land resulting from high velocity water from the TRR4 Project.		Storage of chemicals and fuels to be bunded with a capacity of 120% of maximum storage capacity.	AS 1940 – 2004
	Minimise surface water velocities across the site with velocity dissipating controls.	MRS 11.03	

6.0 Construction Mitigation Measures and Strategies

6.1 Soils

6.1.1 Objectives

- Erosion control (i.e. preventing initial dislodgement of particles) should be the focus of the ESCP. Erosion and sediment control will be sensitive to the local characteristics of the site (e.g. soil types, weather patterns etc.). Both dry and wet seasons must be considered and appropriate management principles proposed and implemented.
- Minimise the effect on water quality/watercourses by limiting disturbance of ground surfaces and implementing effective erosion controls where required.
- Minimise land/water contamination by employing appropriate storage, handling and disposal methods of materials and respond to spills immediately.
- Where disturbance to soils exhibiting actual acidity cannot be avoided, implement all reasonable and practical measures to minimise impact to the surrounding environment from acidic material and drainage.

6.1.2 Environmental Impact and Control Measures

Table 1 Soil impacts and mitigation measures

Issue	Control Actions (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
Erosion, sedimentation, and loss of topsoil material.	<p>Provide an ESCP that documents suitable erosion and sediment controls to reflect the moving focus of construction activity. Erosion and sediment controls to be implemented with consideration for the Contractor's preferred construction approach. Submission of the ESCP for approval to the Principal and/or Principal's PM, and subsequent construction of the erosion and sediment controls as per the approved documents, is required prior to disturbance of the ground surface.</p>	Prior to start of work on-site.	Construction Contractor.
	<p>Consideration of Bureau of Meteorology weather reports for the site is to be had and action taken as necessary based on the content of the reports.</p>	Duration of project.	Construction Contractor.
	<p>Minimise impacts to vegetation and the ground surface by, among other things,:</p> <ul style="list-style-type: none"> - providing a visual identification of no-go (exclusionary) areas (marking or taping off the areas); - unless there is a specific job requirement (e.g. weed management), vehicles are to use approved access tracks (except for safety or emergency 	Duration of project.	Construction Contractor. Site Environmental Officer.

Issue	Control Actions (and Source)	Timing	Responsibility
	<p>reasons). Where off-track work is necessary, thought should be given to minimising the disturbance by using where practicable, manual labour or the smallest vehicle possible and pre-planning of the route (to ensure the least disturbance);</p> <ul style="list-style-type: none"> - construction related ground disturbance (including ancillary uses e.g. laydown area) is to occur within pre-approved areas only (see Appendix A); - maintain access tracks to minimise loss of sediment from these areas; and - obeying the site's speed limit(s). 		
	<p>All runoff from disturbed areas including stockpile areas should pass through sedimentation control devices prior to reaching stormwater drains or waterways.</p>	<p>Duration of project.</p>	<p>Construction Contractor. Site Environmental Officer.</p>
<p>Degradation of waterways (especially Saunders Creek and Stoney Creek) from erosion and subsequent sediment transport.</p>	<p>Spoil and vegetation that is disturbed on the site shall not be pushed into or within 10 metres of creeks, flood prone areas or drainage lines.</p>	<p>Duration of project.</p>	<p>Construction Contractor. Site Environmental Officer.</p>
	<p>Any Acid Sulfate Soil (ASS) that is discovered and disturbed as a result of the project will be tested and treated. The Contractor shall comply with the requirements of MRTS04 <i>General Earthworks</i>. An ASS Management Plan may be required.</p>	<p>Duration of project.</p>	<p>Construction Contractor. Site Environmental Officer.</p>
<p>Staging of construction works to minimise soil exposure and potential for erosion.</p>	<p>Large areas of soil exposure should occur outside of the wet season, with rehabilitation completed before the onset of the wet season (particularly in high risk areas e.g. waterways and drainage features). Staging of vegetation clearing / soil exposure, i.e. the whole footprint should not be cleared and grubbed at once if works will not be occurring everywhere at once. In a given work area, rehabilitation should occur immediately after completion of major works in that area, minimising duration of soil exposure. Adherence to the TMR vegetation clearance plan to avoid unnecessary vegetation clearance (see Table 2).</p>	<p>Duration of project.</p>	<p>Construction Contractor. Site Environmental Officer.</p>
<p>Soil contamination.</p>	<p>Spills are to be cleaned up immediately and reported to the appropriate individual or body. Spill kits suitable for terrestrial and aquatic environments are to be available on all construction machinery. In addition, terrestrial and aquatic use spill kits are to be kept in areas that store or may store materials capable of contamination. All spill kits shall be fit for the purpose (depending on the environment and potential contaminant present) and be maintained by the Contractor.</p> <p>Ensure refuelling activities occur in designated areas of the site where appropriate temporary protection measures have been designed and located and are at a suitable distance from surface waters and drainage lines.</p>		

Issue	Control Actions (and Source)	Timing	Responsibility
	<p>All construction related machinery (including small vehicles) are to be in good condition and maintained as such. Machinery that is leaking oil or fuel shall not be permitted on site.</p> <p>All flammable, combustible and hazardous materials are to be stored within bunded areas located at least 30 m from watercourses or drainage lines.</p> <p>The Contractor shall provide the Site Supervisor with a list identifying hazardous, toxic or flammable materials being brought onto site.</p> <p>A copy of the product label or description of material composition and MSDS for all hazardous, toxic or flammable materials to be provided to Site Supervisor.</p> <p>The Contractor shall ensure staff using hazardous, toxic or flammable materials on the site are trained in competent in the safe and correct use.</p> <p>Imported fill shall be sourced from an approved supplier and certified as weed and contaminant free.</p>		

6.1.3 Monitoring

Site inspections shall be 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).

6.1.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.2 Flora

6.2.1 Objectives

- Minimise the impacts of the works on native flora by confining activities to the agreed levels of impact and to the project work areas.
- Recognise and preserve the extent and integrity of Saunders and Stoney Creeks and other watercourses.
- No disturbance to remnant vegetation outside of the footprint during construction works and minimise disturbance to existing and re-establishing native vegetation.
- Minimise impacts on habitat within the project site.
- Manage weed incursions during construction, in particular within Saunders and Stoney Creeks.
- Rehabilitate the project site and maintain viable riparian habitat corridors post construction.

6.2.2 Environmental Impact and Control Measures

Table 2 Flora impacts and mitigation measures

Issue	Control Actions (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
Minimise the loss of habitat.	TMR will develop a vegetation clearance plan that will form part of the tender package and will require the contractor to clear the necessary vegetation in a staged manner where practicable, thereby reducing the impacts on bare ground from wind, raindrop and sheet flow of water. The plan will minimise the clearing of vegetation to be kept to the smallest area possible allowing only for the road alignment and ancillary requirements (e.g. laydown areas, storage of materials, etc.). No clearing or direct damage to vegetation outside of areas identified in the vegetation plan will be permitted.	Pre-Construction.	Construction Contractor.
Net loss or degradation of water sources (either permanent or seasonal in the locality).	<p>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.</p> <p>Permanent or semi-permanent pools of water (inclusive of farm dams, pools within waterways, etc.) are not to be directly disturbed by construction works unless otherwise specified in writing from the Principal or Principal's Project Manager. This includes taking or water for any purpose.</p>	Post – Construction.	Construction Contractor.
Maintaining habitat quality for BTF in the road reserve after clearing to address impacts of fragmentation and edge effects.	<p>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:</p> <ul style="list-style-type: none"> - Slash perimeter fence line firebreaks when undertaking any burning rotations to stimulate grass regrowth and seeding. 	Duration of project.	Construction Contractor.

Issue	Control Actions (and Source)	Timing	Responsibility
	<ul style="list-style-type: none"> - 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 . - Post construction undertake one controlled burn no more than every five years that the road reserve is being managed for BTF habitat. - Hydro mulching would be trialled in some burnt sections to support the introduction of BTF grass species. 		
Introduction / spread of exotic weeds impacting on BTF and squatter pigeon.	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.	Duration of project.	Construction Contractor.
	<p>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.</p> <p>A monitoring program should be developed for use during the construction period to ensure control of potential weed regrowth.</p> <p>Measures to restrict the transport of seed and debris by persons or vehicles associated with the construction process from infested areas to un-infested areas should be implemented where possible.</p>	Duration of project.	Construction Contractor.
	<p>Weed identification of the declared weeds and targeted weeds found onsite will be included in the induction training. Weed identification charts (for weeds found onsite) will be provided in applicable site buildings (e.g. office and crib rooms).</p> <p>The following weeds that have been observed within and adjacent to the proposed TRR4 alignment that impact protected species habitat (e.g. BTF and bog figwort) are listed below with mapping provided in Appendix C:</p> <ul style="list-style-type: none"> - Rat's tail grass <i>Sporobolus</i> spp¹; - stylo <i>Stylosantes</i>; - snakeweed <i>Stachytarpheta jamaicensis</i>; - thatch grass <i>Hypparrhenia rufa</i>; - Guinea grass <i>Megathyruus maximus</i>; and - grader grass <i>Themeda qadrialvis</i> (AECOM, 2012; NRA, 2012). 		
Inappropriate grazing regimes impacting BTF.	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	Post-Construction.	Construction Contractor.

¹ A declared Class 2 species under the *Land Protection (Pest and Stock Route Management) Act 2002*.

Issue	Control Actions (and Source)	Timing	Responsibility
	contractor as a final works measure before the road becomes operational.		
Minimise impacts on mircobats by the minimisation of clearance.	Clearing of roost trees will only occur in the construction zone; cleared logs/stags will be placed in remaining road reserve or adjoining habitat. Trees will be inspected prior to felling by an appropriately licenced and experienced spotter-catcher.	Pre-construction – Construction period.	Construction Contractor
Loss of habitat and habitat connectivity from clearing of grassland and or grassy woodland near 1 km of water sources.	Any BTF nesting areas found in the remaining uncleared road reserve during construction will be protected with suitable construction fencing and or barriers, toolbox talks to ensure all workers are aware of location and reason for protection. Pre-clearance surveys will be undertaken in riparian areas or near water sources to ensure BTF nests have been vacated prior to vegetation clearance.	During construction.	Construction Contractor.
Clearing of grassland and or grassy woodland within 1 km of water sources.	Construction staging plans and methodology will recognise that there will be constraints to native vegetation clearance activities. TMR will prepare a vegetation clearing plan 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.	During construction.	Construction Contractor.
Loss of individuals of Bog figwort.	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. 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 recovered during vegetation clearance, stored temporarily and respread in an area where particular drainage requirements can be replicated. 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. Trial soil-seed bank recovery area should be marked out between February to May while plants are still obvious). Pre-treat area with appropriate herbicide if necessary	Pre-construction – Construction period.	Construction Contractor.

Issue	Control Actions (and Source)	Timing	Responsibility
General clearing of vegetation impacting on habitat.	<p>The following should be considered when clearing vegetation:</p> <ul style="list-style-type: none"> - clearing of vegetation and habitat shall be kept to an absolute minimum; - selective clearing of native species to be used in preference to clear felling; - clearing not to occur for construction site camps or stockpiles; and - limits of clearing are to be clearly marked with flagging tape. <p>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.</p>	Clearing / slashing activities.	Construction Contractor.
Vehicle strike / general disturbance of fauna.	Vehicles / machinery must not travel outside of access track / line route corridor, unless in emergency or unsafe situation.	Duration of project.	Construction Contractor.
Death/damage to vegetation.	Excavations, placement of vehicles and stockpiles are not permitted within the drip line of trees.	Duration of project.	Construction Contractor.
Lighting of fires.	<p>The lighting of fires for construction activities by the Contractor is strictly prohibited.</p> <p>The following preventative measures will be adhered to:</p> <ul style="list-style-type: none"> - fire extinguishers to be kept on all construction machinery and site vehicles; - fire extinguisher must be present at the location where all hot works occur; and - designated smoking areas are to be provided with containers for the safe disposal of cigarette butts. 	Duration of project.	Construction Contractor.

6.2.3 Monitoring

Site inspections will be undertaken at the discretion of the SEO, the Principal or Principal's Project Manager which include visual assessment of vegetation management measures and effectiveness of pest management strategies. Complaints/reports shall be investigated by the SEO and appropriate action taken by this person(s).

6.2.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.3 Fauna

6.3.1 Objectives

- Minimise the impacts of the works on native flora by confining activities to the agreed levels of impact and to the project work areas.
- Promptly attend to the treatment of animals that are injured as a result of project activities.
- Preserve habitat logs, rocks and other shelters.
- Maintain and improve integrity of vegetation communities and habitat for fauna species of conservation significance within the project area.

6.3.2 Environmental Impact and Control Measures

Table 3 Fauna impacts and mitigation measures

Issue	Control Actions (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
BTF and squatter pigeon Habitat management and enhancement.	<p>Vegetation clearance activities will only occur in accordance with the clearance plan locations. No construction vehicle access outside TRR4 road reserve on adjacent state land will occur.</p> <p>Vegetation clearance activities will not occur at night (squatter pigeons roost at night and can be easily run over). Hand clearing of vegetation would occur in riparian areas to ensure soil stability.</p> <p>Squatter Pigeon: Look out for bird sitting or dust bathing and eggs (May-June) on ground, especially in dirt tracks.</p> <p>BTF: Nesting Area: Avoid clearance/slashing for perimeter fence in breeding season (Feb- June).</p> <p>Pre-clearance survey before early works commence in this area.</p>	Construction and Operation	Construction Contractor.
Substantial increases in non-construction related human traffic and or recreational activity.	<p>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.</p> <p>Public access will be restricted and discouraged by appropriate signage. Signage at targeted track closure locations has been found to be an effective deterrent.</p>	<p>Prior to Construction.</p> <p>Construction and Operation.</p>	<p>Project Manager.</p> <p>Project Manager.</p>

Issue	Control Actions (and Source)	Timing	Responsibility
	Maintenance inspections will be undertaken at regular intervals to ensure that the fencing and signage remains effective for the period of construction.		
General disturbance of habitat from construction.	Work activities shall be carried out in a manner that minimises disruption of habitat. Any trees that are cut down shall not be pushed into windrows and burnt but placed in adjacent vegetated areas to provide habitat for ground dwelling species.	Clearing / slashing activities.	Construction Contractor.
General impacts on fauna from construction.	<p>Firearms, dogs and other domestic animals are not permitted on the site.</p> <p>It is prohibited to destroy, take, kill or unnecessarily disturb any animals.</p> <p>Local wildlife carers shall be notified upon discovery of injured, sick or orphaned animals.</p> <p>Feeding native animals is prohibited.</p>	Duration of project.	Construction Contractor.
Potential impacts on vegetation communities and habitat for fauna species.	Conduct clearing activities during the dry season (April to September) as this will minimise impact on most fauna species listed as migratory or marine. Clearing during the dry season will also avoid periods when many other fauna species are known to have eggs or young, reducing their ability to relocate when clearing commences.	Clearing / slashing activities.	Construction Contractor.
Potential impacts on vegetation communities and habitat for fauna species.	Clearing shall not occur at night between the hours of 6pm and 6am, and should be staged. Site disturbance and vegetation removal shall be limited to only the area and stage necessary for construction purposes (progressive staging). Depending on the time constraints on the Project, clearing for the development within fauna habitat shall be staged in addition to sequential clearing.	Duration of project.	Construction Contractor.
Potential impacts on vegetation communities and habitat for fauna species.	A spotter-catcher shall be employed while undertaking any removal of remnant habitat areas identified as being likely habitat of threatened fauna and potentially relocate fauna before clearing commences. Fauna must be returned to the site after works have been completed, or as near as practical to the place of capture, since survival of animals relocated large distances is unlikely. The spotter-catcher's role shall also be to assess and provide assistance during the possible clearing of habitat for native fauna. The spotter-catcher must not be involved in any habitat clearing and shall be certified and hold the relevant permits.	Duration of project.	Construction Contractor.
Potential impacts on vegetation communities and habitat for fauna species.	Liaise with EHP to communicate areas with known locations or likely habitat of rare and threatened species so that suitable management plans may be developed for their future preservation.	Duration of project.	Project Manager.
Impact on downstream environments.	Maintain the current hydrology as far as possible to mitigate impacts to downstream environments.	Duration of project.	Construction Contractor.
Potential impacts on vegetation communities and habitat for fauna species.	Following weed control, improve areas of poor-quality weed-infested habitat through revegetation of disturbed margins with appropriate native species.	Duration of project.	Construction Contractor.

Issue	Control Actions (and Source)	Timing	Responsibility
Potential impacts on vegetation communities and habitat for fauna species.	<p>Ensure livestock and domestic pets cannot access hazardous areas or locations where chemical treatments have been applied for pest control.</p> <p>Include contact information for the Townsville City Council animal control officers and the leasee/farm manager of the State land in the EMP(C) to report wandering animals.</p>	Duration of project.	Construction Contractor.

6.3.3 Monitoring

Monitoring of flora and fauna will be conducted at the discretion of the SEO, the Principal or Principal's Project Manager.

6.3.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.4 Water Quality

6.4.1 Objectives

- Prevent prohibited substances from entering stormwater drains and waterways.
- Recognise and preserve the extent and integrity of Saunders and Stoney Creeks and drainage lines.
- No complaints from the public or regulatory authority regarding detrimental impact to water quality.
- Ensure work is carried out in accordance with the EMP and ESCP.

6.4.2 Environmental Impact and Control Measures

Table 4 Water quality impacts and mitigation measures

Issue	Control Actions (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
Reduction of water quality within water	Environmental awareness training for all staff and subcontractors.	Prior to start of work on-site	Construction Contractor.

Issue	Control Actions (and Source)	Timing	Responsibility
bodies (i.e. Carrying out works without due regard for the Saunders and Stoney Creeks).	<p>No access to stream beds outside of pegged project footprint.</p> <p>Construction of temporary environmental protection works, erosion and sediment controls, fencing, access gates, wheel washing facilities and noise and dust abatement facilities.</p> <p>Revegetate disturbed areas with local native species</p>	Prior to start of work on-site and duration of project	Construction Contractor. Site Environmental Officer
	Waterways and water bodies shall not be polluted by rubbish, felled or cut vegetation, soap, toilet waste, silt, fuel spillage, etc. This is irrespective of whether there is water present in the waterway/water body or not.	Duration of project.	Construction Contractor. Site Environmental Officer
	Adhere to Guideline - Activities in a watercourse, lake or spring carried out by an entity WAP/2010/4165 – Version 7 when destroying native vegetation, excavating, or placing fill in or in proximity to water bodies.	Duration of project.	Construction Contractor. Site Environmental Officer.
Elevated suspended solids and turbidity in stormwater runoff resulting from the disturbance of soil during construction.	Any dewatering activities are to use temporary sediment control techniques such as filter bags to clarify turbid water prior to discharge into the local sewer network.	Duration of project.	Construction Contractor.
	Schedule works to ensure that disturbed areas are revegetated/ stabilised progressively and as soon as practicable after completion of works.	Duration of project.	Construction Contractor. Site Environmental Officer.
Increase of gross pollutants, hydrocarbons, metals and other chemical pollutants in water bodies.	Ensure water quality protection measures are maintained throughout the duration of construction and maintenance works and during operation.	Duration of project.	Construction Contractor. Site Environmental Officer.
	<p>Ensure all materials and hazardous substances are stored and handled in accordance with relevant standards and guidelines including inter alia AS 1940 <i>Dangerous Goods Safety Management Act 2001</i> and the <i>Workplace Health and Safety Act 1995</i>.</p> <p>All flammable, combustible and hazardous materials are stored in locations at least 30 m from watercourses or drainage lines.</p>	Duration of project.	Construction Contractor. Site Environmental Officer.
	Ensure refuelling activities occur in designated areas of the site where appropriate temporary protection measures have been designed and located and are at a suitable distance from surface waters and drainage lines.	Duration of project.	Construction Contractor.
	All plant/machine/equipment servicing must be undertaken off-site. Where insitu repairs are necessary (i.e. the machinery cannot be removed from site) these are only to be undertaken where protection measures have been implemented to prevent hydrocarbons and other chemical pollutants entering water sources.	Duration of project.	Construction Contractor.

Issue	Control Actions (and Source)	Timing	Responsibility
Degradation of land and waterways from improper handling and disposal of wastes.	Spoil materials removed from the site shall be disposed of at a place approved by TMR's Project Manager.	Duration of project.	Construction Contractor. Site Environmental Officer.
Reduced quality and/or contamination of groundwater.	Check all vehicles, equipment and material storage areas regularly for possible fuel, oil and chemical leaks.	Duration of project.	Construction Contractor.
	Rubbish and waste materials, if dispersible, are to be stored in covered receptacles to ensure that they do not enter drainage lines.	Duration of project.	Construction Contractor.
	Contractor will check all erosion and sediment control structures as part of the environmental inspection to ensure their condition and effectiveness.	Duration of project.	Construction Contractor.

6.4.3 Monitoring

Site inspections shall be conducted at the discretion of the Site Environmental Officer (SEO), the Principal or Principal's Project Manager which involves visual assessment of waters to determine the presence of sediment and chemical plumes. Monitoring may be undertaken weekly and immediately following a rain event causing runoff from the work site. 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*.

6.4.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.5 Noise

6.5.1 Objectives

- Maintaining equipment and undertaking activities at appropriate times.
- Keeping local communities informed of the reasons, times and duration of noise generating activities.
- Conduct works in a manner that minimises nuisance to the local community.
- Receive no complaints from the surrounding community regarding nuisance.

6.5.2 Environmental Impact and Control Measures

Table 5 Noise impacts and mitigation measures

Potential Environmental Impacts	Control Measures (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; 	Prior to start of work on-site.	Construction Contractor.

Potential Environmental Impacts	Control Measures (and Source)	Timing	Responsibility
	<ul style="list-style-type: none"> - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 		
Increased noise levels.	Include noise and vibration training in induction.	Duration of project	Construction Contractor and Site Environmental Officer.
	Construction works will be undertaken between the hours of 6pm and 6am.	Duration of project	Construction Contractor.
	Monitoring of significant plant and equipment noise should be undertaken to assess compliance with expected noise emission levels.	Duration of project	Site Environmental Officer.
	Conduct baseline noise monitoring prior to commencement of construction works.	Duration of project	Site Environmental Officer.
	Specific noise reduction devices such as silencers, mufflers and/or acoustic rock breaking heads shall be installed as appropriate to site plant and equipment.	Duration of project.	Construction Contractor.
	Acoustic enclosures and acoustic screenings should be considered, where appropriate, to reduce noise level emissions and potential annoyance.	Duration of project.	Construction Contractor and Site Environmental Officer.
	Staged clearing (periodic impact noise) to allow bats to leave roosting sites. Limit construction works at dusk.	Pre- Construction and construction.	Construction Contractor and Site Environmental Officer.
Vibration due to construction.	Prior to construction, the Contractor shall undertake a risk assessment of the potential for damage to nearby premises, buildings and structures caused by vibration.	Duration of project.	Construction Contractor.
	Monitoring of construction vibration levels should be considered when equipment is introduced to site to determine appropriate buffer distances for equipment and to assess vibration during heavy compaction activities in close proximity to buildings and underground utilities. This need only be undertaken in response to legitimate complaints from the community and businesses.	Duration of project.	Construction Contractor and Site Environmental Officer.
Deterioration of visual values as a result of work activities.	Equipment or site facilities no longer required to carry out the contract shall be removed from the site following washdown and other requirements.	Duration of project.	Construction Contractor.
	Storage of any vehicle, equipment or materials not directly required to carry out the contract is prohibited from the site.	Duration of project.	Construction Contractor.

Potential Environmental Impacts	Control Measures (and Source)	Timing	Responsibility
	The site shall be kept neat and tidy at all times by ensuring wastes are suitably contained until disposal at appropriate local authority waste disposal facility.	Duration of project.	Construction Contractor.
Complaint Management Procedure.	TMR should maintain a project "hotline" to receive any complaints. TMR should nominate a person to assist with complaints resolution who will be appropriately trained in community consultation and have the ability to act on the complaint.	Duration of project.	TMR's Project Manager to delegate.
	All incidents, complaints and non-compliances related to noise shall be reported in accordance with MRTS51. All records and registers maintained by the Contractor shall be available for inspection by the TMR PM.	Duration of project.	Construction Contractor.
Community Consultation.	TMR should undertake ongoing consultation with nearby stakeholders during the project.	Duration of project.	TMR's Project Manager to delegate.

6.5.3 Monitoring

Noise and/or vibration monitoring will be incident based and conducted at the discretion of the SEO, the Principal or Principal's Project Manager in response to legitimate complaints.

6.5.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.6 Air Quality

6.6.1 Objectives

- Minimise the emission of greenhouse gases and other air contaminants.
- Minimise the potential for odour.
- Conduct works in a manner that minimises nuisance to the local community.
- Receive no complaints from the surrounding community regarding nuisance.
- Prompt investigation and resolution of any complaints received.

6.6.2 Environmental Impact and Control Measures

Table 6 Air quality impacts and mitigation measures

Issue	Control Actions (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
Increase in dust levels at sensitive receptors.	Implement effective dust management measures in all areas during construction using air quality management strategies outlined in MRTS51.	Duration of project.	Construction Contractor.
	Unless specified otherwise, air quality monitoring shall be undertaken in accordance with the Air Quality Sampling Manual, EPA 2007.	Duration of project.	Construction Contractor.
	Vehicles and plant shall be maintained to keep emissions within the limits set by Australian Design Rules.	Duration of project.	Construction Contractor.
	No burning of material is permitted on-site.	Duration of project.	Construction Contractor.
	Ensure that materials to be stockpiled on-site are not ordered/purchased until they are required for works.	Duration of project.	Construction Contractor.
	Locate material stockpile areas as far as practicable from sensitive receptors, i.e. Saunders and Stoney Creeks and drainage lines.	Duration of project.	Construction Contractor.
	Rubbish skips and receptacles should be covered, if the contents are dispersible, and located as far as practicable from sensitive receptors.	Duration of project.	Construction Contractor.
	Provide means for washing down site vehicles.	Duration of project.	Construction Contractor.
	Restrict speeds on-site and access tracks.	Duration of project.	Construction Contractor.
	Cover loads of haul trucks when in transit.	Duration of project.	Construction Contractor. Site Environmental Officer.

Issue	Control Actions (and Source)	Timing	Responsibility
Minimisation of dust generated onsite.	<ul style="list-style-type: none"> - Exposed surfaces or any potential dust-generating areas should be regularly watered. - Early stabilisation, revegetation and landscaping should be carried out as soon as possible after disturbance. - Speed limits on site set to minimise dust generation. - Soil stockpiles should be stabilised with a sterile grass crop – or local grass endemic to site. - Construction work that has the potential to generate dust should cease in excessively windy conditions and/or mist sprays should be applied to suppress dust generation. - Access roads should be sealed where possible. 	Duration of project.	Construction Contractor. Site Environmental Officer.

6.6.3 Monitoring

Monitoring will be incident based and conducted at the discretion of the SEO, TMR's Project Manager or the appointed Project Manager in response to legitimate complaints.

6.6.1 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.7 Cultural Heritage

6.7.1 Objectives

- No damage to items or areas identified as having cultural or archaeological significance.
- Stop work procedures if items of cultural heritage are uncovered during the construction phase.

6.7.2 Environmental Impact and Control Measures

Table 7 Cultural heritage impacts and mitigation measures

Potential Environmental Impacts	Control Measures (and Source)	Timing	Responsibility
Environmental harm.	<p>All staff, including subcontractors, are to be provided with a site induction detailing:</p> <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
Damage or disturbance to significant cultural heritage during the earth disturbances and land clearing activities.	Prior to commencing ground disturbance activities, ensure that all staff involved in, or supervising these activities are made aware of TMR's requirements for cultural heritage through the site induction.	Duration of project.	Construction Contractor.
	At the time of clearing and grubbing operations, representatives of the Aboriginal parties are to monitor the site for cultural sites, finds or values.	Clearing and grubbing	Construction Contractor.
	Ensure that the <i>Aboriginal Cultural Heritage Act 2003</i> Duty of Care Guidelines are adhered to at all times.	Duration of project.	Construction Contractor.
	Where items of potential cultural heritage significance are discovered when monitors are present, construction work shall only proceed in co-ordination with the monitors' activities. The Contractor shall immediately stop work and notify the Site Supervisor. The Site Supervisor will promptly arrange for the site to be inspected and assessed for cultural significance. Under some circumstances, where significant cultural heritage objects are identified, then the PM may declare the object and/or area an exclusion zone for a period of time.	Duration of project.	Construction Contractor.
	Where items of potential cultural heritage significance are discovered when no monitors are present, the Contractor shall immediately stop work and notify the Site Supervisor. The Site Supervisor will promptly arrange for the site to be inspected and assessed for cultural significance. The Site Supervisor may declare the object and/or area an exclusion zone for a period of time as per standard MRTS51.	Duration of project.	Construction Contractor.

6.7.3 Monitoring

Cultural heritage management will be event based via:

- Stop work procedures if items of cultural heritage are uncovered during the construction phase.
- Requests of traditional owners.
- The discretion of the SEO, the Principal or the Principal's Project Manager.

6.7.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

6.8 Waste Management

6.8.1 Objectives

- Minimise land / water contamination by employing appropriate storage, handling and disposal methods of materials.
- Management of waste in accordance with the 'Waste Management Hierarchy' outlined in the Queensland *Environment Protection (Waste Management) Policy 2000*.
- Minimise generation and impacts of waste during pre-construction and construction.

6.8.2 Environmental Impact and Control Measures

Table 8 Waste impacts and mitigation measures

Potential Environmental Impacts	Control Measures (and Source)	Timing	Responsibility
Environmental harm.	All staff, including subcontractors, are to be provided with a site induction detailing: <ul style="list-style-type: none"> - general environmental duty and duty to notify; - conditions of environmental licences, permits and approvals; - environmental management strategies contained in the Contractor's management plans; - identified site specific areas, such as limits of the construction, designated refuelling and waste disposal points, etc.; and - definition and management of environmental incidents. 	Prior to start of work on-site.	Construction Contractor.
Production of wastes and excess use of resources.	Waste management practises shall be conducted in accordance with the <i>Environmental Protection Regulation (Waste Management) 2000</i> .	Duration of project.	Construction Contractor.
Disposal of waste potentially contaminating the site.	All waste that is stored on-site is to be stored in a designated place that complies, where necessary, with regulatory requirements (e.g. Australian Standards), out of drainage lines and away from areas that are to remain uncleared.	Duration of project.	Construction Contractor.
	Disposal of materials (except cleared vegetation and excess excavated materials) on-site is prohibited.	Duration of project.	Construction Contractor.
	Burning or burying of waste is prohibited.	Duration of project.	Construction Contractor.

Potential Environmental Impacts	Control Measures (and Source)	Timing	Responsibility
	Dumping of oil or fuel on-site is prohibited. All oils, oily waste (e.g. oil filters, containers), fuels and fuel containers shall be removed from site by an appropriately licenced person and vehicle, and disposed of at an approved waste disposal facility.	Duration of project.	Construction Contractor and Site Environmental Officer.
	Hydrocarbon wastes shall be stored in colour coded and labelled receptacles placed around fuelling locations.	Duration of project.	Construction Contractor and Site Environmental Officer.
	Materials and substances used or created as waste throughout the project shall be adequately collected, stored and transported off-site for proper disposal or recycling.	Duration of project.	Construction Contractor and Site Environmental Officer.
	Waste receptacles labelled to enable segregation of waste between recyclable and non-recyclable items.	Duration of project.	Construction Contractor and Site Environmental Officer.

6.8.3 Monitoring

Waste will be managed in accordance with the *Environmental Protection (Waste Management) Regulation 2000*. A register of wastes shall be maintained by the Construction Contractor in accordance with MRTS51.

6.8.4 Reporting

The Construction Contractor shall report monitoring results to TMR's Project Manager on a monthly basis as a component of the Monthly Construction Report and shall immediately notify TMR of incidents involving material or serious environmental harm.

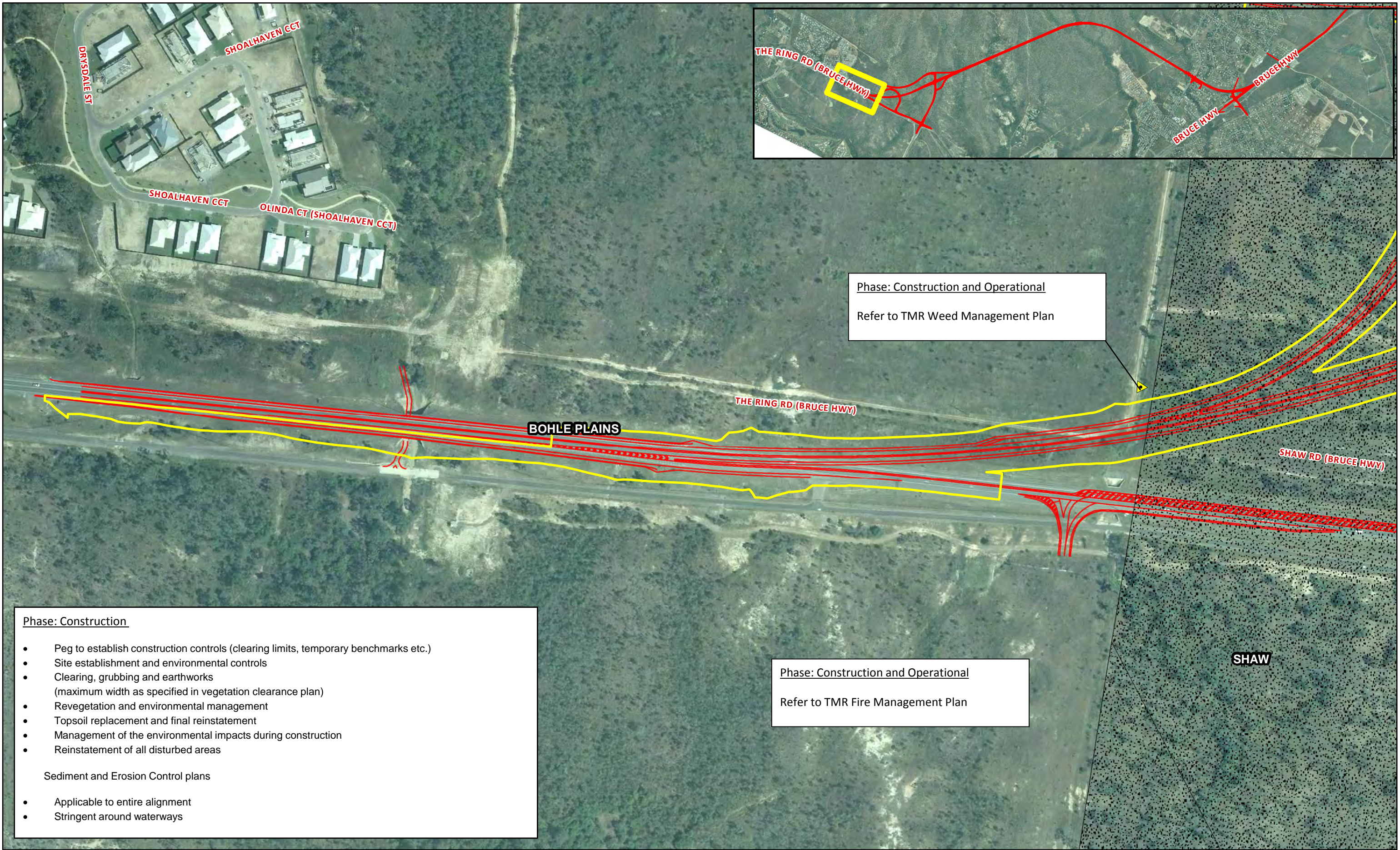
7.0 References

- AECOM (September 2012), Townsville Ring Road 4; Flora and Fauna Survey, Unpublished report for Department of Transport and Main Roads, Reference: 60264706.
- AECOM (September 2012a), Townsville Ring Road; Contaminated Lands Report, Unpublished report for Department of Transport and Main Roads, Reference: 60264706.
- AECOM (September 2012b), Townsville Ring Road Stage 4; Referral of Proposed Action, Unpublished report for Department of Transport and Main Roads, Reference: 60264706.
- AECOM (September, 2012c), Townsville Ring Road 4, Threatened Bat Roost Tree Survey, Unpublished report for Department of Transport and Main Roads, Townsville.
- AECOM (October 2012), Townsville Ring Road Section 4, Review of Environmental Factors, Unpublished report for Department of Transport and Main Roads, Reference: 60264706.
- AECOM, 2013a. *Northern Spadefoot Toad (Notaden melanoscaphus)*, Supplementary Information. AECOM Australia Pty Ltd.
- AECOM, 2013b. *Bog Figwort (Rhamphicarpa australiensis)*, Background and Protocol for Translocation, AECOM Australia Pty Ltd.
- Bird, M. (8 October 2012), Townsville Ring Road (Section 4) Project (TRR4), Executive Summary – Cultural Heritage, Unpublished report for TMR.
- Buckley Vann Town Planning (2011), *Rural Resources Study*, available at <http://www.townsville.qld.gov.au/business/planning/planningscheme/newscheme/Documents/Rural%20Resources%20Study%20Final%20Report.pdf>.
- Bureau of Meteorology (2012), *Climate of Townsville*, available at http://www.bom.gov.au/qld/townsville/climate_Townsville.shtml.
- Department of Environment, Water, Heritage and the Arts (2009), *Significant impact guidelines for the endangered black-throated finch (southern) (Poephila cincta cincta)*. *Nationally threatened species and ecological communities Background paper to the EPBC Act policy statement 3.13*. Australian Government.
- Gunn, J. and Manning, C. (2010), *Black Ross (Townsville) Water Quality Improvement Plan: Improving Water Quality from Creek to Coral*, available at <http://www.creektocoral.org/wqip/BRWQIP12e.pdf>.
- Hopley, D (1970), *Coastal geomorphology in the Townsville region; a study of the geomorphological evolution of the North Queensland coast between Cape Upstart and Hinchinbrook Island*, available at <http://eprints.jcu.edu.au/1784/>.
- Lokkers, C (2000), *Draft Revegetation Strategy for the Townsville City Council Region*; available at http://www.soe-townsville.org/data/reveg_strat.pdf.
- NRA (2012), *Townsville Ring Road Section 4 Project; Black-throated Finch (Poephila cincta cincta) Assessment – June 2012*, Unpublished report for AECOM Pty Ltd on behalf of the Department of Transport and Main Roads.
- NRA (2013), *Townsville Ring Road Section 4 Project, Black-throated Finch Supplementary Assessment*, December 2012 and April 2013, AECOM Australia Pty Ltd.
- Pearce, H. (2009), *WWII – NQ; A cultural heritage overview of significant places in the defence of north Queensland during World War II*, State of Queensland (Department of Environment and Heritage Protection).
- RPS (2012), Townsville Ring Road, Stage 4; Assessment of Occurrence Threatened Bat Species, Unpublished report for AECOM Australia Pty Ltd, Reference: 60264706.
- RPS (2013), Townsville Ring Road, Stage 4; Assessment of Bare-rumped Sheath-tail Bat, Unpublished report for AECOM Australia Pty Ltd, Reference: 60264706.

Woinarski, J.C.Z., Brock, C., M. Armstrong, Hempel, C., Cheal, D. and Brennan, K. (1990), 'Bird distribution in riparian vegetation in the extensive natural landscape of Australia's tropical savanna: a broadscale survey and analysis of a distributional database', *Journal of Biogeography* 27(4):843-868.

Appendix A

Mitigation Figures



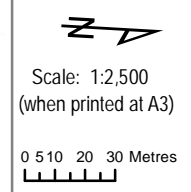
Phase: Construction and Operational
Refer to TMR Weed Management Plan

Phase: Construction and Operational
Refer to TMR Fire Management Plan

- Phase: Construction**
- Peg to establish construction controls (clearing limits, temporary benchmarks etc.)
 - Site establishment and environmental controls
 - Clearing, grubbing and earthworks (maximum width as specified in vegetation clearance plan)
 - Revegetation and environmental management
 - Topsoil replacement and final reinstatement
 - Management of the environmental impacts during construction
 - Reinstatement of all disturbed areas
- Sediment and Erosion Control plans
- Applicable to entire alignment
 - Stringent around waterways

PROJECT ID 60285754
 LAST MODIFIED CFS 27-Aug-2013
 FILE NAME 60285754_ENV_18

Property Boundary, Regional Ecosystem, High Value regrowth - QLD Gov.2013
 Roads, Watercourse - © 2010 PSMA Australia Pty Ltd
 Survey Corridors, Surevs - AECOM, NRA 2013



Known Weed Locations	Squatter Pigeon AECOM Survey	BTF Breeding Habitats	Potential Habitat for Bare-rumped Sheath-tail Bat
NRA Field BTF Sighting and Nest Records (December 2012, April 2013 data)	Squatter Pigeon NRA Survey	Higher Probability BTF Habitat	Roosting (optimal)/foraging
BTF Sightings (AECOM Survey)	TRR4 Project	Higher Probability BTF Supporting Habitat	Roosting (marginal)/foraging
Bog Figwort Population	Extent of Proposed Disturbed Area	Lower Probability BTF	Roosting (very marginal)/foraging
		Lower Probability BTF Supporting Habitat	