Intra Regional Transport Corridor - Northern Section

Department of Transport and Main Roads, South Coast Region

10 September 2010

AECOM

# Strategic Review of Environmental Factors

## Road Corridor Development Planning

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Road Corridor Development Planning

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Prepared for

Department of Transport and Main Roads, South Coast Region

Prepared by

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## Approvals

This report is accepted, subject to the following conditions/clarifications:

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| Title | Name | Signature | Date |
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# Acronyms

The following acronyms have been used within the Strategic Review of Environmental Factors:

| | |
|---|---|
| ACH | Aboriginal Cultural Heritage |
| AHD | Australian Height Datum |
| BOM | Bureau of Meteorology |
| BPA | Biodiversity Planning Assessment |
| CLR | Contaminated Land Register |
| COA | Commonwealth of Australia |
| CPRS | Carbon Pollution Reduction Scheme |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DEWHA | Department of Environment Water Heritage and the Arts |
| DIP | Department of Infrastructure and Planning |
| DNRW | Department of Natural Resources and Water |
| DPI | Department of Primary Industries |
| DPIF | Department of Primary Industries and Fisheries |
| DTMR | Department of Transport and Main Roads |
| EDR | Environmental Design Report |
| EHMP | Ecosystem Health Monitoring Program |
| EMP | Environmental Management Plan |
| EMR | Environmental Management Register |
| EPP | Environmental Protection Policy |
| EV | Environmental Values |
| FHA | Fish Habitat Area |
| GCCC | Gold Coast City Council |
| GCIMP | Gold Coast International Marine Precinct |
| GQAL | Good Quality Agricultural Land |
| i-METT | Integrated Motorsport Education Tourism and Technology |
| IPCC | Intergovernmental Panel on Climate Change |
| IRTC | Intra Regional Transport Corridor |
| LP | Land Protection |
| NC | Nature Conservation |
| NGER | National Greenhouse and Energy Reporting |
| OCC | Office of Climate Change |
| PER | Public Environmental Review |
| QGEOP | Queensland Government Environmental Offsets Policy |
| QH | Queensland Heritage |
| QWQG | Queensland Water Quality Guidelines |
| RCDP | Road Corridor Development Planning |
| RE | Regional Ecosystem |
| REDD | Regional Ecosystem Description Database |
| SDPWO | State Development and Public Works Organisation |
| SPRP | State Planning Regulatory Provisions |
| SREF | Strategic Review of Environmental Factors |
| UXO | Unexploded Ordinance |
| VN | Vegetation Management |
| WSUD | Water Sensitive Urban Design |

WQO Water Quality Objectives

# 1.0 Introduction

## 1.1 Background

AECOM has been commissioned by the Department of Transport and Main Roads (DTMR) South Coast Region to carry out the Road Corridor Development Planning for the Intra Regional Transport Corridor – Northern Section (Beattie Road to Stapylton-Jacobs Well Road) (IRTC).

The IRTC is a preserved road corridor which extends along a north-south alignment between Stapylton-Jacobs Well Road and the Coomera River. A southern section of the IRTC (Beattie Road to Nerang-Broadbeach Road) has also been preserved as road corridor and has previously been the subject of Road Corridor Development Planning. The IRTC as a whole (northern and southern sections) will serve as the primary arterial for local traffic for the rapidly growing northern Gold Coast areas.

The overall objective of the IRTC Road Corridor Development Planning is to preserve a transport corridor which will adequately cater for future requirements and to document critical issues associated with the route. This has been based on a range of desktop planning studies.

As part of the environmental planning studies, AECOM has completed a Strategic Review of Environmental Factors (SREF) to be submitted as Volume 2 of the Road Corridor Planning Report. The SREF builds on the findings of the previous South Coast Motorway Environmental Impact Assessment Study (Connell Wagner, 1995).

## 1.2 Purpose

This document is the Strategic Review of Environmental Factors for the Road Corridor Development Planning (RCDP). It identifies, describes and assesses the environmental opportunities and constraints associated with the proposed IRTC. The purpose of this investigation was to determine areas of environmental significance that are important for the decisions being made in early planning that relate to corridor alignment and the purchase of land.

It documents the information provided to the project engineering team during the review and options development stage. The SREF also documents any potential environmental "showstoppers" and how they may be managed and/or addressed in future detailed studies. Based on the findings an environmental approvals strategy is recommended and some guidelines for timing when DTMR should seek environmental approval for the IRTC.

This has enabled significant environmental issues to be considered in the Road Corridor Development Planning and the preparation of layout drawings. It also provides strategic direction for the next steps required for environmental management and approval.

## 1.3 Project Description

### 1.3.1 Location

The IRTC is a preserved road corridor which extends along a north-south alignment between Beattie Road (Coomera) and Stapylton-Jacobs Well Road (Stapylton) to the east of the Pacific Motorway, and is shown in **Appendix B**, Figure 1. The Queensland Government has purchased a number of properties along this corridor; however a significant area of the corridor remains in private ownership.

The IRTC passes through the suburbs of Coomera, Pimpama and Gilberton. The corridor also crosses several creeks (Oaky, McCoys, Hotham, Halfway and Sandy Creeks) as well as the Pimpama River. The corridor also traverses the floodplains of the Coomera, Logan and Albert Rivers. It also crosses a number of existing roads (Quinns Hill Road East, Rossmans Road, Burnside Road, Goldmine Road, Eggersdorf Road, Pimpama Jacobs Well Road, Kerkin Road, Yawalpah Road, Foxwell Road and Shipper Drive).

The section to the south of that covered by this report, between the Beattie Road, Coomera and Nerang-Broadbeach Road at Nerang (IRTC – South), was the subject of a separate study (Maunsell, 2005).

The scope of work is to consider the environmental elements between Beattie Road and Stapylton-Jacobs Well Road (IRTC – North) only. However, reference is made to environmental factors in the IRTC – South in particular with reference to project and environmental approvals.

### 1.3.2 Description

The IRTC will serve as the primary arterial road connecting the rapidly growing northern Gold Coast areas with Logan to the north, and the Gold Coast southern suburbs. It will comprise a new 21km six lane motorway including four general purpose lanes and two high occupancy vehicle lanes. It requires the following major construction elements:

- Civil earthworks
- New pavement and kerb construction
- Construction of new interchanges at Stapylton-Jacobs Well Road, Burnside Road, Eggersdorf Road, Pimpama-Jacobs Well Road, Yawalpah Road and Oakey Creek Road
- Construction of new bridges or culverts to span existing watercourses at Sandy Creek, Halfway Creek, Pimpama River, Hotham Creek, McCoys Creek, and Oaky Creek
- Services relocations
- Stormwater management
- Installation of road lighting
- Noise barriers where required
- Provision for landscaping.

## 1.4 Relationship to Other Projects

### 1.4.1 General

There are a number of other significant infrastructure projects within close vicinity to the IRTC. These infrastructure projects may potentially provide project and environmental opportunities and constraints. These projects are briefly discussed below.

### 1.4.2 Intra Regional Transport Corridor – Southern Section

As noted above the IRTC – South was the subject of a study by AECOM in 2005. It comprised a 15km divided dual carriageway between Beattie Road, Coomera and Nerang-Broadbeach Road, Nerang. This corridor lies directly to the south of the IRTC being considered within this current AECOM SREF. The IRTC – South comprised five major interchanges together with major bridges over the Coomera and Nerang Rivers.

The Road Corridor Development Planning for the IRTC – South is documented on drawings dated 23 January 2006 which are contained in the 'White Books' stored at the DTMR Gold Coast District Office. The IRTC – South is not currently included on the DTMR Roads Implementation Program (2009-10 to 2013-14) and timing for further design or construction works is uncertain.

As part of the AECOM review in 2005, a SREF was prepared. The SREF concluded that most environmental issues associated with the corridor could be effectively managed through the use of best practice design principles. However, it was determined that a referral would have to be made to the Australian Government Environment Minister as a result of the corridor crossing the Coombabah wetlands. These wetlands are a declared Ramsar area of national significance, protected by Commonwealth legislation, and as such the Minister must make a decision as to whether assessment and approval is required under the EPBC Act.

The SREF also concluded that whilst there were no environmental issues which would preclude the preservation of a corridor for the IRTC – South, there were a number of environmental issues that would have implications upon design and construction and would therefore need to be considered further. These included the potential loss of a koala (fauna) corridor adjacent to Ridgevale Drive, Helensvale, the loss of remnant vegetation listed as 'endangered' and 'of concern' under the *Vegetation Management Act 1999*, cultural heritage, flooding, and acid sulphate soils. It was therefore recommended that the design should consider incorporation of stormwater quality improvement measures, noise modelling, air quality modelling, the use of high culverts or a bridge across Coombabah Creek to assist in fauna movement, the use of an elevated structure over the Coombabah wetland area to minimise vegetation clearing, and the siting of the Smith Street interchange to minimise the loss of 'endangered' remnant vegetation.

### 1.4.3 Integrated Motorsport, Education, Tourism and Technology Project (i-METT)

The i-METT Queensland Group Pty Ltd is proposing to redevelop 600 hectares of rural land into master planned development consisting of an integrated motorsport, education, tourism and technology precinct at Gilberton, near Ormeau in Gold Coast City.

On 15 February 2008, the Coordinator-General declared the i-METT project to be a 'significant project' for which an Environmental Impact Statement (EIS) is required pursuant to section 26(1)(a) of the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The Terms of Reference for the EIS were approved by the Department of Infrastructure and Planning in September 2008 with EIS preparations currently in progress.

There is currently no master plan available for this development. The extents, scope and timing of the development is unknown at this time.

DTMR is participating in the EIS process as an Advisory Agency in order to assist informed consideration of the i-METTs external infrastructure requirements and potential impacts on the IRTC Road Corridor Development Planning (RCDP).

### 1.4.4 Gold Coast International Marine Precinct (GCIMP)

The Gold Coast International Marine Precinct (GCIMP) is a major development of an integrated industrial marina on the Coomera River. The marina site is located on Shipper Drive at Coomera, and is bound on the northern and western sides by Oakey Creek and on the eastern side by the Coomera River. The IRTC bisects the proposed development site (approximately north to south), as such GCIMP is required to consider integration with the IRTC design and environmental controls.

The Terms of Reference for the EIS were approved by the Department of Infrastructure and Planning in March 2009 with EIS preparations currently in progress.

DTMR is currently liaising with the proponent of this development in order to assist integration of the IRTC and GCIMP. Consideration of joint impacts within the site area will also be required. This process is ongoing and has not been completed within the current timeframe for completion of this SREF.

### 1.4.5 Gold Coast City Council Road Upgrades

In the Priority Infrastructure Plan Schedule of Works, Gold Coast City Council (GCCC) are likely to upgrade a number of local arterial roads that intersect with the proposed IRTC. Current proposals exist for:

- Yawalpah Road (2007-2011)
- Eggersdorf Road (2017 – 2021)
- Foxwell Road (2007 – 2011).

GCCC are responsible for environmental studies associated with the above upgrades.

### 1.4.6 Other DTMR Road Upgrades

The DTMR Roads Implementation Program 2009-10 to 2013-14 identifies a number of committed and proposed projects on Stapylton-Jacobs Well Road. This includes concept planning for a future four lane road upgrade as well as intersection improvements at Quinns Hill Road.

### 1.4.7 Waterway Downs Proposed Residential Development

Thomson Projects Pty Ltd is proposing a residential development of Lot 1 SP150729 at Coomera, to be called Waterway Downs. The development would provide a mixture of residential accommodation including duplex, townhouses, apartments and eco-housing amongst a landscape of parklands and public open space overlooking the Coomera River.

Traffic volumes and access conditions from Waterway Downs are likely to impact Oakey Creek Road and the proposed IRTC.

The timing for implementation of this development is unknown. Land boundaries around the site have previously been determined by DTMR and there is no current involvement with any of the environmental studies being undertaken by the proponent.

## 1.5 Approach to Environmental Investigations

The methods that have been utilised for the analyses of environmental elements have included:

- A review of the 1995 IAS. This was done to assess the currency and relevance of the data
- A review of all relevant literature from other projects within the study area
- A review of all available databases and registers maintained by Commonwealth, State and Local Governments
- Current Commonwealth and Queensland legislation.

Given that this SREF is part of an early corridor planning and stewardship phase, it has taken a strategic view on issues that may preclude the development of the road corridor and issues that may require external environmental assessment.

The environmental elements included in this SREF, as agreed between DTMR and AECOM (Technical Meeting No. 3 – SREF 24 June 2009) are:

- Flora
- Fauna
- Topography and Soils
- Surface and Groundwater Quality
- Aboriginal Cultural Heritage
- Historic Cultural Heritage
- Sustainability and Climate Change
- Project and Environmental Approvals.

A land use and planning investigation has been undertaken and is included in the RCDP Report. Additionally, a hydrology and hydraulic assessment has been undertaken and is also included in the RCDP Report.

Other environmental elements prescribed by the Road Project Environmental Processes Manual (2004) have not been included as part of this SREF, these include air quality, visual impact, social impact, waste management and noise. These environmental elements will be investigated at a later date in conjunction with further development of the IRTC project.

## 1.6 Associated Documents

The Road Corridor Development Planning has three major outputs

- Road Corridor Development Planning Summary Report (Volume 1);
- Strategic Review of Environmental Factors (Volume 2) (this document)
- Road Corridor Development Planning Layouts (Volume 3).

The technical studies that support these outputs are collated as Appendices to Volume 1 and include:

- Hydraulic Report
- Geotechnical Report
- Property Access and Interchange Report
- Land Impacts and Requirements Report
- Public Utility Report
- Shared Pedestrian and Cycle Path Report
- Geometric Design Report
- Noise Assessment Report.

# 2.0 Flora

## 2.1 Methodology

The desktop studies investigated various sources and databases and consisted of the following:

- Commonwealth Department of Environment, Water, Heritage and the Arts Protected Matters Search Tool (DEWHA, 2009) to identify matters of National Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Department of Environment and Resource Management (DERM)- Wildlife Online Database search (DERM 2009) to identify species listed under the *Nature Conservation Act 1992* (NC Act) and EPBC Act within a defined study area (see below)
- DERM Queensland Herbarium records (HERBRECS 2009) search
- DERM Biodiversity Planning Assessment and Mapping Assessment (DERM 2007a)
- DERM Regional Ecosystem Mapping (version 5) and Regional Ecosystem Description Database (REDD) assessment (DERM, 2007a)
- DERM Essential Habitat mapping assessment (DERM 2009b)
- ArcGIS software to calculate approximate areas of vegetation
- South Coast Motorway – Impact Assessment Study (Connell Wagner 1995),
- Southern Moreton Bay to Wongawallan Bioregional Corridor Study (prepared by Conics on behalf of GCCC, October 2009).

EPBC databases were searched within a 1 km buffer using various coordinate points along the proposed corridor (27.73501, 153.225, 27.72551, 153.2931, 27.86707, 153.3486, 27.87656, 153.3168). The wildlife online database was searched within a 10km radius area from a central coordinate (27.78, 153.292). The HERBRECS database search was based on 27.7167–27.75; 153.2167 – 153.35.

## 2.2 Description of Environmental Values

### 2.2.1 EPBC Threatened Ecological Communities

The Protected Matters Search tool did not detect any threatened ecological communities in the study area.

### 2.2.2 Threatened Flora Species

The database searches (Protected Matters, Wildlife Online, HERBRECS) identified 29 threatened species that are listed under the EPBC Act and NC Act within the area of interest.

Table 2.1 lists these species and their relative status.

**Table 2.1: Threatened Flora species listed in database searches (Protected Matters, Wildlife Online and HERBRECS)**

| Scientific Name | Common Name | EPBC Act Status | NC Act Status |
|---|---|---|---|
| *Alyxia magnifolia* | | | R |
| *Baloghia marmorata* | marbled balogia | V | V |
| *Bosistoa selwynii* | heart-leaved bosistoa | V | |
| *Bosistoa transversa* | three-leaved bosistoa | V | |
| *Cassia marksiana* | | | R |
| *Choricarpia subargentea* | giant ironwood | | R |
| *Corchorus cunninghamii* | native jute | E | E |
| *Cryptocarya foetida* | stinking cryptocarya, stinking laurel | V | V |
| *Cryptostylis hunteriana* | leafless tongue-orchid | V | |
| *Cupaniopsis newmanii* | long-leaved tuckeroo | | R |
| *Endiandra floydii* | Floyd's walnut | E | E |
| *Eucalyptus curtisii* | plunkett mallee | | R |
| *Gossia gonoclada* | | E | E |
| *Jasminum jenniae* | | | E |
| *Macadamia integrifolia* | macadamia nut, Queensland nut, smoothshelled macadamia, bush nut, nut oak | V | V |
| *Macadamia tetraphylla* | | V | V |
| *Marsdenia coronata* | slender milkvine | V | V |
| *Marsdenia hemiptera* | rusty vine | | R |
| *Pararistolochia praevenosa* | | | R |
| *Parsonsia lenticellata* | narrow-leaved parsonsia | | R |
| *Persicaria elatior* | | | V |
| *Phaius australis* | lesser swamp-orchid | E | |
| *Phebalium distans* | Mt Berryman phebalium | CE | |
| *Planchonella eerwah* | | | E |
| *Plectranthus habrophyllus* | | E | E |
| *Pouteria eerwah* | shiny-leaved condoo, black plum, wild apple | E | |
| *Randia moorei* | spiny gardenia | E | E |
| *Sophora fraseri* | brush sophora | V | V |
| *Taeniophyllum muelleri* | minute orchid, ribbon-root orchid | V | |

Key: CE (Critically Endangered), E (Endangered), V (Vulnerable) and R(Rare)

### 2.2.3 State Significant Vegetation

State significant vegetation includes the following:

- Regional Ecosystems;
- Essential Habitat; and
- Bioregional Wildlife Corridors defined under the Biodiversity Planning Assessment (BPA).

**Regional Ecosystems**

Regional Ecosystem (RE) mapping has been compiled by the Queensland Herbarium and is an important tool for the DERM in assessing the environmental impacts of developments. The term "Regional Ecosystems" refers to vegetation communities in a bioregion that are consistently associated with a particular combination of landform, soil and geology.

RE's are classified in one of three categories that denote their conservation status under the Queensland *Vegetation Management Act 1999* (VM Act). These categories are:

- **"Endangered"** – Remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion
- **"Of Concern"** – Remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion

- **"Not of Concern"** – Remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion.

Table 2.2 overleaf identifies and lists the RE's that are found within the IRTC road corridor. It provides a short description of the RE, its VM Act status and location (road chainage).

The distribution of these vegetation communities is limited to isolated patches predominantly of 'Not of Concern' RE's in the northern section of the corridor, with the southern section more densely vegetated. The southern section (approximately south of Kerkin Road) is also dominated by 'Not of Concern' RE, with several small patches of 'Of Concern-Dominant' RE also present. **Appendix B**, Figure 2 demonstrates the distribution of the vegetation communities.

**Table 2.2: REs mapped within the IRTC**

| Regional Ecosystem | Short description | VM Act Status | Location (Approximate Chainage) |
|---|---|---|---|
| 12.1.1 | *Casuarina glauca* open forest on margins of marine clay plains. Estuarine RE | Of Concern | 53500 |
| 12.1.2 | Saltpan vegetation including grassland and herbland on marine clay plains. Estuarine RE. | Not of Concern | 53700 |
| 12.1.3 | Mangrove shrubland to low closed forest on marine clay plains and estuaries. Estuarine RE. | Not of Concern | 52750 |
| 12.2.15 | Swamps with *Baumea spp.*, *Juncus spp.* and *Lepironia articulate*. Palustrine RE. | Not of Concern | 53000, 53700 |
| 12.3.5a | *Melaleuca quinquenervia*, *Casuarina glauca* +/- *Eucalyptus tereticornis* open forest. Occurs on lowest river terraces of Quaternary alluvial plains in coastal areas. Palustrine RE | Not of Concern | 53000, 48500, 44000, 43400, 40000, 38000 |
| 12.3.6 | *Melaleuca quinquenervia*, *Eucalyptus tereticornis*, *Lophostemon suaveolens* woodland on coastal alluvial plains. Palustrine RE. | Not of Concern | 36500 |
| 12.3.8 | Swamps with *Cyperus spp.*, *Schoenoplectus spp.* and *Eleocharis spp.* Palustrine RE. | Of Concern | 45500 |
| 12.3.11 | *Eucalyptus siderophloia*, *E. tereticornis*, *Corymbia intermedia* open forest on alluvial plains usually near coast. Contains palustrine wetland RE. | Of Concern | 50000, 49000, 34800 |
| 12.9-10.7a | *Eucalyptus tereticornis*, *E. siderophloia* and/or *E. crebra*, *Corymbia intermedia* and *Lophostemon suaveolens* woodland. Occurs on Cainozoic and Mesozoic sediments. | Of Concern | 44000 |
| 12.11.3a | Open-forest of *Lophostemon confertus* with *Eucalyptus microcorys* and *E. propinqua*. Occurs in gullies and exposed ridges of Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics | Not of Concern | 36500 |
| 12.11.5 | Open forest complex with *Corymbia citriodora*, *Eucalyptus siderophloia*, *E. major* on metamorphics ± interbedded volcanics | Not of Concern | 40500 |
| 12.11.5a | Open forest of *Eucalyptus tindaliae*, *Eucalyptus carnea* ± *Corymbia citriodora*, *Eucalyptus crebra*, *Eucalyptus major*, *Corymbia henryi*, *Angophora woodsiana*, *C. trachyphloia* (away from the coast) or E. siderophloia, E. microcorys, E. racemosa subsp. racemosa, E. propinqua (closer to the coast). Occurs on Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics | Not of Concern | 51500, 50500, 50000, 49500, 49000, 36000, 35000 |
| 12.11.5j | Open forest of Eucalyptus racemosa subsp. racemosa, E. seeana and Lophostemon suaveolens ± Corymbia intermedia, E. siderophloia, C. citriodora, E. pilularis on low-altitude coastal metamorphics around Brisbane. Melaleuca quinquenervia may be present and at times becomes locally co-dominant. Occurs on Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics | Not of Concern | 51500, 50500, 50000, 49500, 49000 |

### Essential Habitat

Essential habitat is vegetation that is habitat for some threatened species listed under the NC Act. The IRTC intersects a number of patches of Essential Habitat. Table 2.3 outlines their location and a brief description of the habitat values as defined by DERM.

The majority of the Essential Habitat potentially impacted by the IRTC is located in the northern section of the corridor with significant areas around Sandy Creek. **Appendix B**, Figure 2 demonstrates the distribution of Essential Habitat.

**Table 2.3: Essential Habitat mapped within the IRTC**

| Regional Ecosystem | Description | Species | Location |
|---|---|---|---|
| 12.2.15 | Swamps with *Baumea spp.*, Juncus spp. and *Lepironia articulate*. Palustrine RE. | Wallum Froglet | 53700, 53000 |
| 12.3.5 | *Melaleuca quinquenervia*, *Casuarina glauca* +/- *Eucalyptus tereticornis* open forest. Occurs on lowest river terraces of Quaternary alluvial plains in coastal areas. Palustrine RE. | Wallum Froglet | 51500 |
| 12.3.5a | *Melaleuca quinquenervia*, *Casuarina glauca* +/- *Eucalyptus tereticornis* open forest. Occurs on lowest river terraces of Quaternary alluvial plains in coastal areas. | Wallum Froglet | 53000, 48500, 44000, 43400, 38000, |
| 12.3.6 | *Melaleuca quinquenervia*, *Eucalyptus tereticornis*, *Lophostemon suaveolens* woodland on coastal alluvial plains. Palustrine RE. | Wallum Froglet | 36500 |
| 12.3.11 | Eucalyptus siderophloia, E. tereticornis, Corymbia intermedia open forest on alluvial plains usually near coast. Contains palustrine wetland RE. | Wallum Froglet | 34800 |
| 12.11.5a | Open forest of E. siderophloia, E. microcorys, E. racemosa subsp. racemosa, E. propinqua (closer to the coast). | Wallum Froglet | 36000, 35000 |

### State Forest Reserve and Conservation Reserves

The IRTC does not directly impact on any listed State Forest Reserve or conservation reserves managed by DERM or GCCC. The closest reserve is the Pimpama River Conservation Area which is within 1 km of the proposed alignment and provides significant habitat for a variety of native fauna species.

### Biodiversity Planning Assessment

The Biodiversity Planning Assessment (BPA) undertaken by DERM has identified a number of areas of vegetation that are of significance for biodiversity at the local, regional and state scale. BPA Mapping covering the IRTC is shown in **Appendix B**, Figure 3. Local significance is defined as areas that have been assessed as not being significant for biodiversity at the state or regional scales (EPA 2002). Regional significance is defined as areas being assessed as significant for biodiversity at the sub-bioregional scale, while state significance is ascribed to areas that are assessed as being significant for biodiversity at the bioregional or state scale, as well as including areas that are known to be nationally or internationally significant (EPA 2002).

The most significant expanse of vegetation is found in the southern section of the alignment. A corridor of vegetation along McCoys Creek connects the Coomera/Pimpama area to the hinterland area of Wongawallan. This area falls under the Southern Moreton Bay to Wongawallan Bioregional Corridor of regional and State significance. GCCC is currently mapping priority areas within this corridor for protection and rehabilitation (Conics, 2009).

A small patch of vegetation in the northern section of the alignment near Burnside Road is listed as State Habitat for Endangered, Vulnerable and Rare species.

### 2.2.4 Marine Plants

Marine plants are defined in the *Fisheries Act 1994* and include mangroves, seagrass, salt couch, samphires and algae growing on or adjacent to tidal lands. Under the *Fisheries Act 1994*, all marine plants are protected regardless of whether they are alive or dead or whether they grow on freehold, leasehold or unallocated State lands. HERBRECS data and field observations from the 1995 IAS indicate that there a number of marine plants likely to be impacted by the development of the proposed road corridor. HERBRECS data provides a comprehensive list of species (**Appendix A**), which are from the following marine plant Family groups:

- Aizoaceae
- Chenopodiaceae
- Cyperaceae
- Juncaceae
- Poaceae
- Primulaceae.

Marine plants play an important role in ecosystem processes as well as providing habitat for a variety of aquatic and terrestrial species. Marine plants and their associated communities are vital to maintaining aquatic biodiversity through their integral part of the food chain and their provision of habitat (shelter, feeding, nursery areas) (Couchman and Beumer 2007). The removal of these individuals and communities will reduce the population of the individuals and the overall ecological integrity of the aquatic communities.

### 2.2.5 Declared Pest Flora Species

Table 2.4 below lists the declared pest flora species under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) that were identified as part of the HERBRECS database search. The table includes management responsibilities in relation to Class 1, 2 and 3 pest species listed under the LP Act.

**Table 2.4: Declared pest species identified in HERBRECS database search**

| Scientific Name | Common Name | Declared Status |
|---|---|---|
| *Alternanthera philoxeroides* | alligator weed | 1 |
| *Ambrosia artemisiifolia* | annual ragweed | 2 |
| *Hygrophila costata* | hygrophila | 1 |
| *Lantana camara* | common lantana | 3 |
| *Schinus terebinthifolius* | broad-leaved pepper tree | 3 |

## 2.3 Legislation and Approvals

This section of the SREF outlines the legislative requirements associated with the impacts on flora and vegetation within the IRTC. A summary of the applicable legislation and approvals that relate to flora and vegetation communities is provided in Table 2.5.

### 2.3.1 Clearing of Vegetation and Native Plants

DTMR are exempt from requiring development approval under the *Sustainable Planning Act 2009* (SP Act) for the clearing of native vegetation (including high-value regrowth which is also protected under the *Vegetation Management Act 1999* following recent amendments) for the purposes of :

"a State-controlled road under the *Transport Infrastructure Act 1994* —

(i) road works carried out on the State-controlled road; or

(ii) ancillary works and encroachments carried out under section 50 of that Act" (Schedule 24, *Sustainable Planning Regulation 2009*).

The definition for "road works" is the same as defined in Schedule 6 of the *Transport Infrastructure Act 1994*:

"(a) works done for -

(i) constructing roads or things associated with roads; or

(ii) maintaining roads or things associated with roads (other than public utility plant); or

(iii) facilitating the operation of road transport infrastructure; or

(b) works declared under a regulation to be road works."

Therefore, once the proposed route has been declared (gazetted) as a State-controlled road, vegetation cleared for the purposes of constructing the road does not require approval under the SP Act and associated assessment against the *Vegetation Management Act 1999*.

However, DTMR have an obligation under the Queensland Government Environmental Offsets Policy (QGEOP) (Section 2.3.3) to consider the requirement of environmental offsets if a project will have remaining environmental impacts on environmental values addressed in an existing specific-issue offset policy which includes the Policy for Vegetation Management Offsets. Currently it is unclear whether this obligation is triggered only when a clearing permit is required under the SP Act.

DTMR are currently not exempt from the provisions of the *Nature Conservation Act 1992* which require permits to clear any native plants, including those listed as 'least concern'. To obtain a permit to clear native plants under the *Nature Conservation Act 1992* it is likely that offset land and plantings will be required. The Draft Policy for Biodiversity Offsets may be used by DERM as a guide to offsets that are required for clearing of native plants under the *Nature Conservation Act 1992*.

### 2.3.2 Disturbance of Marine Plants

The *Fisheries Act 1994* recognises fisheries resources, including fish and marine plants, as the critical management unit that sustains fisheries productivity (DPI&F FHMOP001). Marine plants are likely to be present and disturbed at Oaky Creek, McCoys Creek, Hotham Creek and the Pimpama River therefore permits will be required under current legislation.

There may be some uncertainty as to the particular areas of disturbance that require approval because species recognised as marine plants are only protected when they are growing on or adjacent to tidal land. It can be difficult to determine whether land is tidal, or whether plants are located adjacent to tidal areas and therefore whether a permit is required to disturb marine plants. If there is uncertainty about whether a permit is required for disturbance of marine plants in a certain area along the proposed road corridor, advice should be sought from the Department of Primary Industries and Fisheries (DPIF).

Activities causing marine fish habitat loss, including disturbance of marine plants, are addressed in DPIF's fish habitat management operational policies, including:

- Management and protection of marine plants and other tidal fish habitats (FHMOP 001)
- Management of declared Fish Habitat Areas (FHMOP 002)
- Mitigation and compensation for activities and works causing marine fish habitat loss: Departmental procedures (FHMOP 005)
- Reclamation of tidal fish habitats (FHMOP 010).

DPIF will require marine plant loss to be avoided, minimised and mitigated. It may also be necessary to provide offsets for marine plant loss in accordance with FHMOP 005 Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss.

### 2.3.3 Queensland Government Environmental Offsets Policy

The QGEOP came into effect on 1 July 2008. The DTMR now have an obligation under the QGEOP to consider specific-issue offsets policies within their administrative guidelines of the project development and environmental assessment process. Figure 2.1 outlines the structure of the QGEOP and how it integrates with the issue specific offsets policies.

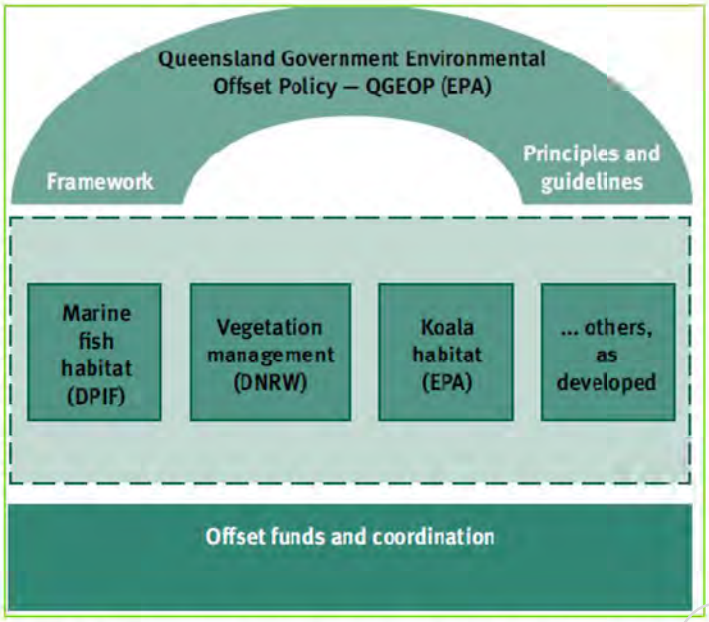



**Figure 2.1: Structure of the QGEOP with specific issue offset policies and implementation mechanisms (Source DERM 2008).**

An environmental offset is required to be provided for projects where there will be remaining environmental impacts on environmental values after the principles of avoid, minimise and mitigate have been applied, and which are addressed by a specific-issue offsets policy.

The existing specific-issue offset policies are:

- Vegetation Management – Policy for Vegetation Management Offsets, September 2007
- Marine Fish Habitat – Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss, 2002
- Koala Habitat – Offsets for Net Benefit to Koalas and Koala Habitat, 2006.

Proposed specific-issue offset policies are currently under development to address impacts on waste water quality and biodiversity.

DTMR have drafted an Appendix to their Road Project Environmental Processes Manual (2004) that addresses the Queensland Government Environmental Offsets Policy. The draft Appendix states "the most important aspect of managing offsetting requirements for road projects is the early identification of such requirements. The assessment of the road project against the triggers in the offsets policies must occur in the Road Project Environmental Assessment process. If it is determined that one or more offsets policies will be triggered, contact must be made with the relevant Government department/s to ascertain the extent of offset required."

In relation to fauna impacts for the Project, the Road Project Environmental Processes Manual recognises offset obligations in relation to koala habitat which are discussed under Section 3.3.1. The draft Policy for Biodiversity Offsets, discussed under Section 2.3.6 may also impose offset obligations in relation to the proposed road corridor in the future.

### 2.3.4 Policy for Vegetation Management Offsets

A vegetation management offset (offset) is a legal arrangement or agreement that, over time, guarantees to maintain the extent, structure and function of a vegetation value such as RE or Essential Habitat. An offset is a means of meeting certain performance requirements of the Vegetation Management (VM) Code under the VM Act.

The Policy for Vegetation Management Offsets (VM Offsets Policy) (DNRW 2009) sets criteria and provides guidance on what would constitute an acceptable offset, which is generally designed to be used in conjunction with the applicable VM Code for a vegetation clearing application in accordance with the VM Act. For the IRTC, the VM Offsets Policy would have to be used as a tool in conjunction with assessing a project in accordance with the DTMR's project development and environmental assessment processes.

Generally under the VM Offsets Policy, an offset must ensure that a development will "maintain the current extent" of the RE or habitat by meeting, as a minimum, Criteria 1-6 and 10 outlined in the VM Offsets Policy in relation to the following:

1) Limitations on offset vegetation – e.g. cannot be mapped as remnant vegetation;

2) Values and regional ecosystems – e.g. consideration of the values relevant to the particular PR, in this case being Connectivity and Essential Habitat. The Project will not be impacting any of the critically limited REs listed in the VM Offsets Policy so these measures do not need to be considered;

3) Obtaining ecological equivalence – including consideration of strategic position in landscape, species diversity, condition of vegetation, landscape context attributes (patch size, connectivity, context) and special values (guidance provided by Table 2 of the VM Offsets Policy);

4) Ensuring the offset area is legally secured – by a legally binding mechanism that secures the offset area within four months of the development approval being issued; or consistent with the timeframes identified in a legally binding agreement;

5) Offset area implementation – a proposal that identifies how the offset requirements will be implemented including an offset area management plan, estimated management costs, details of the dispersal of funds for ongoing management and the entities responsible for actions.

6) Minimum information requirements – a proposal must identify supporting information including how the development has been designed and located to minimise the extent of clearing and details of how the proposed offset area meets the vegetation offset criteria.

7) When an offset ceases to have effect – to bring an offset area to an end, the landowner must provide the chief executive with evidence that the requirements of the legally binding mechanism and management plan have been achieved. This includes evidence that the offset area has achieved remnant status, is a RE (where applicable), includes at least three essential habitat factors for the *Cycas megacarpa* including all mandatory factors or is where *Cycas megacarpa* is located.

Although no offset ratios are outlined in the current version of the VM Offsets Policy, the DERM have indicated that the previous policy can be used as a guide to offset ratios.

### 2.3.5 Offsets: Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss

In accordance with FHMOP 005 Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss, DPIF may require offsets for the loss of marine plants to address residual impacts of activities and works.

Offset measures will be negotiated and selected with the DPIF and may include:

- Fish habitat enhancement
- Fish habitat restoration, rehabilitation or creation
- Fish habitat exchange
- A financial offset amount for applied research; fish habitat enhancement, restoration, rehabilitation or creation; education, training or extension; or fish habitat acquisition or exchange.

### 2.3.6 Uncertain future obligations: Draft Policy for Biodiversity Offsets

A consultation draft of the Policy for Biodiversity Offsets (Policy) was released by the Queensland Government Environmental Protection Agency (now DERM) in December 2008. The Policy was available for public comment however, as a result of the Queensland Government election in March 2009, the draft has not been advanced further at the stage of writing this report.

The current version of the draft Policy is lacking clarity on obligations that would apply to projects such as the IRTC. Despite the lack of clarity, the Policy is likely to significantly affect future linear infrastructure projects if enacted.

The Policy is intended to apply to the use of offsets to address impacts on biodiversity values resulting from development or activities where a State Government agency is responsible for assessing the potential biodiversity impacts of a development or activity, which specifically includes DTMR development approval processes.

The Policy specifies that Main Roads projects would require an offset package or financial contribution using multipliers in accordance with the Offset Rules Table which is set out in Appendix 2 of the Policy.

As a preliminary assessment of the draft Policy, the following offset obligations are relevant for consideration for the Project:

- Offsets to address the viability of the threatened species and their habitat
- Offsets to address extent of regional ecosystems and essential habitat.

The draft Policy indicates that offsets would not be triggered if the same biodiversity values are already captured under other specific-issue offsets policies, therefore, if offsets are triggered under the VM Offsets Policy in relation to a particular environmental value, the same value will not require further offsetting under this Policy.

### 2.3.7 Summary of approvals and obligations

Table 2.5 below outlines a summary of the applicable legislation and approvals that relate to flora and vegetation communities.

**Table 2.5: Legislation and approvals - Flora**

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Commonwealth | | | | | |
| *Environment Protection and Biodiversity Conservation Act 1999* | Department of Environment Water, Heritage and Arts (DEWHA) | Significant impact on Matters of National Environmental Significance including:<br>• nationally threatened species and ecological communities;<br>• migratory species protected under international agreements;<br>• Ramsar wetlands of international importance; and<br>• National Heritage places | EPBC Referral and if "controlled action" approval from DEWHA | 20 business days for DEWHA to make a decision on a referral application. | Without site inspection and more detailed engineering it is not possible to determine whether the plant species listed in the database are actually present within the IRTC or whether the impact is likely to be significant to the viability of the plant populations.<br>However, a referral is necessary for the potential impacts on Coomabah wetlands (IRTC-South).<br>As this project (the IRTC-North) is a component of a larger action, the IRTC must be referred (refer to s9.1.2). |
| State | | | | | |
| *Environmental Protection Act 1994* and *Environmental Protection Regulation 2008* | DERM | DTMR must comply with the general environmental duty not to undertake activities that cause or are likely to cause environmental harm unless all reasonable and practicable measures are taken to prevent or minimise the harm (s319). DTMR must also comply with more specific obligations imposed under the EP Act. | Compliance | N/A | The general environmental duty applies to all project activities.<br><br>The following environmental protection policies and subordinate legislation have been prepared under the EP Act and must be complied with and considered in preparing environmental management plans:<br>Environmental Protection Regulation 2008;<br>Environmental Protection (Air) |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| | | | | | Policy 2008;<br>Environmental Protection (Noise) Policy 2008;<br>Environmental Protection (Waste Management) Policy 2000;<br>Environmental Protection (Waste Management) Regulation 2000; and<br>Environmental Protection (Water) Policy 2009. |
| *Fisheries Act 1994* | DPIF | Clearing marine plants including mangroves. "Marine plant" includes the following: a) a plant (a tidal plant) that usually grows on, or adjacent to tidal land, whether it is living, dead, standing or, b) material of a tidal plant, or other plant material on tidal land, c) a plant, or material of a plant, prescribed under a regulation or management plan to be a marine plant (s 123). | Development Approval to remove, destroy or damage marine plants | 3 months from date of application | Development Approval will be required for disturbance of marine plants at the following creeks:<br>• Oaky Creek;<br>• McCoys Creek;<br>• Hotham Creek; and<br>• Pimpama River. |
| | DPIF | Operational work completely or partly within a declared fish habitat area if it is not self-assessable development. | Development Approval to conduct works within a declared fish habitat area | 3 months from date of application | Development Approval will not be required because works are not occurring within a declared fish habitat area. |
| *Land Protection (Pest and Stock Route Management) Act 2002* | DPIF | Landowners must take reasonable steps to keep their land free of Class 1 and 2 weeds and pests or hold a declared pest permit. | Compliance | N/A | Section 2.2.5 specifies the declared pest species likely to be found in the study area.<br><br>The contractor and DTMR must ensure that Class 1 and 2 weeds and pests are controlled within the Project area. |
| *Nature* | DERM | Taking of or interfering with protected plants | Approval to take, | Up to 6 months | Permit, licence or authority may |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Conservation Act 1992* | | and/or removal of wildlife listed as protected in the Nature Conservation (Wildlife) Regulation 2006 (ss 88-89).<br><br>It is a defence to a charge under the NC Act for taking of a protected animal if it can be demonstrated that the animal was taken whilst conducting a lawful activity and that taking could not have been reasonably avoided. | keep or use protected animals or plants | | be required to remove protected flora (which includes least concern plants being all native vegetation) and to take native fauna during construction phase.<br><br>The DERM can include conditions on the permit to require the provision of offsets for the impacted vegetation.<br><br>It is understood that DTMR are currently working towards developing a Memorandum of Understanding to streamline the process of obtaining clearing permits under the Nature Conservation (Protected Plants) Conservation Plan 2000 and achieving a State-wide approach for the DTMR to offset any impacts. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (Koala Plan) | DERM | Sequential clearing obligations for the whole site (s 15).<br><br>Koala spotter requirement for all clearing within Koala Habitat Areas (s 16).<br><br>Compliance with the Koala Conservation Criteria is required for development located in a Koala Habitat Area if the development is assessable under the SP Act, local government planning scheme or is a community infrastructure designation.<br>Offset requirements in accordance with the Policy 2: Offsets for net benefit to koalas and koala habitat in the Koala Plan as a result of the QGEOP. | Approval to clear vegetation within koala conservation area or koala sustainability areas listed under the Koala Plan.<br><br>Compliance with clearing and offset obligations. | 3 months | Project currently would not require assessment against the Koala Conservation Criteria because it is not seeking a Community Infrastructure Designation and does not constitute development that requires assessment and approval under the SP Act.<br>See Section 2.3.1 for more detail on exemption from SP Act for clearing native vegetation.<br>However, DTMR may still have to comply with the Koala Conservation Criteria due to State Government commitments that are further discussed in 3.3.1.<br><br>The general clearing provisions under the Koala Plan (s 15) would still apply to the whole area and the requirement for a koala spotter (s16) to all Koala Habitat Areas.<br><br>See Section 3.3.1 for more detail on these offset obligations in relation to koala. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| South East Queensland Koala State Planning Regulatory Provisions (SEQ Koala SPRP) (February 2010) | DIP | A development application, for a material change of use, reconfiguring a lot or operational work for the clearing of native vegetation, in an interim koala habitat protection area or protected koala bushland habitat area unless certain criteria are satisfied. | Approval from DIP to clear vegetation within a koala protection area, including possible offset requirements | 3 months | The Project is located within the interim koala habitat protection area designated on the regulatory map. See Section 3.3.1 for other possible implications.<br><br>Requirements that are applicable under the SEQ Koala SPRP are in addition to those obligations under the Koala Plan. The current SEQ Koala SPRPs are referred to as interim development controls by the Department of Infrastructure and Planning.<br><br>The Queensland Government have also released the Draft South East Queensland Koala Conservation State Planning Regulatory Provisions and the Draft South East Queensland Koala Conservation State Planning Policy in December 2009 for public consultation until 28 February 2010. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Vegetation Management Act 1999* / SP Act | DERM | Clearing assessable vegetation (including high-value regrowth) outside of land designated as gazetted road corridor. | Operational works, Vegetation Clearing Permit | Approximately 3 months | Exemption under Schedule 24 of *Sustainable Planning Regulation 2009* "for a State-controlled road under the *Transport Infrastructure Act 1994* —<br>(i) road works carried out on the State-controlled road; or<br>(ii) ancillary works and encroachments carried out under section 50 of that Act".<br>Clearing prior to road gazettal would require a permit. See Section 2.3.1 for further information on exemption and possible obligations. |

## 2.4 Potential Impacts

The IRTC has the potential to impact on native flora species and floristic communities as a result of clearing and the indirect impacts associated with ground disturbance and construction activities. The most vulnerable environments are those communities shown as regional ecosystems and essential habitat as these areas typically have mature vegetation, are relatively undisturbed and offer greatest species diversity and therefore habitat value to native species. It is most likely that individuals of threatened plant species identified in the database searches will be found in these regional ecosystem communities than elsewhere in the corridor due to the level of disturbance.

As many of the regional ecosystem communities are also mapped Essential Habitat, the management of these areas has particular importance to the protection of fauna species as well as flora.

The most likely impacts (direct and indirect) on flora and vegetation communities from the IRTC include:

- Loss and disturbance of significant flora species
- Loss and disturbance of regional ecosystem
- Loss and disturbance of essential habitat
- Loss and disturbance of marine plant species and communities
- Degradation of regional ecosystem patches that remain after clearing due to weed invasion and new edge effects.

The critical areas of sensitive vegetation that fall within the IRTC were considered as "environmental constraints" as part of the Options Assessment process in Workshop 1 of the Road Corridor Development Planning (Figure 3 in Volume 2 of the Background Information and Options Report, October 2009). It is important to note that the Options Assessment focused on options for interchange layout and was not intended as a full corridor options assessment with alternatives.

Given the interchange options considered, the environmental outcomes are reasonably positive with the road corridor typically passing across the edge of regional ecosystem and essential habitat patches, rather than dissecting large tracts or completely removing entire areas. Effort was concentrated on reducing impacts around Burnside Road, Pimpama-Jacobs Well Road, Yawalpah and Oakey Creek Road Interchanges where impacts on vegetation are most notable.

The full record of environmental opportunities and design outcomes a property level are documented in the Background Information and Options Report (AECOM, 2009).

Whilst some improvements were achieved to limit the potential impacts on flora, the IRTC still has the potential to negatively affect protected flora and vegetation communities.

## 2.5 Recommendations

Several measures can be integrated into the planning and design phases to avoid and reduce impacts on individual plants and vegetation communities. Other issues will require some form of management to control or compensate for the impact on sensitive vegetation.

Recommendations for future design stages are:

- Avoid: It is acknowledged that the road corridor alignment has considered and avoided, where possible, areas of environmentally sensitive vegetation during Stage 1 – Review and Options Development and Stage 2 – Refinement of Project Options, These communities were Of Concern RE 12.1.1, 12.3.8, 12.3.11, 12.9-10.7a. It is further recommended that opportunities to avoid these sensitive areas, as shown on the Environmental Constraints Map, be reviewed at the concept design stage should further motorway or interchange options be considered. The most recent protected area mapping should be retrieved from DERM at the time of concept design as this data is constantly updated
- Minimise: Where vegetation cannot be avoided, minimise the width of the proposed road to limit the vegetation clearance and impacts on surrounding habitat
- Mitigate: Where impacts cannot be avoided, mitigation measures should be prescribed and managed to compensate for the environmental harm. Typically, these should include weed management, compensatory

planting, ground restoration and stabalisation. Where the proposed alignment requires the removal of riparian vegetation and marine vegetation (e.g. mangroves) erosion and drainage protection should be implemented to protect the surrounding receiving environment and other significant receiving environments downstream. These include the Fish Habitat Area on the Coomera and Pimpama Rivers, the Moreton Bay Ramsar Site of international significance, the Moreton Bay Aggregation of Wetlands a Nationally Significant Wetland and the Pimpama River Conservation Area

- Review: New research and information continually becomes available. The Southern Moreton Bay to Wongawallan Bioregional Corridor Report (Conics, 2009) (received 30 November 2009) references several previous studies in the area of interest that were not previously known to DTMR. These reports should be reviewed and critically assessed accordingly as part of the environmental investigations during the concept design phase or at the time when a referral is prepared to DEWHA.

The critical issues for vegetation that have the potential to affect project timeframes and may have significant cost implications are:

**Offsets**

DTMR is to consider offset obligations through the introduction of a number of Queensland Government Offsets Policies. It is recommended that DTMR should liaise closely with DERM to clarify offset obligations and develop appropriate strategies that fulfil all legal responsibilities under relevant pieces of legislation and offset policies. There are potentially significant cost implications for the provision of offsets, and investigations should be undertaken at an early stage to quantify all offset requirements to allow sufficient time for the identification of suitable offset locations.

**Consultation**

GCCC has identified properties within the Southern Moreton Bay – Wongawallan bioregional corridor that require rehabilitation (Conics, 2009). Many of these properties lie close to the IRTC and are potentially suitable for offsets. It is recommended that DTMR consult with DERM and GCCC to discuss priority rehabilitation areas and how DTMR can support GCCC restoration program.

**Uncertainty at level of impact on species and communities protected under the EPBC Act**

It is recommended that a detailed flora assessment be undertaken to ground truth the current location and extent of mapped RE's and EH and to identify and threatened species of communities within the corridor. This will further clarify the integrity of the vegetation communities and provide greater information for the calculation of direct impact and loss of vegetation. This detail will be required either for an EPBC referral (particularly riparian and marine vegetation protected under the Ramsar Convention) or as part of the project environmental assessment in order to gain environmental approval for the project. This information is also required to determine the need and quantify offsets.

**Approvals and Permits**

The IRTC has the potential to impact threatened flora species that are afforded protection under the EPBC Act. The Coomabah wetland in the IRTC-South is considered the key trigger for a referral under the EPBC Act, however these matters of national environmental significance that occur in the IRTC-North area of interest must also be addressed as part of this referral. Consideration must be given to the significant timeframes associated with the preparation of a referral to DEWHA, and the subsequent environmental assessment and approvals process should an EIS be required.

## 2.6 Conclusion

There will be direct impacts on individual floral species and vegetation communities as a result of the development of the IRTC. Based on the results presented in this SREF, there are no flora issues that will prevent the development of the proposed road corridor. However, there are a number of emerging issues that will require DTMR attention to ensure that all potential issues are adequately managed.

Once the proposed route has been declared (gazetted) as a State-controlled road, vegetation cleared for the purposes of constructing the road does not require approval under the *Sustainable Planning Act 2009* and associated assessment against the *Vegetation Management Act 1999*. DTMR are not exempt from the provision

of the *Nature Conservation Act 1992* and will require permits to clear any native plants, including those listed as 'least concern'.

Without site inspection and more detailed engineering it is not possible to determine whether any plant species protected under the EPBC Act are actually present within the IRTC or whether the impact is likely to be significant.

However, a referral is necessary for the potential impacts on Coomabah wetlands (IRTC-South). As this project (the IRTC-North) is a component of a larger action, the IRTC as a whole (northern and southern sections) must be referred to the DEWHA (refer to s9.1.2 for detail).

The main issue highlighted in this SREF is the new obligations that have emerged from the QGECP and the potential for DTMR require offsets for the impacts on flora of the IRTC. The provision of offsets does potentially introduce a significant cost impact to the project as DTMR is legally required to either source adequate and appropriate land to meet the requirements of the VM Offsets Policy, or provide a financial contribution. It is strongly recommended that DTMR consult directly with DERM to resolve these outstanding legal responsibilities and obligations as offset obligations at the time of writing are likely to be different at future stages of the propose project.

The remaining floral and vegetation impacts can be managed appropriately through planning and engineering design. Specific measures will need to be detailed and communicated to the design engineers during the concept and design development phases.

# 3.0 Fauna

## 3.1 Methodology

The desktop studies consulted various sources and databases and consisted of the following:

- Commonwealth Department of Environment, Water, Heritage and the Arts Protected Matters Search Tool (DEWHA, 2009) to identify matters of National Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Department of Environment and Resource Management (DERM)- Wildlife Online Database search (DERM 2009) to identify species listed under the *Nature Conservation Act 1992* (NC Act) and EPBC Act within a defined study area (see below)
- DERM, Queensland Herbarium records (HERBRECS 2009) search
- DERM Biodiversity Planning Assessment and Mapping Assessment (DERM 2007a)
- DERM Regional Ecosystem Mapping (version 5) and Regional Ecosystem Description Database (REDD) assessment (EPA 2007b)
- DERM Essential Habitat mapping assessment (DERM 2009b)
- DERM Moratorium mapping assessment (DERM 2009b)
- ArcGIS software to calculate approximate areas of vegetation
- Connell Wagner (1995), South Coast Motorway – Impact Assessment Study
- Biolink (2007) Conserving koalas in the Coomera-Pimpama Koala Habitat Area: a view to the future. Report prepared for Gold Coast City Council.
- GCCC Flora and Fauna database records supplied by GCCC to DTMR (retrieved 29 July 2009)
- GCCC Nature Conservation Strategy 2009-2019
- Southern Moreton Bay to Wongawallan Bioregional Corridor Study (prepared by Conics on behalf of GCCC, October 2009).

**Study Area**

EPBC databases were searched within a 1 km buffer of the IRTC alignment using various coordinate points along the proposed corridor (-27.73501, 153.225, -27.72551, 153.2931, -27.86707, 153.3486, -27.87656, 153.3168). The wildlife online database was searched within a 10km radius area from a central coordinate (-27.78, 153.292).

## 3.2 Description of Environmental Values

### 3.2.1 EPBC Threatened Ecological Communities

The Protected Matters Search tool did not detect any threatened ecological communities in the study area.

### 3.2.2 Threatened Fauna Species

Table 3.1 below lists the threatened species listed under the EPBC Act and the NC Act that were reported in the database searches.

**Table 3.1: Threatened fauna species listed in database searches (Protected Matters and Wildlife Online)**

| Scientific Name | Common Name | EPBC Act Status | NC Act Status |
|---|---|---|---|
| *Accipter novaehollaniae* | grey goshawk | | R |
| *Adelotus brevis* | tusked frog | | V |
| *Anthochaera phrygia* | regent honeyeater | E | |
| *Calyptorhynchus lathami* | glossy black-cockatoo | | V |
| *Calyptorhynchus lathami lathami* | glossy black-cockatoo (eastern) | | V |
| *Chalinobus dwyeri* | large eared pied bat | V | |
| *Chelonia mydas* | green turtle | V | V |
| *Coeranoscincus reticulates* | three toed snake tooth skink | V | |
| *Crinia tinula* | wallum froglet | | V |
| *Cycloopsitta diophthalma coxeni* | Coxen's fig parrot | E | |
| *Dasyurus maculates maculates* | spotted tail quoll | E | |
| *Ephippiorhynchus asiaticus* | black-necked stork | | R |
| *Erythrotriorchis radiatus* | red goshawk | V | E |
| *Esacus magnirostris* | beach stone-curlew | | V |
| *Lathamus discolour* | swift parrot | E | E |
| *Lewinia pectoralis* | Lewin's rail | | R |
| *Littoria lolongburensis* | wallum sedge frog | V | |
| *Lophoictinia isura* | squaretailed kite | | R |
| *Mixopheys iterates* | southern barred frog, giant barred frog | E | |
| *Ninox strenua* | powerful owl | | V |
| *Numenius madagascariensis* | eastern curlew | | R |
| *Ornithoptera richmondia* | Richmond birdwing | | V |
| *Petrogale penicillata* | brush tailed rock wallaby | V | |
| *Phascolarctos cinereus* | koala | | V |
| *Poephila cincta cincta* | black throated finch | E | |
| *Potorous tridactylus tridactylus* | long nosed potoroo | V | |
| *Pteropus poliocephalus* | grey headed flying fox | V | |
| *Rostratula australis* | Australian pained snipe | V | V |
| *Sternula albifrons* | little tern | | E |
| *Turnix melanogaster* | black breasted button quail | V | |
| *Xeromys myoides* | false water-rat | V | V |

Key: E (Endangered), V (Vulnerable) and R (Rare)

### 3.2.3 Migratory Bird Species

Table 3.2 below lists the migratory and marine bird species that potentially occur or utilise habitat in the study area.

**Table 3.2: EPBC Migratory terrestrial, wetland and marine bird species listed in Protected Matters database**

| Scientific Name | Common Name | EPBC Act Status |
|---|---|---|
| *Apus pacificus* | fork-tailed swift | Migratory and Marine |
| *Ardea alba* | great egret, white egret | Migratory and Marine |
| *Ardea ibis* | cattle egret | Migratory and Marine |
| *Cyclopsitta diophthalma coxeni* | Coxen's fig parrot | Migratory |
| *Gallinago hardwickii* | Latham's snipe, Japanese snipe | Migratory |
| *Haliaeetus leucogaster* | white-bellied sea-eagle | Migratory |
| *Hirundapus caudacutus* | white-throated needletail | Migratory |
| *Merops ornatus* | rainbow bee-eater | Migratory |
| *Monarcha melanopsis* | black-faced monarch | Migratory |
| *Monarcha trivirgatus* | spectacled monarch | Migratory |
| *Myiagra cyanoleuca* | satin flycatcher | Migratory |
| *Nettapus coromandelianus albipennis* | Australian cotton pygmy-goose | Migratory |
| *Rhipidura rufifrons* | rufous fantail | Migratory |

| Scientific Name | Common Name | EPBC Act Status |
|---|---|---|
| *Rostratula benghalensis s. lat.* | painted snipe | Migratory |
| *Xanthomyza phrygia* | Regent honeyeater | Migratory |

### 3.2.4 Species of Regional Significance

**Koala**

There are a number of koala sightings recorded in the Wildlife Online results (DERM 2008) for the study area defined (-27.78, 153.292). The IRTC passes through two Koala Habitat Areas as defined by the Koala Plan, a Koala Conservation Area and an Urban Koala Area.

This Koala Habitat Area is formally known as the Coomera-Pimpama Koala Habitat Area and covers an area of 3640ha. This Koala Habitat Area is home to a large population of koalas, with recent investigations estimating a population of 500 individuals (Biolink 2007). This Koala Habitat Area is subject to the East Coomera Koala Conservation Project managed by the Gold Coast City Council in consultation with DERM.

The koala is a regionally significant fauna species and is considered iconic within South East Queensland (SEQ). As such, it has been afforded a number of specific planning instruments that protects it and its habitat within the SEQ region. The Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (the Koala Plan) is the principal policy that addresses the major threats to the koala and defines the strategies implemented by the Queensland Government to prevent the current decline in koala populations (DERM 2009b). Legislative obligations in relation to koalas, including the Koala Plan, are discussed in Section 3.3.

The Koala Plan focuses on the protection of Koala habitat, which is achieved through the creation of Koala Habitat Areas under the plan, including Koala Conservation Areas, Koala Sustainability Areas, and Urban Koala Areas.

### 3.2.5 Habitat Present

There are a variety of habitats that are directly impacted by the IRTC. These habitats support a broad suite of terrestrial, arboreal and aquatic species and are distributed across the full length of the IRTC. As mentioned in Section 2.2.3 there a number of patches of mapped Essential Habitat under the VM Act and these patches of vegetation provide habitat to Wallum Froglet under the NC Act. Table 3.3 lists the mapped areas of Essential Habitat impacted by the IRTC.

**Table 3.3: Mapped Essential Habitat directly impacted by the IRTC**

| Regional Ecosystem – Essential Habitat | Location (Chainage) |
|---|---|
| 12.2.15 | 53700, 53000 |
| 12.3.5a | 53000, 48500, 44000, 43400, 38000, |
| 12.3.5 | 51500 |
| 12.11.5a | 36000, 35000 |
| 12.3.6 | 36500 |
| 12.3.11 | 34800 |

There are a number of other areas that are likely to provide habitat and corridors for fauna movement to terrestrial, arboreal and aquatic species. These areas are found at the following locations:

- The riparian vegetation and aquatic habitat associated with the waterways that are intersected by the IRTC (Sandy Creek Ch 38060, Halfway Creek Ch 38500, Pimpama River Ch 43300, Hotham Creek Ch 45040, McCoys Creek Ch 50320, and Oaky Creek Ch 53700)
- Mapped Koala Habitat areas located in the southern section of the proposed corridor between approximately Ch 48000 – 54000.

At a broader scale, the section of the IRTC south of Burnside Road as far as the Coomera River overlaps with the Southern Moreton Bay to Wongawallan Bioregional Corridor.

### 3.2.6 Aquatic Environment

**Watercourses of the IRTC**

The IRTC crosses a number of watercourses that will require cross drainage culverts or bridge structures. The watercourses crossed by the proposed alignment and their approximate chainage are:

- Oaky Creek Ch 53700
- McCoys Creek Ch 50320
- Hotham Creek Ch 45040
- Pimpama River Ch 43300
- Halfway Creek Ch38500
- Sandy Creek Ch 38060

**Ramsar Wetlands**

The IRTC is approximately within 1 kilometre upstream of the Moreton Bay wetlands, which are listed as a Wetlands of International Significance (See **Appendix B**, Figure 4). The Moreton Bay Ramsar site is protected under the EPBC Act as a Matter of National Environmental Significance as it is designated under Article 2 of the international Ramsar Convention as an internationally significant wetland.

**Wetlands of National Significance**

The IRTC is approximately within 1 kilometre upstream of the Moreton Bay Aggregation of wetlands, which is listed as wetland of National Significance under the Directory of Important Wetlands in Australia.

**Fish Habitat Areas**

The IRTC is within 1 kilometre upstream of the 607ha Coomera (Fish Habitat Area (FHA)-023) and the Pimpama Fish Habitat Area declared under Section 120 of the *Fisheries Act 1994*, both assigned as management level 'B'. A declared Fish Habitat Area (FHA) is a defined area of inshore or estuarine fish habitat which contains values that are important to sustaining local and regional fish stocks and fisheries (DPI 2008).

The Coomera Fish Habitat Area was originally declared in 1983, with a subsequent re-declaration in 1999. The habitat values include *Avicennia* and *Rhizoophora* (mangroves) along estuarine and tidal creeks, salt marshes and scattered sea grass beds (DPI 1999). Fish species protected by the Coomera Fish Habitat Area include:

- Bream (*Acanthopagrus australis*)
- Estuary cod (*Epinephelus coioides*)
- Flathead (*Platycephalus arenarius*)
- Garfish (*Hyporhamphus australis*)
- Luderick (*Girella tricuspidata*)
- Mangrove jack (*Lutjanus argentimaculatus*)
- Sea mullet (*Mugil cephalus*)
- Tailor (*Pomatomus saltatrix*)
- Whiting (*Sillago ciliate*)
- Banana prawns (*Penaeus merguiensis*)
- Eastern king prawns (*Penaeus plebejus*)
- Bay prawns (*Metapenaeus bennettae*).

The Pimpama FHA was initially declared in 1971 with a re-declaration in 1999. The habitat values of the FHA include shallow mangrove-lined estuary dominated by *Avicennia* and *Rhizophora*; sandy shoals and delta (DPI 1999a). Fish species protected by the Pimpama FHA are the same as those listed above for the Coomera FHA.

### Aquatic Survey Results

The IAS (Connell Wagner 1995) conducted field surveys at a number of sites along the proposed South Coast Motorway, of which 6 study sites correlate to the study area for the proposed IRTC and can provide some description of the existing environment. This information has been presented in the SREF because no new credible qualitative or quantitative data can be readily presented without undertaking a field assessment to describe the baselines aquatic environment. However, it should be noted that these study results are approximately 15 years old and will require further detailed field investigations to verify and update their findings. Table 3.4 overleaf lists the study sites of relevance to the proposed road corridor, and briefly describes the location and characteristics, their vegetation types present and fauna results where provided.

**Table 3.4: IAS Aquatic study site descriptions and results**

| Location and Characteristics | Vegetation | Fauna |
|---|---|---|
| Site 1 (Site 3 of the IAS Study (See Figure 7.6 of Connell Wagner 1995) is located at the Burnside Road crossing of Sandy Creek and is downstream of the proposed alignment used for that study. The survey site is not influenced by tidal fluctuations, however lower reaches of Sandy Creek are tidally influenced. Freshwater sections of Sandy Creek are indicative of smaller tributaries draining into the Albert/Logan River basin, influenced by unpredictable patterns of rainfall and runoff. | Aquatic plants in the pool upstream of the road culvert included *Ludwigia peploides* (Water Primrose), Azolla sp. and *Nymphaea* sp. | The IAS (Connell Wagner 1995) cited recent surveys of the area (Arthington *et al* 1994) which had found a suite of small freshwater fish common to the region, including *Melantaenia duboulayi* (crimson-spotted rainbowfish, *Hypseleotris galii* (firetail gudgeon), *H. Compressa* (empire gudgeon) and several other gudgeon species, *Retropinna semoni* (the smelt), *Pseudomugil signifier* (the blue-eye), as well as hardyheads, ambassids and Glossamia aprion. |
| Site 2 (Site 4 of the IAS study) (See Figure 7.6 of Connell Wagner 1995) is located south east of Burnside Road in a 5ha remnant paperbark stand situated on Sandy Creek. The survey site was dry at the time of the survey, however staining on the trunks of the paperbarks indicate that flood waters raise up at least 1.5 m into the paperbark stand. | The vegetation at the survey site was dominated by the stand of paperbark trees, with little to no understorey. This was observed to be most likely a result of grazing with pasture on both sides of the paperbark stand. Aquatic vegetation, where present was emerging sedge species, with a number of grasses and herbaceous weed species also present. | Given the survey was undertaken at a time when the water was not flowing, very few fish and other vertebrate species were recorded. However, a number of invertebrate species were observed, with particular reference to species of Odonata (dragonflies) and Trichoptera (caddisflies). |
| Site 3 (Site 5 of the IAS) (See Figure 7.6 of Connell Wagner 1995) was located on the Pimpama River at the crossing of the river near the intersection of Pimpama-Jacobs Well and Norwell Road. The IAS did not provide any survey results, rather it outlined the importance of the Pimpama River and its importance as a mangrove wetland habitat for the Gold Coast region, and the impacts of downstream development (Jumpinpin Bar Breakthrough, construction of the tidal barrage in the Pimpama River and the Gold Coast Seaway) on the mangrove population. | NA | NA |

| Location and Characteristics | Vegetation | Fauna |
|---|---|---|
| Site 4 (Site 6 of the IAS study) (See Figure 7.6 of Connell Wagner 1995) was located on Hotham Creek at a bridge crossing on an unnamed road east of Old Wharf Road, approximately 50-100m from its confluence with the Pimpama River. Hotham Creek is tidally influenced. | Riparian vegetation consisted of *Casuarina glauca* and some *Avicennia marina* with an understorey of grasses. | NA |
| Site 5 (Site 7 of the IAS study) (See Figure 7.6 of Connell Wagner 1995) was located on McCoys Creek south east of the intersection of Wallaby Way and Yawalpah Road, which is a tributary of the Pimpama River. McCoys Creek is tidally influenced and is fringed by paperbark forest. | McCoys Creek and its tributaries are surrounded by wet paperbark forest. Weed species were present, with para grass forming an understorey where light penetration was sufficient. | NA |
| Site 6 (Site 8 of the IAS study) (See Figure 7.6 of Connell Wagner 1995) was located on Oaky Creek south of Oakey Creek Road and is a tributary of the Coomera River. The survey site is approximately 200m upstream from its confluence with the Coomera River. Accordingly, Oaky Creek is tidally influenced and the survey site demonstrated signs of significant tidal flushing. | Both sides of the creek are vegetated with *Avicennia marina*, *Aegieras corniculatum* and *Casuarina glauca*. *Sporobolus virginicus* salt marshes are also found on the southern side of the creek. | It was noted that this variety of salt marsh and creek environment support an assortment of aquatic invertebrate species. |

### 3.2.7 Pest Fauna

The IAS fauna study observed a number of pest fauna species during their field investigations, some of which are declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act). These include:

- *Bufo marinus* (Cane Toad)
- *Canis familiaris* (Wild dog) - declared Class 2 pest animal
- *Felis catus* (Feral Cat) – declared Class 2 pest animal
- *Lepus capensis* (Brown Hare)
- *Sus scrofa* (feral pig) - declared Class 2 pest animal
- *Vulpes vulpes* (Fox) - declared Class 2 pest animal.

Class 1 and 2 pest species listed under the LP Act place legal obligations for their management and eradication.

## 3.3 Legislation and Approvals

### 3.3.1 Koala

The Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (the Koala Plan) came into effect on 2 October 2006. The Koala Plan addresses the key threats facing koalas and sets out strategies to stop the decline of koala numbers and set in motion the species' recovery.

#### 3.3.1.1 Whole of site

The IRTC will be located wholly within District A as defined by the Koala Plan which triggers a number of obligations for the whole site.

Clearing of koala habitat trees (Genera *Angophora, Corymbia, Eucalyptus, Lophostemon* or *Melaleuca*) in District A must comply with the sequential clearing conditions (s15, Koala Plan). The sequential clearing conditions must be applied to clearing throughout the IRTC site and is in addition to clearing obligations under any other legislation or policy.

The following conditions apply in relation to sequential clearing as specified in Section 15(3):

a) That clearing of trees is carried out in a way that ensures koalas in the area being cleared have enough time to move out of the clearing site without human intervention, including in particular, for clearing sites with an area of more than 3ha, by:

   carrying out the clearing in stages

   ensuring not more than the following is cleared in any 1 stage:

   (A) for a clearing site with an area of 6ha or less – 50% of the site's area;

   (B) for a clearing site with an area of more than 6ha – 3ha or 3% of the site's area, whichever is the greater

   ensuring that between each stage and the next there is at least 1 period of 12 hours that starts at 6pm on a day and ends at 6am on the following day, during which no trees are cleared on the site

b) that clearing of trees is carried out in a way that ensures, while the clearing is being carried out, appropriate habitat links are maintained within the clearing site and between the site and its adjacent areas, to allow koalas living on the site to move out of the site

c) that no tree in which a koala is present, and no tree with a crown overlapping a tree in which a koala is present, is cleared.

#### 3.3.1.2 Koala Habitat Areas

Within District A of the Koala Plan, more stringent obligations apply in relation to development in Koala Habitat Areas, including Koala Conservation Areas, Koala Sustainability Area and Urban Koala Areas, which the proposed alignment will traverse through in the southern section (See **Appendix B**, Figure 5).

#### 3.3.1.3 Koala spotter

Any clearing, in a Koala Habitat Area, of koala habitat trees that have a trunk with a diameter of more than 10cm at 1.3m above the ground in a habitat area must ensure the clearing is carried out in the presence of a koala spotter (s16, Koala Plan). A koala spotter is a person who has demonstrated experience in locating koalas in koala habitats or conducting fauna surveys.

Prior to the commencement of, and during felling operations, it is the responsibility of the koala spotter to identify trees in which a koala is present and any trees where their crown overlaps trees in which a koala is present and convey this information to the person(s) conducting the clearing. Koala spotters cannot be involved in the felling operations themselves, and must not physically move koalas to another location. Koalas must be allowed to move on of their own accord.

#### 3.3.1.4 Koala Conservation Criteria and Offsets

Different koala conservation obligations apply to the different Koala Habitat Areas under the Koala Plan with the strictest obligations applying to Koala Conservation Areas.

The Queensland Government have indicated that all community infrastructure provided by the State will address the Koala Plan, irrespective of whether the particular development is assessable, subject to community infrastructure designation, or exempt development under the SP Act.

Main Roads have drafted an Appendix to their Road Project Environmental Processes Manual that addresses the Queensland Government Environmental Offsets Policy. The draft Appendix states that "the Koala Offsets Policy applies to community infrastructure that can demonstrate an overriding need in the public interest located within mapped koala habitat in South East Queensland, referred to as Koala Conservation Areas or Koala Sustainability Areas."

For the purposes of fulfilling this obligation the koala conservation criteria set out in the Koala Plan should be considered in relation to the Project at the time of gazetting the state controlled road and 12 months prior to detailed design. Koala conservation criteria are provided that must be met by different types of development. It is recommended that an assessment be conducted at the time of declaring the road corridor. The current criteria contained in the Koala Plan 'uncommitted community infrastructure' within a Koala Conservation Area and Koala Sustainability Area are outlined in Section 3.2.4 along with examples of actions that may be required to satisfy the criteria.

**Table 3.5 Koala Conservation Criteria from the Koala Plan**

| Criteria for uncommitted community infrastructure development (taken from Table 10 of the Koala Plan) | State Government Comments on compliance with criteria (taken from Table 10 of the Koala Plan) | Example of Project Actions Required |
|---|---|---|
| 1. Community infrastructure development demonstrates an overriding need in the public interest justifying its location in the Koala Conservation or Koala Sustainability Area. | Further guidance on meeting Criterion 1 is located in Policy 3: Determining overriding need in the public interest. | 1. Must demonstrate there is no suitable alternative outside Koala Conservation Area.<br>2. Social, economic and environmental benefits outweigh: (i) any detrimental impact upon the natural values of the site; (ii) conflicts with the desired outcomes of the SEQ Regional Plan; and (iii) conflicts with the Koala Plan.<br>3. Community would experience significant adverse economic, social or environmental impacts if the development proposal were not to proceed. |
| 2. Community infrastructure development results in a net benefit to koalas and koala habitat. | Compliance with Criterion 2 will be achieved if consistent with Policy 2: Offsets for net benefit to koalas and koala habitat.<br>An application without a proposed offset package, as identified in Policy 2: Offsets for net benefit to koalas and koala habitat, will be the subject of an information request. | An offset package will need to be developed to ensure compliance with Policy 2:<br>Offsets for net benefit to koalas and koala habitat. The package must include provision of offsets for impacts of the development on the quantity, quality and connectivity of koala habitat on the development sites (residual habitat impact). Policy 2 does not require offsets for non-habitat based impacts such as road related mortality; however, offsetting actions can include non-habitat related actions such as directional fencing to reduce vehicle mortality of koalas.<br>An appropriate offset package cannot be calculated until the road footprint has been finalised. |
| 3. Community infrastructure development is designed and constructed in a way that minimises the loss and degradation of koala habitat. | An ecological assessment survey and report, supported by a vegetation management plan (or similar), should be provided to support the development proposal where removal of koala habitat is proposed.<br>Refer to the Koala Plan and Policy 6: Vegetation clearing requirements of this document for further information regarding vegetation clearing requirements. | Where practicable the final corridor should minimise impact on koala habitat by avoiding koala habitat trees, minimising the width of construction and locating the line as close as possible to the edge of the Koala Conservation Area so as to minimise the size of the fragment of the Koala Conservation Area that will be created.<br>An ecological assessment survey should be conducted and report and Landscape Management Plan |

| Criteria for uncommitted community infrastructure development (taken from Table 10 of the Koala Plan) | State Government Comments on compliance with criteria (taken from Table 10 of the Koala Plan) | Example of Project Actions Required |
|---|---|---|
| | | prepared.<br><br>Any clearing within the Koala Conservation Area should be undertaken in accordance with Policy 6: Vegetation Clearing requirements and any Landscape Management Plan should incorporate these requirements. |
| 4. Areas cleared or otherwise disturbed by community infrastructure development, and which do not form part of the ongoing use, are progressively rehabilitated and protected. | A rehabilitation plan (or similar) should be provided with the development application to support the development proposal where removal of koala habitat is proposed. Such a plan will be the subject of an information request when not provided with the development application. | All areas disturbed by the proposed construction of the Project and not directly required for operational aspects of the development should be rehabilitated in accordance with a Landscape Management Plan. |
| 5. Plants used for landscaping consist of at least 70% Australian plants, of which at least 50% of plants are native to the area; including koala habitat trees native to the area, to the greatest practicable extent. | | All plants used for landscaping and rehabilitation works should be locally endemic and will have been sourced from the locality. This should be detailed within a Landscape Management Plan. |
| 6. Community infrastructure development provides for koala movement across the landscape in its design and layout by incorporating koala sensitive development, as applicable to the community infrastructure development. | | Design options that provide for koala movement across the landscape need to be considered. The final design should include crossing points at bridges, and directional fencing to ensure koala movement at identified crossing points. |
| 7. Development minimises adverse impacts on koalas during operation. | | The installation of directional fencing or alternatives should be used to ensure minimal impacts upon koalas by directing koala away from construction areas.<br><br>Any rehabilitation of areas of habitat undertaken as part of the offset strategy should be located so as to minimise potential conflict between koalas and traffic by reducing the need for koalas to cross the road. |

#### 3.3.1.5 Interim Koala Habitat Protection Areas

The South East Queensland Koala State Planning Regulatory Provisions (SEQ Koala Provisions) are interim provisions recognising the steep decline in the region's koala population and the need to put in place protection measures in addition to the Koala Plan until the proposed State Planning Instrument for koala conservation is in place. The Queensland Government have also released the Draft South East Queensland Koala Conservation State Planning Regulatory Provisions and the Draft South East Queensland Koala Conservation State Planning Policy in December 2009 for public consultation until 28 February 2010. When passed, the Draft South East Queensland Koala Conservation State Planning Regulatory Provisions will replace the current SEQ Koala Provisions.

The current SEQ Koala Provisions impose obligations on development within the mapped Interim Koala Habitat Protection Areas and Protected Koala Bushland Habitat Area. The IRTC intersects mapped Interim Koala Habitat Protection Areas along the southern banks of Oaky Creek. Any development within these areas for the purposes of the Project must not adversely affect movement of koalas through a koala movement corridor or must comply with the following assessment criteria:

1) Be consistent with the proposed biodiversity outcomes in a planning scheme for the premises
2) Maximise opportunities for safe koala movement through its design and layout
3) Offset the loss of mature koala habitat trees through replanting koala habitat trees at a rate of 1 tree for every 1 metre height of tree lost, occurring either:
   a) on-site; or if this is not possible
   b) off-site.

The IRTC also intersects areas of Protected Koala Bushland Habitat Area but these areas overlap Koala Habitat Area that is already subject to the Koala Plan obligations as outlined in Section 3.3.1.2.

The SEQ Koala Provisions are one measure in the State Government's Koala Response Strategy which it has also been announced will include a requirement that all new state controlled roads and upgrades in koala habitats are to be koala-friendly (e.g. include safe crossing points and fencing).

### 3.3.2 Queensland Government Environmental Offsets Policy

Section 2.3.2 provides an overview of the new QGEOP that came into effect on 1 July 2008. As mentioned in Section 2.3.3, Main Roads have drafted an Appendix to their Road Project Environmental Processes Manual that addresses the QGEOP. The draft Appendix does not include guidance in relation to obligations under the Policy for Vegetation Management Offsets because of the exemption from approval under the *Vegetation Management Act 1999* for works on State-controlled roads. However, DTMR have an obligation under the QGEOP to incorporate a requirement of environmental offsets if a project will have remaining environmental impacts on environmental values addressed in an existing specific-issue offset policy, which includes the Policy for Vegetation Management Offsets. Currently it is unclear whether this obligation is triggered only when a clearing permit is required under the SP Act. Legal clarification should be sought as to whether Main Roads should be considering offsets in relation to impacts on environmental values protected by the Policy for Vegetation Management Offsets regardless of whether a permit is triggered under the *Vegetation Management Act 1999*.

### 3.3.3 Uncertain future obligations: Draft Policy for Biodiversity Offsets

Section 2.3.6 provides a detailed overview of the current Draft Policy for Biodiversity Offsets. The draft Policy indicates that offsets would not be triggered if the same biodiversity values are already captured under other specific-issue offsets policies, for example, if offsets are provided in accordance with the VM Offsets Policy (discussed under Sections 2.3.6 and 3.3.4) for RE and Essential Habitat.

### 3.3.4 Summary of approvals and obligations

Table 3.6 provides a summary of applicable fauna related approvals.

**Table 3.6: Legislation and approvals - Fauna**

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Commonwealth | | | | | |
| *Environment Protection and Biodiversity Conservation Act 1999* | Department of Environment Water, Heritage and Arts (DEWHA) | Significant impact on Matters of National Environmental Significance including:<br>• nationally threatened species and ecological communities<br>• migratory species protected under international agreements<br>• Ramsar wetlands of international importance<br>• National Heritage places | EPBC Referral and if "controlled action" approval from DEWHA | Decision on referral should be delivered within 20 business days. | Without site inspection and more detailed engineering it is not possible to determine whether the habitat is present to support the threatened fauna species listed in the database or whether the impacts are likely to be significant to the viability of the fauna populations. The proximity to Moreton Bay Ramsar wetlands and the potential scale of earthwork activities in this project is a concern which should be addressed in a referral.<br>As a referral is necessary for the potential impacts on Coomabah wetlands (IRTC-South), the potential impacts on migratory birds, fish habitat, marine plants and Moreton Bay can also be referred.<br>As this project (the IRTC-North) is a component of a larger action, the IRTC must be referred (refer to s9.1.2). |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| State | | | | | |
| *Environmental Protection Act 1994* and Environmental Protection Regulation 2008 | DERM | DTMR must comply with the general environmental duty not to undertake activities that cause or are likely to cause environmental harm unless all reasonable and practicable measures are taken to prevent or minimise the harm (s319). DTMR must also comply with more specific obligations imposed under the EP Act. | Compliance | N/A | The general environmental duty applies to all project activities.<br><br>The following environmental protection policies and subordinate legislation have been prepared under the EP Act and must be complied with and considered in preparing environmental management plans:<br><br>• Environmental Protection Regulation 2008<br>• Environmental Protection (Air) Policy 2008<br>• Environmental Protection (Noise) Policy 2008<br>• Environmental Protection (Waste Management) Policy 2000<br>• Environmental Protection (Waste Management) Regulation 2000<br>• Environmental Protection (Water) Policy 1997. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Fisheries Act 1994* | DPIF | Erection of waterway barrier works. (Subdivision 3) | Development Approval to build or raise waterway barrier works | 3 months from date of application | Any activity that will or potentially block or obstruct the movement of fish species will require an approval of this nature. The provision of fish movement / passage is required when seeking a waterway barrier works permit.<br><br>Waterway barrier works approvals and fishway assessments: Departmental procedures (FHMOP 008) |
| *Land Protection (Pest and Stock Route Management) Act 2002* | DPIF | Landowners must take reasonable steps to keep their land free of Class 1 and 2 and pests or hold a declared pest permit. | Compliance | N/A | Section 3.2.7 specifies the declared pest species likely to be found in the study area.<br><br>The contractor and DTMR must ensure that pests are controlled within the Project area. |
| *Nature Conservation Act 1992* | DERM | Taking of or interfering with protected plants and/or removal of wildlife listed as protected in the Nature Conservation (Wildlife) Regulation 2006 (ss 88-89).<br><br>It is a defence to a charge under the NC Act for taking of a protected animal if it can be demonstrated that the animal was taken whilst conducting a lawful activity and that taking could not have been reasonably avoided. | Approval to take, keep or use protected animals or plants | 6 weeks | Permit, licence or authority may be required to remove protected flora (which includes least concern plants being all native vegetation) and to take native fauna during construction phase. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (Koala Plan) | EPA | Sequential clearing obligations for the whole site (s 15).<br><br>Koala spotter requirement for all clearing within Koala Habitat Areas (s 16).<br><br>Compliance with the Koala Conservation Criteria is required for development located in a Koala Habitat Area if the development is assessable under the SP Act, local government planning scheme or is a community infrastructure designation.<br><br>Offset requirements in accordance with the Policy 2: Offsets for net benefit to koalas and koala habitat in the Koala Plan as a result of the QGEOP. | Approval to clear vegetation within koala conservation area or koala sustainability areas listed under the Koala Plan.<br><br>Compliance with clearing and offset obligations. | 3 months | Permit not required because activities for the Project will constitute "specified activities" which are exempt from the requirement to obtain vegetation clearing approval. See Section 2.3.1 for more detail.<br><br>The general clearing provisions under the Koala Plan (s 15) would still apply to the whole area and the requirement for a koala spotter (s16) to all Koala Habitat Areas.<br><br>See Section 3.3.1 for more detail on these offset obligations in relation to koala. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| South East Queensland Koala State Planning Regulatory Provisions (SEQ Koala SPRP) (February 2010) | DIP | A development application, for a material change of use, reconfiguring a lot or operational work for the clearing of native vegetation, in an interim koala habitat protection area or protected koala bushland habitat area unless certain criteria are satisfied. | Approval from DIP to clear vegetation within a koala protection area, including possible offset requirements | In force until replaced by draft Provisions. | The Project is located within the interim koala habitat protection area designated on regulatory map so no further obligations would apply however, see Section 3.3.1 for other possible implications.<br>The current SEQ Koala SPRPs are referred to as interim development controls by the Department of Infrastructure and Planning.<br><br>The Queensland Government have also released the Draft South East Queensland Koala Conservation State Planning Regulatory Provisions and the Draft South East Queensland Koala Conservation State Planning Policy in December 2009 for public consultation until 28 February 2010.<br><br>Requirements that are applicable under the SEQ Koala SPRP are in addition to those obligations under the Koala Plan. |

## 3.4 Potential Impacts

The IRTC has the potential to impact on native fauna through the removal or degradation of habitat that provides shelter, breeding and food resources, but also by impairing the way animals, birds and fish move across the landscape by severing either large tracts of vegetation, removing critical patches from a network of 'stepping stones' or imposing a physical barrier.

The pressures on wildlife movement through this area of interest has been recognised by the DERM and GCCC who are working towards protecting and rehabilitating areas to enhance fauna movement between Southern Moreton Bay and Wongawallan.

The Pimpama-Coomera area has significant habitat value to koala and is therefore a particularly sensitive area in terms of actual habitat availability and risk of mortality through construction or road strike.

Several threatened fauna species, protected under both the EPBC and NC Acts have previously been recorded in the area of interest, including bats, birds, frogs and reptiles.

Typical impacts on native fauna that can be expected from the IRTC include:

- Removal and disturbance of native fauna habitat, including threatened species, migratory and marine bird habitat and Essential Habitat to Wallum froglet. Significant impacts on fauna species and migratory and/or marine birds are a potential trigger for approval under the EPBC Act
- Loss or damage to riparian vegetation and aquatic habitat associated with the waterways that are intersected by the IRTC (Sandy Creek Ch 37000, Halfway Creek Ch39500, Pimpama River Ch 42200, Hotham Creek Ch 45000, McCoys Creek Ch 50500, and Oaky Creek Ch 53750). The removal of riparian vegetation for cross drainage and bridge structures can alter/remove vital ecosystem processes; such as the filtering and buffering processes undertaken by riparian vegetation (Barling and Moore 1993)
- Damage to aquatic habitats from road runoff including altered levels of salinity, turbidity and dissolved oxygen. These alterations can harm the health and functioning of aquatic organisms and ecosystems. This has the potential to harm Moreton Bay Ramsar wetlands and is therefore considered a potential trigger for approval under the EPBC Act
- Physical barrier to fauna movement including arboreal and terrestrial mammals, frogs, reptiles and fish passage
- Severance/fragmentation of habitat and connectivity, particularly towards the southern end in the Coomera Pimpama koala habitat area (approximate Ch 48000 – 54000)
- Fauna mortality during vegetation clearing and vehicle collision whilst attempting to cross the IRTC, particularly near the creek crossings
- Relocation of protected fauna species
- The creation of new habitat types including bare grassy areas on roadsides, remnant vegetation edges dominated by weeds or pioneer regrowth species, altered hydrology of creeks, and physical changes in topography
- Changes to hydrological regimes, flow velocities removal of eddying effects and pools as a result of alteration and removal of bed and banks for cross drainage and bridge structures. This can reduce the ability of aquatic species to move up and down stream and reach feeding and breeding areas normally within their movement range
- Disruption to natural fish movement processes through poor drainage design and construction
- Depletion of fish energy reserves as a result of increased efforts required to navigate through cross drainage structures that have increased stream flow velocities
- Increased risk of fish mortality through the following factors:
  - increased predation through delays and trapping below crossings
  - increased exposure to silt and sediment and the potential for injury and illness
  - loss of access to food resources
- The creation of hydraulic barriers to fish movement
- Altered shading and temperature effects on aquatic environments affecting the balance of algal and aquatic plant growth. This in turn can impact upon the pH, temperature and as a result the amount of dissolved oxygen available.

## 3.5 Recommendations

It is recommended the following measures be integrated into future planning and design phases:

- Avoid: It is acknowledged that the road corridor has considered, and avoided, where possible, habitat areas (refer to s2.4). It is recommended that opportunities to limit the disturbance to areas mapped as Essential Habitat are reviewed at the concept design stage and the width of the road corridor be reduced where possible to avoid these areas. The most recent protected area mapping should be retrieved from the DERM at the time of this review as the data is constantly updated
- Minimise: Consider design solutions to reduce the physical barrier to koala movement through the Coomera Pimpama Koala Habitat Area (particularly southern bank of Oaky Creek). All attempts should be made to minimise the corridor footprint to the minimum area required in this location and opportunities to retain or replace koala feed trees investigated
- Mitigate: All disturbed areas should be rehabilitated/revegetated to ensure that habitats are restored. Particular attention should be paid to riparian vegetation and known fauna movement corridors.
- Mitigate: Apply Fauna Sensitive Road Design principles (refer to DTMR Fauna Sensitive Road Design, Volumes 1 and 2), particularly at McCoys Creek crossing to allow for continued fauna movement along creek banks and through the retention of riparian vegetation
- Mitigate: Investigate opportunities for fauna connectivity during concept and development planning. A request to GCCC should be made for sharing of fauna records collected as part of the Southern Moreton Bay to Wongawallan Bioregional Corridor monitoring study and Coomera Pimpama Koala Conservation Project. These records, or similar, will be required to determine the most appropriate location and form of wildlife movement solution for koala and other fauna across the IRTC
- Mitigate: Include fauna exclusion fencing to encourage fauna species to use specifically design fauna friendly crossing points along the alignment and consider use of fauna friendly lighting
- Mitigate: Consider the use of baffles in cross drainage design to allow provision for aquatic species movement. The DTMR Culvert Fishway Planning and Design Guidelines (Kapitzke, 2009) should be consulted during design
- Review: It is strongly recommended that during future stages of the project that a detailed fauna (including aquatic) investigation is undertaken to update the results presented in the 1995 IAS and the results from the desktop assessment presented in this SREF. This area has been subject to significant development in the 15 years preceding the IAS (Connell Wagner 1995), and as such the baseline environmental values of the local environment have changed. Importantly, the local environmental and population dynamics of fauna will continue to change. Given this project is unlikely to proceed within 10 years; we can expect significant changes in land use and availability of natural areas on the Gold Coast. Detailed field investigations during the concept design phase will provide greater clarity as to the potential occurrence of threatened species and allow for the development of species specific mitigation measures that are relevant to the environmental landscape at that time.

The critical issues that have the potential to affect project timeframes and may have significant cost implications are:

**Offsets**

An environmental offset is required to be provided for projects where there will be remaining environmental impacts after the principles of avoid, minimise and mitigate have been applied. Offsets may therefore be required to compensate for the loss of Essential Habitat, as compensation for causing marine fish habitat loss and for impacts on koala habitat.

**Koala Management**

Legislation protecting koala populations and koala habitat continue to evolve and it is likely that the laws protecting koala will become more stringent in the future. Under the current legislation, DTMR have obligations to offset the loss of koala habitat and provide for koala movement within the road development. The IRTC corridor intercepts the Coomera-Pimpama koala habitat area and overlaps the Southern Moreton Bay to Wongawallan Bioregional Corridor. As mentioned in Section 3.2.4 there is increased community awareness of the pressures on koala populations and habitat.

**Nature Reserve Effect**

Preserving a road corridor in the planning scheme form only has the risk of creating a 'nature reserve' effect on the ground. Ongoing major developments planned for the surrounding area will have a cumulative effect of reducing the availability of local habitat to flora and fauna. In turn, the land preserved for the future road corridor becomes increasingly important to wildlife as it provides refuge. At the time of developing the road corridor, there is an inherent risk that the habitat value of the land preserved for the IRTC is greater than the value it holds today

**Fauna movement solutions**

In addition to the obligations to provide for koala connectivity under the SEQ Koala Provisions, permeability of other native fauna across the IRTC is an important environmental issue that is also receiving much attention from State and local government. DTMR should consider opportunities to facilitate fauna movement (terrestrial and aquatic) in the road design and the potential for additional land requirements to accommodate such features. It is also recommended that DTMR consult with DERM to inform them of the intention to develop a road corridor that impacts the Southern Moreton Bay to Wongawallan Bioregional Corridor and Coomera-Pimpama Koala Habitat Area.

There are opportunities for Council and DTMR to work together on some of the protection measures proposed for the Southern Moreton Bay to Wongawallan Bioregional Corridor. Long-term monitoring of the bioregional corridor by GCCC will provide valuable knowledge on patterns of fauna usage. DTMR should request access to these records and any evidence that will help locate wildlife movement solutions. Consideration should be given to the additional land requirements for fauna movement infrastructure as well as the potential for significant additional costs.

**Consultation**

The environmental impacts of the IRTC will attract significant public, agency and likely media attention. It is important that DTMR are transparent about the environmental management of the IRTC and seek meaningful input from State agencies. DTMR should allow for significant agency and public consultation and consider the implications this attention and consultation will have on project timeframes.

Consultation requirements also need to be considered when deciding a strategy for the project environmental approvals process, for example an EIS for a State significant project or under the EPBC Act both have mandatory consultation periods including for the Terms of Reference as well as the EIS proper.

**Approvals and Permits**

The IRTC has the potential to impact migratory and marine species, threatened fauna and wetland habitat that are afforded protection under the EPBC Act. The Coomabah wetland in the IRTC-South is considered the key trigger for a referral under the EPBC Act, these matters of national environmental significance that occur in the IRTC-North area of interest must also be addressed as part of this referral. Consideration must be given to the significant timeframes associated with the preparation of a referral to DEWHA, and the subsequent environmental assessment and approvals process should an EIS be required.

## 3.6 Conclusion

The development of the IRTC has the potential to cause animal mortality, habitat loss, fauna movement barriers and the severance of fauna movement corridors. A number of threatened and migratory species have been observed within the study area, and the Coomera-Pimpama Koala Habitat Area will be directly impacted by the proposed alignment. Given the increased awareness of the community on the declining SEQ Koala population and increased state and local Government policy a road corridor through critical habitat will not be precluded at this stage but will remain an important environmental issue that will require significant management and public consultation throughout the life of this project. Further detailed field investigations are required to confirm the availability of habitat required to support the threatened species listed in this report and therefore enable specific management measures to be adopted.

Other significant fauna issues that will require DTMR attention and investigation in future project stages include the offset of lost habitat for threatened species and the provision of aquatic fauna movement in cross drainage structures.

The close proximity and potential impact on migratory species and the Moreton Bay Ramsar site must be included in the EPBC referral.

# 4.0 Topography and Soils

## 4.1 Methodology

The investigation of the geological and topographic conditions within the IRTC study area involved a desktop review. Reference has been made to the Digital Atlas of Australian Soils to broadly categorise the soil landscape and topographic features of the study area. A review of the DERM Acid Sulfate Soil (ASS) mapping for the Logan – Coomera area has also been undertaken to identify areas within the proposed corridor that are likely to contain actual or potential ASS. Additionally, the IAS (Connell Wagner 1995) results and descriptions of existing conditions for soils and topography were used as part of the desktop review.

Several sources of information have been reviewed to assess the study area for any potential contamination issues. A search of the Environmental Management Register (EMR) and Contaminated Land Register (CLR), maintained by DERM, has been undertaken to identify any lots within the study area which are considered to pose a contamination risk. Finally, the Department of Defence's Unexploded Ordinance (UXO) register was also reviewed to locate any parcels of land within the study area that are potentially contaminated with live ammunition.

## 4.2 Description of Environmental Values

### 4.2.1 Geology and Soils

The IRTC study area comprises Neranleigh-Fernvale Beds and Estuarine Deposits. The Neranleigh-Fernvale Beds, consisting of greywacke, argillite, quartzine, chert, shale, sandstone and greenstone cover much of the IRTC alignment (See **Appendix B**, Figure 6). Estuarine deposits of mainly mud, silt, sand, clay and gravel with minor peat and coral debris are found in low lying areas adjacent to the rivers and creeks throughout the study area. The remainder of the study area is made up of flood plain alluvium consisting of clay, silt, sand and gravel.

The Digital Atlas of Australian Soils maps much of the study area as either non-hard setting duplex soils, friable acidic gley soils, friable yellow mottled soils and acidic friable earths (See **Appendix B**, Figure 7). Soils within the study area are consistent with the geology and lithology of the parent material, and are closely related to the topography of the soil landscape.

Previous investigations in the IRTC study area indicate that much of the lowland estuarine deposits contain gley soils, particularly in areas subject to tidal influence (Connell Wagner, 1995). The alluvial regions of the study area contain a mixture of acidic clays and humic gley soils. In the Pimpama area, meadow podzolic soils occur adjacent to streams and creeks, whilst cracking brown grey and red clay soils exist on the intermediate alluvial plains.

The IRTC study area traverses Class A and Class B Good Quality Agricultural Land (See **Appendix B**, Figure 8). Good quality agricultural land is a finite resource critical to the future productivity and efficiency of Queensland's rural industries and food security. The State Planning Policy 1/92: Development and the Conservation of Agricultural Land sets out principles to guide the protection of this important natural resource. The impacts of the development of the IRTC on GQAL should be considered as part of future Land Use and Planning Assessment of the area and project, including assessment in accordance with the State Planning Policy.

### 4.2.2 Landform

Much of the IRTC study area consists of gently undulating low hills and rises with vast areas of low lying, flood prone alluvial plains (See **Appendix B**, Figure 9). Overall, the terrain is generally flat with elevations ranging between 2m AHD at the alluvial flood plains and 15m AHD at Foxwell Road north of Coomera River and around the hard rock quarry reserves at Stapylton. Pockets of freshwater and brackish swamps exist throughout the study area in the vicinity of the rivers and creeks.

These observations are consistent with the South Coast Motorway – Southern Section Impact Assessment Study. The study describes the terrain as gently to moderately undulating terrain and basal slopes with infilled gullies / valleys underlain by Palaeozoic Neranleigh-Fernvale Beds comprising commonly low strength, highly weathered rock and variable clayey sand and silty sand with gravel in infilled gullies (Connell Wagner, 1995).

### 4.2.3 Acid Sulfate Soils

A review of the Queensland Department of Environment and Resource Management (DERM) acid sulfate soils (ASS) mapping of the Logan - Coomera area reveals that much of the study area has been subject to investigation. Low-lying regions of the study area east of the proposed corridor have been mapped, whilst much of the land to the west of the corridor has not been assessed. The areas not assessed were not considered to pose a great threat given that they are beyond the boundary established as the limit of Holocene, estuarine and sulfidic sediments.

Mapping from the Logan – Coomera investigation identifies ASS and potential acid sulfate soils (PASS) in low-lying areas of the proposed IRTC (DERM, 2002). (**Appendix B**, Figure 10) shows the location of ASS and PASS from the DERM 1:25,000 ASS mapping of the Logan – Coomera area. Areas of actual ASS are mapped in Gilberton and Woongoolba to the west of the IRTC alignment. Much of this area has actual ASS layers at depths no greater than 1 m BGL overlaying PASS.

Actual ASS are also encountered in the low-lying areas adjacent to Sandy and Hotham Creeks, and the Pimpama and Coomera Rivers. Much of the IRTC traverses the boundary of the Holocene estuarine deposits and the Devonian – Carboniferous sedimentary deposits, and as such has a low probability of ASS occurrence.

### 4.2.4 Contaminated Land

The assessment of contamination of the IRTC study area is limited to a literature review of previous investigations undertaken in the area. Additionally, a search of DERM's Environmental Management Register (EMR) and Contaminated Land Register (CLR) was conducted for land parcels traversed by the IRTC. Of the 146 lots within the IRTC, a total of five lots are listed on the EMR. A summary of the register search is provided in Table 4.1 below.

**Table 4.1: Lots within the study area listed on the EMR / CLR**

| Lot | Plan | Description |
|---|---|---|
| 92 | WD6698 | Area management site (AMA) |
| 466 | W312186 | Listed on EMR on 7/11/1995 for notifiable activity of landfill |
| 20 | SP132860 | Related to base parcel lot 112 WD23 is listed on EMR on 5/5/92 for notifiable activity of petroleum product or oil storage |
| 12 | SP109916 | Related to base parcel lot 112 WD23 is listed on EMR on 5/5/92 for notifiable activity of petroleum or oil storage. |
| 111 | W3174 | Listed on EMR on 27/04/1992 for notifiable activity of landfill |

Sites within the study area listed on the EMR are subject to the following notifiable activities:

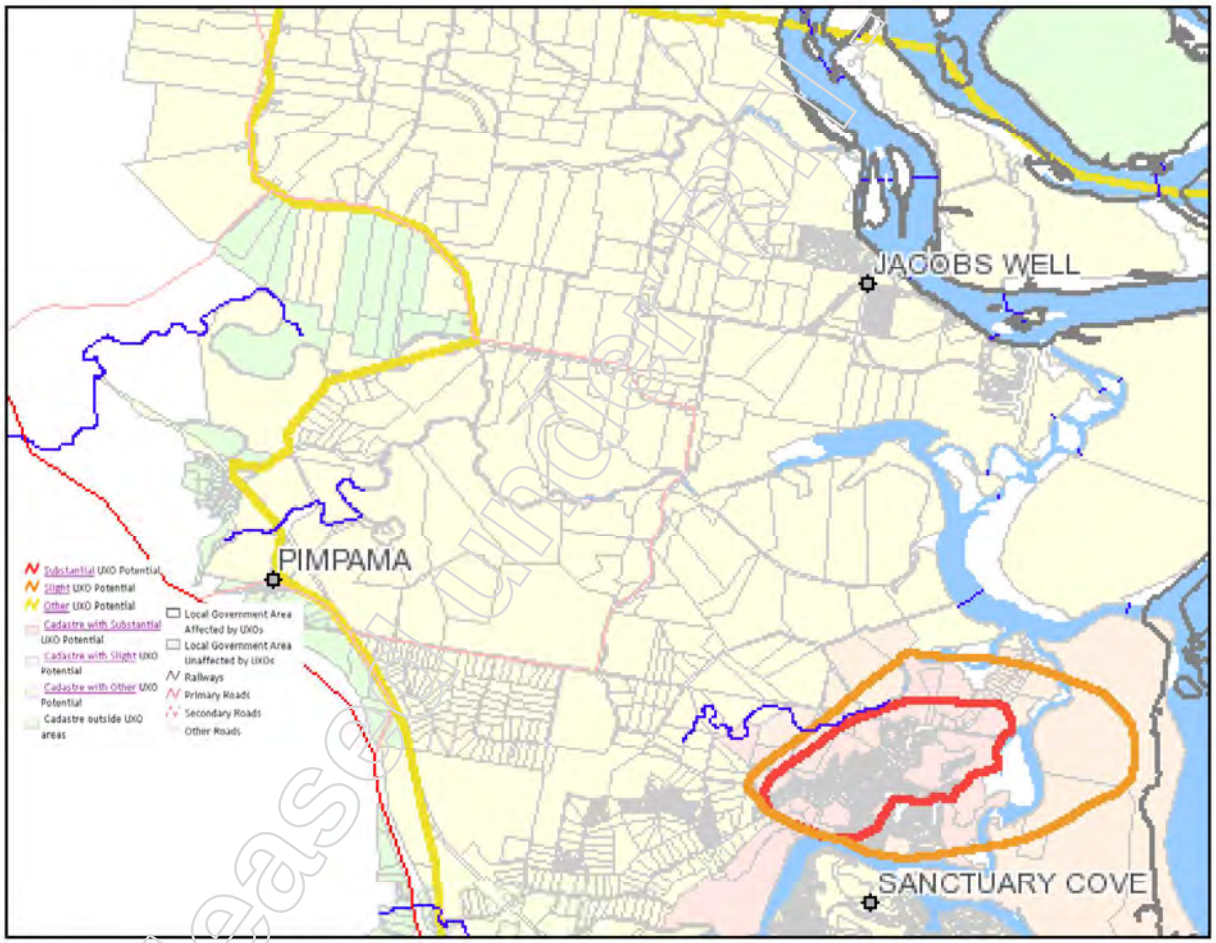
- Petroleum product or oil storage – storing petroleum products or oil in above ground tanks -
  - For petroleum products or oil in class 3 in packing groups 1 and 2 of the dangerous goods code – more than 2500L capacity; or
  - For petroleum products of oil in class 3 in packing groups 3 of the dangerous goods code – more than 5000L capacity; or
  - For petroleum products that are combustible liquids in class C1 or C2 in Australian Standard AS1940 – more than 25000L capacity
- Landfill – disposing of waste (excluding inert and construction and demolition waste).

The lots listed on the EMR (92WD6698) classified as Area Management Sites are on the AMA register because of their potential to contain unexploded ordinance (UXO) as listed by the Department of Defence.

Previous investigations undertaken for the IRTC study area have indicated the possibility of contamination issues within the corridor and on adjacent sites (Maunsell, 2006). Possible sources of contamination are associated with the construction and operation of rail infrastructure within the vicinity of the rail corridor, and the industrial activities undertaken on sites adjoining the study area. Other potential sources of contamination include current and historic agricultural activities (application of chemicals as part of sugar cane cultivation) and filling activities as part of urban development processes.

A review of the Commonwealth's Department of Defence Unexploded Ordinance (UXO) database was undertaken as part of the contamination investigation of the IRTC study area. The UXO database search of the Gold Coast area identified one parcel of land affected by UXO in the vicinity of the IRTC study area as shown on Figure 4.1. This parcel is located at the southern end of the corridor, adjacent to the Coomera River where a history of military activity has been recorded. The lot (92 WD6698) is listed as having a 'substantial' potential for UXO presence.

**Figure 4.1: Potential UXO areas identified by the Department of Defence UXO mapping**




Source: Department of Defence UXO mapping database

'Area Management Advice' (AMA) is defined in Schedule 26 of the *Sustainable Planning Regulation 2009* as a written notice given by the administering authority (DERM) to an affected local government about planning for or managing land contaminated because of "natural mineralisation, industrial activity or unexploded ordnance".

The AMA's application DOES NOT constitute a listing of affected lot/s on the Environmental Management Register (EMR) or Contaminated Land Register (CLR) that are maintained by the DERM pursuant to the EP Act.

## 4.3 Legislation and Approvals

### 4.3.1 Contaminated Land Management

The *Environmental Protection Act 1994* (EP Act) administered by DERM is the principal piece of environmental legislation in Queensland. The EP Act stipulates the appropriate management of potentially contaminating activities and contaminated sites in Queensland. Potentially contaminating activities are considered 'notifiable activities' under the EP Act and land subject to these activities requires investigation and management.

The EP Act identifies lots based on the risk of contamination to exist. The EMR lists lots that have been used for a notifiable activity (Schedule 3 of the EP Act) and/or land that has been identified to contain a degree of contamination through a preliminary site investigation as detailed in Appendix 5, Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. As such, land listed on the EMR is considered to pose a low risk to human health or the environment under the current land use.

Land is recorded on the CLR when the extent of contamination following site investigation is deemed by DERM to require remediation or management. Remedial action is required to reduce risk to human health and the environment, thereby preventing potential harm.

### 4.3.2 Summary of approvals and obligations

Table 4.2 outlines the relevant legislation and approvals for topography and soils.

**Table 4.2 Legislation and approvals – Topography and Soils**

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Environmental Protection Act 1994 | DERM | Removal and disposal of contaminated soil from sites listed on the Contaminated Land Register (CLR) or Environmental Management Register (EMR) (unless done under a remediation notice). | Disposal Permit for contaminated soils | No legislative timeframe (up to 3 months) | Potentially contaminated land has been identified on five lots along the alignment (Section 4.2.4) |

## 4.4 Potential Impacts

### 4.4.1 Disturbance of Acid Sulfate Soils

As areas of ASS occur in the study area, excavation of these areas below topsoil or groundwater levels may result in the oxidation of these soils and release of quantities of acids and metals. These exports have the potential to cause significant damage to the surrounding environment. Where possible; excavations of ASS should be avoided. Where it is unavoidable appropriate controls and rehabilitation measures should be employed as outlined in the DERM publication Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines.

The presence of ASS can also impact on the structural integrity of introduced structures. This is a result of the impact of acidic waters on the concrete and steel reinforcement of structures, with implications for maintenance and replacement costs.

The disturbance of ASS also has the potential to impact on downstream fisheries production and other aquatic environmental values. Impacts can include:

- Fish kills
- Alteration and loss of habitat
- Skin and gill damage through increased pH levels
- Increased susceptibility to diseases.

### 4.4.2 Disturbance of Contaminated Land

Disturbance to parcels of land listed on the EMR/CLR register with notifiable activities such as "Landfill" and "Oil or Petroleum Storage" has the potential to create numerous environmental impacts. Potential environmental impacts as a result of disturbance of these lots may include:

- Creation of airborne contaminated particles
- Release of landfill gas
- Identification of hazardous materials (asbestos)
- Rupture of underground oil or petroleum storage tanks
- Contamination of groundwater sources
- Contamination of watercourses and drainage lines.

## 4.5 Recommendations

### 4.5.1 Acid Sulfate Soils Management

As a result of the low lying environs of the IRTC disturbance of ASS is largely unavoidable. As a result of the high potential for ASS disturbance and exposure, it is recommended that a detailed ASS investigation be undertaken to accurately baseline the presence and distribution of ASS's potentially impacted by the IRTC.

Following this investigation, all disturbances to soils below 5m AHD, irrespective of natural ground level, should be designed and managed to avoid potential adverse effects on environmental and human health from ASS. It is recommended that an ASS Management Plan should be developed during later design stages outlining the extent of ASS distribution as identified by the investigation and detailed management strategies for the treatment and management of these soils documented.

### 4.5.2 Contaminated Land Management

To reduce the environmental impact of disturbing contaminated land there are some measures that can be undertaken at an early stage of the project. Contaminated land issues will not prevent the development of the IRTC; however they can create cost implications if remediation is required as a result of unnecessary disturbance. It is recommended that a Stage 1 preliminary site investigation be undertaken for the entire alignment, based on desktop research and historical investigations in the study area to ascertain the likelihood of contamination. Intrusive sampling could be undertaken on the parcels of land previously identified as being contaminated. This is particularly important for parcels of land where the Notifiable Activity is oil or petroleum storage as there is the potential for these storage items to be located underground.

The Department of Defence recommends that any land usage rezoning or development of land with a 'substantial' UXO potential should only proceed following the conduct of UXO investigation and any necessary remediation by a qualified UXO investigation and remedial search contractor. It is recommended that a UXO investigation be undertaken during later design stages on lot 92 WD6698 to ascertain whether UXO is present on the parcel of land.

Defence operators will dispose of any UXO that has been found and reported. Requests are to be made through the Queensland Police Service.

## 4.6 Conclusion

The investigation of the topography and soils of the study area highlight a number of issues that will require detailed management in the following project stages. There are no soils or topography issues identified in this SREF that will preclude the development of the proposed road corridor, however further investigation will be required to quantify the costs associated with the investigation, remediation and treatment of potentially contaminated soils and soils that are highly likely to contain acid sulphate soils. Additionally, it is recommended that all structures placed within known ASS areas be treated to withstand the impacts of acidic waters where possible. It is also recommended that land use and planning issues associated with the disturbance and fragmentation of GQAL be considered as part of subsequent studies for the IRTC.

# 5.0 Surface and Groundwater Quality

## 5.1 Methodology

The investigation of surface and groundwater quality was done through a review of existing data provided by DERM for the Coomera and Pimpama Rivers. Data is available for the catchments from previous investigations undertaken by others and through the Healthy Waterways Ecosystem Health Monitoring Program (EHMP). Additionally, a review of the 1995 IAS was undertaken to identify the relevant environmental values for the study area.

## 5.2 Description of Environmental Values

The IRTC traverses the Coomera River and Pimpama River Catchments to the east of the Pacific Motorway. The proposed corridor also crosses several minor creeks and tributaries including Oaky Creek, McCoys Creek, Hotham Creek, Pimpama River, Halfway Creek and Sandy Creek. The waterways and sensitive aquatic environments within the IRTC study area are shown in (**Appendix B**, Figure 11).

### 5.2.1 Surface Water

Water quality data is available for the Pimpama and Coomera River Catchments from previous investigations undertaken by others and through the EHMP. As part of the program, data is collected for a range of parameters including turbidity, salinity, dissolved oxygen, pH, nitrogen and phosphorus. EHMP results for the Pimpama and Coomera River Catchments are summarised in Table 5.1 below. The EHMP results indicate that the catchments are generally in good condition with water quality parameters recorded within guideline values.

**Table 5.1: EHMP Pimpama and Coomera Catchments Ecosystem Annual Report Card Summary**

| | Pimpama River Catchment | | Coomera River Catchment | |
|---|---|---|---|---|
| Year | Score1 | Comments | Score1 | Comments |
| 2004 | C | • High nutrients and low dissolved oxygen levels above the weir<br>• Poor bank habitat in the upper estuary<br>• Some biological nutrient processing. | B | • Good water quality throughout<br>• Highly modified channel and river banks<br>• Some nutrient processing. |
| 2005 | C | • Total nitrogen values remain high in the upper reaches<br>• Poor dissolved oxygen and low pH levels in upper reaches<br>• Degraded riparian cover in upper reaches. | B+ | • Consistently good water quality over past three years<br>• Low sewage nitrogen levels<br>• Highly modified channel, banks and riparian habitat. |
| 2006 | C | • Total nitrogen values remain high in the upper reaches;<br>• Poor dissolved oxygen and low pH levels in upper reaches, likely associated with acid sulfate soils; and<br>• Poor riparian cover in upper reaches. | A- | • Consistently good quality over past four years<br>• Low sewage nitrogen levels<br>• Estuary resilient to pulses of poor water quality<br>• Highly modified channel and river banks. |
| 2007 | C+ | • Consistently elevated nutrient levels but improved dissolved oxygen levels above the weir<br>• Lower freshwater inputs from the catchment resulting in significantly higher salinity levels above the weir compared with 2006<br>• Extensive and intact natural riparian habitat in the inter-tidal zone with impacted background habitat in the reaches above the weir. | B | • Generally good water quality, but more stringent water quality guidelines lead to non-compliance for some indicators<br>• Heavily impacted riparian habitat throughout the estuary, particularly on the southern banks. |
| 2008 | C+ | • Decrease in dissolved oxygen concentrations compared to 2006-07 particularly in the upper reaches<br>• Higher freshwater inputs from the catchment resulting in much lower salinity levels compared to 2006-07<br>• Extensive and intact natural riparian habitat in the intertidal zone with impacted background habitat in the reaches above the weir. | B | • General good water quality throughout the system, elevated phytoplankton abundance and lower TP levels compared to 2006-07<br>• Lower salinity levels compared to 2006-07 due to increased freshwater inputs in January/February 2008<br>• Impacted riparian habitat in both ether intertidal and background zones throughout the system but especially on the southern side of the system. |

[1] Scoring system: 'A' Excellent, 'B' Good, 'C' Fair, 'D' Poor, 'F' Fail

**Pimpama River Catchment**

The Pimpama River catchment covers an area of approximately 171 km2 with a total stream network of 389 kilometres. The catchment extends from native bush and intensive agriculture in the upper and middle reaches to a highly developed urban landscape consisting of canal estates throughout the lower catchment. The Pimpama catchment drains to the Southern Moreton Bay catchment (Ramsar site see Section 3.2.6), adjacent to the Woogoomphah Island Conservation Park.

The IAS (Connell Wagner, 1995) describes the Pimpama River catchment as largely agricultural and subject to periodic inundation. Sections of the Pimpama River have been extensively channelized downstream of the proposed IRTC to aid drainage from the adjacent lands which are subject to sugar cane cultivation. Parts of the tidal lands and waters of the Pimpama catchment have been declared a Wetland Reserve.

**Coomera River Catchment**

The Coomera River catchment covers an area of 489 km2 at the southern end of the proposed IRTC. The 928 kilometre stream network meanders through a mixture of native bush, rural residential and grazing in the upper reaches to the largely urban landscape of the lower reaches. The Coomera River catchment drains the heavily developed and increasingly urbanised areas of Gaven, Helensvale, Oxenford, Coombabah and Hope Island before outflowing to the junction of the Broadwater and Southern Moreton Bay catchments.

The Coomera River catchment supports some of the largest areas of salt-marsh in South-East Queensland. Much of this important bird and marine habitat has been displaced and destroyed as a result of urbanisation and development. Much of Coomera Island, located at the mouth of the Coomera River, is gazetted as a Wetland Reserve.

**Groundwater**

Groundwater in the Jacobs Well / Coomera region is not widely utilised and as such, limited information regarding groundwater quality is available for the study area. Nevertheless, the likely groundwater resources can be inferred from the hydrogeological units typical of the region. Groundwater is likely to occur in both the Neranleigh-Fernvale Group and estuarine deposits mapped in the study area.

The nature of the Neranleigh-Fernvale Group is such that fractured hard rock aquifers are likely to exist with yields at approximately 60 metres. Groundwater quality is likely to be variable, ranging from unsuitable for any purpose to suitable for stock and domestic purposes. It is anticipated that the estuarine deposits contain substantial yields of groundwater in areas containing sands and gravels. Studies undertaken by others indicate that the aquifer contains a layer of freshwater overlaying saline water at depths ranging from 7 to 9 metres (Connell Wagner, 1995).

## 5.3 Legislation and Approvals

### 5.3.1 Water Quality Management

The Environmental Protection (Water) Policy 1997 (EPP (Water)) is the principal legislative basis for water quality management, providing a legislative framework for identifying environmental values (EV) for Queensland waters. The policy also sets water quality guidelines and water quality objectives (WQO) to enhance or protect the EV. The purpose of this framework is to provide a means in which consistent and equitable decisions can be made about Queensland waters that promote efficient use of resources and best practice environmental management.

A range of EV have been established for Queensland waters pursuant to the provisions of the EPP (Water). These values are considered the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses and as such need to be protected. To support the EV, a series of WQO, or targets, have been identified under Schedule 1 of the EPP (Water). WQO are long term water quality goals expressed as numerical concentration levels for a range of physico-chemical properties.

The Queensland Water Quality Guidelines (QWQG) are Queensland's primary guidelines for water quality management. The guidelines specify locally and regionally relevant water quality data for fresh, estuarine and marine waters based upon water quality data collected by the Department of Environment and Resource Management since 1992. Where more locally specific guidelines are required, the QWQG provide a framework for deriving regional / sub regional guidelines.

### 5.3.2 Waterway Barrier Works Permit

The *Fisheries Act 1994* provides the state's legislative framework for the regulation of fisheries, coastal areas important as fisheries habitat, and marine plants. The main purpose of the Act is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of Ecologically Sustainable Development.

Under the Act, construction of waterway barriers cannot be undertaken without addressing the requirement for fish passage. The construction of a waterway barrier can potentially obstruct the natural flow of the water body, and preclude the movement of fish both up and down stream. Section 76G of the Act provides specific criteria for the assessment of development applications for the construction or raising of waterway barrier works and the requirements for addressing fish passage. It is likely that a waterway barrier works permit will be required at all watercourses along the proposed corridor (refer to Section 3.2.6 for Aquatic environment description).

### 5.3.3 Tidal works

Tidal works are defined in the *Coastal Protection and Management Act 1995* (Coastal Act) as operational works in, on or above land under tidal water, or land that will or may be under tidal water because of development on or near the land.

"Prescribed tidal work" is a subset of "tidal works" defined in Part 4 of the Coastal Protection and Management Regulation 2003 as tidal works completely or partly within a "local government tidal area". The applicable local government tidal area for this project is the GCCC.

Prescribed tidal work is code assessable and would be assessed by the local government as prescribed tidal work against the Prescribed Tidal Work Code contained in schedule 4A of the Coastal Protection and Management Regulation 2003.

### 5.3.4 Summary of approvals and obligations

Table 5.2 below outlines the relevant legislation and approvals for surface and ground water.

**Table 5.2: Legislation and approvals – Surface and Ground water**

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Coastal Protection and Management Act 1995* | DERM and GCCC | Tidal works in, on or above land under tidal water, or land that will or may be under tidal water because of development – see Schedule of the Act for further definition.<br><br>[Part 3. (Coastal Management District) declaration of Coastal Management Districts, identified activities undertaken in these areas. Part 5 (Quarry Materials) relates to the allocation of quarry materials and obtaining these allocations. Part 6. Development of approvals for assessable development.] | Prescribed Tidal Works Permit / Allocation notice for removal of quarry material | 6-12 months | Works will be required in tidal areas for the project. The South East Queensland Coastal Management District Sheet 13.28 Pimpama shows the boundary of the district.<br><br>Prescribed tidal work applications that involve the removal of quarry material below the high water mark are required to be supported by a resource allocation notice from the DERM when lodged with the assessment manager. Refer to s73 of the Act. |

| | | | | | |
|---|---|---|---|---|---|
| *Environmental Protection Act 1994* | DERM | DTMR must comply with the general environmental duty not to undertake activities that cause or are likely to cause environmental harm unless all reasonable and practicable measures are taken to prevent or minimise the harm (s319). DTMR must also comply with more specific obligations imposed under the EP Act. | Compliance | N/A | The general environmental duty applies to all project activities.<br><br>The following environmental protection policies and subordinate legislation have been prepared under the EP Act and must be complied with and considered in preparing environmental management plans:<br>• Environmental Protection Regulation 2008<br>• Environmental Protection (Air) Policy 2008<br>• Environmental Protection (Noise) Policy 2008<br>• Environmental Protection (Waste Management) Policy 2000<br>• Environmental Protection (Waste Management) Regulation 2000<br>• Environmental Protection (Water) Policy 1997. |
| *Water Act 2000* / Water Regulation 2002 | DERM | Taking water from the waterways for the use in construction works (s 206). | Permit required to take water | 3 months | May be required during the construction phase of the Project, depending on the construction requirements. |

| | | | | | |
|---|---|---|---|---|---|
| *Water Act 2000* / Water Regulation 2002 | DERM | Destroying vegetation, excavation or placing fill in a watercourse, lake or spring if works are not in accordance with the Guideline for Activities in a watercourse, lake or spring carried out by an entity as part of Part 5 of the Water Regulation 2002 (s 814) | Riverine Protection Permit to do one or more of the following activities within a watercourse:<br>destroy vegetation;<br>excavate; or<br>place fill (s 269) | 3 months | A Riverine Protection Permit may not be required for the Project either because works do not occur within a watercourse or because of compliance with the relevant guideline discussed below.<br><br>DTMR is listed as an entity under Guideline - Activities in a watercourse, lake or spring carried out by an entity and is therefore exempt from this permitting requirement as long as activities are undertaken in accordance with the guideline.<br><br>However, where it is proposed to destroy an area of native vegetation greater than two hectares or excavate or place fill to a volume greater than 5,000 cubic metres DTMR should notify the local office of DNRW at least five (5) business days before commencement of the activity. |
| *Water Act 2000* / Water Regulation 2002 | DERM | Any removal of quarry material in or from watercourse (which is upstream of where the high spring tide ordinarily flows and reflows). | Development application and allocation notice to remove quarry material in or from a watercourse | 6 months | A development application for the removal of quarry material must be accompanied by an allocation notice granted under s 283 of the Act. |

| | | | | | |
|---|---|---|---|---|---|
| *Water Act 2000* / Water Regulation 2002 | DERM | Diversion of a watercourse | Water licence to interfere with the flow of water (watercourse diversion) | Up to 6 months | It is likely that a watercourse diversion permit will be required for the construction of numerous cross drainage culvert culverts for the IRTC North. A water licence would be granted under s 206 of the Water Act and the associated operational works are assessable development under Schedule 3, Part 1, Table , Item 3 of the *Sustainable Planning Regulation 2009*. |

## 5.4 Potential Impacts

The IRTC has the potential to impact upon surface and groundwater quality resulting from increased nutrient and sediment loads, contamination from spills and disturbance of hydrological regimes. Additionally, parts of the proposed corridor are mapped as environments where actual and potential acid sulfate soils occur. The most vulnerable environments within and downstream from the study area include Moreton Bay, Coomera and Pimpama River Fish Habitat Area, Pimpama River Conservation Area, the Woogoomphan Island Conservation Park and the Pimpama and Coomera Wetland Reserves.

As the runoff from both construction and operation of the IRTC has the potential to impact wetlands with high conservation significance and fisheries resources, the management of runoff has particular importance.

The most likely impacts on water quality from the proposed IRTC include:

- Marginal increase in the impervious portion of the Pimpama and Coomera catchments
- Increase in sediment loads, particularly during the construction phase
- Increase in heavy metals, oils and greases in the catchments during the operational phase
- Acidification due to potential disturbance of acid sulfate soils, particularly around low-lying areas associated with the Coomera River
- Associated physico-chemical changes of watercourses, including reduced dissolved oxygen, heavy metal release etc
- Altered overland flow paths.

Given that the Pimpama and Coomera River catchments are highly disturbed, water quality within the study area is already affected by poor quality run-off and drainage waters. However, impacts associated with the construction and operation of the IRTC can be limited with the implementation of appropriate control measures.

Potential impacts to groundwater include hydrocarbon contamination of the recharge zone. Groundwater flows may also be impacted where construction disturbs low-lying areas, with shallow groundwater tables.

## 5.5 Recommendations

It is recommended that to protect the environmental values of the watercourses of the study area and those areas of environmental importance downstream, that the design of the alignment and drainage use Water Sensitive Urban Design (WSUD) principles to ensure that stormwater is managed and treated prior to discharge. Detailed hydrological and hydraulic analyses will be undertaken during future design stages. Table 5.3 below describes some of the treatment options that are available and recommended and notes some considerations that must be made when selecting the relevant treatment. More detail on the proposed control measures will be developed as part of the conceptual engineering studies for this project. Potential sites for treatment devices will be documented on the RCDP layout plans following selection of the preferred option.

As a result of the high potential for ASS disturbance and exposure, it is recommended that a detailed ASS investigation be undertaken to accurately baseline the presence and distribution of ASS's potentially impacted by the IRTC and a strategy for management be developed during planning and design.

**Table 5.3: Options and considerations for the treatment of run-off waters**

| Treatment Option | Description | Considerations |
|---|---|---|
| Gross Pollutant Traps (GPT) | A means of screening stormwater run-off, used to prevent large waste items from entering local waterways.<br><br>Traps may screen inlet/out-fall pipes or straddle channels.<br><br>Traps can store collected items above (dry) or below (wet) standing water levels. | Smaller, suspended and dissolved pollutants are not contained by GPTs.<br><br>Regular cleaning and maintenance is required. Wet load traps are more maintenance intensive with suction equipment required for cleaning and all waste water classified as toxic liquid.<br><br>Decomposition of, or reactions between trapped pollutants may exacerbate the pollution problem if cleaned infrequently. |
| Sedimentation Basins | A small pond, about 1 m deep, designed to capture sediment >125 µm prior to waters entering a downstream treatment system (e.g. constructed wetland or bioretention basin).<br><br>Treatment through settling of suspended particles. | Sufficient land availability – must be designed to ensure detention time is adequate for pollutant removal.<br><br>Maintenance and accessibility – low maintenance costs when compared in isolation to other options; includes removing trash and debris, mowing, unclogging the outlet control device and removing accumulated sediment from the pond floor.<br><br>Does not remove some pollutants, e.g. <125 µm sediments and nutrients.<br><br>May harbour water-borne pest species, e.g. mosquitoes and cane toads. |

| Treatment Option | Description | Considerations |
|---|---|---|
| Grass Swales | Broad, shallow channel with a dense stand of vegetation covering the side slopes and bottom.<br><br>Can be natural or man-made and are designed to trap particulate pollutants (suspended solids and trace metals), promote infiltration and reduce flow velocity of run-off. | Impractical in areas with flat grades or steep topography, with slope gradients no greater than 1:3 recommended.<br><br>Gravelly and coarse sandy soils that cannot support dense vegetation should be avoided. Alkaline soils should be used to promote the retention of metals. Soil infiltration rates should exceed 0.2 mm/sec.<br><br>Not effective, and may even erode, when flow volumes and/or velocities are high (greater than 140 L/sec).<br><br>Fine, close-growing, water-resistant vegetation is necessary e.g. a grass-legume mix.<br><br>Infiltration through the swale may transport pollutants into the local groundwater system.<br><br>May harbour water-borne pest species, e.g. mosquitoes and cane toads. |
| Hydrodynamic Separators | Flow-through structures with a settling or separation unit to passively remove sediments and other pollutants. Separation by swirl action or indirect filtration. | Most effective with the removal of heavy, precipitating particulates or lighter floatables which can be captured. Dissolved or suspended pollutants are less effectively removed.<br><br>Proper maintenance required for effective operation involving frequent inspections throughout the first year of installation.<br><br>When reaching capacity, units require emptying by sump vac or vacuum truck.<br><br>Units are less suited to wet weather operation due to the variability of net solids removal.<br><br>Appropriate soil depth and stability required to support the unit structurally. |

| Treatment Option | Description | Considerations |
|---|---|---|
| Bio-retention Basins | A vegetated bed of filter material, such as sand and gravel, designed to capture stormwater run-off which then drains through the filter media.<br>Pollutants are removed by filtration and biological uptake of nutrients. | Sufficient land availability - must be designed to ensure detention time is adequate for pollutant removal. Further investigation required.<br><br>Maintenance and accessibility – higher maintenance costs when compared to sedimentation basins alone; additional maintenance activities include vegetation pruning, weed removal, routine inspections for scouring and/or blockages and occasional replacement of filter media to prevent clogging.<br><br>Greater removal of dissolved and suspended pollutants.<br><br>Less ponding of water reduces likelihood of harbouring water-borne pest species. |
| Constructed Wetlands | Shallow, vegetated water bodies.<br>Use enhanced sedimentation, fine filtration and biological uptake processes to remove pollutants. | Sufficient land availability – must be designed to ensure detention time is adequate for pollutant removal (48-72 hours for nutrients).<br><br>Maintenance and accessibility – moderate maintenance costs when compared to sedimentation basins and bioretention basins; requires regular inspections, vegetation management and occasional de-silting through excavation.<br><br>Some potential for harbouring water-borne pest species, depending on the effectiveness of maintenance regime in reducing long-term ponding.<br><br>Provides potential habitat for many wetland bird species. |

Particular attention should be made during the design phase of the project to ensure adequate protection of the watercourses crossed by the proposed road corridor. This is particularly important in areas of the alignment that are close to significant habitats downstream (e.g. Coomera Fish Habitat Area, Coomera River, Pimpama River, Moreton Bay Ramsar Site). This may include the provision of spill containment devices to ensure that harmful chemicals and pollutants cannot significantly impact on the downstream environmental values listed above. Specified containment volumes have been set by Government agencies in the past to ensure environmental protection on previous road projects, such as the Townsville Port Access Road – Eastern Access Corridor.

Importantly, these issues should be considered to ensure that adequate land is resumed to allow for large water quality treatment structures (e.g. Sediment basins) (Refer to **Appendix B**, Figure 11). Additionally, the provision of these devices will provide a cost implication on the IRTC if required for all major watercourse crossings.

The management of drainage particularly in the context of the high potential for ASS to be encountered in the IRTC project area is an issue that will required detailed mitigation measures (refer to Section 0).

## 5.6 Conclusion

The impact of the proposed road corridor on the surface and ground water environmental values are likely to be limited to the construction phase of the project where disturbance is required within and around watercourses. Operational impacts are likely to be mitigated by the inclusion of water quality treatment devices highlighted in Section 5.5. Additionally, if spill containment devices are incorporated into the water quality treatment regime the operational impact on the water quality of the study area and downstream areas should be negligible.

Numerous water quality treatment options are available however these may require a large area to facilitate the appropriate treatment prior to release to the environment. The acquisition of additional land may be required and this will be assessed by the engineering team as the concept design is progressed.

# 6.0 Aboriginal Cultural Heritage

## 6.1 Methodology

AECOM has completed a due diligence assessment of the IRTC's potential Aboriginal cultural heritage values and constraints.

This assessment has been completed with reference to the *Aboriginal Cultural Heritage Act 2003* (Qld) and the gazetted cultural heritage duty of care guidelines. Its aim is to determine the potential risk of the IRTC impacting any Aboriginal cultural heritage values.

A methodology was developed to support this task that was specific to the IRTC and utilised AECOM's experience and knowledge of Aboriginal cultural heritage management.

The assessment included:

- A review of previous reports of the proposal area
- A search of the Department of Environment and Resource Management (DERM) Aboriginal and Torres Strait Islander Cultural Heritage Database and Register
- Consultation with DTMR representatives
- A review of available aerial photography (2009).

These tasks were completed through a desktop study of available resources only. No ground survey or field inspection was undertaken by a cultural heritage specialist and no consultation with Aboriginal party(s) for the area was undertaken.

Through this methodology known and potential sites and places of Aboriginal cultural heritage significance have been identified.

Recommendations have been made to ensure compliance under the legislation and to appropriately manage potential adverse impacts to Aboriginal cultural heritage should the project proceed.

## 6.2 Description of Environmental Values

### 6.2.1 Database and Register Search

AECOM undertook a search of DERM Aboriginal and Torres Strait Islander Cultural Heritage Database and Register. The search was conducted using Lot on Plan details found within the IRTC.

The sites in Table 6.1 are on the register and database:

**Table 6.1: Aboriginal Cultural Heritage Database search results**

| Site Id | Latitude | Longitude | Record Date | Attribute |
|---|---|---|---|---|

NR

**Appendix B**, Figure 12 also demonstrates the location of these items in relation to the IRTC. This figure provides a broad overview of the project region and the distribution of the artefacts, for a more detailed location of the artefacts refer to the RCDP layout plans.

DERM also advised that the Aboriginal parties for the area are:

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### 6.2.2 Review of Previous Reports

**South Coast Motorway Southern Section; Impact Assessment Study, Prepared for Queensland Transport, South Coast-Hinterland District by Connell Wagner, April 1995**

This report identified 9 sites where Aboriginal artefacts were located and one site where an intact bora ring was identified. There was no record in this report of consultation with or involvement of the Aboriginal party(s) for the area as part of this assessment.

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### 6.2.3 Review of Aerial Photography

NR

### 6.2.4 Due Diligence Assessment

Section 28 of the Act states that the Minister "may gazette cultural heritage duty of care guidelines" to identify reasonable and practicable measures for ensuring activities are managed to avoid or minimise harm to Aboriginal cultural heritage.

The duty of care guidelines identify 5 categories under which an activity can be classified. The five categories are:

- Category 1 relates to activities involving no surface disturbance
- Category 2 applies to activities that will cause no additional surface disturbance and as such will not result in additional harm to Aboriginal cultural heritage to that which has already occurred
- Category 3 activities occur in developed areas

- Category 4 activities are those that may occur in an area that has been subject to significant ground disturbance, but where there is a possibility in some cases that residual cultural heritage significance may reside in these areas
- Category 5 areas include all other activities that do not fall within these four categories.

Using the results of the desktop study, significant areas of the IRTC have been assessed to be Category 4 or Category 5 areas under the duty of care guidelines. These areas are shown on **Appendix B**, Figure 13.

## 6.3 Legislation and Approvals

### 6.3.1 Aboriginal Cultural Heritage

The *Aboriginal Cultural Heritage Act 2003* (ACH Act) was enacted to protect Aboriginal cultural heritage and establish mechanisms to assess and manage land use activities that may impact on cultural heritage.

The ACH Act establishes a cultural heritage duty of care for all land users, such as DTMR, to take all reasonable and practicable measures to ensure activities do not harm Aboriginal cultural heritage. Traditional owners have a key role in assessing and managing their cultural heritage.

Cultural Heritage Duty of Care Guidelines were prepared under Section 28 of the ACH Act to identify reasonable and practicable measures for ensuring activities are managed to avoid or minimise harm to Aboriginal cultural heritage. A due diligence assessment in accordance with these Guidelines is outlined in Section 6.2.4.

Recommendations to assist DTMR in compliance with obligations under the ACH Act are contained in Section 0.

### 6.3.2 Native Title

The *Native Title (Queensland) Act 1993* and the *Commonwealth Native Title Act 1993* recognise native title in relation to land and prescribe the impacts of past land tenure on the existence of native title.

Any areas of non-freehold land affected by the alignment have the potential to be subject to Native Title. A tenure history search will be required to identify all areas within the IRTC where native title has not been extinguished. Subsequently, a Section 24KA Notification – Facilities for Service to the Public will be required for all areas where native title has not been extinguished.

## 6.4 Potential Impacts

Based on the desktop research completed as part of this due diligence assessment, there is potential for the proposed IRTC to adversely affect Aboriginal cultural heritage values. As part of this assessment, no ground survey was undertaken by a qualified heritage professional. However, this desktop review is based on accepted heritage assessment methodology.

The review of available aerial photography determined there are substantial areas of the IRTC that may have a high potential for the discovery of Aboriginal cultural heritage.

Supporting this, previous investigations and reports have identified and recorded places of Aboriginal cultural heritage significance within or close to the proposed IRTC.

Correspondingly, the majority of the IRTC has been assessed to be Category 4 or Category 5 areas under the duty of care guidelines.

As such, there is a potential that the area's Aboriginal cultural heritage may be adversely affected by the IRTC. Potential impacts during the construction and operation phase of the IRTC and their affects include, but are not limited to those listed in Table 6.2 below:

**Table 6.2: Potential impacts of the IRTC on the Aboriginal cultural heritage values**

| Impact | Example of Features Affected | Affect | Likelihood |
|---|---|---|---|
| Sub-surface disruption | • Archaeological evidence<br>• Ceremonial places<br>• Burials<br>• Occupation sites<br>• Quarries and artefact scatters<br>• Grinding grooves<br>• Wells | • Destruction of places of Aboriginal cultural heritage<br>• Damage to places of Aboriginal cultural heritage<br>• Destruction of residual evidence of places of Aboriginal cultural heritage significance. | Likely. Unless areas where sub-surface disruption will take place are identified and appropriate cultural heritage surveys are undertaken there is potential for inadvertent, adverse affects to Aboriginal cultural heritage. |
| Clearing and Grubbing | • Scarred or carved trees<br>• Areas of biogeographically significance<br>• Particular types of native vegetation. | • Removal of scarred or carved trees<br>• Disturbance of culturally significant landscapes<br>• Disturbance of culturally significant native vegetation. | Likely. Unless vegetation and flora of cultural significance are identified there is a high potential for inadvertent adverse impacts to Aboriginal cultural heritage during clearing and grubbing stages. |
| Severance of Traditional Owners access to culturally significant sites | • Ceremonial sites<br>• Boras<br>• Caves<br>• Other culturally significant places | • Construction of new road line may sever access to places of cultural significance for traditional owners. | Likely. The proposal will result in the provision of a new road meaning there are potential affects caused by severance of access to any identified culturally significant places. |
| Introduction of new environmental elements into the area | • Culturally significant landscapes. | • The introduction of new visual, noise, and air quality impacts into the environment may affect culturally significant landscapes | Likely. The IRTC calls for the construction of a new road meaning there are potential affects to the environmental setting of the area surrounding the IRTC. |

## 6.5 Recommendations

In order to ensure DTMR complies with its obligations under the legislation it should consider the following two recommendations:

1) Identify and consult with the Aboriginal party(s) for the proposed IRTC to discuss the appropriate management strategies for the project area's cultural heritage
2) Arrange for a survey of all previously identified areas of cultural heritage significance and areas that are identified as Category 4 and Category 5 according to the duty of care guidelines.

Adopting such an approach will ensure compliance with legislation and foster a good working relationship with Aboriginal parties for the project area.

In relation to Native Title, a Section 24KA Notification – Facilities for Service to the Public is recommended for all areas where native title has not been extinguished.

## 6.6 Conclusion

This desktop review has determined there is the potential for adverse affects on Aboriginal cultural heritage in the IRTC.

Existing information including the DERM register and database, aerial photography, and previous reports, revealed that significant areas of the proposed IRTC contain identified Aboriginal cultural heritage and have the potential to retain other, unidentified residual cultural heritage.

Should there be no mitigation measures implemented to identify and provide appropriate management recommendations for these areas there is potential that Aboriginal cultural heritage will be harmed.

To mitigate these potential adverse affects this study recommends that consultation with the Aboriginal parties for the area takes place, and an Aboriginal cultural heritage survey of the areas with IRTC categorised under Category 4 and Category 5 of the duty of care guideline be commissioned. This process and the results of the survey are likely to need to be formalised into a heritage management agreement between DTMR and the Aboriginal parties for the area.

# 7.0 Historic Cultural Heritage

## 7.1 Methodology

A desktop review was undertaken to determine the potential for items of historic cultural heritage significance to be affected by the IRTC. The desktop review included:

- Searches of appropriate registers
- A review of relevant studies and contextual histories
- A review of the relevant planning scheme
- An assessment of the potential for the discovery of previously unknown sites of heritage significance.

This assessment was undertaken with reference to the *Queensland Heritage and Amendments Act 1992*, Using the Criteria: A Methodology, and the Burra Charter.

## 7.2 Description of Environmental Values

This section includes a contextual history of the IRTC Study Area and the results of heritage register searches. A contextual history is an important part of the process of making informed judgements regarding the potential heritage values of a proposed project site. The history provides insight into the vital underlying historical influences that have shaped and continue to shape the North Gold Coast area and its potential heritage values.

### 7.2.1 Contextual History

Much of the area between the Logan and Coomera Rivers was part of the original 20,000 acre run taken up by William Duckett White during the 1850s. A small settlement was established on Pimpama River around 1860 until it was abandoned in favour of a new site on Hotham Creek (DEWHA 2009a). Settlers around the Pimpama area during the 1870s began the cultivation of Arrowroot, as the climate was ideal for this crop. (DEWHA 2009b)

Original agricultural activity in the region included experiments with cotton and sugar growing during the American Civil War (DEWHA 2009a). With the advent of the South Coast Railway line in 1889 the towns of Pimpama and Ormeau became stops on the line leading to some urban growth in the area and the provision of related community services (Fass, 5).

By 1908 the region that included Nerang, Ormeau, Pimpama, and Yatala was supplying almost all of the arrowroot in Australia, all of which was being processed at the nearby mill run by Fred Klienschmidt (DEWHA 2009b). Arrowroot cultivation continued to grow in the early decades of the twentieth century reaching a peak in 1939 with 357 hectares under cultivation. (DEWHA 2009a).

By the 1950s Arrowroot production began to decline due to intensive labour costs and the importation of less expensive West Indian arrowroot (DEWHA 2009a).

Much of the current project area's development since the 1950s has been typified by agricultural land use. Intermittent areas of residential and industrial land use have developed to support the increase in population and activity in the wider Gold Coast region.

Today, the suburbs of Staplyton, Pimpama, Ormeau, and Coomera feature low density residential development and associated community infrastructure, some rural-residential land uses, and sporadic industrial development.

### 7.2.2 Register Searches

To identify existing places or sites of historic cultural heritage significance, a search of the relevant registers for the suburbs of, Staplyton, Pimpama, Ormeau, and Coomera was conducted. The registers searched were:

- World Heritage List
- National Heritage List
- Commonwealth Heritage List
- Register of the National Estate
- Overseas Places of Historic Significance to Australia
- Places under consideration, or that may have been considered for, any one of these lists

- Queensland Heritage Register
- Gold Coast Regional Council Planning Scheme.

Table 7.1 lists the places listed on the heritage registers in the vicinity of the study area and their locations are illustrated in **Appendix B**, Figure 12.

**Table 7.1: Places listed on the Queensland Heritage Register in the study area**

| Suburb | Name of Place | Register and identification number | Location | Status | Distance from Study Area |
|---|---|---|---|---|---|
| Willow Vale | Laurel Hill Farmhouse | Queensland Heritage Register (6001936) Register of the National Estate (102004) | Ruffles Road | Indicative Place | 5.75 km |
| Pimpama | Pimpama & Ormeau War Memorial | Queensland Heritage Register (600004) Register of the National Estate (15804) | Pacific Highway, Pimpama | Indicative Place | 3.35 km |

### 7.2.3 Potential Places of Historic Heritage Significance

The Queensland Cultural Heritage Places Context Study was commissioned to assist the identification of potential places of heritage significance throughout Queensland as part of the State Wide survey. The current study area is a part of the South Coast (SEQ South) Region and the Context Study identified seven key themes for further investigation.

Those themes that relate directly to the current study area are:

- Pastoral development in hinterland in 1840s and 1850s
- Closer settlement in Coomera district 1860s
- Sugar industry commenced in Coomera.

Future environmental and heritage assessment of the project area should ensure that any places that may exhibit characteristics related to these themes should be identified and assessed by a suitably qualified heritage professional.

## 7.3 Legislation and Approvals

### 7.3.1 Historic Cultural Heritage

The *Queensland Heritage Act 1992* (QH Act) protects Queensland's cultural heritage that is not protected under the ACH Act.

Section 71 of the QH Act applies to development by the State if the development is in relation to a registered place. If a registered place is going to be affected by a development, DTMR should provide the Queensland Heritage Council with a report on the proposed development. The following sections discuss the potential of the project to affect registered places.

There is also an obligation under Section 89 of the QH Act to report the discovery of an archaeological artefact to the Chief Executive of the DERM, stating where it was discovered and including a description and photograph (s.89).

## 7.4 Potential Impacts

Due to the distance of known places of historic cultural heritage significance to the proposed IRTC North alignment it is considered unlikely that there will be direct or indirect adverse affects on these places as a result of the proposal.

## 7.5 Recommendations

The relative distance of identified places of historic heritage significance from the proposed alignment means there will be no adverse effects on these places' environmental setting, current amenity, or physical fabric. Consequently, there are no historic cultural heritage issues identified in this SREF that would preclude the development of the proposed road corridor.

In regard to unknown places of heritage significance, all site personnel should be made aware of their obligation under the *Queensland Heritage Act 1992* to report the discovery of an archaeological artefact to the Chief Executive of the DERM, stating where it was discovered and including a description and photograph (s.89).

However, due to the ongoing State-Wide survey and recent amendments to the QHA there is potential for the identification and registering of previously unidentified places of historic heritage significance within or close to the IRTC. The DERM State-wide survey is designed to identify places of historic heritage significance throughout Queensland. As a result of this survey, previously unknown or unidentified places of state heritage significance may be entered onto the Queensland Heritage Register.

Recent amendments to the QHA require local government authorities to keep a register of places of local heritage significance. This register will be deemed to be part of the planning scheme. As a result there is the potential that places of local heritage significance may be identified within or close to the IRTC.

New entries to either the Queensland Heritage Register or the Gold Coast Regional council planning scheme should be considered as part of any future environmental assessment.

## 7.6 Conclusion

This historic cultural heritage assessment has considered the potential impact on identified and potential heritage places as a result of the proposal.

A search of relevant National, State, and local registers indicates that there are 2 places identified in the suburbs that the IRTC will pass through. However, none of these places of heritage significance have the potential to be affected either directly or indirectly by the IRTC.

Additionally, a review of previous reports and contextual histories, and an assessment of potential places of heritage significance, failed to identify any places or values of historic heritage significance that may be adversely affected by the proposal.

Based on the findings of the research undertaken, the IRTC is highly unlikely to have an adverse affect on the cultural heritage places and values.

# 8.0 Sustainability and Climate Change

## 8.1 Project overview

The latest scientific evidence confirms that Queensland is highly vulnerable to the potential impacts of climate change. At an international level, the built environment of South East Queensland is recognised as being vulnerable to impacts associated with sea level rise, storm surges and floods.

There is growing evidence that early action in response to climate change is more cost-effective than delayed action or no action at all. This is particularly relevant for road infrastructure, which is a long-lived investment that is often designed, constructed and maintained based on historical climate information. It is often not possible to easily or cost-effectively retrofit assets – such as bridges and tunnels – that are already in place. It is almost certain that these structures will be affected by changing climatic conditions during their lifetimes. Given that they cannot be readily modified, it is important that the potential impacts of climate change are understood and appropriately accounted for during the planning and design process.

This section provides an overview of:

- The relevant legislative frameworks that may impact the sustainability and climate change outcomes of the project
- The latest climate change science and the range of potential climate change risks that may be relevant to the IRTC
- Potential adaptation opportunities in planning, design, construction and operational phases to reduce the risk to climate-related impacts on the IRTC.

## 8.2 Project methodology

A desktop assessment was undertaken to identify how the project may be affected by climate change. This primarily involved reviewing current climate change science to identify likely risks and adaptation opportunities. Key references included:

- Climate Change Assessment of the Pacific Motorway (Nerang to Tugun) Upgrade – Draft Climate Change Risk Assessment Workshop Background Paper (AECOM 2009)
- Climate Change in Australia (CSIRO & BOM 2007)
- Climate Change in Queensland: what the science is telling us (OCC 2008)
- Garnaut Climate Change Review (CCA 2008)
- IPCC Fourth Assessment Report (2007)
- Infrastructure and Climate Change Risk Assessment for Victoria (CSIRO *et al* 2007)
- Briefing: a post-IPCC AR4 update on sea-level rise (Church *et al* 2009)
- Queensland climate change and community vulnerability to tropical cyclones: Oceans hazards assessment – Stage 3 (Hardy *et al* 2004)
- Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts (Luca *et al* 2007).

## 8.3 Legislative Frameworks

A summary of relevant legislative frameworks, both present and emerging that has the potential to influence and prescribe sustainability reporting requirements for IRTC, is summarised below.

For the purposes of this report, sustainability reporting has been interpreted to include broader sustainability reporting as well as reporting on greenhouse gas emissions.

### Overview

In Australia, there is no legal requirement for corporations, projects or facilities to report sustainability performance, although various sustainability frameworks exist and may be applied by IRTC. Various codes, standards and guidelines have evolved and are considered important for achieving comparability, reliability and relevance in sustainability reports. They also serve to protect against self bias by making reports more robust and consistent. Examples of sustainability reporting guidelines include:

1) Global Reporting Initiative (GRI) G3 Sustainability Reporting Guidelines – provides a generalised reporting format of guidelines and delineates boundaries in the process of sustainability reporting with respect to an organisation's economic, environmental and social performance. It also includes standard disclosures comprised of performance indicators and other disclosure items. Preparing a sustainability report along the GRI may be a useful tool for engaging with stakeholders throughout the project. IRTC will need to ensure that reporting is supported by appropriate systems that collect and monitor data and measure performance.
2) AA1000 Assurance Standard – is a tool to support assurance for sustainability reporting that was developed to align with, and to complement, the Global Reporting Initiative (GRI), as well as other related standards. Reporting against the AA1000 is based around the application of the principles of materiality, completeness and responsiveness. It should be used as a guide for Boards and directors in their oversight of financial disclosures. It also provides stakeholders with a yardstick to assess the integrity and quality of a report's assurance and corresponding reporting.

Alignment with these guidelines and standards imposes certain obligations on the reporting organisation, and to be done well, must be supported by a management system that provides for effective data collection, monitoring and measurement. IRTC will need to decide whether sustainability reporting in accordance with the frameworks outlined above is relevant to the proposed project. Sustainability reporting may provide significant long term benefits by communicating the positive environmental, social and economic outcomes of the development while mitigating potential financial, regulatory and political risks associated with the proposed activities.

### Greenhouse gas reporting

IRTC will potentially be impacted by the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and the proposed Carbon Pollution Reduction Scheme (CPRS).

#### National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) established a national system for reporting greenhouse gas emissions, energy consumption and production by corporations from 1 July 2008. Data reported under the NGER Act will underpin the Australian Government's proposed Carbon Pollution Reduction Scheme (CPRS). Monitoring, reporting and auditing of corporations' greenhouse gas emissions data will be essential to maintain the environmental and financial integrity of the CPRS.

IRTC may trigger the NGER Act reporting threshold for greenhouse gas emissions, that is, the project may exceed 25,000 tonnes of $CO_2$-equivalents per year. For this reason, it is recommended that IRTC maintain a watching brief on future amendments in legislation that could result in changes to the reporting threshold and legislative requirements. These changes may result in the inclusion of other activities that are currently exempt from this reporting responsibility.

#### Carbon Pollution Reduction Scheme

The proposed CPRS is a 'cap and trade' emission trading scheme aimed at achieving substantial greenhouse gas emissions mitigation at the lowest possible cost, by introducing a financial cost for emitting greenhouse gases. It is an incentive for large emitters to reduce their greenhouse gas emissions. The proposed CPRS is aligned with the Government's commitment to reduce Australia's greenhouse gas emissions by 60 percent below 2000 levels by 2050 and by 5-25 percent below 2000 levels by 2020.

The overall number of carbon pollution permits available nationally is capped based on the greenhouse gas emission reduction for the designated year, and is reduced over time. Emitters can purchase carbon pollution permits from monthly Federal Government auctions, the proposed CPRS compliant 'opt in' forestry projects, other entities that have excess permits and/or eligible overseas abatement permits (such as the Certified Emission Reductions from the Clean Development Mechanism under the Kyoto Protocol and the Emissions Reduction Units from a joint venture under the Kyoto Protocol).

The project may potentially impact IRTC's responsibilities under the CPRS if emission thresholds are triggered. At this stage of the proposal, there is insufficient information to determine whether these emissions thresholds are likely to be triggered. Ultimately, this can have significant economic implications. Given the primary purpose of the CPRS is to reduce emissions, it is recommended that IRTC also consider this an objective of the proposal, aiming to minimise carbon emissions and avoid impacting existing carbon sinks along the corridor.

## 8.4 Climate Change Variables

### 8.4.1 Latest Climate Change Science

Since 1990, the Intergovernmental Panel on Climate Change (IPCC) has provided regular scientific assessments of past, present and future climate. Four scientific assessments have been undertaken to date – in 1990, 1996, 2001 and 2007.

The IPCC Fourth Assessment Report (IPCC, 2007) concluded that:

- Warming of the climate system is unequivocal
- Most of the warming in the past 50 years is 'very likely' (more than 90% in probability) due to the observed increase in greenhouse gas concentrations from human activities such as the burning of fossil fuels and land use change
- It is 'very likely' that changes in the global climate system will continue well into the future, and that they will be larger than those seen in the recent past.

In October 2007, the CSIRO and the Australian Bureau of Meteorology (BoM) released Climate Change in Australia — Technical Report 2007 which provides the most recent climate change projections for Australia. The report was based upon international climate change research including the latest IPCC conclusions, and built on a large body of climate research for the Australian region.

The climate change projections presented in this report are drawn from both these reports.

Climate change projections have been developed using many climate models and a range of scenarios of future global greenhouse gas emissions which have been produced by the IPCC. Emission scenarios are based on various assumptions about demographic, economic and technological driving forces likely to influence the level of emissions in the future. These emission scenarios are then used to 'force' the climate models and projections of possible future climatic conditions are derived.

However, there are uncertainties within the models, especially for 2070 because it is harder to predict greenhouse gas emission rates that far into the future. Therefore there is greater certainty about projections for 2030 than 2070. For this reason, the projections for 2030 are usually based on a mid-range emissions scenario, whereas for 2070, low and high emissions scenarios are given.

There are also differing levels of confidence of the various climatic variables in future climate change projections as described in Figure 8.1. For example, there is greater uncertainty with rainfall projections than with temperature projections. This is because there is a direct relationship between greenhouse gas concentrations and temperature, whereas rainfall depends on what happens to general atmospheric circulation.

The latest climate change projections suggest that the future climate of eastern Australia will generally be characterised by:

- Lower average rainfall
- More intense extreme rainfall events
- Higher sea level and storm surge events
- Higher average temperatures

- More frequent occurrence of extreme temperatures
- More frequent extreme fire danger days (CSIRO and BoM, 2007).

Small changes in annual and seasonal temperature and rainfall conditions can be associated with large changes in extreme weather events, such as heatwaves, storms, stronger winds, increased lightning and higher intensity rainfall, which are potentially of greater significance than changes in average conditions. Changes in extreme weather events that are projected for eastern Australia include:

- An increase in the frequency of hot days and warm nights, and a decrease in the frequency of cold nights
- An increase in both daily precipitation intensity (rain per rain-day) and the number of dry days, leading to longer dry spells interrupted by heavier rainfall events
- El Niño events becoming drier and La Niña events becoming wetter (CSIRO and BoM, 2007).

Consistent with scientific literature on climate change risks, it can be expected that there will be changes in the flood, bushfire, and storm risk associated with the above changes in average climate conditions and extreme weather events.

There is more confidence in temperature projections than rainfall projections because there is a direct relationship between atmospheric greenhouse gas concentrations and temperatures.

**Very high confidence**
- Higher temperatures and changes in extreme temperatures
- Global sea-level rise
- Declining soil moisture

**High confidence**
- Direction of rainfall change (decreasing)
- Increasing potential evaporation (actual depends on many factors)
- Increasing storm-surge heights and the risk along the east coast of Queensland
- Increasing cyclone intensity
- Increasing temperatures at the regional scale, including extremes

**Medium to high confidence**
- Increased risk of bushfire
- Increased incidence of extreme rainfall

**Medium confidence**
- Overall amount of rainfall decline and seasonality of that change
- Changes in average stream flow
- Increased drought

**Low confidence**
- Abrupt or irreversible changes such as melting of polar ice sheets and changes in global ocean currents

**Figure 8.1: Climate Change Confidence Levels (Department of Natural Resources and Mines, 2005)**

## 8.5 Projected Climate Change

The climate change projections that have been used in identifying potential climate change risks for the IRTC proposal are for time-periods centred on 2030 and 2070. Projections are relative to a 1990 baseline. Projections for 2030 are for a mid-range emissions scenario. Beyond 2030, changes become more dependent on future greenhouse gas emissions. As a precautionary approach, projections for a high emissions scenario are given for 2070.

Although the projections give an estimate of the average climate around 2030 and 2070, individual years can vary markedly within any climate period. Therefore, the values can be taken as representative of the decade around the single year stated – for example, projections for 2030 are representative of the time-period 2026 – 2035. Even then, natural variability may also modify the actual means for the decade, particularly for a small region.

Projections for a range of climate variables are illustrated graphically on a State-wide basis in the following sections. Table 8.1 also provides more specific information for Brisbane. The projections provided for Brisbane are indicative of the climate conditions that could be anticipated in the surrounding areas and can be used as a proxy for the Gold Coast.

### 8.5.1 Temperature

In Queensland, it is projected to be warmer on average, although coastal regions may warm less quickly due to the moderating influence of the ocean.

Projected annual temperature increases for Queensland for 2030 and 2070 are provided in Figure 8.2.

By 2030, annual average temperatures in Queensland's coastal areas are projected to increase by about 0.9°C relative to the climate of recent decades. Inland areas are projected to increase by about 1.1°C.

By 2070, annual average temperatures are projected to increase by about 1.7°C across the state under a low emissions scenario but as high as 3 °C under a high emissions scenario, with warmings slightly larger in the south-west.

The declining trends in extremely cold temperatures and increasing trends in extremely hot temperatures are expected to continue in the future across the State.

It is important to note that associated with the warming is a projected strong increase in frequency of hot days and warm nights (CSIRO and BoM, 2007).

**Table 8.1: Projected best-estimate climate changes for Brisbane**

| Climatic variable | Season | 2030 | 2070 |
|---|---|---|---|
| Temperature (°C) | Annual | +1 | +3.1 |
| | Summer | +0.9 | +3 |
| | Autumn | +0.9 | +3 |
| | Winter | +1 | +3.1 |
| | Spring | +1 | +3.2 |
| No. days over 35°C (current 1.0) | Annual | 2.0 | 7.6 |
| Rainfall (%) | Annual | -3 | -9 |
| | Summer | -1 | -3 |
| | Autumn | -3 | -9 |
| | Winter | -6 | -18 |
| | Spring | -6 | -18 |
| Potential evaporation (%) | Annual | +3 | +11 |
| | Summer | +3 | +11 |
| | Autumn | +4 | +12 |
| | Winter | +4 | +12 |
| | Spring | +3 | +9 |
| Wind-speed (%) | Annual | +2 | +6 |
| | Summer | +2 | +7 |
| | Autumn | +1 | +3 |
| | Winter | 0 | -1 |
| | Spring | +5 | +17 |
| Relative humidity (%) | Annual | -0.1 | -0.2 |
| Solar radiation (%) | Annual | 0.2 | 0.7 |

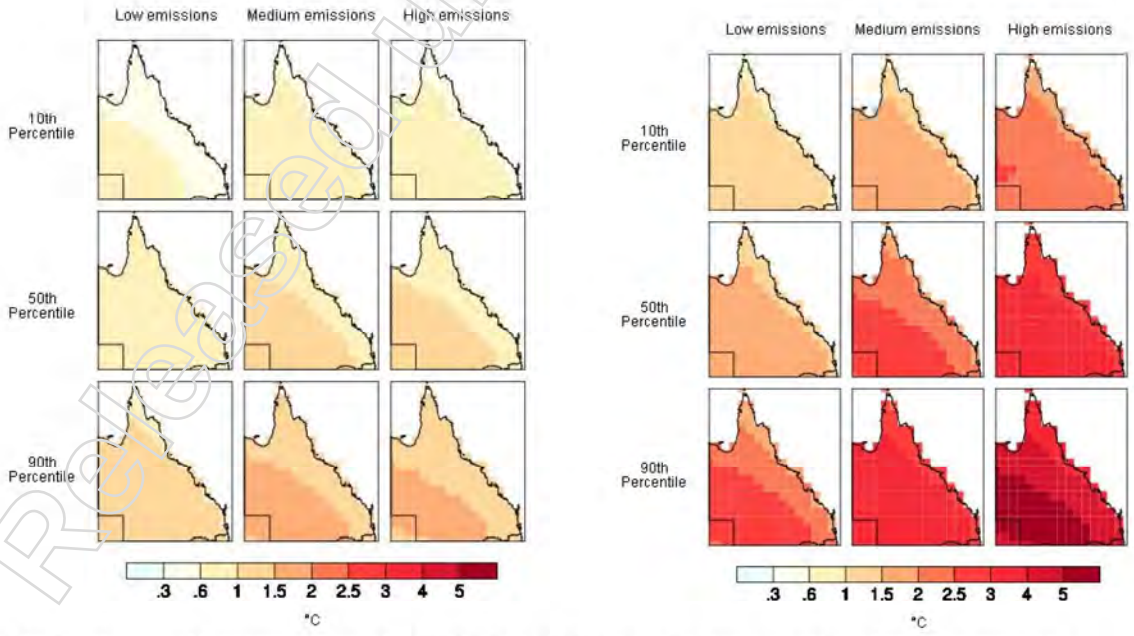


**Figure 8.2: Projected annual temperature change for 2030 (left) and 2070 (right) – the deeper the red, the larger the temperature increase. (CSIRO and BoM, 2007)**

### 8.5.2 Rainfall

There is greater uncertainty with rainfall projections than with temperature projections. This is because, unlike temperature, there is not a direct relationship between greenhouse gas concentrations and rainfall.

Future rainfall levels are dependent on a number of factors therefore there are discrepancies between rainfall projections. Climate model results show both decreases and increases in the amount of rainfall across Australia.

The best estimate (50th percentile) projected changes for rainfall in eastern Australia include:

- A decrease in annual rainfall of between 2% to 5% by 2030
- A decrease in annual rainfall of between 5% to 10% by 2070.

In no region or season do models suggest a 'likely' increase in rainfall.

In Queensland, the most recent projections indicate that winter and spring rainfall is likely to decrease, especially in central and southern areas. Changes in summer and autumn rainfall are less certain.

The future climate of eastern Australia is projected to be drier on average.

Projected annual rainfall changes for Queensland for 2030 and 2070 are provided in Figure 8.3.

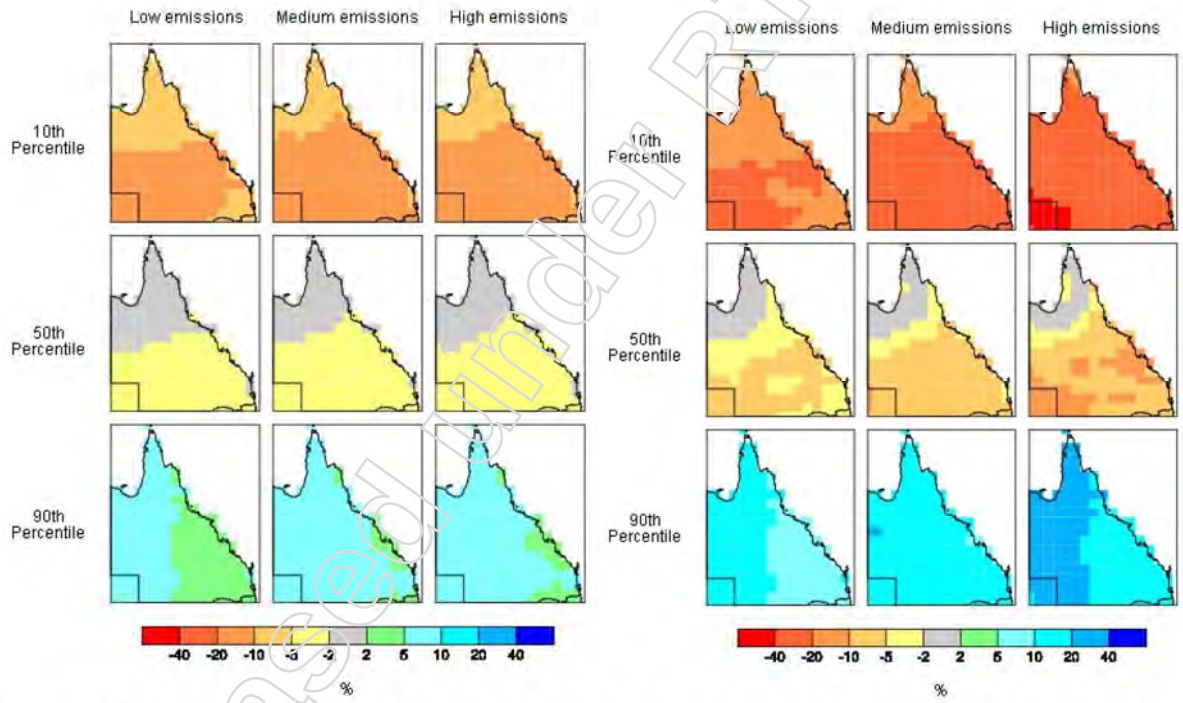


**Figure 8.3: Projected annual rainfall change for 2030 (left) and 2070 (right). Red indicates rainfall decline and blue indicates rainfall increases (CSIRO and BoM, 2007).**

### 8.5.3 Extreme Rainfall

The future climate of many parts of the State is projected to not only be drier but the character of daily rainfall is also likely to change.

An increase in daily rainfall intensity (rain per rain-day), intensity of extreme rainfall and the number of dry days is likely. The climate is projected to have longer dry spells interrupted by heavier precipitation events (CSIRO and BoM, 2007).

Localised projections of extreme rainfall have been completed by the CSIRO for the Gold Coast Region. The Gold Coast and Broadwater contain large areas of developed flood plain spanning several catchments, including the Nerang, Coomera, Pimpama and Albert/Logan that are at risk of flooding during extreme rainfall events.

Projections indicated that climate change is likely to result in an increase in 24-hour and 72-hour rainfall extremes for the region. Larger projected changes are likely in regards to 2-hour rainfall events, with the largest changes occurring in the high terrain inland from the Gold Coast. The 2-hour rainfall events have average increases in intensity of more than 70% in these regions for both 2030 and 2070. By 2070, most regions are likely to experience an increase in the intensity of extreme rainfall events (Abbs et. al., 2007).

Regional studies also indicate a likely increase in the proportion of tropical cyclones in the more intense categories potentially decaying further south, but a possible decrease in the total number of cyclones.

### 8.5.4 Evapotranspiration

Evapotranspiration is the combination of evaporation of water from soil and transpiration from vegetation.

The best estimate (50th percentile) for potential evapo-transpiration changes for eastern Australia is:

- An increase in annual potential evapotranspiration of 2% by 2030
- An increase in annual potential evapotranspiration of between 6% and 10% by 2070 (CSIRO and BoM, 2007).

Projected annual evapotranspiration changes for Queensland for 2030 and 2070 are provided in Figure 8.4.

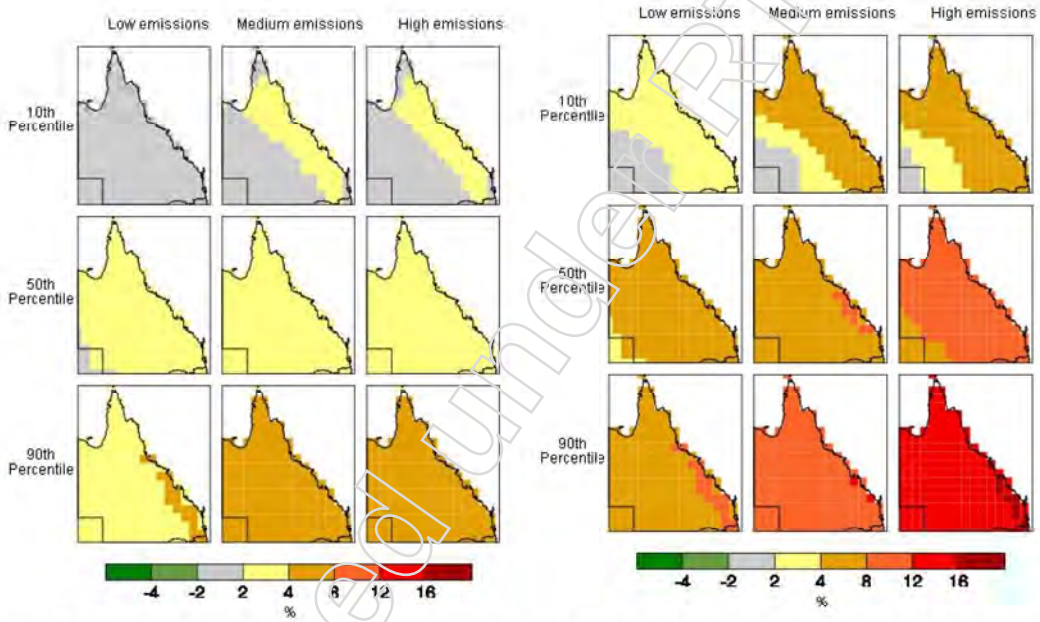


**Figure 8.4: Projected annual evapo-transpiration change for 2030 (left) and 2070 (right). Red indicates the areas of greatest increase (CSIRO and BoM, 2007).**

### 8.5.5 Wind Speed

Projections of future climate conditions indicate that average wind speeds in eastern Australia on an annual basis by 2030 or 2070 will increase (CSIRO and BoM, 2007).

Projected annual wind-speed changes for Queensland for 2030 and 2070 are provided in Figure 8.5.

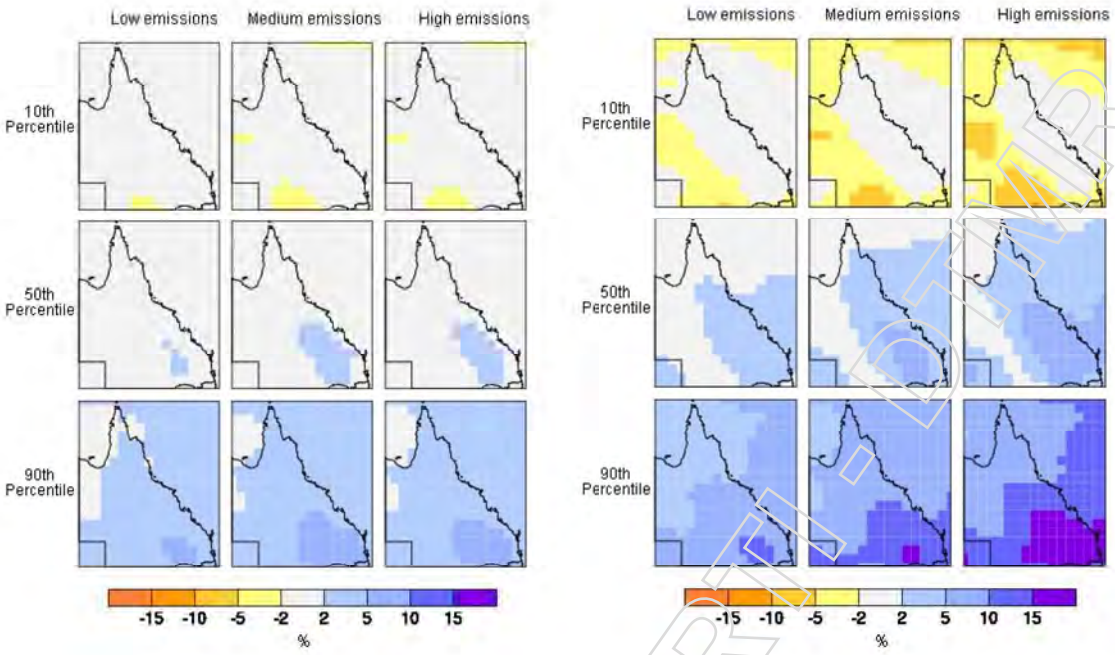


**Figure 8.5: Projected annual wind-speed change for 2030 (left) and 2070 (right). Purple indicates the areas of greatest increase (CSIRO and BoM, 2007).**

### 8.5.6 Sea-Level Rise

Global sea level rise is projected by the IPCC to be 18-59 cm by 2100, with a possible additional contribution from ice sheets of 10 to 20 cm or more. However, further ice sheet contributions that cannot be quantified at this time may increase the upper limit of sea level rise substantially. Global climate models indicate that mean sea level rise on the east coast of Australia may be greater than the global mean sea level rise (OCC, 2008). Furthermore, recent developments since the release of the IPCC's projections indicate that observed sea level is tracking near the upper limit of the projections for the current time period (Church *et al*., 2009).

### 8.5.7 Extreme Sea Level Events

The frequency and heights of storm surges are expected to change with climate change. The effect of rising mean sea levels will be felt most profoundly during extreme storm conditions when strong winds and falling pressure bring about a temporary and localised increase in sea level known as a storm surge (CSIRO and BoM, 2007). For many locations, sea level rise means that the present 1 in 100 year event could potentially occur more than once a year by 2100 (Church *et al*., 2009). In Queensland, scientists predict that storm surges will occur more frequently (OCC, 2008).

A 2004 study by Hardy *et al*. of the east coast of Queensland showed that a 30 cm sea-level rise, a 10% increase in cycles intensity and a 130 km shift southwards in cyclone tracks could add an average of 0.35 m to the 1-in-100 year storm surge event at Surfers Paradise (Hardy et.al., 2004).

### 8.5.8 Bushfire

Fire weather conditions are expected to worsen due to climate change. A study by Lucas *et al*. has found that climate change can exacerbate the fire-weather risk of any given day (leading to increased frequency or intensity of extreme fire weather days) and result in a longer fire season (Lucas *et al*., 2007).

The findings of the study also suggest that fire seasons will start earlier and end slightly later, while being generally more intense throughout their length. This effect is most pronounced by 2050, although it should be apparent by 2020 (note the shift in timeframe).

## 8.6 Potential Climate Change Risks for the IRTC

Outlined in Table 8.2 is an initial range of potential risks that may be of relevance to the IRTC. These risks have been identified through a review of existing literature and information about the impacts of climate change on road and transport infrastructure.

**Table 8.2: Potential climate change risks**

| **Risk Descriptions** | |
|---|---|
| **Infrastructure (planning and design, construction and maintenance)** | **Operations (safety, service disruptions and environmental externalities)** |
| Warmer temperatures and more days of extreme heat result in reduced durability of materials, such as steel and concrete in pavement and bridges, leading to increased risk of failure | More extreme temperatures lead to vehicle overheating and tyre deterioration, resulting in traffic delays |
| Warmer temperatures and more days of extreme heat result in greater thermal expansion on bridge joints and paved surfaces | Power (grid) failures occurring during times of extreme heat resulting in equipment failure (e.g. signals and streetlights) |
| Increased solar radiation and high temperatures cause rutting of road pavement and more rapid breakdown of asphalt seal binders, resulting in cracking potholing and bleeding | Increase in dust from unsealed road surfaces (during construction) resulting in impacts on vegetation and dust infiltration of residential properties |
| More frequent maintenance required for road surfaces (e.g., pothole patching, kerb and channel cleaning, patching, surface correction and resealing) resulting in higher maintenance costs | Reflectivity of materials contributing to increased localised temperatures |
| Current maintenance regimes not adequate for a changing climate | Deterioration of water quality due to build up of pollutants during dry spells between rainfall events |
| Impacts on the health and safety of construction workers from exposure to extreme heat result in limitations on periods of construction activity | Increased flooding of evacuation routes |
| Warmer and drier conditions increase dust during construction/re-surfacing resulting in increased clean up costs and potential public relations issues | While bridge foundations and supports may withstand storm events and flooding, failing abutments result in isolation of bridges rendering it useless and blocking communities' access to emergency and essential services |
| Current infrastructure design criteria and standards do not adequately consider the impact of increased frequency and intensity of extreme rainfall events, storm surge and sea level rise | Increases in weather-related delays and traffic disruptions |
| Drainage systems unable to adequately capture the "first flush" as a result of increased frequency and intensity of extreme rainfall events | Loss of power during severe storms resulting in equipment failure |
| Coastal roads require relocation in the future in line with settlement retreat or require increased coastal protection investment | Increased impacts on watercourses and wetlands during operation from increased stormwater – e.g., potential contamination due to road run-off |
| Warmer temperatures and reduced annual rainfall place stress on trees and landscaped areas | Increased localised flooding |
| Changes to the watertable/groundwater levels impact on materials' suitability and durability | Increased runoff resulting in increased mechanical, chemical and biological impacts on receiving water bodies – particularly smaller water courses (e.g., erosion of riverbeds and banks, alterations to hydraulic regime inc. flooding, increased turbidity, deterioration of riparian vegetation, degradation of benthic habitats) |
| Falling water tables expose acid sulphate soils, which left untreated can have a dramatic corroding effect on concrete and steel. (e.g. bridge piles, drainage structures and corrugated steel culverts) | Deterioration in water quality due to increased run-off and sedimentation |

| | |
|---|---|
| Shrinkage and subsidence of clay soils resulting in damage to embankments, cuttings, pipes and road and bridge foundations, making them more vulnerable to extreme weather events | More frequent interruptions in travel on coastal and low-lying roadways due to storm surges |
| Increase in frequency and severity of landslides | Increased impacts on watercourses and wetlands during construction from increased stormwater |
| Overloading of drainage systems (e.g., culverts undersized for flows) causing backups and localised flooding | More debris and vegetation on roads as a result of more frequent and intense storms and stronger winds |
| Increased erosion and scouring of bridge supports resulting in increased risk of bridge failure | |
| Increased scouring of unsealed road surfaces during construction/re-surfacing | |
| Increased threat to stability of bridge decks as a result of increased frequency and intensity of storms | |
| Increased damage to signs, lighting fixtures and supports as a result of more frequent and intense storms and stronger winds | |
| Sea level rise causes intrusion of saline water into fresh groundwater in coastal aquifers resulting in corrosion of steel reinforcement in pavements and bridge foundations | |
| Increased frequency and duration of inundation of low lying coastal roadways | |
| Erosion and subsidence of road bases as a result of sea level rise and storm surge | |
| Reduced clearance under bridges as a result of increased frequency and height of storm surges | |
| Increased erosion and scouring of bridge supports as a result of increased frequency and height of storm surges | |
| Land subsidence a result of increased frequency and height of storm surges | |
| Direct threats to road infrastructure as a result of an increase in the frequency and intensity of bushfire events | |

## 8.7 Adaptation Measures

Whilst it is not possible to predict exactly how the climate will change and how these changes will affect the IRTC, it is possible to identify and implement strategies that will lessen the potential impacts of climate change on the infrastructure. Potential management strategies are identified in Table 8.3.

**Table 8.3: Adaptation measures**

| Project Phase | Potential Impact | Potential Mitigation Measures |
|---|---|---|
| Design | Underestimation of the likelihood and consequences of identified impacts. | • Proactively consider climate change implications<br>• Undertake a more detailed climate change risk assessment to develop a better understanding of the likelihood and consequences of the identified impacts<br>• Undertake a more detailed assessment of the design options available to address the identified climate change impacts. |
| Design | Power failures occurring during times of extreme heat and extreme weather (storms). | Ensure there is adequate back-up power supply at the construction site. Develop contingency plans to be implemented in the event of a power failure. |
| Design | Conditions being more suitable for fires. | Ensure access to construction sites and the IRTC for emergency vehicles. |
| Design | Flooding of the surrounding area and/or the IRTC. | Ensure all planning and design work is based on a rainfall scenario that includes consideration of climate change. |
| | | Consider the consequences and responses needed to cope with an event that goes beyond the planned scenario. |
| | | Ensure access to and from the IRTC can be maintained in extreme rainfall events. |
| | | Develop emergency response plans to effectively evacuate the IRTC during extreme weather/flooding. |
| Construction | Damage to the construction site, injuries or fatalities and/or disruptions to the construction schedule. | Ensure the construction site can cope with more extreme weather events, heat and rainfall:<br>• Ensure sediment and waste are securely stored in case of extreme weather events<br>• Develop an extreme heat policy and actions to reduce the impacts of severe temperatures on construction workers<br>• Develop contingency plans to allow work to continue safely during extreme weather events such as torrential rain. |
| Construction | Construction workers exposed to extreme heat.<br>(This is likely to be beyond the scope of influence at the project design stage.) | Ensure work practices protect health and safety of workers in times of extreme heat (e.g. appropriate PPE, stop-work guidelines). |
| | | Ensure temperature-critical construction practices (e.g. laying of concrete) occur when conditions are suitable. |
| Operation | Impacts on the durability and suitability of materials. | Consider the long-term durability of the IRTC over its design life (100 years). Consider the long-term durability of materials. Give preference to durable materials that perform well under increased stress (e.g. in hot conditions). |
| Operation | Loss of plants in landscaped areas. | Use drought resistant plants in landscaping<br>Maximise water harvesting opportunities to enable stormwater to be re-used to irrigate plants. |
| Operation | Changes to the watertable/ groundwater levels. | Ensure construction materials can cope with wetting/drying cycle. |

## 8.8 Summary

Climate change is a reality that will have an impact on the design life of the IRTC. In particular, hotter temperatures and more intense rainfall events will impact the useability and durability of the road. Although the extent of climate change impacts are unknown, steps can be taken to reduce the consequences of climate change.

Recommended future steps include:

Proactively considering climate change implications and implementing practical measures, such as selecting durable materials.

Further work in subsequent project stages may include:

- Undertaking a more detailed climate change risk assessment to develop a better understanding of the likelihood and consequences of the identified impacts
- Undertaking a more detailed assessment of the design options available to address the identified climate change impacts.

This information can then be used to inform the development of any future CCIS that is required to be completed for the project.

# 9.0 Project and Environmental Approvals

## 9.1 Project Environmental Assessment Processes

The scope of this project is to consider the environmental elements from Beattie Road to Stapylton-Jacobs Well Road (referred to as the Northern Section of the IRTC). It is not, however, appropriate to discuss approvals and form recommendations without considering the environmental factors and recommendations from the Southern Section of the IRTC from Beattie Road to Nerang-Broadbeach Road. To do so would be considered a piecemeal approach with a risk that the environmental protection objectives would be undermined by the project being considered in stages rather than as a component of a larger action.

The following discussion therefore considers the implications and recommendations from the Strategic Review of Environmental Factors for the Beattie Road to Nerang-Broadbeach Road IRTC project (Maunsell, 2005).

### 9.1.1 Internal (DTMR) Environmental Assessment Processes

The purpose of the Road Project Environmental Processes Manual (the Manual) is to provide DTMR with guidelines for complying with their environmental duty of care. The Manual provides specific guidance on environmental processes at various stages of the road planning and delivery process. In particular, it outlines the key stages in the assessment of environmental factors and impacts for projects undertaken by DTMR. The Manual provides a process that can be followed in order to assist in satisfying DTMR's environmental obligations in the absence of an alternative statutory process.

The Manual also provides guidance on when a project is likely to trigger assessment under the various external legislative processes.

The assessment process outlined in the Manual requires that reports be prepared at the environmental assessment, management and certification stages of a project. These would generally take the form of:

- Assessment stage – Review of Environmental Factors (REF)
- Management stage – Environmental Management Plan (Planning) (EMP(P))
- Certification stage – Environmental Certification and Environmental Design Report (EDR).

This Strategic Review of Environmental Factors (SREF) is preliminary to these stages of assessment. Should the project proceed using DTMR internal assessment processes, approximately 12 – 24 months should be allowed from Assessment to Certification stage. Consultation with State agencies may however extend this period.

### 9.1.2 Commonwealth

The EPBC Act provides for environmental regulation of development at a Commonwealth level. Any proposed action that it is considered has, will have or is likely to have a significant impact on a Matter of National Environmental Significance, or another matter specified under the Act, must be referred to the Department of Environment, Water, Heritage and the Arts (DEWHA) for consideration of whether it is a "controlled action" requiring approval and the level of environmental assessment required.

The DEWHA has the ability to refuse a referral if it covers only one part of a larger action. This is to ensure that environment protection objectives are not undermined by developments being considered in stages rather than in terms of their overall likely impacts on matters protected under the EPBC Act. It is important for DEWHA to be fully aware of the full scope of a development proposal rather than consider impacts in a piecemeal fashion. The referral must therefore cover the northern and southern sections of the IRTC (Stapylton-Jacobs Well Road to Nerang-Broadbeach Road).

For parts of the proposed road to be the subject of separate EPBC Act referrals it must be justified why the referred action is "stand-alone" and viable in its own right or another reason as to why it is reasonable and not misleading for the components of the road project to be split. In this case it is considered inappropriate to refer either the northern or southern parts of the road separately as the intent of the larger action is clear.

A referral under the EPBC Act is considered necessary for the Project because of the requirement to refer the southern section for the potential impacts on Coomabah wetlands. The proximity of the northern section to Moreton Bay, a Matter of National Environmental Significance and the potential for impacts on migratory and threatened species further adds to the weight of evidence that supports the need for a referral to DEWHA.

It is then for the Minister of Environment to decide whether the IRTC requires approval under the EPBC Act (a "controlled action"). It will be the Ministers decision whether an Environmental Impact Statement or Public Environment Report is required, whether approval can be given on the information provided solely within the referral and other supporting documentation, or whether the project is "not a controlled action" and can proceed under the DTMR internal assessment process. Refer to Appendix C for guidelines on EPBC Act environmental assessment process.

To demonstrate the next steps required within the environmental assessment process and the relationship to DTMR project management phases, the following diagram has been adapted from Table O-1 in DTMR Road Project Environmental Processes Manual (DMR, 2004).

Consideration must be given to the significant timeframes associated with the preparation of a referral to DEWHA, and the subsequent environmental assessment and approvals process should an EIS be required.

Some indicative timeframes for various stages in the environmental approval process are included here:

- Preparation of a referral – 3 to 6 mths
- Development of EIS Terms of Reference – 3 to 6 mths
- Preparation of an EIS including public and agency consultation – 12 to 36 mths
- Preparation of a Supplementary EIS – 6 to 12 mths.

| Strategic Framework for Road System Asset Management | Phase 3 Corridor Planning & Stewardship <15 years | Phase 4 Program Development | | | Phase 5 Program Delivery | | Phase 6 Audit | |
|---|---|---|---|---|---|---|---|---|
| Project Management Methodology | | CONCEPT | | | DEVELOPMENT | | IMPLEMENTA-TION | FINALISATION |
| | Road Corridor Development Planning | Proposal | * Ministerial decision whether approval is required under the EPBC Act | Options Analysis / Business Case | Preliminary Design | Detailed Design | Process Control | Wind Up Control |
| Main Roads Environmental Policy / Practices | Use of Road Corridor Environmental Assessment data as part of Corridor Development Plans | | | • Project Environmental Assessment<br>• Project Environmental Management | • Project Environmental Management<br>• Project Environmental Certification | • Project Works – Environmental Management Plans | | Project Environmental Auditing and Reporting |
| Main Roads Environmental Documents | Strategic Review of Environmental Factors | | Either:<br>Not a Controlled Action → | • Environmental Scoping Study to determine level of assessment necessary (Appendix C of Road Project Environmental Processes Manual)<br>• Review of Environmental Factors followed by Environmental Management Plan; or<br>• Environmental Approval Report | | Environmental Management Plan (Construction) | • Statement of Environmental Effects<br>•Environmental Management Plan (Maintenance) | Environmental Audit Report |
| External Environmental Assessment Documents | | Referral under EPBC Act | Or:<br>Controlled Action →<br>Or:<br>Action clearly unacceptable | • Assessment by Environmental Impact Statement or Public Environment Report; or<br>• Assessment by public enquiry; or<br>• Assessment on preliminary documentation; or<br>• Assessment on referral information; or<br>• Accredited assessment (case by case) | | Supplementary EIS (if required) | | |
| Delivery Actions | PRE-CONSTRUCTION | | | | | | CONSTRUCTION | |

The level of detail required for the referral will depend on whether DTMR intend to seek the project as 'not a controlled action' or 'controlled action'. Typically, where a proponent intends to justify that the impacts caused will not be significant and do not therefore require approval under the EPBC Act, a greater level of project understanding and detail is required in the referral documentation to demonstrate this.

Should DTMR prefer to seek Commonwealth approval and recommend in the referral documentation that the project is likely to be considered a controlled action, less detail would be required and it may not be necessary to complete extensive field investigations prior to referring the project. These investigations would then occur as part of the EIS process in accordance with the Terms of Reference. As a minimum, the referral must consider the following:

- an assessment of alternatives or reasonable justification why no alternatives have been considered
- elevating the road on structure over Coomabah wetlands, Pimpama River, Hotham and McCoys creeks and other areas of sensitive habitat
- knowledge of migratory bird breeding, roosting and foraging habitat requirements and seasonality
- incorporation of stormwater quality improvement devices
- potential impacts on koala at Helensvale and south of Kerkin Road to Coomera River and possible solutions to provide for fauna connectivity at these locations
- fish passage devices along Pimpama River, Hotham and McCoys creeks
- a commitment to the management of Aboriginal Cultural Heritage.

At such time that the IRTC enters the Proposal stage, DTMR must consider whether any changes to environmental legislation would affect the recommendations for making an EPBC referral and determine a strategy for the referral, i.e. whether the intention is to seek a 'controlled action' or not.

### 9.1.3 Queensland

Under the *Transport Infrastructure Act 1994*, the Minister may, by gazette notice, declare a road or route, to be a State-controlled road. A declaration must be consistent with criteria about the declaration of State-controlled roads in the transport infrastructure strategies. Before making a declaration the Minister must notify each local government that would be affected by the proposed declaration and give the local governments a reasonable opportunity to make submissions to the Minister on the proposed declaration.

Once a road or route has been declared a State-controlled road, the chief executive may exercise, in the area of a local government, all of the powers that the local government may exercise for a local government road in the area.

The chief executive is authorised under the *Transport Infrastructure Act 1994*, to carry out, or enter into contracts for the State with other persons for the carrying out of road works on a State-controlled road (s29). Road works include "works done for:

(i) constructing roads or things associated with roads; or

(ii) maintaining roads or things associated with roads

(other than public utility plant); or

(iii) facilitating the operation of road transport infrastructure; or

(b) works declared under a regulation to be road works" (Schedule 6).

Under the SP Act, the following activities are exempt from assessment against the local planning scheme because they are listed in Schedule 4 of the *Sustainable Planning Regulation 2009* as "community infrastructure activities".

"All aspects of development -

a) for the maintenance, repair, augmentation, upgrading, duplication or widening of State-controlled road infrastructure; or

b) for ancillary works and encroachments carried out by the State; or

c) adjacent to a State-controlled road and ancillary to the construction, maintenance, repair, augmentation, upgrading, duplication or widening of the road, such as excavating, crushing, screening, cutting, filling, preparing road construction material (including concrete), storing materials, removing vegetation, dam building, site offices and worker accommodation."

It is unlikely that any activities associated with the road itself will be assessable under the Gold Coast Planning Scheme.

**Alternative Assessment Processes**

The *State Development and Public Works Organisation Act 1971* (State Act) provides for a number of alternative assessment and approval processes for certain major projects in Queensland, including the power of the Coordinator-General to declare a project to be a "significant project" under the State Act. If an EIS is required for the project then the EIS process under the State Act must be followed.

The Coordinator-General can declare a project to be a "significant project" on their own initiative or in response to an application by the proponent. The Coordinator-General has a broad power to determine whether a project is significant which can include declaring a project as a significant project because of its potential environmental effects and thereby require the project to undertake environmental assessment in accordance with the State Act.

The EIS process for a "significant project" under the State Act is accredited under a bilateral agreement between the Australian and Queensland Governments for the purposes of assessment under the Commonwealth EPBC Act. For projects that trigger EIS assessment under the EPBC Act, being declared a "significant project" can avoid duplication of EIS documents, with the one EIS being used to assess the project at a State and Commonwealth level. A period of 12-36 months should be allowed for the development of the Terms of Reference and EIS reports in addition to public consultation.

## 9.2 Environmental Approvals and Obligations

Table 9.1 outlines the environmental approvals that may be required and legislative obligations that may apply to the Project under Commonwealth and Queensland legislation. This summary has been developed after consideration of the likely activities and potential impacts of the proposal based on the proposed alignment. At the time when the proposal reaches construction stage, some approvals and obligations may no longer be relevant, likewise, further approvals and obligations not listed may need to be obtained as a result of potential amendments to legislation and proposed activities.

Not all of the approvals outlined in this SREF have statutory timeframes. Estimates of timeframes have been provided in Table 9.1, however, these are estimates only and as with approvals for any major projects they are difficult to predict and are subject to variation.

**Table 9.1: Environmental Approvals and Obligations**

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Commonwealth | | | | | |
| *Environment Protection and Biodiversity Conservation Act 1999* | Department of Environment Water, Heritage and Arts (DEWHA) | Significant impact on Matters of National Environmental Significance including:<br>• nationally threatened species and ecological communities<br>• migratory species protected under international agreements including JAMBA and CAMBA<br>• Ramsar wetlands of international importance<br>• National Heritage places | EPBC Referral and if "controlled action" approval from DEWHA | Decision on referral should be delivered within 20 business days. | Referral considered necessary because of the proximity to and potential to have significant impacts upon Matters of National Environmental Significance and requirement to refer the southern section for potential impacts on Coomabah wetlands. |
| *Native Title Act 1993* | National Native Title Tribunal | The construction, operation, use, maintenance or repair by or on behalf of the Crown, local government body or statutory authority of the Crown in any of its capacities, of particular facilities (including roads) on non-freehold land. | Section 24KA Notification – Facilities for Service to the Public | N/A | Notification will be required for non-freehold land.<br><br>Notification not required for freehold land because native title is extinguished on freehold land. |
| Queensland | | | | | |
| *Aboriginal Cultural Heritage Act 2003* | DERM | Conducting an activity that may harm Aboriginal Cultural Heritage. | Cultural Heritage Management Plan (CHMP) or alternative agreement | 12-18 months | Likely to be required.<br>Consult with the interested Aboriginal parties listed in Section 6.2.1 to arrange suitable agreement. |
| *Agricultural Chemicals Distribution Control Act 1966* and Regulation | Queensland Primary Industries and Fisheries (DPIF) | Spraying, spreading or dispersing of any herbicides or any preparation containing any herbicide by ground OR<br>Spraying, spreading o r dispersing of any agricultural chemical from an aircraft in flight (s 39 of Act). | Unrestricted Commercial Operator's Licence | 14 days | Likely to be required.<br>Contractor to use licensed operator and comply with the Agvet Code. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Chemical Usage (Agricultural and Veterinary Control) Act 1998* | DPIF | Use of registered chemical from unlabelled container (s 7);<br>possession of prescribed chemical (s 9);<br>discarding a container or chemical (s 10);<br>use of registered chemical (s 13); and<br>use of unregistered chemical (s 13(a)). | Permit for possession, use of registered/ unregistered prescribed chemical product | 14 days | Likely to be required.<br>Chemical use/storage/disposal in accordance with the Act. |
| *Coastal Protection and Management Act 1995* | DERM and GCCC | Tidal works in, on or above land under tidal water, or land that will or may be under tidal water because of development – see Schedule of the Act for further definition.<br>[Part 3. (Coastal Management District) declaration of Coastal Management Districts, identified activities undertaken in these areas. Part 5 (Quarry Materials) relates to the allocation of quarry materials and obtaining these allocations. Part 6. Development of approvals for assessable development.] | Prescribed Tidal Works Permit / Allocation notice for removal of quarry material | 6-12 months | Works will be required in tidal areas for the project. The South East Queensland Coastal Management District Sheet 13.28 Pimpama shows the boundary of the district.<br><br>Prescribed tidal work applications that involve the removal of quarry material below the high water mark are required to be supported by a resource allocation notice from the DERM when lodged with the assessment manager. Refer to s73 of the Act. |
| *Dangerous Goods Safety Management Act 2001* | GCCC | Storage of fuels onsite<br><br>License for storage above specified limits (ss 55 and 82) and Schedule 3 | Flammable and Combustible Liquids Permit | Uncertain | Likely to be required.<br>Most likely required for construction phase. |
| *Electricity Act 1994* | Relevant electricity entity (e.g. Energex, Ergon, Powerlink) | Works near electrical infrastructure | Notification | 14 days (Notification) 7 days (after Notification) | Several codes apply for works and activities around live electrical wires. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Environmental Protection Act 1994* and Environmental Protection Regulation 2008 | DERM | DTMR must comply with the general environmental duty not to undertake activities that cause or are likely to cause environmental harm unless all reasonable and practicable measures are taken to prevent or minimise the harm (s319). DTMR must also comply with more specific obligations imposed under the EP Act. | Compliance | N/A | The general environmental duty applies to all project activities.<br><br>The following environmental protection policies and subordinate legislation have been prepared under the EP Act and must be complied with and considered in preparing environmental management plans:<br>• Environmental Protection Regulation 2008<br>• Environmental Protection (Air) Policy 2008<br>• Environmental Protection (Noise) Policy 2008<br>• Environmental Protection (Waste Management) Policy 2000<br>• Environmental Protection (Waste Management) Regulation 2000<br>• Environmental Protection (Water) Policy 1997. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Environmental Protection Act 1994* and Environmental Protection Regulation 2008 | DERM and GCCC | Conducting an environmentally relevant activity (ERA), which is relevant to the specific Chapter 4 activities under the Environmental Protection Regulation 2008 that commenced on 1 January 2009, including:<br>• Activity 8: Chemical storage<br>• Activity 16: Extractive and screening activities<br>• Activity 43: Concrete batching<br>• Activity 57: Regulated waste transport. | Registration Certificate for Chapter 4 Activities<br><br>Development approval for the activity or operate under a code of environmental compliance | Approximately 3 months to obtain development approval and subsequent registration certificate. | One or more Chapter 4 activity approvals are likely to be required during the construction phase of the project and details will depend on the construction methods. |
| | DERM | Removal and disposal of contaminated soil from sites listed on the Contaminated Land Register (CLR) or Environmental Management Register (EMR) (unless done under a remediation notice). | Disposal Permit for contaminated soils | No legislative timeframe (up to 3 months) | Contaminated land has been identified on numerous lots along the alignment (Section 4.2.4) |
| *Explosives Act 1999* | Department of Mines and Energy (DME) | Authority for the use, storage, transportation of defined explosives (ss 34, 44 and 53). | Permit for possession, storage, transportation and use of explosives | Approximately 7 days | May be required during the construction phase of the project, depending on the construction methods chosen by the contractor. |
| *Fisheries Act 1994* | DPIF | Clearing marine plants including mangroves. "Marine plant" includes the following: a) a plant (a tidal plant) that usually grows on, or adjacent to tidal land, whether it is living, dead, standing or, b) material of a tidal plant, or other plant material on tidal land, c) a plant, or material of a plant, prescribed under a regulation or management plan to be a marine plant (s 123). | Development Approval to remove, destroy or damage marine plants | 3 months from date of application | Development Approval will be required for disturbance of marine plants which will be required for the project. |
| | DPIF | Operational work completely or partly within a declared fish habitat area if it is not self-assessable development. | Development Approval to conduct works within a declared fish habitat area | 3 months from date of application | Development Approval will not be required because works are not occurring within a declared fish habitat area. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| | DPIF | Erection of waterway barrier works. (Subdivision 3) | Development Approval to build or raise waterway barrier works | 3 months from date of application | This Development Approval may be required. The provision of fish movement / passage is required when seeking a waterway barrier works permit.<br><br>Waterway barrier works approvals and fishway assessments: Departmental procedures (FHMOP 008) |
| *Land Protection (Pest and Stock Route Management) Act 2002* | DPIF | Landowners must take reasonable steps to keep their land free of Class 1 and 2 weeds and pests or hold a declared pest permit. | Compliance | N/A | Section 3.2.7 and 2.2.5 specifies the declared pest species likely to be found in the study area.<br><br>The contractor and DTMR must ensure that Class 1 and 2 weeds and pests are controlled within the Project area. |
| *Nature* | DERM | Taking of or interfering with protected plants | Approval to take, | 6 weeks | Permit, licence or authority may |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Conservation Act 1992* | | and/or removal of wildlife listed as protected in the Nature Conservation (Wildlife) Regulation 2006 (ss 88-89).<br><br>It is a defence to a charge under the NC Act for taking of a protected animal if it can be demonstrated that the animal was taken whilst conducting a lawful activity and that taking could not have been reasonably avoided. | keep or use protected animals or plants | | be required to remove protected flora (which includes least concern plants being all native vegetation) and to take native fauna during construction phase.<br><br>The DERM can include conditions on the permit to require the provision of offsets for the impacted vegetation.<br><br>It is understood that DTMR are currently working towards developing a Memorandum of Understanding to streamline the process of obtaining clearing permits under the Nature Conservation (Protected Plants) Conservation Plan 2000 and achieving a State-wide approach for the DTMR to offset any impacts. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (Koala Plan) | DERM | Sequential clearing obligations for the whole site (s 15).<br><br>Koala spotter requirement for all clearing within Koala Habitat Areas (s 16).<br><br>Compliance with the Koala Conservation Criteria is required for development located in a Koala Habitat Area if the development is assessable under the SP Act, local government planning scheme or is a community infrastructure designation.<br><br>Offset requirements in accordance with the Policy 2: Offsets for net benefit to koalas and koala habitat in the Koala Plan as a result of the QGEOP. | Approval to clear vegetation within koala conservation area or koala sustainability areas listed under the Koala Plan.<br><br>Compliance with clearing and offset obligations. | 3 months | Permit not required because activities for the Project will constitute "specified activities" which are exempt from the requirement to obtain vegetation clearing approval. See Section 2.3.1 for more detail.<br><br>The general clearing provisions under the Koala Plan (s 15) would still apply to the whole area and the requirement for a koala spotter (s16) to all Koala Habitat Areas.<br><br>See Section 3.3.1 for more detail on these offset obligations in relation to koala. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| South East Queensland Koala State Planning Regulatory Provisions (SEQ Koala SPRP) (February 2010) | DIP | A development application, for a material change of use, reconfiguring a lot or operational work for the clearing of native vegetation, in an interim koala habitat protection area or protected koala bushland habitat area unless certain criteria are satisfied. | Approval from DIP to clear vegetation within a koala protection area, including possible offset requirements | In force until replaced by draft Provisions. | The Project is located within the interim koala habitat protection area designated on regulatory map so no further obligations would apply however; see Section 3.3.1.5 for other possible implications.<br><br>The current SEQ Koala SPRPs are referred to as interim development controls by the Department of Infrastructure and Planning.<br><br>The Queensland Government have also released the Draft South East Queensland Koala Conservation State Planning Regulatory Provisions and the Draft South East Queensland Koala Conservation State Planning Policy in December 2009 for public consultation until 28 February 2010.<br>Requirements that are applicable under the SEQ Koala SPRP are in addition to those obligations under the Koala Plan. |
| *Queensland Heritage Act 1992* | DERM | Interference or impact on any listed sites or items (s 71). | Approval of non-indigenous cultural heritage report | No legislative timeframe | Approval is not required for the Project because there are no places currently listed on the Queensland Heritage Register within the study area. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| *Vegetation Management Act 1999* / SP Act | DERM | Clearing assessable vegetation (including high-value regrowth) outside of land designated as gazetted road corridor. | Operational works, Vegetation Clearing Permit | Approximately 3 months | Exemption under Schedule 24 of the *Sustainable Planning Regulation 2009* for clearing native vegetation "for a State-controlled road under the *Transport Infrastructure Act 1994* —<br>(i) road works carried out on the State-controlled road; or<br>(ii) ancillary works and encroachments carried out under section 50 of that Act".<br>Clearing prior to road gazettal would require a permit. See Section 2.3.1for further information on exemption and possible obligations. |
| *Water Act 2000* / Water Regulation 2002 | DERM | Taking water from the waterways for the use in construction works (s 206). | Permit required to take water | 3 months | May be required during the construction phase of the Project, depending on the construction requirements. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| | | Destroying vegetation, excavation or placing fill in a watercourse, lake or spring if works are not in accordance with the Guideline for Activities in a watercourse, lake or spring carried out by an entity as part of Part 5 of the Water Regulation 2002 (s 814) | Riverine Protection Permit to do one or more of the following activities within a watercourse:<br>destroy vegetation;<br>excavate; or<br>place fill (s 269) | 3 months | A Riverine Protection Permit may not be required for the Project either because works do not occur within a watercourse or because of compliance with the relevant guideline discussed below.<br><br>DTMR is listed as an entity under Guideline - Activities in a watercourse, lake or spring carried out by an entity and is therefore exempt from this permitting requirement as long as activities are undertaken in accordance with the guideline.<br><br>However, where it is proposed to destroy an area of native vegetation greater than two hectares or excavate or place fill to a volume greater than 5,000 cubic metres DTMR should notify the local office of DNRW at least five (5) business days before commencement of the activity. |
| | | Any removal of quarry material in or from watercourse (which is upstream of where the high spring tide ordinarily flows and reflows). | Development application and allocation notice to remove quarry material in or from a watercourse | 6 months | A development application for the removal of quarry material must be accompanied by an allocation notice granted under s 283 of the Act. |

| Legislation | Administering Authority | Trigger for Approval / Obligation | Type of Approval/Action Required | Timing | Relevance to Project |
|---|---|---|---|---|---|
| | | Diversion of a watercourse | Water licence to interfere with the flow of water (watercourse diversion) | Up to 6 months | If a permit to divert a watercourse was required the water licence would be granted under s 206 of the Water Act and the associated operational works are assessable development under Schedule 3, Part 1, Table , Item 3 of the *Sustainable Planning Regulation 2009.* |

# 10.0 Conclusion

This SREF has presented the key environmental opportunities and constraints associated with the proposed IRTC. It determines areas of environmental significance that are important to the decisions being made that relate to corridor alignment and the purchase of land.

Further, understanding the environmental sensitivity of the area and the potential scale of environmental impact of the project is crucial in early planning to allow realistic timeframe to gain environmental approval. The intent of the SREF is also to identify the next steps for the environmental management planning and to ensure sufficient lead time.

Given the range and scale of environmental issues on this project, it is highly likely that the IRTC will receive public and agency scrutiny. It is vital that sufficient time and resources are allocated to the environmental management and project approvals. It is possible for the project environmental approval process to take between 2 – 6 years from the Proposal stage in Concept Design through to approval for construction as part of Implementation.

Based on current desktop investigations, none of the environmental issues identified in the SREF will prevent the development of the road corridor. There are however a number of environmental issues associated with the IRTC that will constrain and influence the development and implementation of this project.

The critical issues are:

- Environmental offsets may be required to compensate for the loss of Regional Ecosystem and/or Essential Habitat, as compensation for causing marine fish habitat loss and for impacts on koala habitat
- Loss of koala habitat from within the Coomera-Pimpama koala habitat area. Under the current legislation, DMTR have obligations to offset the loss of koala habitat and provide for koala movement within the road development
- Provision of wildlife movement solutions to allow permeability of native fauna across the IRTC, particularly at locations where the IRTC intercepts with the Southern Moreton Bay to Wongawallan Bioregional Corridor
- Potential cost implications associated with the infrastructure and additional land requirements for environmental offsets, to accommodate wildlife movement solutions and water treatment infrastructure. The management and treatment of Acid Sulfate Soil has the potential to also have significant cost implications.
- The value of the area to Aboriginal cultural heritage with known items of heritage value located within the IRTC and the potential for other, unidentified items to occur
- The environmental impacts of the IRTC will attract significant public, agency and likely media attention. It is important that DTMR are transparent about the environmental management of the IRTC and seek meaningful input from State agencies. DTMR should allow for significant agency and public consultation and consider the implications this attention and consultation will have on project timeframes
- The IRTC must be referred to the Department of Environment, Heritage, Water and the Arts to determine whether the impacts on matters protected under the EPBC Act are likely to be significant and therefore Commonwealth approval is required.

On the basis of these critical issues and the information gathered for this SREF, a referral to the DEWHA under the EPBC Act must be made for the whole action, i.e. northern and southern sections of the IRTC to ensure the project is assessed for its overall likely impacts on matters protected under the EPBC Act rather than in a piecemeal fashion.

The level of detail required for the referral will depend on whether DTMR intend to seek the project as 'not a controlled action' or 'controlled action'. As a minimum, the referral must consider the following:

- An assessment of alternatives or reasonable justification why no alternatives have been considered
- Elevating the road on structure over Coomabah wetlands, Pimpama River, Hotham and McCoys creeks and other areas of sensitive habitat
- Knowledge of migratory bird breeding, roosting and foraging habitat requirements and seasonality
- Incorporation of stormwater quality improvement devices

- Potential impacts on koala at Helensvale and south of Kerkin Road to Coomera River and possible solutions to provide for fauna connectivity at these locations
- Fish passage devices along Pimpama River, Hotham and McCoys creeks
- A commitment to the management of Aboriginal Cultural Heritage.

At such time that the IRTC enters the Proposal stage, DTMR must consider whether any changes to environmental legislation would affect the recommendations for making an EPBC referral and determine a strategy for the referral, i.e. whether the intention is to seek a 'controlled action' or not.

Assessment under the *State Development and Public Works Organisation Act 1971* is an available external assessment option for DTMR to consider. If Section 26 of the *State Development and Public Works Organisation Act 1971* is triggered then an Environmental Impact Statement is likely to be required and will require ultimate approval to proceed from the Coordinator-General. This will also add up to 12-36 months for the development of the Terms of Reference and EIS reports in addition to public consultation.

Looking forward, environmental management can be incorporated into design by applying the hierarchy of avoid, minimise and mitigate. The SREF has focused on strategic environmental issues and is not intended as a complete assessment of impacts and mitigations; however, this body of work has identified a number of environmental issues that should be considered through the design development:

- Opportunities to avoid sensitive areas of vegetation (Of Concern RE 12.1.1, 12.3.8, 12.3.11, 12.9-10.7a and Essential Habitat, as shown on the Environmental Constraints Map) should be reviewed as part of the motorway or interchange options at the options analysis phase of the concept design. The most recent protected area mapping should be retrieved from DERM at the time of concept design as this data is constantly updated
- Where vegetation cannot be avoided, the width of the road corridor should be reduced, where possible, to limit the vegetation clearance and impacts on surrounding habitat
- To minimise harm, the road should be designed following the principles of Fauna Sensitive Road Design (refer to DTMR Fauna Sensitive Road Design, Volumes 1 and 2)
- Where the proposed alignment requires the removal of riparian and marine vegetation, erosion and drainage protection should be implemented to protect the surrounding receiving environment and other significant receiving environments downstream
- Consider the use of baffles in cross drainage design to allow provision for aquatic species movement. The DTMR Culvert Fishway Planning and Design Guidelines (Kapitzke, 2009) should be consulted
- Consider design solutions to facilitate fauna connectivity and to reduce the physical barrier, in particular, to koala movement through the Coomera Pimpama Koala Habitat Area (southern bank of Oaky Creek), Pimpama River and Hotham Creek. Additional infrastructure or design modifications may be required to facilitate fauna movement at watercourse crossings, in-stream fish passage devices, fauna exclusion fencing and fauna friendly lighting
- Management and treatment of stormwater prior to discharge using the 'treatment train' and 'Water Sensitive Urban Design' Principles. Consider the use of spill containment devices for defined volumes.

The outstanding issues that have not yet been considered as part of this SREF are a number of other quasi-environmental elements that may potentially impact the development of the IRTC and the outcome of the Gold Coast International Marine Precinct Environmental Impact Statement.

The quasi-environmental issues outstanding are:

- Socio-economic impact
- Land use and planning of the study area
- Noise
- Visual Impact.

The appropriate time to assess these issues will depend on the outcome of the EPBC referral. If the project is declared a "controlled action" and an EIS or PER is required, the Terms of Reference for these environmental assessments will include the above environmental elements to be assessed. Should the IRTC not require approval under the EPBC Act, DTMR should complete an Environmental Scoping Study early in the Options Analysis phase to determine what level of assessment and detail is required in the Review of Environmental Factors. Part A of the Road Project Environmental Processes Manual explicitly states that socio-economic, land use and planning, noise and visual impacts should be addressed along with a further ten environmental elements as a minimum for each Main Roads road project (pA-4).

Maratimo are in the progress of preparing an Environmental Impact Statement for the Gold Coast International Marine Precinct. It is anticipated this document will be available by 2011 for public and agency comment. This document should be reviewed by DTMR to identify and evaluate where the environmental effects of the marine development has the potential to impact on the IRTC. It will be important that the EIS meets the requirements of the Terms of Reference and, as a minimum, appropriately considers:

- The cumulative environmental impacts of the marine precinct and the IRTC
- The potential impacts of proposed new or alternations to transport related infrastructure at a local and regional scale
- The location and direction of stormwater drainage and discharge, energy and telecommunication infrastructure in relation to the IRTC
- Any potential future conflict in land use requirements with the IRTC.

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# Appendix A
# HERBRECS Database Results

| Aq_Nr | Batch_Nr | Cultivated | Group_Code | Group_Name | Family_Name | Status | Botanical_Name | Bc_Nr | Collect_Name | Collect_Code | Additional_Collectors | Collect_Date | Deter_Name | Deter_Date | Region_Name | District_Name | Locality | Label |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 653970 | 5710 | | A | Angiosperm | Acanthaceae | * | Hygrophila costata Nees | 89721 | Leiper G. | | | APR1997 | Bean A.R. | MAR2000 | Queensland | Moreton | HUGH MUNTZ PARK BEENLEIGH | Hugh Muntz Park, Beenleigh.□<br>On bank of swamp.□<br>Many branched shrub to 1m, flowers cream. |
| 177180 | 1 | | A | Angiosperm | Aizoaceae | | Carpobrotus glaucescens (Haw.) Schwantes | 487 | Baxter P.H. | | | 05JAN1962 | | | Queensland | Moreton | STRADBROKE IS SWAN BAY | |
| 177191 | 1 | | A | Angiosperm | Aizoaceae | | Carpobrotus glaucescens (Haw.) Schwantes | 487 | Pedley L. | | | 30OCT1954 | | | Queensland | Moreton | JUMPINPIN E OF KANGAROO IS NORTH STRADBROKE IS | |
| 664308 | 5881 | | A | Angiosperm | Amaranthaceae | * | Alternanthera philoxeroides (Mart.) Griseb. | 23304 | Reeve J. | | | DEC1998 | | | Queensland | Moreton | 1KM E OF BEENLEIGH | 1 km E of Beenleigh.□<br>Growing on creek bank in sandy gravel.□<br>Prostate herb rooting agressively at nodes.□<br>(Actively targeted for eradication) |
| 579124 | 6414 | | A | Angiosperm | Amaranthaceae | * | Celosia argentea L. | 4271 | Bibby M. | | | 20MAR2004 | Price R. | JUN2004 | Queensland | Moreton | STAPYLTON, SOUTH OF BEENLEIGH NEAR QUARRY ROAD AND STAPYLTON ROAD INTERSECTION, GOLD COAST CITY COUNCIL LANDFILL FACILITY | Stapylton, south of Beenleigh, near Quarry Road and Stapylton road intersection, Gold Coast City Council landfill facility.□<br>Disturbed area, on fill in proximity to wet eucalypt forest near a creek with Melaleuca quinquenervia.□<br>Herb, pink bracts, not cultivated.□<br>Coarse. |
| 179139 | 1 | | A | Angiosperm | Amaryllidaceae | | Proiphys cuninghamii (Aiton ex Lindl.) Mabb. | 32549 | Jensen G. | | | 05AUG1966 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 179405 | 1 | | A | Angiosperm | Anacardiaceae | | Rhodosphaera rhodanthema (F.Muell.) Engl. | 4961 | Michael N. | 1823 | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh.□<br>Tree ca 25ft. |
| 673485 | 5866 | | A | Angiosperm | Anacardiaceae | * | Schinus terebinthifolius Raddi | 31546 | Batianoff G.N. | 98091 | Batianoff,J.; | 13SEP1998 | | | Queensland | Moreton | CLEVELAND BRISBANE BAY BETWEEN JULIA ST AND ORMISTON SLEATH ST | Cleveland Brisbane, bay between Julia St and Ormiston, Sleath St.□<br>Protected sheltered coast mangrove and Melaleuca on dry land.□<br>Small tree red fruit.□<br>Common. |
| 210449 | 1 | | A | Angiosperm | Annonaceae | | Meiogyne stenopetala (F.Muell.) Heusden | 97825 | Byrnes N. | 3106 | | 11MAR1975 | | | Queensland | Moreton | MT TAMBORINE | Mt Tamborine.□<br>Rainforest. Low shrub. |
| 210537 | 1 | | A | Angiosperm | Annonaceae | | Polyalthia nitidissima (Dunal) Benth. | 2075 | Wilson C.L. | 632 | | 14MAY1957 | | | Queensland | Moreton | ALONG LOGAN RIVER AT MT STAPYLTON | Along Logan River at Mt Stapylton.□<br>Tree +/- 18ft high, smooth bark; fruit red. |
| 89027 | 1 | | A | Angiosperm | Apiaceae | * | Foeniculum vulgare Mill. | 21211 | Gampe N.A. | | | 02MAR1965 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Growing in grass paddocks.□<br>Height about 3ft, flowers yellow.□<br>One small patch, not seen elsewhere. |
| 137796 | 1 | | A | Angiosperm | Apiaceae | | Platysace ericoides (Sieber ex Spreng.) C.Norman | 3741 | Michael N. | 1864 | | 25SEP1931 | | | Queensland | Moreton | BEENLEIGH | |
| 137815 | 1 | | A | Angiosperm | Apiaceae | | Platysace ericoides (Sieber ex Spreng.) C.Norman | 3741 | Peberdy J. | 2472 | | NOV1960 | | | Queensland | Moreton | MORETON BAY JACOBS WELL | |
| 137992 | 1 | | A | Angiosperm | Apiaceae | | Xanthosia pilosa Rudge | 3962 | White C.T. | | | SEP1913 | Hart J.M. | FEB1949 | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 216351 | 1 | | A | Angiosperm | Apocynaceae | * | Asclepias curassavica L. | 207 | Everist S.L. | | | 11MAY1958 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>Common weed of old cultivation and on roadside.□<br>Perennial with erect stems; whole plant with copious latex.□<br>Suspected of poisoning cattle. |
| 433651 | 1 | | A | Angiosperm | Apocynaceae | | Carissa ovata R.Br. | 48840 | Byrnes N. | 3104 | | 11MAR1975 | | | Queensland | Moreton | MT TAMBORINE | Mt Tamborine.□<br>Rainforest.□<br>Shrub ca. 2m. |
| 600799 | 5396 | | A | Angiosperm | Apocynaceae | | Cynanchum carnosum (R.Br.) Schltr. | 696 | Grimshaw P. | G527 | Gibbs,R.; | 09MAR1994 | | | Queensland | Moreton | ROCKY POINT NR MOUTH OF LOGAN RIVER CAUSEWAY THROUGH MANGROVES (GPS 27 43 12 153 20 57) | Rocky Point near mouth of the Logan River, Southern Moreton Bay, causeway through mangroves; (GPS 27 43 12 153 20 57).□<br>Tidal mudflats with raised causeway, on causeway embankment; tall shrubland of mangrove species.□<br>Scrambling vine to 2m high; green to reddish windmill-like flowers; fruit a long tapered capsule sometimes in pairs.□<br>Restricted-locally common. |
| 767567 | 6461 | | A | Angiosperm | Apocynaceae | V | Marsdenia coronata Benth. | 37059 | Leiper G. | | | JUN2004 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>In spotted gum forest.□<br>Milky sap. |
| 431214 | 1 | | A | Angiosperm | Apocynaceae | | Marsdenia flavescens A.Cunn. ex Hook. | 37061 | Williams K.A. | 84033 | Bird,L.H.; | 14APR1984 | | | Queensland | Moreton | UPPER ORMEAU RD OFF PACIFIC HWY DARLINGTON RA | Private property, Barry and Allan Muir, Upper Ormeau Rd (off Pacific Highway), Darlington Range.□<br>Hilltop, notophyll vine forest, remnant rainforest at high elevation, loam soils with stone content, some outcrop.□<br>A slender vine growing on the sunny edge of the rainforest, does not reach any great height, rambes through vegetation, very open growth and many of the slender stems are loose, free and pendulous from supports. |
| 216663 | 1 | | A | Angiosperm | Apocynaceae | | Marsdenia fraseri Benth. | 4785 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island, Moreton Bay. |
| 212654 | 1 | | A | Angiosperm | Apocynaceae | | Melodinus acutiflorus F.Muell. | 4801 | Simmonds J.H. | | | 1888 | Leeuwenberg A.J. | 2001 | Queensland | Moreton | PIMPAMA | Pimpama. |
| 212656 | 1 | | A | Angiosperm | Apocynaceae | | Melodinus acutiflorus F.Muell. | 4801 | Shirley J. | | | | Leeuwenberg A.J. | 2001 | Queensland | Moreton | PIMPAMA | Pimpama. |
| 767571 | 6461 | | A | Angiosperm | Apocynaceae | | Parsonsia lanceolata R.Br. | 1929 | Leiper G. | | | JUN2004 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>In eucalypt forest of Corymbia citriodora, Eucalyptus microcorys, E.propinqua and E.acmenoides.□<br>Clear sap. |
| 431213 | 1 | | A | Angiosperm | Apocynaceae | | Parsonsia velutina R.Br. | 1935 | Williams K.A. | 84030 | | 14APR1984 | | | Queensland | Moreton | UPPER ORMEAU RD OFF PACIFIC HWY | Private property, Barry and Allan Muir, Upper Ormeau Road (off Pacific Highway), eastern foothills of Darlington Range.□<br>Disturbed area over-run with grasses and lantana at edge of remnant patch of rainforest at fairly high elevation, soils are loam that contain stone with occasional outcrops. Hilltop, Notophyll vine forest. |
| 216993 | 1 | | A | Angiosperm | Apocynaceae | | Tylophora paniculata R.Br. | 37378 | Simmonds J.H. | | | 18MAR1888 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 216997 | 1 | | A | Angiosperm | Apocynaceae | | Tylophora paniculata R.Br. | 37378 | Simmonds J.H. | | | 18MAR1888 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 777446 | 6316 | | A | Angiosperm | Araliaceae | | Trachymene procumbens (F.Muell.) Benth. | 3921 | Leiper G. | | | 30JUN2003 | | | Queensland | Moreton | MT STAPYLTON NEAR BEENLEIGH ABOUT 10M BELOW THE SUMMIT | Mt Stapylton near Beenleigh about 10m below the summit.□<br>In Lophostemon confertus & Eucalyptus crebra forest.□<br>Herb with white flowers. |
| 75508 | 1 | | A | Angiosperm | Arecaceae | | Calamus muelleri H.Wendl. | 19202 | Simmonds J.H. | | | APR1888 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 102081 | 1 | | A | Angiosperm | Arecaceae | | Linospadix monostachya (Mart.) H.Wendl. | 4755 | Byrnes N. | 3103 | | 11MAR1975 | | | Queensland | Moreton | MT TAMBORINE | Mt Tamborine.□<br>Rainforest. Small palm. |
| 396367 | 1 | | A | Angiosperm | Aristolochiaceae | | Aristolochia meridionalis E.M.Ross subsp. meridionalis | 76734 | Sankowsky G. | | Sankowsky,N.; | MAR1983 | Ross E.M. | SEP1994 | Queensland | Moreton | BEENLEIGH BAHR'S SCRUB RD | Bahr's Scrub Rd, Beenleigh.□<br>Small vine to 60cm; in open forest or to 2m in scrub.□<br>Also sighted at Goodnight Scrub, Mt Coo-tha, Mt Nebo & Mt Tamborine. |
| 396366 | 1 | | A | Angiosperm | Aristolochiaceae | | Aristolochia meridionalis E.M.Ross subsp. meridionalis | 76734 | Sankowsky G. | | Sankowsky,N.; | 04MAR1983 | Ross E.M. | SEP1994 | Queensland | Moreton | BEENLEIGH BAHR'S SCRUB RD | Bahr's Scrub Rd, Beenleigh.□<br>Fruit in spirit collection. |
| 244772 | 1 | | A | Angiosperm | Asteraceae | * | Acanthospermum hispidum DC. | 3109 | Everist S.L. | | | 11MAY1958 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>Weed in cultivation in bean patches and in pawpaw plantations. Red brown loam. |
| 247544 | 1 | | A | Angiosperm | Asteraceae | * | Ageratina riparia (Regel) R.M.King & H.Rob. | 81147 | White C.T. | | | MAY1921 | | | Queensland | Moreton | CEDAR CK VIA BEENLEIGH | Cedar Creek, via Beenleigh.□<br>Along a creek. |
| 245021 | 1 | | A | Angiosperm | Asteraceae | * | Ambrosia artemisiifolia L. | 3126 | Young H.E. | | | 08MAY1968 | | | Queensland | Moreton | WOONGOOLBA BEENLEIGH AREA | Woongoolba, Beenleigh area.□<br>In old disused slaughter yeard and has spread into adjacent cane farm of E.W Berndt where it is becoming a problem in cane. |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 245011 | 1 | | A | Angiosperm | Asteraceae | * | Ambrosia artemisiifolia L. | 3126 | Ladds P.W. | | | | 22MAR1962 | | | Queensland | Moreton | WOLFDENE VIA BEENLEIGH | Property of K.Finch, Wolfdene via Beenleigh.□<br>Growing on river flat with grey, sandy soil. Annual ragweed. |
| 456103 | 1 | | A | Angiosperm | Asteraceae | | Brachyscome microcarpa F.Muell. | 3216 | Leiper G. | | | | 1989 | | | Queensland | Moreton | UPPER PIMPAMA ACREAGE HOUSING DEV | Acreage housing Development, Upper Pimpama.□<br>Soil heavy, loamy and dark. On steep hillside with Themeda triandra, Xanthorrhoea sp., Cassinia subtropica, Daviesia arborea, Casuarina torulosa, Lophostemon confertus, Eucalyptus crebra, E. microcorys, E. tereticornis, E. acmenoides. Daisy having mauve flowers and very common in sunnier spots. |
| 245682 | 1 | | A | Angiosperm | Asteraceae | | Brachyscome microcarpa F.Muell. | 3216 | Michael N. | 1882 | | | | | | Queensland | Moreton | ORMEAU | |
| 246058 | 1 | | A | Angiosperm | Asteraceae | | Calotis lappulacea Benth. | 3241 | Michael N. | 1876 | | | 04SEP1931 | Davis G.L. | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 653857 | 5709 | | A | Angiosperm | Asteraceae | | Cassinia laevis R.Br. | 4268 | Leiper G. | 10 | | | FEB1997 | Francis R. | MAR1997 | Queensland | Moreton | SOUTH STRADBROKE ISLAND COURAN AREA | S/S Stradbroke Island Couran area.□<br>Moist Euc forest with E. tessellaris, E. intermedia, E. tereticornis, Endiandra sieberi, Calochaena dubia.□<br>Shrub, uncommon. |
| 246466 | 1 | | A | Angiosperm | Asteraceae | | Cassinia quinquefaria R.Br. | 3264 | White C.T. | 3400 | | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS | |
| 652664 | 5692 | | A | Angiosperm | Asteraceae | * | Facelis retusa (Lam.) Sch.Bip. | 13077 | Leiper G. | 6 | | | DEC1996 | Holland A. | JAN1997 | Queensland | Moreton | GROWING ON ROADSIDE AT PIMPAMA (PIMPAMA JACOBS WELL RD) | Growing on roadside at Pimpama (Pimpama - Jacobs Well RD).□<br>Common in area. |
| 247637 | 1 | | A | Angiosperm | Asteraceae | * | Galinsoga parviflora Cav. | 24608 | Everist S.L. | | | | 11MAY1959 | Schulz D.L. | | Queensland | Moreton | RUSSELL IS | Russell Island, forming common roadside weed, in brown loam. |
| 247805 | 1 | | A | Angiosperm | Asteraceae | | Pseudognaphalium luteoalbum (L.) Hilliard & B.L.Burtt | 67830 | Michael N. | | | | 30DEC1931 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 271072 | 1 | | A | Angiosperm | Asteraceae | | Sigesbeckia orientalis L. | 25670 | not known | | | | | Schulz D.L. | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 790140 | 6350 | | A | Angiosperm | Asteraceae | * | Soliva anthemifolia (Juss.) Sweet | 42261 | Bean A.R. | 20658 | | | 19AUG2003 | | | Queensland | Moreton | SUGARCANE RD WOONGOOLBA, ESE OF BEENLEIGH | Sugarcane Rd, Woongoolba, ESE of Beenleigh.□<br>Roadside adjacent to Melaleuca quinquenervia woodland. Clay soil.□<br>Prostrate forb, inflorescence green and sessile. □<br>Abundant at site. |
| 271167 | 1 | | A | Angiosperm | Asteraceae | * | Soliva sessilis Ruiz & Pav. | 89013 | Curtis D. | 3 | | | 06NOV1935 | Thompson I.R. | JUN2005 | Queensland | Moreton | HOPE DALE BEENLEIGH ALBERT RIVER | Hope Dale, Albert River, Beenleigh.□<br>School childern complain of the little spike sticking into their feet. |
| 271954 | 1 | | A | Angiosperm | Asteraceae | | Vittadinia tenuissima (Benth.) J.M.Black | 12184 | Simmonds J.H. | | | | 18MAR1889 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 554476 | 6160 | | A | Angiosperm | Asteraceae | | Wollastonia biflora (L.) DC. | 74920 | Kerr D. | | | | 20FEB2002 | | | Queensland | Moreton | MT WARREN PARK GOLF COURSE, ALBERT RIVER | Mt Warren Park Golf Course, Albert River. |
| 600798 | 5396 | | A | Angiosperm | Avicenniaceae | | Avicennia marina subsp. australasica (Walp.) J.Everett | 74381 | Grimshaw P. | G526 | | | 09MAR1994 | | | Queensland | Moreton | ROCKY POINT NR MOUTH OF LOGAN RIVER CAUSEWAY THROUGH MANGROVES (GPS 27 43 12 153 20 57) | Rocky Point near mouth of the Logan River, Southern Moreton Bay, causeway through mangroves; (GPS 27 43 12 153 20 57).□<br>Tidal mudflats with raised causeway; tall shrubland of mangrove species.□<br>Shrub or low tree to 3.5m high; leaves opposite yellowish green upper surface, greyish undersuface; flowers yellow in small terminal clusters.□<br>Very common (dominant). |
| 219620 | 1 | | A | Angiosperm | Bignoniaceae | | Pandorea jasminoides (Lindl.) K.Schum. | 1921 | White C.T. | | | | 23OCT1913 | Van Steenis | | Queensland | Moreton | MOSQUITO CK (MORETON BAY) | Mosquito Creek (Moreton Bay). |
| 219058 | 1 | | A | Angiosperm | Bignoniaceae | | Pandorea pandorana (Andrews) Steenis | 1922 | Parke E.N. | | | | SEP1917 | Van Steenis | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 219639 | 1 | | A | Angiosperm | Boraginaceae | * | Echium plantagineum L. | 36927 | Everist S.L. | | | | 11MAY1959 | Piggins C. | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>In grey sandy loam. Has appeared in area sown with beans.□<br>Herb with dull reddish tap roots and close rosette of green leaves, rough to touch. |
| 337967 | 1 | | A | Angiosperm | Brassicaceae | * | Cardamine hirsuta L. | 34962 | Blake S.T. | 20095 | | | 12MAR1957 | | | Queensland | Moreton | NEAR YATALA NEAR BEENLEIGH | Near Yatala, near Beenleigh.□<br>In heavily grazed Eucalyptus forest.□<br>Green annual, petals white, mauve-pink outside.□<br>Occasional. |
| 278899 | 1 | | A | Angiosperm | Brassicaceae | * | Rapistrum rugosum (L.) All. | 32703 | Everist S.L. | | | | 11MAY1959 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>In brown loam. Weed in pawpaw plantation. |
| 9855 | 1 | | A | Angiosperm | Caesalpiniaceae | | Barklya syringifolia F.Muell. | 3175 | Smith L.S. | 5148 | | | 21DEC1953 | | | Queensland | Moreton | YATALA | Yatala. |
| 16453 | 1 | | A | Angiosperm | Caesalpiniaceae | | Caesalpinia subtropica Pedley | 4202 | Simmonds J.H. | 124 | | | 1888 | | | Queensland | Moreton | MEZONEURUM | Mezoneurum. |
| 12733 | 1 | | A | Angiosperm | Caesalpiniaceae | R | Cassia marksiana (F.M.Bailey) Domin | 4262 | Smith L.S. | 5181 | | | MAR1954 | Guymer G.P. | AUG2004 | Queensland | Moreton | BEENLEIGH AREA | Beenleigh area.□<br>On stream bank. A small tree. |
| 608337 | 6439 | | A | Angiosperm | Caesalpiniaceae | * | Senna occidentalis (L.) Link | 5015 | Leiper G. | | | | 22MAY2004 | | | Queensland | Moreton | UPPER ORMEAU RD, ORMEAU ON BANKS OF PIMPAMA RIVER AT CNR OF BARRENJOEY RD | Upper Ormeau Road, Ormeau, on barks of Pimpama River at corner of Barrenjoey Road.□<br>Specimen is total above-ground plant. |
| 27185 | 1 | | A | Angiosperm | Campanulaceae | | Lobelia alata Labill. | 1617 | Pedley L. | 63 | | | 13NOV1955 | | | Queensland | Moreton | JACOB'S WELL NR WOONGOOLBA | Jacob's Well near Woongoolba.□<br>In sandy soil beneath Casuarina glauca on edge of Sporobolus virginicus swamp. □<br>A procumbent herb with milky sap. Flowers blue.□<br>Not common. |
| 27227 | 1 | | A | Angiosperm | Campanulaceae | | Lobelia gibbosa Labill. var. gibbosa | 9628 | Michael N. | 1805 | | | 03OCT1931 | Walsh N. | JUN2004 | Queensland | Moreton | ORMEAU | Ormeau. |
| 27319 | 1 | | A | Angiosperm | Campanulaceae | | Lobelia purpurascens R.Br. | 1651 | not known | | | | | Francis W.D. | | Queensland | Moreton | PIMPAMA | |
| 29198 | 1 | | A | Angiosperm | Caryophyllaceae | * | Spergularia rubra (L.) J.Presl & C.Presl | 5038 | Michael N. | 2002 | | | 22FEB1933 | | | Queensland | Moreton | BEENLEIGH RWY STN | |
| 431220 | 1 | | A | Angiosperm | Celastraceae | | Maytenus disperma (F.Muell.) Loes. | 2761 | Williams K.A. | 84033 | et al.; | | | | | Queensland | Moreton | DARLINGTON RA UPPER ORMEAU RD OFF PACIFIC HWY | Private Property, Barry and Allan Muir. Upper Ormeau Rd off Pacific Hwy.□<br>Remnant hilltop notophyll vine forest, bam soils with stone content, some outcrops.□<br>Open shrub to small tree C. 4m high, understory plant in fores and also along edge of forest in sunshine. |
| 397994 | 1 | | A | Angiosperm | Celastraceae | | Maytenus disperma (F.Muell.) Loes. | 2761 | Leiper G. | | | | 05JUL1985 | | | Queensland | Moreton | BETWEEN ORMEAU & CEDAR CK | Ridge running between Ormeau and Cedar Creek.□<br>Rainforest. |
| 657172 | 5756 | | A | Angiosperm | Chenopodiaceae | | Atriplex semibaccata R.Br. | 246 | Leiper G. | 14 | | | APR1997 | Francis R. | JUL1997 | Queensland | Moreton | BANKS OF PIMPAMA RIVER AT YAWALPAH | Banks of Pimpama River at Yawalpah.□<br>Tidal. |
| 242962 | 1 | | A | Angiosperm | Chenopodiaceae | | Enchylaena tomentosa var. glabra Benth. | 35049 | White C.T. | 3406 | | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS | Russell Island, Moreton Bay.□<br>Straggly plant growing under shade of trees behind the beach. |
| 674274 | 5875 | | A | Angiosperm | Chenopodiaceae | | Sarcocornia quinqueflora (Bunge ex Ung.-Sternb.) A.J.Scott subsp. quinqueflora | 2299 | Dowling R.M. | W263 | Stephens,K.M.; | | 01SEP1998 | | | Queensland | Moreton | ROCKY POINT ROAD (AMG 56 534201E 6933682N) | Rocky Pt Road.□<br>(AMG 56 534201E 6933682N).□<br>Tidal flat of black peat.□<br>Phragmites open grassland with dense mixture of shrubs & herbs below. |
| 243531 | 1 | | A | Angiosperm | Chenopodiaceae | | Suaeda arbusculoides L.S.Sm. | 5063 | White C.T. | 6003 | | | 28FEB1929 | | | Queensland | Moreton | MOSQUITO CK MORETON BAY | Mosquito Creek Moreton Bay. |
| 674273 | 5875 | | A | Angiosperm | Chenopodiaceae | | Tecticornia pergranulata subsp. queenslandica (Paul G.Wilson) K.A.Sheph & Paul G.Wilson | 99189 | Dowling R.M. | W262 | Stephens,K.M.; | | 01SEP1998 | | | Queensland | Moreton | ROCKY POINT ROAD (AMG 56 534201E 6933682N) | Rocky Pt Road.□<br>(AMG 56 534201E 6933682N).□<br>Tidal flat of black peat.□<br>Phragmites open grassland with dense mixture of shrubs & herbs below. |
| 663380 | 5845 | | A | Angiosperm | Cleomaceae | | Cleome | 45795 | Leiper G. | | | | JUL1998 | Francis R. | AUG1998 | Queensland | Moreton | S STRADBROKE IS | South Stradbroke Island.□<br>Weed of disturbed sand. |
| 276614 | 1 | | A | Angiosperm | Convolvulaceae | * | Ipomoea quamoclit L. | 1511 | Simmonds J.H. | | | | 18MAR1889 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 674277 | 5875 | | A | Angiosperm | Cucurbitaceae | | Neoachmandra cunninghamii (F.Muell.) W.J.de Wilde & Duyfjes | 98162 | Dowling R.M. | W266 | Stephens,K.M.; | | 01SEP1998 | | | Queensland | Moreton | OFF CANE TRACK FOLLOWING POWER LINES OF ROCKY POINT ROAD (AMG 56 533271E 6933851N) | Off cane track, following power lines of Rocky Pt Road.□<br>(AMG 56 533271E 6933851N).□<br>Swamp of black organic soil.□<br>Casuarina glauca woodland, Einadia hastata under. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 431216 | 1 | | A | Angiosperm | Cucurbitaceae | | Trichosanthes subvelutina F.Muell. ex Cogn. | 47593 | Williams K.A. | 84032 | Bird,L.H.; | | 14APR1984 | | | Queensland | Moreton | B & A MUIR PROPERTY UPPER ORMEAU RD OFF PACIFIC HWY | Upper Ormeau Rd off Pacific Hwy.□<br>B & A Muir's Property.□<br>Hilltop; Notophyll vine forest, remnant rainforest of high elevation, soils loam with a good deal of stone, some outcrops.□<br>A vine which extends over the forest floor in straight lines. Occasional stems climbing tree trunks into the canopy; fruit a small melon c 15cm long, oval, green mottled and striped with greenish-white, opened fruit has very pleasant 'fruit salad' aroma. |
| 311147 | 1 | | A | Angiosperm | Cyperaceae | | Baumea articulata (R.Br.) S.T.Blake | 4144 | Michael N. | 1847 | | | 11SEP1931 | | | Queensland | Moreton | YATALA | Yatala.□<br>Stems up to 5ft above water. |
| 311153 | 1 | | A | Angiosperm | Cyperaceae | | Baumea articulata (R.Br.) S.T.Blake | 4144 | Smith L.S. | 12235 | | | 04NOV1964 | | | Queensland | Moreton | NR BEENLEIGH 1 MILE ALONG WATERFORD RD | Near Beenleigh, C. 1M along Waterford Road.□<br>Growing beside moist drainage line.□<br>An erect sedge to 1.5m high. |
| 387864 | 1 | | A | Angiosperm | Cyperaceae | | Baumea articulata (R.Br.) S.T.Blake | 4144 | Smith L.S. | 12235 | | | 04NOV1964 | | | Queensland | Moreton | NR BEENLEIGH CA 1 MILE ALONG WATERFORD RD | Near Beenleigh, C. 1M along Waterford Road.□<br>Growing beside moist drainage line.□<br>An erect sedge to 1.5m high. |
| 311351 | 1 | | A | Angiosperm | Cyperaceae | | Baumea rubiginosa (Spreng.) Boeck. | 303 | Cribb H.G. | | | | 14JAN1933 | | | Queensland | Moreton | PIMPAMA CK | Pimpama Creek.□<br>Growing near water's edge. Dark saoil, basaltic? |
| 666363 | 5937 | | A | Angiosperm | Cyperaceae | | Carex fascicularis Sol. ex Boott | 46684 | Stanley J. | | | | SEP1997 | Spokes T.M. | SEP1997 | Queensland | Moreton | LOGANHOLME AT JENSENS TREE NURSERY (2) | Loganholme, at Jensens Tree Nursery.□<br>On swamp and sodden ground, freshwater. |
| 554537 | 6161 | | A | Angiosperm | Cyperaceae | | Carex hubbardii Nelmes | 46688 | Leiper G. | | | | MAR2002 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Dry rainforest remnant. |
| 312730 | 1 | | A | Angiosperm | Cyperaceae | | Caustis blakei Kuek. subsp. blakei | 84804 | Sharpe P.R. | 2146 | Dowling,R.M.; | | 07JAN1977 | | | Queensland | Moreton | SOUTH LAGOON SOUTH STRADBROKE IS | South Lagoon, South Stradbroke Island.□<br>Dry sclerophyll woodland of various Eucalyptus spp. To 18m high. Understory of Acacia spp., Persoonia sp., and other shrubs. Sandy soil.□<br>Erect to oblique growing sedge, light green stems and leaves, inflorescence brown. Growing on ridge close to the lake. |
| 316816 | 1 | | A | Angiosperm | Cyperaceae | | Cyperus difformis L. | 704 | Cribb H.G. | | | | 14JAN1933 | | | Queensland | Moreton | LOGANHOLME | Loganholme.□<br>Around margin of water hole at roadside in flat country on dark brown clay soil. |
| 316803 | 1 | | A | Angiosperm | Cyperaceae | | Cyperus difformis L. | 704 | Cribb H.G. | | | | 14JAN1933 | Sharpe P.R. | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Waterhole side of road. Dark basaltic clay soil. |
| 308988 | 1 | | A | Angiosperm | Cyperaceae | | Cyperus haspan L. subsp. haspan | 713 | Cribb H.G. | | | | | Sharpe P. | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Waterhole, side of road. Dark clayey, basaltic soil. |
| 308423 | 1 | | A | Angiosperm | Cyperaceae | | Cyperus pilosus Vahl | 722 | Cribb H.G. | | | | 14JAN1933 | Sharpe P. | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Waterholes, side of roads. Brownish soil. |
| 414484 | 1 | | A | Angiosperm | Cyperaceae | | Cyperus sculptus S.T.Blake | 44226 | Blake S.T. | 20094 | | | 12MAR1937 | Sharpe P.R. | | Queensland | Moreton | YATALA NR | Near Yatala.□<br>In heavily grazed Eucalyptus forest.□<br>Green spreading tufts. Common. |
| 299906 | 1 | | A | Angiosperm | Cyperaceae | * | Cyperus sesquiflorus (Torr.) Mattf. & Kuek. | 29858 | Willis L.A. | | | | MAR1954 | | | Queensland | Moreton | NORWELL | Norwell.□<br>Suspected of causing scouring on cows. |
| 320626 | 1 | | A | Angiosperm | Cyperaceae | | Eleocharis cylindrostachys Boeck. | 928 | Michael N. | 1848 | | | 11SEP1931 | Blake S.T. | | Queensland | Moreton | YATALA | Yatala. |
| 320614 | 1 | | A | Angiosperm | Cyperaceae | | Eleocharis cylindrostachys Boeck. | 928 | Cribb H.G. | | | | 14JAN1933 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Waterholes by roadside. Brownish soil. |
| 170891 | 1 | | A | Angiosperm | Cyperaceae | | Eleocharis equisetina C.Presl | 4529 | Elsol J.A. | 36 | | | 09SEP1976 | Sharpe P.R. | | Queensland | Moreton | BEENLEIGH CA 0.5KM N OF BEENLEIGH DRIVE-IN THEATRE | C. 0.5km N of Beenleigh Drive-In Theatre, Beenleigh.□<br>Creekline of low relief forming a flat bog, with almost pure stand of this sedge. Soil was a reduced grey colour of high clay content and water saturated. In a disturbed area.□<br>Seedlings were numerous. |
| 412915 | 1 | | A | Angiosperm | Cyperaceae | | Eleocharis equisetina C.Presl | 4529 | Blake S.T. | 20097 | | | 12MAR1957 | Sharpe P.R. | JAN1992 | Queensland | Moreton | YATALA NR | Near Yatala.□<br>In wetter parts of swamp, mainly in shallow water.□<br>Forms green strands of more or less erect stems. |
| 300590 | 1 | | A | Angiosperm | Cyperaceae | | Eleocharis sphacelata R.Br. | 931 | Cribb H.G. | | | | 14JAN1933 | Blake S.T. | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Creek on Brisbane side of township, on the bank and in the water. |
| 674276 | 5875 | | A | Angiosperm | Cyperaceae | | Fimbristylis ferruginea (L.) Vahl | 1191 | Dowling R.M. | W265 | Stephens,K.M.; | | 01SEP1998 | Sharpe P.R. | NOV1999 | Queensland | Moreton | ROCKY POINT ROAD (AMG 56 534201E 6933682N) | Rocky Pt Road.□<br>(AMG 56 534201E 6933682N).□<br>Tidal flat of black peat.□<br>Phragmites open grassland with dense mixture of shrubs & herbs below. |
| 302770 | 1 | | A | Angiosperm | Cyperaceae | | Fuirena ciliaris (L.) Roxb. | 1216 | Cribb H.G. | | | | 24JAN1933 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>On damp open flats alongside of road in shallow waterhole. Brownish, probably basaltic clayey soi. |
| 790167 | 6350 | | A | Angiosperm | Cyperaceae | | Isolepis inundata R.Br. | 1515 | Beard J.R. | 20659 | | | 19AUG2003 | | | Queensland | Moreton | SUGARCANE RD, WOONGOOLBA, ESE OF BEENLEIGH | Sugarcane Rd, Woongoolba, ESE of Beenleigh.□<br>Roadside adjacent to Melaleuca quinquenervia woodland. Clay soil.□<br>Sedge 25cm high, spikelets green with a reddish tinge.□<br>Occasional at site. |
| 155920 | 1 | | A | Angiosperm | Cyperaceae | | Isolepis nodosa (Rottb.) R.Br. | 1520 | Cribb H.G. | | | | 14JAN1933 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Water hole by roadside. Dark basaltic clay; flat country. |
| 303942 | 1 | | A | Angiosperm | Cyperaceae | | Lipocarpha microcephala (R.Br.) Kunth | 1638 | Michael N. | 1819 | | | | Sharpe P. | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 304157 | 1 | | A | Angiosperm | Cyperaceae | | Ptilothrix deusta (R.Br.) K.L.Wilson | 74370 | White C.T. | | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 156138 | 1 | | A | Angiosperm | Cyperaceae | | Schoenoplectus validus (Vahl) A.Love & D.Love | 2334 | Cribb H.S. | | | | 14JAN1933 | | | Queensland | Moreton | PIMPAMA CK | Pimpama Creek.□<br>In water. |
| 582380 | 5509 | | A | Angiosperm | Cyperaceae | | Schoenus brevifolius R.Br. | 4985 | Coaldrake J.E. | JT615 | | | 26JAN1971 | | | Queensland | Moreton | SE SPUR STRADBROKE IS | SE Spur, Stradbroke Island. |
| 156370 | 1 | | A | Angiosperm | Cyperaceae | | Scleria levis Retz. | 2348 | Sharpe P.R. | 2022 | | | 24APR1976 | | | Queensland | Moreton | PIMPAMA YAWALPAH RD 5KM E OF OLD GOLD COAST RD N OF SOUTHPORT | Yawalpah Rd 5K E of Old Gold Coast Rd, Pimpama N of Southport.□<br>Dry sclerophyll woodland of Eucalyptus, Casuarina trees understory of Acacias, Persoonia and grasses, gravelly soil. □<br>Oblique to erect herb to 60cm high; green culms and leaves; brown inflorescence. |
| 180966 | 1 | | A | Angiosperm | Dilleniaceae | | Hibbertia vestita var. thymifolia Benth. | 33855 | White C.T. | | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | |
| 115244 | 1 | | A | Angiosperm | Elaeocarpaceae | | Tetratheca thymifolia Sm. | 2566 | White C.T. | | | | SEP1913 | Thompson J. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 224034 | 1 | | A | Angiosperm | Ericaceae | | Brachyloma scortechinii F.Muell. | 373 | Dick R.S. | WW38 | | | SEP1977 | | | Queensland | Moreton | WOONGOOLBA | Woongoolba Wallum Scrub.□<br>Adjoining Eucalypt forest. |
| 187028 | 1 | | A | Angiosperm | Ericaceae | | Epacris microphylla R.Br. var. microphylla | 33765 | White C.T. | 3401 | | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay.□<br>Swamps. |
| 396634 | 1 | | A | Angiosperm | Ericaceae | | Leucopogon juniperinus R.Br. | 1610 | Williams K.A. | 84062 | | | 07AUG1984 | | | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh.□<br>Hillside slope in open sunny situations. Soils stony, well drained, containing large amount of clay.□<br>Shrub, C. 1m high, open growth.□<br>Photograph with K. Williams. |
| 187607 | 1 | | A | Angiosperm | Ericaceae | | Leucopogon parviflorus (Andrews) Lindl. | 1617 | White C.T. | 3402 | | | 16APR1927 | Powell J.M. | JUN1993 | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>Behind the pebbly beach.□<br>Low stunted subshrubs. |
| 188149 | 1 | | A | Angiosperm | Ericaceae | | Monotoca scoparia (Sm.) R.Br. | 1809 | White C.T. | 3404 | | | 16APR1927 | Albrecht D.E. | JUL1993 | Queensland | Moreton | MORETON BAY RUSSELL IS | Russell Island, Moreton Bay. |
| 188187 | 1 | | A | Angiosperm | Ericaceae | | Monotoca sp. (Fraser Island P.Baxter 777) | 73345 | White C.T. | 3403 | | | 16APR1927 | Albrecht D.E. | OCT1993 | Queensland | Moreton | RUSSELL IS | Russell Island, Moreton Bay. |
| 188373 | 1 | | A | Angiosperm | Ericaceae | | Styphelia viridis subsp. breviflora (Benth.) J.M.Powell | 55154 | Bowen G.D. | | | | 03JUN1956 | Powell J.M. | APR1993 | Queensland | Moreton | STRADBROKE IS OPPOSITE CANAIPA PASSAGE | Stradbroke Island, opposite Canaipa Passage.□<br>Sand hills, W aspect. |
| 201033 | 1 | | A | Angiosperm | Euphorbiaceae | | Acalypha capillipes Muell.Arg. | 34891 | not known | | | | 18MAR1889 | | | Queensland | Moreton | PIMPAMA | Pimpama. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 201067 | 1 | | A | Angiosperm | Euphorbiaceae | | Acalypha eremorum Muell.Arg. | 43 | Simmonds J.H. | | | 18MAR1889 | | | Queensland | Moreton | PAMPAMA | |
| 456105 | 1 | | A | Angiosperm | Euphorbiaceae | | Acalypha nemorum F.Muell. ex Muell.Arg. | 44 | Leiper G. | | | 1989 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Growing on bank of gorge, dark loamy soil.□<br>Twiggy plant to about 1m high, flowers are filamentous, creamy-green in colour. |
| 201374 | 1 | | A | Angiosperm | Euphorbiaceae | V | Baloghia marmorata C.T.White | 35413 | Stanley T.D. | 54 | | 11MAR1975 | McPherson G. | | Queensland | Moreton | UPPER COOMERA-CANUNGRA RD 25KM FROM UPPER COOMERA (REFSET) | Upr Coomera-Canungra Rd 25K from Upr Coomera.□<br>On side of hill, in a small area of remnant rain forest by the road, surrounded by a new housing development.□<br>Shrubs of understory from 1m - 2.5m. Flowers but not fruit seen. |
| 198244 | 1 | | A | Angiosperm | Euphorbiaceae | | Mallotus megadontus P.I.Forst. | 89368 | Smith L.S. | 5149 | | 21DEC1953 | Sierra S. | FEB2006 | Queensland | Moreton | YATALA | Yatala. |
| 198660 | 1 | | A | Angiosperm | Fabaceae | | Aeschynomene micranthos (Poir.) DC. | 34902 | Simmonds J.H. | | | 18MAR1889 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 199843 | 1 | | A | Angiosperm | Fabaceae | | Aotus ericoides (Vent) G.Don | 3136 | White C.T. | 3525 | | 02JAN1928 | | | Queensland | Moreton | JACOBS WELL | Jacobs Well.□<br>Sandy forestlands, Euc. haemastana and Banksia aemulla. Shrub up to 6ft high. Flowers yellow. |
| 253488 | 1 | | A | Angiosperm | Fabaceae | | Callerya megasperma (F.Muell.) Schot | 81365 | Olsen M. | | Lebler,B.; | 16OCT1977 | | | Queensland | Moreton | NUMINBAH VALLEY | Numinbah Valley.□<br>In Callistemon viminalis at edge of cave creek. Rampant vine. |
| 776907 | 6308 | | A | Angiosperm | Fabaceae | | Crotalaria brevis Dorrin | 4356 | Bean A.R. | 20265 | | 30APR2003 | Holland A.E. | AUG2004 | Queensland | Moreton | NEAR STANMORE RD, YATALA | Near Stanmore Rd, Yatala.□<br>Woodland of Eucalyptus carnea, E. intermedia, E. siderophloia, Lophostemon confertus.□<br>Forb 20cm high. □<br>Rare at site. |
| 18400 | 1 | | A | Angiosperm | Fabaceae | * | Crotalaria goreensis Guill. & Perr. | 3321 | Everist S.L. | | | 11MAY1956 | | | Queensland | Moreton | RUSSELL IS | Russell Island. □<br>Fairly common roadside weed, in brown and pale grey brown loams. |
| 542853 | 5125 | | A | Angiosperm | Fabaceae | | Daviesia arborea W.Hill | 3352 | Leiper G. | | | 17APR1992 | | | Queensland | Moreton | SHAWS POCKET NR BEENLEIGH | Shaw's Pocket, near Beenleigh.□<br>On rocky slopes of southern hills.□<br>Dominant plant at locality, up to 6metres tall. |
| 587813 | 5646 | | A | Angiosperm | Fabaceae | | Daviesia arborea W.Hill | 3352 | Leiper G. | | | | | | Queensland | Moreton | CA 1/M S OF PIMPAMA RIVER WEIR ON KERKIN RD PIMPAMA ON E SIDE OF RD | About 1km S of Pimpama River Weir on Kerkin Road, Pimpama on E side of road.□<br>Shrub 1m. |
| 19533 | 1 | | A | Angiosperm | Fabaceae | | Daviesia ulicifolia subsp. stenophylla G.Chandler & Crisp | 80975 | White C.T. | | | SEP1913 | Crisp M.D. | JUN1996 | Queensland | Moreton | RUSSEL IS | Russel Island. |
| 776900 | 6308 | | A | Angiosperm | Fabaceae | | Desmodium rhytidophyllum F.Muell. ex Benth. | 3377 | Bean A.R. | 20261 | | 30APR2003 | | | Queensland | Moreton | NEAR STANMORE RD, YATALA | Near Stanmore Rd, Yatala.□<br>Woodland of Eucalyptus carnea, E. intermedia, E. siderophloia, Lophostemon confertus.□<br>Prostrate shrub.□<br>Abundant at site. |
| 230638 | 1 | | A | Angiosperm | Fabaceae | | Erythrina numerosa A.R.Bean | 100170 | Simmonds J.H. | 115 | | 18MAR1889 | Bean A.R. | FEB2009 | Queensland | Moreton | PIMPAMA | Pimpama. |
| 231949 | 1 | | A | Angiosperm | Fabaceae | | Gompholobium pinnatum Sm. | 3517 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | |
| 232334 | 1 | | A | Angiosperm | Fabaceae | | Hardenbergia violacea (Schneev.) Stearn | 3530 | Everist S.L. | 5849 | | 02AUG1956 | | | Queensland | Moreton | PACIFIC HWY BETWEEN YATALA & ORMEAU | Stearn Pacific HWY between Yatala and Ormeau.□<br>In grey loam on shoulder of formed road. Vine with numerous wiry branched stems forming a mat or soil surface. Leaves dark green, horizontal; inforescence erect; flowers deep violet. |
| 232341 | 1 | | A | Angiosperm | Fabaceae | | Hardenbergia violacea (Schneev.) Stearn | 3530 | Michael N. | 1855 | | 22SEP1931 | | | Queensland | Moreton | HOLMVIEW | Holmview. |
| 232322 | 1 | | A | Angiosperm | Fabaceae | | Hardenbergia violacea (Schneev.) Stearn | 3530 | Parker E.N. | | | SEP1917 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 232181 | 1 | | A | Angiosperm | Fabaceae | | Hovea heterophylla A.Cunn. ex Hook.f. | 85537 | Michael N. | 1858 | | 18SEP1931 | Thompson I. | MAR2000 | Queensland | Moreton | ORMEAU | Ormeau. |
| 232174 | 1 | | A | Angiosperm | Fabaceae | | Hovea heterophylla A.Cunn. ex Hook.f. | 85537 | Parker E.M. | | | SEP1917 | Thompson I. | MAR2000 | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 232804 | 1 | | A | Angiosperm | Fabaceae | | Indigofera hirsuta L. | 3581 | Everist S.L. | | | 11MAY1959 | Wilson P.G. | NOV2005 | Queensland | Moreton | RUSSELL IS | |
| 233465 | 1 | | A | Angiosperm | Fabaceae | * | Indigofera suffruticosa Mill. | 17253 | Thurlow C. | | | 29JUL1959 | Wilson P.G. | JUL2007 | Queensland | Moreton | ORMEAU ON PIMPAMA CK | |
| 233642 | 1 | | A | Angiosperm | Fabaceae | | Indigofera trifoliata L. | 17246 | Simmonds J.H. | 101 | | 18MAR1889 | Wilson P.G. | JAN1994 | Queensland | Moreton | PIMPAMA | |
| 235800 | 1 | | A | Angiosperm | Fabaceae | | Podolobium scandens (Sm.) DC. | 81236 | Michael N. | 1868 | | 22SEP1931 | | | Queensland | Moreton | HOLMVIEW | Holmview.□<br>Small spreading legume. |
| 236920 | 1 | | A | Angiosperm | Fabaceae | | Pultenaea myrtoides A.Cunn. ex Benth. | 3786 | White C.T. | | | SEP1913 | de Kok R.P. | 2001 | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 237054 | 1 | | A | Angiosperm | Fabaceae | | Pultenaea retusa Sm. | 3789 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 237037 | 1 | | A | Angiosperm | Fabaceae | | Pultenaea retusa Sm. | 3789 | Parker E.N. | | | SEP1911 | de Kok R.P. | 2002 | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 237277 | 1 | | A | Angiosperm | Fabaceae | | Rhynchosia acuminatissima Miq. | 3802 | not known | | | | Nooteboom H.P. | | Queensland | Moreton | BARR SCRUB NEAR BEENLEIGH | Barr Scrub, near Beenleigh. |
| 238158 | 1 | | A | Angiosperm | Fabaceae | | Swainsona queenslardica Joy Thomps. | 68528 | Simmonds J.H. | 106 | | 18MAR1889 | Thompson J. | OCT1991 | Queensland | Moreton | BRISBANE PIMPAMA | Pimpama, Brisbane.□<br>Jabya or Goats Rose-leaved. |
| 640565 | 5574 | | A | Angiosperm | Fabaceae | | Tephrosia filipes Benth. subsp. filipes | 3863 | Leiper G. | | | FEB1996 | | | Queensland | Moreton | BENJUL DRIVE BEENLEIGH | Benjul Drive, Beenleigh.□<br>Multi-stemmed herb amongst grasses & other herbs, on shaly slope.□<br>Stems of Tephrosia are length of these specimens.□<br>Flowers deep rich pink.□<br>In euc. forest. |
| 239084 | 1 | | A | Angiosperm | Fabaceae | * | Vicia sativa subsp. nigra (L.) Ehrh. | 54236 | Michael N. | 1873 | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 209757 | 1 | | A | Angiosperm | Flagellariaceae | | Flagellaria indica L. | 1201 | Simmonds J.H. | | | 1888 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 220485 | 1 | | A | Angiosperm | Gentianaceae | | Schenkia australis (R.Br.) G.Mans. | 97595 | Michael N. | 1861 | | 17OCT1931 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 222055 | 1 | | A | Angiosperm | Goodeniaceae | | Dampiera sylvestris Rajput & Carolin | 739 | White C.T. | | | SEP1913 | Rajput M.T. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 222100 | 1 | | A | Angiosperm | Goodeniaceae | | Goodenia bellidifolia subsp. argentea Carolin | 1261 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 254738 | 1 | | A | Angiosperm | Goodeniaceae | | Goodenia paniculata Sm. | 4615 | Michael N. | 2001 | | 22FEB1933 | Carolin R. | JAN1978 | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 225148 | 1 | | A | Angiosperm | Goodeniaceae | | Scaevola ramosissima (Sm.) K.Krause | 2315 | White C.T. | | | SEP1913 | Carolin R. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 137150 | 1 | | A | Angiosperm | Haloragaceae | | Myriophyllum latifolium F.Muell. | 27155 | Simmonds J.H. | | | 18MAR1889 | Orchard A.E. | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 764117 | 6371 | | A | Angiosperm | Haloragaceae | | Myriophyllum latifolium F.Muell. | 27155 | Leiper G. | | | JAN2004 | Edginton M. | | Queensland | Moreton | PIMPAMA RIVER UPPER ORMEAU | Pimpama River Upper Ormeau.□<br>Submerged and emergent foliage. |
| 299614 | 1 | | A | Angiosperm | Hemerocallidaceae | | Dianella revoluta R.Br. var. revoluta | 4472 | White C.T. | | | SEP1913 | Henderson R.J. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 137470 | 1 | | A | Angiosperm | Hydrocharitaceae | | Hydrilla verticillata (L.f.) Royle | 4684 | Stanley T.D. | 52 | | 11MAR1975 | | | Queensland | Moreton | COOMERA RIVER 2ND CROSSING ON COOMERA-CANUNGRA RD (REFSET) | Coomera River, second crossing on Upper-Canungra Road ca. 15km from Upper Coomera.□<br>In slow moving water ca. 0.75 deep with Vallisneria spiralis. □<br>Quite common. |
| 137552 | 1 | | A | Angiosperm | Hydrocharitaceae | | Vallisneria nana R.Br. | 85685 | Stanley T.D. | 53 | | 11MAR1975 | | | Queensland | Moreton | COOMERA RIVER 2ND CROSSING COOMERA-CANUNGRA RD (REFSET) | Coomera River, 2nd crossing on Upper Coomera-Canugra Rd C. 15km from Upper Coomera.□<br>Slow moving water, C. 0.75m deep with Hydrilla verticillata.<br>Quite common. |
| 114016 | 1 | | A | Angiosperm | Iridaceae | * | Watsonia meriana var. bulbillifera (J.W.Mathews & L.Bolus) D.A.Cooke | 86496 | Byrnes N. | 3489 | | 11JAN1976 | | | Queensland | Moreton | BEAMS CK ROAD NR WOONGOOLBA (REFSET) | Behms Creek Road near Woongoolba.□<br>Roadside weed. |
| 53411 | 1 | | A | Angiosperm | Johnsoniaceae | | Caesia parviflora R.Br. var. parviflora | 411 | Michael N. | 1881 | | 04SEP1931 | Henderson R.J. | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 362351 | 1 | | A | Angiosperm | Johnsoniaceae | | Tricoryne elatior R.Br. | 2610 | Michael N. | 1905 | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 139406 | 1 | | A | Angiosperm | Juncaceae | | Juncus prismatocarpus R.Br. | 1549 | Smith L.S. | 12236 | | 04NOV1964 | | | Queensland | Moreton | NR BEENLEIGH C 1 MILE ALONG WATERFORD RD | Near Beenleigh, ca. 1 mile along Waterford Road.□<br>Growing beside moist drainage line.□<br>A bright green plant ca. 30-40cm high. |
| 387893 | 1 | | A | Angiosperm | Juncaceae | | Juncus prismatocarpus R.Br. | 1549 | Smith L.S. | 12236 | | 04NOV1964 | | | Queensland | Moreton | NR BEENLEIGH CA 1 MILE ALONG WATERFORD RD | Near Beenleigh, ca. 1 mile along Waterford Road.□<br>Growing beside moist drainage line.□<br>A bright green plant ca. 30-40cm high. |
| 160187 | 1 | | A | Angiosperm | Lamiaceae | | Anisomeles malabarica (L.) R.Br. ex Sims | 3131 | Simmonds J.H. | | | | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 504685 | 5052 | | A | Angiosperm | Lamiaceae | | Mentha diemenica Spreng. | 11734 | Leiper G. | | | 26APR1991 | | | Queensland | Moreton | AT BASE OF HILL OPPOSITE SIDE OF BAHRS SCRUB RD TO BAHRS HILL | At base of hill, opposite side of Bahrs Scrub, road to Bahrs hill.□<br>On very rocky soil with Daviesia squarrosa in very shady area.□<br>Herb, forming a loose mat up to 20cm tall. |
| 161090 | 1 | | A | Angiosperm | Lamiaceae | * | Salvia coccinea Buchoz ex Etl. | 31509 | Everist S.L. | | | 11MAY1956 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>In brown loam. Weed around farm buidings. |

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| 767569 | 6461 | | A | Angiosperm | Lauraceae | | Endiandra compressa C.T.White | 940 | Leiper G. | | | | JUN2004 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Gully of rainforest remnant.□<br>Young tree 2m tall. |
| 767464 | 6459 | | A | Angiosperm | Lauraceae | E | Endiandra floydii B.Hyland | 61290 | Leiper G. | | | | JUL2004 | Leiper G. | JUL2004 | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Rainforest margin; growing with Cryptocarya microneura.□<br>Small tree or shrub. Some leaves with domatia. |
| 767463 | 6459 | | A | Angiosperm | Lauraceae | E | Endiandra floydii B.Hyland | 61290 | Leiper G. | | | | JUL2004 | Leiper G. | JUL2004 | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Rainforest margin; growing with Cryptocarya microneura.□<br>Small tree/shrub c. 2m tall. |
| 540374 | 5111 | | A | Angiosperm | Lauraceae | | Endiandra muelleri subsp. bracteata B.Hyland | 31166 | Hauser J. | | Leiper,G.; | | 08FEB1992 | | | Queensland | Moreton | ON BANK OF HOTHAM CK PIMPAMA (REFSET) | On bank of Hotham Creek, Pimpama.□<br>Creek bank.□<br>Tree to about 4metres by 4metres. |
| 118186 | 1 | | A | Angiosperm | Laxmanniaceae | | Lomandra filiformis (Thunb.) Britten subsp. filiformis | 1655 | White C.T. | | | | SEP1913 | Lee A. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 587814 | 5646 | | A | Angiosperm | Laxmanniaceae | | Lomandra longifolia Labill. | 1661 | Leiper G. | | | | | | | Queensland | Moreton | CA 3.5KM W OF JACOBS WELL VILLAGE | About 3.5km W of Jacob's Well Village.□<br>Hill, clayish soil.□<br>Strong perfume. |
| 587815 | 5646 | | A | Angiosperm | Laxmanniaceae | | Lomandra longifolia Labill. | 1661 | Leiper G. | | | | | | | Queensland | Moreton | TIPPLERS CAMPING AREA S STRADBROKE IS | Tipplers Camping area, S Stradbroke Island.□<br>Deep white sand.□<br>No noticeable perfume. |
| 118373 | 1 | | A | Angiosperm | Laxmanniaceae | | Lomandra multiflora (R.Br.) Britten subsp. multiflora | 1662 | White C.T. | | | | SEP1913 | Macfarlane T.D. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 431174 | 1 | | A | Angiosperm | Loranthaceae | | Amylotheca dictyophleba (F.Muell.) Tiegh. | 156 | Williams K.A. | 85013 | | | 01JUN1985 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Parasitic plant on introduced camphorlaurel. Forms large clumps with stems c. 1m in length. Produces a prolific crop of fruit. Fruit orange. |
| 478293 | 1 | | A | Angiosperm | Loranthaceae | | Amylotheca dictyophleba (F.Muell.) Tiegh. | 156 | Barlow B.A. | 236 | | | 13MAR1961 | Barlow B.A. | | Queensland | Moreton | PIMPANA CK NR BEENLEIGH | Pimpana Creek, near Beenleigh.□<br>Fringing forest on creek.□<br>Parasitic shrub.□<br>Host Camphor laurel. |
| 55074 | 1 | | A | Angiosperm | Loranthaceae | | Amylotheca dictyophleba (F.Muell.) Tiegh. | 156 | Greham P. | | | | 19FEB1963 | | | Queensland | Moreton | ORMEAU NEAR A TIDAL CREEK | South Coast, Ormeau.□<br>Near a tidal creek.□<br>Mistletoe. |
| 56914 | 1 | | A | Angiosperm | Malvaceae | | Abutilon oxycarpum (F.Muell.) F.Muell. ex Benth. var. oxycarpum | 68018 | Hubbard C.E. | 3821 | | | 31AUG1930 | | | Queensland | Moreton | ALBERT RIVER S OF BRISBANE | |
| 600802 | 5396 | | A | Angiosperm | Malvaceae | | Hibiscus diversifolius Jacq. | 1420 | Grimshaw P. | G530 | Gibbs,R.; | | 09MAR1993 | | | Queensland | Moreton | ROCKY POINT NR MOUTH OF LOGAN RIVER CAUSEWAY THROUGH MANGROVES (GPS 27 43 12 153 20 57) | Rocky Point near mouth of the Logan River Southern Moreton Bay, causeway through mangroves; (GPS 27 43 12 153 20 57).□<br>Barrage wall on inland side of mangrove swamp; regrowth littoral vegetation on embankment.□<br>Spreading shrub to 1.2m high; flowers large yellow with maroon centres; stems prickly; leaves toothed orbicular.□<br>Occasional. |
| 57924 | 1 | | A | Angiosperm | Malvaceae | * | Malva sylvestris L. | 88968 | Lehman K. | | | | 03AUG1961 | | | Queensland | Moreton | ORMEAU PIMPAMA CK ON PROPERTY OF M KERLSIN | |
| 102464 | 1 | | A | Angiosperm | Meliaceae | | Dysoxylum mollissimum subsp. molle (Miq.) Mabb. | 69902 | Byrnes N. | 3107 | | | 11MAR1975 | Mallerby D.J. | | Queensland | Moreton | MT TAMBORINE (REFSET) | Mt Tamborine.□<br>Rainforest.□<br>Tree ca. 8m. |
| 411353 | 1 | | A | Angiosperm | Menyanthaceae | | Nymphoides indica (L.) Kuntze | 4842 | Blake S.T. | 20099 | | | 11MAR1957 | | | Queensland | Moreton | NEAR YATALA NEAR BEENLEIGH | Near Yatala, near Beenleigh.□<br>Swamp.□<br>Leaves more or less yellowish green to green, more or less purplish beneath; flowers white, yellow centre. |
| 167712 | 1 | | A | Angiosperm | Mimosaceae | | Acacia baeuerlenii Maiden & R.T.Baker | 30829 | Curtis D. | | | | FEB1931 | | | Queensland | Moreton | HOPE DALE ALBERT RIVER VIA BEENLEIGH | 'Hope Dale', Albert River via Beenleigh (near Plunkett). |
| 15265 | 1 | | A | Angiosperm | Mimosaceae | | Acacia falcata Willd. | 3007 | White C.T. | | | | SEP1913 | Pedley L. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 192840 | 1 | | A | Angiosperm | Mimosaceae | | Acacia maidenii F.Muell. | 3043 | Hubbard C.E. | 3818 | | | 31AUG1930 | White C.T. | | Queensland | Moreton | ALBERT RIVER S OF BRISBANE NR CURTIS FARM | Albert River, S of Brisbane, near Curtis Farm.□<br>Cleared Eucalyptus forest land. |
| 192832 | 1 | | A | Angiosperm | Mimosaceae | | Acacia maidenii F.Muell. | 3043 | White C.T. | 339 | | | 16APR1927 | Court A.B. | | Queensland | Moreton | MORETON BAY COBBY COBBY IS | Moreton Bay, Cobby Cobby Island.□<br>The sterile branchlets represent transition shoots from young trees. |
| 235229 | 1 | | A | Angiosperm | Mimosaceae | * | Mimosa pudica var. hispida Brenan | 62229 | Crowley L.F. | | | | 11MAR1959 | Cowan R.S. | AUG1994 | Queensland | Moreton | NORWELL | Norwell.□<br>Weed in school grounds; also reported to be growing along roadside about Ormeau and Pimpama. |
| 414222 | 1 | | A | Angiosperm | Molluginaceae | | Glinus oppositifolius (L.) A.DC. | 4600 | Blake S.T. | 20046 | | | 12MAR1957 | | | Queensland | Moreton | NR YATALA | Near Yatala.□<br>On tree swamp in swamp.□<br>Sprawling, green to orange brown plant with ascending stems. |
| 192623 | 1 | | A | Angiosperm | Molluginaceae | | Macarthuria neocambrica F.Muell. | 1700 | Sharpe P.R. | 2147 | Dowling,R.M.; | | 07JAN1977 | | | Queensland | Moreton | SOUTH STRADBROKE IS SOUTH LAGOON 1KM S OF | 1km S of South Lagoon, South Stradbroke Island.□<br>Dry sclerophyll woodland of various Eucalyptus spp. to 18m high with understory of Acacia spp. and other shrubs. Sandy soil.□<br>Semi prostrate herb, small, white flowers. |
| 64534 | 1 | | A | Angiosperm | Moraceae | | Maclura cochinchinensis (Lour.) Corner | 6294 | White C.T. | | | | 23OCT1915 | | | Queensland | Moreton | MORETON BAY MOSQUITO CK | Mosquito Creek, Moreton Bay.□<br>In a scrub. |
| 67669 | 1 | | A | Angiosperm | Moraceae | | Trophis scandens (Lour.) Hook. & Arn. subsp. scandens | 76093 | Simmonds J.H. | | | | 18MAR1889 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 69706 | 1 | | A | Angiosperm | Myoporaceae | | Eremophila debilis (Andrews) Chinnock | 36650 | Michael N. | 1854 | | | 22SEP1921 | Chinnock R.J. | 1987 | Queensland | Moreton | HOLMVIEW | Holmview.□<br>Trailing undershrub. |
| 600801 | 5396 | | A | Angiosperm | Myrsinaceae | | Aegiceras corniculatum (L.) Blanco | 79 | Grimshaw P. | G529 | Gibbs,R.; | | 09MAR1994 | | | Queensland | Moreton | ROCKY POINT NR MOUTH OF LOGAN RIVER CAUSEWAY THROUGH MANGROVES (GPS 27 43 12 153 20 27) | Rocky Point near mouth of the Logan River Southern Moreton Bay, causeway through mangroves, (GPS 27 43 12 153 20 27).□<br>Tidal mudflats with raised causeway; tall shrubland of mangrove species.□<br>Low shrub to 1.5m high on lower edge of embankment; leaves elliptical alternate; fruit cylindrical curved in clusters; flowers white in symmetrical clusters.□<br>Occasional. |
| 91471 | 1 | | A | Angiosperm | Myrsinaceae | | Aegiceras corniculatum (L.) Blanco | 79 | Jones W.T. | | | | JAN1962 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 91476 | 1 | | A | Angiosperm | Myrsinaceae | | Aegiceras corniculatum (L.) Blanco | 79 | White C.T. | | | | 1911 | | | Queensland | Moreton | LOGAN RIVER | Logan River.□<br>River mangrove. |
| 91479 | 1 | | A | Angiosperm | Myrsinaceae | | Aegiceras corniculatum (L.) blanco | 79 | White C.T. | | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russel Island. |
| 91753 | 1 | | A | Angiosperm | Myrsinaceae | | Myrsine variabilis R.Br. | 97568 | White C.T. | 3378 | | | 21JAN1927 | | | Queensland | Moreton | COOMERA RIVER-NR MOUTH | Near the mouth of Coomera River.□<br>Shrub 3-4ft high, Fruit purplish-blue. |
| 93413 | 1 | | A | Angiosperm | Myrtaceae | | Austromyrtus dulcis (C.T.White) L.S.Sm. | 255 | Shirley J. | | | | | Snow N. | MAR1999 | Queensland | Moreton | PIMPAMA IS | Pimpama Is. |
| 93927 | 1 | | A | Angiosperm | Myrtaceae | | Backhousia myrtifolia Hook. & Harv. | 272 | White C.T. | 3524 | | | 02JAN1928 | | | Queensland | Moreton | | |
| 94789 | 1 | | A | Angiosperm | Myrtaceae | | Calytrix tetragona Labill. | 448 | Curtis D. | | | | 01NOV1938 | Craven L.A. | | Queensland | Moreton | BEENLEIGH | Moreton District, Beenleigh. |
| 133691 | 1 | | A | Angiosperm | Myrtaceae | | Corymbia tessellaris (F.Muell.) K.D.Hill & L.A.S.Johnson | 75174 | Roff C. | | | | 19JAN1953 | Johnson L.A. | AUG1994 | Queensland | Moreton | YATALA | Yatala. |
| 431239 | 1 | | A | Angiosperm | Myrtaceae | | Decaspermum humile (G.Don) A.J.Scott | 2749 | Leiper G. | | | | MAR1986 | Guymer G. | | Queensland | Moreton | BEENLEIGH ALBERT RIVER RUM DISTILLERY | Albert River behind Rum Distillery, Beenleigh.□<br>Remnant rainforest.□<br>Tree 4.5m.□<br>Material in spirit collection at BRI. |
| 130308 | 1 | | A | Angiosperm | Myrtaceae | | Eucalyptus microcorys F.Muell. | 1052 | White C.T. | 3398 | | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island Moreton Bay. |
| 131693 | 1 | | A | Angiosperm | Myrtaceae | | Eucalyptus pilularis Sm. | 1072 | White C.T. | 3399 | | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island Moreton Bay. |
| 133047 | 1 | | A | Angiosperm | Myrtaceae | | Eucalyptus racemosa Cav. subsp. racemosa | 75507 | White C.T. | 3397 | | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 315933 | 1 | | A | Angiosperm | Myrtaceae | | Lophostemon confertus (R.Br.) Peter G.Wilson & J.T.Waterh. | 1666 | Bailey W.B. | | | | OCT1896 | Wilson P.G. | | Queensland | Moreton | PIMPAMA | Pimpama. |

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| 354747 | 1 | | A | Angiosperm | Myrtaceae | | Melaleuca decora (Salisb.) Britten | 11731 | Blake S.T. | 21652 | | | 23DEC1961 | Byrnes N. | | Queensland | Moreton | BETWEEN YATALA & ORMEAU SE OF BEENLEIGH | Between Yatala an Ormeau, SE of eenleigh.□<br>Mixed Eucalyptus forest on flat poorly drained land.□<br>Tree to 8m with firm greyish white bark of many compacted layers. Dull green compact crown anc white flowers - dull green leaves; young ones pale green. Frequent. |
| 42593 | 1 | | A | Angiosperm | Myrtaceae | | Melaleuca decora (Salisb.) Britten | 11731 | Coaldrake J.E. | | | | 04JAN1951 | | | Queensland | Moreton | NEAR YATALA PACIFIC HWY | Near Yatala, alongside Pacific Highway.□<br>Paper bark. |
| 399116 | 1 | | A | Angiosperm | Myrtaceae | | Rhodamnia dumicola Guymer & Jessup | 13504 | Leiper G. | | | | JAN1986 | Guymer G. | | Queensland | Moreton | BAHR'S SCRUB | Bahr's Scrub. |
| 399807 | 1 | | A | Angiosperm | Myrtaceae | | Rhodamnia dumicola Guymer & Jessup | 13504 | Leiper G. | | | | 30MAR1986 | Guymer G.P. | | Queensland | Moreton | DUNNES RD BEHIND BEENLEIGH | Dunnes Road, behind Beenleigh. |
| 599600 | 6020 | | A | Angiosperm | Myrtaceae | | Sannantha similis (A.R.Bean) Peter G.Wilson | 99155 | Leiper G. | | | | DEC1999 | | | Queensland | Moreton | YATALA | Yatala.□<br>On rocky slope with Eucalyptus seeana, Melaleuca nodosa and Melaleuca decora. |
| 600797 | 5396 | | A | Angiosperm | Myrtaceae | | Sannantha similis (A.R.Bean) Peter G.Wilson | 99155 | Grimshaw P. | G525 | Gibbs,R.; | | 09MAR1994 | | | Queensland | Moreton | NR DEFUNCT LION PARK PACIFIC HWY YATALA (GPS 27 44 47 153 13 52) | Near defunct Lion Park Pacific Highway, Yatala; (GPS 27 44 47 153 13 52).□<br>Creek bank on edge of flood plain; very tall open forest with Eucalyptus pilularis, E. seeana, Lophostemon confertus.□<br>Quarternery alluvium.□<br>Shrub or low tree to 4.0m high; flowers white quickly developing into small green seed capsules.□<br>Common. |
| 134629 | 1 | | A | Angiosperm | Myrtaceae | | Syzygium australe (H.L.Wendl. ex Link) B.Hyland | 2506 | Simmonds J.H. | | | | 18MAR1889 | Hyland B. | | Queensland | Moreton | PIMPAMA | |
| 11802 | 1 | | A | Angiosperm | Myrtaceae | | Syzygium francisii (F.M.Bailey) L.A.S.Johnson | 5075 | Smith L.S. | 5150 | | | 21DEC1953 | | | Queensland | Moreton | YATALA | Yatala. |
| 411352 | 1 | | A | Angiosperm | Nymphaeaceae | * | Nymphaea caerulea Savigny | 13409 | Blake S.T. | 20100 | | | 12MAR1957 | Jacobs S. | APR2007 | Queensland | Moreton | NEAR YATALA NEAR BEENLEIGH | |
| 47832 | 1 | | A | Angiosperm | Oleaceae | | Jasminum simplicifolium subsp. australiense P.S.Green | 1543 | Simmonds J.H. | | | | 1908 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 396797 | 1 | | A | Angiosperm | Oleaceae | | Notelaea johnsonii P.S.Green | 1872 | Bird L.H. | | | | 07APR1984 | | | Queensland | Moreton | BAHR'S SCRUB | Bahr's Hill, S of Beenleigh.□<br>Vine forest. Hillside near ridgetop. |
| 438915 | 1 | | A | Angiosperm | Oleaceae | | Notelaea johnsonii P.S.Green | 1872 | Leiper G. | | | | JUN1988 | Guymer G.P. | | Queensland | Moreton | CORNER OF UPPER ORMEAU RD & BARREN-JOEY RD | Corner of Upper Ormeau Road and Barren-Joey Road.□<br>Rainforest.□<br>Shrub. Flowers purple.□<br>Spirit material at BRI. |
| 47978 | 1 | | A | Angiosperm | Oleaceae | | Notelaea longifolia forma glabra P.S.Green | 1874 | Smith L.S. | 12238 | | | 04NOV1964 | Green P.S. | | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh, ca. 1 miles along Barr's Road.□<br>A tree ca. 5m high; fruits greenish. |
| 47979 | 1 | | A | Angiosperm | Oleaceae | | Notelaea longifolia forma glabra P.S.Green | 1874 | Smith L.S. | 12239 | | | 04NOV1964 | Green P.S. | | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh, ca. 1 miles along Barrs Road.□<br>A tree can. 5m high. Fruits greenish. |
| 48121 | 1 | | A | Angiosperm | Oleaceae | | Notelaea ovata R.Br. | 4839 | White C.T. | | | | SEP1913 | Green P.S. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 296191 | 1 | | A | Angiosperm | Orchidaceae | | Bulbophyllum minutissimum F.Muell. | 401 | Rozefelds A.C. | | | | 14APR1979 | | | Queensland | Moreton | JACOBS WELL CABBAGE TREE POINT | |
| 458817 | 1 | | A | Angiosperm | Orchidaceae | | Corybas barbarae D.L.Jones | 56776 | Leiper G. | | | | MAY1989 | Costosk P.L. | | Queensland | Moreton | UPPER ORMEAU 400METRES OF CLIFF BERRONS RD | 400 metres of Cliff Barron's Road, Upper Ormeau.□<br>Growing on rocky shelf, near waterfall, on hillside; Eucalyptus canopy, soil well drained with plenty of leaf litter. Helmet orchid with single leaf and single mauve and white flower.<br>Spirit material only at BRI. |
| 777894 | 6320 | | A | Angiosperm | Orchidaceae | | Dipodium variegatum M.A.Clem. & D.L.Jones | 56847 | Bean A.R. | 20381 | | | 26MAY2003 | | | Queensland | Moreton | CHRISTENSEN RD, STAPYLTON, SE OF BEENLEIGH | Christensen Rd, Stapylton, SE of Beenleigh.□<br>Woodland of Eucalyptus fibrosa, E. henryi, Casuarina littoralis. Low ridgetop. Loamy soil.□<br>Ground orchid with thick fleshy roots, flowers purple with white spots. □<br>2 plants seen. |
| 71154 | 1 | | A | Angiosperm | Orchidaceae | | Diuris | 19462 | White C.T. | | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | |
| 71153 | 1 | | A | Angiosperm | Orchidaceae | | Diuris | 19462 | White C.T. | | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | |
| 461411 | 1 | | A | Angiosperm | Orchidaceae | | Diuris punctata Sm. var. punctata | 53667 | Michael N. | 1877 | | | 11SEP1931 | | | Queensland | Moreton | BEENLEIGH | |
| 71453 | 1 | | A | Angiosperm | Orchidaceae | | Lyperanthus suaveolens R.Br. | 19622 | White C.T. | 9223 | | | 1933 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay.□<br>Flowers greenish yellow. |
| 456104 | 1 | | A | Angiosperm | Orchidaceae | | Pterostylis nutans R.Br. | 56229 | Leiper G. | | | | 1989 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>In gully on a rocky hill with waterfalls. Canopy trees are Eucalyptus acmenoides, Euc. intermedia, Euc. crebra, Euc. propinqua, Euc. tereticornis, Lophostemon confertus, Glochidion ferdinandii, Hoop Pine, Acronychia laevis, Euroschinus falcatus, and Callistemon salignis. Understorey was various grasses (Themeda, et.), Hovea acutifolia, Smilax australis, Hibbertia aspera, Adiantum spp., Casuarina torulosa, Cissus sterculifolia, Swainsona galegifolia, and Corybas barbarae. Other orchids present: Sarcochilus ceilae, Sarcochilus sp., Dendrobium mortii, D. monophyllum, D. linguiforme and Oberonia muelleriana. Growing in richly mulched dark, loamy soil, in a semi-shaded position. |
| 456101 | 1 | | A | Angiosperm | Orchidaceae | | Pterostylis ophioglossa R.Br. | 56230 | Leiper G. | | | | 1989 | | | Queensland | Moreton | ORMEAU OFF CLIFF BARRONS RD | Off Cliff Barrons Road, Ormeau.□<br>Growing in moist Eucalyptus forest, adjoining rainforest on thickly wooded ridge. Soil dark and loamy. Canopy made up of Eucalyptus crebra, Sp. aff E. paniculata, E. propinqua, E. secana, E. tereticornis and E. acmenodes, Lophostemon confertus, Casuarina torulosa. Understorey are Wodelia spilanthoides, Swainsona sp., Viola hederacea and V. betonicufolia, Themeda triandra, Indigofera australis, Opercularia diphylla, Lantana camara and lobelia purpurascens. |
| 72529 | 1 | | A | Angiosperm | Orchidaceae | | Thelymitra ixioides Sw. var. ixioides | 5095 | White C.T. | | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 201568 | 1 | | A | Angiosperm | Phyllanthaceae | | Breynia oblongifolia (Muell.Arg.) Muell.Arg. | 376 | Simmonds J.H. | | | | 1888 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 676983 | 5922 | | A | Angiosperm | Phyllanthaceae | | Bridelia exaltata F.Muell. | 35441 | Blake S.T. | 20092 | | | 12MAR1957 | | | Queensland | Moreton | NR YATALA NR BEENLEIGH | Near Yatala, near Beenleigh.□<br>Few trees at edge of Eucalyptus forest and open swampy ground.□<br>Bushy headed tree to 5m with grey rough irregularly furrowed bark; green leaves, paler beneath; fleshy depressed globose reddish green fruits.□<br>Host of scale insects given to A.R.Brimblecombe. |
| 201667 | 1 | | A | Angiosperm | Phyllanthaceae | | Bridelia exaltata F.Muell. | 35441 | Michael N. | 1822 | | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 203426 | 1 | | A | Angiosperm | Phyllanthaceae | | Glochidion sumatranum Miq. | 1244 | White C.T. | | | | SEP1913 | Bruhl J.J. | AUG1995 | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 431218 | 1 | | A | Angiosperm | Phyllanthaceae | | Phyllanthus microclacus Muell.Arg. | 85553 | Williams K.A. | 84026 | et al.,; | | 14APR1984 | | | Queensland | Moreton | PIMPAMA RIVER JUNCTION OF BARREUJOEY RD UPPER ORMEAU RD OFF PACIFIC HWY | |
| 431217 | 1 | | A | Angiosperm | Phyllanthaceae | | Sauropus albiflorus (F.Muell. ex Muell.Arg.) Airy Shaw | 2311 | Williams K.A. | 84029 | et al.,; | | 14APR1984 | | | Queensland | Moreton | UPPER ORMEAU RD OFF PACIFIC HWY E FOOTHILLS OF DARLINGTON RA | |
| 431916 | 1 | | A | Angiosperm | Phyllanthaceae | | Sauropus albiflorus (F.Muell. ex Muell.Arg.) Airy Shaw | 2311 | Bird L.H. | | | | 08DEC1986 | | | Queensland | Moreton | UPPER ORMEAU PIMPAMA RIVER | |
| 204333 | 1 | | A | Angiosperm | Rhizophoraceae | | Petalostigma pubescens Domin | 1977 | White C.T. | 3410 | | | 16APR1927 | Airy Shaw H.K. | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay. |
| 108689 | 1 | | A | Angiosperm | Pittosporaceae | | Pittosporum multiflorum (A.Cunn. ex Loudon) L.Cayzer, Crisp & I.Telford | 91125 | Michael N. | 1824 | | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh.□<br>Low rambling undershrub. |
| 78788 | 1 | | A | Angiosperm | Pittosporaceae | | Pittosporum revolutum W.T.Aiton | 2039 | Simmonds J.H. | 19 | | | 1888 | Bennett E.M. | | Queensland | Moreton | PIMPAMA | |
| 456102 | 1 | | A | Angiosperm | Plantaginaceae | | Plantago debilis R.Br. | 20030 | Leiper G. | | | | 1989 | | | Queensland | Moreton | UPPER PIMPAMA ACREAGE HOUSING DEV | Acreage housing development, upper Pimpama.□<br>Soil heavy, loamy and dark. On steep hillside with Themeda triandra, Brachyscome microcarpa, Xanthoerrhoea sp., Cassinia subtropica, Daviesia arborea, Casuarina torulosa, Lophostemon confertus, Eucalyptus crebra, E. tereticornis, E. microcorys and E. acmenoides.□<br>Herb. |

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| 777900 | 6320 | | A | Angiosperm | Poaceae | | Aristida warburgii Mez | 38314 | Bean A.R. | 20380 | | 08MAY2003 | | | Queensland | Moreton | CHRISTENSEN ROAD, STAPYLTON, SE OF BEENLEIGH | Christensen Road, Stapylton, SE of Beenleigh.□<br>Woodland of Eucalyptus fibrosa, E. henryi, Casuarina<br>littoralis. Low ridgetop. Loamy soil.□<br>Grass with very fine foliage, inflorescence procumbent to<br>prostrate. □<br>Occasional at site. |
| 307 | 1 | | A | Angiosperm | Poaceae | | Austrostipa pubescens (R.Br.) S.W.L.Jacobs & J.Everett | 81411 | Stanton J.P. | | | 10NOV1971 | | | Queensland | Moreton | 4KM SW OF VICTORIA POINT | 4km SW of Victoria Point.□<br>On sandstone. |
| 259012 | 1 | | A | Angiosperm | Poaceae | | Cenchrus caliculatus Cav. | 4272 | Byrnes N. | 3108 | | 11MAR1975 | | | Queensland | Moreton | MT TAMBORINE (REFSET) | Mt Tamborine.□<br>Rainforest. Edge of cleared area. |
| 280840 | 1 | | A | Angiosperm | Poaceae | | Chloris ventricosa R.Br. | 3283 | White C.T. | | | MAY1920 | Lazarides M. | | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh. |
| 281919 | 1 | | A | Angiosperm | Poaceae | | Cymbopogon refractus (R.Br.) A.Camus | 3342 | Michael N. | 1913 | | 10JAN1932 | Blake S.T. | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 285817 | 1 | | A | Angiosperm | Poaceae | | Echinopogon nutans C.E.Hubb. var. nutans | 43882 | Michael N. | 1914 | | 10JAN1932 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 287254 | 1 | | A | Angiosperm | Poaceae | | Enteropogon unispiceus (F.Muell.) Clayton | 3433 | White C.T. | | | MAY1920 | | | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh. |
| 777893 | 6320 | | A | Angiosperm | Poaceae | | Entolasia marginata (R.Br.) Hughes | 3434 | Bean A.R. | 20382 | | 08MAY2003 | Simon B.K. | APR2009 | Queensland | Moreton | CHRISTENSEN RD, STAPYLTON, SE OF BEENLEIGH | Christensen Rd, Stapylton, SE of Beenleigh.□<br>Woodland of Eucalyptus fibrosa, E. henryi, Casuarina<br>littoralis. □<br>Low ridgetop. Loamy soil.□<br>Slender erect grass, stems very hairy.□<br>Common at site. |
| 287656 | 1 | | A | Angiosperm | Poaceae | * | Eragrostis cilianensis (All.) Vignolo ex Janch. | 3441 | Coleman F.B. | | | 20MAR1930 | Lazarides M. | | Queensland | Moreton | MORETON BAY RUSSELL IS | Russell Island, Moreton Bay. |
| 777895 | 6320 | | A | Angiosperm | Poaceae | | Eremochloa bimaculata Hack. | 3465 | Bean A.R. | 20383 | | 08MAY2003 | | | Queensland | Moreton | CHRISTENSEN RD, STAPYLTON, SE OF BEENLEIGH | Christensen Rd, Stapylton, SE of Beenleigh.□<br>Woodland of Eucalyptus fibrosa, E. henryi, Casuarina<br>littoralis. Low ridgetop. Loamy soil.□<br>Smallg rass with bright green leaves. □<br>Abundant at site. |
| 300036 | 1 | | A | Angiosperm | Poaceae | | Eremochloa bimaculata Hack. | 3465 | Michael N. | 1911 | | 10JAN1932 | Hubbard C.E. | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 790162 | 6350 | | A | Angiosperm | Poaceae | | Hemarthria uncinata R.Br. var. uncinata | 39567 | Bean A.R. | 20657 | | 19AUG2003 | Simon B.K. | JUN2006 | Queensland | Moreton | SUGARCANE RD, WOONGOOLBA, ESE OF BEENLEIGH | Sugarcane Rd, Woongoolba, ESE of Beenleigh.□<br>Roadside adjacent to Melaleuca quinquenervia woodland.<br>Clay soil.□<br>Slender grass with short green leaves. Inflorescence<br>cylindrical.□<br>Rare at site. |
| 425160 | 1 | | A | Angiosperm | Poaceae | | Hemarthria uncinata var. spathacea (Domin) Vickery | 3549 | Blake S.T. | 20093 | | 12MAR1957 | Simon B.K. | | Queensland | Moreton | NR YATALA | Near Yatala.□<br>Swampy ground.□<br>Culms more or less erect upwards, leaves green to<br>somewhat reddish. |
| 674278 | 5875 | | A | Angiosperm | Poaceae | | Lachnagrostis filiforms (G.Forst.) Trin. | 92241 | Dowling R.M. | W267 | Stephens,K.M.; | 01SEP1998 | | | Queensland | Moreton | OFF CANE TRACK FOLLOWING POWER LINES OFF ROCKY POINT ROAD (AMG 56 533271E 6933851N) | Off cane track, following power lines off Rocky Pt Road.□<br>(AMG 56 533271E 6933851N).□<br>Swamp of black organic soil.□<br>Casuarina glauca woodland, Einadia hastata under. |
| 790163 | 6350 | | A | Angiosperm | Poaceae | | Lachnagrostis filiforms (G.Forst.) Trin. | 92241 | Bean A.R. | 20661 | | 19AUG2003 | | | Queensland | Moreton | SUGARCANE RD, WOONGOOLBA, ESE OF BEENLEIGH | Sugarcane Rd, Woongoolba, ESE of Beenleigh.□<br>Roadside adjacent to Melaleuca quinquenervia woodland.<br>Clay soil.□<br>Grass 70cm high, inflorescence disarticulating at the base.□<br>Rare at site. |
| 776908 | 6308 | | A | Angiosperm | Poaceae | | Oplismenus aemulus (R.Br.) Roem. & Schult. | 3694 | Bean A.R. | 20263 | | 30APR2003 | | | Queensland | Moreton | NEAR STANMORE RD, YATALA | Near Stanmore Rd, Yatala.□<br>Woodland of Eucalyptus carnea, E. intermedia, E.<br>siderophloia, Lophostemon confertus.□<br>Prostrate grass, leaves bright green.□<br>Occasional at site. |
| 398611 | 1 | | A | Angiosperm | Poaceae | | Paspalidium distans (Trin.) Hughes | 4865 | Whitten R. | | | 07OCT1985 | | | Queensland | Moreton | EAGLEBY HERSES RD | Herses Road, Eagleby.□<br>Open. Grey loam. Short tufted grass. |
| 635603 | 5472 | | A | Angiosperm | Poaceae | * | Paspalum mandiocarum Trin. | 42012 | Hauser J. | | | DEC1993 | Simon B.K. | AUG2001 | Queensland | Moreton | UPPER ORMEAU RD ORMEAU 4208 | In garden Greentangles, upper Ormeau Rd Ormeau 4208.□<br>Occurring along banks of Pimpama River and into moist<br>gullies along Darlington Range, Ormeau.□<br>Spreading fast.□<br>Spirit at BRI. |
| 13482 | 1 | | A | Angiosperm | Poaceae | | Paspalum vaginatum Sw. | 3726 | Dowling R. | 159 | | 20MAR1974 | Simon B.K. | | Queensland | Moreton | COBBY COBBY IS SW CORNER SOUTHERN MORETON BAY (REFSET) | SW corner of Cobby Cobby Island, south Moreton Bay.□<br>Growing amongst Sporobolus virginicus, on mud flat. |
| 293159 | 1 | | A | Angiosperm | Poaceae | * | Pennisetum clandestinum Hochst. ex Chiov. | 44555 | Perkins J. | | | 01OCT1961 | | | Queensland | Moreton | ORMEAU | Ormeau. |
| 747341 | 6833 | | A | Angiosperm | Poaceae | * | Schizachyrium microstachyum (Desv. ex Ham.) Roseng., B.R.Arill. & Izag. | 52672 | Halford D. | Q9693 | | 27DEC2008 | | | Queensland | Moreton | STEIGLITZ, STAPYLTON-JACOBS WELL ROAD, C. 200M S OF JUNCTION WITH CABBAGE TREE POINT ROAD | Steiglitz, Stapylton-Jacobs Well road, c. 200m S of junction<br>with Cabbage Tree Point Road.□<br>Unused sugarcane paddock, moist clay soil.□<br>Tufted grass, culms erect, 40cm high.□<br>Common at site. |
| 297191 | 1 | | A | Angiosperm | Poaceae | * | Setaria parviflora (Poir.) Kerguelen | 64514 | Michael N. | 1910 | | 30DEC1931 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 79910 | 1 | | A | Angiosperm | Polygalaceae | | Comesperma hispidulum Pedley | 43184 | White C.T. | | | SEP1913 | Pedley L. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 79909 | 1 | | A | Angiosperm | Polygalaceae | | Comesperma retusum Labill. | 6867 | Parker E.N. | | | SEP1917 | Pedley L. | | Queensland | Moreton | RUSSELL IS | |
| 100125 | 1 | | A | Angiosperm | Polygalaceae | | Polygala japonica Houtt. | 15349 | Michael N. | 1886 | | 03OCT1931 | Pedley L. | | Queensland | Moreton | ORMEAU | Ormeau. |
| 776906 | 6308 | | A | Angiosperm | Polygalaceae | | Polygala linariifolia Willd. | 55133 | Bean A.R. | 20264 | | 30APR2003 | | | Queensland | Moreton | NEAR STANMORE RD, YATALA | Near Stanmore Rd, Yatala.□<br>Woodland of Eucalyptus carnea, E. intermedia, E.<br>siderophloia, Lophostemon confertus.□<br>Forb 15cm high, flowers purple.□<br>Rare at site. |
| 100953 | 1 | | A | Angiosperm | Polygonaceae | * | Acetosella vulgaris Fourr. | 72692 | Michael N. | 1880 | | 04SEP1931 | Wilson K.L. | AUG1995 | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 431215 | 1 | | A | Angiosperm | Polygonaceae | | Muehlenbeckia gracilima Meisn. | 4822 | Williams K.A. | 84027 | Bird,L.H.; | 14APR1984 | | | Queensland | Moreton | PIMPAMA RIVER CORNER OF BARREUJOEY RD UPPER ORMEAU RD OFF PACIFIC HWY | Pimpama River, corner of Barreujoey Rd-Upper Ormeau Rd<br>off Pacific Hwy.□<br>Edge of remnant lowland riverine dry vine forest on bank of<br>small creek; soils moist and stony alluvials.□<br>A slender softwood perennial climber; not very vigourous but<br>tending to cascade from the plants which support it, can be<br>fairly dense growth, grows along the edges of these scrubs;<br>flowers very small, greenish-cream in colour. |
| 653851 | 5709 | | A | Angiosperm | Polygonaceae | V | Persicaria elatior (R.Br.) Sojak | 15741 | Leiper G. | 13 | | FEB1997 | Francis R. | MAR1997 | Queensland | Moreton | SOUTH STRADBROKE ISLAND COURAN AREA | Sth Stradbroke Island Couran area.□<br>In waterhole under Livistona australis.□<br>To 1.5m tall. |
| 411057 | 1 | | A | Angiosperm | Polygonaceae | | Persicaria strigosa (R.Br.) H.Gross | 4873 | Blake S.T. | 20098 | | 12MAR1957 | Wilson K.L. | AUG1995 | Queensland | Moreton | NEAR YATALA NEAR BEENLEIGH | Near Yatala near Beenleigh.□<br>Occasional patches with Eleocharis equisetina and Paspalum<br>destichum in more or less permanent water.□<br>Stems ascending from more or less prostrate leaves, leaves<br>pale green above, purple beneath; pink and white flowers. |
| 101462 | 1 | | A | Angiosperm | Polygonaceae | | Polygonum | 2090 | Simmonds J.H. | 414 | | 18MAR1889 | | | Queensland | Moreton | PIMPANA | |
| 102789 | 1 | | A | Angiosperm | Primulaceae | * | Anagallis arvensis L. | 50635 | Waite J. | | | 24AUG1966 | | | Queensland | Moreton | ORMISTON REDLANDS BAY HORTICULTURAL RESEARCH STN | Redlands Bay Horticultural Research Station, Ormiston.□<br>Seed voucher specimen for Standards Branch. |
| 103452 | 1 | | A | Angiosperm | Proteaceae | | Banksia serrata L.f. | 288 | White C.T. | | | SEP1913 | George A.S. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 103150 | 1 | | A | Angiosperm | Proteaceae | | Banksia spinulosa Sm. var. spinulosa | 291 | White C.T. | | | SEP1913 | George A.S. | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>See Carpological collection. |
| 337163 | 1 | | A | Angiosperm | Proteaceae | | Grevillea hilliana F.Muell. | 15455 | Shirley J. | | | | McGillivray D.J. | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 104194 | 1 | | A | Angiosperm | Proteaceae | | Hakea florulenta Meisn. | 4636 | White C.T. | | | SEP1913 | Barker R.M. | FEB1998 | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>Flora Nat. Club Excursion. |
| 104217 | 1 | | A | Angiosperm | Proteaceae | | Hakea florulenta Meisn. | 4636 | White C.T. | | | SEP1913 | Barker R.M. | FEB1998 | Queensland | Moreton | RUSSELL IS | Russell Island. |

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| 777447 | 6316 | | A | Angiosperm | Proteaceae | V | Macadamia integrifolia Maiden & Betche | 1687 | Leiper G. | | | 30JUN2003 | | | Queensland | Moreton | MT STAPYLTON, NEAR BEENLEIGH ON SOUTH WEST SLOPES | Mt Stapylton, near Beenleigh on south west slopes.□ Dry vine thicket on scree slope, remnant. |
| 9856 | 1 | | A | Angiosperm | Proteaceae | V | Macadamia integrifolia Maiden & Betche | 1687 | Smith L.S. | 5147 | | 21DEC1953 | Gross C.L. | JUN1992 | Queensland | Moreton | YATALA | Yatala. |
| 105255 | 1 | | A | Angiosperm | Proteaceae | V | Macadamia integrifolia Maiden & Betche | 1687 | Smith L.S. | 5180 | | MAR1954 | Gross C.L. | JUN1992 | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh. |
| 105328 | 1 | | A | Angiosperm | Proteaceae | V | Macadamia tetraphylla L.A.S.Johnson | 1689 | Smith L.S. | 5182 | | MAR1954 | Gross C.L. | JUN1992 | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh. |
| 105320 | 1 | | A | Angiosperm | Proteaceae | V | Macadamia tetraphylla L.A.S.Johnson | 1689 | Smith L.S. | 5183 | | | Gross C.L. | JUN1992 | Queensland | Moreton | NR BEENLEIGH | Near Beenleigh. |
| 141171 | 1 | | A | Angiosperm | Proteaceae | | Persoonia adenantha Domin | 28401 | Lebler B. | | Sharpe,P.; | 23APR1976 | Weston P.H. | MAY1995 | Queensland | Moreton | PIMPAMA | Pimpamam.□ In open eucalyptus mixed forest on gravelly ridge. |
| 116910 | 1 | | A | Angiosperm | Proteaceae | | Persoonia adenantha Domin | 28401 | Sharpe P.R. | 2032 | Lebler,B.; | 24APR1976 | Weston P.H. | MAY1995 | Queensland | Moreton | YAWALPAH RD 5KM E OF OLD GOLD COAST RD PIMPAMA | Yawalpah Road, 5km E of Old Gold Coast Road, Pimpama.□ Disturbed site at edge of road. Regrowth of Eucalyptus sp., Acacia sp., and Persoonia adenantha. Tree to 3.5m high, somewhat erect branches grey smooth bark but tesselated and rough towards base. Flowers yellow, not very conspicuous. Trees growing mainly on the ridges in gravelly soil. |
| 105847 | 1 | | A | Angiosperm | Proteaceae | | Persoonia sericea A.Cunn. ex R.Br. | 1971 | Michael N. | 1859 | | 18SEP1931 | | | Queensland | Moreton | ORMEAU | Ormeau.□ Small shrub 2-4ft. |
| 105823 | 1 | | A | Angiosperm | Proteaceae | | Persoonia sericea A.Cunn. ex R.Br. | 1971 | Shirley J. | | | | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 105741 | 1 | | A | Angiosperm | Proteaceae | | Persoonia stradbrokeasis Domin | 70570 | White C.T. | 3407 | | 16APR1927 | Weston P.H. | MAY1995 | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 106752 | 1 | | A | Angiosperm | Ranunculaceae | | Clematis glycinoides DC. | 585 | Parke E.M. | | | SEP1917 | Eichler H. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 106886 | 1 | | A | Angiosperm | Ranunculaceae | | Ranunculus lappaceus Sm. | 2204 | Michael N. | 1856 | | 22SEP1931 | Melville R. | | Queensland | Moreton | HOLMVIEW | Holmview. |
| 192622 | 1 | | A | Angiosperm | Restionaceae | | Coleocarya gracilis S.T.Blake | 598 | Sharpe P.R. | 2145 | Dowling,R.M.; | 07JAN1977 | | | Queensland | Moreton | SOUTH STRADBROKE IS 1KM S OF SOUTH LAGOON | About 1km S of Sough Lagoon, South Stradbroke Island.□ Dry sclerophyll woodland of Eucalyptus signata, E. intermedia etc. to 18m high, understorey of Acacia spp., Persoonia virgata, etc.; sandy soil.□ Tufted, erect sedge, brown colour to 40cm high; growing in clumps. □ Locally abundant. |
| 107984 | 1 | | A | Angiosperm | Restionaceae | | Leptocarpus tenax (Labill.) R.Br. | 4727 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS EDGE OF BIG SWAMP | Edge of Big Swamp, Russell Island. |
| 108436 | 1 | | A | Angiosperm | Rhamnaceae | | Alphitonia excelsa (A.Cunn. ex Fenzl) Reissek ex Benth. | 50053 | Wilson C.L. | 633 | | 14MAY1957 | Thiele K.R. | SEP1995 | Queensland | Moreton | LOGAN RIVER MT STAPYLTON | Along Logan River at Mt Stapylton.□ Tall tree, rough bark; fruits small, green. |
| 109415 | 1 | | A | Angiosperm | Rhamnaceae | | Cryptandra longistamnea F.Muell. | 12917 | Shirley J. | | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 395655 | 1 | | A | Angiosperm | Rhamnaceae | | Cryptandra longistamnea F.Muell. | 12917 | Leiper G. | | | 16JUL1984 | Udovicic F. | JAN1996 | Queensland | Moreton | BEENLEIGH-BEAUDESERT RD | Beenleigh-Beaudesert Road.□ Rocky (shale) slope on hillside facing south with Eucalyptus sp. and Lophostemon confertus.□ Shrub 20cm high, multibranched, with arching branches 30cm long. Only one plant seen.□ Spirit collection at BRI. |
| 14084 | 1 | | A | Angiosperm | Rhizophoraceae | | Bruguiera gymnorhiza (L.) Savigny | 385 | Dowling R. | 158 | | 20MAR1974 | | | Queensland | Moreton | COBBY COBBY IS SOUTH-EAST CORNER | SE corner of Cobby Cobby Island, southern Moreton Bay.□ Growing on firm mud amongst Avicennia marina var australasica and Rhizophora stylosa. |
| 600800 | 5396 | | A | Angiosperm | Rhizophoraceae | | Rhizophora stylosa Griff. | 2221 | Grimshaw P. | G528 | Gibbs,R.; | 03MAR1994 | | | Queensland | Moreton | ROCKY POINT NR MOUTH OF LOGAN RIVER CAUSEWAY THROUGH MANGROVES (GPS 27 43 12 153 20 27) | Rocky Point near mouth of the Logan River, Southern Moreton Bay, causeway through mangroves; (GPS 27 43 12 153 20 27).□ Tidal mudflats with raised causeway; tall shrubland of mangrove species.□ Shrub to 2m high; leaves elliptical with mucro in whorls or decussate; persistant sepals enclosing flowers in clusters.□ Occasional. |
| 121787 | 1 | | A | Angiosperm | Rosaceae | * | Prunus munsoniana W.Wight & Hedrick | 25202 | Lebler B. | | | 19OCT1967 | | | Queensland | Moreton | HOTHAM CK 20M SE OF BRISBANE | Hothan Creek, about 20 miles SE of Brisbane, on both side of the creek on the southern side of the bridge on the Pacific Highway. |
| 121799 | 1 | | A | Angiosperm | Rosaceae | * | Prunus munsoniana W.Wight & Hedrick | 25202 | Jones W. | | | 12DEC1966 | | | Queensland | Moreton | 15M S OF BRISBANE | About 15 miles S of Brisbane. Between Waterford and Logan Village.□ Two large clumps, the older beside a derelict untenanted house, the younger growing in the ashes beside the railway line. |
| 121941 | 1 | | A | Angiosperm | Rosaceae | | Rubus moluccanus var. trilobus A.R.Bean | 86292 | White C.T. | 3395 | | 16APR1927 | Symon D.E. | 2002 | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay. |
| 664575 | 5896 | | A | Angiosperm | Rosaceae | | Rubus probus L.H.Baley | 76911 | Clarkson H. | | Leiper,G.;McDonald,G.;Lieberman,M.; | 12AUG1999 | Bean A.R. | AUG1999 | Queensland | Moreton | NW LOWER OF MT STAPYLTON ON BANKS OF ALBERT RIVER ALBERTON/BEENLEIGH | North-western lower end of Mt Stapylton, on banks of Albert River, Alberton/Beenleigh.□ In riverine remnant rainforest of Flinderia australis, Barklya syringifolia, Cryptocarya triplinervis, C obovata and Toechima tenax.□ Also Macadamia integrifolia, Dissiliariabalogh ioides, Notelaea johnsonii and Bosistoa pentacocca. |
| 654978 | 5726 | | A | Angiosperm | Rosaceae | | Rubus x novus Kuntze | 84220 | Leiper G. | | | JUN1997 | | | Queensland | Moreton | INTERSECTION OF BEHMS RD AND STAPYLTON-JACOBS WELL ROAD JACOBS WELL | Intersection of Behms Rd and Stapylton-Jacobs Well Road, Jacobs Well.□ Open forest with Eucalyptus robusta, E. intermedia, E. tereticornis, Melaleuca quinquenervia and rainforest species in understorey.□ Low shrub, flowers pink. |
| 618860 | 6645 | | A | Angiosperm | Rubiaceae | | Cyclophyllum coprosmoides (F.Muell.) S.T.Reynolds & R.J.F.Hend. var. coprosmoides | 92079 | Stephens R. | | | 13MAR2006 | | | Queensland | Moreton | STAPYLTON DISTRICT, APPROX. 2KM FROM YATALA, CORNER OF YELLOWOOD ROAD AND QUINNS HILL ROAD WEST | Stapylton district, approx. 2km from Yatala. Corner of Yellowood Road and Quinns Hill Road West.□ Fairly dry level ground, between the base of Mt Stapylton and above flood plain.□ Black/brown soil.□ Pasture with remnant/native regrowth vegetation, mostly Eucalyptus and Acacia species.□ Tree approx. 3m tall with slender habit. Light brown/grey slightly mottled bark. Flowers buds are yellow at tips.□ Located within a patch of native species, especially in association with eucalypt trees. |
| 124634 | 1 | | A | Angiosperm | Rubiaceae | | Ixora beckleri Benth. | 24865 | Simmonds J.H. | | | 1888 | | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 674279 | 5875 | | A | Angiosperm | Rutaceae | | Acronychia imperforata F.Muell. | 2755 | Dowling R.M. | W268 | Stephens,K.M.; | 01SEP1998 | Halford D. | APR2004 | Queensland | Moreton | ROCKY POINT RD (AMG 56 534201E 6933682N) | Rocky Point Rd.□ (AMG 56 534201E 6933682N).□ Tidal flat of black peat.□ Phragmites open grassland with dense mixture of shrubs & herbs below. |
| 777445 | 6316 | | A | Angiosperm | Rutaceae | | Acronychia pauciflora C.T.White | 2757 | Leiper G. | | | 30JUN2003 | | | Queensland | Moreton | MT STAPYLTON, NEAR BEENLEIGH ON SOUTH WEST SLOPES | Mt Stapylton, near Beenleigh on south west slopes.□ Remnant vine thicket on Flindersia australis, stenocarpus sinuatus, Jagera pseudorhus, Macadamia integrifolia and Toechina tenax.□ Tree 4m tall.□ Fruits to 13mm diameter shrunk considerably on drying. |
| 384132 | 1 | | A | Angiosperm | Rutaceae | | Bosistoa pentacocca (F.Muell.) Baill. var. pentacocca | 29184 | Simmonds | | | 18MAR1889 | Hartley T.G. | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 209908 | 1 | | A | Angiosperm | Rutaceae | | Flindersia australis R.Br. | 35785 | Wilson C.L. | 635 | | 14MAY1957 | Hartley T.G. | | Queensland | Moreton | MT STAPYLTON | Mt Stapylton. |
| 431185 | 1 | | A | Angiosperm | Rutaceae | | Zieria smithii Jacks. | 2723 | Williams K.A. | 85012 | | 01JAN1985 | | | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□ Remnant notophyll vine scrub, hillside slope, brown clay loam soils; the plants were growing as understory shrubs in this small remnant between roadside and property fence lines.□ Shrub of rather nondescript shape, growing to 2m high. |
| 153718 | 1 | | A | Angiosperm | Sambucaceae | | Sambucus australasica (Lindl.) Fritsch | 3810 | not known | | | | Bolli R. | 1992 | Queensland | Moreton | PIMPAMA | Pimpama. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102817 | 1 | | A | Angiosperm | Samolaceae | | Samolus repens (J.R.Forst. & G.Forst.) Pers. | 2295 | Michael N. | 1897 | | | | | Queensland | Moreton | PIMPAMA IS | Pimpama Island. |
| 350063 | 1 | | A | Angiosperm | Samolaceae | | Samolus repens (J.R.Forst. & G.Forst.) Pers. | 2295 | Williams K.A. | 79010 | | 15SEP1979 | | | Queensland | Moreton | JUMPINPIN SWAN BAY NORTH STRADBROKE IS (PUBREF) | Swan Bay, Jumpinpin.□<br>Open sunny areas in swampy grounds. Peaty sandy soil.□<br>Small herb with one or two erect stems to 20cm. Small white flowers. |
| 30143 | 1 | | A | Angiosperm | Sapindaceae | | Alectryon connatus (F.Muell.) Radlk. | 97 | Wilson C.L. | 634 | | 14MAY1957 | | | Queensland | Moreton | MT STAPYLTON ALONG LOGAN RIVER | Along Logan River at Mt Stapylton.□<br>Tree 12-15ft. In fruit only. |
| 30146 | 1 | | A | Angiosperm | Sapindaceae | | Alectryon connatus (F.Muell.) Radlk. | 97 | White C.T. | 6777 | | 04JUN1930 | | | Queensland | Moreton | MOSQUITO CK MORETON BAY | Mosquito Creek, Moreton Bay.□<br>One or two trees left in a rainforest remnant.□<br>Tree 20m high; leaves light glossy green above, glaucescent beneath; fruit green or yellow tinged with red; seed black, more than half immersed in a red succulent arillus. |
| 30142 | 1 | | A | Angiosperm | Sapindaceae | | Alectryon connatus (F.Muell.) Radlk. | 97 | White C.T. | | | APR1917 | | | Queensland | Moreton | MOSQUITO CK MORETON BAY | Mosquito Creek, Moreton Bay. |
| 30166 | 1 | | A | Angiosperm | Sapindaceae | | Alectryon coriaceus (Benth.) Radlk. | 98 | White C.T. | 3392 | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay. |
| 30241 | 1 | | A | Angiosperm | Sapindaceae | | Alectryon tomentosus (F.Muell.) Radlk. | 105 | Smith L.S. | 12240 | | 04NOV1964 | Leenhouts P.W. | | Queensland | Moreton | 1 MILE ALONG BARRS RD NEAR BEENLEIGH | Near Beenleigh, c 1 mile along Barr's Road.□<br>Tree c 5m high. |
| 167151 | 1 | | A | Angiosperm | Sapindaceae | | Arytera divaricata F.Muell. | 201 | Byrnes N. | 3490 | | JAN1977 | Turner H. | NOV1992 | Queensland | Moreton | CA 5KM E OF LOGAN VILLAGE | C 5km E of Logan village.□<br>Rainforest on steep stony slope. |
| 397614 | 1 | | A | Angiosperm | Sapindaceae | | Atalaya multiflora Berth. | 11308 | Leiper G. | | Thompson,J.; | MAY1983 | | | Queensland | Moreton | 4KM ALONG CLIFFBARREN RD UPPER ORMEAU | 4km along Cliffbarren Road, Upper Ormeau.□<br>Rainforest.□<br>Tree 10m. |
| 12530 | 1 | | A | Angiosperm | Sapindaceae | | Harpullia hillii F.Muell. | 1357 | Smith L.S. | 5140 | | 19DEC1953 | Vente M. | | Queensland | Moreton | HOTHAM CK NEAR BEECHMONT | Hotham Creek, on way to Beechmont. |
| 31919 | 1 | | A | Angiosperm | Sapindaceae | | Harpullia pendula Planch. ex F.Muell. | 1358 | White C.T. | | | 23OCT1915 | Vente M. | | Queensland | Moreton | MOSQUITO CK MORETON BAY | Mosquito Creek, Moreton Bay.□<br>In a small scrub.□<br>F.N.C. excursion. |
| 462444 | 1 | | A | Angiosperm | Sapotaceae | | Planchonella australis (R.Br.) Pierre | 4896 | not known | | | JAN1977 | | | Queensland | Moreton | NR BEENLEIGH | Nr Beenleigh.□<br>Spirit only. |
| 554478 | 6160 | | A | Angiosperm | Scrophulariaceae | | Bacopa monnieri (L.) Pennell | 268 | Kerr D. | | | 20FEB2002 | | | Queensland | Moreton | ALBERT RIVER | Albert River.□<br>Along the banks of the river. |
| 790139 | 6350 | | A | Angiosperm | Scrophulariaceae | | Gratiola pedunculata R.Br. | 1283 | Bean A.R. | 20660 | | 19AUG2003 | | | Queensland | Moreton | SUGARCANE RD, WOONGOOLBA, ESE OF BEENLEIGH | Sugarcane Rd, Woongoolba, ESE of Beenleigh.□<br>Roadside adjacent to Melaleuca quinquenervia woodland. Clay soil.□<br>Forb 30cm high, in shallow water.□<br>Flowers white.□<br>Occasional at site. |
| 36026 | 1 | | A | Angiosperm | Scrophulariaceae | | Gratiola pedunculata R.Br. | 1283 | Michael N. | 1904 | | | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 663379 | 5845 | | A | Angiosperm | Scrophulariaceae | * | Scoparia dulcis L. | 2364 | Leiper G. | | | JUL1998 | Francis P. | AUG1998 | Queensland | Moreton | S STRADBROKE IS | South Stradbroke Island.□<br>Weed of disturbed sand.□<br>Plant 30 cm tall. |
| 30008 | 1 | | A | Angiosperm | Scrophulariaceae | | Veronica plebeia R.Br. | 2649 | Michael N. | 1887 | | 03OCT1931 | | | Queensland | Moreton | ORMEAU 25M SE OF BRISBANE | Ormeau, 25 miles SE of Brisbane. |
| 192627 | 1 | | A | Angiosperm | Scrophulariaceae | | Veronica plebeia R.Br. | 2649 | Sharpe P.R. | 2154 | | 07JAN1977 | | | Queensland | Moreton | SOUTH STRADBROKE IS SLIPPING SANDS | 1km E of Slipping Sands near Duck or Never Never Creek, South Stradbroke Island.□<br>Open dry sclerophyll woodland of various species to 20m high. Sandy south facing slope.□<br>Prostrate herb, flowers pale blue, growing amongst grasses. |
| 776909 | 6308 | | A | Angiosperm | Solanaceae | * | Physalis peruviana L. | 11856 | Bean A.R. | 20262 | | 30APR2003 | Sullivan J.R. | FEB2007 | Queensland | Moreton | NEAR STANMORE RD, YATALA | Near Stanmore Rd, Yatala.□<br>Woodland of Eucalyptus carnea, E. intermedia, E. siderophloia, Lophostemon confertus.□<br>Shrub 90cm high, flowers yellow, fruits immature.□<br>Rare at site. |
| 39509 | 1 | | A | Angiosperm | Solanaceae | * | Solanum americanum subsp. nodiflorum (Jacq.) R.J.F.Hend. | 54115 | Everist S.L. | | | 11MAY1959 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>Brown loam. Weed around farm buildings and in plantations. |
| 663378 | 5845 | | A | Angiosperm | Solanaceae | * | Solanum chrysotrichum Schltdl. | 91164 | Leiper G. | | | JUL1998 | Bean A.R. | MAY2001 | Queensland | Moreton | S STRADBROKE IS | South Stradbroke Island.□<br>Edge of disturbed area.□<br>Shrub 3-5 m. |
| 39480 | 1 | | A | Angiosperm | Solanaceae | * | Solanum physalifolium var. nitidibaccatum (Bitter) Edmonds | 2421 | Marshall D.A. | | | 09JUL1959 | | | Queensland | Moreton | WOLFFDENE VIA BEENLEIGH | Wolffdene, via Beenleigh.□<br>Cultivation of rye grass and clover. |
| 431219 | 1 | | A | Angiosperm | Solanaceae | | Solanum shirleyanum Domin | 91159 | Williams K.A. | 84028 | Bird,L.H.; | 14APR1984 | Bean A.R. | MAR2001 | Queensland | Moreton | E FOOTHILLS OF DARLINGTON RA UPPER ORMEAU RD OFF PACIFIC HWY | On private property, B and A Muir, Eastern Foothills of Darlington Range, Upper Ormeau Road, off Pacific Highway.□<br>Rainforest at fairly high altitude on ridge top, growing along an old track and also as understory plants on floor of rainforest, soils very stony, some rock outcrops.□<br>Small shrub C. 1m high, slightly spreading. Woody perennial, in fairly dense shade, appears to be fairly high rainfall area. |
| 39910 | 1 | | A | Angiosperm | Solanaceae | | Solanum stelligerum Sm. | 2430 | Michael N. | 1857 | | 14SEP1931 | | | Queensland | Moreton | LOGANHOLME | Loganholme.□<br>Shrub 1-4ft. |
| 39917 | 1 | | A | Angiosperm | Solanaceae | | Solanum stelligerum Sm. | 2430 | not known | | | | White C.T. | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 80932 | 1 | | A | Angiosperm | Stackhousiaceae | | Stackhousia spathulata Sieber ex Spreng. | 5050 | Scortechini B. | | | | | | Queensland | Moreton | LOGAN | |
| 350054 | 1 | | A | Angiosperm | Stackhousiaceae | | Stackhousia spathulata Sieber ex Spreng. | 5050 | Williams K.A. | 79011 | | 15SEP1979 | | | Queensland | Moreton | JUMPINPIN SWAN BAY SOUTH MORETON BAY NORTH STRADBROKE IS (PUBREF) | Swan Bay, Jumpinpin, South Moreton Bay.□<br>Low sand dune with low grass, shrub and herbs. Sandy slope.□<br>Low spreading tufted plant. |
| 80959 | 1 | | A | Angiosperm | Stackhousiaceae | | Stackhousia viminea Sm. | 2455 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | |
| 80590 | 1 | | A | Angiosperm | Typhaceae | | Sparganium subglobosum Morong | 21531 | Michael N. | 1888 | | 16OCT1931 | Cook C.D. | | Queensland | Moreton | YATALA | Yatala. |
| 88226 | 1 | | A | Angiosperm | Ulmaceae | | Trema tomentosa var. aspera (Brongn.) Hewson | 98696 | Smith L.S. | 12237 | | 04NOV1964 | | | Queensland | Moreton | NR BEENLEIGH 1 MILE ALONG BARRS RD | Near Beenleigh C 1M along Bahr's Rd.□<br>Shrub c 1-2m high, flowers white. |
| 88225 | 1 | | A | Angiosperm | Ulmaceae | | Trema tomentosa var. aspera (Brongn.) Hewson | 98696 | Smith L.S. | 12234 | | 04NOV1964 | | | Queensland | Moreton | NR BEENLEIGH 1 MILE ALONG WATERFORD RD | Near Beenleigh C 1M along Waterford Rd.□<br>Common roadside shrub c 1-2.5m high, flowers white. |
| 88215 | 1 | | A | Angiosperm | Ulmaceae | | Trema tomentosa var. aspera (Brongn.) Hewson | 98696 | White C.T. | | | FEB1920 | | | Queensland | Moreton | BEENLEIGH | Beenleigh. |
| 88209 | 1 | | A | Angiosperm | Ulmaceae | | Trema tomentosa var. aspera (Brongn.) Hewson | 98696 | Oelrichs P. | | | 30SEP1965 | | | Queensland | Moreton | BEENLEIGH | C 1M from Beenleigh on Waterford Rd. |
| 89844 | 1 | | A | Angiosperm | Urticaceae | | Pipturus argenteus (G.Forst.) Wedd. | 2809 | Simmonds J.H. | | | 1889 | Chew W.L. | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 418761 | 1 | | A | Angiosperm | Urticaceae | | Pipturus argenteus (G.Forst.) Wedd. | 2809 | not known | | | | Chew W.L. | | Queensland | Moreton | PIMPAMA | Pimpama. |
| 111997 | 1 | | A | Angiosperm | Verbenaceae | * | Lantana camara L. | 86947 | Seawright A.A. | 19 | | SEP1964 | Munir A.A. | JUN1995 | Queensland | Moreton | BEENLEIGH | Bahr's Road Bridge, Beenleigh.□<br>Red flowering lantana. |
| 114576 | 1 | | A | Angiosperm | Violaceae | | Hybanthus monopetalus (Schult.) Domin | 4683 | White C.T. | | | SEP1913 | Bennett E.M. | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay. |
| 117056 | 1 | | A | Angiosperm | Vitaceae | | Clematicissus opaca (F.Muell.) Jackes & Rossetto | 99239 | Michael N. | 1874 | | 21AUG1931 | | | Queensland | Moreton | ORMEAU | Ormeau.□<br>Climber. |
| 118594 | 1 | | A | Angiosperm | Xanthorrhoeaceae | | Xanthorrhoea fulva (A.T.Lee) D.J.Bedford | 24066 | White C.T. | | | SEP1913 | Lee A. | | Queensland | Moreton | RUSSELL IS | Russell Island, swamp. |
| 118522 | 1 | | A | Angiosperm | Xanthorrhoeaceae | | Xanthorrhoea macronema F.Muell. ex Benth. | 24079 | White C.T. | | | SEP1913 | Lee A. | | Queensland | Moreton | RUSSELL IS | Russell Island, forest country. |
| 760770 | 4646 | | B | Bryophyte | Bartramiaceae | | Philonotis slateri (Hampe) A.Jaeger | 83172 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex. Herb. C.J. Wild) |
| 760769 | 4646 | | B | Bryophyte | Bartramiaceae | | Philonotis slateri (Hampe) A.Jaeger | 83172 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex. Herb. C.J. Wild) |
| 760756 | 4646 | | B | Bryophyte | Bartramiaceae | | Philonotis tenuis (Tayor) Reichardt | 83173 | Wild C.J. | | | JUN1887 | | | Queensland | Moreton | PIMPAMA BRIDGE | Pimpama Bridge.□<br>(Ex. Herb. C.J. Wild) |
| 800307 | 4821 | | B | Bryophyte | Brachytheciaceae | | Eurhynchium asperipes (Mitt.) Dixon | 82580 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK. | Pimpama Creek. |
| 800312 | 4821 | | B | Bryophyte | Brachytheciaceae | | Eurhynchium asperipes (Mitt.) Dixon | 82580 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK. | Pimpama Creek. |
| 800310 | 4821 | | B | Bryophyte | Brachytheciaceae | | Eurhynchium asperipes (Mitt.) Dixon | 82580 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA. | Pimpama. |
| 800309 | 4821 | | B | Bryophyte | Brachytheciaceae | | Eurhynchium asperipes (Mitt.) Dixon | 82580 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK. | Pimpama Creek. |
| 761299 | 4698 | | B | Bryophyte | Bryaceae | | Rhodobryum aubertii (Schwaegr.) Ther. | 83473 | not known | | | | Spence J.R. | | Queensland | Moreton | PIMPAMA | Pimpama. |

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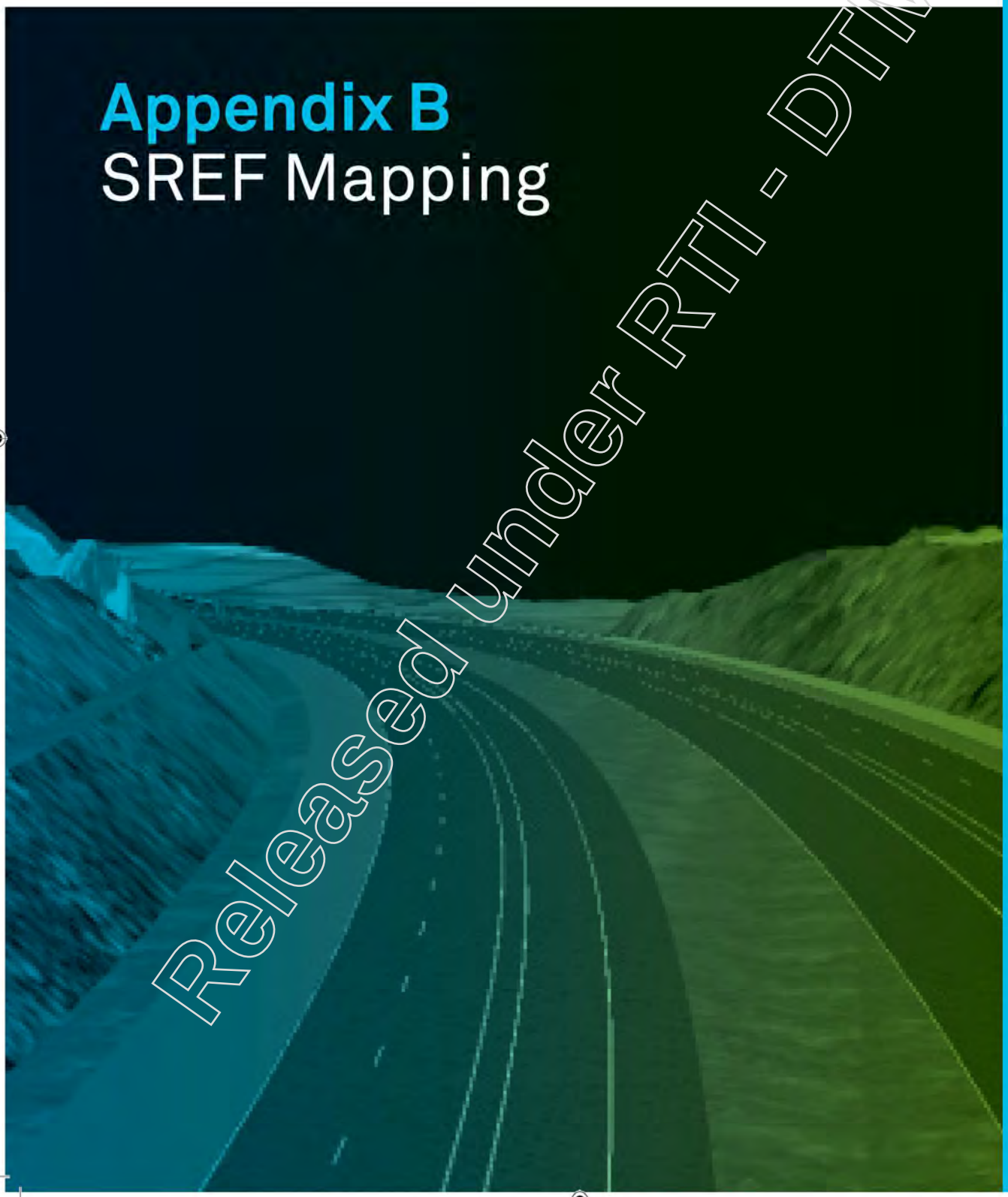
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 761302 | 4698 | | B | Bryophyte | Bryaceae | | Rhodobryum auberti (Schwaegr.) Ther. | 83473 | Wild C.J. | | | 1887 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex. Herb. C.J. Wild) |
| 761465 | 4706 | | B | Bryophyte | Bryaceae | | Rosulabryum subfasciculatum (Hampe) J.R.Spence | 89834 | Wild C.J. | | | AUG1887 | Spence J.R. | AUG1999 | Queensland | Moreton | NEAR BEENLEIGH | Near Beenleigh.□<br>(Ex. Herb. C.J. Wild) |
| 761697 | 4716 | | B | Bryophyte | Calymperaceae | | Syrrhopodon armatus Mitt. | 83580 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>(Ex. Herb. C.J. Wild) |
| 750206 | 4642 | | B | Bryophyte | Cryphaeaceae | | Cryphaea sp. (Pimpama C.J.Wild 465) | 82123 | Wild C.J. | Bailey Herb. 465 | | JUN1887 | | | Queensland | Moreton | PIMPAMA BRIDGE | Pimpama Bridge.□<br>(Ex. Herb. F.M.Bailey 465) |
| 750255 | 4642 | | B | Bryophyte | Cryphaeaceae | | Cyptodon muelleri (Hampe) M.Fleisch. | 91286 | Wild C.J. | | | AUG1887 | | JUL2001 | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>In trees.□<br>(Ex. Herb. C.J.Wild) |
| 642505 | 4608 | | B | Bryophyte | Dicranaceae | | Campylopus introflexus (Hedw.) Brid. | 81987 | not known | | | AUG1887 | | | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub.□<br>(Ex Herb. C.J.Wild) |
| 733941 | 131 | | B | Bryophyte | Dicranaceae | | Holomitrium dietrichiae Muell.Hal. | 82756 | Wild C.J. | | | | | | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>(Bailey Herb. 456). |
| 695302 | 134 | | B | Bryophyte | Fabroniaceae | | Fabronia sp. (Pimpama C.J.Wild AQ695302) | 82562 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA SCRUB. | Pimpama Scrub. |
| 721978 | 1 | | B | Bryophyte | Fissidentaceae | | Fissidens curvatus Hornsch. var. curvatus | 91299 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | |
| 721975 | 1 | | B | Bryophyte | Fissidentaceae | | Fissidens oblongifolius var. hyophilus (Mitt.) Beever & I.G.Stone | 91305 | not known | | | | | | Queensland | Moreton | PIMPAMA | |
| 721976 | 1 | | B | Bryophyte | Fissidentaceae | | Fissidens oblongifolius var. hyophilus (Mitt.) Beever & I.G.Stone | 91305 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | |
| 733905 | 131 | | B | Bryophyte | Funariaceae | | Entosthodon radians (Hedw.) Muell.Hal. | 91328 | Wild C.J. | | | AUG1987 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex herb. C.J.Wild). |
| 760805 | 4646 | | B | Bryophyte | Funariaceae | | Physcomitrium brisbanicum Muell.Hal. | 83175 | not known | Bailey Herb. 327 | | | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Bailey 327) |
| 695255 | 1 | | B | Bryophyte | Garovagliaceae | | Euptychium cuspidatum (Mitt.) Mitt. | 82661 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA SCRUB. | Pimpama Scrub. |
| 801084 | 4828 | | B | Bryophyte | Hypnaceae | | Hypnum | 82912 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK, SOUTH OF BRISBANE. | Pimpama Creek, south of Brisbane. |
| 733967 | 131 | | B | Bryophyte | Hypnaceae | | Hypnum sp. (Cairns C.J.Wild AQ733964) | 82901 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex herb. C.J.Wild). |
| 800940 | 4827 | | B | Bryophyte | Hypnodendraceae | | Hypnodendron | 87432 | not known | Bailey Herb. 141 | | | | | Queensland | Moreton | LOGAN RIVER, SOUTH OF BRISBANE. | Logan River. South of Brisbane. |
| 498623 | 4551 | | B | Bryophyte | Hypopterygiaceae | | Hypopterygium tamarisci (Sw.) Brid. ex Muell.Hal. | 95341 | Wild C.J. | | | | | | Queensland | Moreton | PIMPAMA SCRUB (EX HERB C.J.WILD) | Pimpama Scrub (ex herb C.J.Wild). |
| 498622 | 4551 | | B | Bryophyte | Hypopterygiaceae | | Hypopterygium tamarisci (Sw.) Brid. ex Muell.Hal. | 95341 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub. |
| 551639 | 4596 | | B | Bryophyte | Lembophyllaceae | | Camptochaete excavata (Taylor) A.Jaeger | 83890 | not known | | | | Klazenga N. | JAN2003 | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Bailey Herb. No.443) |
| 551643 | 4596 | | B | Bryophyte | Lembophyllaceae | | Camptochaete excavata (Taylor) A.Jaeger | 83890 | Wild C.J. | | | JUL1887 | Klazenga N. | JAN2003 | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex herb. C.J.Wild) |
| 551609 | 4596 | | B | Bryophyte | Lembophyllaceae | | Camptochaete excavata (Taylor) A.Jaeger | 83890 | Wild C.J. | | | AUG1887 | Klazenga N. | JAN2003 | Queensland | Moreton | PIMPAMA CK | Pimpama Ck.□<br>On fig tree.□<br>(Ex herb. C.J.Wild). |
| 551658 | 4596 | | B | Bryophyte | Lembophyllaceae | | Camptochaete leichhardtii (Hampe) Broth. | 83891 | Bailey F.M. | | | AUG1887 | Klazenga N. | JAN2003 | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>(Ex Herb. C.J.Wild) |
| 642233 | 4602 | | B | Bryophyte | Leucobryaceae | | Leucobryum candidum (Brid. ex P.Beauv.) Wilson | 82952 | Wild C.J. | | | | | | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub.□<br>(Ex Herb. C.J. Wild). |
| 760633 | 4641 | | B | Bryophyte | Meteoriaceae | | Papillaria flexicaulis (Wilson) A.Jaeger | 83163 | Wild C.J. | | | AUG1887 | Streimann H. | 1986 | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub.□<br>(Ex. Herb. C.J. Wild) |
| 551770 | 4601 | | B | Bryophyte | Neckeraceae | | Thamnobryum pandum (Hook.f. & Wilson) I.G.Stone & G.A.M.Scott | 83616 | Wild C.J. | | | AUG1887 | Milne J. | JUN2002 | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub. |
| 760100 | 4625 | | B | Bryophyte | Orthotrichaceae | | Macromitrium involutifolium (Hook. & Grev.) Schwaegr. | 82995 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>(Ex. Herb. C.J. Wild) |
| 760131 | 4625 | | B | Bryophyte | Orthotrichaceae | | Macromitrium involutifolium (Hook. & Grev.) Schwaegr. subsp. involutifolium | 82996 | not known | 448 | | 1886 | Ramsay H. | MAY1939 | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Bailey 448) |
| 760140 | 4625 | | B | Bryophyte | Orthotrichaceae | | Macromitrium involutifolium (Hook. & Grev.) Schwaegr. subsp. involutifolium | 82996 | Wild C.J. | | | AUG1887 | Vitt D.H. | NOV1983 | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub.□<br>(Ex. Herb. C.J. Wild) |
| 760139 | 4625 | | B | Bryophyte | Orthotrichaceae | | Macromitrium involutifolium (Hook. & Grev.) Schwaegr. subsp. involutifolium | 82996 | Wild C.J. | | | AUG1887 | Vitt D.H. | NOV1983 | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>On trees.□<br>(Ex. Herb. C.J. Wild) |
| 760189 | 4630 | | B | Bryophyte | Orthotrichaceae | | Macromitrium ligulaefolium Broth. | 82999 | Wild C.J. | | | JUL1887 | Vitt D.H. | NOV1983 | Queensland | Moreton | PIMPAMA | Pimpama. |
| 760219 | 4630 | | B | Bryophyte | Orthotrichaceae | | Macromitrium microstomum (Hook. & Grev.) Schwaegr. | 83002 | Wild C.J. | | | AUG1887 | Vitt D.H. | NOV1983 | Queensland | Moreton | PIMPAMA SCRUB | Pimpama scrub. |
| 768145 | 149 | | B | Bryophyte | Pottiaceae | | Weissia edentula Mitt | 96174 | Wild C.J. | Bailey Herb. 460 | | AUG1887 | | | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>(Bailey Herb. 460) |
| 750593 | 4690 | | B | Bryophyte | Racopilaceae | | Racopilum cuspidigerum (Schwaegr.) Aongstr. var. cuspidigerum | 83425 | Wild C.J. | | | AUG1887 | Van Zanten B.O. | 1990 | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>On trees.□<br>(Ex herb. C.J.Wild) |
| 750590 | 4690 | | B | Bryophyte | Racopilaceae | | Racopilum cuspidigerum (Schwaegr.) Aongstr. var. cuspidigerum | 83425 | Wild C.J. | | | JUN1887 | Van Zanten B.O. | 1990 | Queensland | Moreton | PIMPAMA BRIDGE | Pimpama Bridge.□<br>(Ex herb. C.J.Wild) |
| 750603 | 4690 | | B | Bryophyte | Racopilaceae | | Racopilum cuspidigerum var. convolutaceum (Muell.Hal.) Zanten & Dijkstra | 83249 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex herb. C.J.Wild) |
| 761115 | 4684 | | B | Bryophyte | Rhizogoniaceae | | Pyrrhobryum paramattense (Muell.Hal.) Manuel | 83241 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA SCRUB | Pimpama Scrub.□<br>On fallen logs.□<br>Ex. Herb. C.J. Wild |
| 761120 | 4684 | | B | Bryophyte | Rhizogoniaceae | | Pyrrhobryum paramattense (Muell.Hal.) Manuel | 83241 | Wild C.J. | Bailey Herb. 331 | | 1887 | Brotherus V.F. | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Ex. Herb. F.M. Bailey No. 331 |
| 761131 | 4684 | | B | Bryophyte | Rhizogoniaceae | | Pyrrhobryum paramattense (Muell.Hal.) Manuel | 83241 | Shirley J.F. | | | | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>Ex. J.F. Shirley Vol.1, 21.7 |
| 750462 | 4682 | | B | Bryophyte | Rhizogoniaceae | | Pyrrhobryum spiniforme (Hedw.) Mitt. | 83429 | Wild C.J. | | | JUN1887 | | | Queensland | Moreton | PIMPAMA CREEK | Pimpama Creek.□<br>(Ex herb. C.J.Wild) |
| 761637 | 4710 | | B | Bryophyte | Sphagnaceae | | Sphagnum falcatulum Besch. | 83597 | Dobson A.T. | 77002 | | 07JAN1977 | | | Queensland | Moreton | NORTH STRADBROKE ISLAND, S END OF ISLAND | North Stradbroke Island, S end of island.□<br>Lepidosperma swamp. |
| 750936 | 4736 | | B | Bryophyte | Thuidiaceae | | Thuidiopsis sparsa (Hook.f. & Wilson) Broth. | 96154 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | PIMPAMA | Pimpama.□<br>(Ex herb. C.J.Wild) |
| 750861 | 4730 | | B | Bryophyte | Thuidiaceae | | Thuidium cymbifolium (Dozy & Molk.) Dozy & Molk. | 83619 | Wild C.J. | | | JUN1887 | Touw A. | 1990 | Queensland | Moreton | PIMPAMA BRIDGE | Pimpama Bridge.□<br>(Ex herb. C.J.Wild) |
| 645691 | 4737 | | F | Fungus | Basidiomycota | | Calvatia candida (Rostk.) Hollos | 90315 | Bailey F.M. | Bailey Herb. 208 | | | | | Queensland | Moreton | LOGAN RIVER. | Logan River.□<br>Bailey Herb. 208.□<br>BRIP 144. |
| 645865 | 4745 | | F | Fungus | Basidiomycota | | Polyporus guilfoylei Cark. & Broome | 94575 | Bailey F.M. | Bailey Herb 211 | | | | | Queensland | Moreton | LOGAN RIVER. | Logan River.□<br>Bailey Herb. 211.□<br>BRIP 427. |
| 645901 | 4745 | | F | Fungus | Basidiomycota | | Poria ferruginosa (Schrad.) P.Karst. | 94469 | Bailey F.M. | Bailey Herb. 209 | | | | | Queensland | Moreton | LOGAN RIVER. | Logan River.□<br>Bailey Herb. 209.□<br>BRIP 673. |
| 140069 | 1 | | G | Gymnosperm | Cupressaceae | | Callitris columellaris F.Muell. | 434 | Everist S.L. | | | 11MAY1959 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>In white sand forming groves.□<br>Tree 20 feet; bark grey, hard, furrowed; leaves green. |
| 140077 | 1 | | G | Gymnosperm | Cupressaceae | | Callitris columellaris F.Muell. | 434 | White C.T. | 3411 | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay. |
| 140065 | 1 | | G | Gymnosperm | Cupressaceae | | Callitris columellaris F.Muell. | 434 | White C.T. | 3411 | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS | Russell Island.□<br>Seedling. |
| 140059 | 1 | | G | Gymnosperm | Cupressaceae | | Callitris columellaris F.Muell. | 434 | White C.T. | 3411 | | 16APR1927 | | | Queensland | Moreton | RUSSELL IS MORETON BAY | Russell Island, Moreton Bay. |
| 140071 | 1 | | G | Gymnosperm | Cupressaceae | | Callitris columellaris F.Muell. | 434 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 685548 | 4527 | | L | Lichen | Collemataceae | | Collema glaucophthalmum Nyl. | 77313 | Stevens N. | 2509 | | 12JUN1978 | Stevens N. | | Queensland | Moreton | SOUTH PART OF NORTH STRADBRCKE ISLAND, OPPOSITE RUSSELL ISLAND | South part of North Stradbroke Island, opposite Russell Island.□<br>On [bark of] old Avicennia species. |
| 720594 | 7153 | | L | Lichen | Parmeliaceae | | Bulbothrix apophystata (Hale & Kurok.) Hale | 77095 | Rogers R. | 7244 | et al.,; | 16DEC1975 | | | Queensland | Moreton | CARBROOK RD CARBROOK | Carbrook.□<br>Eucalyptus drepanophylla. |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 691151 | 4600 | | L | Lichen | Parmeliaceae | | Parmotrema rampodense (Nyl.) Hale | 78158 | Clifford H.T. | 72 | | FEB1975 | Rogers R.W. | MAR1975 | Queensland | Moreton | SOUTHERN TIP OF [NORTH] STRADBROKE ISLAND | Southern tip of [North] Stradbroke Island.□<br>[On twig of] Ceriops? species.□<br>In Mangroves.□<br>Description for paper based on this specimen.□<br>[There are at least two other species on this specimen yet to be identified]. |
| 691198 | 4600 | | L | Lichen | Parmeliaceae | | Parmotrema robustum (Degel.) Hale | 78159 | Stevens N. | 2495 | | 12JUN1978 | | | Queensland | Moreton | SOUTHERN PART OF NORTH STRADBROKE ISLAND, SOUTHERN MORETON BAY | Southern Part of North Stradbroke Island, Southern Moreton Bay.□<br>On [bark of] Bruguiera species. |
| 803317 | 4849 | | L | Lichen | Ramalinaceae | | Ramalina pacifica Asahina | 78602 | Stevens N. | | | 10MAY1977 | Stevens N. | | Queensland | Moreton | MORETON BAY, JUMPINPIN AREA. | Moreton Bay, Jumpinpin area.□<br>On bark/twigs of Ceriops. |
| 804344 | 4859 | | L | Lichen | Teloschistaceae | | Teloschistes flavicans (Sw.) Norman | 79115 | Stevens N. | 2480 | | 12JUN1978 | Stevens N. | | Queensland | Moreton | SOUTHERN MORETON BAY. OFF THE COAST OF BRISBANE. | Southern Moreton Bay. Off the coast of Brisbane.□<br>On twig of Ceriops. |
| 682409 | 4487 | | H | Liverwort | Liverwort | | Liverwort | 83824 | Wild C.J. | | | AUG1887 | | | Queensland | Moreton | ALBERT NR BEENLEIGH | Near Beenleigh. |
| 767465 | 6459 | | P | Pteridophyte | Adiantaceae | | Adiantum hispidulum var. hypoglaucum Domin | 56525 | Leiper G. | | | 30JUN2004 | Bostock P.D. | NOV2005 | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Dry rainforest. |
| 224422 | 1 | | P | Pteridophyte | Adiantaceae | | Cheilanthes sieberi Kunze subsp. sieberi | 538 | White C.T. | | | SEP1913 | Farrant P. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 224381 | 1 | | P | Pteridophyte | Adiantaceae | | Cheilanthes tenuifolia (Burm.f.) Sw. | 38368 | White C.T. | | | SEP1913 | Farrant P. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 145408 | 1 | | P | Pteridophyte | Blechnaceae | | Blechnum indicum Burm.f. | 324 | Schodde R. | 633 | | 08DEC1956 | Andrews S.B. | | Queensland | Moreton | JACOBS WELL 2.5KM W 55KM SE OF BRISBANE. | 2.5km W of Jacobs Well, 55km SE of Brisbane.□<br>On swampy scrub plain. |
| 145798 | 1 | | P | Pteridophyte | Blechnaceae | | Doodia caudata (Cav.) R.Br. | 4501 | Schodde R. | 641 | | 15DEC1956 | Parris B.S. | NOV1994 | Queensland | Moreton | 10KM S OF BEENLEIGH; 35KM S OF BRISBANE | 10km S of Beenleigh, 35km S of Brisbane.□<br>On damp shaded creek bank. |
| 20830 | 1 | | P | Pteridophyte | Dennstaedtiaceae | | Pteridium esculentum (G.Forst.) Cockayne | 2160 | Schodde R. | 634 | | 08DEC1956 | Brownsey P.J. | JUL1983 | Queensland | Moreton | JACOBS WELL 2.5KM W 55KM SE OF BRISBANE | 2.5km W of Jacobs Well, which is 55km SE of Brisbane.□<br>On swampy scrub plain. |
| 20953 | 1 | | P | Pteridophyte | Dicksoniaceae | | Calochlaena dubia (R.Br.) M.D.Turner & R.A.White | 680 | White C.T. | | | SEP1913 | | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 767466 | 6459 | | P | Pteridophyte | Dryopteridaceae | | Lastreopsis munita (Nett.) Tindale | 4720 | Leiper G. | | | 30JUN2004 | Bostock P.D. | AUG2004 | Queensland | Moreton | UPPER ORMEAU | Upper Ormeau.□<br>Dry rainforest. |
| 269323 | 1 | | P | Pteridophyte | Lindsaeaceae | | Lindsaea fraseri Hook. | 23700 | White C.T. | | | SEP1913 | Kramer K.U. | | Queensland | Moreton | RUSSELL IS | Russell Island. |
| 674275 | 5875 | | P | Pteridophyte | Pteridaceae | | Acrostichum speciosum Willd. | 66 | Dowling R.M. | W264 | Stephens,K.M.; | 01SEP1998 | Stephens K.M. | SEP1998 | Queensland | Moreton | ROCKY POINT ROAD (AMG 56 534201E 6933682N) | Rocky Pt Road.□<br>(AMG 56 534201E 6933682N).□<br>Tidal flat of black peat.□<br>Phragmites open grassland with dense mixture of shrubs & herbs below. |
| 173688 | 1 | | P | Pteridophyte | Schizaeaceae | | Lygodium microphyllum (Cav.) R.Br. | 1681 | Schodde R. | 635 | | 08DEC1956 | Andrews S.B. | | Queensland | Moreton | CA 2.5KM W OF JACOBS WELL | ca 2.5km W of Jacobs Well.□<br>On swampy scrub plain. |
| 628094 | 5401 | | P | Pteridophyte | Thelypteridaceae | | Ampelopteris prolifera (Retz.) Copel. | 32107 | Leiper G. | | | JUN1994 | | | Queensland | Moreton | ALBERT RIVER LUSCOMBE BRIDGE CA 10KM W OF BEENLEIGH | Albert River, at Luscombe Bridge, about 10km west of Beenleigh.□<br>Bank of river, on gravelly soil.□<br>Fern forming thicket to 1.5metres tall. |
| 174989 | 1 | | P | Pteridophyte | Thelypteridaceae | | Christella dentata (Forssk.) Brownsey & Jermy | 5591 | Schodde R. | 645 | | 15DEC1956 | Andrews S.B. | | Queensland | Moreton | CK 10KM S OF BEENLEIGH | Ca 10km S of Beenleigh.□<br>Growing on damp creek bank. |
| 711598 | 1 | | Z | Z-Algae | Chlorophyceae | | Caulerpa taxifolia (Vahl) C.Agardh | 66291 | Cribb A.B. | 55.2 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.2) | Canaipa Passage, Moreton Bay. |
| 701671 | 1 | | Z | Z-Algae | Chlorophyceae | | Caulerpa taxifolia (Vahl) C.Agardh | 66291 | Cribb A.B. | 55.2 | | 16MAY1950 | Cribb A.B. | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.2) | Canaipa Passage, Moreton Bay.□<br>Dredged. |
| 702895 | 1 | | Z | Z-Algae | Chlorophyceae | | Codium | 67181 | McKeon C. | | McKeon,G.; | 04JAN1949 | | | Queensland | Moreton | JUMPINPIN STRADBROKE IS | Jumpin Pin, Stradbroke Is.□<br>Washed-up. |
| 714291 | 1 | | Z | Z-Algae | Phaeophyceae | | Phaeophyceae | 71175 | Cribb A.B. | 55.8 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE (COLL. NO. 55.8) | Canaipa Passage.□<br>Phaeophyte epiphyte on Sarconema. |
| 708360 | 1 | | Z | Z-Algae | Rhodophyceae | | Asparagopsis taxiformis (Delile) Trevis. | 71277 | Cribb A.B. | 55.1 | | 16MAY1950 | Cribb A.B. | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.1) | Canaipa Passage, Moreton Bay.□<br>Dredged in 10ft of water. |
| 710729 | 1 | | Z | Z-Algae | Rhodophyceae | | Gracilaria textorii forma tenuis V.May | 72242 | Cribb A.B. | 55.13 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.13) | Canaipa Passage, Moreton Bay.□<br>Dredged 6-12ft. |
| 711495 | 1 | | Z | Z-Algae | Rhodophyceae | | Hypoglossum harveyanum (J.Agardh) Womersley & Shepley | 72397 | Cribb A.B. | 55.6 | | 16MAY1950 | Millar A.J. | AUG1993 | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.6) | Canaipa Passage, Moreton Bay.□<br>Dredged 6-12 ft. |
| 711599 | 1 | | Z | Z-Algae | Rhodophyceae | | Hypoglossum heterocystideum (J.Agardh) J.Agardh | 72417 | Cribb A.B. | 55.5 | | 16MAY1950 | Millar A.J. | AUG1993 | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.5) | Canaipa Passage, Moreton Bay. |
| 711505 | 1 | | Z | Z-Algae | Rhodophyceae | | Hypoglossum heterocystideum (J.Agardh) J.Agardh | 72417 | Cribb A.B. | 55.5 | | 16MAY1950 | Millar A.J. | AUG1993 | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.5) | Canaipa Passage, Moreton Bay.□<br>Dredged 6-12 ft. |
| 713816 | 1 | | Z | Z-Algae | Rhodophyceae | | Sarconema filiforme (Sond.) Kylin | 72454 | Cribb A.B. | 55.7 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.7) | Canaipa Passage, Moreton Bay.□<br>Dredged 6-12 ft. |
| 711587 | 1 | | Z | Z-Algae | Rhodophyceae | | Sarconema filiforme (Sond.) Kylin | 72454 | Cribb A.B. | 55.11 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.11) | |
| 711588 | 1 | | Z | Z-Algae | Rhodophyceae | | Sarconema filiforme (Sond.) Kylin | 72454 | Cribb A.B. | 55.7 | | 16MAY1950 | Millar A.J. | AUG1993 | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.7) | Canaipa Passage, Moreton Bay. |
| 713821 | 1 | | Z | Z-Algae | Rhodophyceae | | Sarconema filiforme (Sond.) Kylin | 72454 | Cribb A.B. | 55.11 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.11) | Canaipa Passage, Moreton Bay.□<br>Dredged 6-12 ft. |
| 714292 | 1 | | Z | Z-Algae | Z-Algae | | Z-Algae | 74501 | Cribb A.B. | 55.10 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.10) | Canaipa Passage, Moreton Bay.□<br>On Sarconema.□<br>Dredged 6-12ft. |
| 714290 | 1 | | Z | Z-Algae | Z-Algae | | Z-Algae | 74503 | Cribb A.B. | 55.3 | | 16MAY1950 | | | Queensland | Moreton | CANAIPA PASSAGE MORETON BAY (COLL. NO. 55.3) | Canaipa Passage, Moreton Bay.□<br>On Caulerpa.□<br>Dredged 6-12 ft. |

# Appendix B
# SREF Mapping



# ACID SULFATE SOILS[1]

## LOGAN - COOMERA AREA

## REFERENCE

### ACID SULFATE SOILS ON RELATIVELY UNDISTURBED LAND

| Depth | Depth Code | Depth to Actual Acid Sulfate Soil[2] (pH ≤ 4.0) | Depth to Strongly Acidic Soil layer[2] (pH > 4.0 to ≤ 5.0) | Depth to Potential Acid Sulfate Soil[3] |
|---|---|---|---|---|
| 0 - 0.5m | 0 | A0 | a0 | S0 |
| 0.5 - 1m | 1 | A1 | a1 | S1 |
| 1 - 2m | 2 | A2 | a2 | S2 |
| 2 - 3m | 3 | A3 | a3 | S3 |
| 3 - 4m | 4 | A4 | a4 | S4 |
| 4 - 5m | 5 | A5 | a5 | S5 |
| > 5m | 5+ | A5+ | a5+ | S5+ |

NOTE:
- The depth codes above imply that a predominance of profiles in the map unit fall within the nominated depth range.
- Actual acid sulfate soil layers (designated with an **A** code) often overlie potential acid sulfate soils layers (designated with an **S** code). Where this occures e.g. the map unit is coloured according to the depth of the upper surface of the 'actual' layer (A0) and overlayed with yellow dots. An 'a' preceding the soil depth code e.g. indicates a strong acid soil layer with field pH ranging from > 4.0 to ≤ 5.0. This may or may not be the result of sulfide oxidation. While 'a' depth code is shown on the map, no colour is assigned to it.
- In areas where there is varying depth to an ASS layer that cannot be separately mapped at the operative scale, two colours are used to designate the dominant depths. This appears as equal width striped colours. e.g.
- $S^P$ - indicates sediments of Pleistocene age[1], so that $S^P5+$ indicates sulfidic sediments (of Pleistocene age) deeper than 5m.
- w - Subscript w indicates areas associated with *Melaleuca sp.* Wetlands and occasionally *Casuarian glauca* communities. Oxidisable sulfur % in surface layers may be highly variable and often exceeds the 'Action Criteria[4]'. This may include sulfur from organic compounds and modern accretion of sulfides in a wet, organic rich environment. ASS typically occurs at depth. Where this occurs e.g. or or the map is coloured as per the actual or potential depth category and is overlayed with pattern.

S — Land mapped at 1:100 000 scale where ASS occurs within 5m of the surface.

$S_{LA}$ — Limited field assessment but occurs in a landscape position where there is a reasonable probability of ASS occurrence. This is usually land where the present use precludes any disturbane e.g. National Parks, Reserves, etc., or land where accessibility is severely restricted.

### ACID SULFATE ON DISTURBED LAND[5]

$S_{DL}$ — Disturbed land, e.g. Canal estate, Marina, Aquaculture, Quarry, Urban, Industrial likely to contain ASS. (In some cases partial or full treatment may have been undertaken). Limited field investigation.

### LAND WITH A LOW PROBABILITY OF ACID SULFATE SOIL OCCURRENCE

LP — Land between the 5m AHD[6] contour and the outer limit[8] of Holocene, estuarine ASS (ie land < 5m AHD) as mapped at this scale, with low probability of ASS occurrence[7]. Limited field investigation.

LP5 — Land > 5m AHD with low or negligible probability of ASS occurrence[9]. Limited field assessment.

### LAND NOT ASSESSED

NA — Land not assessed for ASS as part of this survey. It may include non ASS land beyond the boundary established as the limit of Holocene, esturaine, sulfidic sediments[7] but insufficient or no field testing was carried out[9].

[1] **Acid sulfate soil** is the generic term used to define soils derived from estuarine sediments containing iron sulfides (pyrite) or containing the acidic products of the oxidation of sulfides. The term includes actual and potential acid sulfate soils. Unless used with the superscript P, the code 'S' implies sulfidic sediment of Holocene age. The superscript P implies sediments of Pleistocene age.

[2] An 'A' preceding the soil depth code indicates the probable depth to a soil layer or horizon where a field pH of ≤ 4.0 is first encountered. A field pH of of 4.0 or less is used as an indicator of an **Actual Acid Sulfate Soil (AASS)** which has mobile acidity in the form of ionic hydrogen, aluminium, iron or acid salts. Extensive areas with high actual acidity derived from sulfide oxidation may constitute a significant environmental hazard. Some soils with high organic matter may have low pH from organic acids. An 'a' preceding the depth code indicates the probable depth to a soil layer or horizon with field pH ranging from > 4.0 to ≤ 5.0. This may or may not be a result of ASS oxidation.

[3] An 'S' preceding the soil depth code indicates the probable depth to a **Potential Acid Sulfate Soil (PASS)** layer or horizon. PASS are soils where the oxidisable sulfur percentage exceeds the prescribed 'action criteria[4]' at which treatment is required if disturbed. Testing for Oxidisable sulfur is conducted by the Total Oxidisable Sulfur (TOS) method, the Chromium Reducible Sulfur ($S_{CR}$) method or the Peroxide Oxidisation - Combined Acidity and Sulfate (POCAS) method.

[4] Oxidisable sulfur 'Action Criteria' that trigger treatment are currently: Sands, 0.03 S%; Loams to light clays, 0.06 S%; Medium to heavy clays, 0.1 S%. NOTE: For disturbance > 1000 tonnes the action criteria is 0.03% regardless of soil texture.

[5] Limited or no field checking has been carried out in disturbed lands.

[6] The reliability of elevation data is variable across the study area. AHD refers to Australian Height Datum.

[7] The primary focus of ASS investigation in this study are the sulfidic sediments that were deposited in the Holocene epoch, that is, during the last 10 000 years. Experience in coastal stratigraphic mapping shows that similar, but much older sulfidic sediments of Pleistocene age can occur, still in a reduced (anaerobic) state, being buried under either cemeted sands or old, consolidated alluvium. They are far less common than the Holocene equivalents, and have been found beneath land whose surface is both above and below 5m AHD. Generally, Pleistocene sediments will be found at greater depths below the surface than equivalent Holocene sediments.

[8] The outer boundary of Holocene estuarine ASS commonly occurs at the intersection with hard rock or other materials of non-estuarine origin. It is either at the 5m contour or at lower elevation. This boundary is established using limited field checking at the boundary itself, together with the use of contour lines and geological map boundaries. There is no field assessment beyond the 5m AHD contour level. It should be noted, however, that certain lithologies on land above 5m AHD may contain sulfidic material of non-estuarine / Holocene origin. Additionally, much older, estuarine, sulfidic sediments may occur at depth on land > 5m AHD, as discussed in footnote 7 above.

[9] CAUTION: It is not possible to accurately map the distribution of ASS adjacent to rivers and streams at the current mapping scale (e.g. mangrove fringes). ASS may also be buried below alluvium of past and present stream channels some distance upstream of mapped areas.

| Map Symbol | Lithology |
|---|---|
| DCf | Mudstone, shale, arenite, chert, jasper, basic metavolcanics, pillow lava, conglomerate |
| DCf/c | Massive and banded chert |
| DCf/g | Greenstone |
| DCf/mc | Massive and banded chert and mudstone |
| DCfw | Arenite, greywacke |
| Jbmg | Lithic labile and feldspathic labile sandstone |
| Qa | Clay, silt, sand, gravel; flood plain alluvium |
| Qal | Lakes in alluvial plain: silt, clay |
| Qaw | Swampy areas of alluvial plain (wallum): sand, peat |
| Qha/1 | Lowest river terrace; gravel, sand, silt, clay |
| Qha/2 | Second river terrace; sand, silt, clay gravel |
| Qhac | Mixed alluvial and colluvial deposits: gravel, silt, mud, clay |
| Qhcb | Beach ridges; sand, shelley sand |
| Qhct | Tidal Flats; sand, mud; covered with mangroves |
| Qhcw | Holocene coastal swamp; quartz sand, peaty quartz sand |
| Qhe | Estuarine channels and banks; sandy mud, muddy sand, minor gravel |
| Qhec | Estuarine channels: sandy mud, muddy sand, minor gravel |
| Qhh | Anthropogenic deposits: land fill, mine tailings, rubble |
| Qhh/qsg | Quarry area: sand and gravel extraction: based on SPOT Imagery December 1998 or one metre contour data |
| Qhh/R | Anthropogenic fill: mainly clay, sand,and gravels based on SPCT IMagery September, 1998 and contour data |
| Qhm | Marine basin; thin veneer of muddy sand, sandy mud, mud; over Pleistocene sediments |
| Ql | Dune lakes; sand, organic deposits |
| Qmt | Tidal delta; quartz sand |
| Qpa | High level alluvium; silt, clay, sand, gravel |
| Qpct | Pleistocene tidal delta deposits and sand dunes: quartz sand and clays |
| Ri | Shale, conglomerate, sandstone, coal, siltstone, basalt, tuff |
| Rin | Siltstone, shale, thin coal seams |
| RJbw | Quartzose sandstone, siltstone, shale conglomerate, coal |
| To | Claystone, sandstone, shale, basalt, conglomerate, siltstone, limestone |
| TQr | Pediment slope wash, clay, scree, soil |
| Ts | Quartzose to sublabile sandstone, claystone, conglomerate, minor olivine basalt |
| Tv | Mainly basalt flows |






**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways
- Suburb boundaries

Data sources:

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Meters

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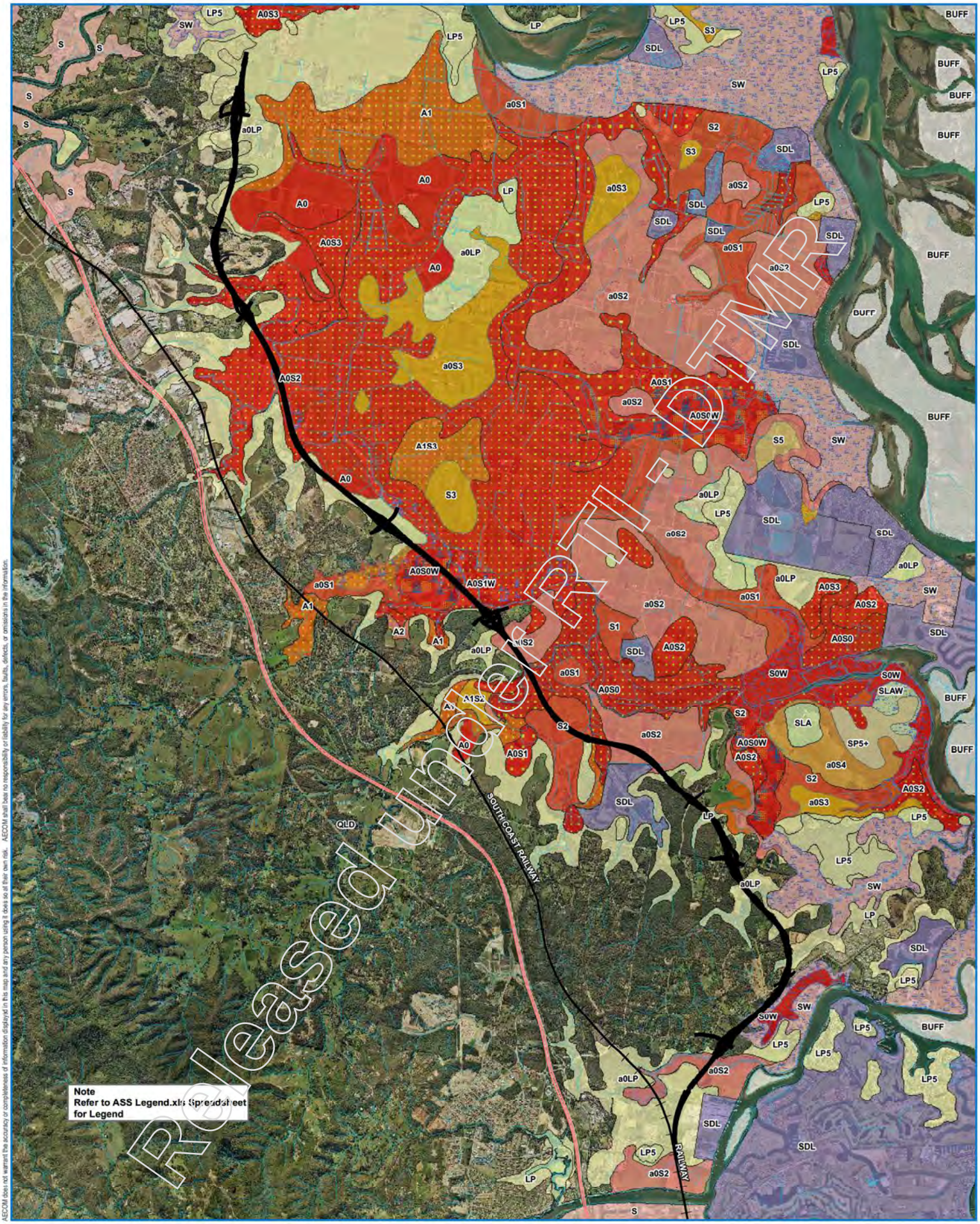
# INTRA-REGIONAL TRANSPORT CORRIDOR
## Base Map

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 1**

A3 size








**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Waterways

Data sources:

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# INTRA-REGIONAL TRANSPORT CORRIDOR
## Acid Sulfate Soils

PROJECT ID 60099643

CREATED BY VV

LAST MODIFIED VV - 17 NOV 2009

**Figure 10A**

A3 size






**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways
- SEQ_RiverPolygons
- DCDB
- Waterway Buffers 100m

Data sources:

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# INTRA-REGIONAL TRANSPORT CORRIDOR
## Waterways and Possible Location of Water Quality Improvement Devices

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 11**

A3 size

NR





**Locality Map**


**Legend**

- Aboriginal Cultural Heritage
- QLD Heritage Registered Places
- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Roads
- Waterways
- Suburb boundaries
- DCDB

Data sources:

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# INTRA-REGIONAL TRANSPORT CORRIDOR
## Cultural Heritage

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 12**

A3 size

NR





**Locality Map**


**Legend**

- Centreline of Proposed Alignment
- Railway Lines
- Highways
- Waterways
- Suburb boundaries

**Category**

- Category 5
- Category 3
- Category 4

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# INTRA-REGIONAL TRANSPORT CORRIDOR
## Cultural Heritage - Due Diligence Assessment

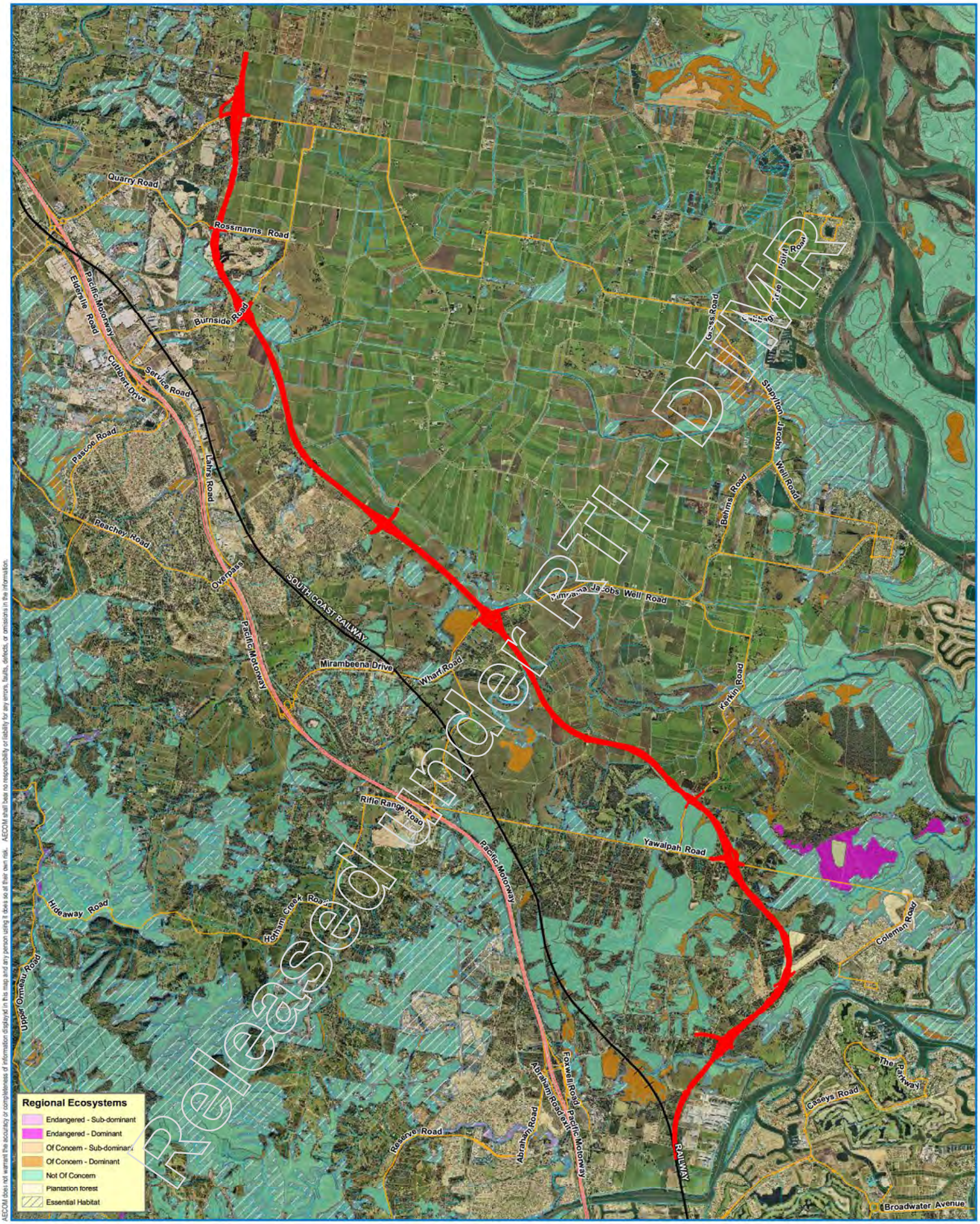
PROJECT ID 60099643

CREATED BY VV

LAST MODIFIED VV - 17 NOV 2009

**Figure 13**

A3 size








**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways
- DCDB

Data sources:

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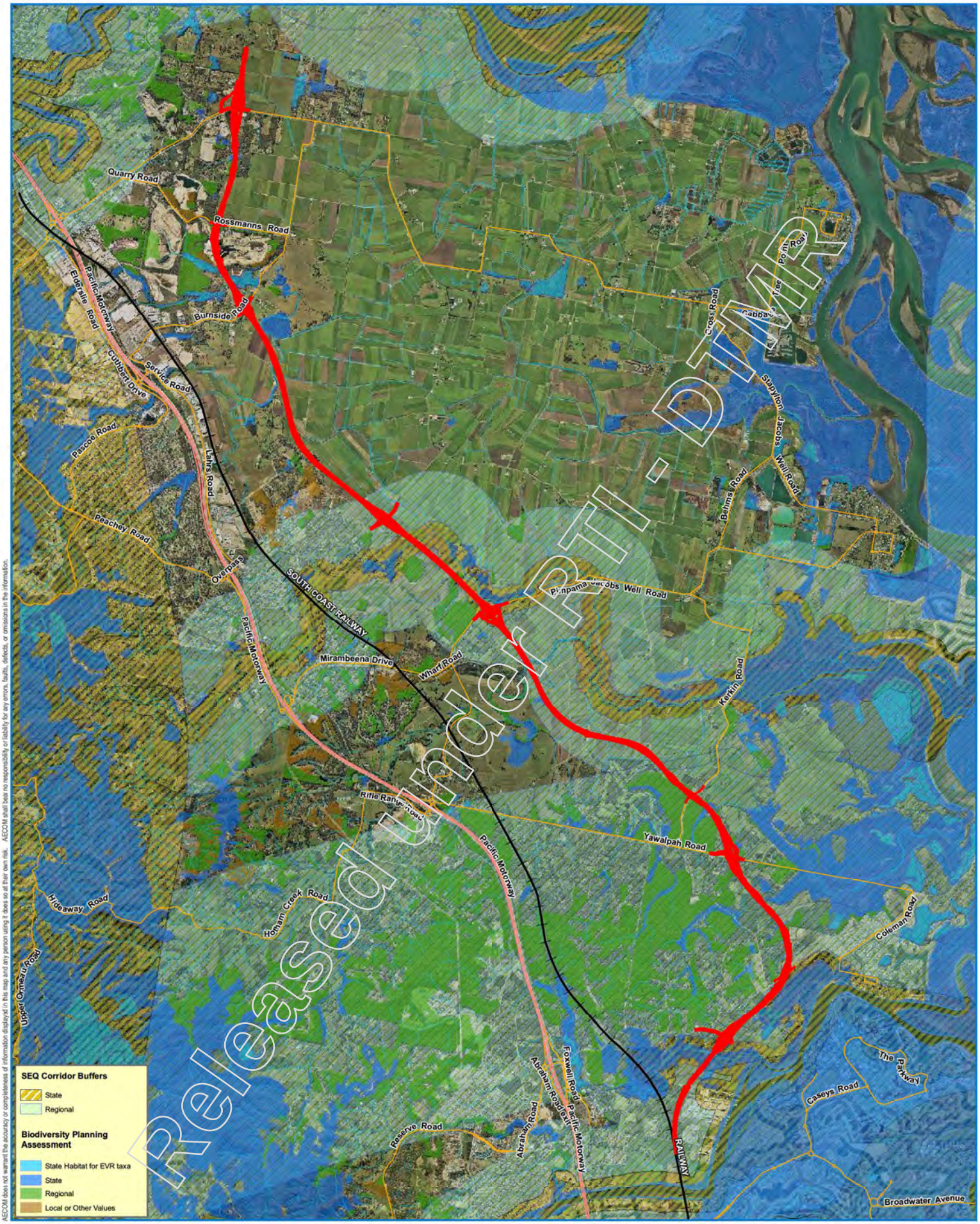
# INTRA-REGIONAL TRANSPORT CORRIDOR

## Regional Ecosystems & Essential Habitat

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

Figure 2

A3 size








**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways

Data sources:

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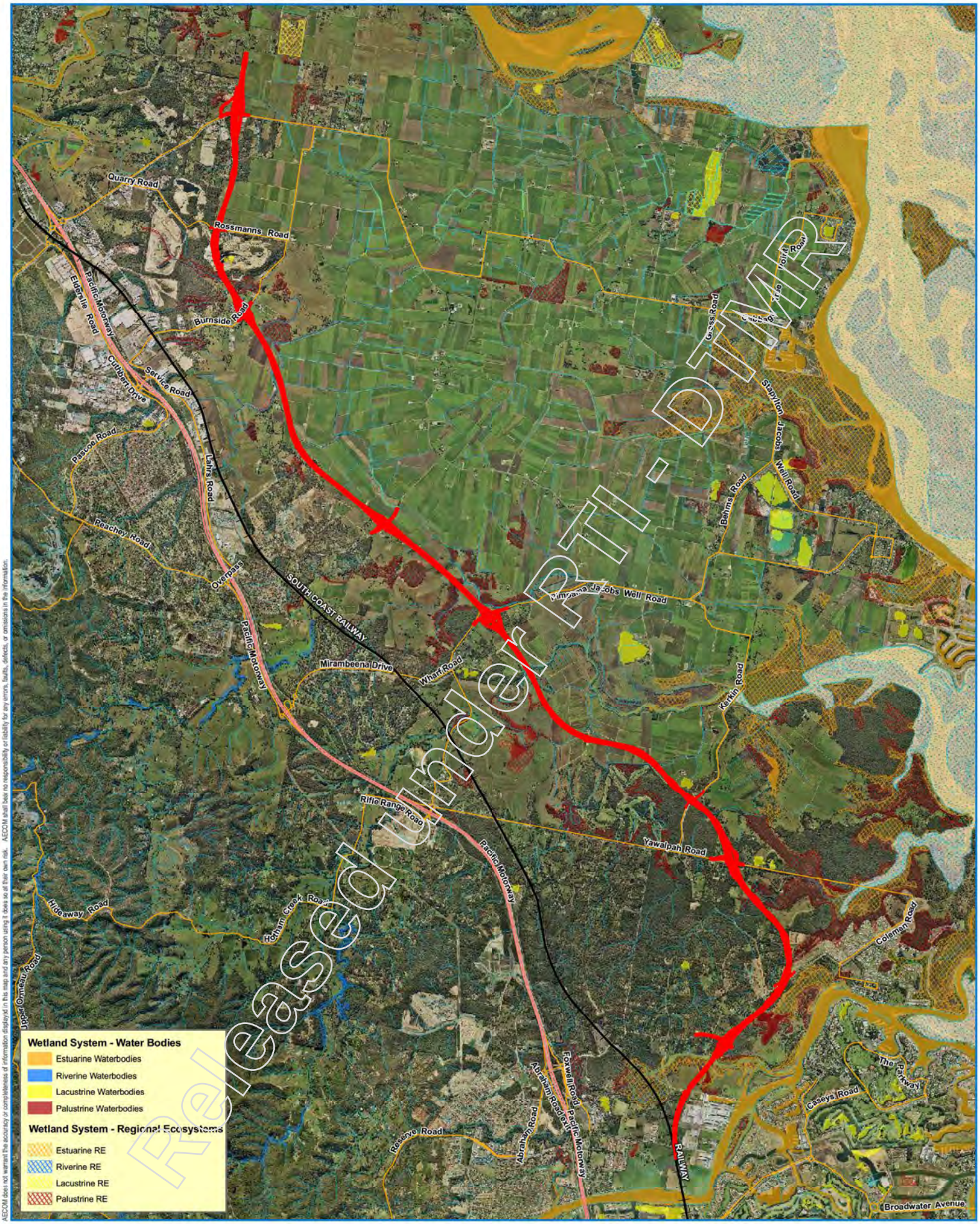
# INTRA-REGIONAL TRANSPORT CORRIDOR
## Biodiversity Planning Assessment

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

Figure 3

A3 size








**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways
- Ramsar

Data sources:

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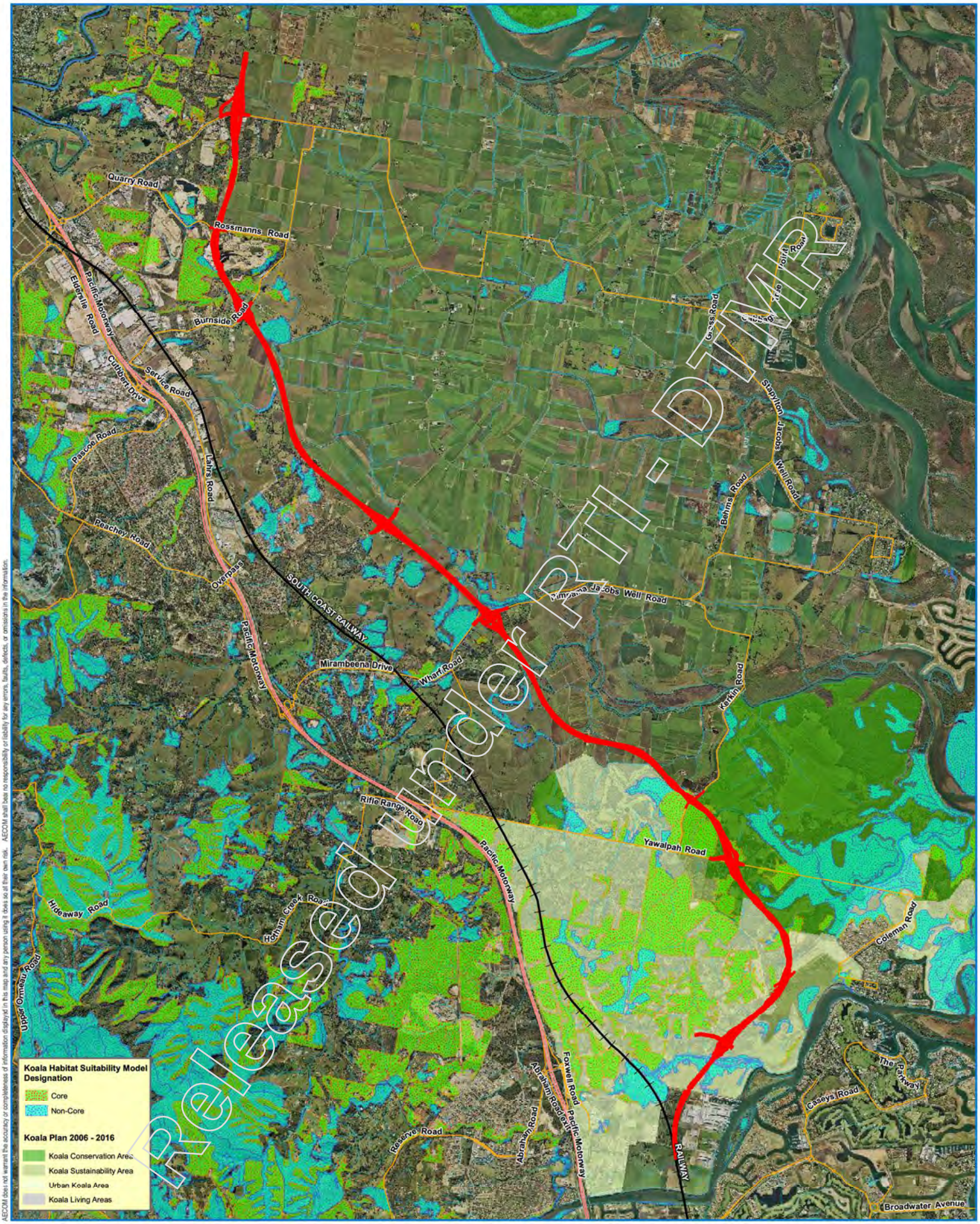
# INTRA-REGIONAL TRANSPORT CORRIDOR
## Ramsar & Wetlands

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 4**

A3 size








**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways

Data sources:

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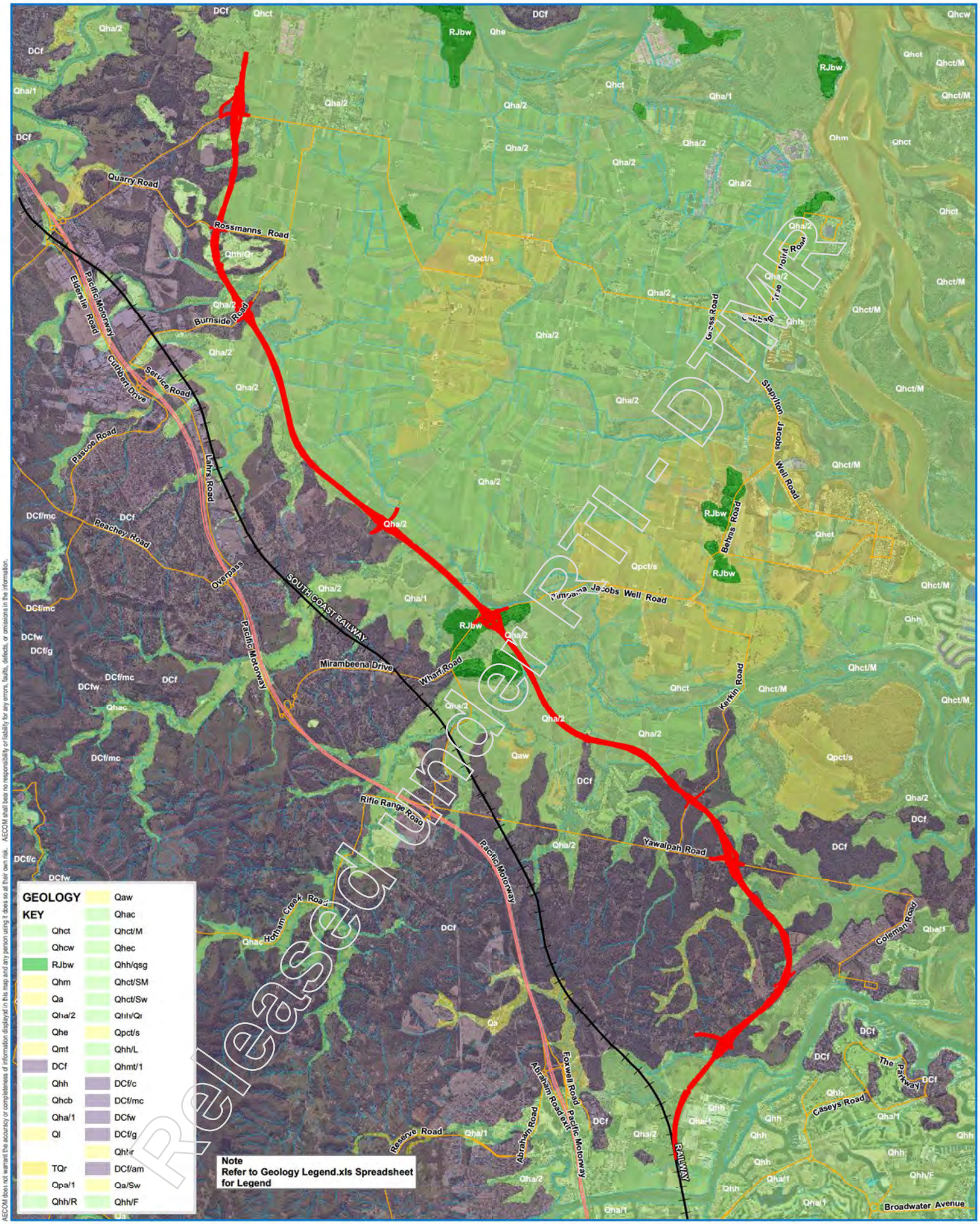
# INTRA-REGIONAL TRANSPORT CORRIDOR
## Koala Habitat

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 5**

A3 size








**GEOLOGY KEY**

| | | | |
|---|---|---|---|
| Qhct | Qaw | Qha/2 | Qpct/s |
| Qhcw | Qhac | Qhe | Qhh/L |
| RJbw | Qhct/M | Qmt | Qhmt/1 |
| Qhm | Qhec | DCf | DCf/c |
| Qa | Qhh/qsg | Qhh | DCf/mc |
| Qha/2 | Qhct/SM | Qhcb | DCfw |
| Qhe | Qhct/Sw | Qha/1 | DCf/g |
| Qmt | Qhh/Qr | Ql | Qhh/r |
| DCf | Qpct/s | TQr | DCf/am |
| Qhh | Qhh/L | Qpa/1 | Qa/Sw |
| Qhcb | Qhmt/1 | Qhh/R | Qhh/F |
| Qha/1 | DCf/c | | |
| Ql | DCf/mc | | |
| | DCfw | | |
| | DCf/g | | |

**Note**
**Refer to Geology Legend.xls Spreadsheet for Legend**

**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways

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Meters

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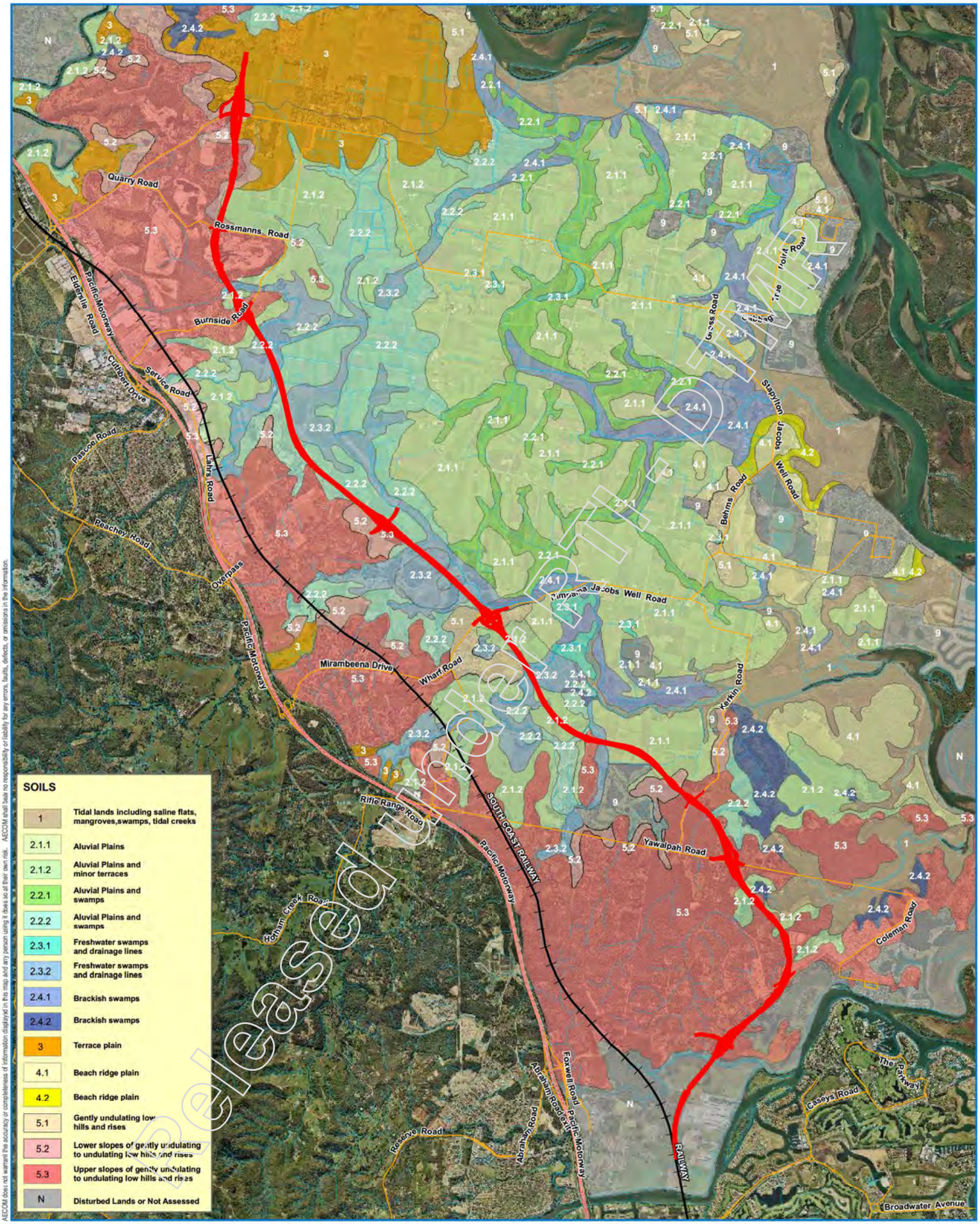
# INTRA-REGIONAL TRANSPORT CORRIDOR
## Geology

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 6A**

A3 size




## SOILS

| | |
|---|---|
| 1 | Tidal lands including saline flats, mangroves,swamps, tidal creeks |
| 2.1.1 | Aluvial Plains |
| 2.1.2 | Aluvial Plains and minor terraces |
| 2.2.1 | Aluvial Plains and swamps |
| 2.2.2 | Aluvial Plains and swamps |
| 2.3.1 | Freshwater swamps and drainage lines |
| 2.3.2 | Freshwater swamps and drainage lines |
| 2.4.1 | Brackish swamps |
| 2.4.2 | Brackish swamps |
| 3 | Terrace plain |
| 4.1 | Beach ridge plain |
| 4.2 | Beach ridge plain |
| 5.1 | Gently undulating low hills and rises |
| 5.2 | Lower slopes of gently undulating to undulating low hills and rises |
| 5.3 | Upper slopes of gently undulating to undulating low hills and rises |
| N | Disturbed Lands or Not Assessed |





**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways

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Meters

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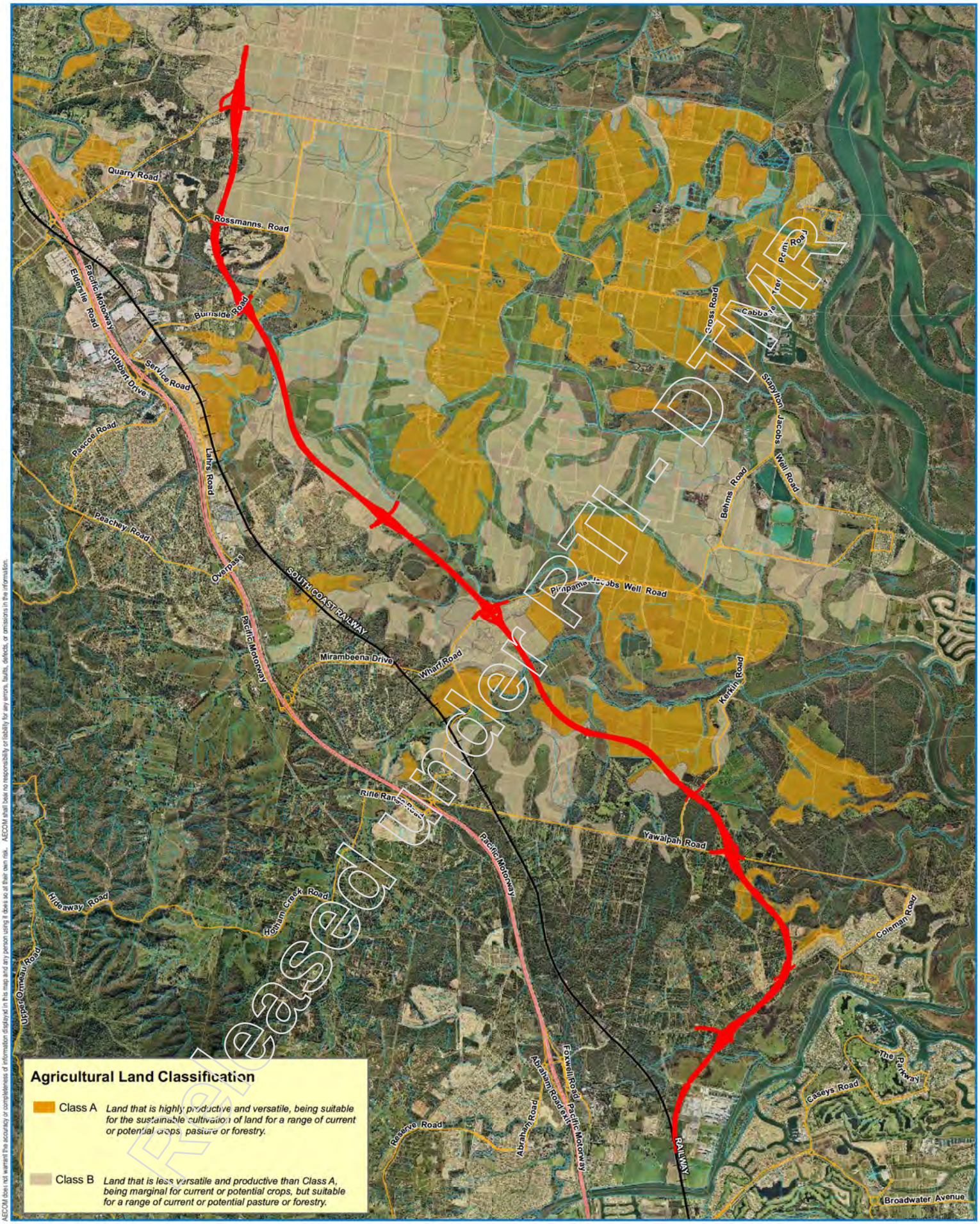
# INTRA-REGIONAL TRANSPORT CORRIDOR
## Soils

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

Figure 7

A3 size








Locality Map


Legend

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways
- DCDB

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# INTRA-REGIONAL TRANSPORT CORRIDOR
## Good Quality Agricultural Land

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

Figure 8

A3 size






**Locality Map**


**Legend**

- Proposed Alignment
- Railway Lines
- Highways
- Main Roads
- Waterways
- 5m Contours

Data sources:

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Aerial Photographic Imagery - June 2005

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GDA

AECOM

www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 56

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Meters

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# INTRA-REGIONAL TRANSPORT CORRIDOR
## Topography

| | |
|---|---|
| PROJECT ID | 60099643 |
| CREATED BY | VV |
| LAST MODIFIED | VV - 17 NOV 2009 |

**Figure 9**

A3 size

# Appendix C
# EPBC Environmental Assessment Process Guidelines

## EPBC Act environment assessment process—referral

*Deciding if a proposed action needs to be referred*

- Is the proposed action likely to have a significant impact on a matter of national environmental significance?

The matters of national environmental significance are:

- world heritage properties
- national heritage places
- wetlands of international importance
- threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park, and
- nuclear actions (including uranium mines)

- Is the proposed action likely to have a significant impact on the environment in general (for actions by Commonwealth agencies or actions on Commonwealth land) or the environment on Commonwealth land (for actions outside Commonwealth land)?
- If you are not certain about whether your proposed action requires approval under the EPBC Act you may refer the proposal for a decision by the minister.

NO → Approval is not required from the minister.

YES

Person proposing to take the action makes a referral to the minister via the department.

→ Action is clearly unacceptable
The minister makes a decision within 20 business days.

The minister makes a decision within 20 business days on whether approval is required under the EPBC Act and on process of assessment.

- Controlled action → Action is subject to the assessment and approval process under the EPBC Act. (Refer to the *Assessment/ decision whether to approve* flowchart)
- Not controlled action 'particular manner' → Approval is not required if the action is taken in accordance with the manner specified.
- Not controlled action → Approval is not required if the action is taken in accordance with the referral.

Person informed of decision.

- Person may withdraw referral and take no action.
- Person may withdraw and submit a modified proposal as a new referral.
- Person may request the minister to reconsider the decision.

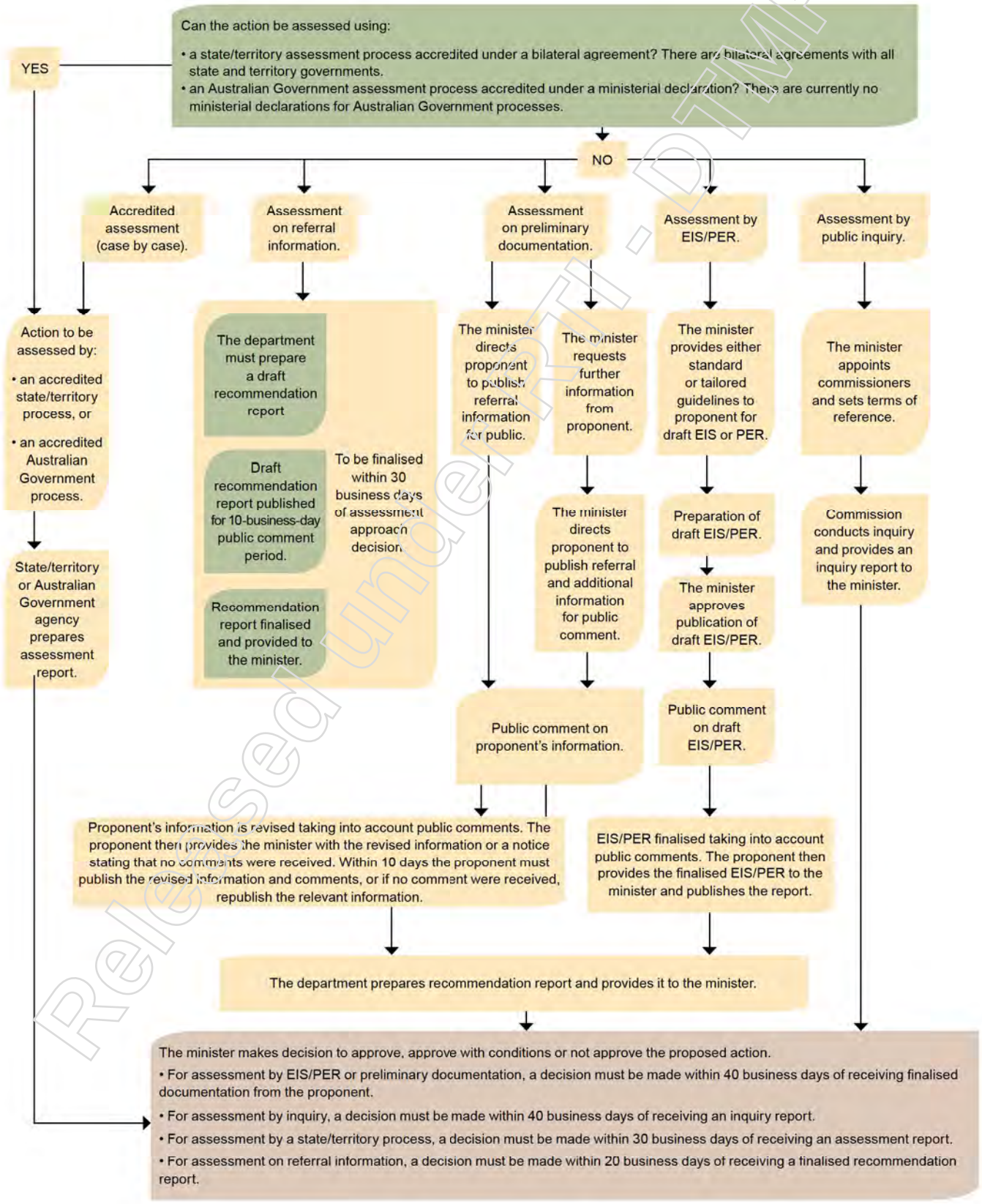
10-business day public comment period.

The department prepares report on relevant impacts and comments.

The minister makes a reconsideration decision within 20 business days.

- Action is clearly unacceptable
- Controlled action

## EPBC Act environment assessment process—assessment/decision whether to approve



AECOM

# Summary Report

## Logan East Link Route Investigation Study - Volume 1

# Summary Report

Logan East Link Route Investigation Study - Volume 1

Prepared for

Transport and Main Roads, South Coast Region

Prepared by

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11 February 2011

60186998

# Quality Information

Document Summary Report

Ref 60186998

Date 11 February 2011

Prepared by Laura Brett, Melanie-Neal Reid, Jo Duncan and Simon Bell

Reviewed by Mark Westaway and John Eckersley-Maslin

Revision History

| Revision | Revision Date | Details | Authorised | |
|---|---|---|---|---|
| | | | Name/Position | Signature |
| A | 21-Dec-2010 | Initial Draft | John Eckersley-Maslin Project Manager | Original signed |
| 0 | 11-Feb-2011 | Final Issue | John Eckersley-Maslin Project Manager | Original signed |
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# Table of Contents

# Acronyms

The following acronyms have been used within this Logan East Link Summary Report and Appendices:

| | |
|---|---|
| AGTRD | Austroads Guide To Road Design |
| AHD | Australian Height Datum |
| ARI | Average Recurrence Interval |
| ASS | Acid Sulfate Soil |
| DCDB | Digital Cadastral Database |
| DERM | Department of Environment and Resource Management |
| DRO | Desired Regional Outcome |
| ECPS | Eastern Corridor Planning Study |
| EPBC | Environment Protection and Biodiversity Conservation |
| GCCC | Gold Coast City Council |
| GIS | Geographic Information Systems |
| GQAL | Good Quality Agricultural Land |
| IRTC | Intra Regional Transport Corridor |
| ITP | Integrated Transport Planning |
| KRA | Key Resource Area |
| LAP | Local Area Plan |
| LCC | Logan City Council |
| LEL | Logan East Link |
| LGA | Local Government Area |
| PRAC | Principal Regional Activity Centre |
| QFRS | Queensland Fire and Rescue Service |
| QT | Queensland Transport |
| RCDP | Road Corridor Development Planning |
| RCMP | Regional Coastal Management Plan |
| RE | Regional Ecosystem |
| SCMP | State Coastal Management Plan |
| SEQ | South East Queensland |
| SEQIPP | South East Queensland Infrastructure Plan and Program |
| SEQKPA | South East Queensland Koala Protection Area |
| SEQRP | South East Queensland Regional Plan |
| SPA | Sustainable Planning Act |
| SPP | State Planning Policy |
| SPRP | State Planning Regulatory Provisions |
| TMR | Transport and Main Roads |
| YEA | Yatala Enterprise Area |

# Executive Summary

AECOM Australia Pty Ltd (AECOM) was commissioned by Transport and Main Roads (TMR), South Coast Region in October 2010 to carry out the Logan East Link Route Investigation Study.

The required outcomes of the Logan East Link (LEL) project were to provide plans illustrating feasible alignments for the LEL that connected the Intra Regional Transport Corridor – Northern Section (IRTC) (east and west) to the Logan Motorway and Beenleigh - Redland Bay Road. These will form inputs into the wider ranging Northern Gold Coast Area Transport Study being undertaken by the Integrated Transport Planning (ITP) unit of TMR. A report was also required to document the decisions made during the process.

This study has built upon previous studies undertaken for the Eastern Corridor, which have been summarised in a Background Report that is included as **Appendix A**. The report included a review of the following documents:

- Eastern Corridor Planning Study (ECPS), 1992
- South Coast Motorway Southern Section Impact Assessment Study, 1995
- Intra Regional Transport Corridor – Northern Section Road Corridor Development Planning, 2010

The earlier documents provided background on previous routes considered, and the reasons for selecting certain alignments. This information was used in the development of links for the LEL study. The IRTC report identified a corridor whose northern end was positioned at the southern extent of the LEL study area (Stapylton – Jacobs Well Road). The IRTC Report documented a preferred, as well as a possible alternative requiring further investigation. These were identified as the western and eastern alignments respectively, and form the southern connection points for the LEL.

Potential alignments were identified through meetings and workshops, taking into account the findings of previous studies that had been undertaken, and the constraints identified through desktop analyses that focussed upon land use, environmental management and hydraulic impacts.

**Land Use**

The Land Use and Planning review involved the review of policy documents, aerial photography, DCDB (Digital Cadastral Database) and Brisway in order to understand Regional and Local policy context as well as the current and future land use pattern. This led to the identification of Beenleigh, Loganholme and Eagleby as growth areas that would benefit from additional infrastructure. Furthermore, two Key Resource Areas in the vicinity of the Logan River at Carbrook were identified as significant constraints, requiring further investigation. Specific land uses that should be avoided were also identified including an educational precinct north of the Logan River, and a denser rural residential development south of the confluence of the Albert and Logan Rivers.

**Environmental Management**

This desktop study reviewed information available on government databases and Geographic Information Systems (GIS), and identified several natural features of National and / or State significance. Of particular concern was the Carbrook Wetlands Conservation Park, which is located at the northern extent of the study, but is considered to have connectivity to a number of less significant wetlands within the area in terms of water flow and species movement. Avoidance of such wetlands was preferred, but if unavoidable it was identified that the impacts should be minimised by impacting as close to the edge of a wetland area as possible.

Koala habitat cluster areas were also identified within the study area, and the requirement for compensation noted should protected habitat be cleared, with the requirement of five new trees planted for every one removed. Several areas were also identified as Essential Habitat for the wallum froglet, noting that a Koala Management Plan and Wallum Froglet Management Plan would likely be required. Several areas of vegetation were also identified as Of Concern Regional Ecosystems, which means that they would potentially need to be offset in a suitable location.

Two historic buildings were identified within the study area between the Logan River and Beenleigh – Redland Bay Road; Fachwerk House, and the former Carbrook State School. Two aboriginal cultural heritage sites were also identified within the study area. Whilst the alignments developed aimed to avoid these areas it has been recommended that consultation be undertaken with the Aboriginal Party for the area.

### Hydraulic Analysis

A hydraulic desktop study was undertaken to determine the feasibility of four proposed alignments based on impacts to the existing hydraulic regime in the study area. Existing conditions were determined based on results from an updated Gold Coast City Council (GCCC) Logan River MIKEFLOOD hydraulic model. Developed conditions consisting of the existing condition case with alignments superimposed with associated bridge structures were also modelled. Impacts to the hydraulic regime were estimated in terms of afflux, changes to flood extent and changes to water velocity by comparison of the developed 'indicative alignments' and existing condition cases. Indicative bridge structure lengths were proposed for scenarios where the impacts to the hydraulic regime were within reasonable limits (generally less than 10mm over the majority of the study area). For each alignment option, bridge structure lengths in excess of 2km were indicated. The study also highlighted areas that were sensitive to reduction in waterway / floodplain conveyance area (i.e.: floodplain between the Eagleby residential area and the Logan River; floodplain southeast of the Albert/Logan River confluence).

### Routes

A network of links was developed providing connections between the desired destinations, and was assessed against the constraints identified through the desktop analyses. From this, the four most feasible routes were identified that should be considered further during future project stages. Whilst the four routes have been chosen to minimise any impacts, the nature of the study area is such that some impacts are inevitable. Further consideration of the relative importance of the constraints would be required, in order to ascertain an acceptable balance between impacts and technical and cost considerations.

# 1.0 Introduction

## 1.1 Project Background

AECOM was commissioned by TMR, South Coast Region in October 2010 to carry out the Logan East Link Route Investigation Study.

The study requires the investigation of routes linking the Intra Regional Transport Corridor – Northern Section (IRTC), with the following roads:

- Pacific Motorway
- Logan Motorway
- Beenleigh – Redland Bay Road.

The Intra Regional Transport Corridor is a proposed route that would form the primary arterial road between Logan, the rapidly growing northern Gold Coast areas, and the Gold Coast southern suburbs. Prior to this study, the corridor was split into two sections, northern and southern, which were reviewed through Road Corridor Development Planning (RCDP), to enable the extents of the overall corridor to be defined for future preservation.

In 2010, the RCDP process determined the corridor requirements for the northern section, having established the alignment of a north-south route between Stapylton – Jacobs Well Road, Stapylton and Beattie Road, Coomera. This alignment formed a connection with the southern section, which was the subject of RCDP in 2006, and comprised a north-south route between Beattie Road, Coomera and Nerang – Broadbeach Road, Nerang.

This study focuses on the area to the north of the Intra Regional Transport Corridor, and therefore refers to the northern section of the corridor only as the IRTC.

The development of route options for the Logan East Link (LEL) also needs to address the two IRTC alignments that were determined as part of the RCDP process. The final RCDP layouts comprised an alignment that intersected with Stapylton – Jacobs Well Road at Alberton Road. However, an alternative 'eastern alignment' option was also developed to the north of Goldmine Road, intersecting with Stapylton – Jacobs Well Road approximately 1km to the east of the adopted IRTC RCDP route. This study requires route options to be determined that commence from either of these alignments. The study area can be seen in **Figure 1-1** below.

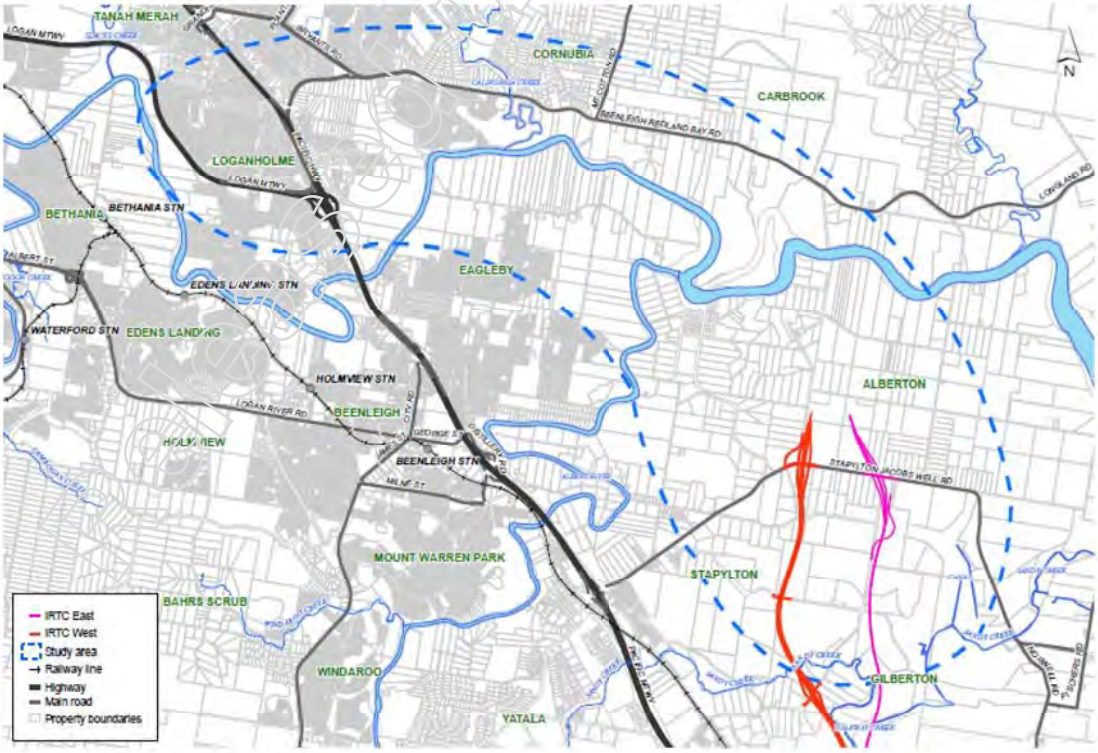



**Figure 1-1 Study Area Location**

Prior to the RCDP stages, other planning and design work was also undertaken that encompassed the Intra Regional Transport Corridor as a whole, but also considered further connections to the north, extending all the way to the Gateway Motorway at Rochedale. These previous studies have been summarised within a Background Report that forms **Appendix A** to this report.

The outcomes of this study will form inputs into the wider ranging Northern Gold Coast Area Transport Study being undertaken by the Integrated Transport Planning (ITP) unit of TMR.

## 1.2 Purpose of the Report

This report is the Summary Report for the Logan East Link Route Investigation Study. It describes the routes that have been investigated, and discusses their impacts on the immediate and surrounding area. The process undertaken to deliver this report is discussed in **Section 1.3**.

The information collated for this report has been assembled into three Volumes:

- Volume 1
  - Summary Report (this report)
- Volume 2
  - Route Investigation Plans
    - Layout plans illustrating crown land
    - Longitudinal sections
    - Typical sections
- Volume 3
  - 12D Model
  - Electronic Drawing Files

## 1.3 Process

The program for the study has been defined by three stages. Between each stage workshops have been held to combine knowledge of, and obtain input from, all AECOM and TMR members of the project team. The project stages are:

1) Initial Investigations
2) Draft Planning Layouts and Reporting
3) Final Planning Layouts and Reporting

**Stage 1**

The end of Stage 1 was signified by Workshop 1, which was held on 12/11/10, and comprised a presentation of the findings of the initial investigations into the study area. These investigations comprised a number of desktop studies focussing on:

- Background Information
- Land Use
- Environmental Management
- Hydraulic Analysis.

Background information was presented in the form of a report summarising the findings of previous studies that had been undertaken within the study area. Additionally, mapping was presented to highlight a number of issues that could serve to constrain the development of route options, such as existing land use, koala habitat, aboriginal cultural heritage sites, and the extent of flooding. This information was discussed by representatives of the AECOM and TMR project team during the workshop, and resulted in the identification of additional routes requiring further investigation.

The Background Report is included for information within **Appendix A** of this report.

**Stage 2**

The desktop studies and constraints maps were further developed and refined during Stage 2 to form the basis of an updated set of route options, which were presented and discussed at Workshop 2 on 02/12/10. Representatives from ITP attended this workshop in addition to the LEL project team, and aided the discussions surrounding the route options. The outcome of the workshop was the identification of four routes that were considered the most feasible in terms of minimised impacts upon the community and environment, whilst providing the desired connectivity.

These four options were subsequently developed to form the basis of this Summary Report and Layout Plans (refer to Volume 2), which were presented and confirmed at Workshop 3 on 14/12/10.

The minutes of all meetings and workshops held during the project are included within Error! Reference source not found. for reference.

**Stage 3**

The final Summary Report and Layout Plans incorporate comments generated by TMR during the review period that followed Stage 2.

# 2.0 Land Use and Planning

## 2.1 Context

The study area is within the South-East Queensland (SEQ) Regional Plan Area and traverses two Local Government Areas (LGA); namely Gold Coast City Council (GCCC) and Logan City Council (LCC). The administrative boundaries are shown on Map D.

The land use pattern within the study area can generally be described as fringe urban and rural residential, with some industrial and rural areas throughout the study area.

### 2.1.1 Tenure and Boundaries

In addition to the above brief discussion of Land Use and Planning Context it is prudent to discuss the tenure and electoral boundaries affecting the study area.

**Tenure**

The land within and surrounding the study area has varied tenure with the vast majority being freehold privately owned land (Map F shows the tenure/ownership mapping for the study area). There are several areas within the study area that are government owned land. Of particular note are the following:

- Large area of GCCC land at Stapylton covering the large industrial precinct and quarry site either side of Quarry Road
- Two significant TMR land holdings, at Stapylton and Carbrook. The Stapylton land covers the interchange of Stapylton – Jacobs well road with the IRTC western alignment, with the large land parcel at Carbrook adjacent to the Carbrook Golf Club
- An area owned by LCC adjacent to the Albert River at Loganholme which is being used for the LCC Water Pollution Control Works
- Various other small areas throughout the study area owned by various other government organisations.

**Electoral Boundaries**

The study area is directly within two federal and four State electorates (Map E shows the electoral boundaries for the study area). There are several electorates outside of the study area that may also influence the study area. **Table 2.1** below details each electorate influencing the study area.

**Table 2.1 Electorates**

| Electorate | State or Federal | Within or Surrounding Study Area? | Holding Party | Minister |
|---|---|---|---|---|
| Fadden | Federal | Within study area | LNQ | Stuart Robert |
| Forde | Federal | Within study area | LNQ | Bert Van Manen |
| Bowman | Federal | Surrounding study area | LNQ | Andrew Laming |
| Rankin | Federal | Surrounding study area | ALP | Craig Emerson |
| Waterford | State | Within study area | Qld Labour Party | Evan Moorhead |
| Springwood | State | Within study area | Qld Labour Party | Barbara Stone |
| Redlands | State | Within study area | LNP | Peter Dowling |
| Coomera | State | Within study area | LNP | Michael Crandon |
| Albert | State | Surrounding study area | Qld Labour Party | Margaret Keech |

## 2.2 Methodology

This Land Use and Planning review has been conducted using a simple methodology to ensure a high level understanding of the current and planned land use pattern within the study area. This information has also been used in the development and assessment of the potential road alignments.

The review is not intended to document every planning policy and its potential impact for the study area nor is it intended to document every land use within the study area. Rather it is intended to provide an understanding of the Regional and Local policy context, and the current and potential future land use pattern.

Investigations have focused on major land use and planning constraints that, if a major road corridor were to proceed, have the potential to result in significant, long-term and / or irreversible impacts on policy intent and the land use pattern.

The review has comprised two main assessments. Firstly, understanding the policy framework through a high level review of State, Regional and Local policy including those listed in **Table 2.2** below.

**Table 2.2 Policy Documents**

| Policy Level | Documents |
|---|---|
| State | • SPP1/92 – Development and the Conservation of Agricultural Land<br>• SPP 1/02 – Development in the Vicinity of Certain Airports and Aviation Facilities<br>• SPP 2/02 – Planning and Managing Development Involving Acid Sulfate Soils<br>• SPP 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide<br>• SPP 1/07 – Housing and Residential Development<br>• SPP2/07 – Protection of Extractive Resources<br>• State and Regional Coastal Management Plans<br>• SPP 1/09 – Reconfiguration of a Lot Code for Land in Indigenous Local Government Areas to which a Local Planning Scheme Does Not Apply<br>• SPP 2/09 – Acceleration of Compliance Assessment<br>• SPP 1/10 – Protecting Wetland of High Ecological Significance in Great Barrier Reef Catchments (Temporary SPP)<br>• SPP 2/10 – South East Queensland Koala Conservation. |
| Regional | • South East Queensland Regional Plan 2009-2031<br>• South East Queensland Infrastructure Plan and Program 2009-2031<br>• Connecting SEQ 2031 – An Integrated Regional Transport Plan for South East Queensland. |
| Local | • Gold Coast City Planning Scheme<br>- Eagleby Local Area Plan<br>- Yatala Enterprise Area<br>- Beenleigh Town Centre.<br>• Logan City Council Planning Scheme<br>- Shailer Park Major Centre Zone<br>- Loganholme Major Centre Zone. |

Secondly, a desktop analysis of aerial photography, DCDB and Brisway was undertaken to provide an overview of the land use pattern and the significant land uses within and surrounding the study area. This information has been presented graphically in Map D, and also within **Section 2.4**. The Mapping reference numbers provided on Map D identify land use considerations which are further explained in **Table 2.4**.

Zoning and current land uses were presented at Workshop 1 as Land Use and Planning Opportunities and Constraints Mapping, and were used to inform appraisal of historic and new route options. Updated versions of the mapping presented in Workshop 1 are included in **Appendix B**. It should be noted that due to data availability and the stage of project lifecycle, the review of current and future land uses has not included an assessment of current Development Applications or Approvals. As such, there may be some changes to the land use pattern that

have not been captured in this assessment and would therefore need to be further investigated at a later project stage.

## 2.3 Planning Policy Review

### 2.3.1 State Planning Policy

State Planning Policies (SPPs) express the State Government's interests in those development-related economic, social, or environmental issues that can be implemented through planning schemes and development assessment. A review of the relevant SPPs was undertaken and their implications for a potential future Logan East Link (LEL) are discussed in **Table 2.3.**

**Table 2.3 State Planning Policies**

| State Planning Policy: | Intent / Impact: | Applicable: | Comments / Assessment: |
|---|---|---|---|
| **SPP1/92 Development and the Conservation of Agricultural Land** | Good Quality Agricultural Land (GQAL) is a valuable resource and must, where possible, be protected from incompatible development.<br>NB: This SPP is currently being reviewed with the intention of the Queensland Government establishing a new State planning instrument to ensure that the new policy on strategic cropping land is reflected in the land use planning system and that appropriate criteria are in place to guide development assessment processes. | Yes | There are identified areas of GQAL in the Eagleby and Alberton suburbs. It therefore seems likely that some impact or severance of GQAL will occur with the development of the LEL. The impacts and severance likely to occur as part of this project should be further investigated during future design stages but do not, at this stage, represent a significant vulnerability for the LEL. This element is further discussed in **Section 3.3.6**. |
| **SPP 1/02 Development in the Vicinity of Certain Airports and Aviation Facilities** | Work beneath, or in the vicinity of, the airports' operational airspace | Unlikely (Nearest airport facility is Gold Coast Airport) | The Gold Coast Airport and its associated safety buffers are a considerable distance away from the study area. Therefore, it is unlikely that this SPP will influence any future LEL project. |
| **SPP 2/02 Planning and Managing Development Involving Acid Sulfate Soils** | Areas of the corridor at or below 5 metres Australian Height Datum (AHD). | Potential | There are areas of land within and surrounding the study area that are at or below 5m AHD. Any future works in those areas of potential Acid Sulfate Soil (ASS) will need to consider the potential implications of disturbance of ASS. |
| **SPP 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide** | Mitigate the potential adverse impacts of bushfire for the corridor. The threshold for determining a bushfire natural hazard management area is land identified as medium and high risk by the Queensland Fire and Rescue Service (QFRS) mapping. | Yes | The Department of Emergency Services mapping of Bushfire Risk shows that the study area contains some areas listed as medium and high bushfire hazard. Future design stages and investigations must consider bushfire hazard. |

| State Planning Policy: | Intent / Impact: | Applicable: | Comments / Assessment: |
|---|---|---|---|
| | Mitigate possible adverse impact of landslide for the corridor. The threshold for determining a landslide natural hazard management area is land with a slope greater than 15%. | Potential | The study area does contain some land with slope greater than 15%. Further study of landslide hazard will need to be undertaken in any future design stages or investigation of the proposed LEL. |
| | Mitigate possible adverse impacts from flooding within the study area and proposed corridors. | Yes | Study area contains areas subject to flooding, in particular the area surrounding the confluence of the Albert and Logan Rivers. Flooding is further considered in **Section 4.0** of this report. Regardless, any future investigations should consider potential flooding impacts on the road corridor. |
| **SPP 1/07 Housing and Residential Development** | The housing needs of the community must be identified. Barriers which prevent opportunities for providing a range of housing options that respond to the housing needs of the community must be mitigated. | No | This SPP only applies to new housing developments and therefore, does not apply to infrastructure assessments such as this project. |

| State Planning Policy: | Intent / Impact: | Applicable: | Comments / Assessment: |
|---|---|---|---|
| **SPP2/07 Protection of Extractive Resources** | There is a need to maintain the long-term availability of major extractive resources. This can be achieved by protecting these resources and their main transport routes from incompatible land uses. | Yes | There are considerable Key Resource Areas (KRAs) within the study area, in particular the currently undeveloped area of Eagleby Flood Plain and the area surrounding and including the current Carbrook Golf Club is identified as a KRA. The following KRAs are within or are directly surrounding the study area:<br>• KRA 63 – Carbrook / Eagleby<br>• KRA 69 – Stapylton.<br>Map C shows the extent of Carbrook / Eagleby and Stapylton KRAs. Additionally, there are KRAs at Jacobs Well, which are shown on Map C but do not directly influence the LEL project.<br><br>As discussed, this SPP is intended to provide a mechanism for KRAs to be protected from incompatible development and thus potential sterilisation, through their inclusion in Local Government Planning Schemes. However, while the SPP endorses the principle of extractive industry development in a KRA, development for such a use is by no means guaranteed and development applications over KRAs are subject to applicable planning processes. Accordingly, the SPP does not guarantee the use of the land for extractive industry and rather provides a guide for the inclusion of KRAs in local government planning schemes.<br><br>Regardless of the above, there is a need to further investigate the potential limitations of using the identified KRAs for road infrastructure during future design stages. While this SPP does expose the LEL to some vulnerability it is likely that any potential impacts on KRAs can be effectively mitigated. |

| State Planning Policy: | Intent / Impact: | Applicable: | Comments / Assessment: |
|---|---|---|---|
| **State and Regional Coastal Management Plans** | The State Coastal Plan describes how the coastal zone is to be managed as required by the *Coastal Protection and Management Act, 1995* (CPM Act).<br>The CPM Act provides the mechanisms for State Coastal Management Plans (SCMP) and Regional Coastal Management Plans (RCMP) to be prepared and gazetted into statutory documents.. For the purposes of the *Sustainable Planning Act 2009* (SPA) the documents have the effect of an SPP. | Unlikely | The Logan and Albert Rivers within the study area fall into the SEQ Regional Coastal Management Plan District. Therefore, it is considered prudent to consider the RCMP as part of any future design stages in the event that any part of a future road corridor significantly affects the RCMP district. |
| **SPP 1/09 Reconfiguration of a Lot Code for Land in Indigenous Local Government Areas to which a Local Planning Scheme Does Not Apply** | In the absence of a local planning scheme within Indigenous local government areas, this policy acts as a code for the assessment of a development application for reconfiguring a lot and any associated operational works for the purposes of private residential housing and ancillary development. | No | The LEL project falls within the Logan and Gold Coast City Council's Local Government Area – neither of which are Indigenous local government areas. |
| **SPP 2/09 Acceleration of Compliance Assessment** | This SPP applies for assessing requests for compliance assessment for development when reconfiguring a lot that requires compliance assessment under Schedule 18 of the Sustainable Planning Regulation 2009 (the Regulation).<br>This temporary state planning policy takes effect on 18th December 2009 and will be in effect until 17th December 2010. | No | Although reconfiguration of a lot may occur in the future as part of a road corridor, it is unlikely that this will be undertaken under Schedule 18 of the Regulation and will not occur prior to the 17th of December 2010.<br><br>Nevertheless, any future investigations ought to monitor the currency of all SPP's. |
| **SPP 1/10 Protecting Wetland of High Ecological Significance in Great Barrier Reef Catchments (Temporary SPP)** | Ensure that development in or adjacent to wetlands of high ecological significance in Great Barrier Reef catchments is planned, designed, constructed and operated to prevent the loss or degradation of wetlands and their values, or enhances these values, in particular, the hydrological regime and ecological values of those wetlands. | No | The study area is not within or adjacent to a wetland of high ecological significance in the Great Barrier Reef catchment. |

| State Planning Policy: | Intent / Impact: | Applicable: | Comments / Assessment: |
|---|---|---|---|
| **SPP 2/10 South East Queensland Koala Conservation** | Koala habitat within the South East Queensland Koala Protection Area (SEQKPA) needs to be conserved through protection and consideration in planning processes. Contributing to a net increase in koala habitat in South East Queensland will assist in the long term retention of viable koala populations in South East Queensland. | Potential | The study area contains significant areas of land mapped as suitable for rehabilitation for koala habitat. Consideration should be given to koala habitat and rehabilitation works during future design stages. Further discussion of this environmental value is provided in **Section 3.3.2**. |

### 2.3.2 Regional Planning

The *South-East Queensland Regional Plan 2009-2031* (SEQRP) is the pre-eminent plan for regional planning across South-East Queensland (SEQ) and was updated from the 2005 version at the end of 2009. The purpose of the SEQRP is to manage regional growth and change in the most sustainable way to protect and enhance quality of life in the region. In addition, the *South East Queensland Infrastructure Plan and Program 2010-2026* (SEQIPP), working within the regional land use pattern, desired regional outcomes and infrastructure priorities defined in the SEQRP, sets relevant timeframes and budgets to ensure the timely delivery of the priority infrastructure required to support the region's growth.

***South-East Queensland Regional Plan 2009-2031***

A key strategic direction for the SEQRP is to "facilitate growth to the west", through an increased proportion of the region's population growth being accommodated in the western and, importantly for the LEL, the south-western corridor, making use of the available land within these areas. The plan states that "...future growth in (these) corridors also provides the opportunity to achieve compatibility between employment, transport infrastructure and population growth".

No map presently exists of the south-western corridor but the SEQRP states that the south-western corridor covers the southern area of Logan and the north-eastern section of the Scenic Rim Councils. Therefore while the project area is outside the designated south-western corridor area the growth initiatives and areas and its infrastructure requirements would need to the dealt with at a council wide level. Therefore, much of the following discussion is based on the LEL being a "part" of the south-western corridor.

Parts of Logan are identified within the SEQRP as key growth areas in the south-western corridor of SEQ. It is identified that by 2031 Logan will require approximately 70,000 additional dwellings, with Eagleby identified as an urban area that can accommodate further infill and redevelopment growth. The Plan however, states that any further urban development would be reliant on the delivery of coordinated road and public transport infrastructure (amongst other infrastructure delivery). The regionally significant growth predicted within and surrounding the study area will be dependent on the timely delivery of state and local infrastructure. This provides the opportunity for the LEL to be identified and protected at a regional level so that the potential for impact on sensitive land uses is limited through appropriate planning.

The Desired Regional Outcome (DRO) (8) – Compact Settlement aims to provide an "...urban structure of well-planned communities, supported by a network of accessible and convenient centres and transit corridors linking residential areas to employment locations". The DRO advocates a balanced approach to settlement ensuring efficient use of land and infrastructure within the urban footprint. The LEL itself falls generally outside the urban footprint but would connect areas that are within the urban footprint providing for self-containment within the area.

Additionally, Desired Regional Outcome (10) – Infrastructure aims to "plan, coordinate and deliver regional infrastructure and services in a timely manner to support the regional settlement pattern and desired community outcomes" and in particular provide infrastructure that anticipates growth. The provision of timely and well planned infrastructure in the south-western corridor will be critical to the success of residential, commercial and industrial development in the south-western corridor. The linkage that the LEL provides would therefore be particularly significant to the development of this area and beyond as it is in anticipated that the LEL will ultimately support the

M1. Indeed, the SEQRP supports the use of infrastructure delivery to create "...more compact urban pattern, cohesive urban and rural communities, and regional economic development". Therefore, the coordination, prioritisation, and sequencing of upgrades to the road infrastructure in the study area, starting with this high level options review, is supported by this DRO.

Based on the above discussion the SEQRP provides support for the project, and future delivery of the LEL. In addition to the wider IRTC, the LEL will be an important infrastructure investment to support growth and development in the south-western corridor.

***South East Queensland Infrastructure Plan and Program 2010-2026***

The SEQIPP outlines the Queensland Government's infrastructure priorities to support and deliver the outcomes envisaged in the SEQRP. The SEQIPP identifies regionally significant infrastructure projects (including associated timeframes and project budgets) that collectively total an $82 billion commitment to the planning and delivery of priority infrastructure to support the region's growth and development over the next 20 years.

The SEQIPP highlights strategic transport needs for the Greater Brisbane region (in which the study area falls). This includes providing quality transport and public transport infrastructure and services to improve access to new residential, commercial and industrial development. Additionally, investigations of the long-term transport requirements of the subregion and preserving transport corridors to cater for future growth is noted as a requirement.

LEL is not specifically mentioned in SEQIPP as an identified project however SEQIPP states that "further upgrades are planned to major routes including the Ipswich, Logan, Gateway and Pacific Motorways and connecting roads." This indicates that connector roads, such as LEL may become a specific road project to be catered for by the SEQIPP. Since the SEQIPP is updated yearly, its inclusion in the future would seem possible.

***Connecting SEQ 2031 – An Integrated Regional Transport Plan for South East Queensland***

Since the release of the original *Integrated Regional Transport Plan for South East Queensland* in 1997, land use and infrastructure planning and coordination have significantly changed with the introduction of the *South East Queensland Regional Plan* and supporting policies. As well as the need to manage the sustained growth of the region, some significant new challenges have emerged for the transport system over the last decade. These include:

- The need to reduce emissions to respond to climate change
- The dwindling supply and increasing price of oil
- Increasing congestion, impacting on the region's quality of life and economic growth
- Increasing costs to provide transport infrastructure and services.

In order to address these new challenges and provide a strategic framework for developing the future transport network for the region the Queensland Government has recently released the Draft for Consultation *Connecting SEQ 2031 – An Integrated Regional Transport Plan for South East Queensland* (Connecting SEQ).

There is limited mention of a LEL project within Connecting SEQ, however, the document states that further investigation may be required into an urban arterial connection from Logan City to the Intra-Regional Transport Corridor. Such an investigation could be in the form of detailed design for LEL or further route investigations.

### 2.3.3 Local Planning

The study area is located within the Gold Coast City Council (GCCC) and Logan City Council (LCC) LGAs. Map D shows the boundaries of the LGAs as they relate to the study area. Planning schemes provide development controls as well as identify future land uses and potential changes to the land use fabric. As such, a review was conducted of relevant local planning schemes for both GCCC and LCC to understand the potential future uses in the study area. These are briefly discussed below.

**Gold Coast City Council Planning Scheme**

The planning area for the Gold Coast City Council Planning Scheme covers areas that are now within the administrative boundaries of Logan City Council – after changes to the LGA boundaries in 2007. However the general planning intent remains the same. Map B shows the zoning and extent of Local Area Plans for the Gold Coast City Planning Scheme.

The prudent elements of the Gold Coast City Council Planning Scheme to note are as follows:

- The majority of urban zonings for this scheme cover the Eagleby Urban Area, and those areas on the eastern side of the Pacific Motorway, with the majority of the balance of the study area covered by the Gold Coast scheme zoned for rural uses. The main exceptions to this are the Yatala / Stapylton extractive industry and industry areas, which are generally zoned for their corresponding uses.
- The Beenleigh Town Centre is identified in the SEQRP as a Principal Regional Activity Centre (PRAC), and this has been reflected in the identification of the Beenleigh Town Centre as a major administrative and service centre for the southern Brisbane metropolitan area, and will need to generate significant amounts of commercial and residential growth as part of its function as a PRAC. The Gold Coast City Council Planning Scheme states that "as a significant employment centre, it is vitally important that land use controls, economic development projects and transport functions are integrated in an efficient manner to ensure that the prosperity of the centre is guaranteed into the future". Therefore the LEL will likely benefit the Beenleigh Town Centre but the road should respond by providing good access to the centre. It is important to note at this stage however, that the objectives of this land use review do not include economic opportunities, as its primary concern is the identification of known constraints. It should be noted that the Beenleigh Town Centre is now located within the boundaries of LCC, and a Draft Master Plan for Beenleigh is currently being advertised. The outcomes of this new master plan would need to be considered as part of any further project stages,although it is noted that traffic modelling regarding the potential impact to the M1 is likely to determine some of the probable impacts of this development on the LEL.
- The Yatala Enterprise Area (YEA) is located in the industrialised Yatala / Stapylton area within the GCCC LGA. The Gold Coast City Council Planning Scheme states that there "...is an opportunity to create a dedicated area that could be a market leader in terms of innovative industrial development that would facilitate growth in long term employment in the 21st century. Therefore, the purpose of this LAP is to promote the orderly economic development of the YEA as a major industrial employment district for both the Gold Coast City and the South East Queensland region." Given this status, access for this area to a major transport route with connections to inter and intra-regional road networks would be vital for the development of this area. Therefore, the LEL will provide an opportunity for the ongoing development of the YEA. However, careful consideration should be given to the placement of the LEL in relation to the YEA to ensure that the area is not unjustly severed reducing the ongoing functionality of the centre.
- The Eagleby Local Area Plan (LAP) responds to the community need to renew the area to produce an area with an "...improved sense of community confidence, pride and amenity as the quality and integration of local housing, services, facilities and infrastructure is raised". As is reflected in the current land use pattern for the area Eagleby is "...distinguished from its surroundings by its extensive frontages to the Logan and Albert Rivers and its 'green belt' of agricultural pastoral natural areas and parklands". The plan intends that the urban footprint would remain the same, however there would be a need to adequately mitigate the effects of changing the amenity of the northern fringe of the urban area.

**Logan City Council Planning Scheme**

The planning area for the Logan City Council Planning Scheme generally covers those areas north of the Logan River. Map B1shows the zoning for the Logan Planning Scheme.

The prudent elements of the Logan Planning Scheme to note are as follows:

- The majority of the urban zonings are confined to the Loganholme, Cornubia, Tenah Merah and Beenleigh areas, with the majority of the remaining study area covered by this planning scheme being identified for rural, rural residential or conservation uses.
- The major centre zone of Shailer Park is identified in the Logan Planning Scheme as the area straddling the Pacific Motorway at Shailer Park and Loganholme. This area is identified as a major commercial area along the Pacific Motorway and is therefore an activity generator in the area. The zone concentrates uses around the Logan Hyperdome and provides for a future "town centre" area including a plaza and pedestrian thoroughfare. There is little potential for the LEL to limit the ongoing uses of this major centre; rather it is likely that an alternative road corridor to the area will benefit the centre.

- South of the Shailer Park Zone and the Logan Motorway exit, extending to the Loganholme Wetlands is the Loganholme Major Centre Zone. This Major Centre is identified as an area for industrial and large commercial development. This area is an employment centre for the area and is thus an activity generator. The LEL is likely to provide an alternative transport corridor encouraging commuters to avoid using the Pacific Motorway for short commuter trips.

**Local Planning Policy**

As discussed above, the local planning outcomes for the study area and surrounds generally support the development of a road project to improve local access and integrated transport. There would need to be further investigations during future design stages to ensure that the road project does not affect the intended future land uses in a manner that is immitigable.

## 2.4 Existing Land Uses

The following sections provide an understanding of the wider land use pattern and a description of specific land uses that may have implications for a future road corridor.

### 2.4.1 Land Use Pattern

Due to the significant physical barriers within the study area, the land use characteristics have been generally shaped by external factors. The Pacific Motorway forms a considerable barrier for land uses with the majority of intense levels of development being confined to the western side of the highway. Such uses include the:

- Beenleigh rail line and associated train stations of Bethania, Edens Landing, Holmview and Beenleigh
- Beenleigh Town Centre and Loganholme Centre and their associated higher levels of development including residential, commercial and business uses
- More intense levels of residential development within and surrounding the study area.

The eastern side of the motorway within, and immediately surrounding the study area, has much less intense uses, though Eagleby has developed into a definable neighbourhood and the Yatala industrial area has been progressively developed.

The Logan and Albert Rivers have a considerable impact upon the shape and nature of the land use within the study area. These form a physical barrier and shape the surrounding land uses through the potential for flooding. This is particularly notable through the following land use characteristics:

- The shape of the urban development of Eagleby corresponds directly to the flooding contours across the area
- The use of the flood plains in Eagleby for solely rural uses
- Undisturbed and only slightly disturbed environmental values close to the river particularly the wetland values at the confluence of the two rivers
- The rural and rural residential uses on the flood plains in Alberton
- The limited development along the northern bank of the Logan River – limited generally to open space, rural and recreational uses.

### 2.4.2 Specific Land Uses

Using aerial photography, DCDB and Brisway information, a desktop analysis was completed of those land uses that may either impact on a future road corridor or that may be impacted by the road corridor. The following table (**Table 2.4**) should be read in conjunction with Map D. The Map Reference number relates to the alphabetic reference point given to the specified land use. Where there is more than one occurrence of a land use, a number has been added to the letter to provide a secondary descriptor.

**Table 2.4 Specific land uses**

| Map Ref. | Description | Discussion |
|---|---|---|
| A1-A4 | Beenleigh Rail Line Train Stations – Bethania, Edens Landing, Holmview and Beenleigh | These train stations – in particular Beenleigh Station – are likely to generate activity within the study area with commuters moving from the eastern side of the Pacific Motorway to the train station. The significance of this is that commuters are likely to use the Pacific Motorway for short trips to the train station, thus further congesting the motorway during peak times. The implementation of the LEL is unlikely to affect commuters needing to access the train station but it will likely remove some short distance commuter traffic from the motorway. |
| B | Beenleigh Town Centre | As discussed in **Section 2.3.3** the Beenleigh Town Centre has been identified in the GCCC Planning Scheme (now under the jurisdiction of LCC) as a major development centre, with a particular focus on administrative and commercial development. |
| C | Loganholme Industrial Area | As discussed in **Section 2.3.3** the Loganholme Industrial Area has been identified in the LCC Planning Scheme for further industrial and commercial development. The area is currently developed quite considerably for industrial and commercial uses and therefore is of significant value to the study and wider area. Additionally, the fragmented nature of the DCDB of this area shows that there are likely many different discrete uses and, potentially, owners. Therefore, it is desirable that this area be avoided. |
| D | Logan City Council Water Pollution Control Works | Located west of the Loganholme Industrial Area is the sewerage works for this area of Logan. While it is unlikely that the development of LEL would have a negative impact on this land use, it is generally unfeasible to move sewerage treatment plants as their locations are usually dependent upon the wider infrastructure network. This being the case the LEL should avoid this location. Further investigation and consultation with Council should confirm whether there are plans for expansion in this area, |
| E | Cornubia Residential Development | This residential area is located adjacent to the Riverlakes Golf Course and has been developed for low-medium density residential. Residents in this residential estate are vulnerable to potential impacts from the LEL such as increased traffic noise, impacts on visual amenity and additional pollution. The highly fragmented DCDB in the area also shows that there are likely to be a large number of discrete owners in the area. Therefore, it is desirable that this area be avoided by the proposed LEL. |

| Map Ref. | Description | Discussion |
|---|---|---|
| F | Eagleby Urban Area | The Eagleby urban area covers a significant portion of the Eagleby peninsula and is directly adjacent to the Pacific Motorway meaning parts of the residential area are already impacted by a high volume transport corridor.<br><br>The Eagleby urban area is likely to effect the proposed road project in the following ways:<br>• It is likely that the residents of the Eagleby area use the Pacific Motorway for short commuter trips given its proximity to the motorway entrance, adding to the congestion of the road. The new road will provide an alternative access road for residents of the area, pending linkages to Beenleigh-Redland Bay Road directly south of Mount Cotton Road.<br>• The residents on the northern side of the Eagleby urban area currently have good residential amenity and are adjacent to low intensity rural uses. The development of a road through this area is likely to have an impact on the current levels of residential amenity of the existing residential development.<br><br>Whilst a new route would provide improved connectivity for the residents of Eagleby it should not be provided at the expense of impacting the urban footprint of Eagleby, which should be avoided. |
| G | Eagleby Flood Plains | The confluence of the Logan and Albert Rivers occurs at the eastern end of the Eagleby Flood Plains and as such this area is prone to heavy flooding. This flooding has confined the development of the Eagleby urban area and has provided good quality agricultural land in the flood plain area. Any road through this area will likely be provided on structure removing the road from flood danger, but also potentially severing the agricultural land from further use. |
| H | Beenleigh Water Reclamation Plant and Oliver's Sports complex | Located on the eastern side of the Eagleby peninsula, this area is used for recreation at the Oliver's Sports Complex, and water re-use and recycling at the Beenleigh Water Reclamation Plant. As discussed in Map Ref. D above, moving a water treatment plant is both costly and difficult, and therefore should be avoided. |
| I | Education Precinct | This area, located on the northern bank of the Logan River on Beenleigh – Redland Bay Road, is a cluster of educational uses including Kimberley College, Carbrook Primary School, Old Carbrook State School and Calvary Christian College Carbrook Campus. Additionally, this area includes the Wirunya Independent Living Units and Aged Care. These uses are particularly sensitive to road projects, and the area should be avoided. |
| J1-J2 | Environmental Values | Both these locations contain wetlands of significant environmental value. This is further discussed in **Section 3.0** |
| K1-K3 | Recreation Areas | These recreation areas north of the Logan River, are Carbrook Golf Club (K1), Cable Ski Logan (K2), and Carbrook Wetlands Conservation Park 1 (K3). These areas generally cover land that is unsuitable for other types of development and are themselves activity generators. While these areas are unlikely to preclude the road project their value to the wider community makes them an important land use and warrants consideration of the provision of alternative locations for the uses should they be impacted by the LEL. |
| L | Aquatic Gardens Caravan Park | This caravan park is located adjacent to the north of Cable Ski Logan. Caravan parks often provide an alternative accommodation option for lower socio-economic groups and therefore consideration should be given to providing an alternative location should the proposed road project impact upon the provision of residential options. |

| Map Ref. | Description | Discussion |
|---|---|---|
| M | Significant Residential Development | This is a small pocket of residential development on the southern banks of the Logan River close to the confluence of the Albert and Logan Rivers. Due to the increase in density in this small area and the relatively large size of the dwellings, this area should be avoided to prevent adverse residential impacts. |
| N1-N3 | Large Lot Rural Residential | There are three large lot rural residential areas within and directly surrounding the study area. Two of these are within the Alberton suburb area and the other is in Carbrook on the northern side of Beenleigh-Redland Bay Road. There are a number of houses and other rural uses in these areas. Careful management of any decision to traverse these areas with a new road would be required to ensure that community severance is reduced, that there are reduced impacts on the rural residential amenity in the area, and to limit the number of properties affected. |
| O1-O2 | Prawn Farms | Within the Alberton suburb area there are several prawn farms (shown in O1 and O2) which represent significant and viable rural industries. Although none of the proposed four alignments are near this area, the rural production value of these farms should be considered in any further assessment. |
| P | Alberton Cricket Pitch | Located in Alberton near the large lot residential area this recreational use is likely to be a focus for the community and therefore an important part of the land use. However, given the relatively small size of this cricket pitch, if it should be impacted by the LEL consideration should be given to the provision of an alternative location. |
| Q1-Q5 | Stud / Animal Racing Practise Tracks | Within and immediately surrounding the study area are a number of stud / practise racing tracks. These usually represent a component of a workable stud (usually equine). They are valuable to the ongoing use of the farm but should they be impacted there are appropriate mitigation strategies that could be put in place. |
| R1-R3 | Quarry / Extractive Industry | In the Stapylton area there are three extractive industry locations. These uses are unlikely to be impacted by the development of a road through the area. The extent of the resources being extracted is likely to need to be protected through state and local regulations (such as the Extractive industry SPP). Additionally, the extractive industry should be decommissioned prior to any other use of the land – including for a road. |
| S1-S4 | Industrial Uses | The Stapylton and Yatala industrial area (as discussed in **Section 2.3.3**) is used for larger footprint industrial uses and is identified in the Yatala Enterprise Area (GCCC Planning Scheme) as being a potential future industrial hub. Therefore the proposed LEL is likely to benefit the current and potential future industrial development by providing an additional access road making the industrial area more viable. However, it should be noted that severing the industrial area by placing the road through the middle of the area is far less desirable than running the road adjacent to the industrial area further to the east. |
| T | Crematorium | Located on Stapylton - Jacobs Well Road is the Newhaven Crematorium and Memorial Garden. Wherever possible this use should be avoided. |

## 2.5 Summary

As discussed above the Land Use and Planning considerations for the LEL vary from a regional policy direction to site based uses that may potentially be impacted by a road corridor.

The planning policy within and surrounding the study area identifies that more intense land uses are desired for the future of the area. In particular, the Beenleigh, Loganholme and Eagleby areas are identified as growth areas, and as such the timely delivery of infrastructure will be important to their growth. Additionally, the development of the LEL will provide for an alternative transport corridor for those currently using the Pacific Motorway for short commuter trips.

The Yatala Enterprise Area (YEA) is predicted to be a major industrial employment and economic development district for the future Gold Coast and Logan Areas. Given potential future status, access for this area to a major transport route with connections to inter and intra-regional road networks would be vital for the development of this area. Therefore, it is likely that the LEL will provide an opportunity for the ongoing development of the YEA. However, consideration should be given to the placement of the LEL in relation to the YEA to ensure that the area is not unjustly severed reducing the ongoing functionality of the centre.

The most significant planning policy constraint for the LEL is the identification of the Eagleby Flood Plain and the Carbrook Golf Club and their immediate surrounds as a KRA. This issue will need further investigations and liaison with the relevant state authority to ensure that this does not cause a significant impediment to the development of the LEL.

The current land use patterns within and surrounding the study area are generally summarised as urban / denser development on the eastern side of the Pacific Motorway and east of the Albert River, and rural / large lot uses on the western side of the motorway. Particular current land uses that really should be avoided to reduce the vulnerability of the LEL are the:

- Urbanised areas containing higher levels of development, including low and low-medium density areas (map identifiers – C,E and F)
- Waste water treatment plants in the Loganholme and Eagleby areas – known as the LCC Water Pollution Control Works and Beenleigh Water Reclamation Plant (map identifiers – D and H)
- Educational precinct north of the Logan River (map identifier – I)
- Denser rural residential development at the confluence of the Albert and Logan Rivers (map identifier – M)
- Prawn farms in Alberton which are economically viable rural uses (map identifiers – O1-O2).

# 3.0 Environmental Management

This section presents the outcome of an environmental desktop review. It describes the environmental values within the study area and their significance within the locality. Guidance is given where there are opportunities to avoid and limit environmental harm. The potential implications of introducing a new highway corridor are described in terms of environmental approvals, offsets and subsequent environmental management actions.

This section is supported by Environmental Constraints Maps G1 and G2.

This information is intended to inform where route options are (not) viable. At further design stages of the project, more detailed environmental investigations will be required in accordance with the Transport and Main Roads Road Project Environmental Processes Manual to ensure the appropriate environmental management measures and controls are achieved.

## 3.1 Context

The study area is found within the southern coastal lowlands of the South East Queensland biogeographic region. The Logan River and Albert River tributary are major features within the natural landscape, and support a variety of mangrove communities and estuarine wetlands. These wetlands form part of a larger vegetation mosaic extending from the Logan River north to an area generally known as the Carbrook Wetlands as far as Mount Cotton, west to Cornubia / Venman Bushland National Park, and east to Redland Bay via the Sheldon - Mount Cotton corridor.

On drier ground away from the floodplain, predominantly the south-west portion of the study area, other native vegetation communities persist, typically open eucalypt and / or melaleuca forest. Much of this vegetation is important habitat to koala.

Surrounding land is dominated by strategic cropping land, for primary production, and rural residential land uses.

## 3.2 Methodology

This desktop study investigates the broad environmental values of the study area, and is based on analysis of data sourced through government databases and Geographic Information Systems (GIS). In describing the environmental values of the study area the following data sources were used:

- Searches of the Department of Environment and Resource Management's (DERM) Wildlife Online database
- Searches of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters database
- Searches of the Queensland State Heritage Register
- Review of the existing vegetation mapping for the study area including the Queensland Herbarium's Regional Ecosystem (RE) mapping
- Review of the Gold Coast City Council Nature Conservation Strategy (Vegetation and Ecological Significance) Mapping and Logan City Council Planning and Development online mapping
- GIS data layers for the following values:
  - Aboriginal Cultural Heritage
  - Register of National Estate
  - Wetlands
  - Essential Habitat
  - Regional Ecosystem and Regrowth
  - State Planning Policy (SPP) Koala Habitat Values
  - National and State parks / conservation areas
  - Strategic Cropping Land.

Investigations focused on desktop analysis of major environmental constraints that, if a major road were to proceed, have the potential to result in significant, long-term and / or irreversible impacts on the environment and cultural heritage values.

Environmentally significant areas and features were presented at Workshop 1 and 2 (as detailed within **Section 1.3**) as Environmental Constraints Mapping, and used to inform appraisal of historic and new route options.

## 3.3 Environmental Values

### 3.3.1 Wetlands and Waterways

#### 3.3.1.1 Carbrook

The Carbrook Wetlands are found north east of the study area with some partially within and others immediately adjacent to it. They form part of a large vegetation mosaic in South East Queensland. A Directory of Important Wetlands in Australia has been compiled as part of Australia's obligations and commitments with respect to the Ramsar Convention. Carbrook Wetlands has been listed as a site of national importance in this Directory and this designated area extends across Beenleigh-Redland Bay Road and into the Carbrook golf course.

Carbrook Wetlands Conservation Park and Serpentine Creek Conservation Park) form part of the Carbrook Wetlands. These areas are referenced as W1 and W2 on Map G1. These protected areas in Carbrook Wetlands are dedicated under the *Nature Conservation Act 1992* (NC Act) as conservation parks. The parks are also part of the Koala Coast, a region considered to be the largest urban koala habitat in Australia.

*Any proposed action or development that would cause an impact on a feature of national significance is subject to the requirements of the EPBC Act. It is highly recommended that all features of national significance be completely avoided. Preservation of the integrity of these sites must be considered during future design stages.*

#### 3.3.1.2 Eagleby

There are a series of wetlands that stretch in an east to west direction, north of Eagleby and south of the Logan River (area W3 on Map G1). These wetlands are mapped by DERM as part of the Queensland Wetlands Programme and are identified to be within a Wetland Management Area. They are therefore assessable by DERM. These wetlands also have pockets of Essential Habitat associated with them for wallum froglet, koala and black-necked stork.

Each mapped wetland unit has a general description provided by DERM that comments on its current condition and level of integrity. The wetlands north of Eagleby, as shown by the area referenced as W3 on Map G1, vary in their condition and level of modification. Those at the western end (map reference W.10 – W.14) are modified to the extent that the ecological character has changed. Those at the confluence of the rivers (map reference W.1 – W.9) and north of the river (map reference W.16, W.17, W.19 and W.20) are unmodified and support important vegetation and habitat for wildlife.

Whilst all the wetlands within the referenced area W3 on Map G1 are afforded the same level of protection by law, priority should be given to the protection of those wetlands that remain unmodified over those that have lesser ecological value and have previously been modified.

The condition of the wetlands varies with differing degrees of modification. Those at the western end of the study area north of Eagleby appear to be modified, whilst those around the confluence of the Logan and Albert Rivers appear to be less disturbed. A summary of these wetlands is given in **Table 3.1**.

**Table 3.1 Wetlands In Area W3 on Map G1**

| Map ID | Description |
|---|---|
| W.1 | Freshwater, modified wetland that has been converted, completely or mostly, to a controlled storage. Logan catchment. |
| W.2 | Tidally influenced, estuarine wetland system with no observable modifications. Supporting RE 12.1.3 (mangroves). Logan catchment. |
| W.3 | Tidally influenced, estuarine wetland system with no observable modifications. Supporting RE 12.1.3 (mangroves). Logan catchment. |
| W.4 | Tidally influenced, estuarine wetland system with no observable modifications. Supporting RE 12.1.3 (mangroves). Albert catchment. |
| W.5 | Freshwater, palustrine wetland (vegetated swamp), appears unmodified. Supporting RE 12.3.8. |
| W.6 | Tidally influenced, estuarine wetland, no modifications observed. Part of the Albert River catchment. RE 12.1.3 (mangroves). |
| W.7 | Palustrine, freshwater wetlands, supporting RE 12.3.5 (*Melaleuca quinquenervia* open forest). No modifications observed. *Crinia tinnula* (Wallum Froglet) Essential Habitat. |
| W.8 | Palustrine, freshwater wetlands, supporting RE.12.3.5 (*Melaleuca quinquenervia* open forest). No modifications observed. *Crinia tinnula* (Wallum Froglet) Essential Habitat. |
| W.9 | Palustrine, freshwater wetlands, supporting RE.12.3.5 (*Melaleuca quinquenervia* open forest). No modifications observed. *Crinia tinnula* (Wallum Froglet) Essential Habitat. |
| W.10 | Modified palustrine wetland where size and / or hydrology has changed due to levee bank. Intermediately inundated. |
| W.11 | Freshwater. Modified palustrine wetland where ecological character has changed due to gross mechanical disturbance e.g. cropping. RE 12.3.8. |
| W.12 | Modified palustrine wetland where size and / or hydrology has changed due to levee bank. Intermediately inundated. |
| W.13 | Modified palustrine wetland where size and / or hydrology has changed due to levee bank. Intermediately inundated. |
| W.14 | Modified lacustrine wetlands that have been converted, completely or mostly, to a ring tank or other controlled storage. RE 12.3.6. |
| W.15 | Freshwater, modified lacustrine wetlands where size and / or hydrology has changed due to levee bank. |
| W.16 | Freshwater, palustrine wetland, from RE 12.3.8. (Of Concern). No modifications observed. |
| W.17 | Freshwater, palustrine wetland, from RE 12.3.8. (Of Concern). No modifications observed. |
| W.18 | Freshwater, modified lacustrine wetlands where size and / or hydrology has changed due to levee bank. |
| W.19 | Freshwater, palustrine wetland, no modifications observed. RE 12.3.5 (Least Concern). |
| W.20 | Tidally influenced, estuarine wetland community with no observable modifications. Supports RE 12.1.3 (mangroves) (Least Concern) |
| W.21 | Artificial wetland (freshwater) – dam or ring tank. |

*Further survey work must be undertaken to determine whether these wetlands contain these species. If they are found, any work in these areas of Essential Habitat must meet the essential habitat performance requirements by adopting the acceptable solutions, or by providing another solution that meets the performance requirement. There must be demonstration of how there would be maintenance of the extent of the species by offsetting, propagation etc.*

#### 3.3.1.3 Confluence of the Logan River and Albert River

There are numerous state recognised wetlands that surround the confluence of the Logan River and Albert River. These are identified to be within a Wetland Management Area and are therefore assessable by DERM. In particular, those that line the banks of the rivers (map reference W1. – W.6) and to the north-east towards Beenleigh – Redland Bay Road (map reference W.16, W.17, W.19 and W.20) are of high ecological significance.

These wetlands have pockets of Essential Habitat possibly associated with koala and giant ironwood.

It is assumed that there is some connectivity between the wetlands in this area and those associated with the Carbrook Wetlands. This connectivity may be for fauna, flora and water quality elements. It is probable that these wetlands provide additional feeding areas for those protected migratory bird species known to be present within Carbrook and that are protected under the EPBC Act.

Approximately 5km downstream of the study area, the Logan River is protected under the Register of the National Estate as Southern and Eastern Moreton Bay (map reference R1, Map G1). Any significant adverse impact to the river and its water quality is a potential trigger under the EPBC Act.

*Survey, mitigation and possible offsets would be required for Essential Habitat, as above.*

*It is highly recommended that there is no link that passes through these wetlands severing them from those further north east. If avoidance is not possible, the link should be placed on the edge of existing wetlands and vegetated areas.*

*Further survey work would determine the extent of protected species, vegetation and habitats within the area to better inform an alignment in this location.*

### 3.3.2 Koala Habitat

#### 3.3.2.1 South of Logan River

There are known areas of koala bushland habitat of medium and low value south of the Logan River and east of Albert River in Alberton (map references K2 and K3, Map G2). These pockets of habitat are in between residential developments and roads, and some are designated as Essential Habitat for koala. As a buffer, surrounding land is categorised as suitable for rehabilitation.

*It is preferable that no major infrastructure is built through the area shown as K2 on Map G2This includes the areas mapped as Essential Habitat, Remnant Vegetation and Medium Value Bushland. If this cannot be achieved and the route is aligned in this location, significant measures will be required to ensure koala connectivity is retained and protection from road strike included. This is to ensure some connectivity remains for the existing bushland. Any removal of koala habitat will require offsetting (refer to* ***Section 3.3.2.3*** *below for further explanation).*

#### 3.3.2.2 North of Logan River and Surrounding Beenleigh - Redland Bay Road

The South East Queensland Koala Conservation State Planning Regulatory Provisions (SPRP) identifies the area north of Logan River encompassing Carbrook (map reference K4, Map G2) and Cornubia (map reference K1, Map G2) as a Priority Koala Assessable Development Area. The SPRP identifies priority koala areas that are known to be under the most significant risks.

There are also areas identified on the State Planning Policy of high bushland value and as Essential Habitat.

*It is preferable that any route in this area is aligned south, close to Logan River and does not sever any pockets of koala habitat. Any removal of koala habitat will require offsetting (refer to* ***Section 3.3.2.3*** *for further explanation).*

#### 3.3.2.3 Overview of Offset Requirements

If the proposed development requires the clearing of habitat that is protected koala habitat under Queensland State legislation, this would require that the proponent provide biodiversity offsets to compensate for the loss of protected habitat. Queensland offset legislation and policy is complex, with up to three specific issue policies potentially applicable to koala offsets:

- The "Offsets for Net Gain of Koala Habitat in Southeast Queensland Policy" (Koala Offset Policy), which identifies offsets for areas mapped as koala habitat
- The "Policy for Vegetation Management Offsets" (Vegetation Offsets Policy), which outlines offsets for areas that are mapped as Essential Habitat for species listed as threatened under the NC Act
- The draft Biodiversity Offsets Policy, which specifies offsets for species listed as threatened under the NC Act.

It is only necessary to provide offsets for impacts on a particular biodiversity value such as koala habitat under one policy. Under the SPP, the remnant vegetation in the study area is mapped as koala medium and high value bushland. Areas mapped as koala medium and high quality bushland are normally subject to offsets under the Koala Offset Policy. This Koala Offset Policy aims to achieve a net gain in habitat for koalas. The policy requires that non-juvenile koala habitat trees must be offset at a ratio of 5 to 1 (for every one adult koala tree removed, five more must be planted). Any koala offset site must be protected from future development impacts by permanently securing the site for conservation purposes.

### 3.3.3 Significant Flora and Fauna Species and Vegetation Communities

#### 3.3.3.1 Eagleby

As noted in **Section 3.3.1.2**, Eagleby supports a series of ephemeral wetlands on the boundary between the river floodplain and urban footprint. The majority of these wetlands are mapped as Regional Ecosystems (either Of Concern or Of Least Concern) and some also as Essential Habitat to threatened fauna species (Wallum froglet and koala). The remnant vegetation communities are:

- Ephemeral wetlands on alluvium (RE 12.3.8) Of Concern
- Broad leaved paperbark (*Melaleuca quinquenervia*) Open Forest on Alluvium (RE 12.3.5 / Essential Habitat for Wallum froglet)
- Spotted Gum / Ironbark (*C.citriodora / E.crebra / E.siderophloia*) Woodland on Metasediments (RE 12.11.5 / Essential Habitat for koala) Least Concern
- River mangrove (*Aegiceras corniculatum*) Low Open Forest on Marine Deposits (RE 12.1.3) Least Concern (Map reference W3.2, W3.3 and W3.4).

Regional Ecosystems are declared in the *Vegetation Management Regulation 2000* and are classified as:

**Endangered** if:

- The area of remnant vegetation for the Regional Ecosystem is less than 10% of the pre-clearing extent of the Regional Ecosystem; or
- The area of remnant vegetation for the Regional Ecosystem is 10% to 30% of the pre-clearing extent of the Regional Ecosystem and less than 10,000ha.

**Of Concern** if:

- The area of remnant vegetation for the Regional Ecosystem is 10% to 30% of the pre-clearing extent of the Regional Ecosystem; or
- The area of remnant vegetation for the Regional Ecosystem is more than 30% of the pre-clearing extent of the Regional Ecosystem and less than 10,000ha.

**Least Concern** if:

- The area of remnant vegetation for the Regional Ecosystem is more than 30% of the pre-clearing extent of the Regional Ecosystem and more than 10,000ha.

Any clearing of remnant vegetation will require approval from DERM. According to the performance criteria under the *Regional Vegetation Management Code for South East Queensland (The Code),* clearing that is greater than 0.5ha or greater than 10m wide is not permitted in Regional Ecosystems that are Endangered or Of Concern. Consequently, the clearing of this vegetation will potentially require the provision of offsets in a suitable location.

Essential Habitat is declared for known habitat of threatened species and is protected under the Queensland *Vegetation Management Act 1999*. Design development in later project stages will need to consider opportunities to avoid and minimise potential harm to these species or their habitat. Specific ecological advice should be sought with regard to designing appropriate fauna management into the project and budget. At a minimum, the movement of koalas and amphibians should be accommodated within habitat areas that are severed by the road corridor.

Development approval normally requires the provision of offsets under the Vegetation Offsets Policy to compensate for the loss of Essential Habitat. However, offsets under the more specific Koala Offset Policy (as described above) are likely to take precedence over the Vegetation Offsets Policy, as long as all impacts to biodiversity values of Essential Habitat are addressed by the former policy.

#### 3.3.3.2 Confluence of the Logan River and Albert River

Mangrove communities line the banks of Logan and Albert Rivers as an extension of the Carbrook wetland aggregates. These are predominantly River Mangrove (*Aegiceras corniculatum*) Low Open Forest on Marine Deposits (RE 12.1.3) Least Concern.

The grey headed flying fox is likely to be found within the study area as it is listed within the EPBC and the DERM databases and is known to roost in mangroves. It is unknown at this stage whether any camps exist locally. Any trees that hold a camp of grey-headed flying foxes cannot be disturbed, and their presence must be determined through survey. Bird surveys would also need to be undertaken to determine nests as certain migratory species return to the same site annually.

*It is highly recommended that there is no link that passes through these wetlands severing them from those further to the north east. If avoidance is not possible, the link should be placed on the edge of existing wetlands and vegetated areas. Survey, mitigation and possible offsets would be required for removal of regional ecosystem and essential habitat as above.*

#### 3.3.3.3 Carbrook Wetlands

The wetlands appear to be well connected forming large extents of remnant vegetation. These vegetation communities consist predominantly of:

- Ephemeral wetlands on alluvium (RE 12.3.8) Of Concern
- Broad leaved paperbark (*Melaleuca quinquenervia*) Open Forest on Alluvium (RE 12.3.5 / Essential Habitat for Wallum froglet)
- Broad-leaved Paperbark / Forest Red Gum / Swamp Box (*M.quinquenervia / E.tereticornis / L.suaveolens*) Open Forest on Alluvium (RE 12.3.6 / Essential Habitat for koala) Least Concern.
- River mangrove (*Aegiceras corniculatum*) Low Open Forest on Marine Deposits (RE 12.1.3) Least Concern (Map references W3.2, W3.3 and W3.4, Map G1).

The Carbrook Wetlands are known to support a very diverse flora and fauna, some of which have restricted distribution, and provide refuge during drought. The ephemeral swamp is utilised by many waders, including migratory species. The EPBC Act database lists a potential 36 threatened species and 26 migratory species within the entire study area. Many of these are highly likely to be supported by Carbrook and surrounding wetlands.

*Any proposed action or development that would cause an impact on a feature of national significance is subject to the requirements of the EPBC Act. It is highly recommended that all features of national significance be completely avoided.*

#### 3.3.3.4 East of the Albert River and North of Logan River and surrounding Beenleigh-Redland Bay Road

The remnant vegetation in these areas is dominated by open eucalypt forest providing important koala habitat. They include the following Regional Ecosystems:

- Spotted Gum / Ironbark (*C.citriodora / E.crebra / E.siderophloia*) Woodland on Metasediments (RE 12.11.5 / Essential Habitat for koala) Least Concern
- Forest Red Gum / Pink Bloodwood / Grey Ironbark (*E.tereticornis / C.intermedia / E.siderophloia*) Open Forest on Alluvium (RE 12.3.11 / Essential Habitat for koala) Of Concern
- Broad-leaved Paperbark / Forest Red Gum / Swamp Box (*M.quinquenervia / E.tereticornis / L.suaveolens*) Open Forest on Alluvium (RE 12.3.6 / Essential Habitat for koala) Least Concern
- Ironbark / Small Fruited Grey Gum (*E.siderophloia, E. propinqua*) open forest on metamorphics +/- interbedded volcanic (RE 12.11.3) Least Concern.

As above, any clearing of remnant vegetation will require approval from DERM and must conform to the requirements of The Code. Offsets are likely to apply.

*It is preferable that any route avoids bifurcating areas of Regional Ecosystem in the form of a barrier or isolates areas of remnant vegetation from other bushland. Connectivity between vegetated areas will need further consideration during future design stages.*

#### 3.3.3.5 Whole of Study Area

The search of protected matters within the EPBC Act Database has identified that there is the potential for 36 Threatened Species and 26 Migratory Species within the entire study area. However, it is highly unlikely to find the species of turtle listed within this area. The area immediately surrounding the study area supports a larger number of Threatened Species, some of which may use locations within the study area or pass through them as part of a migratory route.

This database does not allow for more localised area searches therefore the species identified may apply to any locations within the study area. More specific locations can only be verified through field survey.

The DERM Wildlife Online Search also has recorded sightings of threatened species within the study area. This includes koala, as discussed above, and wallum froglet which is listed as Vulnerable under the NC Act and has a restricted distribution, being generally confined to acid lakes and wallum swamps.

Threatened bird species include grey goshawk, square-tailed kite, freckled duck, radjah shelduck, black-necked stork, little tern, Lewin's rail and numerous other migratory birds that are Of Least Concern but use the area.

Notable flora that are threatened and are likely to be within the study area include *Marsdenia coronata, Fontainea venosa, Choricarpia subargentea, Gossia gonoclada, Persicaria elatior, Macadamia integrifolia, Planchonella eerwah,* and *Maundia triglochinoides*. Under Queensland legislation, construction is likely to require some overall project approvals and various environmental approvals for specific activities, including potential impacts to threatened flora species.

*Further survey work would determine the extent of protected species, vegetation and habitats within the area to better inform measures to protect rare and threatened species.*

### 3.3.4 Historic Buildings

Krugers Farm, located at 445-469 Beenleigh-Redland Bay Road, Carbrook, is a historic place with Indicative status, listed on the Register of National Estate (I.D 19970) and is protected under the EPBC Act. This property is also the historic place for Fachwerk House, as listed on the Queensland Heritage Register (map reference H1, Map G1). The former Carbrook State School is also listed on the Queensland Heritage Register and is located within the study area, as shown by map reference H2, Map G1.

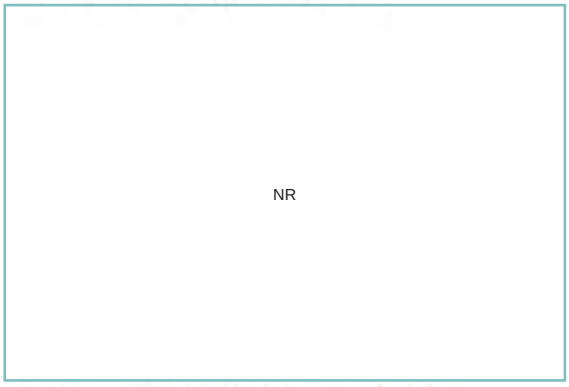
The former Carbrook State School is also listed on the Queensland Heritage Register and is located within the study area. The former school, with its tree lined driveway and original school building located towards the rear of the site, makes a valuable contribution to the Carbrook landscape.

### 3.3.5 Aboriginal Sites

Two known Aboriginal cultural heritage sites containing artefacts lie within the study area, as marked by map references H3 and H4, Map G1. Additionally, an area of land owned by GCCC, but designated as 'special purpose' is also suspected by TMR of containing aboriginal artefacts. The presence of known artefacts is indicative that other areas of undisturbed land surrounding these sites may also contain artefacts of cultural heritage value.

*Consultation with the Aboriginal party for the area should be initiated as part of the Project Environmental Assessment stage (RPEPM, 2004).*

The Aboriginal party for the area is:




### 3.3.6 Strategic Cropping Land

A proportion of the study area is defined as strategic cropping land. This land typically lies on the floodplain of the Logan and Albert Rivers surrounding Eagleby and the eastern end of the study area near Alberton. Its extent is shown on Map G1.

The Queensland Government considers that the best cropping land, defined as strategic cropping land, is a finite resource to be conserved and managed for the longer term. As a general aim, the State government relies on local government planning and approval powers to protect such land from those developments that lead to its permanent alienation or diminished productivity.

*It is desirable to protect strategic cropping land from impact or severance where possible. However, where a route is proposed through strategic cropping land, the impacts and severance issue will need to be addressed in future design stages of the project. Geotechnical investigations would help to gain a better understanding of the value of the cropping land and ways to minimise disruption to primary production.*

### 3.3.7 Acid Sulfate Soils

Acid Sulfate Soils (ASS) cover approximately 2.3 million hectares of land in Queensland and occur naturally along the coast usually where land elevation is less than 5m AHD.

Logan City Council and Gold Coast City Council have identified the majority of the land surrounding the Logan River, Albert River and east of the Pacific Motorway as an Acid Sulfate Soil Hazard Area. There are pockets of higher ground within the study area in Eagleby and Alberton that have not been identified as a hazard area.

*It is preferable to avoid the disturbance of ASS due to potentially significant adverse effects the soils can have on the natural and built environment.* The release of acid and metal contaminants can degrade the water quality and ecology of the local wetlands. If disturbance is planned due to development, the soils will require treatment and management to prevent acid generation, and to neutralise existing acidity. During future design stages it will be necessary to investigate the actual extent and severity of ASS conditions. Any potential for environmental impacts from ASS, and other land or water-based contaminants, can be effectively managed following the processes set out in the Road Project Environmental Processes Manual (Queensland Department of Main Roads, 2004).

### 3.3.8 Community

The study area includes the suburbs of Loganholme, Cornubia, Eagleby, Alberton and Stapylton. These communities support a mixture of rural residential, agriculture, mining and aquaculture land uses. The project will have both direct and indirect impacts on these stakeholders. This may include, but is not limited to, changes to noise, visual and social amenity, air quality, access, and ability to operate businesses.

Sensitive community receptors to environmental changes include schools, hospitals, cemeteries and community places. These include (but are not limited to):

- Schools within Eagleby and Eagleby Shopping Centre
- Loganholme Primary School
- Calvary Christian College and Kimberly College south of the Beenleigh - Redland Bay Road in Carbrook
- Crematorium and Memorial Garden east of Alberton.

Further detail on the current and future land uses are described in **Section 2.0**.

## 3.4 Summary

The study area contains, or is in proximity to, several natural features of National and / or State significance.

Those protected under Commonwealth legislation:

- Ramsar wetlands associated with Serpentine Creek Conservation Park
- Parts of the Logan River are defined as Moreton Bay and are listed on the Register of National Estate
- A historic place (Indicative) listed on the Register of National Estate
- Threatened and Migratory species.

Those protected under State legislation:

- Carbrook Conservation Park is listed under the Directory of Important Wetlands
- Two historic buildings listed on the Queensland Heritage Register
- Areas of bushland protected as Essential Habitat to koala, wallum froglet, black-necked stork and giant ironwood
- Areas of mangroves, open eucalypt forest, and ephemeral wetlands identified as Regional Ecosystem.

The study considers a number of links that pass through or close to these features. Any proposed action or development that would cause an impact on a feature of national significance is subject to the requirements of the EPBC Act. The EPBC Act is triggered and a referral required if an action will have, or is likely to have, a significant impact on Matters of National Environmental Significance as listed under Part 3 of the Act. This includes issues of national heritage places, wetlands of international importance, listed threatened species and ecological communities, and migratory species. Further environmental studies will determine whether it is recommended that a referral to the Department of Environmental, Water, Heritage and the Arts will be considered necessary for the LEL. However, it is recommended that all features of national significance be completely avoided. Mitigation through design may be possible in some designated areas where there is likely to be no significant change to the existing environment (e.g. minor improvements to existing infrastructure).

Any construction will need to follow the TMR processes, which meet the requirements of Queensland legislation. Under Queensland legislation, construction is likely to require some overall project approvals and various environmental approvals for specific activities. Further survey work of the local ecology would inform this. Appropriate design and mitigation measures can be employed to gain approvals by ensuring the likelihood of significant disturbances to protected species, habitats and areas is minimal. As an example, the design of bridges or roads that pass through wetlands should take into consideration the requirement of light for adjacent habitats to survive (e.g. mangroves). Flight paths of associated migratory birds will also need to be considered and avoided. Utilisation of existing routes and corridors is preferable.

The alignment of the LEL should also consider the potential indirect adverse impacts to threatened species and their habitat, in particular the wetlands. Any additional road or structure could result in increased surface runoff and therefore alter flows within the area and affect the water quality of watercourses. The increased flow may alter the specialised habitat that is required by the threatened species as mentioned in the sections above. Furthermore, sediment, rubbish and contaminants as a result of construction and operation of the road also have the potential to adversely impact aquatic and wetland habitats. Drainage should be carefully considered in design.

The wetlands identified within map area W3 are of lesser importance when compared to those within the Carbrook Wetlands. However, some may have direct connectivity to the Carbrook Wetlands in terms of water flow and species movement, which should be further investigated through ecological survey work. If avoidance is not possible, the alignment should preferably run as far to the edge of a designated wetland area as possible to ensure connectivity remains.

The area north of Logan River and surrounding Beenleigh - Redland Bay Road that is identified by the SPRP is a priority koala area that should be avoided. It is preferable that in this area any route is aligned south, close to Logan River and does not sever any pockets of koala habitat. South of Logan River and east of Albert River in Alberton, the pockets of koala habitat are in between residential developments and roads. In this area it is advised that any route be placed as far north towards the Logan River as possible, to ensure some connectivity remains for the existing bushland. As noted in **Section 3.3.2.3** any removal of koala habitat or severance of areas will require offsetting and mitigation.

Further assessment would be required to establish the impact on the local heritage sites values. However, it is recommended that there should be no removal or direct impact on the building structures and their surrounding features. Indirect impacts should also be considered (e.g. from noise and vibration) and a visual assessment would be required of any works in the vicinity of Carbrook State School (former).

The known Aboriginal artefacts in the study area highlight that there is potential for discovery of Aboriginal cultural heritage. It is highly recommended that consultation with the Gold Coast Native Title Group is undertaken to establish the significance of the known artefacts and whether others exist in the area and to confirm the location of the existing sites.

# 4.0 Hydraulic Analysis

## 4.1 Background

### 4.1.1 Previous Studies

The Eastern Corridor Logan River Flood Study (1994) and the associated extension report (1995) investigated the hydraulic impacts of a proposed Logan River crossing. The alignment options proposed a link between the south side of the Logan River (in the vicinity of the IRTC connection to Stapylton – Jacobs Well Road) and the northern side of Logan River (Beenleigh – Redland Bay Road).

The one dimensional link-node RUBICON model was used to assess four options with various cross-drainage arrangements to cater for the 100 year Average Recurrence Interval (ARI) (Q100) flood flows. One such option included a 625m bridge structure and a 650m bank of culverts catering for the southern floodplain flows during large events. Generally, the 1994 results showed an afflux (increase in maximum surface water elevation) of 60-70mm for most of the modelled scenarios. The 1995 extension study, in addition to the bridge and cross-drainage structures, recommended excavation of the Logan River bank to increase the waterway area under the proposed bridge structure. This measure purported to reduce the afflux to less than 10mm.

### 4.1.2 Available Information

The following information was used in the hydraulic investigation of the LEL alignment options:

- GCCC MIKEFLOOD Logan River model (2007)
- Alignment options.

## 4.2 GCCC Hydraulic model

### 4.2.1 Logan River Model

The GCCC MIKEFLOOD Logan River hydraulic model (GCCC Logan River model) was used in this investigation. This version of the GCCC Logan River model was developed using the DHI MIKEFLOOD hydraulic modelling software package and consists of a two dimensional MIKE21 representation of the model domain coupled with a one dimensional representation of waterways and hydraulic structures. The use of the MIKEFLOOD model enables the benefit of including the floodplain topography (important for interpreting floodplain storage) at a reasonable resolution, waterway channels (with a more precise resolution if necessary) and hydraulic structures. The construction and calibration of the model has been reported elsewhere in the Logan Flood Study Report, Waterways & Flood Management, prepared by GCCC in August 2007 (GCCC, 2007).

Since the supplied GCCC Logan River model was constructed in an older version of the DHI MIKEFLOOD software, the model was updated to the current version. In doing so, it was noted that some corrections were needed. One such correction undertaken involved the representation of a small number of cross sections. Other problems included the mismatch of bed levels that could lead to numerical instabilities; however these were deemed insignificant to the area of interest. The corrections undertaken during the updating of the model do not have any significant implications with respect to the reported calibration of the model.

The resulting model is known as the updated GCCC Logan River model.

### 4.2.2 Assumptions

The assumptions made during the construction and calibration of the model are detailed in the GCCC model report (GCCC 2007).

It was further assumed that the updated GCCC Logan River model is adequately calibrated for this level of assessment.

## 4.3 Methodology

The following methodology was applied to determine the hydraulic impacts of the selected alignments.

### 4.3.1 Existing Q100 Floodline

The 2007 results supplied by GCCC with the Logan River model were used to determine the initial Q100 floodline for a 100 year ARI (refer to Map H). It should be noted that the Q100 floodline was defined as a composite of maximum water surface elevations defined by multiple critical duration results.

In this study, the area of interest (from Stapylton – Jacobs Well Road to the Logan Motorway / Pacific Motorway Interchange) is dominated by the 48 hour and 24 hour critical duration zones, as shown on Map H. As can be seen in Map H, the downstream reaches of the Logan River are dominated by the 100 year ARI 48 hour critical duration design storms with respect to maximum surface water elevation. The upper reaches are dominated by the 100 year ARI 24 hour critical duration zone.

### 4.3.2 Establishment of the Existing Case

The updated GCCC Logan River model was used to determine the existing or current conditions for the 48 hour critical duration design storm event. The selection of the 48 hour duration over the 24 hour duration was deemed prudent due to domination of the study area by the 48 hour critical duration, the short duration of the study and the long run times associated with the model. The implication of this assumption is that the calculated afflux in the upstream reaches of the Logan River in the vicinity of Pacific Motorway may not be the maximum value.

The existing conditions were used as a benchmark for the identification of impacts to the hydraulic regime as a result of the future alignment options.

### 4.3.3 Option Assessment of Selected Routes

Five alignment options were assessed using the updated GCCC Logan River model. Two sets of modelling were undertaken – the first to identify the impacts of minimal bridge structure for three initial options, and the second based on larger bridge structures (but not optimised) for four alignment options. The potential routes were developed and refined during the course of the study, resulting in the five options that are described in **Section 4.5** below. For modelling purposes, the alignments were assumed to be 80m wide and have a flood immunity of 100 year ARI. As such, the alignments are assumed to be never inundated in the model.

Allowing the passage of the 100 year ARI floodwaters requires the definition of one or more bridge openings, including location and size. The updated GCCC Logan River model was used to define flood extent, afflux and water velocities associated with the selected bridge structures. It should be noted that the degree of optimisation was, among other factors, determined by the balance between model run time and project duration. In this case, each model run takes approximately 2.5 days to complete, and as a result, a maximum of two runs were performed for each alignment option.

Future design stages will require further optimisation to determine optimum bridge structure lengths balanced against defined maximum impact criteria.

## 4.4 Existing Conditions

The existing conditions (Base Case) were modelled using the updated GCCC Logan River model for a 100 year ARI 48 hour design rainfall event.

The resulting maximum surface water elevation and water velocity maps for the area of interest are shown on Maps H1 and H2.

## 4.5 Route Option Assessment

### 4.5.1 Modelled Alignment Options

A description of the final alignment options considered for the study is given in **Section 5.7**. However, to gain a general understanding of hydraulic impacts, it was considered that five basic alignments that contain characteristics of the full set of alignments should be modelled using the updated GCCC Logan River model.

- Alignment 1: Stapylton – Jacobs Well Road to Beenleigh – Redland Bay Road (one Logan River crossing)
- Alignment 2: Stapylton – Jacobs Well Road to Logan Motorway (three Logan River crossings)

- Alignment 3: Stapylton – Jacobs Well Road to Logan Motorway (three Logan River crossings)
- Alignment 4: Stapylton – Jacobs Well Road to Logan Motorway (one Logan River and one Albert River crossing)
- Alignment 5: Stapylton – Jacobs Well Road to Mount Cotton Road (one Logan River and one Albert River crossing)

### 4.5.2 Bridge Structure Requirements

Two sets of modelling (Case 1 and Case 2) were undertaken to establish the impact of varying lengths of bridge structure on the existing hydraulic regime for selected alignment options. Each of the models assumes an 80m rectangular section with 100 year ARI flood immunity (i.e. no water passage over road surface). Bridges and major culverts are represented as a length of the alignment at existing surface levels with rectangular long sections. The modelled alignments, together with the locations and extent of the representative embankments, are shown in **Figure 4-1** for Case 1 and **Figure 4-2** for Case 2.

**Case 1**

The modelling for Case 1 was undertaken as a means of understanding the impacts of the road embankment associated with each alignment, and as such, the initial bridge structure lengths were kept to a minimum. These three alignments options (Option 1, 2 and 5) showing bridge structure (thin line) and embankment (thick line) are shown in **Figure 4-1**. These minimal bridge structure lengths are tabulated as Case 1 in **Table 4.1**.

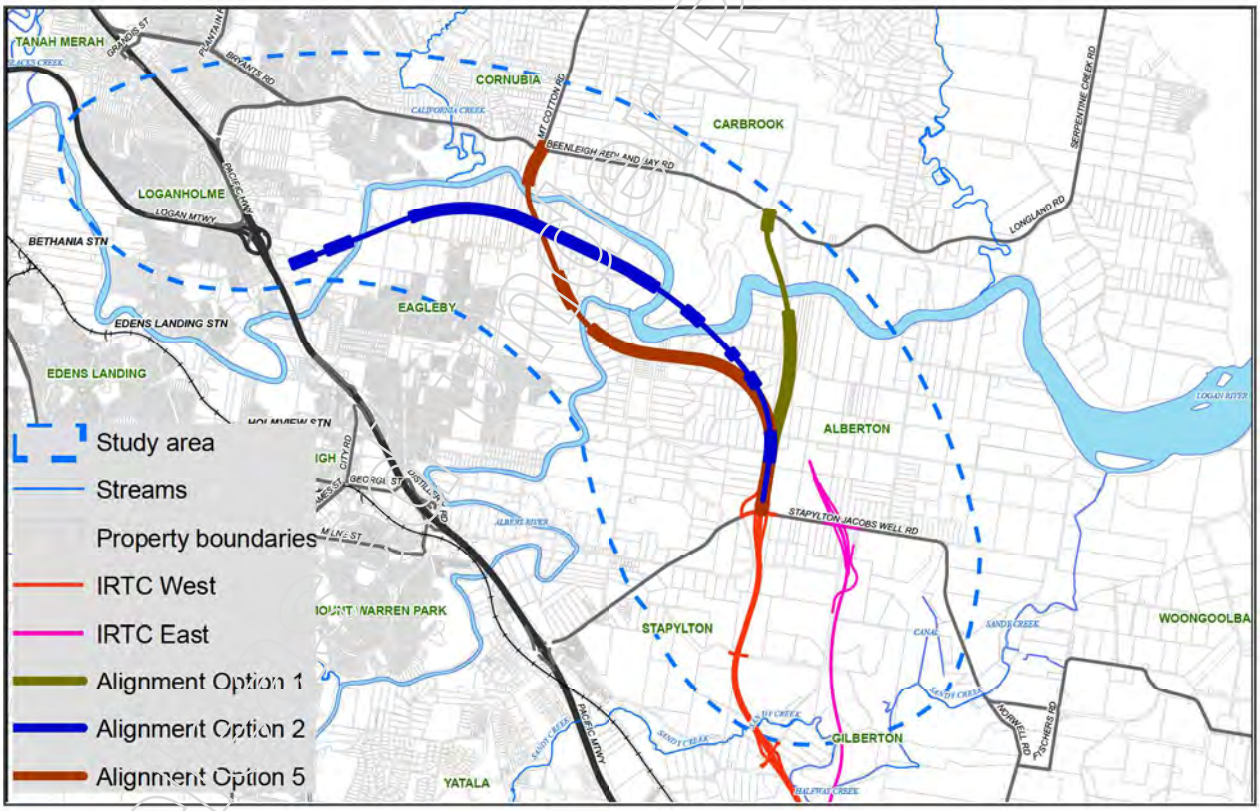



**Figure 4-1 Modelled Alignment Options for Case 1**

### Case 2

The initial results from Case 1 highlighted areas sensitive to a decrease in waterway conveyance area. Where the afflux was found to be excessive, the bridge structure lengths were increased. The increased bridge structure lengths for Alignment Options 1 and 2, and bridge structure lengths for Alignment Options 3 and 4 for Case 2 are shown in **Table 4.1**.

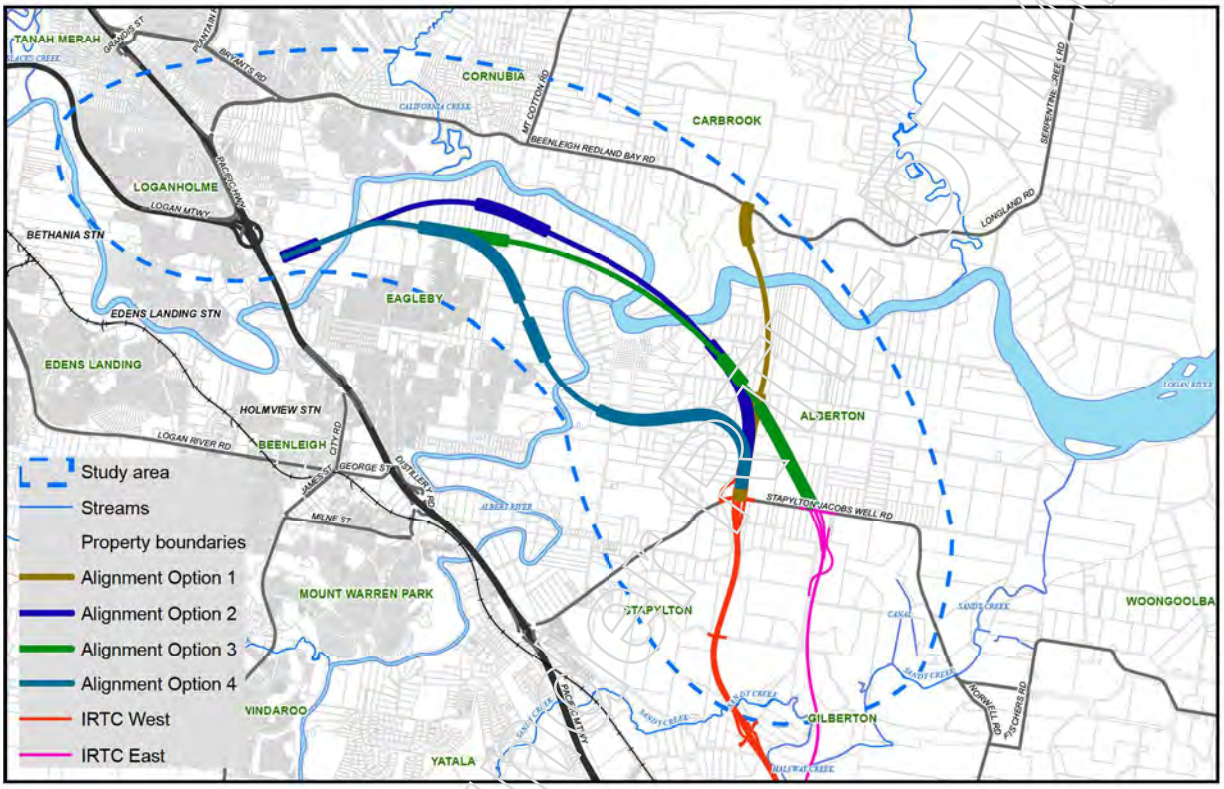



**Figure 4-2 Modelled Alignment Options for Case 2 (road embankment is indicated by width of alignment)**

**Table 4.1 Approximate Opening Lengths of Bridge Structures**

| Alignment Option | Opening for ... | Length (m) | |
|---|---|---|---|
| | | Case 1 | Case 2 |
| Alignment 1 | 1. Overland flow | 0 | 80 |
| | 2. Logan River crossing | 1060 | 2080 |
| Alignment 2 | 1. Overland flow | 0 | 80 |
| | 2. Logan River 1 | 2180 | 2680 |
| | 3. Logan River 2 | 1110 | 2220 |
| Alignment 3 | 1. Overland flow | - | 330 |
| | 2. Logan River 1 | - | 3310 |
| | 3. Logan River 2 | - | 1950 |
| Alignment 4 | 1. Albert River | - | 1000 |
| | 2.Overland flow | - | 250 |
| | 3. Logan River | - | 1930 |
| Alignment 5 | 1. Albert River | 400 | - |
| | 2. Logan River | 1280 | - |

### 4.5.3 Hydraulic Impact Minimisation and Afflux Mapping

The assessment of impacts to the hydraulic regime was undertaken by comparison of the modelled Alignment Option results with the Base Case or existing condition results. Afflux, changes in flood extent and water velocity due to the developed conditions, were used as the criteria for determining the size of the impact.

For Cases 1 and 2, the maximum afflux at locations associated with alignment bridge openings is given in **Table 4.2.** Alignment 5 was omitted from the Case 2 analysis because it showed in Case 1 that the area of concern (crossing the Logan River and adjacent southern floodplain) requires bridge structure, since any north-south road embankment would reduce the floodplain conveyance considerably.

It can be seen that, generally, where the impact to the hydraulic regime was excessive (determined by large amounts of afflux and / or increased flood extent or erosion potential) an increase in the size of the bridge structure openings in the alignment resulted in a decrease in the impacts. It was also noted that the reduction of afflux was achieved by maintaining the alignment embankment away from the hydraulically sensitive areas (where a reduction in floodplain conveyance areas result in large backwater effects). These areas are:

- The floodplain area between the Logan River and the Eagleby residential area
- The floodplain area south-east of the Albert / Logan River confluence
- The overland flow area just north of Stapylton – Jacobs Well Road

**Table 4.2 Hydraulic Impacts Due To Developed Conditions (As Compared To The Base Case)**

| Alignment Option | Map (Appendix D) | Opening for... | Maximum Afflux (m) | |
|---|---|---|---|---|
| | | | Case 1 | Case 2 |
| Alignment 1 | Map H3 Case 2 | 1. Overland flow | 1.500 | 0.350 |
| | | 2. Logan River | 0.250 | 0.005 |
| Alignment 2 | Map H5 Case 2 | 1. Overland flow | 1.150 | 0.710 |
| | | 2. Logan River 1 | 0.010 | 0.110 |
| | | 3. Logan River 2 | 0.105 | 0.110 |
| Alignment 3 | Map H7 Case 2 | 1. Overland flow | - | 0.200 |
| | | 2. Logan River 1 | - | 0.015 |
| | | 3. Logan River 2 | - | 0.060 |
| Alignment 4 | Map H9 Case 2 | 1. Albert River | - | 0.016 |
| | | 2.Overland flow | - | 0.000 |
| | | 3. Logan River | - | 0.060 |

Afflux, flood extent and water velocity mapping for the four modelled alignments of Case 2 (with location and size of openings) are shown on Maps H3 to H10.

## 4.6 Summary

The desktop analysis of impacts to the existing hydraulic regime due to the alignment options has highlighted areas sensitive to development. More precisely, these impacts are due more to the reduction in floodplain conveyance and reduced access to floodplain storage than to the loss of floodplain storage due to new road embankment. As a result, the use of bridge structures over some of the floodplain areas is necessary for the mitigation of these hydraulic impacts.

Generally, the floodplain areas south of the Logan River require consideration with respect to alignment options and the location of bridge openings. In particular, the floodplain between the Logan River and the Eagleby residential area and the floodplain south-east of the confluence of the Albert and Logan Rivers shows a high sensitivity to reductions in conveyance. Consideration must also be given to the residences that have been built close to the Q100 floodline. For example, the Eagleby and Cornubia residential developments may be highly susceptible to afflux and increased flood extent.

The approximate structure lengths for each of the alignment options are shown in **Table 4.1**. Total length for bridge structure ranges from 2.1km (Alignment Option 1) to 5.5km (Alignment Option 3).

The afflux generated by the alignment options varies dependent upon the location of road embankment impinging upon the sensitive floodplain areas. For the case of Alignment Option 1, the main bridge structure can be reduced in length since afflux is negligible. Conversely, the overland flow afflux can be reduced by increasing the 80m bridge structure length. However, to provide connectivity to the Pacific Motorway, Alignment Option 4 shows the least impacts to the hydraulic regime, and has minimal bridge structure compared to Options 2 and 3.

It should be noted that Alignment Option 3 connects to the eastern IRTC option. Under this scenario, it can be seen that afflux generated just north of Stapylton – Jacobs Well Road is on the eastern side of the alignment (refer to Map H7). This is due to the restriction of the expanding flows from the floodplain to the east of this alignment. This is verified by the associated velocities illustrated on Map H8.

This study has provided a limited analysis (due to long model run times and a short project time) of the impacts associated with selected alignment options, and the effectiveness of bridge structure lengths. However, for this level of assessment, the use of bridge openings to mitigate the impacts to the existing hydraulic regime for each alignment option has been shown to be feasible from a hydraulic perspective.

This analysis does not, however, include the effects of piers and abutment arrangements. Further analysis will be required at a later, more detailed stage. It is noted that the impacts of the pier and abutment arrangements will generally lead to increased bridge structure lengths.

# 5.0 Route Options

## 5.1 Background

A number of previous planning studies have been undertaken within the study area that provide important background information to be taken into consideration for this investigation. A review of these studies has been undertaken and the information compiled into a Background Information Report that forms **Appendix A** to this report. A brief summary of this report is provided in the following sections in relation to the history of route locations previously considered.

### 5.1.1 Eastern Corridor Planning Study, 1992

The Eastern Corridor Planning Study (ECPS) was prepared by Rankine & Hill to:

- Determine the need for an additional corridor between Brisbane and the Gold Coast
- Determine the most appropriate form of the corridor
- Identify an appropriate location for a corridor.

The study considered a total of seventeen route options to the south of the Logan River (S1 to S17) and twenty route options to the north of the Logan River (N1 to N20). Those that are relevant to this study are included on Map A, included within **Appendix A** of this report. Each of these route options (S1, N3 etc) was treated as a link that could form part of a number of overall routes e.g. S4 / S10 / N5. Every link was appraised in relation to community and property impacts, environmental impacts, engineering requirements and cost.

The study concluded that the preferred route to the south of the Logan River extended in an east-west direction between Stapylton and the Logan Motorway. This route (S6 / S10 / S15 / S16) was identified as being difficult to construct due to its position within the floodplain, but was preferred due to no impact on the community of Eagleby. However, it was subsequently determined that the route to the Logan Motorway did not provide significant benefits to the transport network, and was consequently removed from the scheme.

A route leading from Stapylton across the Logan River to the north was subsequently considered, and was determined to comprise links S6 / N3 / N7. However, link S6 was identified as impacting a quarry owned by Boral. It was considered that if the effects on the quarry could not be mitigated then an alternative route to the east, between Goldmine Road and the Logan River, incorporating a new link between S6 and N4, should be adopted.

### 5.1.2 South Coast Motorway Southern Section Impact Assessment Study, 1995

The Impact Assessment Study (IAS) was prepared by Connell Wagner to investigate the corridor requirements for the preferred route that had been identified within the ECPS, now termed the South Coast Motorway. However, the IAS focused only on the southern section of this motorway between Beenleigh-Redland Bay Road and Nerang.

The Terms of Reference for the IAS referred to both the preferred and alternative routes that had been identified within the ECPS between Goldmine Road and the Logan River. It highlighted that the alternative eastern alignment would have a major impact on cane lands, and should only be considered if the impact assessment process proved that the preferred inland alternative was not viable.

The IAS report determined that with a few adjustments to the alignment, the ECPS preferred route was viable, and made no comment on the eastern alternative. The operation of the quarry was addressed through the provision of an underpass beneath the motorway. The IAS alignment is also shown on Map A in **Appendix A**.

### 5.1.3 Modified South Coast Motorway & South East Connector, 1996 (Approx. Date)

This report was prepared by Queensland Transport in response to community concerns regarding the location of the South Coast Motorway, specifically where it crosses Brisbane's southern suburbs and Daisy Hill forest. These concerns relate to the northern section of the South Coast Motorway, which lies to the north of the route covered by the IAS described in **Section 5.1.2**.

The report considered an alternative option for the South Coast Motorway, limiting its length by providing a connection to the Pacific Motorway and Logan Motorway, rather than extending north through the Daisy Hill forest towards the Gateway Motorway. This is similar to link S16 that was considered, and then eliminated from, the ECPS.

Three options were considered for the alternative route, with the alignments taking different routes around a number of existing quarries, but with all alignments having a common route adjacent to the Logan River, north of Eagleby. The report notes that the consequence of all the options crossing both the Logan and Albert Rivers, and traversing the floodplain is 3km of bridging to provide flood immunity for a 50 year ARI.

The report concluded that despite impacting some wetlands to the north of the Albert River, a connection to the Logan Motorway is a viable option.

### 5.1.4 Integrated Regional Transport Plan (1997)

In accordance with the Integrated Regional Transport Plan (IRTP), 1997 for South East Queensland, reference was made under Chapter 8: Part B: Shaping the future transport system – major road corridors held in reserve.

This chapter identified the southern portion of the 'South Coast Motorway Corridor / Smith Street Connector' from Beenleigh – Redland Bay Road to Nerang – Broadbeach Road is to be retained and protected pending investigation of future transport needs.

Although this corridor was originally approved by a Cabinet decision in 1995, a bi-partisan agreement was later reached to change the corridor such that it commenced at Stapylton – Jacobs Well Road (not Beenleigh – Redland Bay Road).

This corridor from then onwards is now known as the Intra-Regional Transport Corridor.

### 5.1.5 Intra Regional Transport Corridor - Northern Section, 2010

This report was prepared by AECOM, and details the factors taken into consideration in the development of Road Corridor Development Planning (RCDP) Layouts for the Intra Regional Transport Corridor – Northern Section (IRTC) between Stapylton – Jacobs Well Road and Beattie Road. This required the review and update of the 1995 IAS alignment (refer to **Section 5.1.2**) to ensure that it met with current design standards, such that the corridor extents could be defined for future preservation.

The report notes the function of the IRTC as forming the primary arterial for local traffic between the Gold Coast, and ultimately Logan and Brisbane. It also identifies the Yatala Enterprise Area Local Area Plan as having a direct influence on the location of the IRTC.

In determining an optimal alignment for the IRTC, two options were considered and the key features reported on, between Goldmine Road and Stapylton – Jacobs Well Road. These were similar to links S6 / N3 and S6 / N4 within the earlier ECPS (refer to **Section 5.1.1**). A western option was designed predominantly along the line of the South Coast Motorway, with an eastern option located approximately 1km to the east. The key features of the two alignments are summarised below:

Western Alignment

- Adopted EIA alignment
- Severs the Yatala Enterprise Area
- Severs the urban footprint
- Bisects the Boral quarry
- Requires one interchange at Burnside Road
- Requires four bridges

Eastern Alignment

- Investigative alignment
- East of the Yatala Enterprise Area
- East of the urban footprint
- Avoids the Boral quarry
- No interchange required at Burnside Road
- Requires two bridges

The outcome of the review of the two options was that the western alignment was documented on the RCDP Layouts. However, it was determined that the eastern alignment represented a viable alternative that may need to be considered during future stages of the project.

Whilst the northern limit of the IRTC was Stapylton – Jacobs Well Road, requiring an at-grade intersection between the two roads, an ultimate interchange layout was also developed to allow for the possibility of the continuation of the route to the north in the future.

## 5.2 Consultation

The IAS report summarises the extent of consultation that was undertaken during both the ECPS and IAS studies. It states that a comprehensive consultation exercise was undertaken during the ECPS to inform the community

and involve them in the study process, with a two-way communication process established. Following the completion of the ECPS, Queensland Transport (QT) issued letters to the land owners directly affected by the government decision on the corridor, advising them of the decision and giving them the opportunity to contact the Department for further discussion. Property owners subsequently began registration with QT regarding the precise location of the corridor and acquisition processes.

It is noted that the ECPS ultimately proposed a preferred corridor and a possible alternative eastern corridor between Goldmine Road and the Logan River, subject to operations at the Boral quarry site. It is likely that the consultation during the ECPS was based upon the multiple links (S1 to S17 and N1 to N20) considered during the study. However, the alternative corridor was nominated at the end of the study, and comprised an additional link that was not previously referenced with a link number. It is therefore unclear whether the consultation related to both the preferred and alternative corridors, or simply the preferred western corridor, which was taken forward to the IAS.

The report comments that limited additional consultation was required during the IAS due to the extent of consultation already completed during the ECPS. However, it notes that meetings were held with relevant parties where the corridor remained the subject of minor variations or where the complexity of land use and other considerations required further assessment of the corridor impacts, such as the Boral quarry. Local government, State government and other organisations were also consulted, and the draft IAS displayed publicly for four weeks in 1995.

The extent of the IAS design was such that the public display would have included the section that lies within the LEL study area between Goldmine Road and Beenleigh - Redland Bay Road.

## 5.3 Description of Options

The original scope of this study was to investigate the feasibility of routes between the IRTC at Stapylton - Jacobs Well Road (both eastern and western alignments) and:

- Logan Motorway
- Pacific Motorway
- Mount Cotton Road.

It was determined early in the option development process that a connection directly onto the Pacific Motorway would not be viable due to the proximity of the existing interchanges at the Logan Motorway and Beenleigh – Redland Bay Road.

The previous route investigations undertaken within the ECPS were considered in relation to movements to the north, and two further connection points onto Beenleigh - Redland Bay Road created in addition to one at Mount Cotton Road. From east to west, the three northerly points were selected at the following locations:

- Mount Cotton Road
  - Allows for future connectivity to the north within the existing Mount Cotton Road corridor
- To the west of Carbrook Golf Club
  - Similar to ECPS link N2
  - N2 realigned to the east to avoid the former Carbrook State School historic site
- To the west of Ferry Road
  - Similar to ECPS link N7
  - Similar to IAS design
  - Traverses land owned by TMR to the north of Logan River
  - Allows for potential future connectivity to the north via Serpentine Creek Road

Routes were subsequently created between each of the origin and destination points, with several alternative alignments that addressed the constraints identified during desktop analyses and workshops. The routes comprise a series of links (L1 to L34) which can be incorporated into a number of different alignments leading to different destinations. The links are shown on Map I, and SK-60186998-0003 contained within Volume 2.

## 5.4 Geometry

### 5.4.1 Design Speed

The ECPS determined that the corridor should operate under a design speed of 110km/h, corresponding to a posted speed of 100km/h. This design speed was carried through to the IAS and IRTC designs, and has been adopted for this LEL study.

### 5.4.2 Cross Section

The ECPS identified that a 100m wide corridor was required with the following elements:

- 60m wide road facility including:
  - Four general traffic lanes
  - Two High Occupancy Vehicle (HOV) lanes
  - 9m landscaped median
- 20m wide future public transit facility
- 20m wide service road / utilities corridor / bicycle / pedestrian needs.

This was used as the basis for the subsequent IAS and IRTC designs. A maximum corridor width of 100m was also specified by TMR for this LEL study, in line with the previous investigations. An illustration of the proposed cross section is shown within the plans contained in Volume 2.

### 5.4.3 Alignment

The alignment of each link has been undertaken in accordance with Austroads Guide To Road Design (AGTRD), Part 3.

The minimum horizontal radius with adverse crossfall has been applied where possible. For a design speed of 110km/h, this is a 2400m radius curve (Table 7.10 of AGTRD, Part 3). However, numerous constraints are present that restrict the geometry, such that a minimum radius of 750m has been applied, which would require a superelevation of 5%. It has been assumed that the alignments would connect onto Beenleigh – Redland Bay Road via an at-grade intersection. The design speed of links in these areas has therefore been reduced to 90km/h.

**Section 4.6** noted that significant lengths of bridging would be required within all of the alignments. Barriers would be required on these bridges, which would restrict the sight distance around horizontal radii, resulting in the need for widening. Widening has not been incorporated at this stage, but would need to be considered further during future project stages.

Vertically, the links have been aligned such that they are positioned above the Q100 level, allowing for a freeboard of approximately 0.3m at the edge of the pavement. Vertical curvature has been applied to suit the design speeds. It is noted that the need to position the road surface above the Q100 level results in the earthworks footprint extending beyond the specified maximum 100m corridor width. This is discussed further in **Section 5.6**.

## 5.5 Property Access and Interchanges

### 5.5.1 Property Access

The majority of the route options pass through privately owned parcels of land. This will result in the severance of existing access routes, both within the properties, and to the existing local road network. Additionally, the LEL is intended to be a limited access road, and as such no properties will be allowed direct access to or from it. Measures such as overpasses or underpasses would therefore be required to ensure that access via the local road network is available to all parcels of land affected by the routes, and that no existing parcels become landlocked.

The development of such measures is beyond the scope of this study, but would need to be considered further during subsequent design stages.

### 5.5.2 Interchanges

Several interchanges are required within the study area to provide connectivity between the LEL and adjoining roads. The location and form of the interchanges will be subject to the outcomes of ITP's Northern Gold Coast Area Transport Study, and the ultimate planning requirements for the area. The provision of interchanges is also subject to being able to achieve adequate spacing between interchanges without compromising the capacity and / or safety of the road. The required interchanges are described in the following **Sections 5.5.2.1 to 5.5.2.3**, and have been considered in relation to the links shown in **Figure 5-1** below.

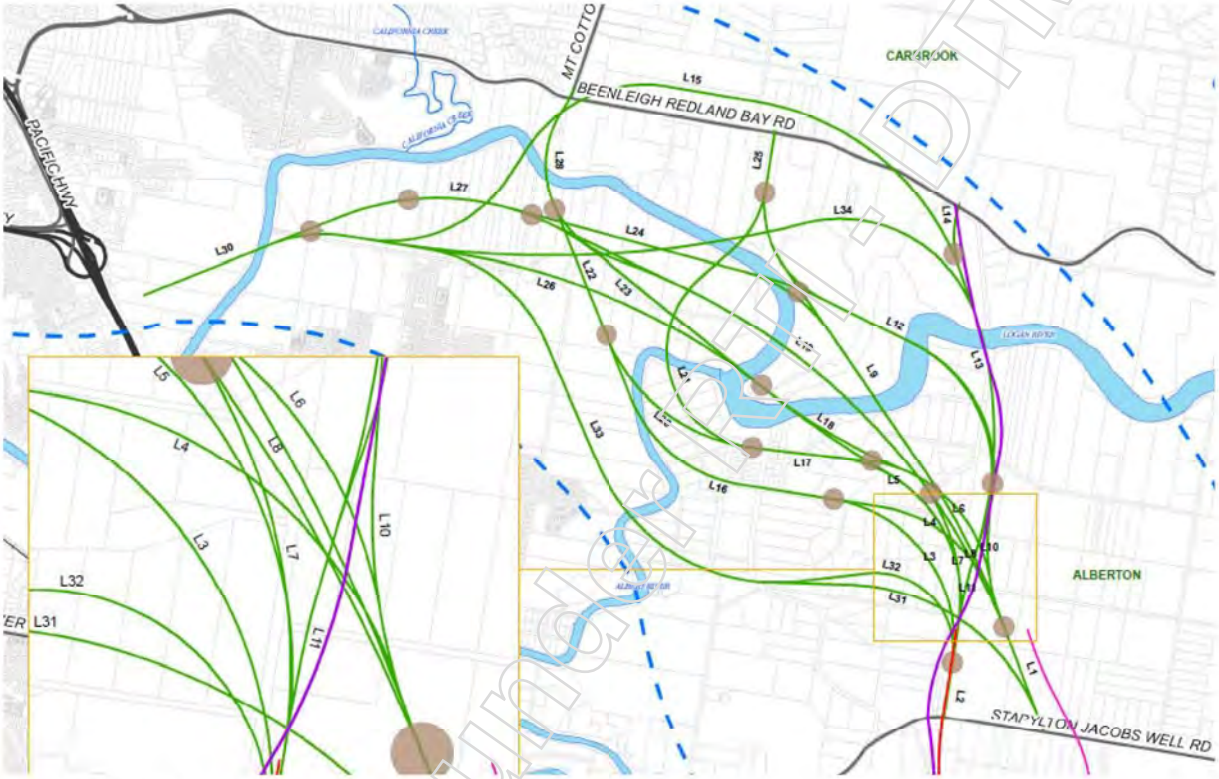



**Figure 5-1 Links Considered within the Study Area**

#### 5.5.2.1 Stapylton – Jacobs Well Road

Two interchanges connecting Stapylton – Jacobs Well Road with the eastern and western IRTC alignments were designed as part of the IRTC RCDP.

An objective of this study is to confirm the alignment of the IRTC at both of these interchanges. It is considered that any amendments to the IRTC orientation at Stapylton – Jacobs Well Road would not largely affect the form and size of the interchanges required beyond those already designed within the IRTC project.

#### 5.5.2.2 Logan Motorway / Pacific Motorway

**Existing Interchange**

The existing Logan Motorway / Pacific Motorway interchange was designed by Maunsell (now AECOM) in 1997. It was designed such that a future connection to the east could be incorporated with minimal disruption to the existing. This original design is shown on the plans contained within Volume 2. Whilst the original design did not provide for any connectivity between an eastern link and the Pacific Motorway, two new ramps have been shown on the plan, illustrating how the following additional connections could be incorporated:

- Pacific Motorway southbound to LEL eastbound
- LEL westbound to Pacific Motorway northbound

**Proposed Interchange**

The interchange has been reviewed in relation to the original upgrade design, as well as the current LEL proposals, and a revised layout proposed, which is also shown on the plans in Volume 2. The proposed interchange allows for all movements with the exception of the following:

- LEL to Pacific Motorway southbound
- Pacific Motorway northbound to LEL

It is considered that these movements would not be necessary. For movement 1 above, it is assumed that vehicles travelling north on the IRTC onto the LEL would have no reason to then join the Pacific Motorway southbound, having just come from the south. Additionally, those travelling southbound from north of the Logan River would be able to access the Pacific Motorway southbound via the existing interchange with Beenleigh-Redland Bay Road.

For movement 2 above, it is assumed that there would be no demand for vehicles heading northbound on the Pacific Motorway to access the LEL which would lead them onto the IRTC southbound, back towards their origin. Similarly, vehicles looking to travel to the north of Beenleigh - Redland Bay Road would not need to access the LEL as they could utilise the existing Pacific Motorway / Beenleigh - Redland Bay Road interchange.

This concept interchange design has no impact upon the Beenleigh - Redland Bay interchange to the north, and a minimal impact on properties, with the majority of the works occurring within the existing road corridor. The proposed layout also avoids the need for three layers within the interchange.

#### 5.5.2.3 North - South / East - West Interchange

An interchange will be required to connect the east-west movement between the IRTC and the Logan Motorway with the north-south movement across the Logan River. The exact location of this interchange is subject to the route selected, whilst the form of the interchange is a function of the road hierarchy that needs to be determined during subsequent stages of the design. Furthermore, TMR advised that wherever the location of the interchange, a connection into the suburb of Eagleby would be desirable.

An indicative interchange design has therefore been developed that has assumed that the east-west route is the priority route. The interchange is shown on the plans contained within Volume 2, which illustrate that full connectivity can be achieved, with a new route formed in the north-south direction enabling the residents of Eagleby to access Mount Cotton Road.

## 5.6 Land Impacts and Requirements

As noted in **Section 5.4.3**, the vertical alignment required to provide flood immunity for a 100 year ARI is such that the footprint of the options extends beyond the 100m wide corridor specified by the project brief. As such, a 140m wide corridor has been illustrated on the plans contained in Volume 2 to denote the anticipated land requirements. The 140m wide corridor incorporates the IRTC road cross section (refer to **Section 5.4.2**) so that the two routes are consistent such that the LEL is simply an extension of the IRTC. The corridor width allows for not only the road and earthworks footprint, but also provides capacity for sufficient lateral offsets to be incorporated which could allow for:

- Utilities
- Maintenance access
- Shared path
- Future public transit facility.

Indicative land boundaries have also been shown around the interchanges illustrated on the plans in Volume 2.

Land impacts and requirements would need to be considered further as the alignments are developed during future project stages.

## 5.7 Route Assessment

As noted in **Section 5.3**, thirty four links (L1 to L34) have been developed that form a network of interconnecting routes between Stapylton – Jacobs Well Road, Beenleigh – Redland Bay Road and the Logan Motorway, as shown on Map I, and SK-60186998-0003 in Volume 2. (It is noted that link L29 was eliminated from the options development process, and is therefore not shown on Map I). Each of these links has been assessed in terms of their impact upon the surrounding area in the context of:

- Environment
- Land use
- Hydraulics and flooding.

A summary of these impacts is included in **Table 5.1** which describes the reasons why particular route alignments have been discounted from the study.

**Table 5.1 Summary of Routes Not Taken Forward**

| Start (IRTC) | Route Reference | Reasons For Elimination |
|---|---|---|
| East | L1 / L6 / L17 / L21 / L25<br>L1 / L6 / L17 / L20 / L22 / L28 | • NR<br>• Link L17 bisects the community of Alberton. |
| West | L2 / L5 / L17 / L21 / L25<br>L2 / L5 / L17 / L20 / L22 / L28 | |
| East | L1 / L9 / L25<br>L1 / L9 / L24 / L27 / L29 / L30 | • NR<br>• Link L9 bisects the State significant wetland areas, removing the connectivity for water flow and migratory bird species. |
| West | N/A | |
| East | L1 / L8 / L19 / L28 | • NR<br>• Link L19 bisects the State significant wetland areas, removing the connectivity for water flow and migratory bird species. |
| West | L2 / L7 / L19 / L28 | |
| East | L1 / L8 / L19 / L27 / L29 / L30 | • NR<br>• Link L19 bisects the State significant wetland areas, removing the connectivity for water flow and migratory bird species. |
| West | L2 / L7 / L19 / L27 / L29 / L30 | |
| East | L1 / L10 / L12 / L25 | • Link L12 bisects the State significant wetland areas, removing the connectivity for water flow and migratory bird species. |
| West | L2 / L11 / L12 / L25 | |
| East | L1 / L10 / L12 / L24 / L27 / L29 / L30 | • Link L12 bisects the State significant wetland areas, removing the connectivity for water flow and migratory bird species. |
| West | L2 / L11 / L12 / L24 / L27 / L29 / L30 | |
| East | L1 / L4 / L16 / L22 / L28 | • Link L16 impacts upon the community of Alberton. |
| West | L2 / L3 / L16 / L22 / L28 | |

The identification of unacceptable impacts described within **Table 5.1** led to the development of four alignments (A to D) that were considered the most feasible with least impacts. Each of these alignments has the potential to commence from either the western or eastern IRTC alignments, resulting in a total of eight feasible option alignments, as shown in **Figure 5-2** and Map J. These form the basis of all the plans that are contained within Volume 2, and are described over.

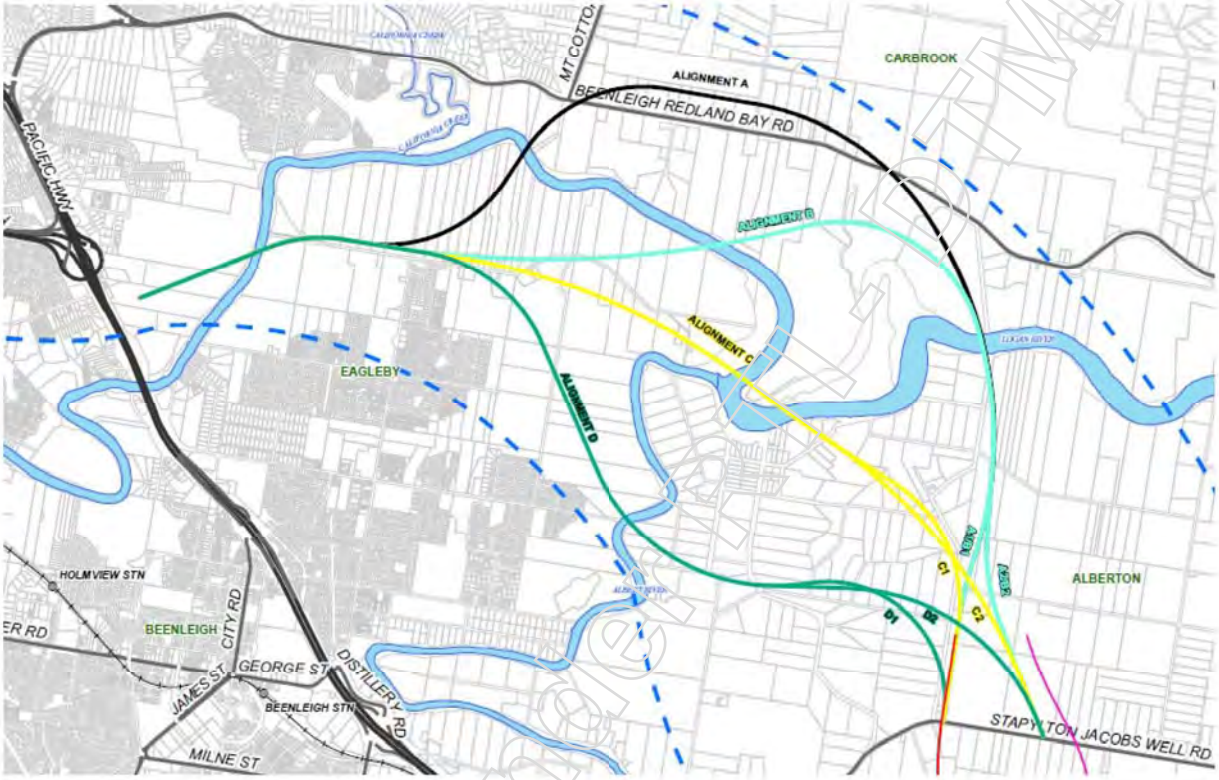



**Figure 5-2 Preferred Alignments**

### Alignment A

This alignment extends north from the IRTC, before travelling parallel to the northern side of Beenleigh – Redland Bay Road, and heading south at Mount Cotton Road to connect to the Logan Motorway. The alignment has been split into two to define connections to both the western and eastern IRTC alignments as follows:

- Route A1
  - Commences at the IRTC western alignment
  - Comprises links L2 / L11 / L13 / L15 / L30
- Route A2
  - Commences at the IRTC eastern alignment
  - Comprises links L1 / L10 / L13 / L15 / L30

These routes represent the ultimate layout at this location. It is possible that this alignment could be implemented in stages, with connections onto the existing Beenleigh – Redland Bay Road provided initially as an interim 'network' solution. This could be modified to form the ultimate grade separated layout at a later date. The ultimate solution together with the interim staging is shown on the plans contained within Volume 2.

**Alignment B**

Alignment B travels north from the IRTC, looping through land owned by TMR and Carbrook Golf Club before heading south-west towards the Logan Motorway. The alignment has been split into two to define connections to both the western and eastern IRTC alignments as follows:

- Route B1
  - Commences at the IRTC western alignment
  - Comprises links L2 / L11 / L13 / L34 / L26 / L30
- Route B2
  - Commences at the IRTC eastern alignment
  - Comprises links L1 / L10 / L13 / L34 / L26 / L30

**Alignment C**

Alignment C heads north-west from the IRTC, crossing the Logan River at its juncture with the Albert River, before continuing in a westerly direction towards the Logan Motorway. The alignment has been split into two to define connections to both the western and eastern IRTC alignments as follows:

- Route C1
  - Commences at the IRTC western alignment
  - Comprises links L2 / L5 / L18 / L26 / L30
- Route C2
  - Commences at the IRTC eastern alignment
  - Comprises links L1 / L6M / L18 / L26 / L30

NR

**Alignment D**

Alignment D travels west from the IRTC, passing to the south of Alberton community, before heading north-west skirting around Eagleby and onto the Logan Motorway. The alignment has been split into two to define connections to both the western and eastern IRTC alignments as follows:

- Route D1
  - Commences at the IRTC western alignment
  - Comprises links L2 / L32 / L33 / L26 / L30
- Route D2
  - Commences at the IRTC eastern alignment
  - Comprises links L1 / L31 / L33 / L26 / L30

The full impacts of each of these routes on all the findings of the desktop analyses are described in the Route Summary Tables (**Tables A1 to A8**) contained within Error! Reference source not found.. The impacts have been colour coded to distinguish between positive and negative impacts to assist in the future assessment of these options:

- Green – Positive
- White – Neutral
- Orange – Moderately negative
- Red – Significantly negative

Two classifications of 'negative' have been adopted in order to distinguish between the relative impacts of options more easily. For instance, more than one option may impact upon a constraint, but some may be to a lesser degree than others.

## 5.8 Summary

Based upon the information gathered from the desktop analyses, the four routes A to D are considered to represent the most feasible options for providing a connection between the IRTC, the Logan Motorway and Beenleigh – Redland Bay Road, and should be considered further during subsequent stages of the project.

# 6.0 Conclusion

This study presents the findings of an investigation into the most feasible routes for the LEL. A large number of options have been developed and reviewed in order to determine possible alignments connecting the IRTC, Beenleigh – Redland Bay Road and the Logan Motorway.

The desktop analyses into land use, environmental management and hydraulics have established that a significant number of constraints are present within the study area. These include koala habitat, wetland areas, existing properties / businesses, and the large area of floodplain associated with the Logan and Albert Rivers. Some of these constraints are impossible to avoid, such as the Logan and / or Albert Rivers and the surrounding floodplains. Bridging will be a requirement of any LEL alignment, which will be costly, although the number of river crossings and length within the floodplain is subject to each individual alignment.

The size and number of constraints is such that whilst the impacts on some can be minimised, and in certain cases avoided, sometimes this is at the expense of others. Further consideration of the relative importance of these constraints would be required, in order to ascertain an acceptable balance between impacts and technical and cost considerations.

Due to the nature and number of constraints, final selection of a preferred alignment should only be undertaken following more detailed ground investigations together with network traffic modelling, which would determine the ultimate function of the LEL within the wider functional road hierarchy. Confirmation of the standard of the road is also a key fundamental requirement as it:

- Establishes an appropriate design speed, which determines the geometry that can be achieved within an alignment
- Determines the required level of flood immunity
- Determines access requirements / limitations
- Influences progressive land use planning along the corridor.

Appendix A

# Background Report

AECOM

# Background Report

## Logan East Link Route Investigation Study

# Background Report

Logan East Link Route Investigation Study

Prepared for

Transport and Main Roads, South Coast Region

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# 1.0 Introduction

## 1.1 Project Background

AECOM Australia Pty Ltd (AECOM) was commissioned by Transport and Main Roads (TMR), South Coast Region in October 2010 to carry out the Logan East Link Route Investigation Study.

The study requires the investigation of routes linking the Intra Regional Transport Corridor – Northern Section (IRTC), with the following roads:

- Pacific Motorway
- Logan Motorway
- Beenleigh – Redland Bay Road.

The Intra Regional Transport Corridor is a proposed route that would form the primary arterial road between Logan, the rapidly growing northern Gold Coast areas, and the Gold Coast southern suburbs. Prior to this study, the corridor was split into two sections, northern and southern, which were reviewed through Road Corridor Development Planning (RCDP), to enable the extents of the overall corridor to be defined for future preservation.

In 2010, the RCDP process determined the corridor requirements for the northern section, having established the alignment of a north-south route between Stapylton – Jacobs Well Road, Stapylton and Beattie Road, Coomera. This alignment formed a connection with the southern section, which was the subject of RCDP in 2006, and comprised a north-south route between Beattie Road, Coomera and Nerang – Broadbeach Road, Nerang.

This study focuses on the area to the north of the Intra Regional Corridor, and therefore refers to the northern section of the corridor only as the IRTC.

The development of route options for the Logan East Link also needs to address two IRTC alignments that were determined as part of the RCDP process. The main RCDP Plans comprised an alignment that intersected with Stapylton – Jacobs Well Road at Alberton Road. However, an alternative 'eastern alignment' option was also developed to the north of Goldmine Road, intersecting with Stapylton – Jacobs Well Road approximately 1km to the east of the main RCDP IRTC route. This study requires route options to be determined that commence from either of these alignments.

Prior to the RCDP stages, other planning and design work was also undertaken that encompassed the Intra Regional Corridor as a whole, but also considered further connections to the north, extending all the way to the Gateway Motorway at Rochedale.

The outcomes of this study will feed into the wider ranging Brisbane to Gold Coast Corridor Study.

## 1.2 Purpose of the Report

The program for the Logan East Link has been defined by three stages. Between each stage a workshop will be held to combine knowledge of, and obtain input from, all AECOM and TMR members of the project team. The project stages are:

1) Initial Investigations
2) Draft Planning Layouts and Reporting
3) Final Planning Layouts and Reporting

Milestone: Workshop 1 occurs at the end of Stage 1, and requires the following items:

- Background Information Report (this report)
- Review of any environmental elements for early identification of any critical issues
- Reflection on the alignments identified in the South Coast motorway studies
- Review of any problem areas where the use of higher geometric standards (that is 110km/hr design speed and Road Planning and Design Manual (RPDM) design parameters) cannot be achieved.

The purpose of this report is to document a review of previous studies and investigations undertaken within the study area, to create an understanding of any issues or constraints that need to be considered by the project team in the development of route options for Logan East Link.

# 2.0 Review of Existing Information

A review of existing information was undertaken to determine the key issues identified as part of previous studies in the area that may be relevant to this study. The following sources of information were supplied by TMR in October 2010 to assist the review process:

- Eastern Corridor Planning Study Main Report, prepared by Rankine & Hill, January 1992
- Eastern Corridor Planning Study Technical Appendix Volume 1, prepared by Rankine & Hill, January 1992
- Eastern Corridor Planning Study Technical Appendix Volume 2, prepared by Rankine & Hill, January 1992
- Eastern Corridor, Logan River Flood Study, prepared by Connell Wagner, May 1994
- Eastern Corridor, Logan River Flood Study, Extension Report, prepared by Connell Wagner, January 1995
- The South Coast Motorway Southern Section Impact Assessment Study (IAS) Final Report, prepared by Connell Wagner, April 1995
- The South Coast Motorway Southern Section Impact Assessment Study (IAS) Final Report - Drawings, prepared by Connell Wagner, April 1995
- Metropolitan South Region, South Coast – Hinterland District, Preliminary Report, Modified South Coast Motorway (Logan Motorway to Smith St) & South East Connector (Smith St to Nerang – Broadbeach Rd), prepared by Queensland Transport, not dated
- Southern Moreton Bay Draft Marine Infrastructure Master Plan, prepared by the Department of Infrastructure and Planning, Qld, December 2009.

In addition to the above documents, AECOM also reviewed the following:

- Intra Regional Transport Corridor – Northern Section, Summary Report, Road Corridor Development Planning, prepared by AECOM, September 2010.

## 2.1 Eastern Corridor Planning Study (1992)

The objectives of the Eastern Corridor Planning Study (ECPS) were to:

- Determine the need for an additional corridor between Brisbane and the Gold Coast
- Determine the most appropriate form of the corridor
- Identify an appropriate location for a corridor.

### 2.1.1 Corridor Need

Traffic modelling was undertaken as part of the ECPS, and determined that the Pacific Motorway would need to be widened to eight lanes in order to provide an acceptable level of service for the year 2006. However, the potential for future urban development resulted in the conclusion that an additional north-south arterial route would be required to the east of the Pacific Motorway.

### 2.1.2 Corridor Form

A nominal corridor width of 100m was adopted, comprising the following elements:

- 60m wide road facility including:
  - Four general traffic lanes
  - Two High Occupancy Vehicle (HOV) lanes
  - 9m landscaped median
- 20m wide future public transit facility
- 20m wide service road / utilities corridor / bicycle / pedestrian needs.

The ECPS determined that this corridor should operate under a design speed of 110km/h, corresponding to a posted speed of 100km/h.

### 2.1.3 Corridor Location

The ECPS considered a total of seventeen route options to the south of the Logan River (S1 to S17), and twenty route options to the north of the Logan River (N1 to N20). The routes that are relevant to the study area for Logan East Link are presented on the map contained within **Appendix A**. Between Stapylton and the Logan River linkages were considered to the Logan Motorway, and across Logan River to the north. A summary of the issues associated with the routes immediately south of the Logan River, as identified within the ECPS, is given in **Table 2.1** below.

**Table 2.1 ECPS Southern Route Findings**

| Link | Positive Finding | Negative Finding |
|---|---|---|
| S6 | • Relates well to future urban areas by separating urban and rural land and activities<br>• Traverses better ground than S7 / S8 near the quarries between Burnside and Rossmanns Roads<br>• Appropriately located to serve future industrial areas near Goldmine and Burnside Roads<br>• Located close to future industrial area of Stapylton, and acts as a buffer between this and Alberton<br>• Less impact on cane lands than S7 / S8 | Passes through a hard rock quarry, owned by Boral, impacting on scarce resources. Traversing the quarry could attract large costs. However, the scale of such costs would be a function of the solution to be determined in conjunction with the planned timescale for extraction |
| S7 | • The report does not detail any specific advantages directly related to this link | • Does not provide a buffer between the future industrial areas and the village of Alberton<br>• Significant severing effects on Alberton community<br>• Greater impact on cane lands than S6<br>• Resides within the lower lying areas more prone to flooding, and consequently noted to pass through "*poor country in terms of foundation conditions and flooding*" (likely to require ground improvement) |
| S8 | • The report does not detail any specific advantages directly related to this link | • Greater impact on cane lands than S6<br>• Resides within the lower lying areas more prone to flooding, and consequently noted to pass through "*poor country in terms of foundation conditions and flooding*" (likely to require ground improvement) |
| S9 | • The report does not detail any specific advantages directly related to this link | • Does not provide a buffer between the future industrial areas and the village of Alberton<br>• Significant severing effects on Alberton community<br>• Greater impact on cane lands than S6<br>• Resides within the lower lying areas more prone to flooding, and consequently noted to pass through "*poor country in terms of foundation conditions and flooding*" (likely to require ground improvement) |
| S10 | • Relates well to future urban areas by separating urban and rural land and activities<br>• Less severance of Alberton community compared to S11 & S12<br>• Mainly traverses higher, stable ground | • Affects a small area of crops |

| Link | Positive Finding | Negative Finding |
|---|---|---|
| S11 | • Mainly traverses higher, stable ground | • Affects a small area of crops<br>• Does not provide a buffer between the future industrial areas and the village of Alberton<br>• Significant severing effects on Alberton community |
| S12 | • Mainly traverses higher, stable ground | • Significant severing effects on Alberton community |
| S14 | • Less impact on the landscape than S16<br>• Less visible from roads than S16<br>• Mainly traverses higher, stable ground<br>• Less costly than S16<br>• Shorter and more direct than S16<br>• Easier to build than S16 due to location out of the floodplain | • Passes near noise sensitive receptors such as Eagleby State School<br>• Highly visible from residential areas<br>• Affects Eagleby State School Playing Fields, residential subdivisions under construction & Lone Pine Sanctuary proposed eucalypt plantation<br>• Significant severing effects on Eagleby community<br>• Greater impact on existing road network than S16<br>• Passes directly through a wetland to the east of Eagleby (foraging habitat for a range of water bird species) |
| S15 | • Impacts lower quality landscape than N4<br>• Less effect on severance of Eagleby community than S14<br>• Can be located to minimise direct impacts on areas that provide foraging habitat for a range of water bird species | • Highly visible from urban areas, roads and rural residential areas |
| S16 | • Less effect on severance of Eagleby community than S14<br>• Can be located to minimise direct impacts on areas that provide foraging habitat for a range of water bird species | • Highly visible from residential areas<br>• More visible from roads than S14<br>• More impact on the landscape than S14<br>• Affects a training track<br>• Traverses unstable (floodplain) alluvial/estuarine soils<br>• Requires two major viaducts to provide for Logan River when in flood (costly)<br>• Affects some cane land on the southern banks of the Logan River<br>• More difficult to build than S14 due to location in floodplain<br>• Passes through wetlands, which are a foraging habitat for a range of water bird species (could be relocated to minimise impact) |
| S17 | • The report does not detail any specific advantages directly related to this link | • The report does not detail any specific disadvantages directly related to this link |

The link numbers highlighted green in **Table 2.1** above were identified as forming the preferred route to the south of Logan River. S6 was deemed preferable to S7 on the proviso that the scarce resources of the Boral quarry (south-west of Rossmanns Road / Burnside Road) could be extracted prior to, or would not be sterilised by, construction. Whilst it was considered that S16 would be considerably more difficult to construct than S14 due to its location within the floodplain, and poor sub-surface conditions, its reduced impact on the community of Eagleby meant that it formed a preferred link.

The overall preferred route to the Logan Motorway was therefore determined to comprise links S6, S10, S15 and S16. However, it was acknowledged that significant issues were still associated with this route, notably:

- High cost
- Construction within the floodplain
- Poor ground conditions
- Loss of cane land on the banks of the Logan River
- Severance to river front properties.

These issues, together with the finding that the route only presented marginal improvements in transport efficiency over existing east-west links, resulted in links S16 and S17 being removed from the scheme, and only a route leading north over the Logan River considered further.

A summary of the issues relating to the routes immediately north of the Logan River is given in **Table 2.2** below. The locations of these routes are illustrated on the map contained within **Appendix A**.

**Table 2.2 ECPS Northern Route Findings**

| Route | Positive Finding | Negative Finding |
|---|---|---|
| N1 | • Least environmentally sensitive river crossing (passes through selectively cleared and residential areas)<br>• Traverses better ground than N7 river crossing | • Less compatible with likely development pattern in Carbrook and Cornubia, than N7 |
| N2 | • Traverses better ground than N7 river crossing | • Passes near noise sensitive receptors such as schools<br>• Partly affects new Calvary College under construction<br>• Highly visible from urban areas, roads and rural residential areas<br>• Less compatible with likely development pattern in Carbrook and Cornubia, than N7 |
| N3 | • Relates well to future urban areas by separating urban and rural land and activities<br>• Affects less cane land than N4<br>• Connects to S6, which forms part of the preferred route to the south of the Logan River | • Affects Alberton cricket ground, and a boat ramp near Logan River<br>• Severance of urban community of Alberton |
| N4 | • Less visible from urban areas, roads and rural residential areas than S15 / N2 | • Does not provide a buffer between the future industrial areas and the village of Alberton<br>• Severance of rural community of Alberton<br>• Impacts higher quality landscape than S15<br>• Affects more cane land than N3 |
| N7 | • Less visible from urban areas, roads and rural residential areas than S15 / N2<br>• More compatible with likely development pattern in Carbrook and Cornubia, than N1 and N2 | • Most environmentally sensitive river crossing, since it bisects the Carbrook Wetlands north of Beenleigh - Redland Bay Road (comprise paperbark open forest)<br>• Affects Redland Bay core koala habitat area<br>• Passes near noise sensitive receptors such as schools<br>• Adjacent to Christian life college, a caravan park, and a ski lake<br>• Traverses poorer ground than N1 or N2 river crossings<br>• Impacts higher quality landscape than S15 |

Despite significant environmental impacts, the preferred route to the north of the Logan River was determined to comprise links N3 and N7 due to reduced cost and better integration with the community.

The overall preferred route was therefore presented as links S6, N3 and N7. However, as noted previously, the incorporation of S6 was dependent upon arrangements in relation to the existing Boral quarry. It was determined that should such arrangements to mitigate the effects on the quarry not be possible, an alternative route via a new link from S6 to N4 and N7 would be preferred. The two preferred routes are highlighted on the map in **Appendix A**.

**Summary of Key Aspects for Logan East Link**

- The width of the corridor was determined to be 100m
- The design speed of the corridor was determined to be 110km/h, with a posted speed of 100km/h
- The issues associated with the links investigated by the ECPS in the vicinity of the Logan River will apply to the options developed for Logan East Link. Options will need to be cognisant of the following concerns in particular:
  - Environmentally sensitive areas such as the Carbrook Wetlands, and koala habitat areas
  - The extent of the floodplain around Logan River, and the associated poor ground conditions that will influence construction costs
  - Local amenities such as schools
  - Severance of communities.

## 2.2 Eastern Corridor Logan River Flood Studies

### 2.2.1 Original Report (1994)

This study was undertaken to provide recommendations for a crossing of the Logan River by the proposed Eastern Corridor. The Corridor alignment roughly followed a north-south line along Alberton Road (south bank) and Ferry Road (north bank).

The report referred to an earlier flood model developed for Logan City Council (LCC), which used a CELLS software model. However, no details of the software or studies were provided.

Connell Wagner developed a more detailed topographic model of the immediate surrounds to the proposed crossing, basically from the Pacific Motorway to mouth of the river. This included additional ground survey and cross-sections for the river and tributaries.

A hydraulic model, using RUBICON software, was established. This software (a Dutch system developed in 1983) was selected by the study consultant. This model is a link/node network model, and had 19 nodes, 25 branches, and 63 separate cross-sections.

Connell Wagner input hydrographs received from LCC as boundary conditions, as well as actual recorded flood levels inside the area, for calibration purposes. The floods of January 1974 and April 1990 were used as reference floods in the calibrations. It was noted that sea level rise did not appear to have any effect on the operation of the model.

A number of concepts for the crossing were tested along the same alignment:

1) 640m long main bridge, plus 650m of 2.4m high, 3.6m span box culverts along the low-lying approaches
2) 640m long main bridge, plus 200m of box culverts along the approaches
3) 360m long main bridge plus 280m of box culverts along the approaches
4) 550m long main bridge plus 280m of box culverts along the approaches

Options 1 and 2 were discounted based upon "hydraulic analysis". Option 3 was deemed to have geotechnical issues, with approach embankments up to 7m high (geotechnical advice was that 5m was the limit for earth embankments on the southern side of the river). It also had roughly double the impact on afflux adjacent to the bridge, which suggests that the opening was not large enough.

The report selected Option 4 as the recommended solution. Examination of the cost estimates, and Summary section of the report, suggests that Option 4 was the cheapest option which did not cause severe afflux.

### 2.2.2 Extension Report (1995)

This report added further links to the model, to allow for the Carbrook Wetlands (Native Dog Creek), which were considered to provide storage in major flood events.

The model was recalibrated using the January 1974 flood information.

Further variations to Option 4 were made, which included excavation of the Logan River cross-section north bank.

The report concluded that, to reduce afflux to negligible levels:

- Excavation is required in the north bank of the river, starting 40m back from the river edge and extending at 1:4 down to bed level at -8.45m Australian Height Datum
- Culvert crossings on the Carbrook Wetlands would need to be 115m$^2$ in effective area.

**Summary of Key Aspects for Logan East Link**

- The modelling was elementary, and is likely to be superseded by more modern software packages like MIKE 21
- Flow velocities approaching scour potential were reported by landowners who witnessed the floods of 1974 and 1990
- The studies indicated that 640m of total length of waterway opening (river and approach embankments) is insufficient to avoid afflux. A total in the order of 850m is more likely to be required
- Flood openings on approach embankments appear necessary, as well as over the main channel
- The study recommended excavation of the river bank to increase flow cross-section. This might not be acceptable on environmental grounds
- The Average Recurrence Interval (ARI) 10,000 year event flood levels are around 6.7m at the proposed crossing, 7.3m at the Albert River confluence, and 9.85m at the Pacific Motorway. (The study had the Finished Surface Level of the road approaches at approximate Reduced Level 5m, so the road was overtopped by over 1m of water in such an event).

## 2.3 South Coast Motorway Impact Assessment Study (1995)

The Impact Assessment Study (IAS) states that in 1992 the government announced that the ECPS preferred route (refer to **Section 2.1)** from Beenleigh-Redland Bay Road to the Coomera River would be adopted, and that detailed investigations for preservation of the corridor would be required. The IAS presents the findings of these investigations.

> **The Terms of Reference for the IAS referred to the preferred and alternative routes identified within the ECPS between Goldmine Road and the Logan River (refer to Appendix A). It highlighted that the alternative alignment (N4) would have a major impact on cane lands, and should only be considered if the impact assessment process proved that the inland alternative (S6 / N3) was not viable.**

The proposed motorway adopts a corridor width of 100m, and a design speed of 110km/h in line with the ECPS. However, minor deviations to the ECPS route were undertaken in order to minimise impacts on residential properties, cane land and rural business. The resulting alignment was developed to a sufficient level of detail to enable resumption boundaries to be identified. This incorporated the design of:

- A toll plaza interchange at Beenleigh – Redland Bay Road
- Crossings of Logan River and Rotary Park Road
- Closure of Zipfs Road
- Realignment of Alberton Road
- An interchange with Stapylton – Jacobs Well Road.

The ECPS alignment was also adapted by relocating it to the west to provide a better approach to the Carbrook Wetlands, resulting in a reduced impact on the more valuable parts of the wetlands. Furthermore, the use of link S6 within the ECPS preferred route (refer to **Section 2.1.3**) was made viable by allowing for the Boral quarry operations to continue via an underpass beneath the motorway. The final alignment of the South Coast Motorway can be seen on the map in **Appendix A** in relation to the ECPS preferred route which comprised links S6, N3 and N7.

The report draws upon the results of the Eastern Corridor Logan River Flood Studies (refer to **Section 2.2**), noting that the bridge works would have minimal effects on afflux and flood behaviour. However, it comments that the local community had not accepted the proposed solution, and that further investigations would be required in conjunction with negotiation with the relevant Local Authorities. Additionally, the positioning of the motorway within the floodplain of the Logan River results in the road being elevated in the order of three to four metres on embankment.

The report confirms that there is very little native vegetation in the area between the Logan River and Nerang due to clearing for sugar cane, and that no rare, threatened or vulnerable plant species would be affected by the corridor. However, a wetland area is identified to the south of Beenleigh – Redland Bay Road which is considered to represent a large and significant habitat for a number of water bird species, including the rare black-necked stork, and should therefore be protected.

In relation to cultural heritage, the proposed motorway alignment is documented as destroying two small Aboriginal stone artefact scatters located NR NR.

The impact of the motorway on properties was also considered. Air quality was anticipated to be within acceptable standards, but noise barriers were recommended adjacent to any residential properties. Individual property impacts between Beenleigh - Redland Bay Road and Stapylton - Jacobs Well Road were also considered. The affected properties are summarised below:

- Three residential dwellings
- Carbrook Golf Club (relocation of five greens and four tees required)
- Alberton Cricket Ground (additional land would be required for the ground to remain useable)
- A horse stud
- A metal fencing works at the Stapylton – Jacobs Well Road intersection.

The IAS also discusses the Rocky Point Sugar Industry, noting that it is primarily located on the low-lying area between the Logan and Pimpama Rivers, as well as in small pockets at Eagleby and Alberton. The area is considered to be suited to sugar cane growing due to its flat profile, poor drainage, and the frequency of flooding. The motorway alignment was positioned to lie along the western edge of the core cane land. It was determined that whilst some cane land would be affected by the corridor, the Rocky Point Mill would remain viable.

**Summary of Key Aspects for Logan East Link**

The issues raised through the development of the IAS will be relevant to any Logan East Link options that are considered along the same north-south route, in particular:

- The importance and extent of wetlands between Logan River and Beenleigh – Redland Bay Road
- The location and type of properties affected
- The presence of poor ground conditions, and the likelihood of flooding
- The sensitivity of the Logan River crossing in relation to the local population
- The location of an Aboriginal Cultural Heritage site.

## 2.4 Modified South Coast Motorway & South East Connector (1996)

This report was prepared by Queensland Transport in response to community concerns regarding the location of the South Coast Motorway (refer to **Section 2.3**), specifically where it crosses Brisbane's southern suburbs, and Daisy Hill forest. It also provides comment on the South East Connector, which connects the South Coast Motorway with Nerang – Broadbeach Road, but this is outside of the Logan East Link study area, and has therefore not been included in the text below).

The report consequently considers an alternative option for the South Coast Motorway, limiting its length by providing a northern connection to the Pacific Motorway and Logan Motorway, rather than extending through the Daisy Hill forest towards the Gateway Motorway. This is similar to link S16 considered within the ECPS.

Three options for this alternative route were considered, and are shown on the map in **Appendix A**:

- Option 1
  - This option follows the South Coast Motorway alignment to Stapylton – Jacobs Well Road before heading north-west towards Eagleby, along the floodplains of the Logan River. Prior to the deviation the alignment crosses the Boral quarry.
- Option 2
  - This option diverges from the Option 1 alignment at Burnside Road, passing to the west of the Boral quarry, and to the east of another operating quarry, before joining Option 1 at Rotary Park Road, and heading to Eagleby.
- Option 3
  - This option also diverges from the Option 1 alignment at Burnside Road, but passes to the west of both the Boral quarry and the other operating quarry along a short, but very high ridge, before joining the Option 1 at Enkelmanns Road, and heading towards Eagleby.

The report notes that two major river crossings are required within all of the options at the Albert and Logan Rivers. Additionally, in order to avoid the community of Eagleby, all of the options traverse the floodplains of the Logan River, resulting in the need for 3km of bridging to provide flood immunity for a 50 year ARI (Q50).

All three options were identified as passing through or near wetlands to the north of the Albert River, which provide foraging habitat for a range of water bird species. However, it is noted that the impact could be minimised by modifying the alignment, and through careful positioning of bridge structures.

The route was aligned to avoid the Eagleby community, but it was determined that this may impact upon the visual amenity of communities on both sides of the Logan River. It was considered that residents may also be concerned about restricted access to the rivers. Extensive landscaping and ready access to the river beneath the bridging structures would be required.

The route also affects approximately 39 hectares of cane land, with a significant impact on individual farmers. However, this route has a far lesser impact on the Rocky Point Mill Cane Area given that the abandoning of the original South Coast Motorway alignment would return 38ha of cane land to the industry.

The report concludes that if the previously proposed northern section of South Coast Motorway does not go ahead, then the modified route towards the Logan Motorway still has a number of significant benefits to the community:

- Greater accessibility to future urban areas between Beenleigh & the Gold Coast
- Provides a necessary element in the future urban structure of the area.

The report recommends that a toll sensitivity study is undertaken together with an IAS for the route between Burnside Road and the Logan Motorway.

**Summary of Key Aspects for Logan East Link**

- A connection to the Logan Motorway is still considered a viable option that requires further investigation
- Further consideration may be needed regarding the route near the existing quarries.

## 2.5 Integrated Regional Transport Plan (1997)

In accordance with the Integrated Regional Transport Plan (IRTP), 1997 for South East Queensland, reference was made under Chapter 8: Part B: Shaping the future transport system – major road corridors held in reserve.

This chapter identified the southern portion of the 'South Coast Motorway Corridor / Smith Street Connector' from Beenleigh – Redland Bay Road to Nerang – Broadbeach Road is to be retained and protected pending investigation of future transport needs.

Although this corridor was originally approved by a Cabinet decision in 1995, a bi-partisan agreement was later reached to change the corridor such that it commenced at Stapylton – Jacobs Well Road (not Beenleigh – Redland Bay Road).

This corridor from then onwards is now known as the Intra-Regional Transport Corridor.

## 2.6 Southern Moreton Bay Draft Marine Infrastructure Master Plan (2009)

This Master Plan aims to facilitate and control the orderly development of marine aspects of the Southern Moreton Bay area.

The draft Master Plan area extends from Oyster Point to Southport, and from the landward side of Stradbroke Island to the Pacific Motorway. The focus of the draft Master Plan is the marine environment, and adjacent dry land. As a result, the area of interest, and detail provided, do not extend up the Logan River as far as the Logan East Link project area, and IRTC.

It is noted that the IRTC is shown on maps within the draft Master Plan, extending from near the Logan River, south to Helensvale.

The Master Plan does mention the Lower Logan River area. Items of interest include:

- An existing extractive industry is identified on the south bank near the mouth
- A Broad Investigation Area (potential area for consideration of Marine Development Areas) is shown along the whole lower reaches of the river, extending further on the southern side
- Comment was made that Logan City Council had identified an area on the northern side of the river as future potential as a marina site (including commercial and recreational facilities)
- The Master plan identifies a Marine Development Area on the south side of the river (30 hectares, 300 wet berths) on the existing extractive industry site
- A No-Go zone (koala habitat) is identified on the northern side of the river.

**Summary of Key Aspects for Logan East Link**

The draft Marine Infrastructure Master Plan does not contain any requirements which would impact the concepts for the Logan East Link.

## 2.7 Intra Regional Transport Corridor – Northern Section (2010)

This report details the factors taken into consideration in the development of Road Corridor Development Planning (RCDP) Plans for the Intra Regional Transport Corridor – Northern Section (IRTC) between Stapylton – Jacobs Well Road and Beattie Road. This required the review and update of the 1995 South Coast Motorway alignment (refer to **Section 2.3**) to ensure that it met with current design standards, such that the corridor extents could be defined for future preservation. Additionally, it required the design to tie in with the previous RCDP undertaken for the IRTC – Southern Section, which extended between Beattie Road and Nerang – Broadbeach Road.

The report notes the function of the IRTC as forming the primary arterial for local traffic between the Gold Coast, and ultimately Logan and Brisbane. It also identifies the Yatala Enterprise Area Local Area Plan as having a direct influence on the location of the IRTC.

Discrepancies between the data arising from two different traffic models were identified, which meant that the required capacity of the IRTC could not be determined. As a result, the corridor was based upon the previous ultimate planning for a six lane motorway (four general lanes and two High Occupancy Vehicle (HOV) lanes). The dimensions within the six lane cross section are noted as conforming to the Road Planning and Design Manual (RPDM), with the exception of the elements listed in **Table 2.3** below, which were adopted to match the previous planning for the IRTC – Southern Section:

**Table 2.3 Non-Standard IRTC Dimensions**

| Element | RPDM | RCDP |
|---|---|---|
| Lane Width (Inner) | 3.7m | 3.5m |
| HOV Buffer Width | 1.0m | 1.2m |
| RH Shoulder Width Adjacent to HOV Lane | 3.5m | 3.0m |

Notes: m = metres

The report states that the lane width and buffer should be amended during subsequent design stages to meet the standards, noting that this does not affect the overall cross sectional width. However, it notes that the reduced shoulder width would impact upon the ability of the police to use the shoulder for enforcement of the correct use of the HOV lane. An assumption is made that alternative means of enforcement would be available in the future that would negate the need for the wide shoulder.

In determining an optimal alignment for the IRTC, two options were considered and the key features reported on, between Goldmine Road and Stapylton – Jacobs Well Road. These were similar to links S6 / N3 and N4 within the earlier ECPS. A western option was designed predominantly along the line of the South Coast Motorway, with an eastern option located approximately 1km to the east. The key features of the two alignments are presented in **Table 2.4** below.

**Table 2.4 IRTC Option Comparison**

| Comparison Criteria | Western Alignment | Eastern Alignment |
|---|---|---|
| Route | Adopted Environmental Impact Assessment alignment | Investigative alternative alignment |
| Interface with the Yatala Enterprise Area | Severs the Yatala Enterprise Area | Immediately to the east of the eastern boundary of the Yatala Enterprise Area |
| Interface with the Boral Quarry | Bisects the Boral Quarry, which could require extensive, and costly, earthworks cuttings depending upon its future use and level | Avoids the Boral Quarry |
| Interchanges | One interchange is required north of Goldmine Road at Burnside Road. | Option that no interchanges are required north of Goldmine Road. The point at which the IRTC alignment crosses Burnside Road is very close to the intersection at Stapylton-Jacobs Well Road which makes an interchange at that location difficult. |
| Local road connectivity | Quinns Hill Road East is severed.<br><br>Access to the IRTC and surrounding network is provided via Woolshed Road, Burnside Road, and Stapylton-Jacobs Well Road. | Connectivity between Burnside Road and Quinns Hill Road East is removed.<br><br>Connectivity between Burnside Road and Jacosa Road is removed. Access to the IRTC and surrounding network is provided via Woolshed Road, Burnside Road, and Stapylton-Jacobs Well Road. |
| No. of Structures | Four bridges are required at:<br>- Rossmanns Road over the IRTC<br>- Sandy Creek<br>- Burnside Road over the IRTC<br>- Halfway Creek | Two bridges are required at:<br>- Burnside Road over the IRTC<br>- Sandy Creek<br>The eastern alignment runs to the east of Rossmanns Road and the waterway network such that it avoids the need for two bridges. |

The outcome of the review of the two options was that the western alignment was documented on the RCDP Plans. However, it was determined that the eastern alignment represented a viable alternative that may need to be considered during future stages of the project.

Whilst the northern limit of the IRTC was Stapylton – Jacobs Well Road, requiring an at-grade intersection between the two roads, an ultimate interchange layout was also developed to allow for the possibility of the continuation of the route to the north in the future.

The report states that the IRTC was designed to provide flood immunity for a 100 year ARI, with the flood level 300mm below the edge line of the outside through lane.

**GCCC MIKEFLOOD Logan River Hydraulic Model**

The GCCC Logan River hydraulic model ('Logan River model'), in conjunction with the GCCC Coomera River hydraulic model, was used in the preliminary estimation of the 100 year ARI flood-line for the IRTC. The Logan River model consists of the 2D MIKE21 model, encompassing the major waterways (Logan and Albert Rivers) and numerous minor waterways, as well as having the ability to delineate the differing overland flow paths associated with various rainfall events. The extent of the model is from the upper Logan River reaches above the Pacific Motorway down to the Gold Coast Broadwater.

Within such a large model domain, there are a number of catchments and associated waterways. Each catchment will have its own critical duration for the determination of maximum surface water elevations for a particular design storm event (ie: in this case the 100 year ARI event). As such, the Logan River model is able to provide a composite mapping of maximum Q100 surface water levels for the area pertinent to the Logan East Link.

Furthermore, the Logan River model is also able to estimate:

- Water velocity (direction and magnitude)
- Overland flowpaths
- Impacts to the hydraulic regime as a result of waterway crossings.

**Summary of Key Aspects for Logan East Link**

- Two IRTC alignment options may need to be considered at the southern limit of Logan East Link
- The cross section for Logan East Link may need to match that of the IRTC, which matches that of the IRTC – Southern Section, for consistency.
- It is envisaged that, as the GCCC Hydraulic Model is an improved hydraulic representation over previous models, the impacts associated with the proposed Logan East Link will be able to be estimated with a greater degree of confidence.

# 3.0 Conclusion

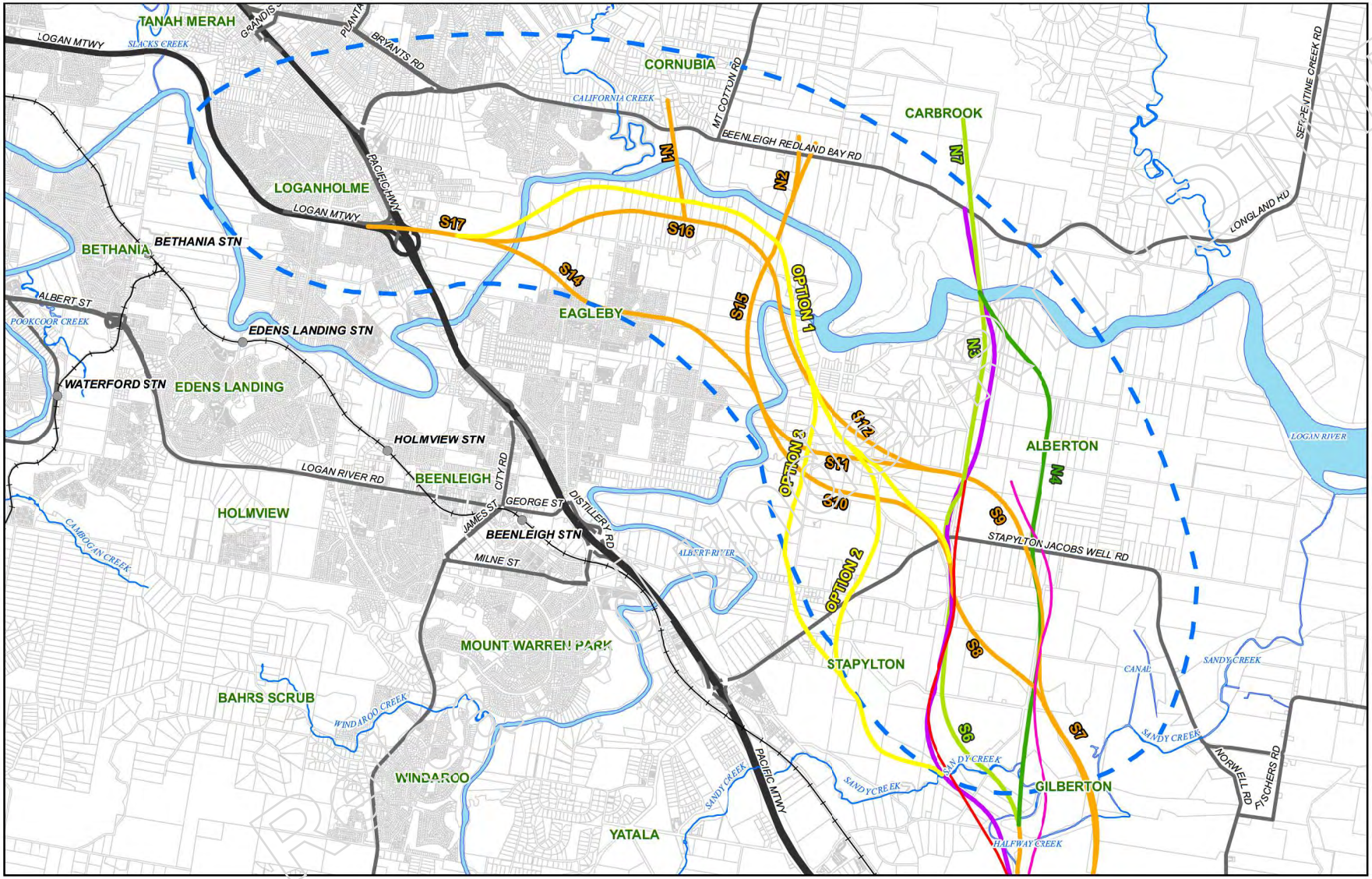
A number of reports have been written between 1992 and 2010 concerning the provision of a new north-south corridor to the east of the Pacific Motorway. Whilst the extents of the schemes within each report varied, a number of recurring themes were evident:

- The required corridor width is 100m, and should comprise a six lane motorway that ties into either of the IRTC options
- To the north of the IRTC, the alignment could travel north across the Logan River towards Beenleigh – Redland Bay Road or to the west towards the Logan Motorway. Either direction has issues
- A number of wetlands are present in the vicinity of the Logan and Albert rivers that provide habitat to several water bird species. The Carbrook Wetlands to the north of the river are of particular significance
- Logan River has an extensive floodplain, with associated poor sub-surface conditions, which will be costly to cross. A crossing of the river has been perceived by the public to cause afflux and flooding issues
- The presence of an Aboriginal Cultural Heritage site.

The above themes will need to be considered in the development of route options for Logan East Link.

Appendix A

# Previous Route Options




AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- ECPS PREFERRED ROUTE - ALTERNATIVE 1992
- ECPS PREFERRED ROUTE 1992
- ECPS ROUTE OPTIONS 1992
- SOUTH COAST MWAY 1995
- MODIFIED SOUTH COAST MOTORWAY OPTIONS 1996
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Route options - Eastern Corridor Planning Study, Rankine and Hill 1992.
South Coast Motorway,Southern Section, Impact Assessment Study, Connell Wagner 1995.
IRTC Road Corridor Development Planning, AECOM 2010
Modified South Coast Motorway and South East Connector, Queensland Transport, 1996

# Logan East Link Route Investigation

## Previous Route Options

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -1/2/2011 |
| VERSION: | 3 |

Map A

A3 size



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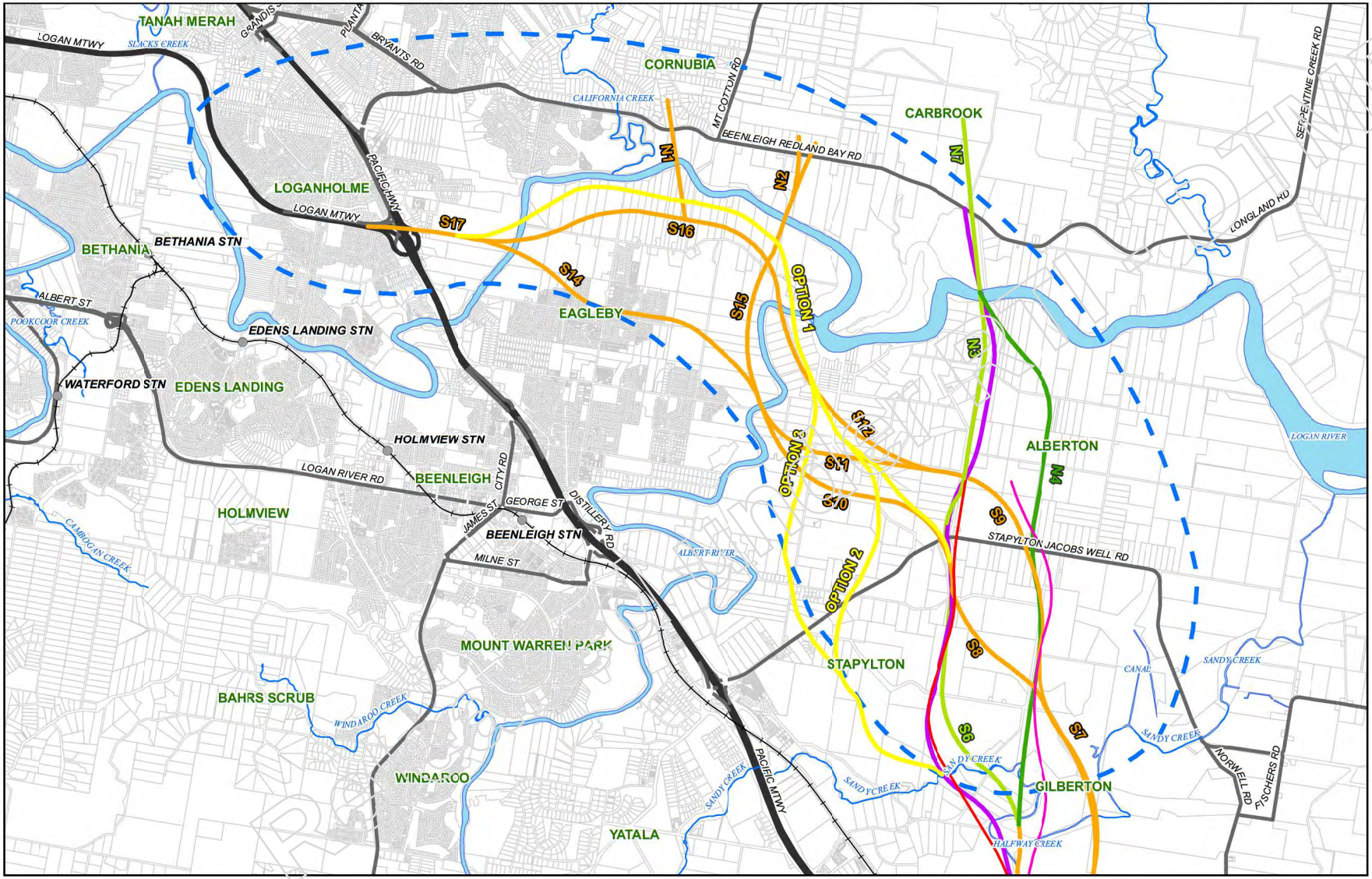
Appendix B

# Mapping




AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- ECPS PREFERRED ROUTE - ALTERNATIVE 1992
- ECPS PREFERRED ROUTE 1992
- ECPS ROUTE OPTIONS 1992
- SOUTH COAST MWAY 1995
- MODIFIED SOUTH COAST MOTORWAY OPTIONS 1996
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Route options - Eastern Corridor Planning Study, Rankine and Hill 1992.
South Coast Motorway,Southern Section, Impact Assessment Study, Connell Wagner 1995.
IRTC Road Corridor Development Planning, AECOM 2010
Modified South Coast Motorway and South East Connector, Queensland Transport, 1996

# Logan East Link Route Investigation

## Previous Route Options

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -1/2/2011 |
| VERSION: | 3 |

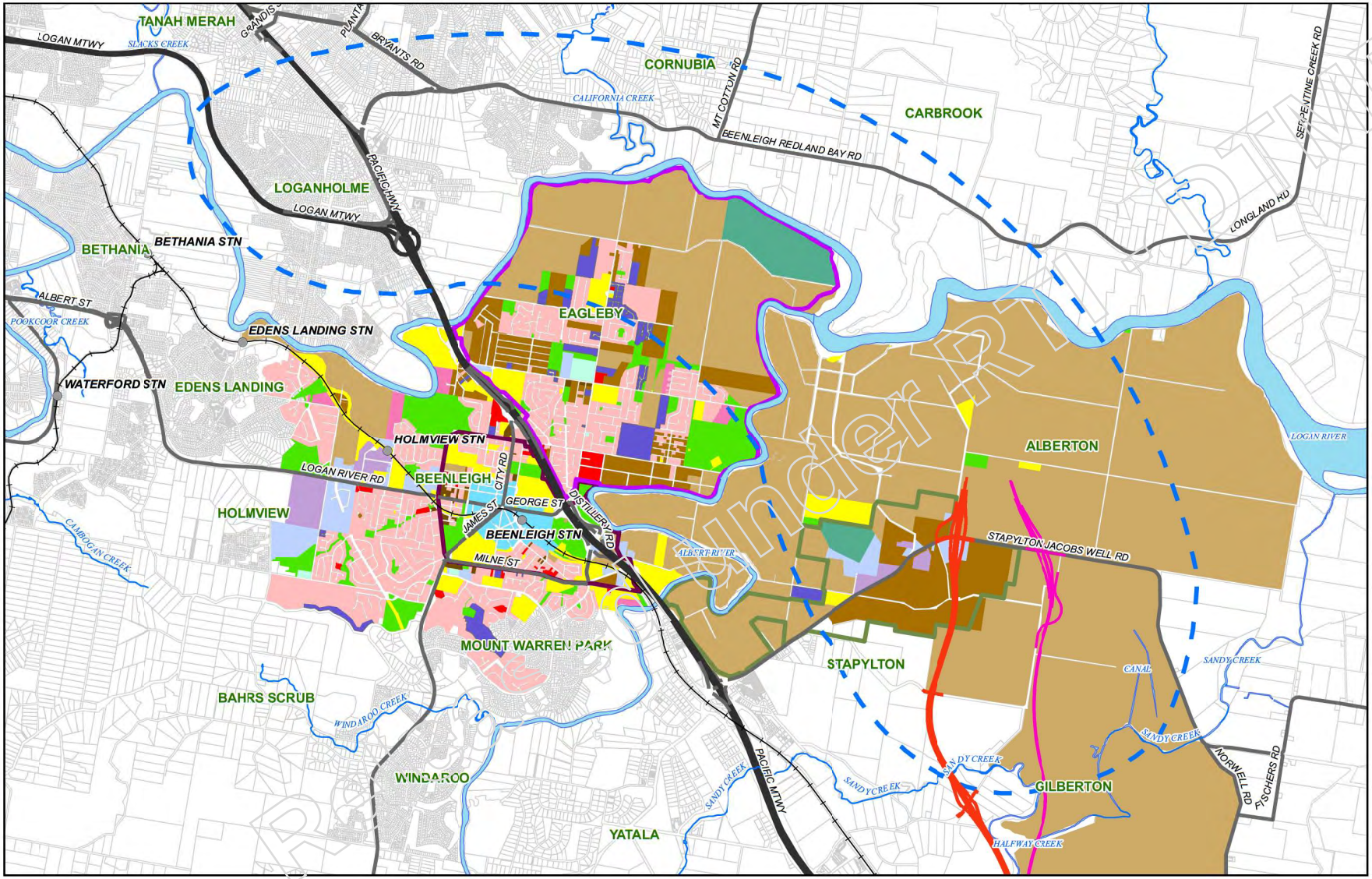
Map

A

A3 size



J:\Projects\60186998\4. Tech Work Area\4.7 GIS\Workspaces\FINAL\previous_route_options.mxd




AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- Yatala Enterprise Area
- Eagleby LAP
- Beenleigh Town Centre

**Gold Coast City Council Zonings**

- Commercial Industry
- Comprehensive Development
- Extractive Industry
- Future Urban
- General Industry
- Local Shopping
- Park Residential
- Public Open Space
- Residential A
- Residential B
- Residential Multi-unit
- Rural
- Special Facilities, Special Purposes
- Special Residential
- Unzoned
- Waterfront Industry
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM, QLD 2010
Zoning - GCCC
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Gold Coast City Council Zonings

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -30/11/2010 |
| VERSION: | 2 |

Map **B**

A3 size



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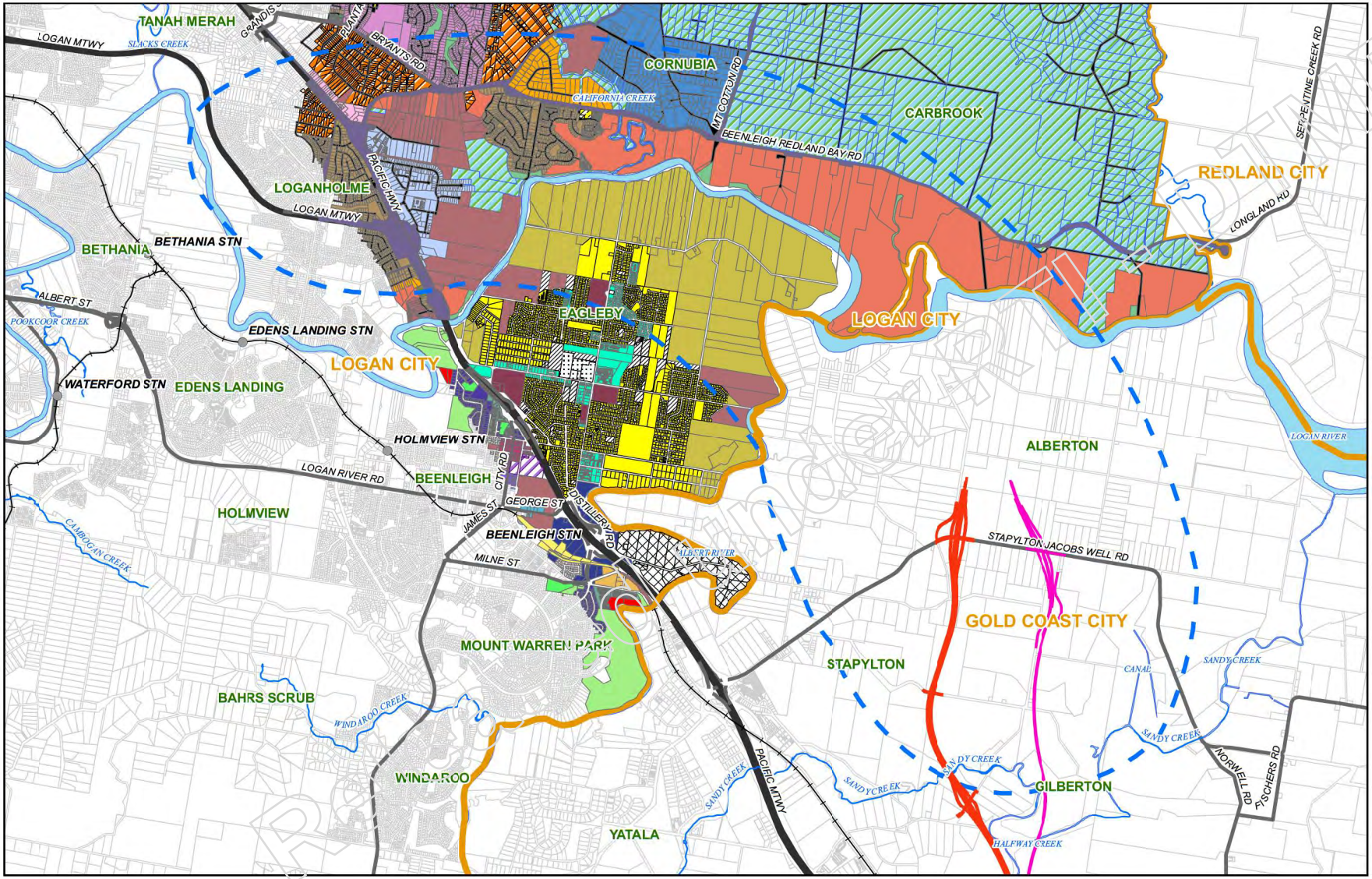


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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West

**Logan City Council Zoning**

- BTC City Heart Precinct 1A
- BTC City Heart Precinct 1B
- BTC Education Precinct 8
- BTC Inner-city North Precinct 6A
- BTC Parklands & Recreation Precinct 7
- BTC River Gateway Precinct 9
- BTC Southpoint Precinct 10
- BTC Town Centre Mixed Residential Precinct 11
- BTC Traditional Residential Precinct 12
- Conservation Sub Areas
- E Commercial/Ecoromic Development Sub Precincts
- E Community Purposes Precinct 3
- E Low Density Residential Sub Precincts
- E Medium Density Residential Sub Precincts
- E Public Open Space Precinct 4
- E Twin Rivers Greenbelt Sub Precincts
- GC Community Purposes Domain
- GC Detached Dwelling Domain
- GC Local Business Domain
- GC Not Domained Domain
- GC Park Living Domain
- GC Public Open Space Domain
- GC Residential Choice Domain
- GC Rural Domain
- Local Business Zone
- Loganholme Sub Areas
- Multiple Zones
- Non Urban Sub Areas
- Public Open Space Sub Area 1 Zone
- Residential 1000 Zone
- Residential 10000 Zone
- Residential 2000 Zone
- Residential 250 Zone
- Residential 5000 Zone
- Residential 5000-1 Zone
- Residential 600 Zone
- Shailer Park Sub Areas
- Transport Major Road Zone
- Transport Minor Road Zone
- Unzoned
- Study area
- Local Government Area boundaries
- Railway line
- Highway
- Main road
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM, QLD 2010
Zoning - LCC
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Logan City Council Zoning

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -9/2/2011 |
| VERSION: | 3 |

Map **B1**

A3 size



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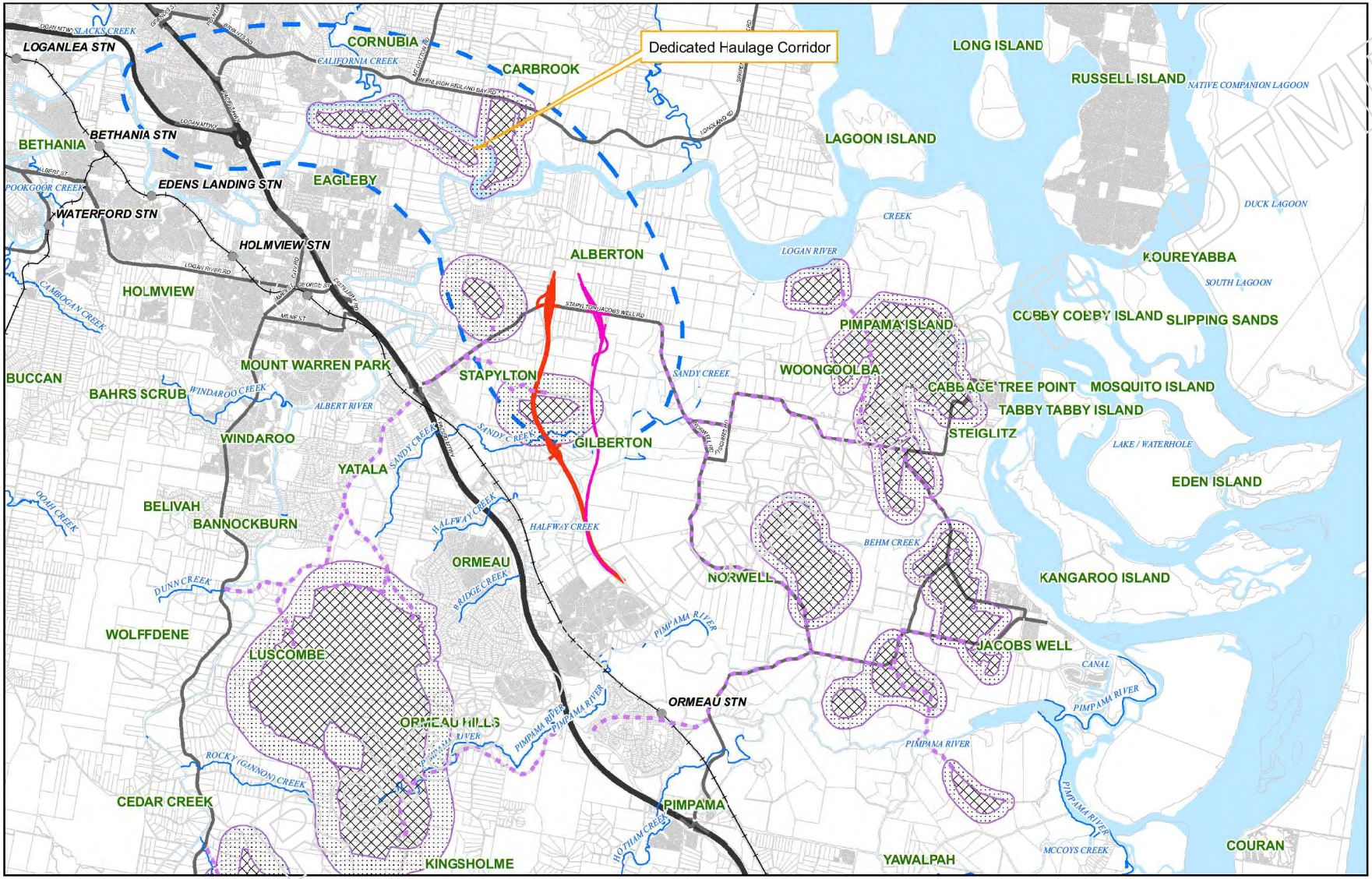


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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 1,400 2,800 5,600

Metres

1:90,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Separation Area
- Resource/Processing Area
- Transport Route Centreline
- Railway line
- Highway
- Main road
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Key Resource Areas

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 06/12/2010 |
| VERSION: | 1 |

Map C

A3 size



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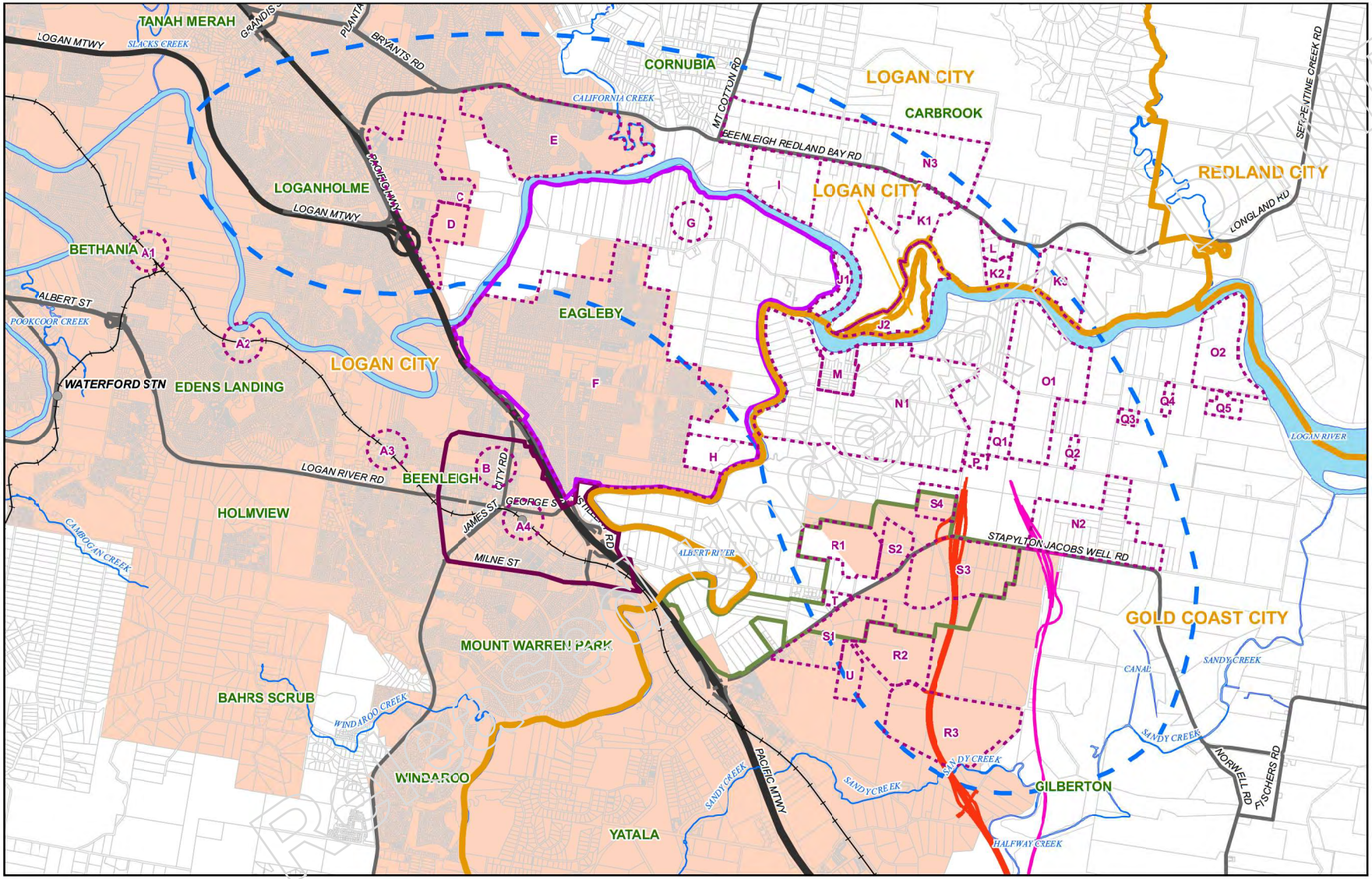
A1 - A4 - Train Stations
B - Beenleigh Town Centre
C - Loganholme Industrial Area
D - LCC Water Pollution Control Works
E - Cornubia Residential Development
F - Eagleby Urban Centre
G - Eagleby Flood Plains
H - Beenleigh Water Reclamation Plant and Olivers Sport Complex
I - Education Precinct
J1 - J2 - Environmental Values
K1 - K3 - Recreation Areas
L - Aquatic Gardens Caravan Park




M - Significant Residential Development
N1 - N3 - Large Lot Residential
O1 - O2 - Prawn Farms
P - Alberton Cricket Pitch
Q1 - Q5 - Stud/Practice Racetracks
R1 - R3 - Quarry/Extractive Industry
S1 - S4 - Industrial Uses
T - Crematorium and Memorial Garden
U - Stapylton Landfill Facility and Recycling Centre

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DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- Zones
- LGA
- Yatala Enterprise Area
- Eagleby LAP
- Beenleigh Town Centre
- Property Boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM, QLD 2010
Zoning - GCCC
Urban footprint - OUM Regional Plan
LGA boundaries - DERM
IRTC Road Corridor Development Planning, AECOM 2010

**Logan East Link Route Investigation**

**Existing Uses**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -30/11/2010 |
| VERSION: | 2 |

Map **D**

A3 size



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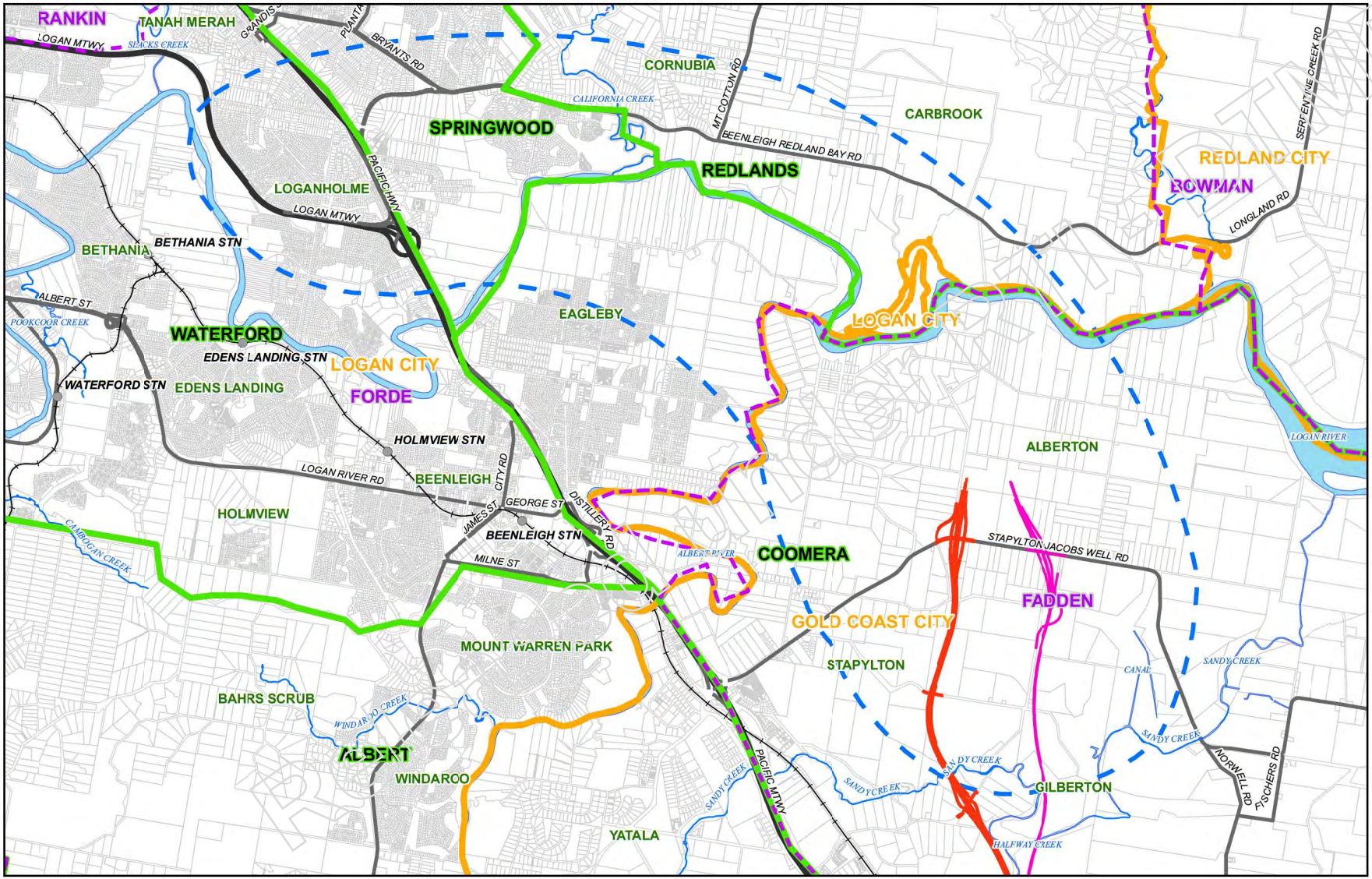


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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- Federal Electoral Boundaries
- State Electoral Boundaries
- Local Government Area boundaries
- Property boundaries

Data sources:

Base Data: (c) StreetPro
Electorate boundaries - Department of Transport and Main Roads (2009)
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## State and Federal Electoral Boundaries

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 2/2/2011 |
| VERSION: | 3 |

Map **E**

A3 size



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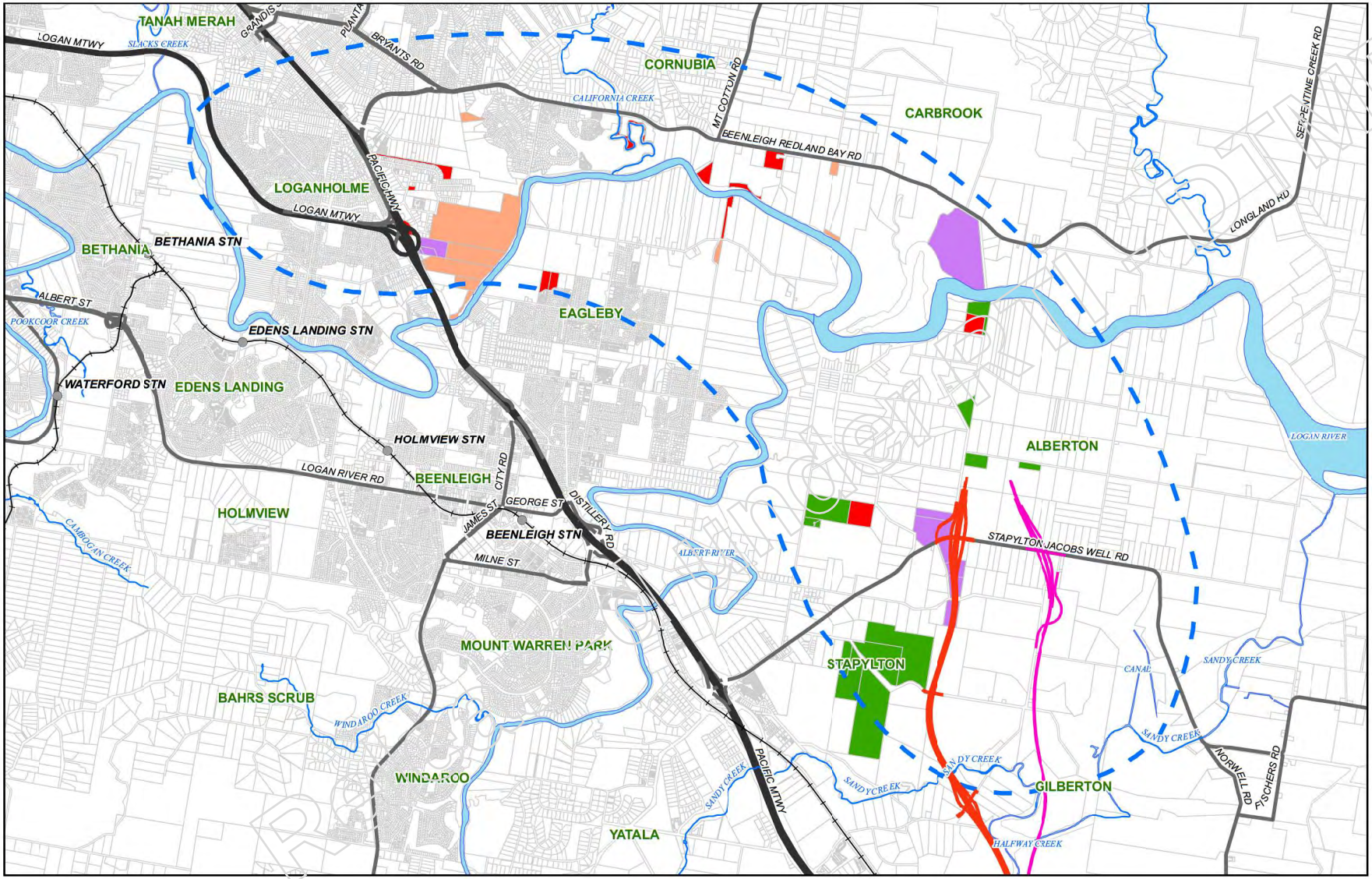


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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- GCCC
- Government (other)
- LCC
- TMR
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Tenure - GCCC
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Tenure / Ownership

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -2/2/2011 |
| VERSION: | 3 |

Map **F**

A3 size



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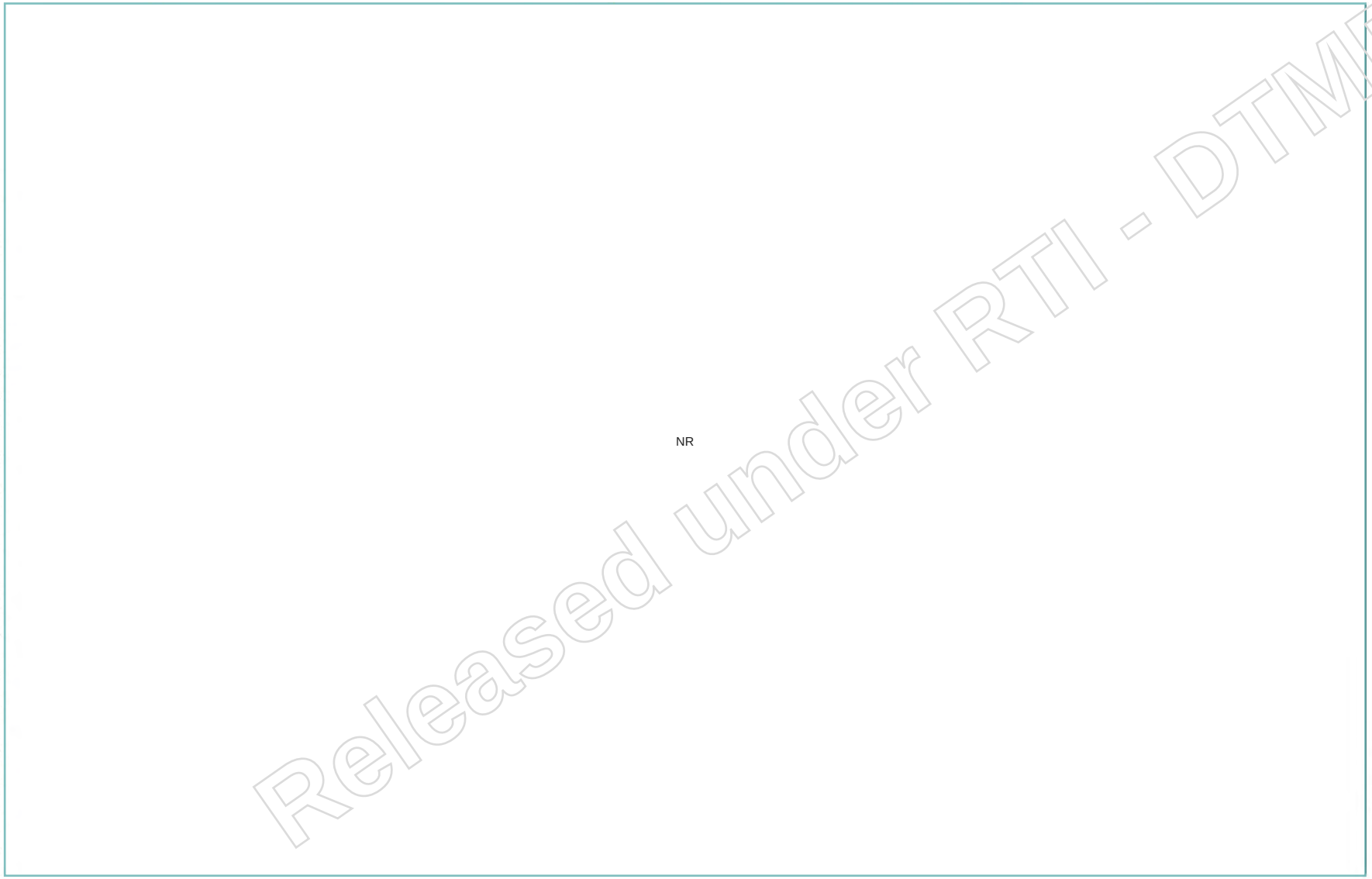


AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- Historic site
- Directory of Important Wetlands
- Wetlands
- Strategic cropping land
- Remnant vegetation
- High Value Regrowth
- Conservation Parks
- Wetlands
- Ramsar Wetlands
- Aboriginal cultural heritage artefact
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB, Regional Ecosystem, Strategic Cropping Land, Wetlands, Ramsar Wetlands, Historic sites, High Value Regrowth, Aboriginal Cultural Heritage - DERM, QLD 2010
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Environmental Constraints

### Map 1 of 2

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -30/11/2010 |
| VERSION: | 2 |

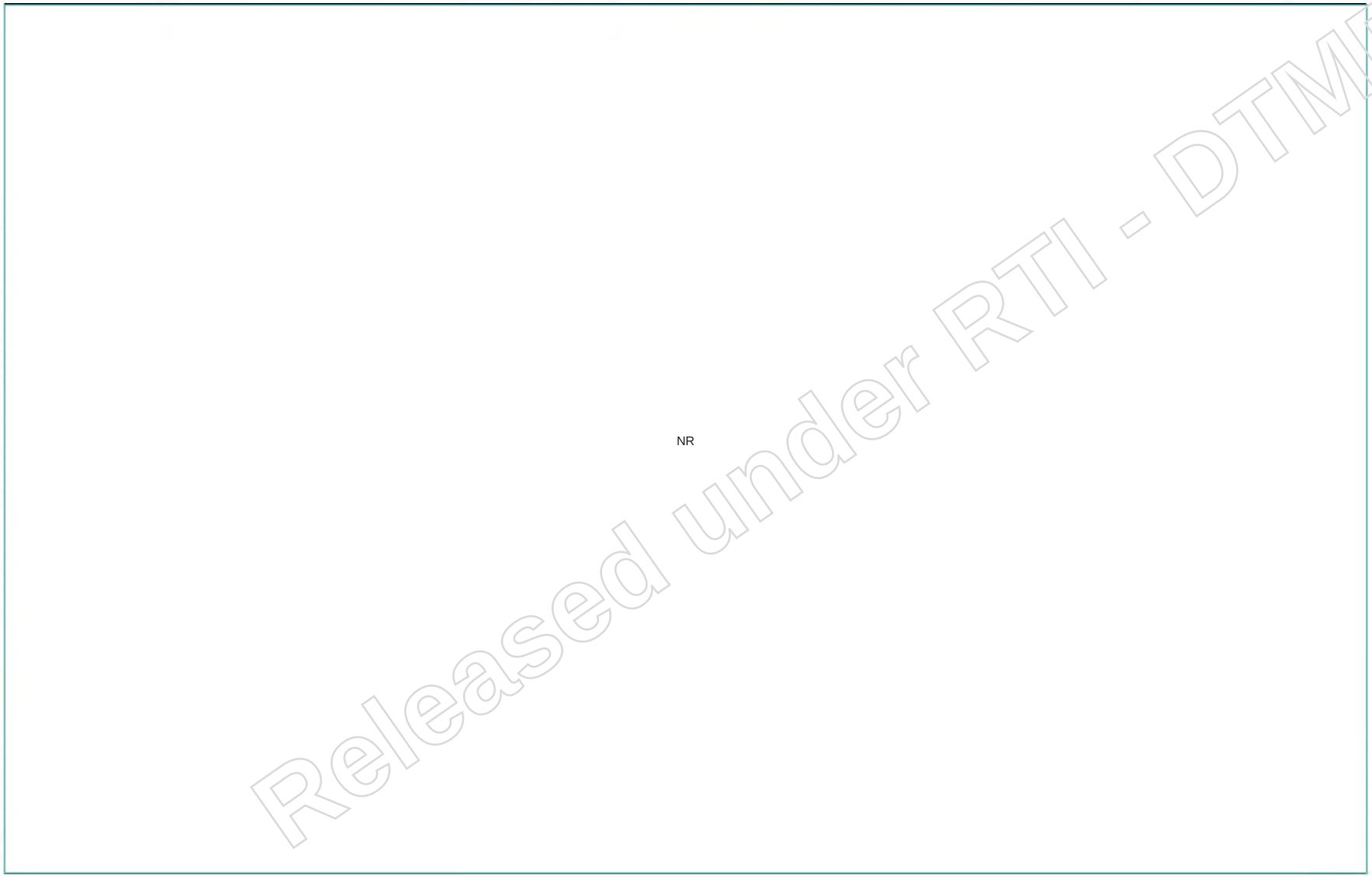
Map G1

A3 size





J:\Projects\60186998\4. Tech Work Area\4.7 GIS\Workspaces\FINAL\environmental_opps_and_constraints.mxd

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N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- Historic site
- Vegetation Management Act Essential Species Record
- Essential Habitat

**Koala Habitat Value Category (SPP and SPRP)**

**Bushland Habitat**

- High Value Bushland
- Medium Value Bushland
- Low Value Bushland

**Suitable for Rehabilitation**

- High Value Rehabilitation
- Medium Value Rehabilitation
- Low Value Rehabilitation
- Priority Koala Assessable Development Areas under SPRP
- Aboriginal cultural heritage artefact
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB, Koala Habitat, Essential Habitat, Historic sites,
Essential Species Aboriginal Cultural Heritage - DERM, QLD 2010
Native Title - Geoscience Australia - 05/10/2010
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Environmental Constraints

### Map 2 of 2

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -13/12/2010 |
| VERSION: | 2 |

Map
**G2**

A3 size



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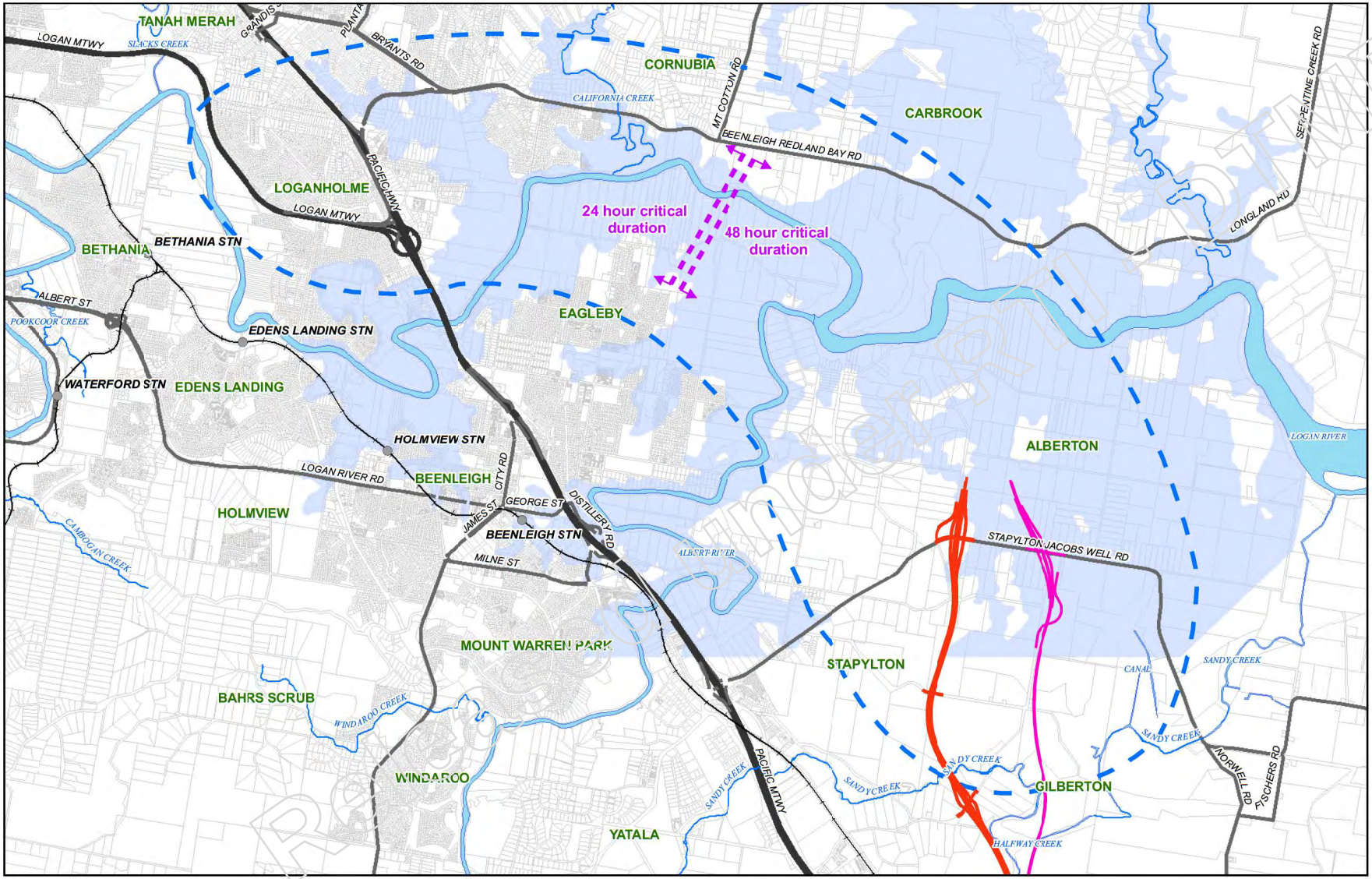


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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Railway line
- Highway
- Main road
- Q100 Flood Extent
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Q100 Flood Extent

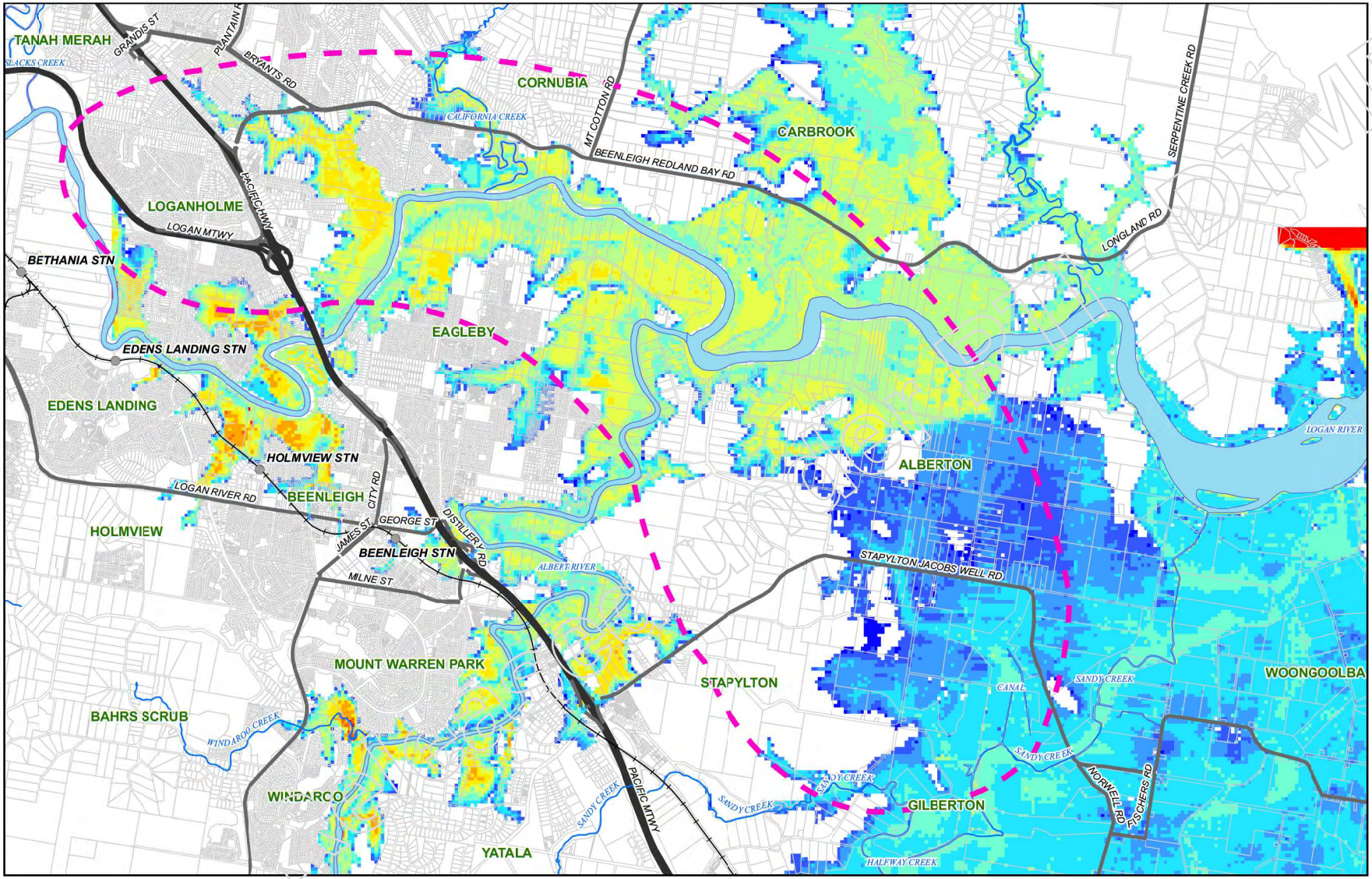
| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB -11/11/2010 |
| VERSION: | 2 |

Map H

A3 size



J:\Projects\60186998\4. Tech Work Area\4.7 GIS\Workspaces\FINAL\Q100.mxd




AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries

**Surface Water Elevation (m AHD)**

- 0.0002 - 0.1
- 0.1 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 7.5
- 7.5 - 8

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC

**Logan East Link Route Investigation**

**Existing Water Surface Elevation (mAHD)**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB/SB |
| LAST MODIFIED | SB - 20/12/2010 |
| VERSION: | 1 |

Map **H1**

A3 size



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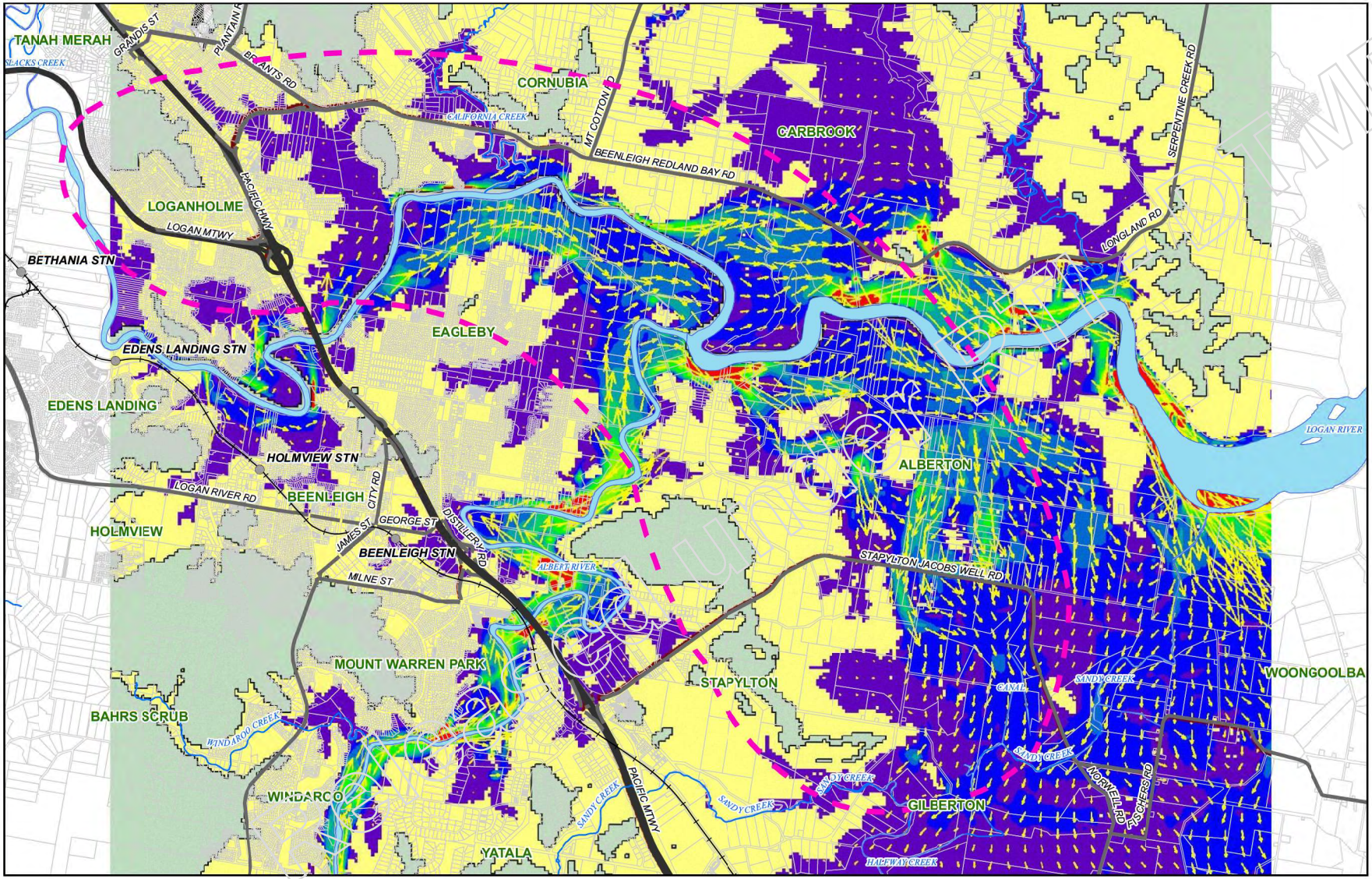


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries

**Current Speed (m/s)**

- Above 0.8
- 0.7 - 0.8
- 0.6 - 0.7
- 0.5 - 0.6
- 0.4 - 0.5
- 0.3 - 0.4
- 0.2 - 0.3
- 0.1 - 0.2
- 0.0 - 0.1
- Below 0.0
- 1 m/s

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC

## Logan East Link Route Investigation

## Velocity - Existing

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 2/2/2011 |
| VERSION: | 1 |

Map **H2**

A3 size



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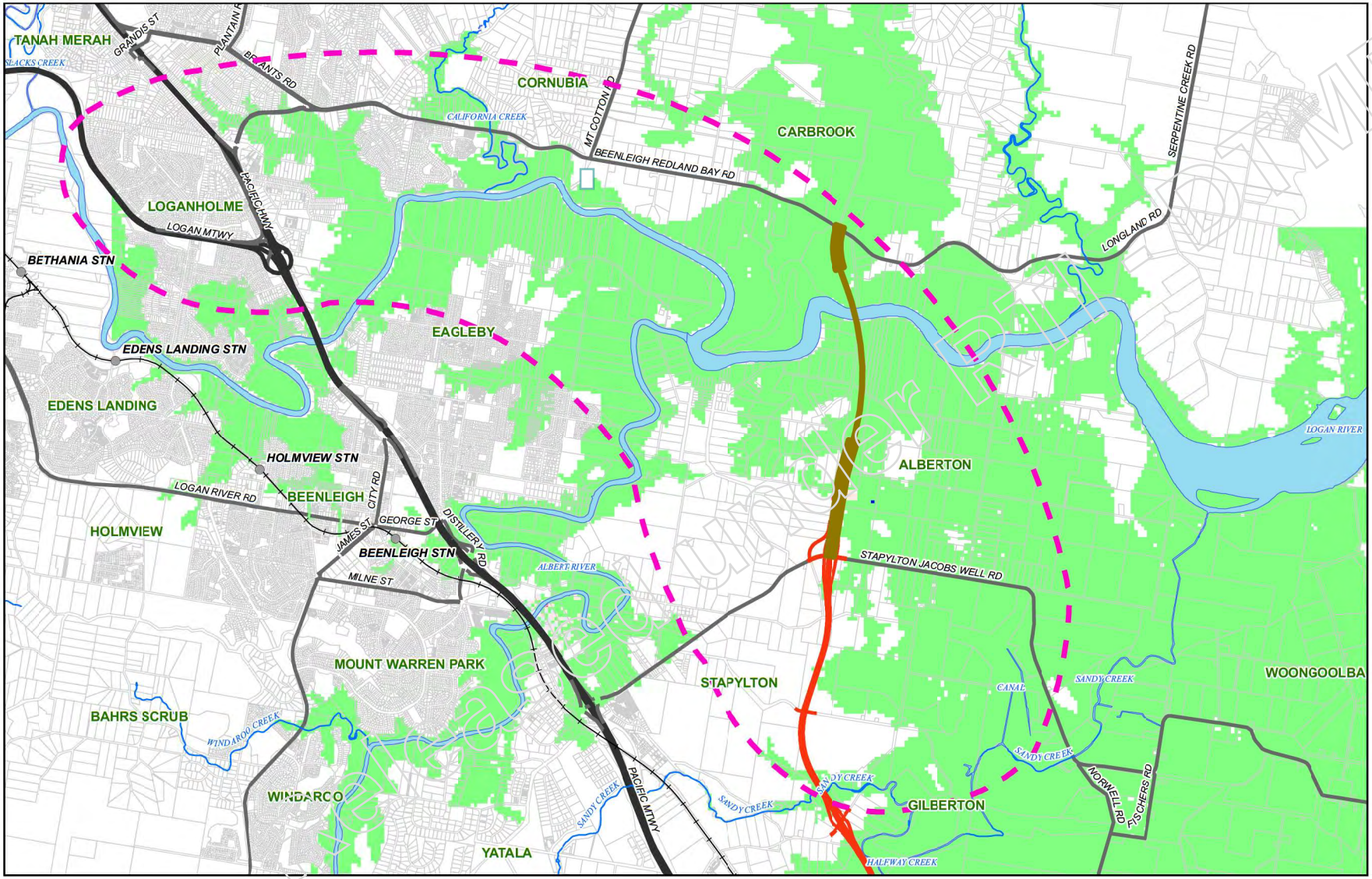


AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 1
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC West

**Afflux (m)**

- < -1
- -1.0 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC
IRTC Road Corridor Development Planning Study,AECOM 2010

**Logan East Link Route Investigation**

**Afflux (m) - Alignment Option 1**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB/SB |
| LAST MODIFIED | SB - 20/12/2010 |
| VERSION: | 1 |

Map **H3**

A3 size



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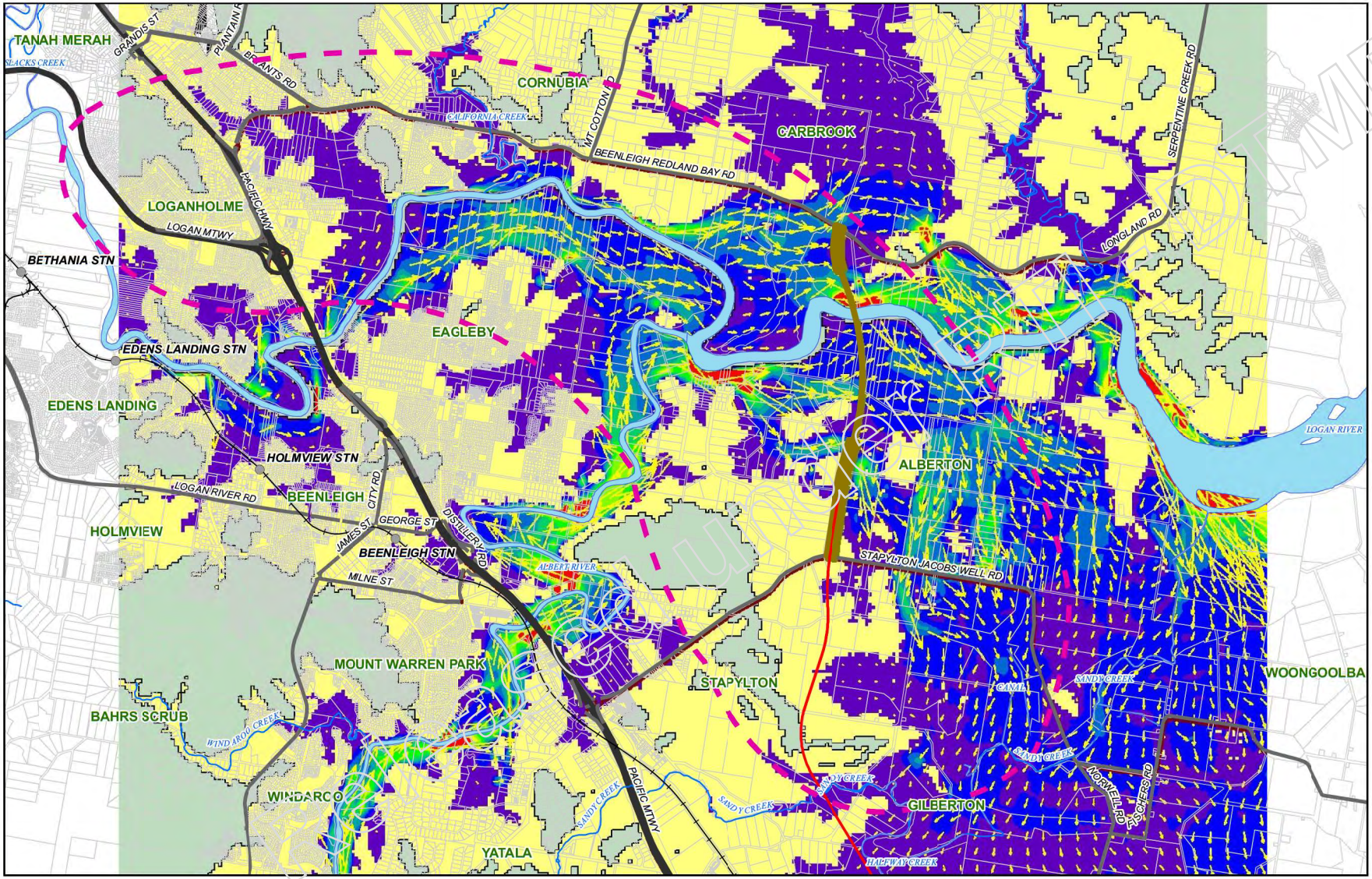


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- IRTC West
- Alignment Option 1
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries

**Current Speed (m/s)**

- Above 0.8
- 0.7 - 0.8
- 0.6 - 0.7
- 0.5 - 0.6
- 0.4 - 0.5
- 0.3 - 0.4
- 0.2 - 0.3
- 0.1 - 0.2
- 0.0 - 0.1
- Below 0.0
- 1 m/s

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC

**Logan East Link Route Investigation**

**Velocity - Alignment Option 1**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 2/2/2011 |
| VERSION: | 1 |

Map **H4**

A3 size



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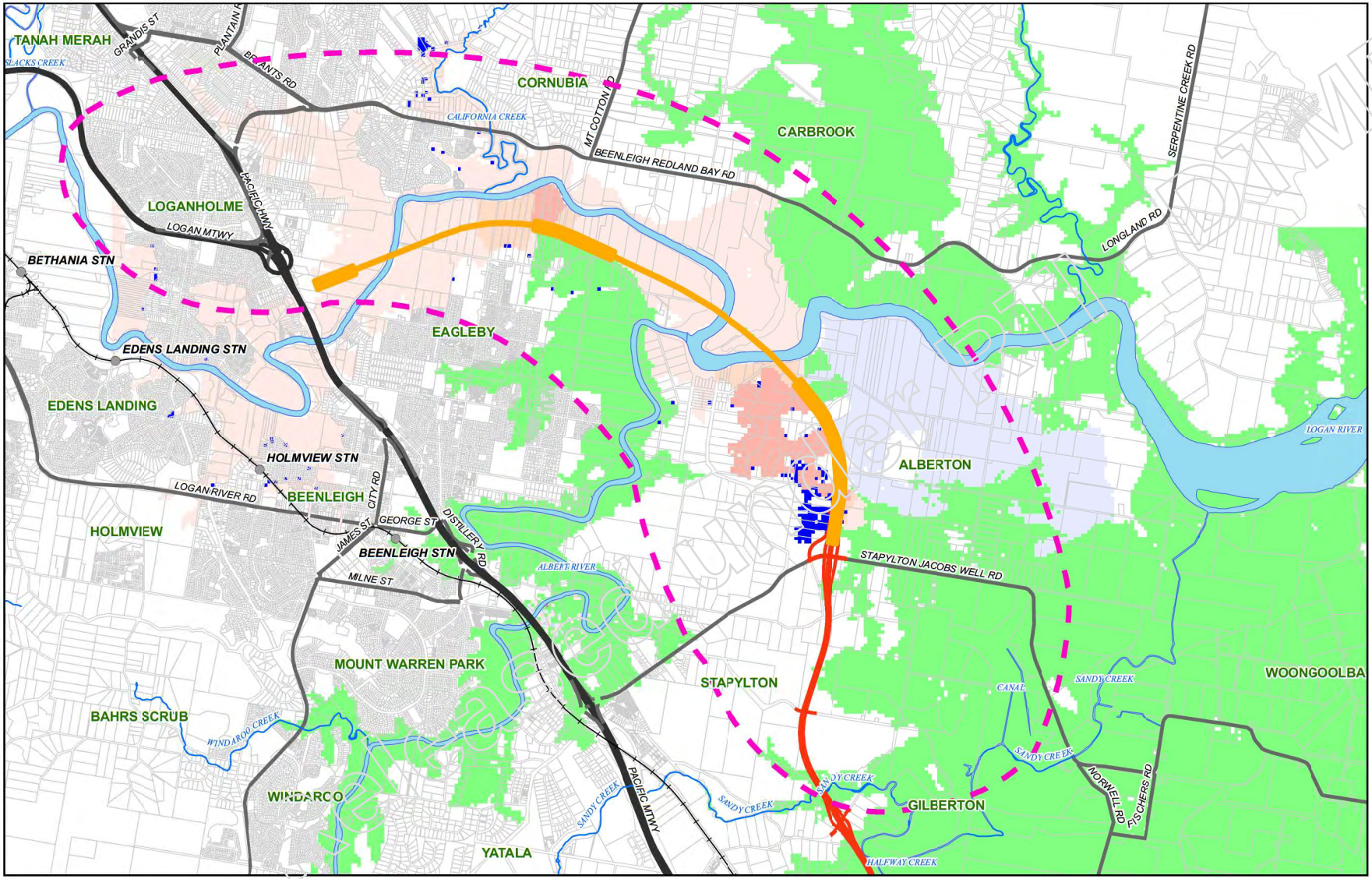


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 2
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC West

**Afflux (m)**

- < -1
- -1.0 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC
IRTC Road Corridor Development Planning Study,AECOM 2010

**Logan East Link Route Investigation**

**Afflux (m) - Alignment Option 2**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB/SB |
| LAST MODIFIED | SB - 20/12/2010 |
| VERSION: | 1 |

Map **H5**

A3 size



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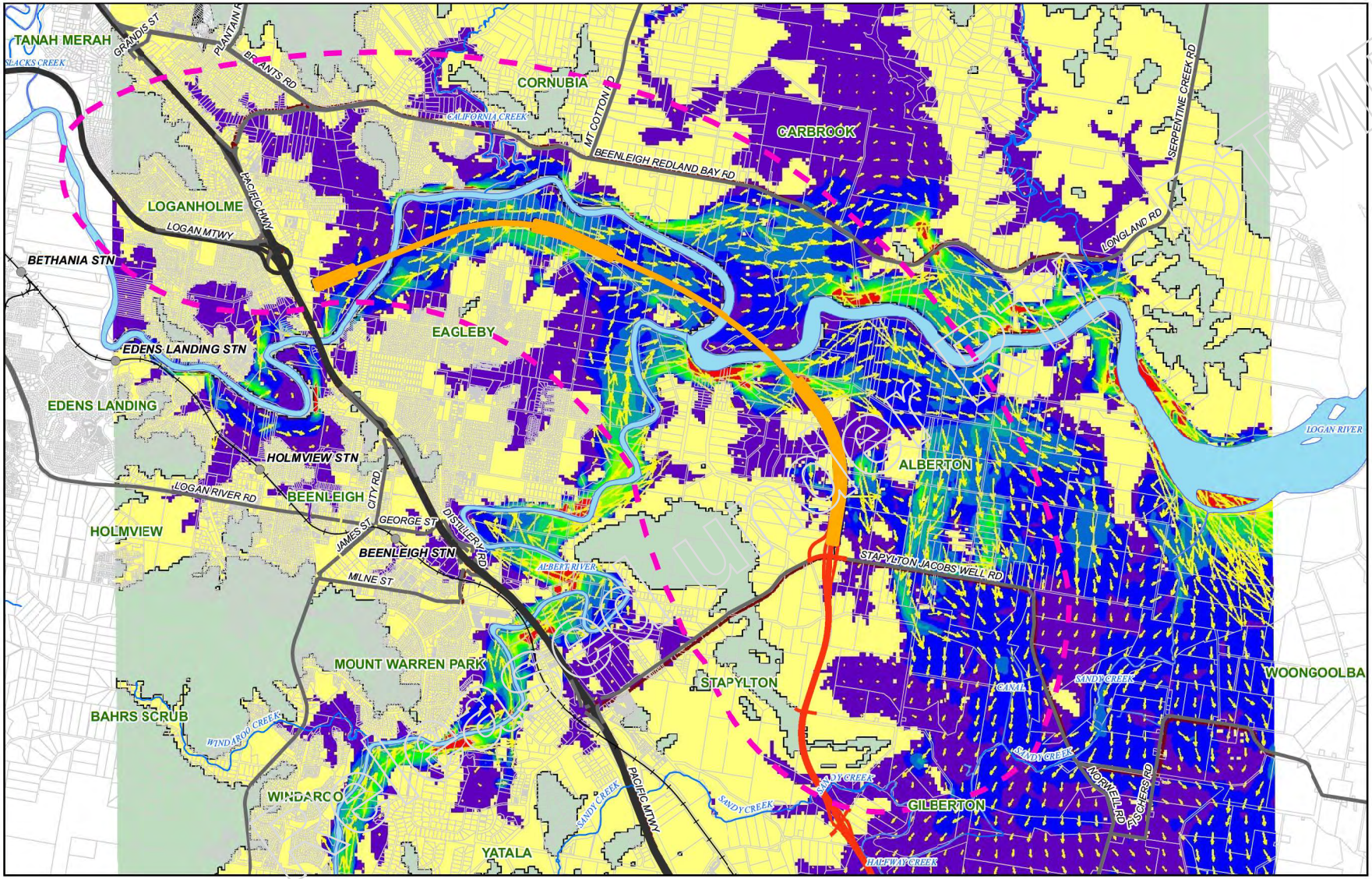


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 2
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC West

**Current Speed (m/s)**

- Above 0.8
- 0.7 - 0.8
- 0.6 - 0.7
- 0.5 - 0.6
- 0.4 - 0.5
- 0.3 - 0.4
- 0.2 - 0.3
- 0.1 - 0.2
- 0.0 - 0.1
- Below 0.0
- 1 m/s

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC

**Logan East Link Route Investigation**

**Velocity - Alignment Option 2**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 2/2/2011 |
| VERSION: | 1 |

Map **H6**

A3 size



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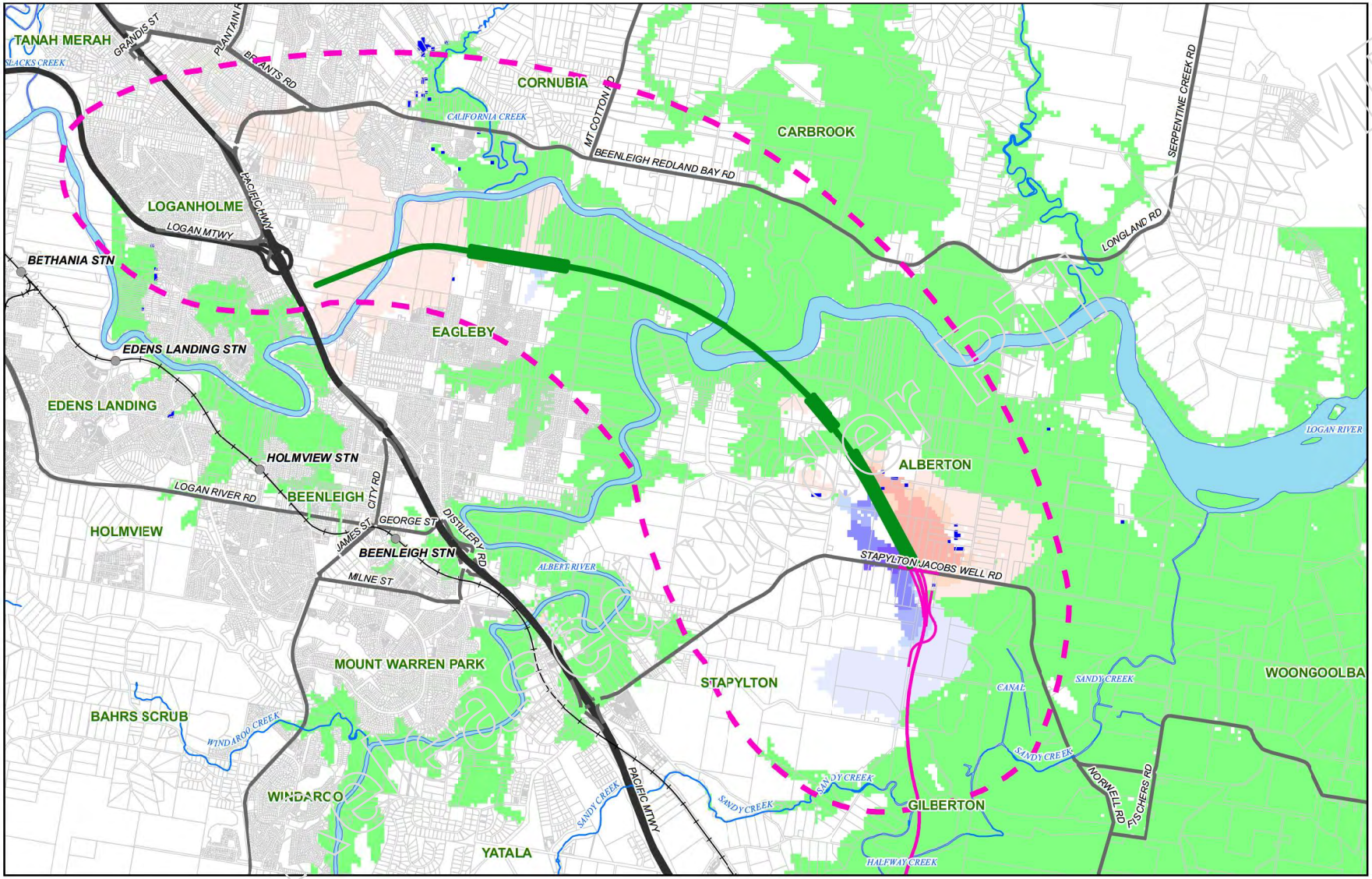


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 3
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC East

**Afflux (m)**

- < -1
- -1.0 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC
IRTC Road Corridor Development Planning Study,AECOM 2010

**Logan East Link Route Investigation**

**Afflux (m) - Alignment Option 3**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB/SB |
| LAST MODIFIED | SB - 20/12/2010 |
| VERSION: | 1 |

Map **H7**

A3 size



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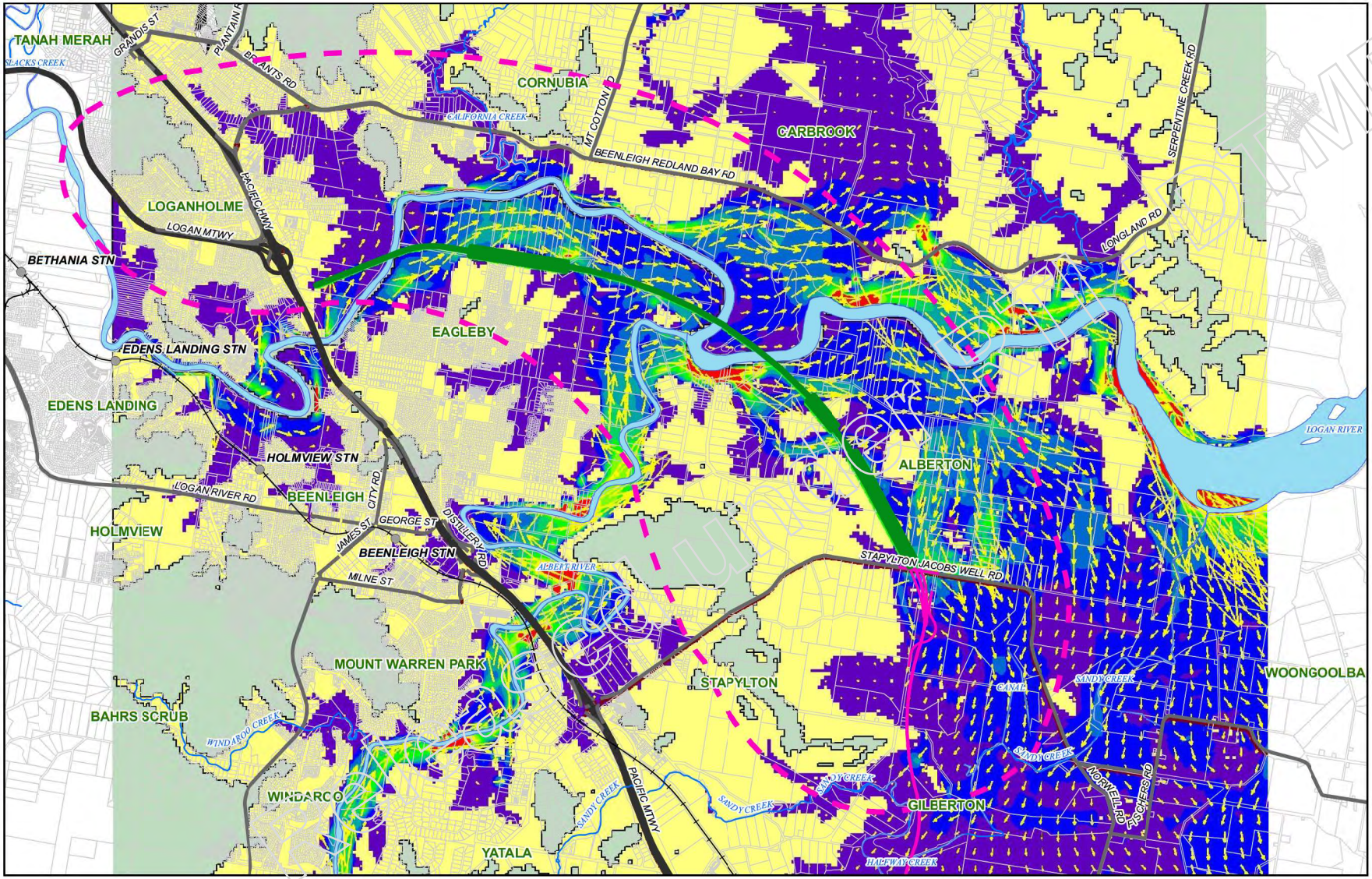


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 3
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC East

**Current Speed (m/s)**

- Above 0.8
- 0.7 - 0.8
- 0.6 - 0.7
- 0.5 - 0.6
- 0.4 - 0.5
- 0.3 - 0.4
- 0.2 - 0.3
- 0.1 - 0.2
- 0.0 - 0.1
- Below 0.0
- 1 m/s

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC

**Logan East Link Route Investigation**

**Velocity - Alignment Option 3**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 2/2/2011 |
| VERSION: | 1 |

Map **H8**

A3 size



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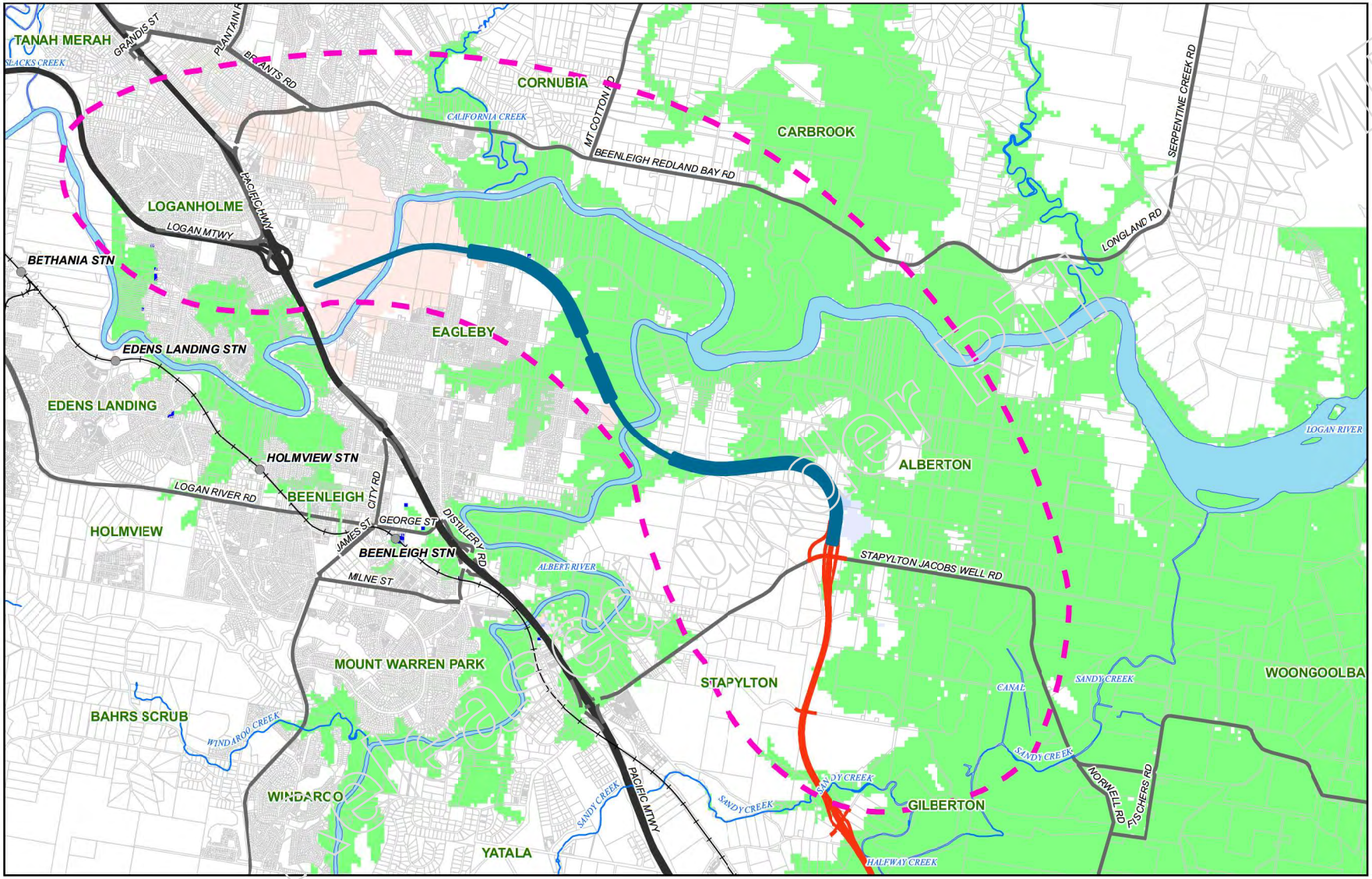


AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 4
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC West

**Afflux (m)**

- < -1
- -1.0 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC
IRTC Road Corridor Development Planning Study,AECOM 2010

**Logan East Link Route Investigation**

**Afflux (m) - Alignment Option 4**

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB/SB |
| LAST MODIFIED | SB - 20/12/2010 |
| VERSION: | 1 |

Map **H9**

A3 size



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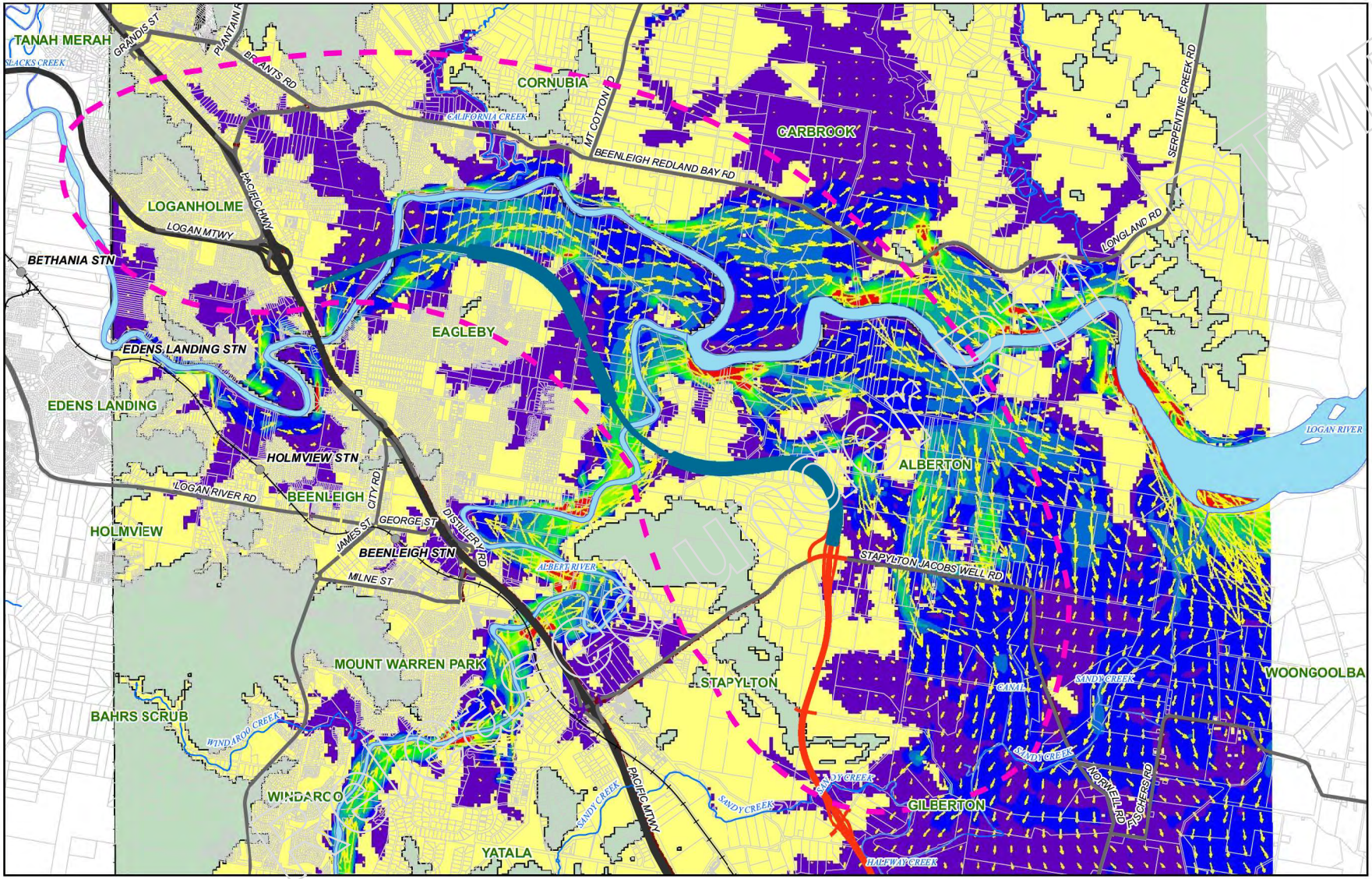



AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 750 1,500 3,000

Metres

1:50,000 (when printed at A3)

- Alignment Option 4
- Embankment
- Railway stations
- Study area
- Railway line
- Streams
- Property boundaries
- IRTC West

**Current Speed (m/s)**

- Above 0.8
- 0.7 - 0.8
- 0.6 - 0.7
- 0.5 - 0.6
- 0.4 - 0.5
- 0.3 - 0.4
- 0.2 - 0.3
- 0.1 - 0.2
- 0.0 - 0.1
- Below 0.0
- 1 m/s

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
Flood model - GCCC

**Logan East Link Route Investigation**

**Velocity - Alignment Option 4**

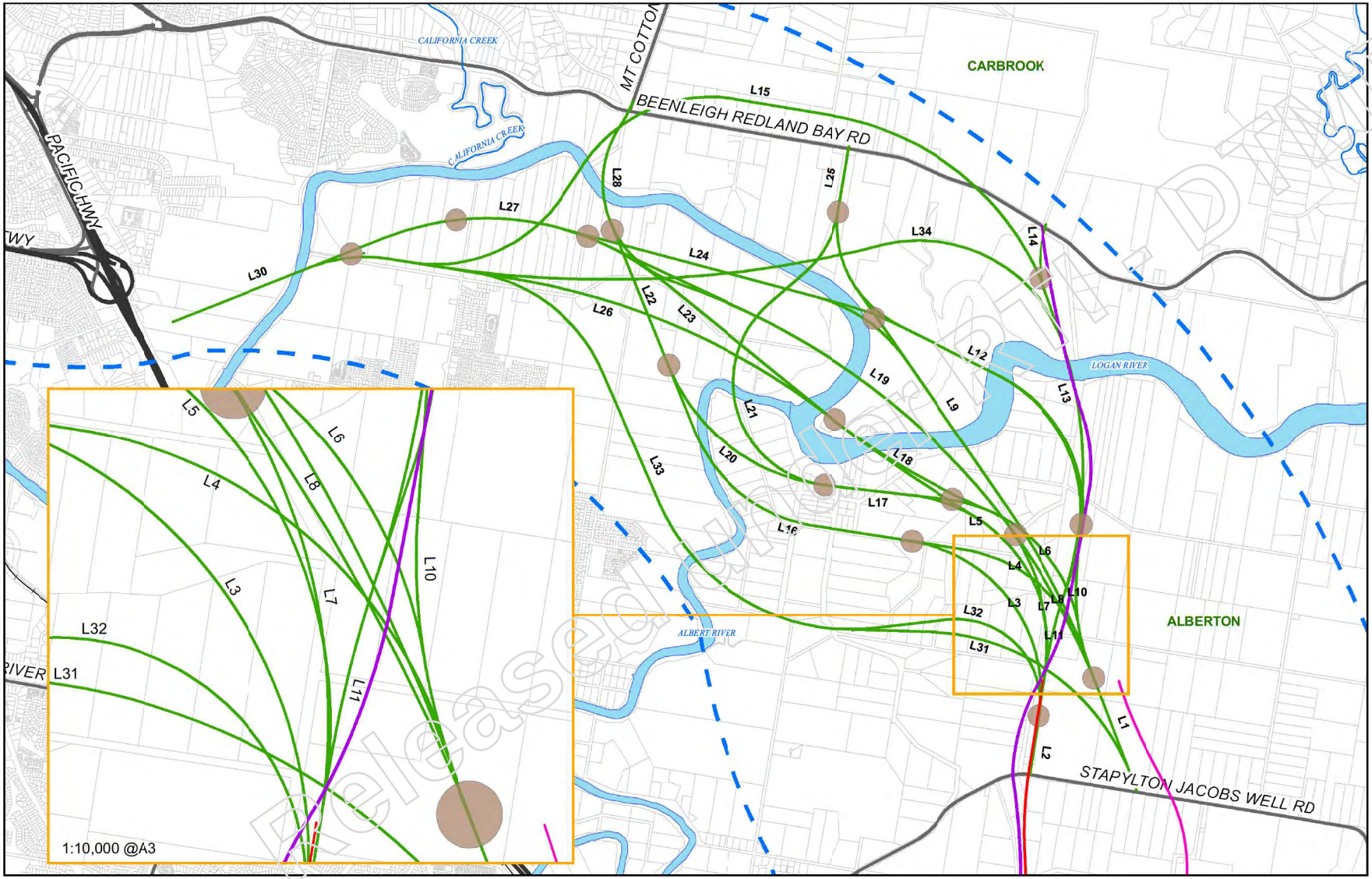
| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 2/2/2011 |
| VERSION: | 1 |

Map **H10**

A3 size



J:\Projects\60186998\4. Tech Work Area\4.3 Engineering\Hydraulics\Q100 Mapping\LEL_Fig_H4.mxd




AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 375 750 1,500

Metres

1:30,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- New options
- South Coast Motorway 1995
- Nodes
- Railway line
- Highway
- Main road
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
South Coast Motorway, Southern Section, Impact Assessment Study, Connell Wagner 1995.
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Current Route Options

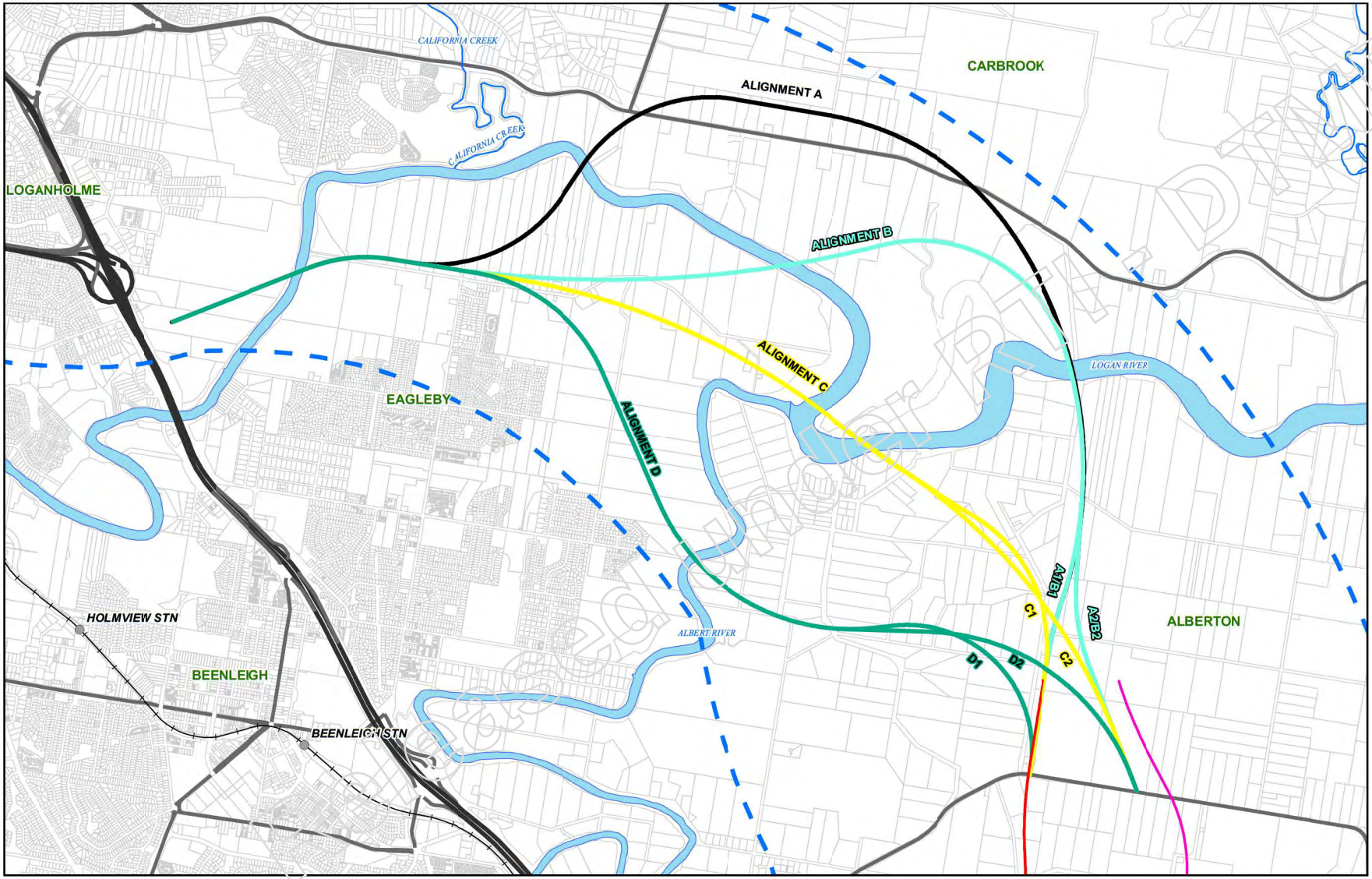
| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 9/2/2011 |
| VERSION: | 3 |

Map I

A3 size



J:\Projects\60186998\4. Tech Work Area\4.7 GIS\Workspaces\FINAL\route_options.mxd




AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 375 750 1,500

Metres

1:30,000 (when printed at A3)

- IRTC East
- IRTC West
- Study area
- Alignment A
- Alignment B
- Alignment C
- Alignment D
- Railway line
- Highway
- Main road
- Property boundaries

Data sources:

Base Data: (c) StreetPro
DCDB - DERM
IRTC Road Corridor Development Planning, AECOM 2010

# Logan East Link Route Investigation

## Preferred Alignments

| | |
|---|---|
| PROJECT ID | 60186998 |
| CREATED BY | KB |
| LAST MODIFIED | KB - 9/2/2011 |
| VERSION: | 3 |

Map J

A3 size



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Appendix C

# Route Summary Tables

# Logan East Link – Route Summary Tables

**Table A-1 Route A1 Summary Impacts**

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route A1 (West)<br>L2 / L11 / L13 / L15 / L26 / L30 | • All links impact upon areas of strategic cropping land. | • Link L2 connects into the IRTC western alignment which:<br>- Severs the Yatala Enterprise Area<br>- Traverses the existing urban footprint. | • Route lies generally within the Q100 flood boundary. | • Route is an extension of the IRTC western alignment that was documented on the RCDP layouts. |
| | • Link L13 aligned to pass to the east of an aboriginal cultural heritage site. | • Link L11 severs the Alberton cricket pitch, which is:<br>- Zoned as public open space<br>- Owned by GCCC. | • Three crossings of the Logan River are required. | • Alignment provides for a 110km/h design speed. |
| | • Link L13 impacts upon wetlands of state importance within the area of land owned by TMR to the north of Logan River. | • Link L13 passes through:<br>- Land owned by government (other) south of Logan River<br>- Land owned by GCCC south of Logan River<br>- Large area of land to the north of the Logan River that is owned by TMR. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • Link L15 is positioned with sufficient separation from Beenleigh – Redland Bay Road to enable it to pass over Beenleigh -Redland Bay Road at a high level. The separation also allows for an interchange to provide connectivity between Beenleigh – Redland Bay Road and the LEL. |
| | • Link L15 impacts upon wetlands of state and national significance. | • Link L15 impacts Key Resource Areas to the north and south of the Logan River. | • Requires approximately 4km of bridging. | • Alignment could be staged with interim connections onto the existing Beenleigh – Redland Bay Road creating 'network' rather than 'system' solutions. |
| | • Link L26 impacts upon wetlands of state significance. | • Links L26 and L30 pass through areas of land owned by LCC. | | • Providing an interchange to allow full connectivity between Eagleby / Mount Cotton Road / IRTC / Logan Motorway / Pacific Motorway is not feasible due to the spacing that would result between interchanges. |
| | • Link L15 increases the severance of the koala habitat cluster that spans Beenleigh – Redland Bay Road. | | | |
| | • Link L15 avoids the following cultural heritage sites to the south of Beenleigh - Redland Bay Road:<br>- Fachwerk House<br>- Former Carbrook State School. | | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-2 Route A2 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route A2 (East)<br>L1 / L10 / L13 / L15 / L26 / L30 | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in the following:<br>- Avoidance of a koala habitat cluster to the north of Stapylton - Jacobs Well Road. | • Link L1 mirrors previous ECPS link S9, which was considered to:<br>- Have significant severing effects on Alberton community<br>- Pass through poor ground conditions. | • Route lies generally within the Q100 flood boundary. | • Realignment of original IRTC eastern alignment is required, but is considered feasible. |
| | • All links impact upon areas of strategic cropping land. | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in:<br>- Fewer properties affected than the original IRTC eastern alignment. | • Three crossings of the Logan River are required. | • Alignment provides for a 110km/h design speed. |
| | • Link L13 aligned to pass to the east of an aboriginal cultural heritage site. | • Realignment of the IRTC eastern alignment results in a moderately larger impact upon the existing urban footprint. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • Link L15 is positioned with sufficient separation from Beenleigh – Redland Bay road to enable it to pass over Beenleigh – Redland Bay Road at a high level. The separation also allows for an interchange to provide connectivity between Beenleigh – Redland Bay Road and the LEL. |
| | • Link L13 impacts upon wetlands of state importance within the area of land owned by TMR to the north of Logan River. | • Realignment of the IRTC eastern alignment results in a minor impact upon the edge of the Yatala Enterprise Area. | • Requires approximately 4km of bridging. | • Alignment could be staged with interim connections onto the existing Beenleigh – Redland Bay Road creating 'network' rather than 'system' solutions. |
| | • Link L15 impacts upon wetlands of state and national significance. | • Link L10 impacts upon the north-east corner of Alberton cricket pitch, which is:<br>- Zoned as public open space<br>- Owned by GCCC. | | • Providing an interchange to allow full connectivity between Eagleby / Mount Cotton Road / IRTC / Logan Motorway / Pacific Motorway is not feasible due to the spacing that would result between interchanges. |
| | • Link L26 impacts upon wetlands of state significance. | • Link L10 positioned to minimise impact upon horse studs. | | |
| | • Link L15 increases the severance of the koala habitat cluster that spans Beenleigh – Redland Bay Road. | • Link L13 passes through:<br>- Land owned by government (other) south of Logan River.<br>- Land owned by GCCC south of Logan River.<br>- Large area of land to the north of the Logan River that is owned by TMR. | | |
| | • Link L15 avoids the following cultural heritage sites to the south of Beenleigh - Redland Bay Road:<br>- Fachwerk House<br>- Former Carbrook State School. | • Link L15 impacts Key Resource Areas to the north and south of the Logan River. | | |
| | | • Links L26 and L30 pass through areas of land owned by LCC. | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-3 Route B1 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route B1 (West)<br>L2 / L11 / L13 / L34 / L26 / L30 | • All links impact upon areas of strategic cropping land. | • Link L2 connects into the IRTC western alignment which:<br>- Severs the Yatala Enterprise Area<br>- Traverses the existing urban footprint. | • Route lies generally within the Q100 flood boundary. | • Route is an extension of the IRTC western alignment that was documented on the RCDP layouts. |
| | • Link L13 aligned to pass to the east of an aboriginal cultural heritage site. | • Link L11 severs the Alberton cricket pitch, which is:<br>- Zoned as public open space<br>- Owned by GCCC. | • Three crossings of the Logan River are required. | • Alignment provides for a 110km/h design speed. |
| | • Link L13 impacts upon wetlands of state importance within the area of land owned by TMR to the north of Logan River. | • Link L13 passes through:<br>- Land owned by government (other) south of Logan River<br>- Land owned by GCCC south of Logan River<br>- Large area of land to the north of the Logan River that is owned by TMR. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • An interchange can be incorporated that provides full connectivity between Eagleby, Mount Cotton Road, IRTC, Logan Motorway and Pacific Motorway. |
| | • Link L34 impacts upon wetlands of national and state significance. | • Links L34, L26 and L30 pass through areas of land owned by LCC. | • Requires approximately 7km of bridging. | |
| | • Link L26 impacts upon wetlands of state significance. | • Link L34 bisects Carbrook Golf Club. | | |
| | | • Link L34 bisects Key Resource Areas to the north and south of the Logan River. | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-4 Route B2 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route B2 (East)<br>L1 / L10 / L13 / L34 / L26 / L30 | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in the following:<br>- Avoidance of a koala habitat cluster to the north of Stapylton - Jacobs Well Road. | • Link L1 mirrors previous ECPS link S9, which was considered to:<br>- Have significant severing effects on Alberton community.<br>- Pass through poor ground conditions. | • Route lies generally within the Q100 flood boundary. | • Realignment of original IRTC eastern alignment is required, but is considered feasible. |
| | • All links impact upon areas of strategic cropping land. | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in:<br>- Fewer properties affected than the original IRTC eastern alignment. | • Three crossings of the Logan River are required. | • Alignment provides for a 110km/h design speed. |
| | • Link L13 aligned to pass to the east of an aboriginal cultural heritage site. | • Realignment of the IRTC eastern alignment results in a moderately larger impact upon the existing urban footprint. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • An interchange can be incorporated that provides full connectivity between Eagleby, Mount Cotton Road, IRTC, Logan Motorway and Pacific Motorway. |
| | • Link L13 impacts upon wetlands of state importance within the area of land owned by TMR to the north of Logan River. | • Realignment of the IRTC eastern alignment results in a minor impact upon the edge of the Yatala Enterprise Area. | • Requires approximately 7km of bridging. | |
| | • Link L34 impacts upon wetlands of national and state significance. | • Link L10 impacts upon the north-east corner of Alberton cricket pitch, which is:<br>- Zoned as public open space<br>- Owned by GCCC. | | |
| | • Link L26 impacts upon wetlands of state significance. | • Link L10 positioned to minimise impact upon horse studs. | | |
| | | • Link L13 passes through:<br>- Land owned by government (other) south of Logan River<br>- Land owned by GCCC south of Logan River<br>- Large area of land to the north of the Logan River that is owned by TMR. | | |
| | | • Links L34, L26 and L30 pass through areas of land owned by LCC. | | |
| | | • Link L34 bisects Carbrook Golf Club. | | |
| | | • Link L34 bisects Key Resource Areas to the north and south of the Logan River. | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-5 Route C1 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route C1 (West)<br>L2 / L5 / L18 / L26 / L30 | • All links impact upon areas of strategic cropping land. | • Link L2 connects into the IRTC western alignment which:<br>- Severs the Yatala Enterprise Area<br>- Traverses the existing urban footprint. | • Route lies generally within the Q100 flood boundary. | • Route is an extension of the IRTC western alignment that was documented on the RCDP layouts. |
| | • Link L18 impacts upon wetlands of state importance. Severance is reduced as a result of positioning on the southern edge of the wetlands. | • Link L5 severs the Alberton cricket pitch, which is:<br>- Zoned as public open space<br>- Owned by GCCC. | • Three crossings of the Logan River are required. | • Alignment provides for a 110km/h design speed. |
| | • Link L26 impacts upon wetlands of state significance. | • Link L18 passes through the southern tip of Carbrook Golf Club. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • An interchange can be incorporated that provides full connectivity between Eagleby, Mount Cotton Road, IRTC, Logan Motorway and Pacific Motorway. |
| | • Route avoids any koala habitat clusters. | • Link L18 impacts the edge of an area zoned as extractive industry south of the Logan River. | • Requires approximately 5.5km of bridging. | |
| | • Route avoids any cultural heritage sites. | • Links L26 and L30 pass through areas of land owned by LCC. | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-6 Route C2 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route C2 (East)<br>L1 / L6M / L18 / L26 / L30 | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in the following:<br>- Avoidance of a koala habitat cluster to the north of Stapylton - Jacobs Well Road. | • Link L1 mirrors previous ECPS link S9, which was considered to:<br>- Have significant severing effects on Alberton community<br>- Pass through poor ground conditions. | • Route lies generally within the Q100 flood boundary. | • Realignment of original IRTC eastern alignment is required, but is considered feasible. |
| | • All links impact upon areas of strategic cropping land. | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in:<br>- Fewer properties affected than the original IRTC eastern alignment. | • Three crossings of the Logan River are required. | • Alignment provides for a 110km/h design speed. |
| | • Link L18 impacts upon wetlands of state importance. Severance is reduced as a result of positioning on the southern edge of the wetlands. | • Realignment of the IRTC eastern alignment results in a moderately larger impact upon the existing urban footprint. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • An interchange can be incorporated that provides full connectivity between Eagleby, Mount Cotton Road, IRTC, Logan Motorway and Pacific Motorway. |
| | • Link L26 impacts upon wetlands of state significance. | • Realignment of the IRTC eastern alignment results in a minor impact upon the edge of the Yatala Enterprise Area. | • Requires approximately 6.5km of bridging. | |
| | • Route avoids any cultural heritage sites. | • New link comprises a realignment of Link L6 (L6M) to avoid an area of land owned by GCCC suspected of containing aboriginal cultural heritage artefacts. | | |
| | | • Link L18 passes through the southern tip of Carbrook Golf Club. | | |
| | | • Link L18 impacts the edge of an area zoned as extractive industry south of the Logan River. | | |
| | | • Links L26 and L30 pass through areas of land owned by LCC. | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-7 Route D1 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route D1 (West)<br>L2 / L32 / L33 / L26 / L30 | • All links impact upon areas of strategic cropping land. | • Link L2 connects into the IRTC western alignment which:<br>- Severs the Yatala Enterprise Area<br>- Traverses the existing urban footprint. | • Route lies generally along the edge of the Q100 flood boundary. | • Route requires realignment of the northern end of the documented IRTC western alignment. This will require the re-configuration of the interchange with Stapylton – Jacobs Well Road, which has the potential to create issues regarding sight distance to ramps. |
| | • Link L32 bisects an area designated as suitable for rehabilitation for koala habitat. | • Link L32 positioned to avoid impact upon a higher density residential settlement adjacent to the Logan River. | • Two river crossings are required:<br>- Link L33 crosses the Albert River in an area of higher ground, resulting in a shorter structure and a reduced impact on the Q100 extent<br>- Link L30 crosses the Logan River. | • Alignment provides for a 110km/h design speed. |
| | • Link L32 passes between areas of Essential Habitat for koala. | • Links L26 and L30 pass through areas of land owned by LCC. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • An interchange can be incorporated that provides full connectivity between Eagleby, Mount Cotton Road, IRTC, the Logan Motorway and the Pacific Motorway. |
| | • Link L32 is likely to require fauna connectivity provisions such as land bridges. | | • Requires approximately 3km of bridging. | |
| | • Link L33 impacts upon wetlands of state importance. | | | |
| | • Link L26 impacts upon wetlands of state importance. | | | |
| | • Route avoids any cultural heritage sites. | | • | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Table A-8 Route D2 Summary Impacts

| Route Ref. | Environment | Land Use | Hydraulics | General |
|---|---|---|---|---|
| Route D2 (East)<br>L1 / L31 / L33 / L26 / L30 | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in the following:<br>- Avoidance of a koala habitat cluster to the north of Stapylton - Jacobs Well Road. | • Link L1 mirrors previous ECPS link S9, which was considered to:<br>- Have significant severing effects on Alberton community<br>- Pass through poor ground conditions. | • Route lies generally along the edge of the Q100 flood boundary. | • Realignment of original IRTC eastern alignment is required, but is considered feasible. |
| | • All links impact upon areas of strategic cropping land. | • Link L1 requires the realignment of the IRTC eastern alignment, resulting in:<br>- Fewer properties affected than the original IRTC eastern alignment. | • Two river crossings are required:<br>- Link L33 crosses the Albert River in an area of higher ground, resulting in a shorter structure and a reduced impact on the Q100 extent<br>• Link L30 crosses the Logan River. | • Alignment provides for a 110km/h design speed. |
| | • Link L31 bisects an area designated as suitable for rehabilitation for koala habitat. | • Realignment of the IRTC eastern alignment results in a moderately larger impact upon the existing urban footprint. | • Link L26 positioned so as to maximise its distance from the Logan River and floodplain. | • An interchange can be incorporated that provides full connectivity between Eagleby, Mount Cotton Road, IRTC, the Logan Motorway and the Pacific Motorway. |
| | • Link L31 passes between areas of Essential Habitat for koala. | • Realignment of the IRTC eastern alignment results in a minor impact upon the edge of the Yatala Enterprise Area. | • Requires approximately 3km of bridging. | |
| | • Link L31 is likely to require fauna connectivity provisions such as land bridges. | • Link L31 positioned to avoid impact upon a higher density residential settlement adjacent to the Logan River. | | |
| | • Link L33 impacts upon wetlands of state importance. | • Links L26 and L30 pass through areas of land owned by LCC. | | |
| | • Link L26 impacts upon wetlands of state importance. | | | |
| | • Route avoids any cultural heritage sites. | | | |

| Legend | |
|---|---|
| | The route has a POSITIVE impact upon the reported item. |
| | The route has a NEUTRAL impact upon the reported item. |
| | The route has a MODERATELY NEGATIVE impact upon the reported item. |
| | The route has a SIGNIFICANTLY NEGATIVE impact upon the reported item. |
| | N/A |

Appendix D

# Minutes of Meetings

AECOM

# Minutes of Meeting

Logan East Link Route Investigation Study

| | | | |
|---|---|---|---|
| Subject | Project Prestart Meeting | Page | 1 |
| Venue | AECOM Offices, Level 8, 540 Wickham Street (King Faisal Room) | Time | 2:00pm |
| Participants | Richard Kretschmer (RK) - TMR<br>NR - AECOM<br>NR - AECOM<br>NR – AECOM<br>NR - AECOM (part) | | |
| Apologies | | | |
| File/Ref No. | 60186998/Min | Date | 26-Oct-2010 |
| Distribution | As above | | |

| No | Item | Action | Date |
|---|---|---|---|
| **1.0** | **Purpose** | | |
| | Introduction of team participants. | | |
| **2.0** | **Proposal Review** | | |
| | RK provided informal feedback on AECOM's proposal. Formal feedback will be provided at a later date.<br><br>Items to note from the proposal were<br>• RK advised AECOM to provide as much information/detail as possible in the relevant section. TMR (South Coast Region – Network Planning) do not score the appendices, therefore the sections need to contain the relevant detail<br>• SS noted that the 500 word limit for this proposal restricted the amount of detail that could be provided<br>• RK noted some errors were found in the document (page numbers etc.). This detracts from submission quality<br>• RK noted Approach was lacking detail. Noted that IRTC Submission had good visual representations which demonstrated a level of understanding for the corridor. This was not done for the East Link submission. | | |

| No | Item | Action | Date |
|---|---|---|---|
| **3.0** | **General Discussions** | | |
| | RK noted that the AECOM submission suggested a "preferred" route would be identified during this investigation. This is not the case and only viable option/s will be identified. | Note | |
| | **Land Use** | | |
| | MW requested GCCC Planning Scheme. RK advised this should be available from GCCC website. RK also advised that the majority of the site is probably located within Logan City Council. AECOM to confirm and advise RK whether any additional data is required | AECOM (MW) | 28-10 |
| | RK handed over *"Southern Moreton Bay Draft Marine Infrastructure Master Plan – 2009"* (Produced by KBR, 2 volumes). | | |
| | RK noted this report is CONFIDENTIAL as it has not yet been approved by government. | NOTE | |
| | AECOM to identify any Land Use impacts from report on Logan or Albert Rivers and incorporate into final Land Use Context report. | AECOM | |
| | Study to show potential connection to residential precincts (i.e. potential access to Eagleby etc.) at 'Thick-pen' preliminary concept level, subject to distances between interchanges are maintained for system to system road network hierarchy principles. | Note | |
| | AECOM to review alignment with respect to Urban Footprint, and Logan's Local Area Plan for Eagleby and report on the alignment merits. | AECOM | |
| | RK handed over *"Eastern Corridor Planning Study – 1992"* (Produced by Rankine and Hill, 3 Volumes). AECOM to review and incorporate into final report any findings on the validity (or otherwise) of the Eastern Alignment and whether the alignment had bi-partisan agreement. | AECOM | 5-11 |
| | RK to provide property ownership information to identify TMR or state/local owned properties in study area | RK | 28-10 Attached (29 Oct, 2010) |
| | RK to provide background information on political or socio-economic constraints in the study area | Note | |

| No | Item | Action | Date |
|---|---|---|---|
| | **Environment** | | |
| | Scope to remain high level. This is a broad, strategic review of constraints only | | |
| | AECOM are not to liaise with council or stakeholders | | |
| | AECOM (Jo Duncan) to liaise with Deb Glassop | AECOM (Jo Duncan) | 29-10 |
| | **Hydraulics** | | |
| | AECOM (Simon Bell) to identify whether additional flood model information is required (i.e. Do we have the correct MIKE11/21 model from the IRTC work for the Logan River catchment). | AECOM (Simon Bell) | |
| | RK handed over *"Eastern Corridor. Logan River Flood Study – Final Report – 1994"* and *"Eastern Corridor. Logan River Flood Study – Extension Report – 1995"* (Produced by Connell Wagner, 1 Volume each). AECOM to review and incorporate any relevant findings/outcomes | AECOM | |
| | **Geometry** | | |
| | Project scope is to investigate direct East Link connection to Logan Motorway. It is outside of scope to develop interchange configurations for the Logan Mwy/Pac Mwy/East Link interchange. | Note | |
| | More detailed interchange arrangements to be explored in later studies | | |
| | Design speed was agreed at 110km/h, but can be reduced for connection to Mt Cotton Road as appropriate | | |
| | AECOM to confirm "orientation" of alignment and interchanges at Stapylton-Jacobs Well Road to suit this study; though it was noted this is not a functional road hierarchy study. The output of this study will be provided for the Brisbane to Gold Coast Corridor Study being undertaken by Integrated Transport Planning. | AECOM | |
| | Plans produced during this phase are to show an indicative land impact for relevant interchange concepts | | |
| | RK handed over *"Modified South Coast Motorway and South East Connector – Preliminary Report – Approximate* | | |

| No | Item | Action | Date |
|---|---|---|---|
| | *date 1996"* (Produced by Metropolitan South Region, 1 Volume) for review.<br><br>AECOM to temporarily hang onto reports and study documents from the IRTC RCDP that are relevant to the Logan East Link route investigation. Revised list to be provided to PPM and remaining documents to be returned as part of IRTC RCDP final handover package. | MW (3/11) | |
| **4.0** | **Project Management** | | |
| | Due to timeframe of project, monthly reports won't be required for their level of effort. RK and JEM agreed to monitor project through fortnightly technical meetings and minutes/actions from those meetings.<br><br>RK noted that it was critical for this project to stay on timeframe (or finish early) to enable the findings of this study to become an input into the Brisbane-Gold Coast Area Transport Study | Note<br><br>Note | |
| **5.0** | **Schedule of Meetings** | | |
| | Next meeting will be Workshop 1 – held approximately November 10 | | |

AECOM

# Minutes of Meeting

Logan East Link

| | | | |
|---|---|---|---|
| Subject | Workshop 1 | Page | 1 |
| Venue | AECOM, 540 Wickham Street, Fortitude Valley | Time | 2.00pm |
| Participants | Richard Kretschmer (TMR)<br>NR (AECOM)<br>NR (AECOM)<br>NR (AECOM)<br>NR (AECOM)<br>NR (AECOM) (part) | | |
| Apologies | NR | | |
| File/Ref No. | 60186998 | Date | 12-Nov-2010 |
| Distribution | As above | | |

| No | Item | Action | Date |
|---|---|---|---|
| **1.0** | **Introductions**<br><br>JEM opened with introductions of team members and noted that AECOM believe the deliverables required for Workshop 1 have been achieved | | |
| **2.0** | **Background Information and Constraints** | | |
| **2.1** | **Background Information**<br><br>RK queried whether AECOM have discovered any text relating to bi-partisan agreement for the IRTC Eastern Alignment (positioned east of Burnside Road from Stapylton-Jacobs Well Road to Goldmine Road).<br><br>LB responded that reports reviewed failed to definitively confirm bi-partisan agreement. However the Eastern Corridor Planning Study (ECPS) Report noted the Eastern alignment should be further progressed should the western alignment become less-viable due to impacts on the Boral Quarry. Both alignments were shown in the report. The South Coast Motorway Report (which followed the ECPS report) had the Eastern alignment contained in the Terms of Reference but the report did not comment on the alignment.<br><br>RK noted that DA's had now been received for 2 properties impacted by the Western alignment in the Stapylton-Jacobs Well Road to Goldmine Road area. Also the | Note<br><br>Note | |

| No | Item | Action | Date |
|---|---|---|---|
| | Western alignment is becoming more constrained as the urban footprint extends into the area of this alignment. | | |
| | LB proceeded to briefly summarise the Background Report (*Doc No: 60186998-RPT-001-A, provided to RK*). Report summarises findings from previous studies undertaken in the area of the current commission | Note | |
| | AECOM are to review the routes identified in the ECPS Report with respect to current SEQ Regional Plan land uses and comment briefly on viability. | AECOM (MNR/LB) | 2-12-10 |
| 2.2 | **Land Use**<br>MNR noted that the process undertaken has been a high-level review of available planning scheme information and a review of land uses shown in available aerial photography. MNR noted that we do not have the Logan CC planning scheme detail in soft copy | | |
| | Primary constraints are Eagleby and the Yatala LAP. Activity generators within the area of interest include rail stations, golf courses, schools etc. These are shown in the Zoning and Land Use maps (Map 2 and Map 3) tabled at the workshop | | |
| | Land use zoning boundaries are similar to extents defined by Urban Footprint | | |
| | AECOM to develop additional map showing Federal/State/Local government boundaries. This is to be included in final report. | AECOM (MNR) | 2-12-10 |
| 2.3 | **Environment**<br>JD noted that environmental review of constraints has investigated Heritage, Land use, Flora, Fauna, Vegetation, waterways and wetlands. | | |
| | Constraints within the study corridor are Remnant Vegetation, Historic Sites, Aboriginal sites, Koala habitat and wetlands. Constraints mapped (Map 1) are those which are considered significant or immovable. | | |
| | RK noted that koala habitat areas could potentially be traversed, with suitable mitigation, but should be considered a key constraint for this project | | |
| | JD noted that the wetlands areas had potential EPBC triggers associated. AECOM to carefully consider alignments in vicinity of wetlands to reduce potential for triggers. | | |
| | It was noted that higher level structures over wetlands areas may be a viable option to ensure sunlight penetrates beneath the structure and enables fauna connectivity beneath. | | |

| No | Item | Action | Date |
|---|---|---|---|
| **2.4** | **Hydraulics**<br>JEM outlined previous hydraulic studies in area, including outcomes from the South Coast Motorway (SCM) Report. Findings in SCM report were quite onerous and possibly not feasible (i.e. dredging and widening Logan River)<br><br>SCM report also noted that global warming increase in sea level would not impact flooding within the study area.<br><br>JEM noted the Pacific Motorway bridge is a constraint to navigation. AECOM to adopt above Pacific Motorway bridge levels as minimum for river crossings in the absence of additional navigation information. | AECOM (MW) | |
| **3.0** | **Options Review**<br><br>MW tabled drawing SK-60186996-0003 showing a series of options linking the IRTC (Eastern and Western options) to 3 locations on Beenleigh-Redland Bay Road and also Logan Motorway/Pacific Motorway interchange<br><br>Options have been developed to avoid Cultural Heritage and Historic sites, Koala habitats and the urban footprint at Eagleby. This has resulted in options impacting wetlands, smaller communities (Alberton village), land noted for strategic cropping purposes and areas subject to hydraulic influences.<br><br>It was noted that the options directly impacting the Alberton village were undesirable due to impact on community and hydraulics (high flows in this area) and should not be progressed.<br><br>Options connecting to Beenleigh-Redland Bay Road near the Former Carbrook School were also noted as undesirable as they offered no apparent destination advantage over the remaining two options. These options were not to be progressed.<br><br>Remaining options to be progressed were<br>1. Options from IRTC (East and West) to Beenleigh-Redland Bay Road through currently owned TMR property<br>2. Options from IRTC (East and West) connecting to Beenleigh-Redland Bay Road at Mount Cotton Road<br>3. Options from IRTC (East and West) connecting to Logan Motorway/Pacific Motorway interchange<br><br>Further refinement/development of options needs to occur to reduce impact on wetlands areas<br><br>AECOM to develop link numbering system for options for final report | AECOM (MW)<br><br>AECOM (MW/LB) | |

| No | Item | Action | Date |
|---|---|---|---|
| | *Note: Post meeting RK requested 2 additional alignments be developed to be reported*<br>1. *Additional option to either utilise or run parallel to the existing road corridor immediately north of Eagleby*<br>2. *Additional option to either utilise or run parallel to the existing Beenleigh-Redland Bay Road corridor* | AECOM | |
| **4.0** | **Actions**<br><br>Workshop 2 noted for Thursday 2 December (*confirmed revised date*)<br><br>AECOM to progress options sufficiently to enable corridor definition to be provided<br><br>AECOM to develop draft Route Investigation Report<br><br>RK to provide Logan City Council zoning layers in GIS format (*requested subsequent to meeting*) | <br><br><br>AECOM<br><br>AECOM<br><br>RK | <br><br><br>2/12/2010<br><br>2/12/2010<br><br>19/11/2010 |

AECOM

# Minutes of Meeting

Logan East Link

| | | | |
|---|---|---|---|
| Subject | Workshop 2 | Page | 1 |
| Venue | AECOM Office, Level 8, 540 Wickham Street, Fortitude Valley (Kelly Kenny Room) | Time | 9.30am |
| Participants | **Transport and Main Roads**<br>Richard Kretschmer (RK)<br>Robert Campbell (BC)<br>David Robinson (DR)<br>Stuart Lyndon (SL)<br>Mark Ilife (MI)<br>**AECOM**<br>NR | | |
| Apologies | | | |
| File/Ref No. | 60186998 | Date | 2-Dec-2010 |
| Distribution | As above | | |

| No | Item | Action | Date |
|---|---|---|---|
| **1.0 / 2.0** | **Introductions / Workshop Objectives**<br><br>Attendees introduced. SL and MI arrived at 9.45 and further introductions were undertaken.<br><br>RK noted that SL and MI (with TMR's ITP department) were attending to enable information gained from this project to feed into the upcoming Northern Gold Coast Area Transport Study.<br>SL noted that they were interested in the IRTC and the connection opportunities presented<br><br>JEM noted objectives of Workshop 2 were to finalise constraint identification and present route options created to date. | | |
| **3.0** | **Constraints**<br><br>**Land Use**<br>MNR noted that the dominant land use areas within the study area are | | |

| No | Item | Action | Date |
|---|---|---|---|
| | • Eagleby,<br>• Cornubia and<br>• Stapylton Industrial areas.<br>These are identified within the SEQ Regional Plan<br><br>Future development areas are noted as<br>• Industrial in the Stapylton area,<br>• Residential and Commercial in the Eagleby/Cornubia/Beenleigh areas<br><br>Seven (7) key constraints exist within the study area<br>1. Eagleby residential areas<br>2. Cornubia residential areas<br>3. Industrial areas in vicinity of Logan Mwy / Pacific Mwy interchange<br>4. Sewage treatment plant in vicinity of Logan Mwy / Pacific Mwy interchange<br>5. Educational precinct at Cornubia<br>6. Alberton community<br>7. Prawn farms on southern banks of Logan River at Alberton<br>Attendees agreed that these were key constraints | Note | |
| **4.0** | **Background Summary**<br><br>LB provided brief history of the studies undertaken within the area of interest<br><br>Eastern Corridor Planning Study (ECPS) (1992) (Rankine and Hill)<br>• Investigated a number of links in area<br>• Developed a preferred link to the Logan Mwy which was subsequently abandoned due to perceived negligible traffic<br>• A new link was developed that connected directly to Beenleigh-Redland Bay Road<br>• Study identified Eastern and Western alignments between Stapylton-Jacobs Well Road and Goldmine Road. Eastern alignment was to be further progressed if Western alignment was deemed non-viable through impacts with Boral Quarry<br><br>South Coast Motorway (SCM) IAS (1995) (Connell Wagner)<br>• Terms of Reference included Eastern and Western alignments between Stapylton-Jacobs Well Road and Goldmine Road<br>• Final report only reported on Western alignment. No mention was made of Eastern alignment.<br><br>Department of Transport Report (1996)<br>• Report re-investigated route connection back to Logan Motorway<br>• Identified 3km bridging for Q50 | | |

| No | Item | Action | Date |
|---|---|---|---|
| | IRTC Road Corridor Development Planning (AECOM) 2010<br>• Re-investigated Eastern and Western alignments between Stapylton-Jacobs Well Road and Goldmine Road for current constraints/issues<br>• Western alignment was documented in RCDP layouts<br>• Eastern option remains a viable option should Western alignment prove undesirable due to Boral Quarry impacts, impact on Yatala Enterprise Area and severance of Urban Footprint<br><br>RK queried whether previous reports had commented on level of community consultation undertaken on Eastern alignment<br><br>LB noted that ECPS report mentioned that significant community consultation was undertaken, but report was unclear on whether the Eastern alignment was included within that consultation.<br><br>BC noted that, should the Western alignment be abandoned, additional consultation on the Eastern alignment would be a Government decision<br><br>RK queried whether cane fields were viable agricultural land<br><br>MNR noted that the land wasn't specifically identified as suitable for agricultural purposes, but the areas were now noted as Strategic Cropping Land from State Govt Agricultural Land Mapping. Additional the areas are identified as Key Resource Areas (KRA) under State Planning Policy (SPP)<br><br>RK requested AECOM included a GIS map identifying the Key Resource Areas within the study area.<br><br>AECOM also to include commentary on KRA's within report | Note<br><br>Note<br><br>Note<br><br>AECOM<br><br>AECOM | |
| **5.0** | **Constraints continued**<br><br>**Environmental**<br>CB noted that the environmental review was a desktop review using national/state and local mapping, no site visits were undertaken.<br>CB outlined the three (3) key environmental issues – koalas, wetlands and heritage<br>Koalas<br>• Significant area to north of Beenleigh-Redland Bay Road<br>• Three (3) areas of existing koala bushland located | | |

| No | Item | Action | Date |
|---|---|---|---|
| | near the Alberton community<br>It is possible for options to impact on the edges of identified areas, but significant offsets would be required (both onerous and expensive) if there is removal of bushland.<br>Wetlands<br>• Areas shown on GIS mapping are state recognised areas assessable by DERM<br>• Wetlands in vicinity of Eagleby potentially contain Wallum Froglet and Black-necked Stork. Also some potential koala habitat.<br>• Carbrook Wetlands are of national significance, they contain a Ramsar site of international significance, and Conservation Parks. Area identified on the Directory of Important Wetlands extends into property currently owned by TMR adjacent Carbrook Golf Course<br>• Wetlands around Logan River/Albert River confluence are state recognised<br>• Logan River is of poor quality and any deterioration would trigger assessment under the EPBC Act. Downstream area is listed under the Register of the National Estate. | Note | |
| | CB noted that connectivity between wetlands is key. Possible to mitigate connectivity issues by bridging in the right area, avoiding severance of habitats.<br>Heritage<br>• Former Carbrook State School – listed on state register. Possible visual amenity issues<br>• Fachwerk House – also on the state register, setting not mentioned in the listing, only the building structure.<br>• Aboriginal site near Alberton – site contents unknown and would need to be determined through consultation with the local party. Exact location would also need to be confirmed.<br>• Air quality and noise are potential issues for schools | Note | |
| | **Hydraulics**<br>SB summarised previous study by Connell Wagner (1995) noting that the study identified approx. 800m of structure was required to cross the Logan River. Report also suggested increasing the depth and width of the Logan River<br>Q100 extents shown on GIS mapping has been developed | | |

| No | Item | Action | Date |
|---|---|---|---|
| | from GCCC 2007 Flood Model using MIKEFLOOD software. Results are a composite of critical durations to give maximum extents and water surface elevations<br><br>Area of interest is predominately within the 48hr critical duration event. A small are near Logan Motorway is in 24hr event, but for expediency of model runs (2.5days computing time) the 48hr event has been adopted<br><br>Three (3) alignments have been tested for Q100. Optimisation is ongoing<br><br>Modelling philosophy has been to begin with minimum structure to determine afflux issues, then iterate model runs with increased structures to minimise afflux.<br><br>BC noted that the best river crossing was into the TMR land near Carbrook Golf Course. | | |
| **6.0** | **Proposed Links / Route Options**<br><br>MW outlined the alignments/links generated to date.<br><br>MW noted that location of Eastern alignment presented in IRTC RCDP Layouts would impact on a corner of a koala zone. A slightly modified alignment has been developed under this project and may result in the IRTC Eastern option needing to be revised slightly.<br><br>Discussion around presented (Drg. SK-60186998-0003) resulted in two new options being identified<br>• Option to south of Alberton koala areas, crossing Albert River and circling around Eagleby<br>• Option to pass through Carbrook Golf Course, across Logan River beneath Carbrook Education Precinct and connect to alignments near Eagleby<br><br>A number of links were noted as being non-viable based on constraints/impacts. These links were<br>• L9 (and associated links)<br>• L12 (and associated links)<br>• L16 (and associated links)<br>• L19 (and associated links)<br>• L20 (and associated links)<br>• L21 (and associated links)<br>• L27<br>• L29<br><br>BC suggested link L6 may impact an aboriginal heritage site and that suggested links should avoid this location. | Note<br><br>AECOM<br><br>Note<br><br>AECOM | |

| No | Item | Action | Date |
|---|---|---|---|
| | It was noted that L15 (link parallel to Beenleigh-Redland Bay Road) should be identified as an upgrade to the road to 4-lanes and possible provision of service road/s | | |
| | MW noted that the corridor width of 100m stated in the brief is insufficient to accommodate corridor, future 20m transport corridor and shared path. AECOM to comment within report. | AECOM | |
| | MW presented new option for connecting links to Logan Mwy/Pacific Mwy interchange. Option will be included in final report. RK requested the original east/west connection to the Logan Mwy identified during the 1997 Pacific Mwy upgrade also be included. | AECOM | |
| **7.0** | **Summary / Remaining Work** | | |
| | RK requested additional workshop (tentatively scheduled for Tuesday 14th December) to discuss additional alignment options | All | Tue-14-Dec. |
| | RK requested AECOM produce a variation to take account of additional options/workshop | AECOM | Fri-3-Dec |
| | AECOM noted that LCC Land Use GIS data supplied by RK provided a very low level of detail. AECOM requested RK to source additional LCC Land Use mapping if available | RK | Fri-10-Dec |

AECOM

# Minutes of Meeting

Logan East Link

| | | | |
|---|---|---|---|
| Subject | Workshop 3 | Page | 1 |
| Venue | TMR Logan District office, 3912 Pacific Hwy, Loganholme | Time | 9.30am |
| Participants | Richard Kretschmer (TMR)<br>David Robinson (TMR)<br>Bob Campbell (TMR)<br>NR (AECOM)<br>NR (AECOM)<br>NR (AECOM) | | |
| Apologies | NR (AECOM)<br>Stuart Lyndon (TMR)<br>Mark Ilife (TMR) | | |
| File/Ref No. | 60186998 | Date | 14-Dec-2010 |
| Distribution | As above | | |

| No | Item | Action | Date |
|---|---|---|---|
| **1.0** | **Introductions/Apologies**<br><br>Apologies - John E-M, Mark I and Stuart L | | |
| **2.0** | **Workshop Objectives**<br><br>Focus on 4 most feasible options identified in Workshop 2 to determine whether any links/alignments need further optimisation<br><br>Resolve corridor width requirements – investigation has shown 140m more realistic than 100m required by brief<br><br>Review the hydraulic analysis of the options | | |
| **3.0** | **Workshop 2 Actions**<br><br>Outstanding action – LCC Land Use data – RK advised that TMR could successfully view land use layers.<br><br>AECOM to review how mapping was viewed in GIS and if problems still occur, contact Rob Verhoef (TMR – Nerang) | AECOM | 14-Jan-11 |
| **4.0** | **Hydraulics**<br><br>Links L13/L14 require 1.2km (approx) of bridging. Good afflux results | | |

| No | Item | Action | Date |
|---|---|---|---|
| | Links L17/L20/L22 – hydraulic analysis undertaken. No significant afflux or velocity issues however option not considered in "most feasible" group due to other environmental/land use constraints.<br><br>It was considered the direct impact to existing residential dwellings, in combination to a constrained corridor between the Logan River and the Koala habitat excluded this option been considered further.<br><br>L18/L26/L30 (preliminary) – option requires extensive structure (approx. 2.8km)<br><br>Hydraulic analyses are taking 2.5 days/option. – this resulted in AECOM not having all options completed for this workshop. However, based on current results extensive lengths of structure will be required for all options<br><br>Analysis to date does not include any piers or substructure where openings are identified. Addition of these elements will increase afflux and potentially require larger structures.<br><br>AECOM to test two more alignments hydraulically<br>• L18/L26/L30 (modified)<br>• L32/L33/L30 | AECOM | 17-Dec-10 |
| **5.0** | **Alignments**<br><br>AECOM presented the 4 alignments that have been identified as most viable (Drg 60186998/SK-0020)<br><br>***Alignment A*** – Links L1/L2, L11, L13, L14, L15, L26, L29/L30 - This alignment is positioned to reflect the previous South Coast Motorway IAS, undertaken in 1995. It seeks to extend the current IRTC RCDP alignment from Stapylton-Jacobs Well Road and the 'What-if' eastern alignment to the north. With this option, it results in a combination of a greenfield corridor and/or a network solution.<br><br>It was agreed that a connection between Stapylton-Jacobs Well Road and Beenleigh-Redland Bay Road, with the option linking to the existing network at Beenleigh-Redland Bay Road, was feasible.<br><br>This alignment hasn't identified a link between Beenleigh-Redland Bay Road and Eagleby<br><br>***Alignment B*** – Links L1/L2, L11, L13, L34, L30<br>This alignment bisects the Carbrook Golf Course and links back across Logan River to Eagleby<br>This alignment provides opportunity for a link between Eagleby and Beenleigh-Redland Bay Road.<br><br>***Alignment C*** –Links L1/L2, L5/L6M, L18, L26, L30 | Note | |

| No | Item | Action | Date |
|---|---|---|---|
| | This alignment traverses the southern tip of the wetlands near Carbrook Golf Course.<br>This alignment provides opportunity for a link between Eagleby and Beenleigh-Redland Bay Road<br><br>***Alignment D*** – Links L1/L2, L31/L32, L33, L26, L30<br>This alignment traverses through Alberton south of koala habitats, crosses the Albert River and around Eagleby.<br>This alignment provides opportunity for a link between Eagleby and Beenleigh-Redland Bay Road | | |
| | AECOM to include commentary in report on need for a land bridge (or similar) to maintain koala connectivity. | AECOM | 17-Dec-10 |
| | BC requested AECOM amend L32 to achieve 110km/h design speed (option presented achieved 100km/h design speed) | AECOM | 17-Dec-10 |
| | ***Logan Motorway/Pacific Motorway Interchange*** -<br>RK requested AECOM show both interchange options developed within final drawing set | AECOM | 14-Jan-11 |
| | BC noted that the interchange option taking Logan Motorway directly east could potentially include ramps to enable north-facing, Pacific Motorway connectivity | AECOM | 14-Jan-11 |
| | ***Cornubia/Eagleby Interchange Options***<br>MW presented several concept interchange arrangements identifying potential interchange arrangements to connect Eagleby/Logan East Link to Cornubia at Mt Cotton Road | | |
| | RK noted that there was not a need to develop the interchange arrangements to a higher level of detail than the concepts presented | Note | |
| **6.0** | **Finalise list of alignments for report** | | |
| | TMR and AECOM agreed that 4 alignments displayed on Drg 60186998/SK-0020 were considered "most viable" and should be reported on | Note | |
| | TMR requested coloured (traffic light) appraisal tables to assist future option appraisal. | AECOM | 17-Dec-10 |
| | BC to confirm if future developments / land uses in vicinity of Logan Mwy interchange can be mentioned within report | BC/RK | 17-Dec-10 |
| **7.0** | **Report Status**<br>LB noted that draft report was intended for delivery on Friday 17 December | AECOM | 17-Dec-10 |

Transport and Main Roads

# Environmental Scoping Report

## Intra-Regional Transport Corridor (IRTC) Northern Connection: Beenleigh-Redland Bay Road to Stapylton-Jacobs Well Road

Project No: D10/D001/901

Connecting Queensland
www.tmr.qld.gov.au

Queensland Government

| PROJECT DETAILS | | | |
|---|---|---|---|
| **Project Name / Description** | IRTC Northern Connection Beenleigh-Redland Bay Road to Stapylton-Jacobs Well Road | | |
| **Project Number** | D10/D001/901 | **Section / Chainage** | N/A |
| **Local Government Area** | City of Gold Coast / Logan City | **QTRIP WBS** | N/A |
| **Road** | 113 (IRTC) | **DMS Reference** | N/A |

| REPORT PREPARATION | | | |
|---|---|---|---|
| I have prepared this report based on the best information available at the time. I have taken into account, to the fullest extent possible, all actual and potential environmental impacts of the project. | | | |
| **Name** | Deborah Glassop | **Signature** | NR |
| **Position** | Environmental Officer | **Date** | 7th June 2017 |
| **REPORT REVIEW** | | | |
| **Name** | | **Signature** | |
| **Position** | | **Date** | |

| VERSION HISTORY | | | |
|---|---|---|---|
| **Version No.** | **Date** | **Changed by** | **Nature of Amendment** |
| | | | |
| | | | |

| PROJECT MANAGER ACCEPTANCE | | | |
|---|---|---|---|
| I agree that this report has been prepared based on the project scope at the time, and accept responsibility for ensuring any future changes to the scope are appropriately assessed. I understand the potential impacts and legislative consequences of not actioning the recommendations outlined in the report. | | | |
| **Name** | Frank Spinella | **Signature** | |
| **Position** | | **Date** | |

***Note:*** *This Environmental Scoping Report shall remain current for 12 months. A review will be required after this time should further subsequent assessment or management actions not be undertaken.*

# EXECUTIVE SUMMARY

The Department of Transport and Main Roads (TMR) are currently investigating high level options to link the proposed Intra-Regional Transport Corridor (IRTC) at Stapylton-Jacobs Well Road with Beenleigh-Redland Bay Road, a project known as the IRTC northern connection.

A previous study was undertaken for this area, known as the Logan East Link (LEL) Route Investigation Study. This study included a high level (desktop) assessment of potential environmental issues within the LEL Route study area.

The project has now progressed to a stage where SCR have identified three possible options that could provide a link between the IRTC and Beenleigh Redland-Bay Road. This Environmental Scoping Report (ESR) has been developed in order to provide a "first pass" environmental assessment of the proposed IRTC Northern Connection between Beenleigh-Redland Bay Road and Stapylton-Jacobs Well Road. It is not intended to provide either a comprehensive account of environmental values within the project area or a detailed assessment of potential environmental impacts associated with the proposed works, but rather to identify key environmental issues and legislative requirements that will require additional assessment as the project progresses.

Key issues identified within this scoping study are as follows:

**Project environmental assessment and management framework.**

This is a critical issue for the project and will require careful consideration at the earliest stages of the planning phase of the project. The size and complexity of the proposed IRTC considered as a whole project from Beenleigh-Redland Bay Road to Nerang-Broadbeach Road may result in the project triggering external environmental assessment processes such as those associated with the federally administered Environment Protection and Biodiversity Protection Act (EPBC) or the state administered State Development and Public Works Organisation Act (SDPWO). Should external environmental assessment processes as outlined in these pieces of legislation be applicable to the planning, design and construction of the IRTC, then the project may need to follow a formal Environmental Impact Statement (EIS) process. The EIS process is significantly more time, cost and resource intensive that the internal TMR environmental assessment and management process that would normally be followed for a road construction project. This will require careful consideration once any stage of the suite of projects that comprise the IRTC reaches the concept phase.

**Water and water quality.**

The proposed IRTC Northern Connection falls within the Logan and Albert River Catchments and will require major crossings of both the Logan and Albert Rivers. Some options will require multiple crossings of these watercourses. The project is within and adjacent to the environmentally sensitive Carbrook wetlands area, which is listed as environmentally significant within the Directory of Important Wetlands in Australia (DIWA).

**Soil and land management.**

Low-lying (below 5 metres AHD) areas occur in the majority of the study area, with both Logan City Council and the City of Gold Coast having identified the majority of the land east of the Pacific Motorway and surrounding the Logan and Alberts rivers as acid sulfate soil hazard areas. These areas are likely to contain potential or actual acid sulphate soils. Excavation and exposure of these soils could result in their oxidation and subsequent release of contaminants such as acids and metals into the surrounding environment. Given the proximity of environmentally sensitive areas such as the Carbrook wetlands, appropriate management and treatment of acid sulphate soils will be required. There are also a number of potentially contaminated sites listed on the Environmental Management Register (EMR) within the study area, notably in the vicinity of Beenleigh-Bay Road.

**Flora and Fauna.**

The Logan and Albert River Floodplains and Carbrook wetlands are known to support a diverse array of flora species, including those protected under state legislation. Carbrook wetlands is a gazetted (protected under the provisions of the Nature Conservation Act) conservation park, and it will therefore be important to minimise impacts on this area where possible. The Carbrook and Eagleby wetlands are also known to provide habitat to many species of waders and waterbirds, including migratory species which are protected under the federally administered Environment Protection and Biodiversity Conservation Act (EPBC). In addition, a number of frog species have also been previously recorded within the Carbrook wetlands, including the legislatively protected wallum froglet, which has a limited distribution due to its preference for acidic lakes and wallum swamps. Areas of drier eucalypt and melaleuca forest away from the Logan and Albert River floodplains may also provide habitat for koalas.

**Public amenity and health.**

The proposed IRTC northern connection is likely to have both direct and indirect impacts on the receiving environment via changes to noise, visual and social amenity, air quality, property access and property severance. Severance of access routes both within individual properties and to the existing local road network are likely. The IRTC northern connection would be classified as a "new road – access controlled" for the purposes of operational (road traffic) noise impact assessment, and as such road traffic noise criterion levels will be significantly lower than for the upgrade of an existing road, particularly where existing ambient noise levels are low.

**Cultural heritage.**

A Cultural Heritage Risk Assessment (CHRA) has been undertaken for the study area, which indicates a high risk of the project impacting on Aboriginal Cultural Heritage (Category 5 under the Cultural Heritage Guidelines). Previous studies undertaken in this area indicate that there are known sites of Aboriginal Cultural Heritage within the study area. A formal Cultural Heritage Management Plan (CHMP) as per part 7 of the Aboriginal Cultural Heritage Act may be required for the project. In addition, there are two sites of historical cultural heritage significance (listed on the Queensland Heritage Register) within the study area on Beenleigh-Redland Bay Road.

**Conclusions and recommendations.**

A number of potential environmental issues will require additional investigation once the project reaches the concept phase. These include potential impacts on the Carbrook wetlands, potential impacts on legislatively protected flora and fauna species, and potential for the project to impact on areas of Aboriginal Cultural Heritage Significance.

From an Options Analysis perspective, at this point in time there is no discernible difference between the three options from an environmental impact perspective. All three options have environmental constraints which will require additional assessment and management as the project progresses.

The most critical issue for the IRTC Northern Connection from an environmental management perspective is its relationship to the future IRTC corridor. Construction of the IRTC between Beenleigh-Redland Bay Road and Nerang-Broadbeach Road could potentially trigger external environmental assessment processes that the IRTC Northern Connection as a "stand alone" project would not. This will require careful consideration, given that external environmental assessment processes such as the Environmental Impact Statement (EIS) process under the EPBC Act or SDPWO Act are significantly more time, cost and resource intensive than internal TMR environmental assessment and management processes.

# 1 INTRODUCTION

## *Background*

The Intra-Regional Transport Corridor (IRTC) is a future road corridor that will eventually form the primary arterial road between Logan, the rapidly expanding northern and established southern suburbs of the Gold Coast. Road Corridor Development Planning (RCDP) has been undertaken for the IRTC in order to establish the extent of the road corridor and protect it from future development. In 2010, the road corridor requirements for the northern section of the IRTC (the section between Beattie Road Coomera to the south and Stapylton-Jacobs Well Road in the north) were determined.

Once the RCDP process was finalised for the northern section of the IRTC, an additional study was undertaken to investigate possible routes to link the IRTC with the Pacific Motorway (M1), Logan Motorway and Beenleigh-Redland Bay Road. This study was known as the Logan East Link (LEL) Route Investigation Study, and the outcome of the study was to establish feasible alignments for the LEL that connected the IRTC (Northern Section) to the Logan Motorway and Beenleigh-Redland Bay Road. These alignments were developed to provide input into the higher level Northern Gold Coast Area Transport Study.

The Logan East Link Route Investigation Study concluded that the LEL is likely to provide an alternative transport corridor to the M1, thus encouraging commuters to avoid using the Pacific Motorway for short commuter trips.

The suburbs of Beenleigh, Loganholme and Eagleby are identified as future growth areas, and as such timely provision of new road infrastructure in these suburbs via the IRTC will be important to their growth. In addition, the Yatala Enterprise Area located to the south of the study area is predicted to be a major industrial and economic development region for the northern Gold Coast and Logan City. Future access to this area via a major transport route with connections to surrounding road networks will be vital to the development of the area.

South Coast Region (SCR) has recently developed three potential options which would provide a new road link connecting Stapylton-Jacobs Well Road with Beenleigh-Redland Bay Road. This project is known as the IRTC Northern Connection. This scoping study has been developed in order to provide a high level assessment of potential environmental impacts associated with each of these three options and establish an environmental assessment and management framework for the project.

## *Project Scope*

As discussed above, the project comprises the construction of a "northern connector" of the proposed IRTC, linking the current northern limit of the future road corridor at Stapylton-Jacobs Well Road with the existing Beenleigh-Redland Bay Road. There are three potential routes (or options) for the Connector.

- Option 1: Runs directly north from the proposed interchange of the IRTC with Stapylton-Jacobs Well Road, across the Logan River to the west of Ferry Road and then along the existing state controlled road (Beenleigh-Redland Bay Road) west as far as the intersection with Mt Cotton Road (also state-controlled).
- Option 2: Runs north from Stapylton-Jacobs Well Road as far as Burrows Road before deviating west and crossing Rotary Park Road. It then runs west and crosses the Albert River just north of Eagleby Wetlands before continuing north to Eagleby Road. It then crosses the Albert River and then runs directly north to the intersection of Mt Cotton Road and Beenleigh-Redland Bay Road.

- Option 3: As for Option 1, but then continues south from the intersection of Beenleigh-Redland Bay Road and Mt Cotton Road across the Logan River to the intersection with Eagleby Road.

At the time of writing, the project is still in the pre-concept phase, and so a detailed scope of works is not available. The high level LEL study indicates that the IRTC northern connection would likely comprise a 100 metre wide road corridor, which would allow for a 60 metre wide road (general traffic lanes) together with HOV lanes, landscaped median, future public transit facility and a service road. The LEL study indicated that the road corridor width was unlikely to exceed a maximum of 100 metres. The three options are shown in Appendix 1.

## 2.1 WATER

**Factors Identification** - *Factors present, or potentially present, within / near to the project footprint*

- ☐ Freshwater water body
- ☒ Marine water body
- ☐ Groundwater / Aquifers
- ☒ Significant water body

The proposed project falls within the Logan and Albert River Catchments. Watercourses within the catchment are the Logan River, Albert River, Native Dog Creek and Serpentine Creek (both tributaries of the Logan River). The confluence of the Logan and Albert Rivers occurs at the eastern end of the Eagleby floodplains and is subject to heavy flooding. The Logan River ultimately flows in Southern Moreton Bay. All major watercourses within the project area are tidal.

The Carbrook wetlands aggregation occurs mainly to the north east of the study area but also extends across Beenleigh Redland Bay Road in the vicinity of the Carbrook golf course. The Carbrook wetlands aggregation is included in the Directory of Important Wetlands in Australia (DIWA) and is considered to be of national importance. While it does not have the significance of a RAMSAR wetland (which have international significance and are therefore protected under the provisions of the federally administered Environment Protection and Biodiversity Conservation Act (EPBC) it is still an area of environmental significance. There is also a series of wetlands at Eagleby, located on the western banks of the Albert River to the north of Staplyton-Jacobs Well Road.

Most of the project area is low lying (less than 5 m ASL). Flooding of low lying areas occurs as a result of localised rainfall in the catchment of Native Dog Creek, with the Melaleuca wetlands and swampy grasslands being inundated for between two and four months of the year. Most of the study area is within a Coastal Management District, and is also mapped as a coastal hazard area (erosion prone area).

The project area is not within a declared fish habitat area. Department of Agriculture and Fisheries (DAF) mapping shows the Logan and Albert Rivers as grey (tidal areas) for which a development approval is nearly always required (see legislation section for more details). There are also numerous other drainage lines and minor watercourses within the study area that may be impacted by the proposed works.

The study also highlighted areas that were especially sensitive to reduction in waterway / floodplain conveyance area – especially the floodplain between the Eagleby residential area and the Logan River, and the floodplain southeast of the Albert / Logan River confluence.

**Aspects & Impacts** - *Proposed project aspects with the potential to impact on factors identified*

Planning & Design – All three proposed options pass through the Logan and Albert River floodplains, and require significant bridge structures to accommodate flood flows. Option 2 in particular would require multiple crossings of the Logan River.

The DIWA listing for the Carbrook wetlands lists alteration of the existing hydrological regime and subsequent loss of ephemeral grassy wetlands as a major threat to the integrity of the wetland which should be avoided when considering any future development proposals (including road construction) in the area.

The emphasis during planning and design should therefore be to design the required bridge structures to minimise impacts on both water flow and water quality that may occur as a result of the proposed project. More detailed assessment of both potential impacts to surrounding water bodies and appropriate mitigation measures to address these impacts should be developed as part of the REF for the proposed project.

Construction & Operation – During construction the emphasis should be on minimising impacts to water quality in surrounding watercourses and wetlands. Prior to construction, baseline water quality monitoring should be undertaken to establish existing water quality and determine appropriate water quality parameters for the construction phase. An appropriate and site specific erosion and sediment control plan will be required to minimise amounts of sediment-laden runoff entering surrounding watercourses. This will be especially important when working within or adjacent to the environmentally sensitive Carbook wetlands area.

☒ Potential Legislative Requirements (refer to Section 3 for more information). (i) General Environmental Duty under the Environmental Protection Act, (ii) Operational Works Permits for Tidal Works, Works within a Coastal Management District and constructing or raising waterway barrier works under the Fisheries Act, (iii) Destroying vegetation, excavating or placing fill in, or taking or interfering with water within a watercourse under the provisions of the Water Act.

## 2.2 SOIL / LAND MANAGEMENT

**Factors Identification** - *Factors present, or potentially present, within / near to the project footprint*

| | |
|---|---|
| ☒ Problem Soils (e.g. erodible, saline, ASS)<br>☐ Steep / Hilly terrain<br>☒ Significant areas<br>☒ Contaminated land | The project area is situated within and adjacent to the floodplains of the Albert and Logan Rivers. Water pH is generally acidic, and pools of standing water in the area have previously been found to contain very high concentrations of iron and manganese, indicating acid sulfate soils. Both Logan City and the City of Gold Coast have identified the majority of land surrounding the Logan River, Albert River and east of the Pacific Motorway as an ASS hazard area.<br>Department of Infrastructure, Local Government and Planning mapping indicates that the majority of the study area is classified as a "coastal hazard erosion prone area".<br>As discussed in section 2.1 above, all options to construct the proposed IRTC Northern Connection require significant bridge structures, with Options 1 and 3 both requiring works within the boundaries of the Carbrook wetlands area where it crosses Beenleigh-Redland Road in the vicinity of the Carbrook Golf Course.<br>There are a number of properties within the study area listed on the Queensland Environmental Management Register (EMR) as currently or historically supporting "notifiable" (potentially land contaminating) activities. These properties are mostly located adjacent to or in the vicinity of existing state-controlled roads (Stapylton-Jacobs Well and Beenleigh-Redland Bay Road). |

**Aspects & Impacts** - *Proposed project aspects with the potential to impact on factors identified*

Planning & Design - As discussed above, acid sulphate soils are highly likely to occur within the project area. Excavation and exposure of these soils could result in their oxidation and subsequent release of contaminants (sulphuric acid, iron and aluminium) which could harm the environmentally sensitive receiving environment.

During the design phase, detailed and site specific investigations will be required in high risk areas (below 5m AHD) to determine locations of ASS and PASS. These investigations should be carried out as per the current QASSIT guidelines (Guidelines for the sampling and analysis of lowland acid sulphate soils in Queensland – October 1998). An appropriate and site specific ASS management plan should be developed to manage and treat any ASS appropriately.

Given the proximity of sensitive water bodies such as the Carbrook wetlands and Logan and Albert Rivers to the proposed project, consideration should be given to appropriate treatment of stormwater runoff to reduce the sediment load entering surrounding creeks and drainage lines. Diversion of stormwater runoff through grassed swales prior to discharge to watercourses will provide primary treatment of the runoff and reduce sediment load. The design will also need to consider

the placement of sediment basins (both temporary and permanent) as a further measure to reduce impacts on adjacent watercourses and environmentally sensitive areas.

With respect to contaminated land, excavation works associated with the construction of the proposed IRTC Northern Connection may disturb any contaminants present in the soil. A search of the EMR and CLR should be undertaken as part of the REF for the proposed project to determine whether any areas of contamination occur within the project area. Should this be the case, further investigation should occur to identify whether any of these areas will be disturbed by construction of the IRTC northern connection and develop appropriate management measures for these areas if required.

Construction and Operation – During construction, the emphasis will be on the appropriate management of "problem" soils such as ASS and minimising erosion of disturbed areas. Areas disturbed during earthworks have an increased erosion potential, and sediment leaving the project area may enter surrounding watercourses. An appropriate and site specific erosion and sediment control plan will be required in order to minimise impacts on the receiving environment. Acid sulphate soils will require management as per the ASS management plan developed during the design phase to avoid release of contaminants (acids and metals) into the surrounding environment.

☒ Potential Legislative Requirements (refer to Section 3) (i) General Environmental Duty under the Environmental Protection Act, (ii) Operational Works Permits for removal of contaminated soil under the Environmental Protection Act.

## 2.3 FLORA

**Factors Identification** - *Factors present, or potentially present, within / near to the project footprint*

| | |
|---|---|
| ☒ Significant species<br>☒ Significant vegetation / ecosystems<br>☒ Pest Plants | The Logan and Albert Rivers and their associated floodplains form a major part of the landscape in the study area, and support mangrove communities (lining the banks of the Logan and Albert Rivers), estuarine wetlands and open eucalypt forest.<br>The Carbrook wetlands area contains a variety of vegetation communities including permanent freshwater ponds, shrub swamps and freshwater (seasonally flooded) swamp forest. The area is known to support a very diverse flora, including some species which have a restricted distribution. Legislatively protected species have been recorded as occurring within the Carbrook wetlands.<br>There is a gazetted Conservation Park (protected under the provisions of the Nature Conservation Act) in the vicinity of the study area – Carbrook Wetlands Conservation Park 1 (515NPW869). A portion of this conservation park is located just to the east of the study area on the southern side of Beenleigh-Redland Bay Road), but it is unlikely to be directly impacted by any of the current options to construct the IRTC northern connection.<br>A desktop search was undertaken of Department of Environment and Heritage Protection (DEHP) regional ecosystem mapping to establish the presence or absence of significant vegetation (regional ecosystems or RE's) within the study area. Regional Ecosystem mapping for the project area indicates the presence of mapped "of concern" remnant vegetation in a number of areas, notably where Beenleigh-Redland Bay Road intersects with both Mount Cotton Road and Ferry Road. In addition, most of the project is mapped as a "high risk area" on DEHP's protected plants flora survey trigger mapping. |

**Aspects & Impacts** - *Proposed project aspects with the potential to impact on factors identified*

Planning & Design –

During planning and design, the emphasis should be on establishing whether there are any legislatively protected flora species or areas of significant vegetation within the study area, and progressing the design in a way that minimises

impacts on these species or areas where possible. A field survey to ground truth the presence or absence of protected species (including marine plants protected under the Fisheries Act) will be required once the project reaches the concept phase.

The Directory of Important Wetlands Australia (DIWA) listing for the Carbrook wetlands aggregation lists clearing of existing remnant vegetation and loss of grassy wetland areas as a major threat to the overall ecological integrity of the wetlands. It will therefore be important to minimise impacts on the wetlands area where possible, in particular in the vicinity of Beenleigh-Redland Bay Road and the Carbrook Golf Course (Options 1 and 3).

While none of the current options will impact on the legislatively protected Carbrook wetlands Conservation Park, should the alignment of either Option 1 or 3 shift to the east as the project progresses, impacts on the park could occur.

Construction – During construction, the emphasis will be on ensuring any vegetation clearing does not extend past defined clearing limits, and ensuring that effective erosion and sediment controls are in place to avoid indirect impacts on native vegetation. It will also be necessary to undertake a weed survey prior to construction to establish whether any declared weeds are present within the construction zone and develop an appropriate plan to manage any declared weed infestations.

☒ Potential Legislative Requirements (refer to Section 3) (i) Clearing permit for the removal of "endangered" or "near threatened" species from areas of remnant vegetation under the Nature Conservation Act, ((ii) Clearing permit for the removal of marine plants under the Fisheries Act (iii) Requirement to remove C1 and C2 pests from land under the Land Protection Act.

## 2.4 FAUNA

**Factors Identification** - *Factors present, or potentially present, within / near to the project footprint*

| | |
|---|---|
| ☒ Significant species<br>☒ Habitat / Breeding places<br>☒ Wildlife corridors<br>☐ Pest animals | As discussed in 2.3 above, the Carbrook wetlands area is known to support a very diverse flora and fauna and likely provides a refuge for fauna species during drought periods. The ephemeral grassy swamps of the Carbrook wetlands are utilised by many waders and waterbirds, including migratory species which are protected under the federally administered EPBC Act.<br>Historical records for the Carbrook wetlands also indicate a high diversity of mammal species, including the koala (protected under both state and federal legislation) and a number of bat species. As discussed in 2.3 above, mangroves line the banks of the Albert and Logan Rivers, which may provide roosting sites for the federally protected grey-headed flying fox. A number of frog species have also been previously recorded within the Carbrook wetlands including the legislatively protected wallum froglet which has a limited distribution due to its preference for acid lakes and wallum swamp.<br>The Eagleby wetlands (situated on the western banks of the Albert River) are located just south of where Option 2 would cross the Albert River. Logan City Council's publication "Threatened wildlife of Logan" indicates that the Eagleby wetlands area may support a number of legislatively protected bird species, including the Black-Necked Stork, Freckled Duck and Lewin's Rail. The Australian painted snipe (classified as "vulnerable" under both state and federal legislation) has also been recorded within Eagleby wetlands.<br>DNRM Regulated Vegetation Mapping for the study area indicates that there are patches of essential habitat for both the koala and the wallum froglet that would be impacted by all three potential options for the IRTC northern connection. The largest of these patches are associated with the Carbrook wetlands where it extends across the existing Beenleigh-Redland Bay into the Carbrook golf course (options 1 and 3).<br>The South East Queensland Koala Conservation State Planning Policy (Koala SPP) |

| | |
|---|---|
| | mapping also indicates areas of koala habitat within the project area. These mainly occur to the south of the Logan River and the east of the Albert River (impacted by option 2) and to the north and south of Beenleigh-Redland Bay (impacted by options 1 and 3). Areas of drier eucalypt and melaleuca forest away from the Logan and Albert River floodplains may also provide koala habitat. The area north of the Logan River is also mapped as a priority koala assessable development area. Check legislative status of this now.<br>In relation to fauna movement, the Carbrook wetlands area could be considered a southern extension of the Mount Cotton – Venman Bushland National Park bushland corridor and is an important lowland retreat for many bird species during their seasonal migrations. Tentative corridor linkages also exist to the west of the study area (to Cornubia Forest) and to the east of the study area to Redland Bay via the Sheldon-Mount Cotton corridor. The DIWA listing for the Carbrook wetlands lists severing of existing wildlife corridor linkages listed as a major threat to the ecological integrity of the wetlands. |

**Aspects & Impacts** - *Proposed project aspects with the potential to impact on factors identified*

Planning & Design – During planning and design, the emphasis should be on establishing whether there are any legislatively protected fauna species or their habitat / breeding areas within or adjacent to the study area, and progressing the design in a way that minimises impacts on these species or areas where possible. A field survey to ground truth the presence or absence of protected fauna species will be required as part of the detailed REF for the proposed project.

The presence of mapped koala habitat within the project area may trigger a requirement for the project to comply with the SEQ Koala Memorandum of Agreement (MoA). See section 3.0 – Legislation – for more details.

New bridges will be required for all three options, with option 2 in particular requiring major crossings of both the Albert and Logan Rivers. Both of these watercourses are mapped as grey (tidal – major impact) within DAF's mapping and so development approvals (for waterway barrier works) are highly likely to be required. An aquatic ecological field survey will be required as part of the detailed REF for the proposed project to identify the presence of fish in these watercourses and appropriate mitigation measures will be required in order to minimise potential impacts on fish movement.

Construction – During construction, the emphasis will be on minimising impacts to adjacent environmentally sensitive areas (Logan and Albert Rivers and the Carbrook wetlands). Aquatic fauna could be impacted if sediment leaving the construction site enters surrounding watercourses. As discussed in 2.2 above, an appropriate and site specific erosion and sediment control plan will be required in order to minimise impacts on the receiving environment.

The wallum froglet is an "acid frog". This species require acidic conditions (pH 4-5.5) to breed, and previous studies undertaken within the Carbrook wetlands indicate that water in the project area is acidic. These species could be impacted indirectly through changes in the pH of runoff waters from the construction site, especially where lime is used to neutralise disturbed acid sulphate soils. The acid sulphate soil management plan for the project should include measures to avoid pH changes to surrounding watercourses.

☒ Potential Legislative Requirements (refer to Section 3) (i) Referral to Federal Department of Sustainability, Environment, Water, Population and Communities for potential impacts on a threatened species and / or impacts on listed migratory species, (ii) Compliance with the SEQ Koala SPP / MoA, (iii) Operational Works Permits for constructing or raising waterway barrier works under the Fisheries Act.

## 2.5 PUBLIC AMENITY / HEALTH

**Factors Identification** - *Factors present, or potentially present, within / near to the project footprint*

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| ☒ Residential areas | The study area includes the suburbs of Carbrook, Eagleby, Alberton and Stapylton. |

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| ☒ Commercial areas<br>☒ Public facilities<br>☒ Structures<br>☒ Aesthetic values | The land tenure is mostly freehold, with small areas of conservation park (Carbrook wetlands) plus other reserves and outdoor recreational areas.<br>Both the Logan and Albert Rivers have had a considerable impact on the nature of land use within the study area as they form a physical barrier and also shape surrounding land use through the presence of their floodplains, which are mostly used for rural residential and agricultural purposes plus open space / recreation as discussed above.<br>The confluence of the Logan and Albert Rivers occurs at the eastern end of the Eagleby flood plains (western extent of the study area) and is prone to heavy flooding. This has confined the development of the Eagleby urban area and provided good quality agricultural land in the flood plain area. Any road through this could potentially impact on the current functionality of this land. In addition, land on the southern side of the Logan River is currently mapped as a "draft SEQ priority agricultural area".<br>With respect to emerging and future land use and planning in the study area, the suburbs of Beenleigh and Loganholme (western side of the Pacific Motorway) and Eagleby (eastern side of the Pacific Motorway) have been identified as future growth areas within South East Queensland. In addition, the Yatala Enterprise Area (YEA) to the south of the study area is predicted to be a major industrial and economic development area in the future. |

**Aspects & Impacts** - *Proposed project aspects with the potential to impact on factors identified*

Planning & Design – The proposed IRTC northern connection is likely to have both direct and indirect impacts on the surrounding areas via changes to noise, visual and social amenity, air quality and property access and property severance. All three options to construct this road pass through parcels of privately owned land. This will result in severance of existing access routes both within individual properties and to the existing local road network. Additionally, the IRTC is intended to be a limited access road, and as such no properties will be allowed direct access to it. Additional infrastructure (over / underpasses) will be required to ensure that local access is maintained. Consultation with directly affected property owners will be required during the concept and design phases of the project.

The IRTC northern connector is a greenfield project and as such would be classified as a "new road - access controlled" as per the TMR Transport Noise Management Code of Practice Volume 1 (2013) for the purposes of operational (road traffic noise) impact assessment. The road traffic noise criterion levels for new roads are significantly lower than for the upgrade of an existing road, particularly where the existing ambient noise levels are below 55 dB(A) $L_{A10}$ (18 hour). Potential noise impacts on outdoor educational and passive recreation areas within the study area may also require consideration. However given the rural residential / agricultural nature of the study area, noise barriers may not be a cost effective option to mitigate road traffic noise. A comprehensive road traffic noise assessment (RTNA) will be required once the project reaches the concept phase.

With respect to landscape and visual amenity, construction of a new state controlled road in the study area will result in some adverse impacts to the scenic amenity of the area, especially when considered in context of the existing rural residential / agricultural / open space land use. Potential impacts could be reduced via appropriate use of screening plantings / revegetation.

While construction of the IRTC northern connection will generate additional vehicle emissions during the operational phase of the project, these are not anticipated to have a significant impact on local air quality.

Construction – During the construction phase, the emphasis will be on minimising construction-related noise, vibration and air quality impacts on adjacent sensitive receptors. Residential properties in the study area may be exposed to construction-related impacts such as increased noise and / or vibration or deterioration of air quality.

Activities such as pile driving and the use of heavy construction equipment will generate noise and vibration during

construction. The construction contractor will need to develop an environmental management plan for the project site that takes into consideration the proximity of noise and vibration sensitive receptors to construction activities and details appropriate strategies to manage impacts on these receptors.

Dust may be generated during construction from a number of activities including vegetation and topsoil removal, transport of construction and waste materials and wind erosion from stockpiles and unsealed areas. The construction contractor will be required to develop and implement appropriate strategies to minimise impacts on adjacent sensitive receptors.

☒ Potential Legislative Requirements (refer to Section 3) (i) General Environmental Duty under the Environmental Protection Act.

## 2.6 CULTURAL HERITAGE

**Factors Identification** - *Factors present, or potentially present, within / near to the project footprint*

☒ Indigenous heritage

☒ Historical heritage

A cultural heritage risk assessment (CHRA) has recently been undertaken for the project by South Coast Region. The CHRA indicates that there is a high risk of the project impacting on Aboriginal Cultural Heritage, and the CHRA therefore classified the project as Category 5 (High Risk) under the Cultural Heritage Guidelines. There are two Aboriginal Parties for the project area: Jagera Daran Pty Ltd and Gold Coast Native Title Group (Jabree Limited).

The LEL study report included a desktop aboriginal cultural heritage assessment, and this assessment identified two sites of potential Aboriginal Cultural Heritage significance within the study area. NR

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Both the recently completed CHRA and the previous desktop assessment (LEL desktop study) indicate the presence of two sites of historical cultural heritage significance (and therefore protected under the provisions of the Queensland Heritage Act) within the study area. These are the former Carbrook State School and Fachwerk Farmhouse located at 597 and 445 Beenleigh-Redland Bay Road respectively. Both of these sites would potentially be impacted by Options 1 and 3.

**Aspects & Impacts** - *Proposed project aspects with the potential to impact on factors identified*

Planning & Design – Given that this is a greenfield project in an area of known cultural heritage significance, it is highly likely that there are areas of previously undiscovered and undisturbed aboriginal cultural heritage within the study area. The presence of known artefacts in the area is indicative that other areas of undisturbed land in the study area may support areas or artefacts of aboriginal cultural heritage significance. Consultation should be undertaken with the relevant aboriginal parties for the area (Jagera Daran Pty Ltd and the Gold Coast Native Title Group) as part of the detailed REF for the project to establish whether there are indigenous cultural heritage values within the study area that may be impacted upon by the proposed works. A Cultural Heritage Management Plan (CHMP) may be required in order for DTMR to meet their obligations under the Aboriginal Cultural Heritage Act 2003.

An additional search of the Queensland Heritage Register will also be required as part of the detailed REF for the proposed project to establish whether there are any sites or areas of historical cultural heritage value that may be impacted upon by the proposed works in addition to the two sites identified above

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| Construction – During construction, DTMR has a Duty of Care under the Aboriginal Cultural Heritage Act. If any cultural heritage material (sites or artefacts) finds occur during construction, the contractor will be required to stop work and report the find to DTMR immediately. |
| ☒ Potential Legislative Requirements (refer to Section 3) (i) Compliance with the General Duty of Care under the Aboriginal Cultural Heritage Act. |

# 3 POTENTIAL LEGISLATIVE REQUIREMENTS

Section 3.0 has been developed with reference to the legislation, policies and standards in force as at June 2017. However, due to the long term nature of this project, these are likely to change over the life of the project. A full review of legislation and policy requirements should be undertaken once the project reaches the concept phase to ensure that all relevant legislative requirements are addressed and appropriate approvals are obtained.

| LEGISLATION | General description and relevance to this project | Further action required (if any) |
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| **Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)** | The *Environment Protection and Biodiversity Conservation Act* (EPBC) is a federally administered act which provides protection to matters of national environmental significance (MNES). Anyone wanting to undertake an action that may have a significant impact on a MNES is required to submit a referral to the federal Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). SEWPaC then make a decision as to whether the project is deemed a "controlled" or "non controlled" action. Where a project is deemed to be a "controlled action", further assessment and approval under EPBC is required.<br><br>As discussed in section 2.1 and 2.4 and above, this scoping report has identified two MNES which may be impacted by the proposed project. These are:<br>- Potential for significant impacts on a listed migratory species and<br>- Potential for significant impacts on a listed threatened species.<br><br>The Carbrook and to a lesser extent the Eagleby wetlands are a known habitat area for species of waterbirds / waders listed under the JAMBA / CAMBA international agreements. While the proposed project will not impact greatly on the designated wetland area, there is still potential for the project to disturb habitat that is used by federally protected migratory species.<br><br>The koala and grey-headed flying fox are both listed as "Vulnerable" under EPBC. As discussed in 2.4 above, the mangrove communities that line the banks of the Albert and Logan Rivers may support populations of grey headed flying fox, and areas of drier eucalypt and melaleuca forest in the study area may | Careful consideration of the implications of Section 74A (split referrals) of the EPBC Act will be required once any section of the suite of projects that comprise the proposed IRTC reach the concept phase. It may be preferable to seek advice from SEWPaC prior to undertaking any detailed environmental assessments for the IRTC, as designation of the project as a controlled action under EPBC may trigger the requirement to undertake a formal EIS for the project. |

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| | provide koala habitat.<br><br>For the purposes of this Environmental Scoping Report, the potential for the IRTC Northern Connection to require referral to SEWPAC under the provisions of EPBC has been considered in isolation from the bulk of the future IRTC (between Stapylton-Jacobs Well Road and Nerang-Broadbeach Road). That is, the ESR assumes that the project will be designed, constructed and maintained as a stand-alone project. However, as discussed in section 1.0 above, the northern connection project connects to the future IRTC, and this raises the question of whether it can be considered as a stand-alone project for the purposes of assessment under EPBC.<br><br>High level environmental assessments undertaken as part of the road corridor development planning (RCDP) process for both the northern (Stapylton-Jacobs Well Road to Beattie Road) and southern (Beattie Road to Nerang-Broadbeach Road) sections of the future IRTC also include preliminary assessment as to the likelihood of the IRTC (i) requiring referral to the federal government under the provisions of EPBC and (ii) being deemed a "controlled action" under EPBC. These assessments concluded that both sections would require referral, and that the southern section in particular could be deemed a controlled action.<br><br>Section 74A of the EPBC Act makes specific provisions which allow the federal environment minister to refuse to accept a referral made under EPBC if it is deemed to be part of a larger action. That is, it is possible that the IRTC (including the northern connection project) may have to be referred to the federal government as a single referral / project, covering the entire route from Beenleigh-Redland Bay in the north to Nerang-Broadbeach Road in the south. This is a critical factor in terms of deciding the future environmental assessment and management framework for the project.<br><br>SEWPaC has developed a policy statement on this issue: http://www.environment.gov.au/system/files/resources/9af4f5a0-6a4b-4322-9dd1-ddbb9710d682/files/epbc-act-policy-staged-developments.pdf<br><br>The policy statement indicates that at this point in time, split referrals are not | |

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| | necessarily rejected automatically, and that where a project is referred to the federal government that appears to be part of a larger action, the minister will "consider whether to accept a split referral where it is likely to promote the objectives of the EPBC Act". In practical terms, this means that the federal environment minister may accept a split referral where there are practical or financial circumstances relating to the design, timeframe or geography of a project that make split referrals a suitable approach. The IRTC could fit this approach, as time and cost constraints will likely result in it being designed and constructed using a staged approach.<br><br>This will require careful consideration once the project reaches the concept phase, as determination of a project as a "controlled action" under EPBC can result in significant time and cost constraints. | |
| **State Development and Public Works Organisation Act 1971** | The purpose of the State Development and Public Works Organisation Act (SDPWO Act) is to facilitate timely, coordinated and environmentally responsible infrastructure planning and development to support Queensland's economic and social progress. The SDPWO Act is currently administered by the Department of State Development.<br><br>The SDPWO Act provides for the appointment of a Coordinator-General and gives them a number of powers, including the power to manage major infrastructure projects and declare a project to be a "coordinated project" and therefore coordinate the environmental impact assessment process.<br><br>The SDPWO Act is not "triggered" by a certain level of potential environmental impact as for the EPBC Act. Rather, TMR could actively seek declaration of the project as being of State Significance if it thought there was benefit in the IRTC being planned, designed and constructed as a State Significant Project. The Coordinator General does however have the power under the SDPWO Act to "call in" any state government department infrastructure project where they feel that timely decisions are not being made on a key project.<br><br>Declaration of a project as a "State Significant Project" under the SDPWO Act is dependent on a number of factors, including employment opportunities provided | Consideration should be given early in the planning stages for the proposed IRTC as to whether there would be benefit in TMR seeking declaration of the project as being of State Significance under the provisions of the SPPWO Act. |

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| | by the project, potential environmental impacts, complexity of state, local and commonwealth requirements and the strategic significance of the project to the region.<br><br>Should TMR decide to seek declaration of the project as being of State Significance, a formal Environmental Impact Statement (EIS) would be required. This would significantly change the environmental assessment process for the project from the internal TMR processes, particularly with respect to timeframes (it takes 12-18 months to complete an EIS under the SDPWO Act EIS process) and the level of consultation required at each stage of the EIS process.<br><br>It is important to note that there is a bilateral agreement in place between the Commonwealth and the State of Queensland relating to environmental assessment and approvals which provides for accreditation of Queensland processes for approval of proposed projects that would otherwise have been assessed by the federal government under the EPBC Act. The EIS process as prescribed by the SDPWO Act is one of these accredited processes, which effectively means that if an EIS is developed for the project under the provisions of the SDPWO Act, this would also be assessed by the federal government to determine potential impacts under the provisions of EPBC, meaning that only one EIS would need to be developed for the project. | |
| **Sustainable Planning Act 2009.** | The purpose of the *Sustainable Planning Act* (SPA) is to achieve ecological sustainability by managing the development process and coordinating and integrating planning at the local, regional and State levels.<br><br>Under the provisions of SPA, a number of activities associated with the project may require development permits through the Integrated Development Assessment System (IDAS). These include material change of use approvals (such as for Environmentally Relevant Activities and permits to remove contaminated land) and operational works approvals (such as works within watercourses, waterway barrier works and vegetation clearing). | Further investigation will be required during the concept phase to establish permits, approvals and policies under the SPA that may be relevant to the project. |
| **Koala Conservation Policy and Memorandum of** | The proposed project falls within the South East Queensland Koala Protection area (SEQ KPA) which includes Noosa, the Sunshine Coast, Moreton Bay, | With respect to the Koala MOA, additional assessment will be required to establish |

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| **Agreement between DERM and TMR in relation to government supported transport infrastructure within the SEQKPA (Koala MOA).** | Brisbane, Ipswich, Logan, Redland and Gold Coast City Council area. Where a proposed project within the SEQ KPA intersects with a mapped koala habitat area as per the koala conservation State Planning Policy (SPP) mapping, the project must comply with the *Memorandum of Agreement between DERM and TMR in relation to government supported transport infrastructure within the SEQKPA* (Koala MOA) unless an exemption applies.<br><br>Under the provisions of the koala MOA, TMR are obliged to consider potential impacts on koala populations during the design phase of the project. The project will be required to avoid (where possible) areas of mapped koala habitat. Where the project cannot avoid areas of mapped koala habitat, it should endeavour to align the corridor so that it intersects areas with the lowest possible koala habitat values, to the extent it is practical to do so. The project should also incorporate koala movement infrastructure and koala safety fencing where appropriate.<br><br>Where impacts to koala habitat areas cannot be avoided, offsets must be provided to mitigate impacts on areas of mapped "bushland" habitat and high and medium value "suitable for rehabilitation" habitat. As discussed in section 2.4 above, the proposed IRTC northern connection is likely to impact on areas mapped as both low and medium value bushland habitat. Therefore it is likely that offsets will be required for this project. | whether the project needs to comply with the koala MOA (requires clearing of more than 125 koala habitat trees or 0.5 hectares of mapped koala habitat). If compliance is required, an appropriate methodology should be developed in order to comply with the koala MOA and establish appropriate offsets where required. |
| **Coastal Protection and Management Act 1995.** | The Coastal Protection and Management Act protects and conserves the coastal environmental, including it's resources and biodiversity. It also ensures that decisions about land use and development in coastal areas are made in a way that protects life and property from the threat of coastal hazards. Assessable development under this act requires a development approval under the provisions of the Sustainable Planning Act.<br><br>As discussed in 2.1 and 2.2 above, most of the study area is mapped as being within a coastal management district, and is also mapped as a coastal hazard (erosion prone) area.<br><br>Prescribed tidal works (sections 14 and 15 of the Coastal Protection management regulation) and royalty payments for the removal of quarry material | Further assessment will be required during the concept phase to establish which permits, approvals and policies under the Coastal Protection and Management Act may be relevant to the project. |

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| | from tidal waters may be triggered by the proposed project. However, TMR has a number of exemptions in place which negates the requirement to pay fees for the removal or quarry material from today waters, and the majority of TMR projects are unlikely to be considered as prescribed tidal works unless they are related to boating infrastructure. | |
| **Environmental Protection Act 1994.** | The purpose of the *Environmental Protection Act* is to protect the environment while allowing for ecologically sustainable development.<br><br>In general terms, the project must comply with section 319 of the Environmental Protection Act (the "General Environmental Duty") and not undertake activities that cause or are likely to cause environmental harm unless all reasonable and practical measures are taken to prevent or minimise the harm.<br><br>There are also a number of issue specific Environmental Protection Policies (EPP's) that the project will need to comply with. These include the EP(Air) Policy 1997, EP(Noise) Policy 1997, EP(Waste Management) Policy 2000 and EP(Water) Policy 1997.<br><br>In co-ordination with the Sustainable Planning Act, The Environmental Protection Act provides for licensing and approval of Environmentally Relevant Activities (ERA's). ERA's are activities that require specific regulation because of the likelihood that they could cause environmental harm. To carry out an ERA a registration certificate must be obtained prior to commencing the activity. A number of ERA's (such as ERA 8 – chemical storage, ERA43 – Concrete Batching and ERA 57 – Regulated Waste Transport) may potentially apply to the project.<br><br>Disposal and removal of contaminated soil from sites listed on the Contaminated Land or Environmental Management Registers (see section 2.1 above) will require a disposal permit. | Further assessment will be required during the concept phase to establish which permits, approvals and policies under the Environmental Protection Act may be relevant to the project. |
| **Aboriginal Cultural Heritage Act 2003.** | The *Aboriginal Cultural Heritage Act* protects and conserves aboriginal cultural heritage within Queensland. Under this act, a person who carries out an activity must take "all reasonable and practical measures to ensure the activity does not harm indigenous cultural heritage". This is known as the Aboriginal Cultural | Once the project reaches the start of the Concept Phase, consultation will be required with the relevant aboriginal parties for the project area and a Cultural Heritage Plan |

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| | Heritage Duty of Care.<br><br>DTMR must comply with the Duty Of Care for the proposed IRTC northern connection project. As discussed in 2.6 above, a Cultural Heritage Risk Assessment (CHRA) has been undertaken for the study area, which classified the project at Category 5 (high risk). Additional assessment, including consultation with the relevant aboriginal parties for the area, will be required once the project reaches the concept phase.<br><br>As discussed in section 2.6 above, if the project is deemed a "controlled action" under the EPBC Act and an EIS is required, this will trigger a requirement for a compulsory Cultural Heritage Management Plan (CHMP) as per part 7 of the Aboriginal Cultural Heritage Act. This is a statutory process and involves a statutory notification period during which the land user (in this case TMR) must notify the relevant Cultural Heritage Body and / or Aboriginal Party of their intention to develop a CHMP. Notification recipients are then given 30 days in which to respond to the notification, which is followed by an 84 day consultation and negotiation period.<br><br>While a formal Part 7 CHMP as outlined above takes more time to develop than an informal (and voluntary) Cultural Heritage Agreement (CHMA), it has the advantage that once approved, it will provide TMR with certainty that they are acting lawfully with respect to the ACH Act and meeting all requirements under the Cultural Heritage Duty of Care. | should be developed. As discussed, this may need to be a formal Part 7 CHMP if the EIS requirement under EPBC is triggered. |
| **Queensland Heritage Act 1992.** | The objective of the *Queensland Heritage Act* is to protect Queensland's historical (European) cultural heritage for the benefit of the community and future generations. Under the provisions of this Act, an individual who discovers an aspect of historical cultural heritage is required to notify the DEHP minister as soon as possible.<br><br>A Cultural Heritage Risk Assessment (CHRA) was undertaken for the IRTC Northern Connection project, which identified two sites of historical cultural heritage significance (listed on the Queensland Heritage Register) within the study area, both of which are located on Beenleigh-Redland Bay Road. | Further investigation will be required once the project reaches the concept phase, including a search of the Queensland Heritage Register. |

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| **Nature Conservation Act 1992.** | The purpose of the *Nature Conservation Act* is the conservation of nature through an integrated and comprehensive conservation strategy for the whole of the State. Under the provision of the NCA, permits are required from the Department of Environment and Heritage Protection (DEHP) where a proposed activity involves the taking of "endangered, "near threatened" or "least concern" native plants in the wild.<br><br>TMR have an approved Compliance Management Plan (CMP) under section 477H of the Transport Infrastructure Act 1994 that allows TMR and it's contractors to clear plants protected under the Nature Conservation Act in areas that have been previously cleared. This CMP is valid until the end of March 2018.<br><br>As discussed in section 2.3 above, most of the project area is mapped as "high risk" on DEHP's protected plants flora survey trigger mapping. | During the concept phase, flora surveys will be required to establish whether any flora species protected under the Nature Conservation Act occur within the project area and appropriate management measures will be required to minimise impacts on protected species if they are present. |
| **Vegetation Management Act 1999.** | The purpose of the *Vegetation Management Act* is to conserve remnant vegetation. The VMA regulates the clearing of vegetation that is mapped as an "endangered", "of concern" or "least concern" Regional Ecosystem (RE). Clearing of native vegetation as defined under the VMA is usually assessable development under the provisions of the Sustainable Planning Act (SPA) and Sustainable Planning Regulation (SPR). However, as per Schedule 24 (Part 1, item 1(16) and Schedule 2 (Part 1, item 10), clearing of native vegetation for the purposes of community infrastructure is not assessable development. Therefore providing that clearing of native vegetation only occurs within the road corridor, approval under the SPA is not required.<br><br>Regional Ecosystem Mapping also indicates areas where essential habitat for significant fauna species may occur (see 2.4 above). The proposed IRTC northern connection may impact on areas of mapped essential habitat for both the wallum froglet and koala. | Given the presence of mapped essential habitat for the wallum froglet and koala within the study area, field investigations will be required during the concept phase to establish whether these species are present in the study area. |
| **Fisheries Act 1994.** | The *Fisheries Act* manages and protects fish habitats, fisheries resources and aquaculture. Operational work that requires approval includes: | Further investigation will be required once the project reaches the concept phase in order to establish which approvals under the Fisheries |

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| | - Tidal work or work within a coastal management district.<br>- Constructing or raising waterway barrier works.<br>- Works in a declared fish habitat and<br>- Removal or damage of marine plants.<br>Given the nature and location of this project (i.e. major bridge construction in a tidal area), it will trigger the requirement for a number of approvals under the Fisheries Act – notably waterway barrier works permits and approval to remove marine plants. Tidal works permits may also be required. | Act will be required for the project. |
| **Land Protection (Pest and Stock Route Management) Act 2002.** | The *Land Protection Act* aims to control and manage invasive pests (weeds and pest animals) in Queensland. Plants and animals can be declared serious (Class 1 and 2) or potentially serious (Class 3) pests under this legislation.<br>Landholders are required to keep land clear of Class 1 and 2 pests, and can be required to remove C3 pests if found adjacent to environmentally significant areas. Weed identification and an appropriate management plan will be required during construction. | Ground-truthing of weed populations within the project area will be required prior to construction. |
| **Water Act 2000.** | The purpose of the *Water Act* is to promote sustainable management and efficient use of water and other resources by establishing a system for the planning, allocation and use of water. Approval will be required for a number of activities, including:<br>- Destroying vegetation, excavation and placement of fill within watercourses (Riverine Protection Permit required).<br>- Taking or interfering with water(including interfering with flow) and<br>- Taking quarry material from the bed or banks of a watercourse.<br>DTMR currently have exemption from obtaining riverine protection permits provided that the project complies with the "Guideline – Activities in a watercourse, lake or spring carried out by an entity".<br>Permits may be required if the taking of water or quarry material is required. | Further investigation will be required during the concept phase into current legislative requirements under the Water Act. |

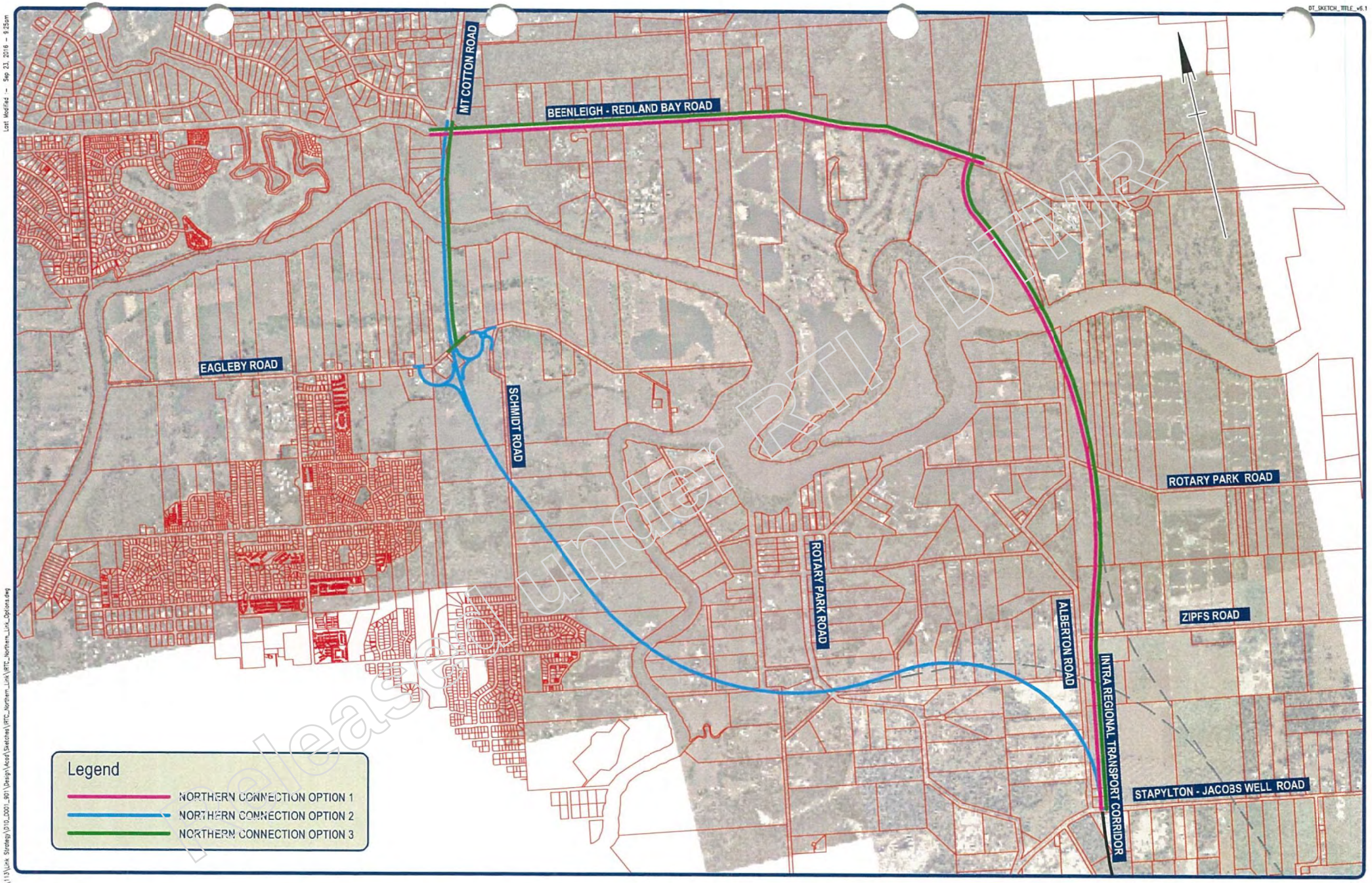
# 4. CONCLUSIONS AND RECOMMENDATIONS.

This ESR has been developed to provide a high level desktop assessment of potential environmental impacts associated with each of the three potential options to link Beenleigh-Redland Bay Road with the future IRTC at Stapylton-Jacobs Well Road. A number of potential environmental issues will require additional investigation once the project reaches the concept phase, including potential impacts on the Carbrook wetlands, potential impacts on legislatively protected flora and fauna species, and potential for the project to impact on areas of Aboriginal Cultural Heritage Significance.

From an Options Analysis perspective, at this point in time there is no discernible difference between the three options from an environmental impact perspective. All three options have environmental constraints which will require additional assessment and management as the project progresses.

The most critical issue for the IRTC Northern Connection from an environmental management perspective is its relationship to the rest of the IRTC corridor. Construction of the IRTC between Beenleigh-Redland Bay Road and Nerang-Broadbeach Road could potentially trigger external environmental assessment processes than the IRTC Northern Connection as a "stand alone" project would not. This will require careful consideration, given that external environmental assessment processes such as the Environmental Impact Statement (EIS) process under the EPBC Act or SDPWO Act are significantly more time, cost and resource intensive than internal TMR environmental assessment and management processes.

# Appendix 1 – IRTC Northern Connection Options 1-3






Design Criteria:
DESIGN SPEED - Major Road 110 km/h; Minor Road 70 km/h
POSTED SPEED - Major Road 100 km/h; Minor Road 60km/h

# IRTC - NORTHERN CONNECTION
# BEENLEIGH - REDLAND BAY ROAD TO STAPYLTON - JACOBS WELL ROAD

A 0 200 400m

Drawing No. SKNC1 (B)
Drawn: G. CROTHERS
Design: G. CROTHERS
Engineer:

Queensland Government

IRTC | D10 / D001 / 901