Appendices

Appendix A

Landowners Consent

Queensland Government

Office of the
Coordinator-General

Our ref: DEPC23/196
Your ref: 12559247

10 March 2023

Ms Amanda Smedley
Senior Environmental Scientist
GHD Pty Ltd
amanda.smedley@ghd.com

Dear Ms Smedley

Request for landowner's consent for lodgement of an application on Lot 1 on SP260750, Lot 25 on SP307529 and Lot 20 on SP272417 in the Gladstone State Development Area

I refer to your correspondence dated 10 March 2023, requesting landowner's consent on behalf of the proponent Gladstone Area Water Board, for lodgement of a development application with the Office of the Coordinator-General over Lot 1 on SP260750, Lot 25 on SP307529 and Lot 20 on SP272417, located within the Gladstone State Development Area (SDA). The Coordinator-General has requested that I respond on his behalf.

The proposed development application is for the construction and operation of a water pipeline in the Gladstone SDA.

As delegate of the Coordinator-General, the registered owner of Lot 1 on SP260750, Lot 25 on SP307529 and Lot 20 on SP272417, I consent to the lodgement of the abovementioned application by GHD Pty Ltd on behalf of Gladstone Area Water Board.

By consenting to the lodgement of the application, the Coordinator-General does not:

- waive any of the Coordinator-General's rights as owner of the land under any law, or
- give or warrant any representation that the Coordinator-General, State of Queensland, or any other person has granted or will grant the proponent or any other person rights to occupy or use any part of the land in future.

Furthermore, nothing in this letter:

- restricts or fetters the exercise by the Coordinator-General, the State of Queensland, or any other relevant authority of any rights, powers or discretions, or any planning, resumptive or other regulatory power, or
- acts as an estoppel, warranty or representation or creates an agreement of any kind.

This consent is valid for a period of six months from the date of this letter.

1 William Street
Brisbane Queensland 4000
PO Box 15517
City East Queensland 4002
Telephone 13 QGOV (13 74 68)
Website www.statedevelopment.qld.gov.au
ABN 29 230 178 530

If you require any further information, please contact Ms Wendy Paton, Principal Project Officer, Office of the Coordinator-General, on 3452 7549, who will be pleased to assist.

Yours sincerely

David Stolz
Assistant Coordinator-General
Planning and Services
(as delegate of the Coordinator-General)

Author: Louise Schefe
Ref number: 2022/002054
Unit: Land Services
Phone: (07) 46241548

Queensland Government

Department of Resources

10 March 2023

Amanda Smedley
GHD Pty Ltd
PO Box 373
GLADSTONE QLD 4680

Dear Amanda

Request for owners consent - Development Application for Material Change of Use (Fitzroy to Gladstone Pipeline) and Operational Works for Vegetation Clearing

Reference is made to the request for owner's consent on behalf of Gladstone Area Water Board required to accompany the development application for a State Development Area application for a Material Change of Use (Fitzroy to Gladstone Pipeline) and Operational Works for vegetation clearing with the proposed works to be located within various roads and Larcom Creek.

The department hereby gives owner's consent to the development application for a State Development Area application for a Material Change of Use (Fitzroy to Gladstone Pipeline) and Operational Works for vegetation clearing as shown on Figures 2 to 7 submitted to the department on 15 July 2022. The owner's consent is subject to the compliance with any requirements of Gladstone Regional Council as road manager including obtaining an appropriate authority to authorise the proposed works.

Although owner's consent for the development has been provided, the applicant will be required to comply with the purpose, terms and conditions of the proposed Council authority to carry out works on road and should undertake works only if and when the development has been approved by the assessment manager or responsible entity, and in accordance with the conditions of that approval.

A copy of this letter is to be attached to your development application as the required evidence of owner's consent.

The applicant will also need to comply with all other legislative and regulatory requirements which may also include approvals that are not part of the assessment of the development application under the Gladstone State Development Area (GSDA) Development Scheme 2015 e.g. a marine park permit if in a marine park.

Further, please note that the above consent will expire on **8 September 2023.** Should the development application not be lodged with the assessment manager or responsible entity prior to this date, you will be required again to lodge a further request for owner's consent and any further request will need to be reconsidered by the Department.

It is also advised that any land use activities must comply with the *Aboriginal Cultural Heritage Act 2003* or the *Torres Strait Islander Heritage Act 2003*. Please note that it is the responsibility of the assessment manager to address native title rights and interests in accordance with the *Native Title Act 1993*.

Finally, owner's consent is required under the GSDA Development Scheme to enable the application to be considered properly made for lodging with the assessment manager or responsible entity and is a completely separate process to assessment of the application under the GSDA Development Scheme.

Accordingly, the State may act at a later date as assessment manager or responsible entity or referral agency or affected entity in the assessment of the development application - providing owner's consent will not influence any role the State may have in this development assessment.

If you wish to discuss this matter please contact Louise Schefe on (07) 46241548.

All future correspondence relative to this matter is to be referred to the contact Officer at the address below or by email to SLAM-Rockhampton@resources.qld.gov.au. Any hard copy correspondence received will be electronically scanned and filed. For this reason, it is recommended that any attached plans, sketches or maps be no larger than A3-sized.

Please quote reference number 2022/002054 in any future correspondence.

Yours sincerely

Louise Schefe
Senior Land Officer
A duly authorised delegate of the Minister
under the current Land Act (Ministerial) Delegation

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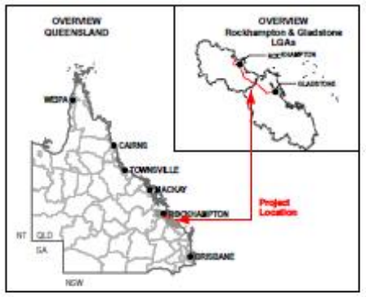
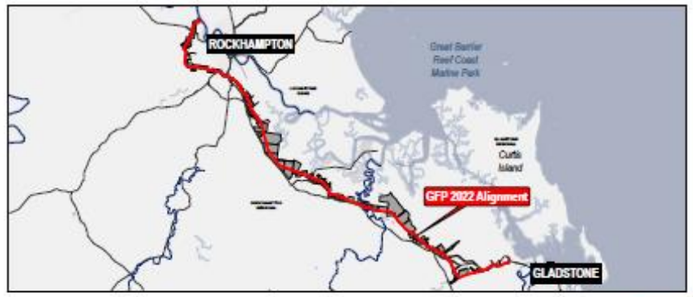
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Cadastral data - Queensland series @ QSpatial, 2022
3. State Development Area precincts - Gladstone SDA @ QSpatial, 2022
4. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Gladstone Area Water Board
P.O. Box 466, Gladstone QLD 4680
Ph: 07 4976 3000 www.gawb.qld.gov.au

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Fitzroy to Gladstone Pipeline Project
Figure 2: Land Subject to Landowner's Request
Unnamed Road
000-G-MAP-2267 Version:1 Date: 27/06/2022

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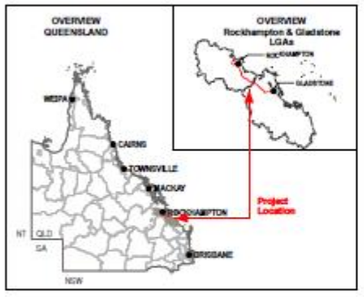
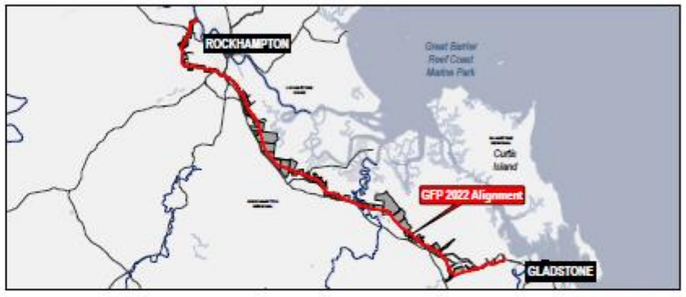
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Lot Subject to Request
- Waterbody
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Cadastral data - Queensland series @ QSpatial, 2022
3. State Development Area precincts - Gladstone SDA @ QSpatial, 2022
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Fitzroy to Gladstone Pipeline Project
Figure 3: Land Subject to Landowner's Request
Larcom Creek
000-G-MAP-2268 Version:1 Date: 27/06/2022

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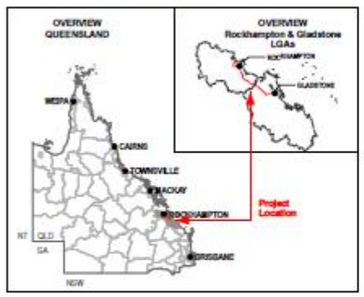
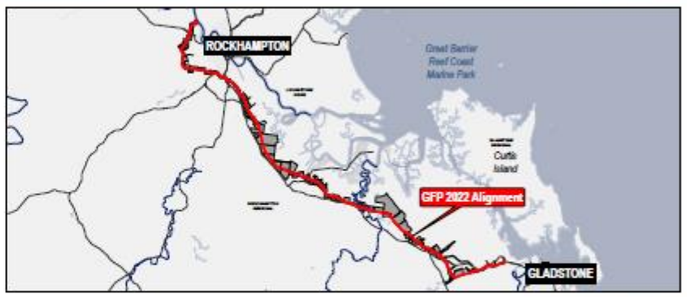
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Pipeline within the road reserves
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Cadastral data - Queensland series @ QSpatial, 2022
3. State Development Area precincts - Gladstone SDA @ QSpatial, 2022
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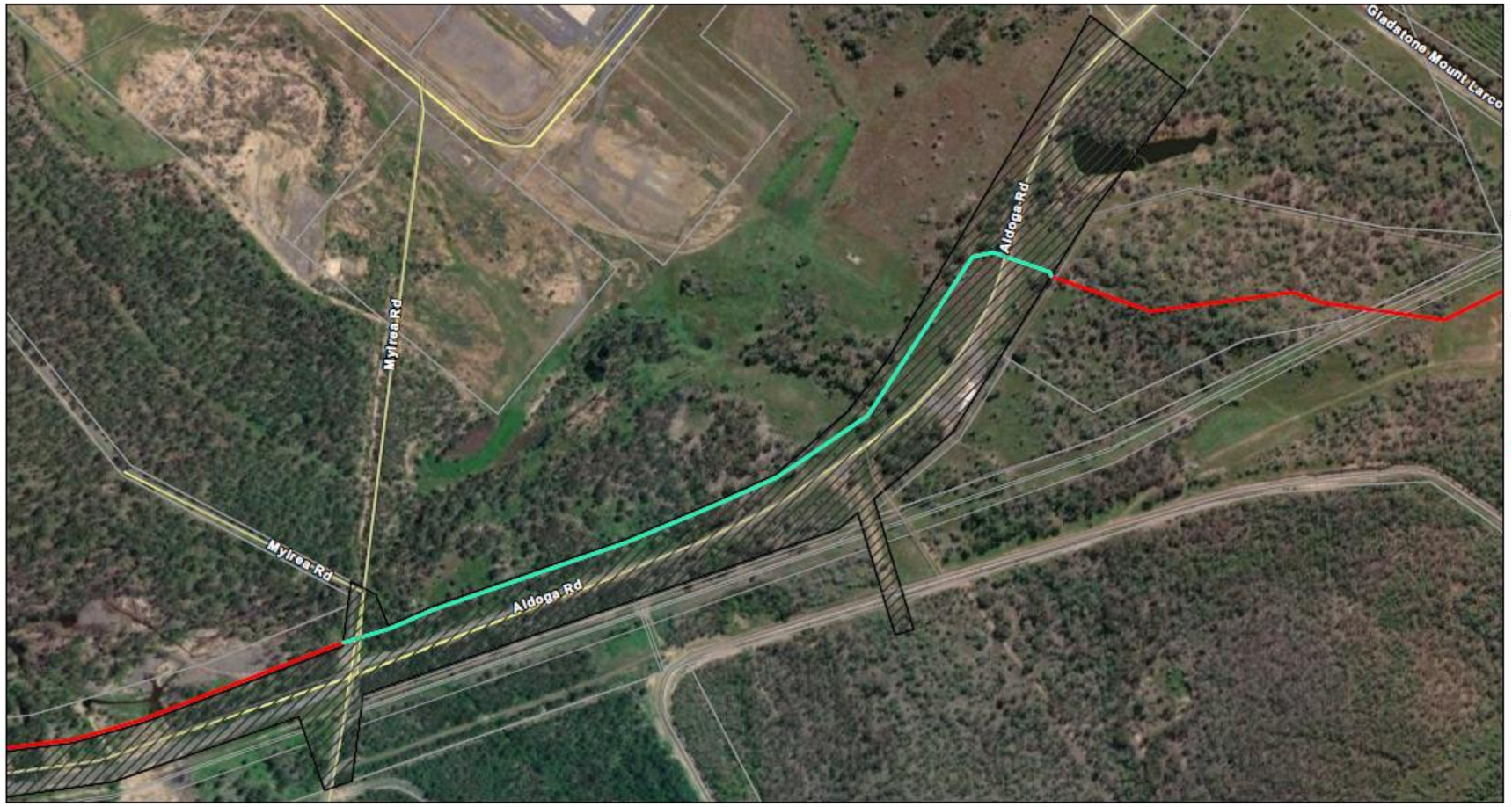
Fitzroy to Gladstone Pipeline Project
Figure 4a: Land Subject to Landowner's Request
Aldoga Road and Mylrea Road
000-G-MAP-2269 Version:1 Date: 27/06/2022



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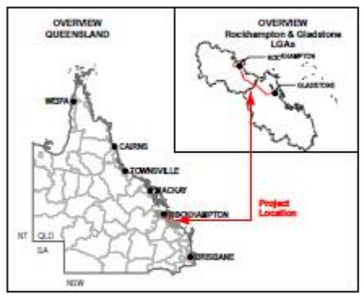
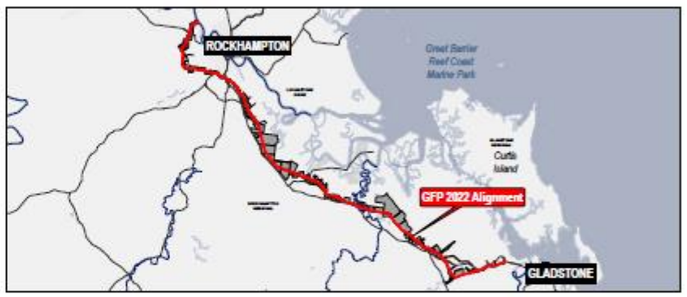
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Pipeline within the road reserves
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

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4. Imagery @ Earl, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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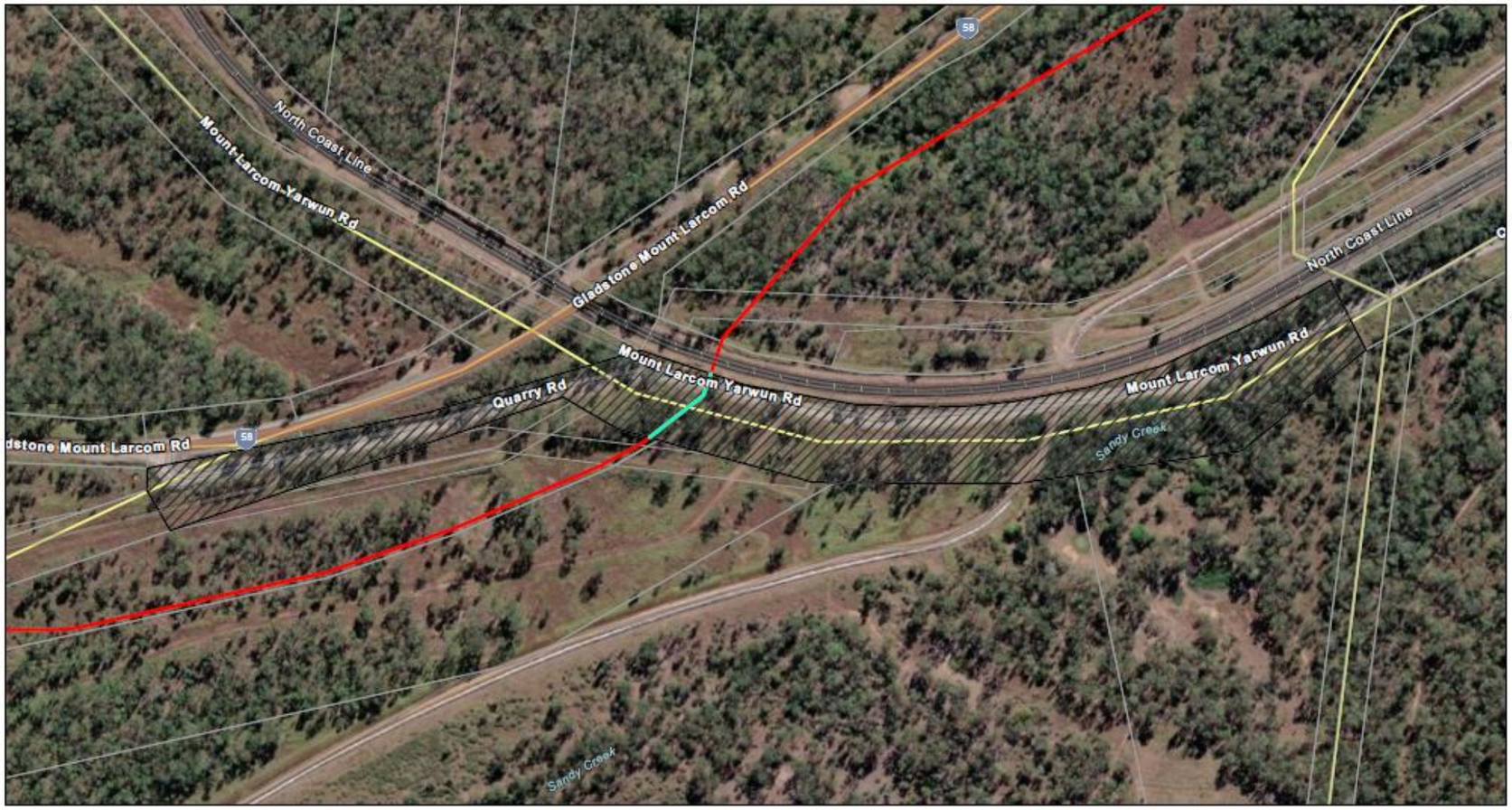
Fitzroy to Gladstone Pipeline Project
Figure 4b: Land Subject to Landowner's Request
Aldoga Road and Mylrea Road
000-G-MAP-2269 Version:1 Date: 27/06/2022



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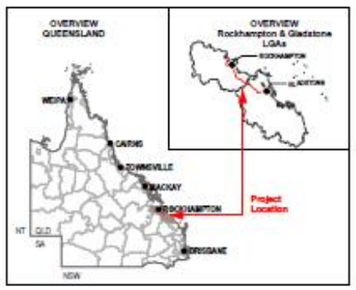
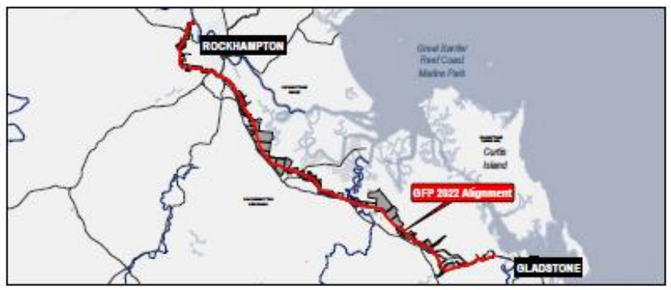
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Pipeline within the road reserves
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ GSpatial, 2021
2. Cadastral data - Queensland series @ GSpatial, 2022
3. State Development Area precincts - Gladstone SDA @ GSpatial, 2022
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Fitzroy to Gladstone Pipeline Project
Figure 5 Land Subject to Landowner's Request
Quarry Road / Mount Larcom Yarwun Road
000-G-MAP-2274 Version:1 Date: 14/07/2022

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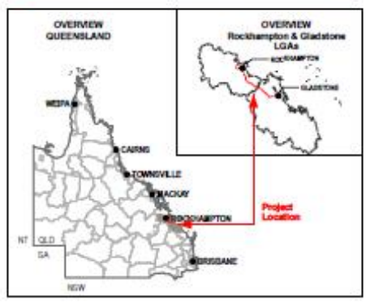
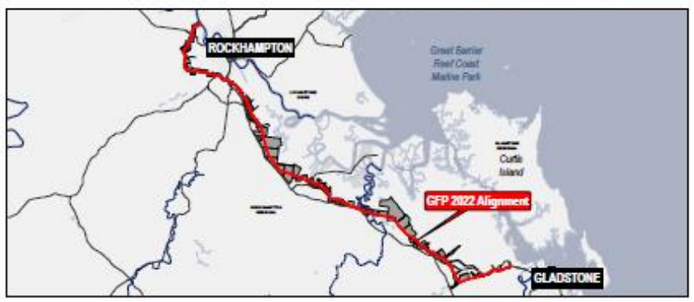
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

Data Sources:
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2. Cadastral data - Queensland series @ QSpatial, 2022
3. State Development Area precincts - Gladstone SDA @ QSpatial, 2022
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Fitzroy to Gladstone Pipeline Project
Figure 6 Land Subject to Landowner's Request
Halls Road
000-G-MAP-2270 Version:1 Date: 27/06/2022

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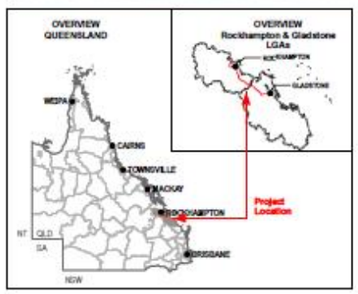
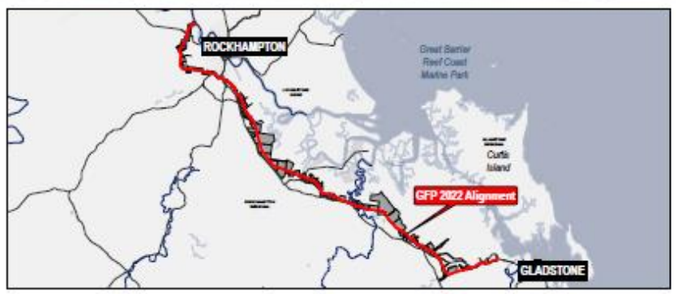
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS

Landowner Name:	Department of Resources
LGA:	Gladstone Regional Council

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Cadastral data - Queensland series @ QSpatial, 2022
3. State Development Area precincts - Gladstone SDA @ QSpatial, 2022
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Fitzroy to Gladstone Pipeline Project
Figure 7: Land Subject to Landowner's Request
Lindherr Road
000-G-MAP-2272 Version:1 Date: 27/06/2022

Amanda Smedley
GHD Pty Ltd
Level 2, 100 Goondoon Street
Gladstone QLD 4680

Landowner's Consent Request – Fitzroy to Gladstone Pipeline Project

22 August 2022

Dear Amanda,

We refer to your letter dated 13 July 2022 seeking landowners' consent for the proposed Fitzroy to Gladstone Pipeline planned to intersect with Aurizon land identified as Lot 2 on RP616271 within the Gladstone State Development Area (**GSDA**) and adjacent to the rail network at 561.700km on the North Coast Line.

Aurizon Property Pty Ltd, as the owner of the land identified, provides consent to the making of a development application by GHD Pty Ltd for the purpose of Material Change of Use and Operational Works for clearing native vegetation within GSDA.

Regards,

Damien Bock
Manager Real Estate Asset Management
Real Estate Asset Management
Aurizon Property Pty Ltd

Queensland Government

Our ref 485/00391, e62283
Your ref 12559247
Enquiries Patrick Leys

Department of
Transport and Main Roads

27 July 2022

Ms Amanda Smedley
Team Leader Environment
GHD
100 Goondoon Street
Gladstone Qld 4680

Dear Ms Smedley

REQUEST TO OBTAIN OWNER'S CONSENT – DETERMINATION NOTICE

This notice is in response to your request of 12 July 2022 to obtain owner's consent from the Department of Transport and Main Roads (TMR) to lodge a development application completely or partially over land held or administered by the department.

Pursuant to section 2.1(2)(d) in Schedule 2 of the *Gladstone State Development Area Development Scheme, May 2022 (GSDA Scheme*), the consent of the owner of land that is the subject of a development application is required in order for the development application to be considered as "properly made". Under Schedule 1 of the GSDA Scheme, the Chief Executive of the Department of Transport and Main Roads is taken to be the owner of the land.

The department has considered your request and **provides owner's consent** for the making of the following application:

Material Change of Use and Operational Works which involves the following rail corridor land;

- Lot 11 on SP233094;
- Lot 1 on SP232672;
- Lot 140 on SP122252;
- Lot 3 on SP101558;
- Lot 1 on SP260289;
- Lot 91 on SP122250; and
- Lot 19 on SP103893.

This consent only applies to the submitted application.

Strategic Property Management
Rail Corridor Management
Level 17, 61 Mary Street
Brisbane Qld 4000
GPO Box 1412 Brisbane Qld 4001

Telephone **+61 7 3066 7430**
Website www.tmr.qld.gov.au
Email **RCM@tmr.qld.gov.au**
ABN 39 407 690 291

TMR's consent is only provided for the purposes of making the application and does not:

- constitute TMR's approval of, or support for, the development application for the purpose of the Development Assessment System (DAS);
- provide permission to undertake works on land held or administered by the department associated with a development approval without the permission of TMR;
- remove the requirement to obtain any other approvals from TMR or another government department;
- constitute owner's consent for any other development application over land owned or administered by the department; or
- constitute approval for any person to enter a rail corridor.

TMR regulates structures, works and activities that occur within land administered or owned by the department. It may be necessary to obtain TMR or Railway Manager approval prior to accessing or undertaking works within an existing or future transport corridor.

If you have any queries or wish to seek clarification about any of the details in this response, please contact Patrick Leys on 3066 7430.

Yours sincerely

Craig England
Manager, Rail Corridor Management
Authorised Delegate of the Chief Executive

Queensland Government

Our ref 500/1219
Your ref 12559247
Enquiries Jason Giddy

Department of
Transport and Main Roads

2 August 2022

Amanda Smedley
Level 2, 100 Goondoon Street
Gladstone QLD 4680
Via email: amanda.smedley@ghd.com

Dear Amanda

I refer to your correspondence dated 14 July 2022 seeking landowner's consent to lodge a material change of use and operational works application within the Gladstone State Development Area (GSDA). The purpose of the application is to facilitate the Fitzroy to Gladstone Pipeline Project.

The submitted request outlines the areas of land in which consent is sought at Table 1, being five (5) crossings of state-controlled roads at various locations along the proposed route.

The department consents to the making of the application by GHD on behalf of GAWB on state-controlled roads. As per previous discussions, any works associated with the road crossings within the state-controlled road reserve will need to be assessed and approved by the department under section 50 of the *Transport Infrastructure Act* 1994.

Please note that this landowner's consent only applies to the affected state-controlled roads. Any crossings of railway land will require separate landowner's consent from the railway manager. For further information please contact the TMR Rail Corridor Management team at rcm@tmr.qld.gov.au.

Yours sincerely

Faruk Hossain
Manager (Project Planning & Corridor Management)

Telephone **+61 7 49311686**
Website www.tmr.qld.gov.au
Email **FitzroyDistrict@tmr.qld.gov.au**
ABN 39 407 690 291

Queensland
Government

Contact officer: John Brun
Contact phone: 07 3452 7469

Department of
State Development, Infrastructure, Local Government and Planning

9 May 2023

Ms. Amanda Smedley
GHD,
Level 2, 100 Goondoon Street
Gladstone, Queensland 4680

Dear Amanda,

RE: Request for Owners Consent to Lodge Application over Lot 68 on SP272417 and Lot 8 on SP 245936 Owned by the Minister for Economic Development Queensland Within the Aldoga Precinct of the Gladstone State Development Area

I, John White, Executive Director, Industrial Development, Economic Development Queensland as delegate of the Minister for Economic Development Queensland, hereby consent to the lodgment of any applications or permits to the relevant administering authority by the following entity, The Gladstone Area Water Board (the Applicant), or its agents and /or nominees required for the application which relates to the Gladstone to Fitzroy Pipe line Project which will take place on lot 68 on SP272417 and Lot 8 on SP245936 with the Aldoga Precinct of the Gladstone State Development Area.

This owner's consent is provided on the basis that:

- This consent is not an agreement by, or confirmation from, the Minister for Economic Development Queensland that the Applicant will be given rights to occupy or use any part of the land for the Project.
- It does not remove the statutory obligation of the Applicant to obtain all necessary cultural, environmental and development approvals from the administering authority prior to the commencement of any construction.
- It will not prejudice Economic Development Queensland from undertaking day to day operations or further detailed reviews of the proposed development and its impacts on land controlled by the Minister of Economic Development Queensland.
- It is only related to the applicant lodging an application with the relevant approving authority.
- It does not allow the Applicant to act on behalf of the Minister of Economic Development Queensland. The Applicant is not the Minister for Economic Development Queensland's agent.
- It has an expiry date of twelve (12) months from the date of this letter.

Should you have any questions regarding the above consent you are encouraged to contact John Brun on 3452 7469 or Jodie Crawter on 0467 795 593.

Yours faithfully,

John White
Executive Director
Industrial Development
Economic Development Queensland

Gladstone Ports Corporation

Growth, prosperity, community.

eDOCS NO:1881859 :cg
Our Ref: Clive Gibson

23 June 2023

Amanda Smedley
Team Leader Environment
GHD
Level 2 100 Goondoon Street
GLADSTONE QLD 4680

Amanda.smedley@ghd.com

Dear Amanda,

LAND OWNERS CONSENT
GLADSTONE AREA WATER BOARD – DEVELOPMENT APPLICATION FOR MATERIAL CHANGE OF USE & OPERATIONAL WORKS – GPC MATERIALS TRANSPORTATION & SERVICES CORRIDOR WITHIN THE GLADSTONE STATE DEVELOPMENT AREA

It is advised that the Gladstone Ports Corporation Limited (GPC) as Land Owner of the Lots listed in attachment 2, hereby provides its written consent to allow GHD on behalf of Gladstone Area Water Board (**"GAWB"**) to submit the following development application to be considered by the appropriate assessment manager and referral agencies:

- Development Application – Material Change of Use of premises for a utility installation (Fitzroy to Gladstone Pipeline) and Operational works for vegetation clearing in the Gladstone State Development Area.

This consent does not negate the requirement for the proponent to gain any relevant legislated approvals from Gladstone Ports Corporation, the relevant local government, or other government entities. The proposed development may also require Building works approval under the *Building Act* 1975 and relevant advice should be sought from a suitably qualified professional (e.g. private building certifier). Additionally, this consent should not be taken as permission to begin any construction works on site.

This consent remains valid from the day issued for a period of 6 months and is subject to GAWB executing final tenure documentation acceptable to GPC before any works commence on the subject site.

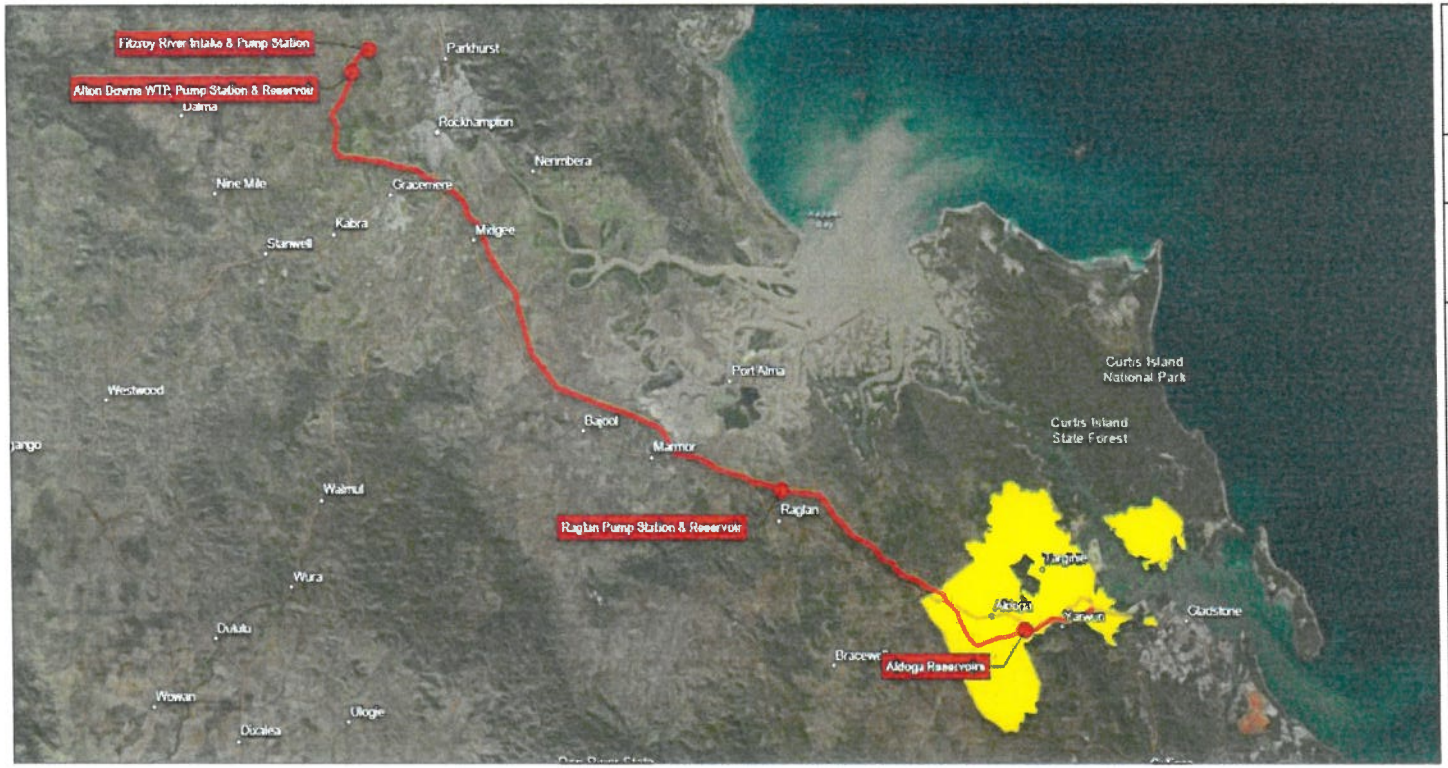
If you have any queries concerning this consent, please do not hesitate to contact the writer on 4976 1334. For any Development Approval queries please contact GPC's Planning Specialist Trudi Smith on 4976 1314 or Principal Planner Erin Clark on 4976 1287.

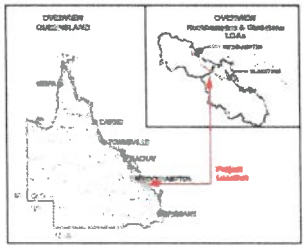
Yours sincerely,

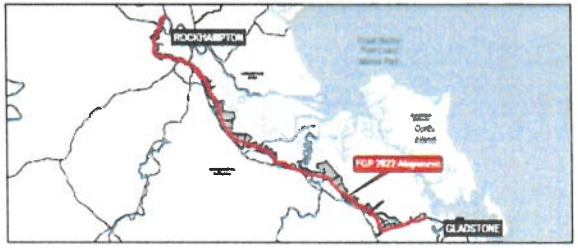
CLIVE GIBSON
PROPERTY SPECIALIST

Attachment 1

Figure 1 – Locality Plan







MAP NOTES

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LEGEND

- Infrastructure Locations
- Fitzroy to Gladstone Pipeline Alignment
- Gladstone State Development Area

Gladstone Area Water Board

PROJECTION UTM Zone 56
(Datum GDA2020)

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Compiled by YS:16139 Date 20/06/2022

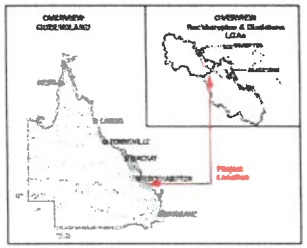
Document Path: V:\PROJECTS\30022681 - GWAB-08_Working\20220620_Landowner Consent Request\Landowner Consent Request.aprx

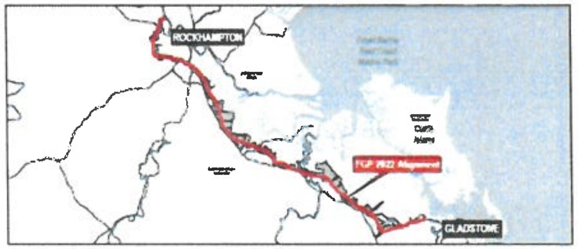
Fitzroy to Gladstone Pipeline Project
Figure 1: Project Overview and Locality
000-G-MAP-2263 Version: 4 Date: 20/06/2022

Attachment 2

Land subject to this landowner's consent request

- Figure 2 – Overview of GPC Land
- Figure 3 – Lot 7 on SP177782
- Figure 4 – Lot 21 on SP115224
- Figure 5 – Lot 13 on RP620157
- Figure 6 – Lot 22 on SP115225
- Figure 7 – Lot 25 on SP115226
- Figure 8 – Lot 31 on SP129157
- Figure 9 – Lot 25 on CP859457
- Figure 10 – Lot 28 on SP115227
- Figure 11 – Lot 1 on RP911260
- Figure 12 – Lot 54 on SP137048
- Figure 13 – Lot 7 on SP145439





LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary
- Waterbody

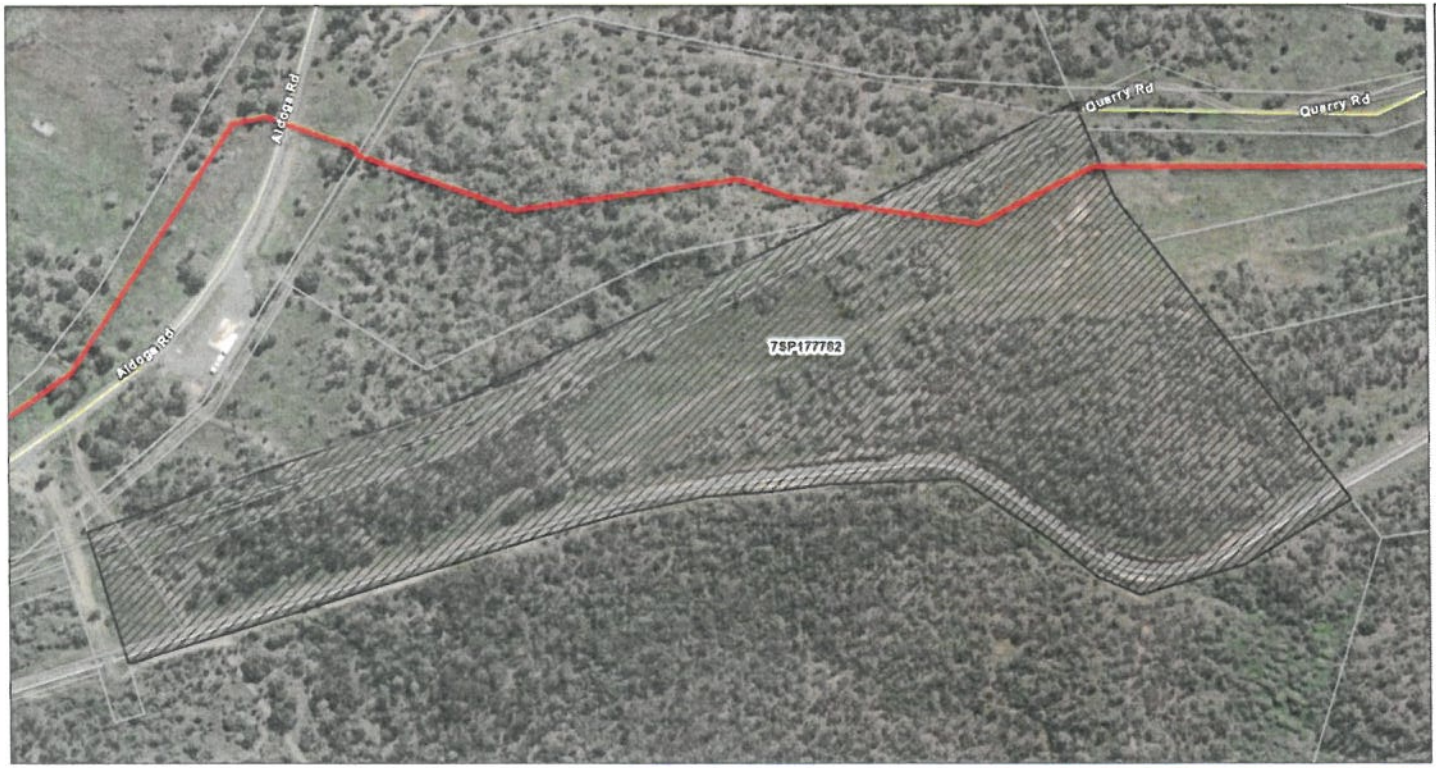
PROPERTY DETAILS

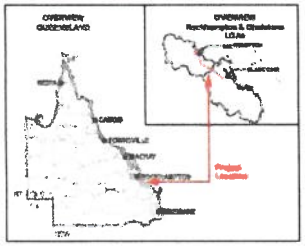
Landowner Name	Gladstone Ports Corporation Limited
LGA	Gladstone Regional Council

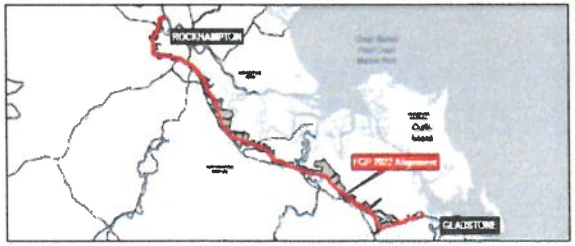
PROJECTION UTM Zone 56
(Datum GDA2020)

Gladstone Area Water Board

Fitzroy to Gladstone Pipeline Project
Figure 2: Overview of Land Subject to Landowner's Request
000-G-MAP-2254 Version: 1 Date: 27/06/2022







PROPERTY DETAILS	
Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Gladstone Area Water Board
PO Box 486, Gladstone, Qld 4680
Ph: 07 4970 7007 www.gawb.qld.gov.au

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(Datum GDA2020)

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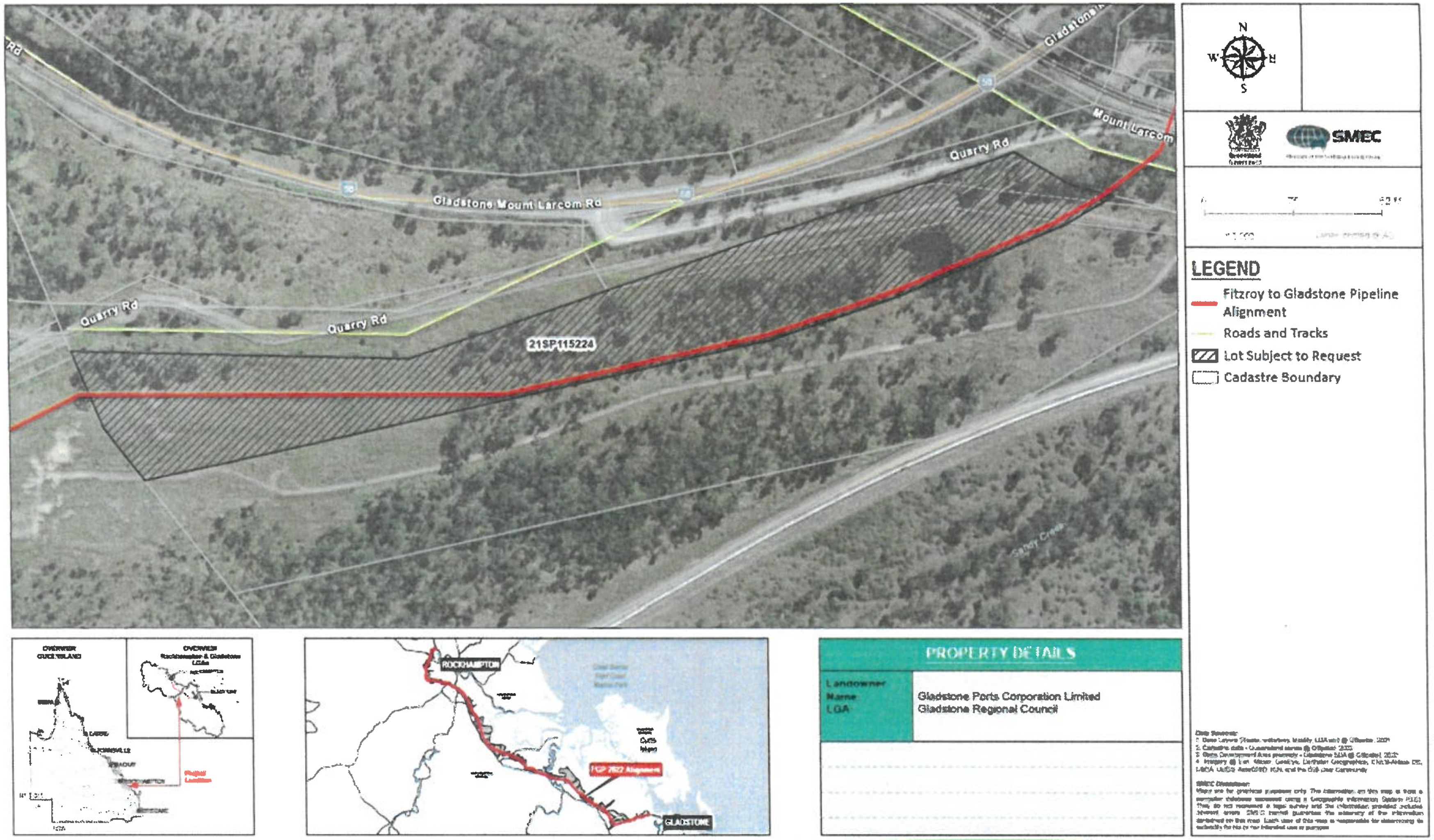
Fitzroy to Gladstone Pipeline Project
Figure 3: Land Subject to Landowner's Request
LOT: 7 PLAN:SP177782
000-G-MAP-2255 Version:1 Date: 27/06/2022

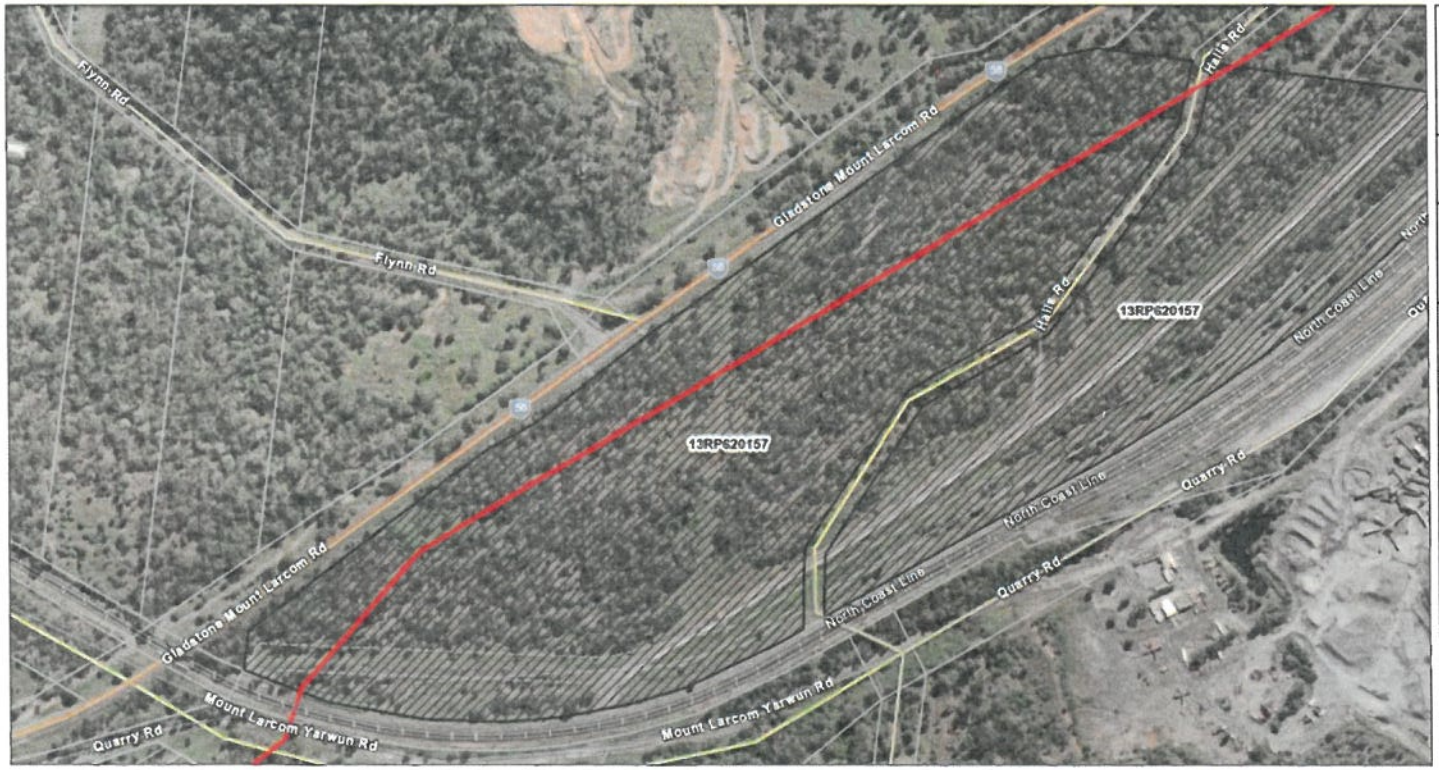


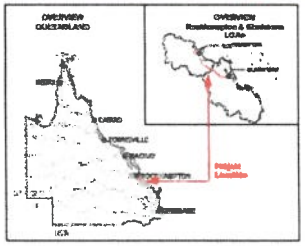
PROPERTY DETAILS	
Landowner Name	Gladstone Ports Corporation Limited
LGA	Gladstone Regional Council

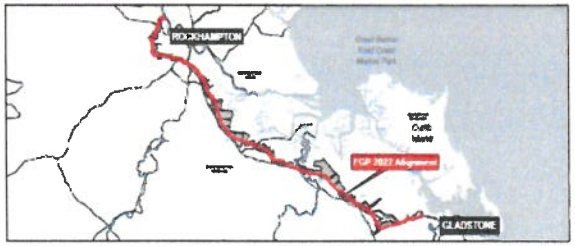
Gladstone Area Water Board

PROJECTION UTM Zone 56
(Datum GDA2020)

Fitzroy to Gladstone Pipeline Project
Figure 4: Land Subject to Landowner's Request
LOT: 21 PLAN:SP115224
000-G-MAP-2256 Version:1 Date: 27/06/2022







PROPERTY DETAILS	
Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

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LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Data Sources:
1. Base Layers (Roads, watercourse, locality, LGA etc) @ QSpatial, 2022
2. Cadastral data - Queensland wide @ QSpatial, 2022
3. State Development Area boundary - Gladstone SDA @ QSpatial, 2022
4. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Gladstone Area Water Board

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(Datum GDA2020)

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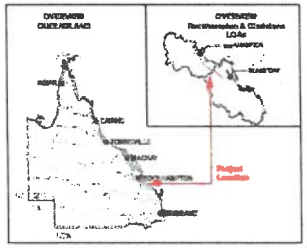
Fitzroy to Gladstone Pipeline Project
Figure 5: Land Subject to Landowner's Request
LOT: 13 PLAN:RP620157
000-G-MAP-2257 Version:1 Date: 27/06/2022



PROPERTY DETAILS	
Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

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LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Gladstone Area Water Board

PROJECTION UTM Zone 56
(Datum GDA2020)

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Corrected by YS18239 Date 27/06/2022

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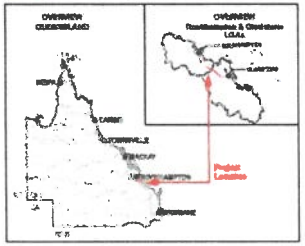
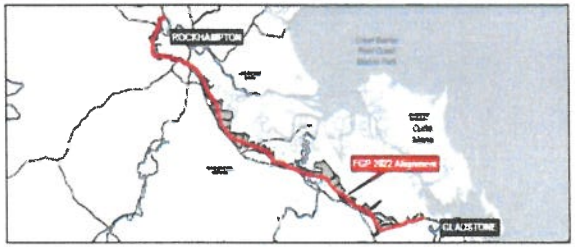
Fitzroy to Gladstone Pipeline Project
Figure 6: Land Subject to Landowner's Request
LOT: 22 PLAN:SP115225
000-G-MAP-2258 Version:1 Date: 27/06/2022





PROPERTY DETAILS	
Landowner Name	Gladstone Ports Corporation Limited
LGA	Gladstone Regional Council

LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Gladstone Area Water Board

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(Datum GDA2020)

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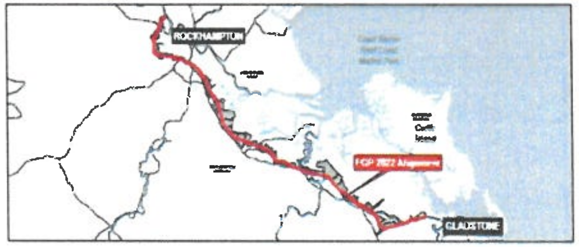
Fitzroy to Gladstone Pipeline Project
Figure 7: Land Subject to Landowner's Request
LOT: 25 PLAN:SP115226
000-G-MAP-2260 Version:1 Date: 27/06/2022



LEGEND

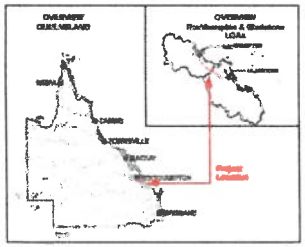
- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

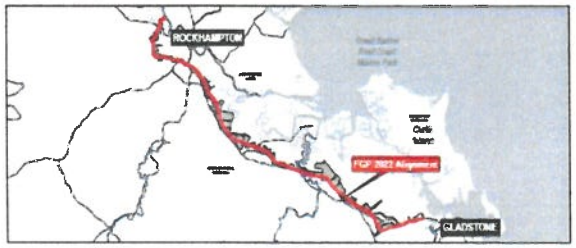
PROPERTY DETAILS	
Landowner Name	Gladstone Ports Corporation Limited
LGA	Gladstone Regional Council

Gladstone Area Water Board

PROJECTION UTM Zone 56
(Datum GDA2020)

Fitzroy to Gladstone Pipeline Project
Figure 8: Land Subject to Landowner's Request
LOT: 31 PLAN:SP129157
000-G-MAP-2259 Version:1 Date: 27/06/2022





PROPERTY DETAILS	
Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

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LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Gladstone Area Water Board

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(Datum GDA2020)

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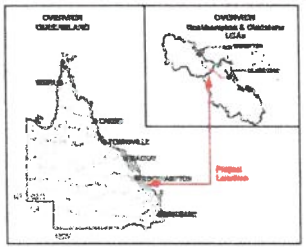
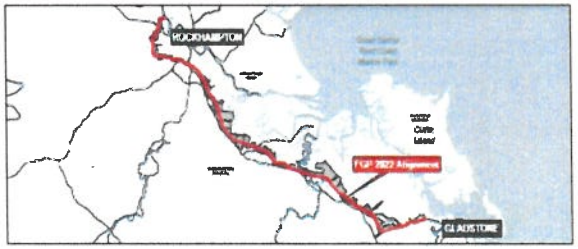
Fitzroy to Gladstone Pipeline Project
Figure 9: Land Subject to Landowner's Request
LOT: 25 PLAN:CP859457
000-G-MAP-2261 Version:1 Date: 27/06/2022





PROPERTY DETAILS	
Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Gladstone Area Water Board

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(Datum GDA2020)

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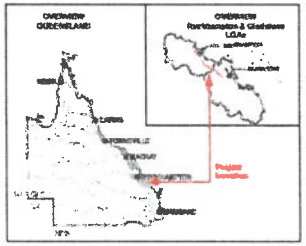
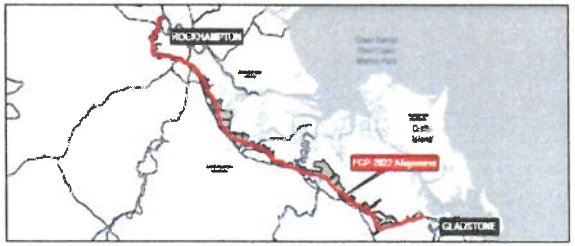
Document Path: V:\PROJECTS\28032687 - GWAB\08_Working\28220628_Landowner Consent Request\Landowner Consent Request.spx

Fitzroy to Gladstone Pipeline Project
Figure 10: Land Subject to Landowner's Request
LOT: 28 PLAN:SP115227
000-G-MAP-2262 Version:1 Date: 27/06/2022





PROPERTY DETAILS

Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

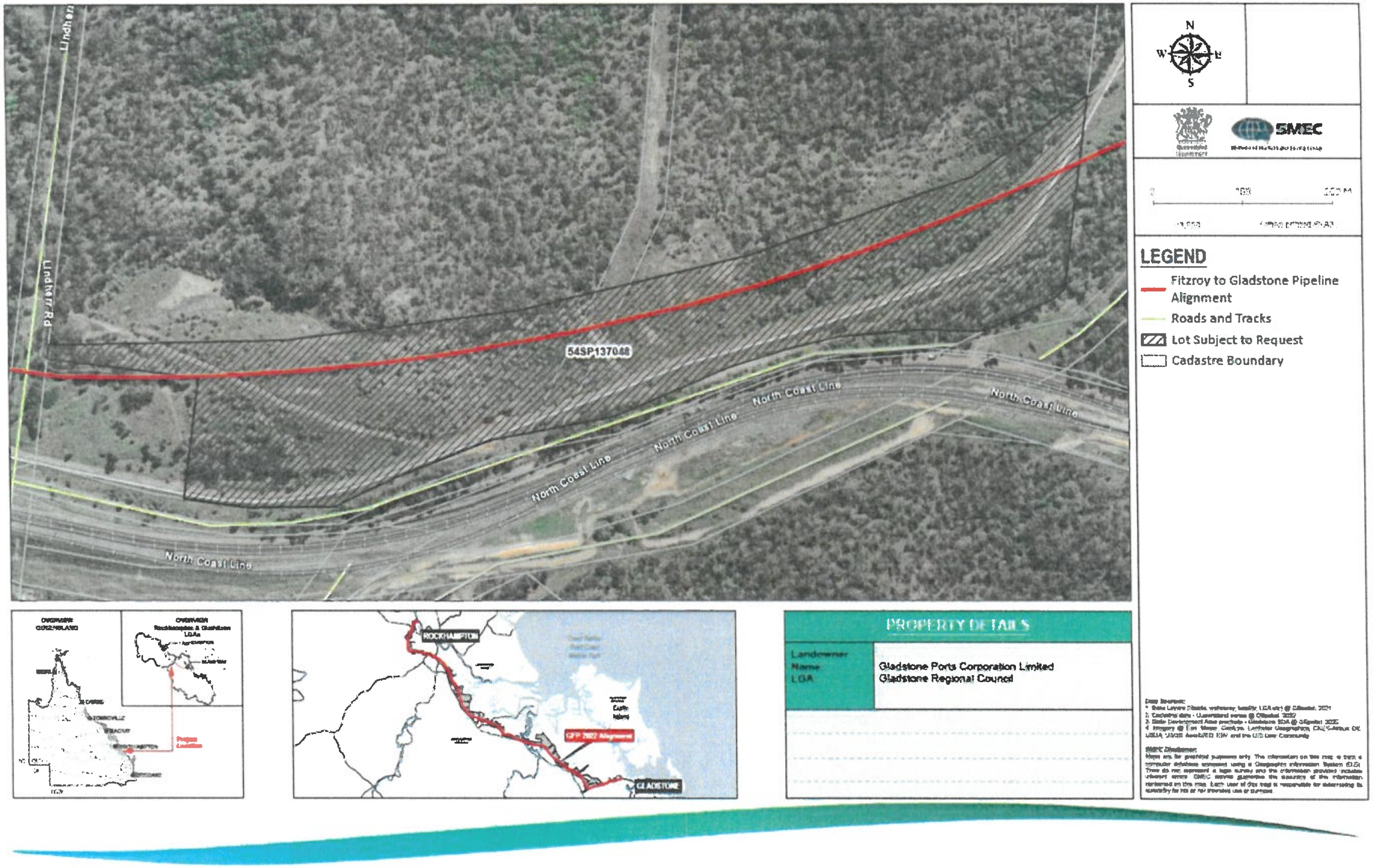
LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary

Gladstone Area Water Board

PROJECTION UTM Zone 56
(Datum GDA2020)

Fitzroy to Gladstone Pipeline Project
Figure 11: Land Subject to Landowner's Request
LOT: 1 PLAN:RP911260
000-G-MAP-2263 Version:1 Date: 27/06/2022



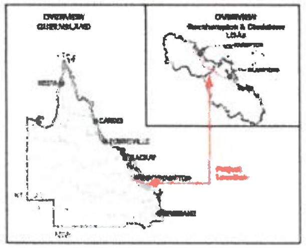
Gladstone Area Water Board

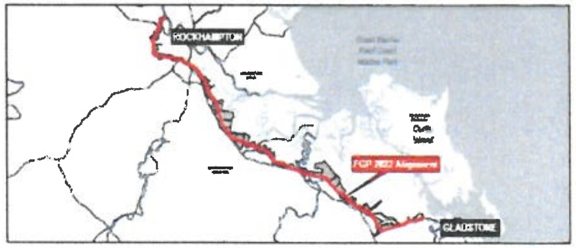
PROJECTION UTM Zone 56
(Datum GDA2020)

Fitzroy to Gladstone Pipeline Project
Figure 12: Land Subject to Landowner's Request
LOT: 54 PLAN:SP137048
000-G-MAP-2264 Version:1 Date: 27/06/2022

LEGEND

- Fitzroy to Gladstone Pipeline Alignment
- Roads and Tracks
- Lot Subject to Request
- Cadastre Boundary





PROPERTY DETAILS	
Landowner Name:	Gladstone Ports Corporation Limited
LGA:	Gladstone Regional Council

Gladstone Area Water Board

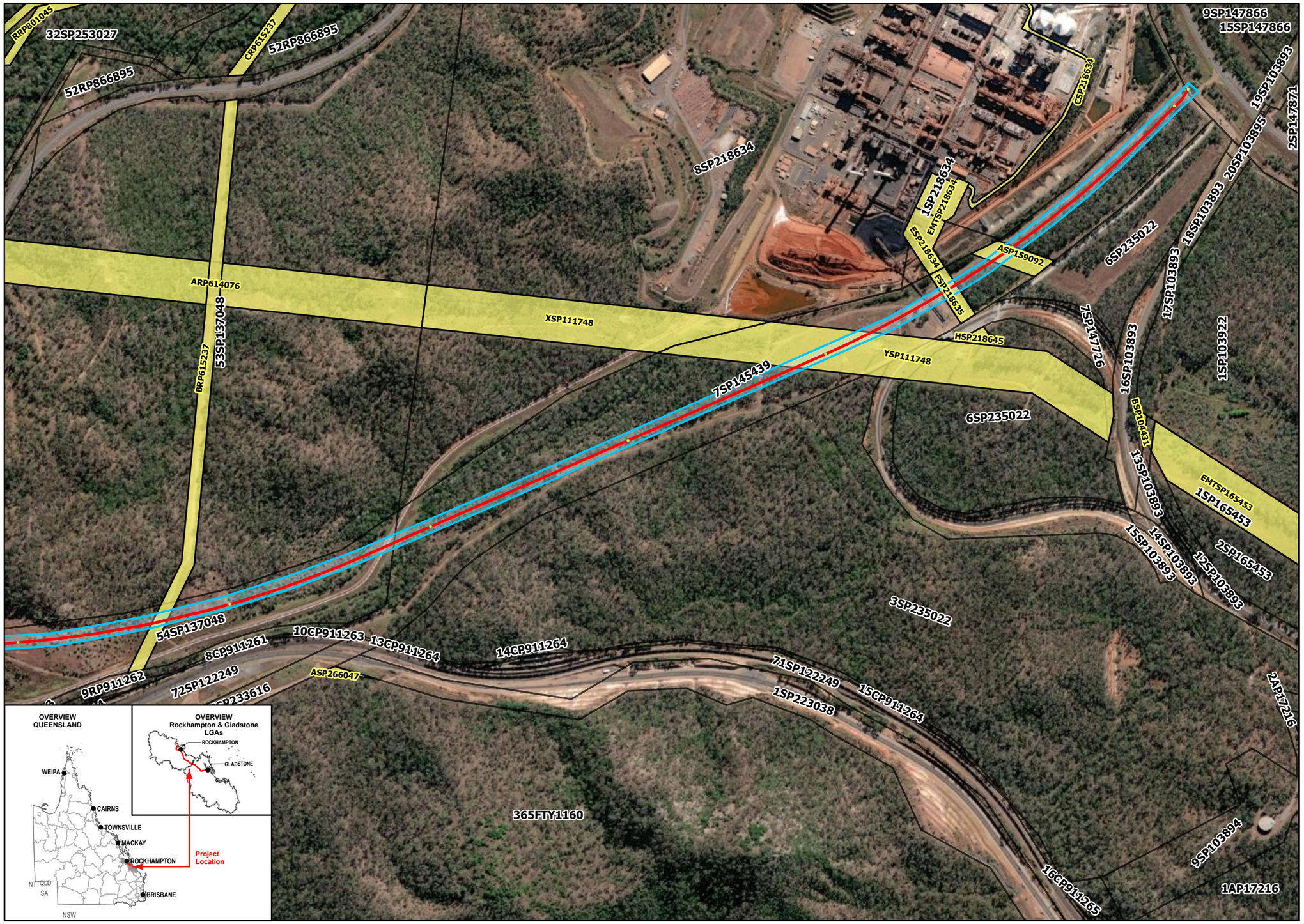
PROJECTION UTM Zone 56
(Datum GDA2020)

Fitzroy to Gladstone Pipeline Project
Figure 13: Land Subject to Landowner's Request
LOT: 7 PLAN:SP145439

000-G-MAP-2265 Version:1 Date: 27/06/2022

Appendix B

ROW



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Queensland Government

SMEC
Member of the Surbana Jurong Group

0 110 220 330 440
Meters

1:9000 (when printed @ A3)

Legend

- Chainage
- Pipe Alignment
- Right of Way (ROW)
- Easement
- Property Boundary

Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
2. Property Boundary @ Department of Resources 2021.
3. Indicative Ecology Survey Location(s) @ GAWB 2022
4. Imagery @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES-Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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PROJECTION UTM Zone 56
(Datum GDA2020)

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Appendix B1 - ROW
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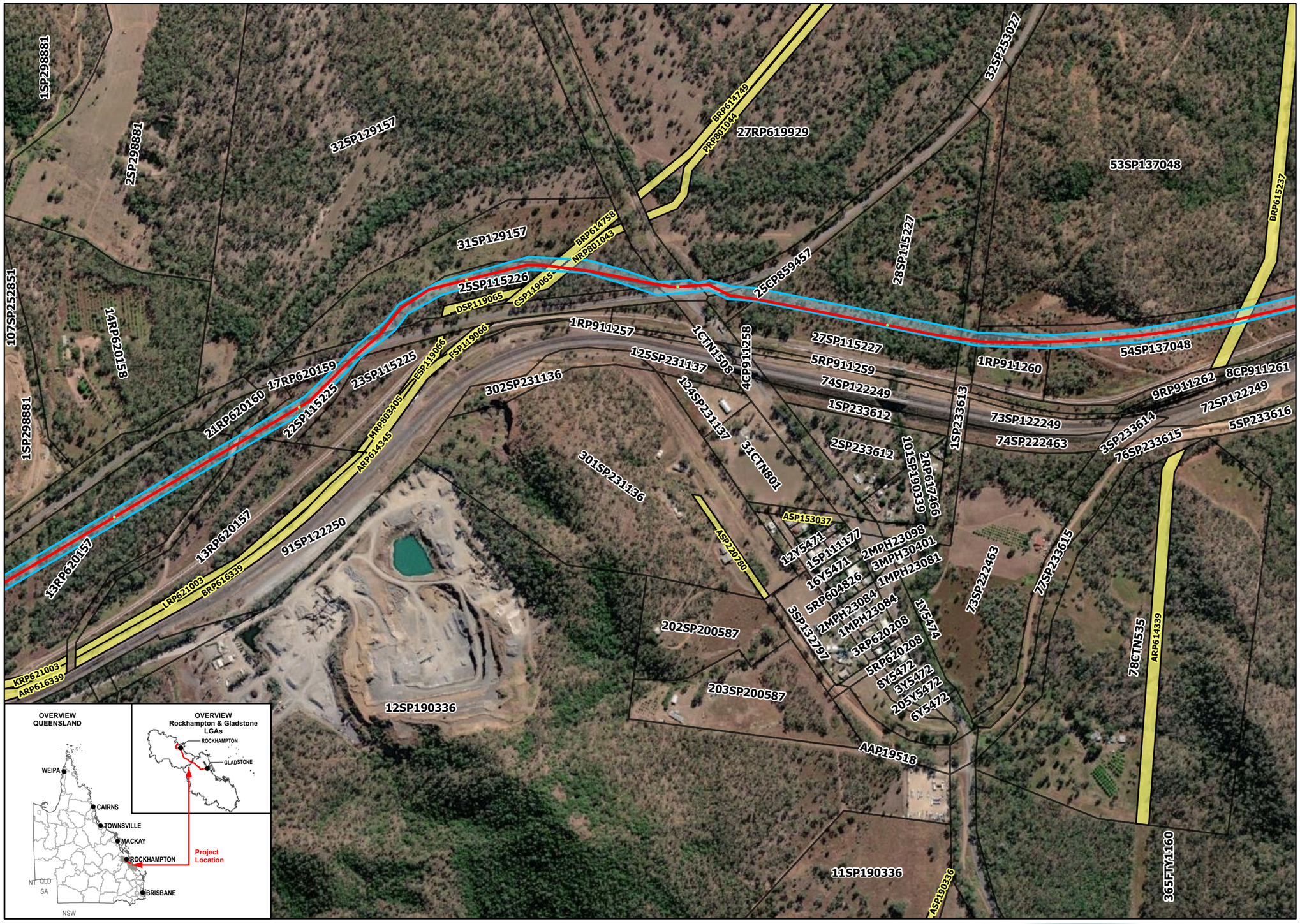

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Data Sources:
1. Base Layers (Roads, waterway, locality, LGA etc) @ QSpatial, 2021
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FITZROY TO GLADSTONE PIPELINE PROJECT
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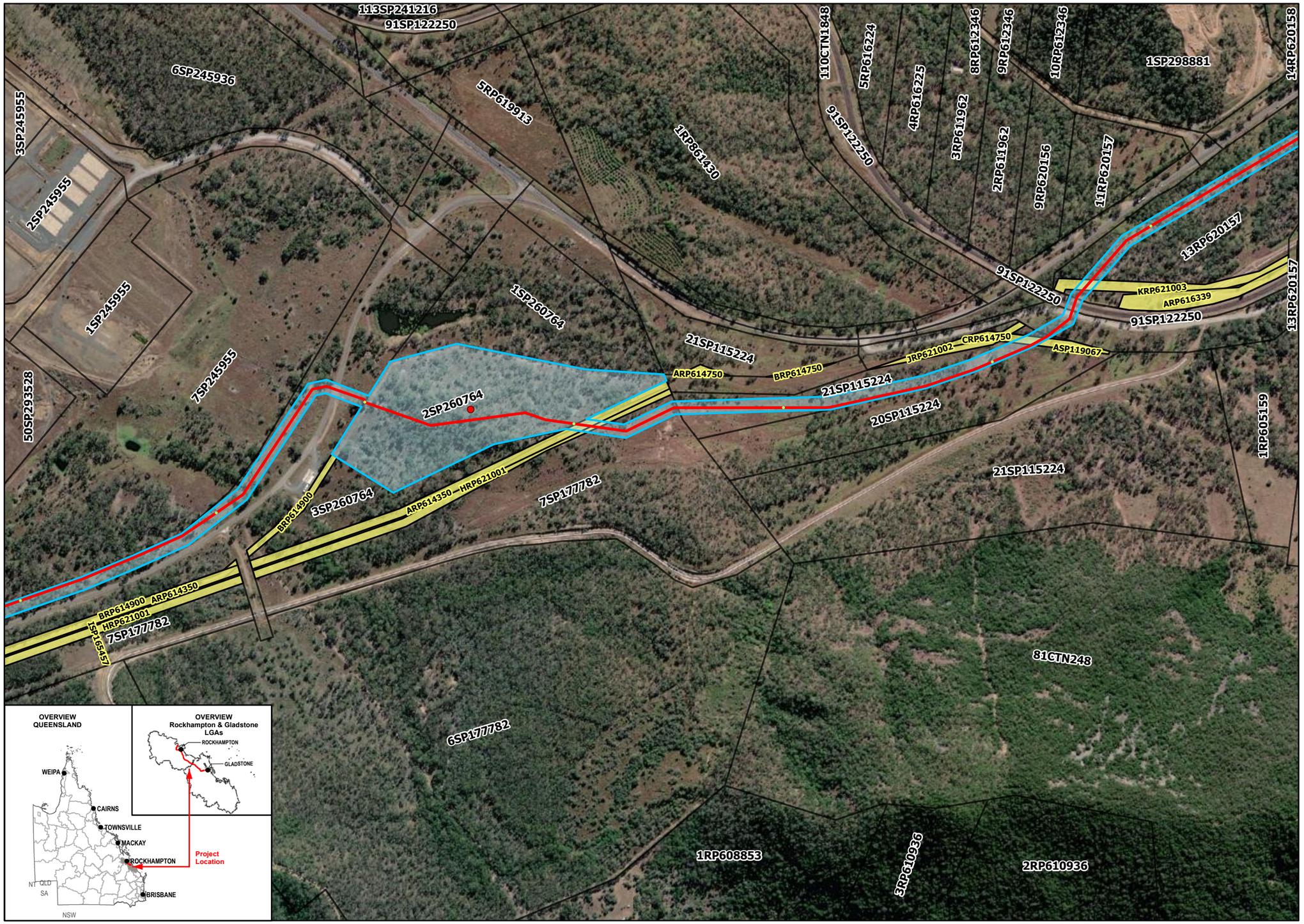

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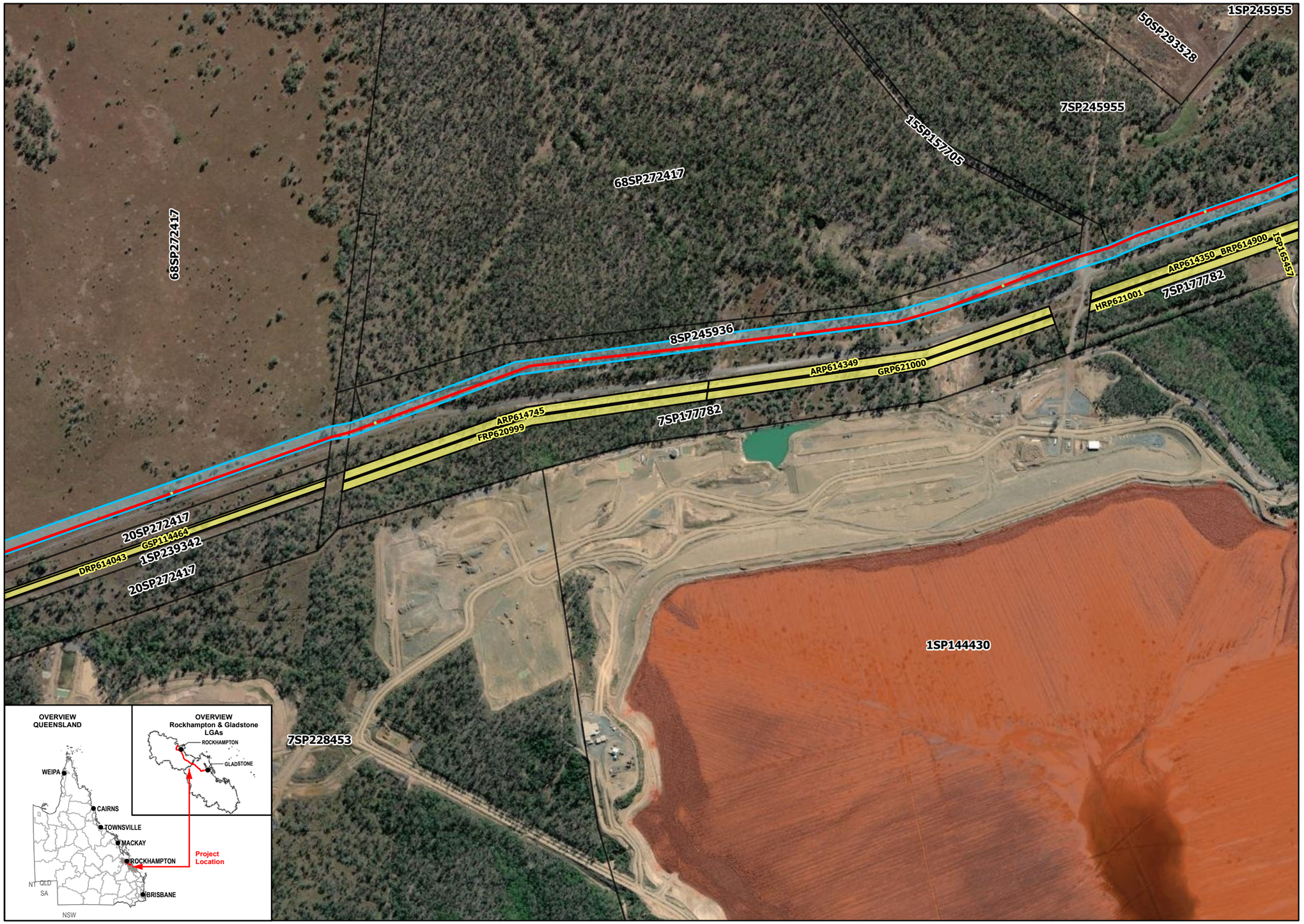

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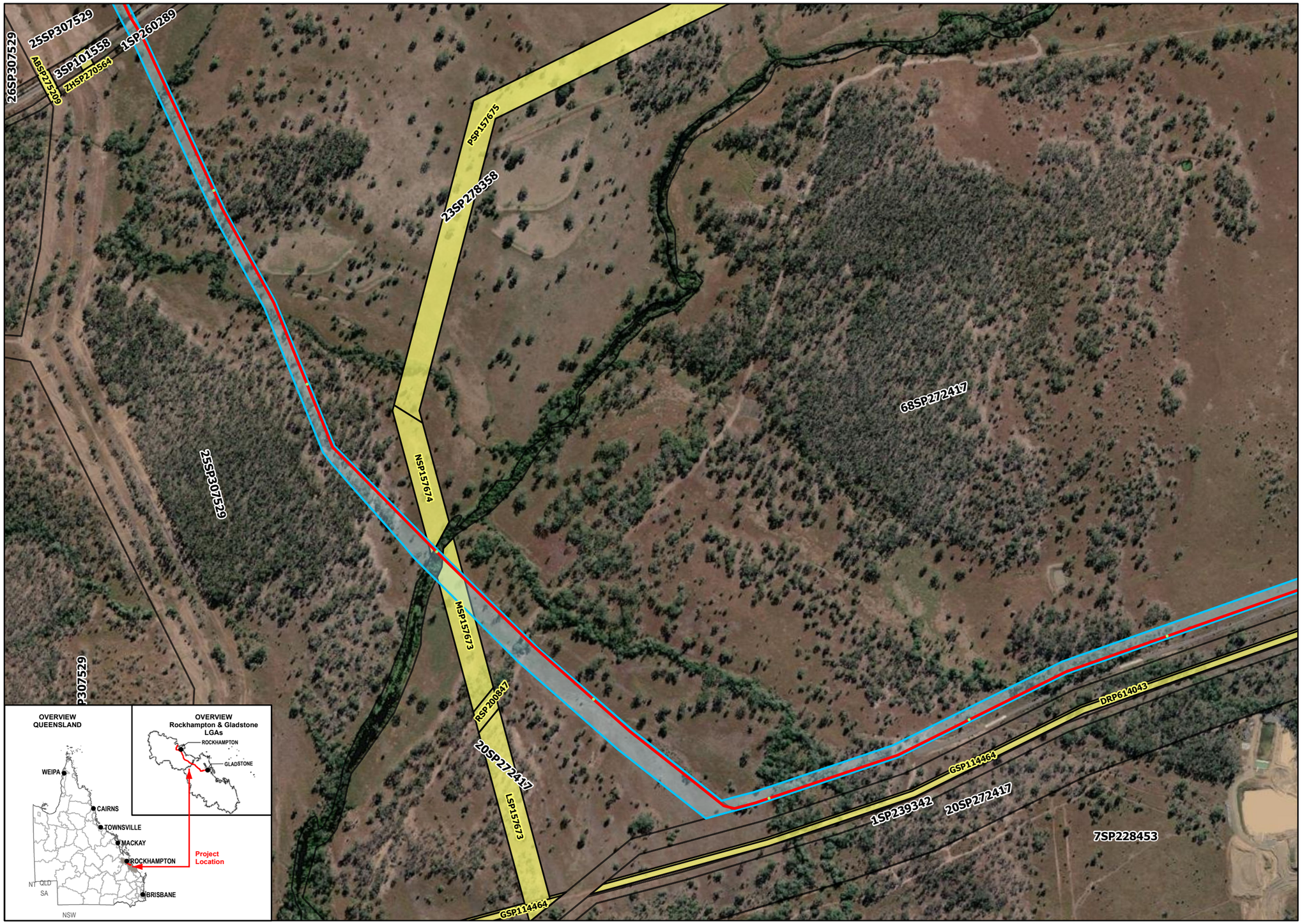

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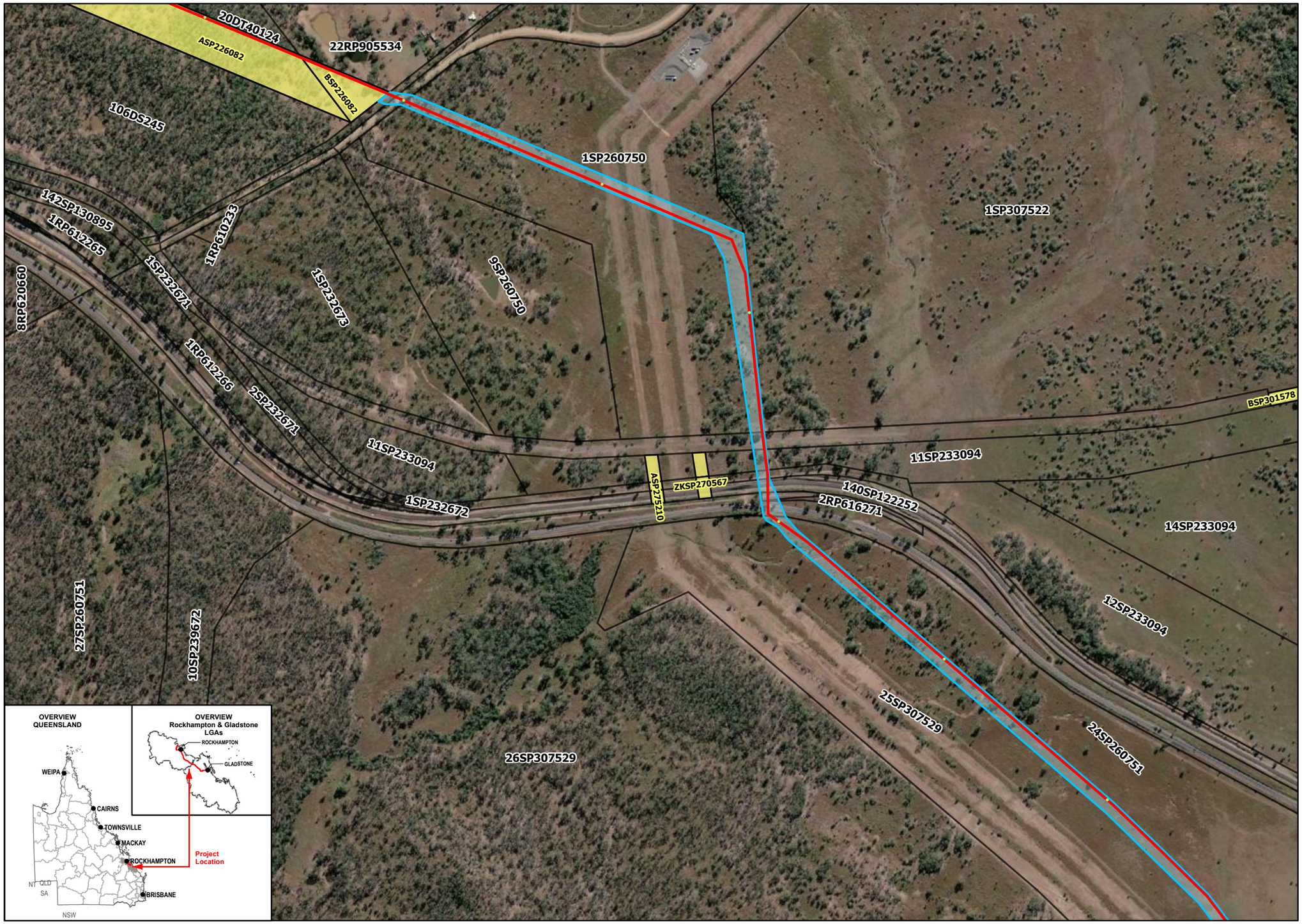

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Appendix B7 - ROW
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Appendix C

EIS – Referenced Chapters

- Chapter 6 – Terrestrial Flora
- Chapter 7 – Terrestrial Fauna
- Chapter 15 – Social and Economic Environment
- Chapter 17 – Landscape and visual impact assessment
- Chapter 18 – Summary of Impacts and Cumulative Effects
- Appendix G – Potential Impacts on Matters of National Environmental Significance

CHAPTER 6

GLADSTONE – FITZROY
PIPELINE PROJECT
Environmental Impact Statement

Terrestrial Flora

Gladstone Area Water Board

Contents

This information has been prepared by, or on behalf of, the Gladstone Area Water Board (GAWB) regarding the Gladstone-Fitzroy Pipeline project. Care has been taken to ensure that the information is accurate and up to date at the time of publishing.

Gladstone Area Water Board

Figures

Tables

6. Terrestrial Flora

6.1 Matters of National Environmental Significance

6.1.1 Introduction

Appendix G describes the likely significant impacts of the Gladstone-Fitzroy Pipeline project (the project) on matters of National Environmental Significance (NES) as defined in the *Environment Protection Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

There is one matter of NES that functions as a controlling provision for this action. This is the controlling provision on listed Threatened species and communities (EPBC Act, Sections 18 and 18a). Hence, the Terms of Reference (ToR) for the EIS require that information be provided specifically on Threatened species and Ecological Communities.

The assessment of potential impact to EPBC Act listed Threatened species and Ecological Communities has been undertaken through desktop research and detailed fieldwork. The chapters of the EIS that address these matters are Chapter 6, Terrestrial Flora; Chapter 7, Terrestrial Fauna; and Chapter 8, Aquatic Flora and Fauna. The findings of these chapters are summarised in the summary of Appendix G and Appendix G itself. Existing information regarding the terrestrial fauna of the project area and surrounding area was collated and reviewed. The findings of the desktop assessments indicated that a number of species of conservation significance may use habitats of the project area and surrounding lands. Consequently, consideration was given to these species (termed target species) in the design and implementation of the field survey program and habitat assessments. The review of existing information assisted in prioritising the variety of habitats and locations for field surveys.

The field study methodology for terrestrial fauna, flora and aquatic flora and fauna are further explained in Appendix G, Sections 4, 5 and 6. These sections also include existing information reviews, information on target species, the field survey program and the assumptions and limitations of the associated field study.

6.1.2 Description of the Affected Environment Relevant to the Controlling Provisions

This section describes the EPBC Act listed Threatened species and Threatened Ecological Communities that have been identified as potentially occurring within the project area. The section is divided into EPBC Act listed threatened fauna (see Appendix G.6.1), and also into EPBC Act listed threatened flora and Threatened Ecological Communities (see Appendix G.6.2). These species, with relevant conservation status and notes on habitat and distribution are provided in Table 3 of Appendix G. The list of EPBC Act listed Threatened fauna derived from review of existing information (including an EPBC Act Protected Matters database search) found three Endangered terrestrial species, 12 Vulnerable terrestrial species and one Critically Endangered terrestrial species. Four Vulnerable aquatic species and two Endangered aquatic species were also found.

The field survey results revealed the following:

Fitzroy to Bajool

The recorded assemblage comprised two EPBC Act listed Threatened fauna species:

- The Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*), which is listed as Vulnerable
- The Ornamental Snake (*Denisonia maculata*), which is also listed as Vulnerable.

Bajool to Gladstone

The recorded assemblage comprised two EPBC Act listed Threatened fauna species:

- The Yellow Chat (*Epthianura crocea macgregori*), which is Critically Endangered
- The Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*), which is Vulnerable.

6.1.3 Aquatic Fauna and Flora Habitat Values for EPBC Act Listed Species

A review of the EPBC Protected Matters Report (DEWHA 2007) and the Wildlife Online (EPA 2007) database for aquatic macrophyte species of conservation significance identified no EPBC Act listed Threatened species occurring, or likely to occur within the project area.

In terms of aquatic fauna, in Fitzroy to Bajool, the Fitzroy River site represents the largest waterbody within the project area, and has a number of inherent functional ecological values, including a potential habitat for the Fitzroy River Turtle, classified as Vulnerable. In addition, several off-stream lagoons (oxbow lakes) and ephemeral streams occur within the project area. It is unlikely that the lagoons and streams within the project area support habitat for EPBC Act listed Threatened aquatic fauna species due to their small size, absence of optimal habitat for these species, and historical (clearing) and ongoing pressures from adjacent catchment land uses.

In Bajool to Gladstone, the only listed marine fauna species that could potentially occur within the project area is the Saltwater Crocodile (*Crocodylus porosus*); however this is listed as Migratory and not as Threatened under the EPBC Act (therefore impacts upon this species is outside of the scope of this report. Nonetheless, an impact assessment concerning the species is provided in Chapter 8, Aquatic Flora and Fauna).

6.1.4 Threatened Terrestrial Flora and Threatened Ecological Communities

A search of the Wildlife Online database (EPA 2007a) for species that are simultaneously listed under the EPBC Act returned a list of 13 plant species (See Table 8 of Appendix G and Section G.6.2 for more information). An EPBC Act Protected Matters Report (DEWHA 2007) was generated from a similar search, but with a more narrowly defined search area (search area and results from original extract are shown in Appendix E2) and returned a list of 11 plant species and their conservation status (nine Vulnerable and two Endangered, as shown in Table 8). Five species were reported that did not occur on the Wildlife Online list, indicating that these species are expected to occur, but have not been recorded in the search area. For these species, refer to the last four entries in Table 8 of Appendix G.

No targeted EPBC Act listed Threatened plant species were observed during survey in either section of the corridor. However, one non-target species was observed, although it was a sterile specimen and absolute confirmation of identification was not possible. This was a Vulnerable species (listed under the EPBC Act), and was one individual of (probably) ooline (*Cadellia pentastylis*) found at Detailed Site 14 (Marble Creek) (see Figure 6.1).

Several EPBC Act referral triggers were identified from preliminary data. Those triggers, based on likelihood of occurrence from habitat and distribution data, were:

- The presence of "semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions" (referred to as scrub), as defined in the EPBC Act Protected Matters Report as Threatened Ecological Communities
- A 200 m stretch of low-growing Brigalow (*Acacia harpophylla*) with extensive gilgai (a high density of small waterholes or pools, each ranging from about 5 m to 10 m in diameter) was observed on the south side of Inkerman Creek on Lot 68 DS141. This patch of vegetation occurred between the tidal interface of Inkerman Creek, and the taller Brigalow further east towards the Toonda Port Alma Road. Brigalow (*Acacia harpophylla*) is a Threatened Ecological Community under the EPBC Act. However, the height of the community on-site averaged approximately 3 m, which does not meet the structural requirements for the definition of remnant Brigalow (11 to 15 m) under the Vegetation Management Act 1999 (VM Act), and the EPBC Act uses the structural classification of the VM Act (in this case Regional Ecosystem 11.3.1 or 11.4.3)

Whilst Brigalow (*Acacia harpophylla*) regrowth may occur immediately south of Inkerman Creek, it constitutes a Threatened Ecological Community under the EPBC Act (if of sufficient structure), but the species as an individual is not listed as Threatened under the Act.

Two species of tree cycads (*Cycas megacarpa and C. ophiolitica*) are known to occur in areas that may be intersected by the proposed corridor. They are Endangered under the EPBC Act, and could be impacted through removal and/or disturbance of vegetation. Scrub species could potentially be impacted along this section of the corridor, through removal and/or disturbance of vegetation.

6.1.5 Assessment of Impacts on NES Matters and Mitigation Measures

6.1.5.1 Terrestrial Threatened Fauna

6.1.5.1.1 Potential Impacts

The alignment of the Gladstone-Fitzroy Pipeline was selected to minimise impact to native fauna habitats. Potential impacts include:

- Vegetation clearing and habitat disturbance
- Habitat fragmentation and disturbance to wildlife movement corridors
- Disturbance to wetlands and waterways
- Trench fall (entrapment of fauna within open trenches during construction)
- Creation of environments favourable to the colonisation and expansion of environmental weeds and pest animals.

These are further explained in Section G.7.1.1 in Appendix G.

More specifically, the primary potential impacts on EPBC species include loss of shelter and food resources, loss of breeding sites, trench fall (primarily herpetofauna) and possibly increased predation (primarily small ground mammals and birds) resulting from:

- Clearing of remnant vegetation and riparian communities
- Removal of habitat trees, especially mature hollow-bearing trees
- Removal of ground debris in the construction of the pipeline;
- Trenching operations
- Increased ease of access for introduced predators.

6.1.5.1.2 Mitigation

Table 10 in Appendix G provides a summary of occurrence status and potential impacts and mitigation responses for EPBC Act listed Threatened fauna that are known to occur, or have the potential to occur, within habitats of the project area and/or land immediately adjacent.

The assessment of potential impacts to these values has generated an extensive suite of mitigation measures for the project in keeping with best management practices (see, Chapter 20, Planning Environmental Management Plan). With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on EPBC Act listed Threatened fauna will be relatively low in significance.

6.1.5.1.3 Residual impact and Significance Criteria classification

As described in Appendix G, the majority of the project area is highly disturbed. For these largely cleared and grazed lands, the implementation of the mitigation strategies outlined above will result in the project creating a negligible residual impact on EPBC Act listed Threatened fauna species (see Table 14 of Appendix G). However, due to the impact upon the key locations (see Section G.7.1.2), the residual impact upon EPBC Act listed Threatened fauna species is considered minor adverse.

6.1.5.2 Aquatic Fauna and Flora

6.1.5.2.1 Potential Impacts

Potential impacts to EPBC Act listed Threatened aquatic flora, fauna and their habitat resulting from the construction and operation phases of the Gladstone-Fitzroy Pipeline project are:

Construction phase:

- Vegetation clearing and channel disturbance
- Water quality modifications (due to changes in turbidity and the mobilisation of organic sediments, Acid Sulfate Soils (ASS) and other toxicants)
- Creation of in-stream barriers (i.e. culverts).

Operational phase:

- Alterations to habitat, both surrounding the intake pipe and within the Fitzroy River weir pool
- Translocation of exotic species, especially the noxious Water Hyacinth* (*Eichhornia crassipes*) from the Fitzroy River
- Water treatment plant (WTP) operational impacts.

6.1.5.2.2 Mitigation

Due to the low probability of occurrence of EPBC Act listed Threatened aquatic flora and fauna species within the project area, significant impacts to listed Threatened species are considered unlikely. Despite this, mitigation measures will still be implemented for non-EPBC Act listed species. These mitigation measures cover impacts on all aquatic flora and fauna (not only EPBC Act species which are listed as Threatened) and hence these can be found in Chapter 8, Aquatic Flora and Fauna.

6.1.5.2.3 Residual impact and Significance Criteria classification

- After mitigation, impacts upon aquatic flora and fauna that are listed under the EPBC Act as Threatened are considered negligible.

6.1.5.3 Threatened Terrestrial Flora and Threatened Ecological Communities

6.1.5.3.1 Potential Impacts

The main potential impacting processes to EPBC Act listed Threatened flora and Threatened Ecological Communities associated with the clearing of the 30 m right-of-way (ROW) and construction of the pipeline are:

- Clearing of vegetation remnants
- Reduction of flora species habitat
- Removal of individual species of significance
- Reduction of wildlife corridor functionality
- Remnant vegetation edge effects
- Riparian vegetation disturbance
- Weed introduction.

Table 15 of Appendix G lists those relevant Ecological Communities which are classified as Endangered under the EPBC Act and responses to the Significant Impact Criteria as described within the EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance (May 2006). None of the Significant Impact Criteria will be met as a result of the project, but the reduction in area of a low-growing patch of Brigalow may occur (at Site 9c). The structural form of this patch of Brigalow does not meet the requirements for classification as remnant under the VM Act, nor the EPBC Act, which uses the structural classification of the VM Act.

Partial clearing of the semi-evergreen vine thickets of the Brigalow Belth (North and South) and Nandewar bioregions at Short Site 4 (see Figure 6.1 of the EIS) would only occur if the right-of-way were extended across existing road. If the corridor is located on the other side of the road, and this is the current intention, then no scrub will need to be cleared.

In addition, it is unlikely that EPBC Act listed Threatened species will be encountered along the corridor, during removal and/or disturbance of vegetation with the possible exception of ooline (*Cadellia pentastylis*). Table 16 of Appendix G shows that none of the Significant Impact Criteria (under the EPBC Act) will be met for EPBC Act listed flora species as a result of the project.

6.1.5.3.2 Mitigation

While it is considered unlikely that EPBC Act listed Threatened species and Ecological Communities along the corridor will be impacted by the proposed project, pre-construction surveys will be conducted.

When any EPBC Act listed Threatened individuals remain within the construction footprint, these can be translocated (or replacements planted, depending on species).

6.1.5.3.3 Residual impact and Significance Criteria classification

The construction of the pipeline and clearing of the ROW is likely to have an overall **negligible to minor** adverse impact to EPBC Act listed Threatened flora and Ecological Communities.

6.1.6 Matters of NES Summary

For EPBC Act listed fauna, the assessment of potential impacts to these values has generated an extensive suite of mitigation measures for the project in keeping with best management practices (see, Chapter 20, Planning Environmental Management Plan). With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on EPBC Act listed Threatened fauna will be relatively low in significance.

The construction of the pipeline and clearing of the ROW is likely to have an overall **negligible** to **minor adverse** impact to (aquatic and terrestrial) EPBC Act listed Threatened flora and ecological communities. Prior to construction, a trained ecologist will identify areas within the corridor where negative impacts on flora communities (in general) and EPBC Act listed Threatened species are possible. This information will be documented in the Construction Environmental Management Plan (CEMP).

6.2 Terrestrial Flora

6.2.1 Background

This chapter constitutes the terrestrial flora component for the EIS for the project.

The study of terrestrial flora investigated the vegetation communities classified as Regional Ecosystems (REs) by the Environmental Protection Agency (EPA) 2007 and Threatened species (as defined under relevant legislation) along the proposed pipeline corridor, which are likely to be impacted by the project. The corridor considered is on average approximately 100 m wide. The ROW for the project is approximately 30 m wide (within the corridor), and vegetation is likely to be completely cleared in this area. Impacts on Threatened Species were assessed for the ROW, with consideration of possible edge effects on Threatened species within 100 m either side of the corridor (i.e. a total width of assessment of approximately 300 m). Impacts on vegetation communities were considered on a broader scale, to account for the effects of fragmentation. In this case the distance assessed from the corridor was highly variable, depending on existing remnant vegetation surrounding the corridor.

In all cases a minimum buffer distance of 100 m either side of the corridor was taken into consideration when assessing impacts, but remnant vegetation corridors were also taken into consideration, and these corridors can extend many kilometres away from the pipeline corridor.

The impacts on terrestrial flora were considered in conjunction with the related indirect effects on other factors including aquatic ecology, fauna, soils and cultural values. The most significant relationships were those of:

- Dependence of aquatic ecology stability on riverine vegetation
- Dependence of terrestrial fauna on terrestrial flora habitat
- Dependence of particular fauna species on particular plant species (not necessarily Threatened plant species)
- Dependence of soil stability on intact terrestrial vegetation
- Dependence of modern and traditional cultures on remnant vegetation and plant species.

The study also considered weed issues in the project area, to avoid exacerbating problems particularly with Parthenium (*Parthenium hysterophorus*) around the northern end of the corridor, and Giant Rats-tail Grass (a number of *Sporobolus* spp.) around the southern end of the corridor.

6.2.2 Aims

The aims of the study were to provide:

- A detailed assessment of the conservation values of terrestrial vegetation within and directly adjacent to the proposed corridor
- An assessment of Threatened species known or potentially occurring within the project area, including species listed under the EPBC Act and Queensland's *Nature Conservation Act 1992, (*NC Act*)*
- An assessment of Threatened Ecological Communities known or potentially occurring within the project area, listed under the EPBC Act. See Chapter 6, Section 6.1 for a summary and Appendix G for a full assessment specifically dealing with the project's relevant matters of NES (Threatened species and Ecological Communities) under the EPBC Act
- An assessment of Endangered and Of Concern REs known or potentially occurring within the project area, listed under the VM Act
- An identification of significant habitats within the study area
- Mitigation measures proposed in response to potential impacts.

Specifically, the information required is stipulated in the ToR issued by the Queensland Government Coordinator-General, included in Appendix A.

6.3 Methodology

6.3.1 Nomenclature and Terminology

In this chapter, project area refers to lands and waterways within the project corridor, which runs from the Fitzroy River in the north to the Gladstone State Development Area (GSDA) in the south as shown in Figure 1.3. The average width of the corridor investigated is approximately 100 m. The ROW is generally 30 m wide passage within the corridor that is likely to be substantially cleared for the construction and operation of the pipeline, its associated infrastructure, and access. The term *surrounding area* refers generally to the lands within 2 km of the project area. The project area is considered in two sections - the northern section is referred to as the *Fitzroy to Bajool* section, and the southern section as the *Bajool to Gladstone* section.

In this chapter, the conservation status of a species may be described as *Endangered*, *Vulnerable*, *Rare*, *Culturally Significant* or *Common*. These terms are used in accordance with the provisions of the *Nature Conservation Act 1992* (Qld) (NC Act) and its amendments[1], and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). *Threatened* is used in this chapter to collectively describe Endangered and Vulnerable species.

This chapter describes the potential impacts of the project on *remnant vegetation* as defined under the *Vegetation Management Act 1999* (Qld) (VM Act). The VM Act and the presence of RE provide the legislative framework for vegetation conservation in Queensland. This occurs through two processes that are administered by the Department of Natural Resources and Water (DNRW) under the VM Act and a process developed by the Queensland Environmental Protection Agency (EPA) and administered under the *Integrated Planning Act 1997* (Qld) (IP Act). The descriptions of conservation status used in this chapter reflect those defined under the VM Act and Regional Ecosystem Description Database (REDD) maintained by the Queensland Herbarium.

Remnant vegetation is that which is defined by RE mapping by the EPA (2005), but also includes vegetation that has not been covered by that mapping process due to reasons of scale or error. The minimum mappable size of a vegetation remnant in coastal areas for RE mapping is 1 ha (EPA 2005a, Section 3.8.1.1 of EPA methodology), and it must meet the height and cover requirements as defined by REDD (EPA 2007b). Unmapped remnant vegetation is recognised as *non-remnant* under the VM Act, but can be incorporated into RE mapping, and converted to remnant, through the *map modification process*, which is administered by DNRW.

[1] For the purposes of this chapter, relevant NC Act regulations and amendments refer to the Nature Conservation (Wildlife) Regulation 1994 and reprinted as in force on 8 March 2004 (including amendments up to 2004 SL No.9).

Botanical names conform to those recognised by the Queensland Herbarium (see Bostock and Holland 2007).

The term *scrub* in this chapter refers to non-eucalypts (i.e. not *Eucalyptus* species) which usually grow in dense communities, and are defined REs, RE 11.11.18 and RE 11.11.5 (EPA 2007b) which are considered as possibly occurring along the corridor (see Table 6.2 for short descriptions of those REs).

The following abbreviations are used in this chapter:

ASS	Acid Sulphate Soils
AVH	Australia's Virtual Herbarium
BAMM	Biodiversity Assessment Mapping Methodology
BPA	Biodiversity Planning Assessment
CEMP	Construction Environmental Management Plan
DEWHA	Australian Department of the Environment, Water, Heritage and the Arts
DIP	Department of Infrastructure and Planning
DNRW	Department of Natural Resources and Water
EMP	Environmental Management Plan
EPA	Queensland Environmental Protection Agency
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Cth)*
EVR	Endangered, Vulnerable or Rare
GIS	Geographical Information System
GPS	Global Positioning System
GSDA	Gladstone State Development Area
IP Act	*Intergrated Planning Act 1997*
Land Protection Act	*Land Protection (Pest and Stock Route Management) Act 2002*
NC Act	*Nature Conservation Act 1992*
NES	National Environmental Significance
REs	Regional Ecosystems
REDD	Regional Ecosystem Description Database
ROW	Right-of-way
SGIC	Stanwell - Gladstone Infrastructure Corridor
ToR	Terms of Reference
VM Act	*Vegetation Management Act 1999 (Qld)*
Wildlife Online	public internet access to Queensland EPA flora and fauna records

6.3.2 Terms of Reference

Methods followed as closely as possible to those stipulated in the ToR, which are presented in Appendix A.

6.3.3 Review of Existing Information

6.3.3.1 Spatial Data

A number of Geographical Information System (GIS) datasets, including the project corridor, were overlaid on rectified aerial photography. The datasets were:

- Rectified aerial photo mosaic (average age of component photos 2005)
- Cadastre (produced by DNRW)
- RE vegetation mapping by the Queensland Herbarium (Version 5.0 with December 2006 Amendments) (EPA 2005b)
- Biodiversity Planning Assessment (BPA) mapping (Version 3.4 – 7 March 2005) (EPA 2005c).

6.3.3.2 Existing Reports

A number of reports pertaining to the project area and surrounds were assessed for relevance and were used for general background information (see references in Section 6.11).

6.3.3.3 Desktop Review of Mapping

RE mapping (EPA 2005b) was used to locate the larger patches of native vegetation intersected by the corridor. Air-photo interpretation was used to identify any other unmapped patches of native vegetation. Representative remnant REs were sampled along the entire length of the proposed corridor, with the exception of those private properties where access was not granted. Each vegetation remnant shown in RE mapping (EPA 2005b) and intersected by the corridor was sampled in detail at least once. Unmapped remnants of sufficient size or width to be mappable according to Queensland Herbarium mapping methodology (EPA 2005a) were also sampled[2]. This was done to verify the mapping, and to check for targeted Rare or Threatened flora species known to occur in the area.

6.3.3.4 Existing Field Data

Brief site data collected in April 2007 by BMT WBM for a preliminary assessment of the corridor were incorporated into this study and used as the main source of background information. Brief site data included the recording of dominant plant species at each site, and other relevant information such as condition and soil type. Conspicuous

[2] According to Herbarium methodology the remnant size can be as small as 0.25 ha and/or 25 m wide.

Threatened species were also targeted as part of the preliminary assessment. For example, for the Threatened species listed in the EPBC Act, *Cycas* spp. were conspicuous in eucalypt forest during reconnaissance, and *Atalaya* spp. in softwood scrub were also relatively distinctive. Publicly accessible roads were mostly used in this stage of the study, and site data is presented in Appendix E2.

6.3.3.5 Databases

Two publicly accessible databases with restricted locational precision were searched to identify Rare or Threatened flora known to occur, or likely to occur, in the project area and surrounds. Both Rare and Threatened categories are used in the NC Act, and Threatened is used in the EPBC Act. Both searches were done by specifying coordinates (defining a rectangle) that contained the entire project area:

- Wildlife Online – a Queensland EPA internet database accessible to the public which stores records of plant collections (and other groups including algae and fungi) for a search area defined by the user. Rare and Threatened species can be selected from the data. The latest data retrieval was performed on 7 August 2007.
- EPBC Act Protected Matters Report – a DEWHA internet database accessible to the public which lists Rare and Threatened Species for a search area defined by the user. The latest data retrieval was performed on 3 July 2008.

The likelihood of occurrence of individual Threatened flora species (strictly, they are *taxa,* since sub-species levels can apply) was assessed in two ways: firstly whether the species was considered likely to occur within close proximity to the corridor (creating a risk of disturbance); secondly whether the species was considered likely to be consistently associated with one or more of the categories defined by the GIS coverages (e.g. a particular RE on the RE mapping).

6.3.4 Field Investigation

A field survey for Threatened species was done concurrently with a detailed site survey as described below for vegetation community sampling, for which both conspicuous and inconspicuous species were searched. Conspicuous Threatened species were also searched for during the entire course of survey work, particularly during Brief site surveys.

Field surveys were undertaken to assess the following:

- To determine where the mapped remnant vegetation communities would be directly intersected by the corridor, by intensive 50 m x 10 m site surveys in a representative location, identifying structure, condition and usually all species (depending on appropriate level of detail). This data was then used to verify the accuracy of the RE mapping and if necessary, revise the mapping in the adjacent area (i.e. approximately a 200 m radius), by broader reconnaissance and/or air-photo interpretation. Vegetation sampling was done in accordance with Queensland Herbarium vegetation survey methodology (EPA 2005a). Sample types were either:
  - **Detailed** – all plant species present on-site were recorded within a 50 m x 10 m plot, along with structural details such as height and cover. This type of site is consistent with a Queensland Herbarium Secondary site, except stem counts were not included. It is more comprehensive than a Queensland Herbarium Tertiary site, in that all plant species in the plot are recorded. Every RE (each type, not each remnant) which occurred along the corridor was intended to be sampled at least once, so that correct RE allocation for the RE mapping could be verified. Detailed sites were only considered in remnants of good condition, so that structural data and complete species lists were meaningful, and could be applied (extrapolated) to other remnants within the corridor of the same RE
  - **Short** – mid-way between a Detailed site and a Brief site. A short list of the most common species was made of the site but structural details were not formally recorded. Like a Detailed site, a Short site was usually strategically placed, and was often a site that was originally intended to be Detailed. Detailed sites were not done where, on initial field assessment, site conditions indicated that a Detailed site was not necessary or not possible (e.g. due to disturbance such as a selectively thinned canopy, or weed infestation). A Short site was also used to confirm an RE when a Detailed site had been done in a nearby remnant of the same RE, especially to consolidate a detailed species list for the local variation of any particular RE
  - **Brief** – only the dominant and indicator plant species present on-site were recorded. This type of site is consistent with a Queensland Herbarium Quaternary site, but some Brief sites were extended species lists similar to a Short site. The data were usually recorded without leaving the vehicle. Brief sites were done to confirm RE mapping, and get an overview of the project area. Brief sites were essential for checking mapped RE polygons.

- To visually check for the presence of Rare or Threatened flora as identified by relevant legislation, which may have been identified as occurring somewhere in the area of the proposed corridor. Any Rare or Threatened species seen *ad hoc* during the vegetation survey were also recorded
- To visually check for small remnants of vegetation which may not feature on the RE mapping due to error or scale, and to assess the value of those remnants based on any or all of the criteria in these methods. These unmapped remnants included stands of trees, or other communities (including grasslands and wetlands) and significant trees (e.g. old growth).

Photographs were taken of each site to illustrate vegetation structure (see Appendix E2), and the position was recorded, where possible, with a hand-held Global Positioning System (GPS). Flora species unable to be identified in the field were collected for later identification. Individual unknown plants were not collected if whole plant removal was required, and instead, close-up photographs and descriptions were taken, along with highly specific location information for return to site if necessary. Public roads and reserves were used to visit all possible publicly accessible sampling points along the corridor, and relevant areas adjacent to the corridor. When areas of interest were on private property, sampling was conducted where permission was granted by landowners.

The location of each sample site is shown overlaid on the RE mapping in Figure 6.1. Sites are identified by arbitrary numerical allocation, in order (north to south) along the corridor, but with subsequent additions of alphabetical characters to allow for insertion of new sites. Some site numbers have been omitted, indicating that a proposed site was subsequently considered redundant or unnecessary, in light of further information becoming available (e.g. a revision of the proposed corridor alignment).

6.4 Assumptions and Limitations

Preliminary site surveys using Brief site observations were done in April 2007, with subsequent Detailed site surveys conducted from 27 August to 7 September 2007. There was little rainfall before and during surveys resulting in drought conditions throughout the project area. Rainfall events in the catchment in February 2008 are likely to have had a positive impact on ground layer flora, but it is not expected that any additional Rare or Threatened species would establish following the rain.

RE mapping (EPA, 2005b) in the project area is relatively coarse and suitable for general planning only. It is not suitable for precise location of infrastructure, and errors of tens or hundreds of metres can occur. The exact extent of some existing vegetation communities is still uncertain due to the age of the aerial photography used in the study. Sources of error that may cause planning problems are:

- **Scale** – base mapping relies on satellite images in many areas and this is coarser than the aerial photography
- **Time lapse** – a considerable amount of clearing or disturbance can occur between the time the remote sensing was done and when the planning begins
- **Remote sensing interpretation error** – this can lead to incorrect REs being applied to vegetation types (due to inability to access ground-truthing areas)
- **Local variation in vegetation type** – this can render RE classification too coarse to be correct. Sub-REs are developed for this purpose but they are being continually developed.

It was assumed for the purposes of the EIS that the ROW for the project is generally 30 m wide, but can be reduced in sensitive areas.

6.5 Relevant Legislation and Policy

The Queensland and Commonwealth statutes, regulations and policies relevant to this chapter are:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – this Act protects Threatened Species at the Federal level
- Queensland *Nature Conservation Act 1992* (NC Act) (and Regulations and Conservation Plans) – this Act protects Threatened Species at the State level
- Queensland *Vegetation Management Act 1999* (VM Act) – this Act protects vegetation from unauthorised clearing (i.e. it focuses on plant communities, not individual plants)
- Queensland *Integrated Planning Act 1997* (IP Act) – this Act coordinates the various Acts described here with other legislation, particularly local government planning schemes
- Queensland *Land Protection (Pest and Stock Route Management) Act 2002 and Regulation 2003* – the Act and Regulation define noxious weeds, which are formally referred to in the Act as Declared Pest Plants.

6.6 Baseline

6.6.1 Background

6.6.1.1 Regional Ecosystems

The project area is located within the Brigalow Belt South and Southeast Queensland bioregions. A bioregion is an area of land that is dominated by similar broad landscape patterns that reflect major structural geologies and climate, as well as major changes in floristic and faunal assemblages (adapted from Sattler and Williams 1999).

The southeastern end of the project area (east of Yarwun) is within the Southeast Queensland bioregion, and this area is characterised by part of the Great Dividing Range, and hilly country with eucalypt forest (but with Poplar Box (*Eucalyptus populnea*) notably absent). The northwestern part of the project area is within the Brigalow Belt South bioregion, and is characterised by flatter, undulating country, with less eucalypt forest (but notably with Poplar Box), and more clay plains, sometimes with Brigalow (*Acacia harpophylla*).

The Fitzroy to Bajool section is located entirely within the Brigalow Belt South bioregion, whereas the Bajool to Gladstone section of the project area is situated within both bioregions. These bioregions represent two of the 13 biogeographical regions (i.e. bioregions) located within Queensland (Sattler and Williams 1999). Other bioregions, for comparison, include the Mulga Lands in Southwest Queensland, Mitchell Grass Downs in Central West Queensland and the Wet Tropics around Cairns.

Remnant vegetation in Queensland is mapped by the EPA (2005b) using REs. These are defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. Each RE is defined by a three-number code:

- The first number defines the bioregion. In the Brigalow Belt South bioregion the bioregional number is 11. In the Southeast Queensland bioregion the bioregional number is 12
- The second number defines the Land Zone, which is based on geology, landform and/or soil. Land Zones of Queensland are shown in Table 6.1. Note that in Southeast Queensland, Land Zones 9 and 10 are combined (as "9/10" or "9-10") because of their similarity
- The third number is a unique identifier for the RE, and sometimes there is also a sub-RE identified by a letter of the alphabet. Examples of REs include 11.3.4 and 12.9-10.17b.

The REDD (EPA 2007b) is an internet-based list of REs, with descriptions that are continually updated, and explanations of the RE classification system, including bioregions, land zones, and the individual REs.

6.6.1.2 Links Between Terrestrial Vegetation, and Fauna and Aquatic Flora

Remnant terrestrial vegetation provides habitat for fauna, so the assessment of terrestrial vegetation is able to provide an indication of fauna habitat value. Refer to Chapter 7, Terrestrial Fauna, for those assessments.

Remnant riparian vegetation provides habitat protection for aquatic flora and fauna, through processes such as shading, erosion control and stream flow regulation. Refer to Chapter 8, Aquatic Flora and Fauna, for assessment of those processes.

6.6.2 Remnant Vegetation Communities

6.6.2.1 General

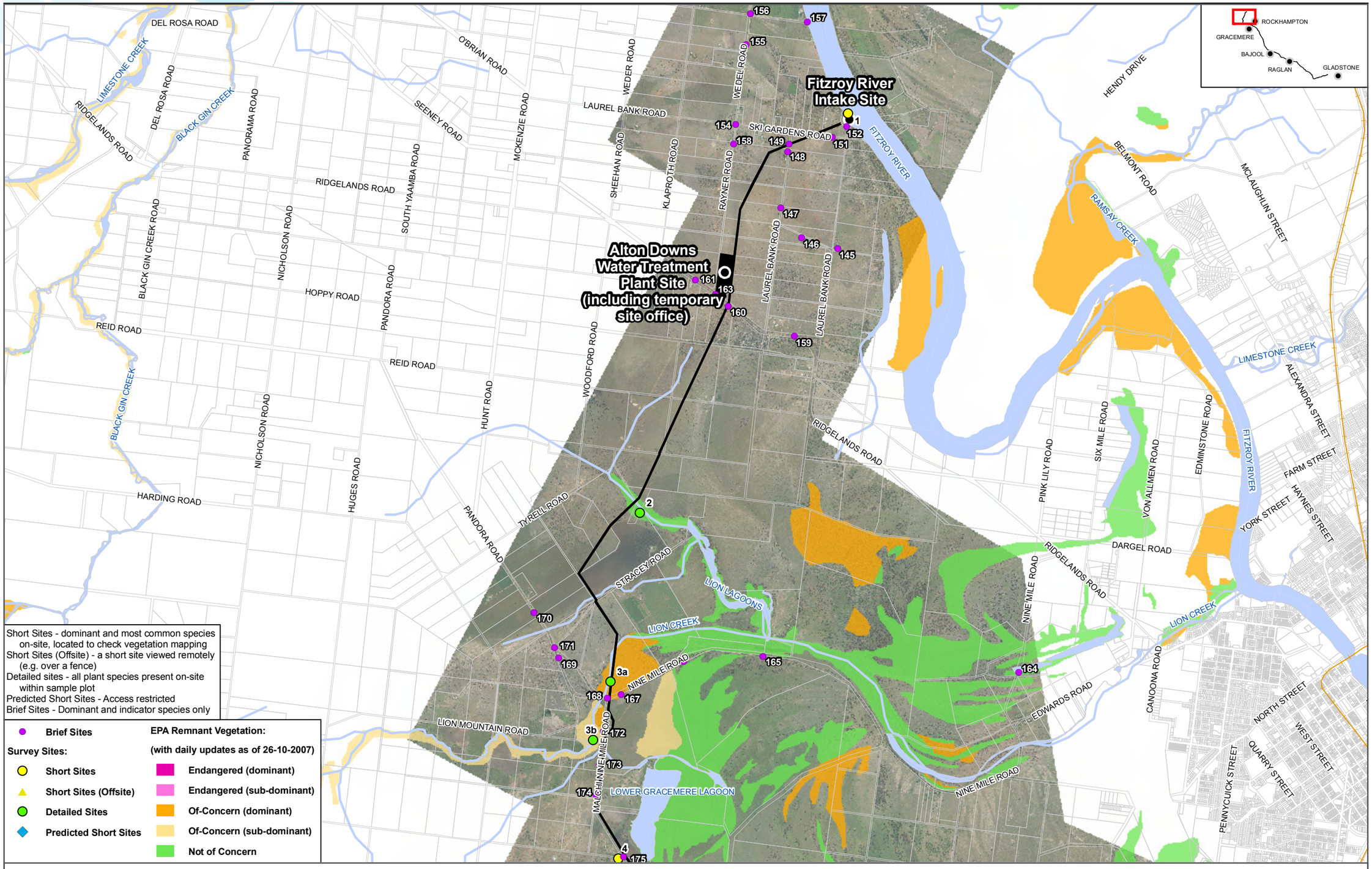
General Condition of Vegetation

Extended drought conditions in the region at the time of field surveys caused what was perceived to be a relative paucity of terrestrial flora species in the lower stratum (the ground layer). As such, it is likely that the full species composition of many terrestrial vegetation communities was not recorded. Upper strata (trees and shrubs) did not appear to be adversely affected by drought. It is likely that recent rain and flooding in the region will have had a positive impact on ground layer flora. However it is not expected that any additional Rare or Threatened Species would establish following the rain, and would not significantly alter the baseline terrestrial flora values as outlined in this chapter.

Scrub Areas Along the Full Length of the Corridor

Softwood scrub is a collective term for non-eucalypt species which are often diverse, and sometimes regarded as "dry rainforest". Some types of softwood scrub in this area are classified as "semi-evergreen vine thicket", but *scrub* (or *softwood scrub*) will be used hereon as a collective term. Scrub in the study area is defined mainly by the RE 11.11.18, as this defines lowland scrub on metamorphic sediments. Scrub in the project area was not necessarily restricted to this RE, depending on geological substrate and species assemblage.

Scrub occurred in patches, along (or near) the corridor. Notable localities included the "Hillview" property in the Gracemere area, Twelve Mile Creek and Marble Creek. These patches were sampled as Sites 4, 13 and 14 respectively, and are discussed further in this section.



Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 1 of 8

Gladstone Area Water Board

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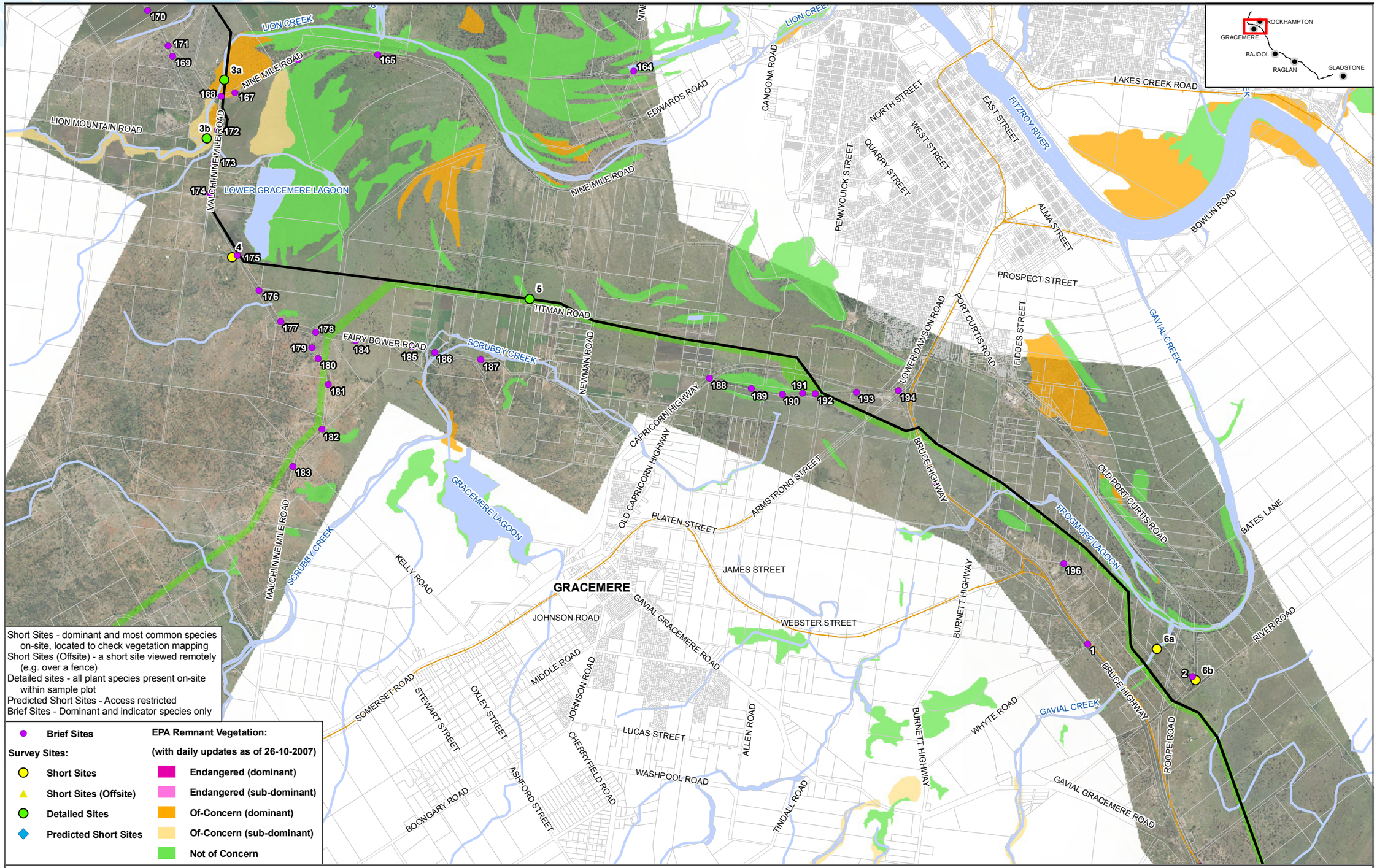

Short Sites - dominant and most common species on-site, located to check vegetation mapping
Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)
Detailed sites - all plant species present on-site within sample plot
Predicted Short Sites - Access restricted
Brief Sites - Dominant and indicator species only

	Brief Sites	EPA Remnant Vegetation:	
Survey Sites:		(with daily updates as of 26-10-2007)	
	Short Sites		Endangered (dominant)
	Short Sites (Offsite)		Endangered (sub-dominant)
	Detailed Sites		Of-Concern (dominant)
	Predicted Short Sites		Of-Concern (sub-dominant)
			Not of Concern

Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 2 of 8

The Right of Way
Project Infrastructure
Railway Line
Waterways
Cadastre
LGA Boundary
SGIC
GSDA

0 1 2 3 4 km

1:50,000 at A3

N

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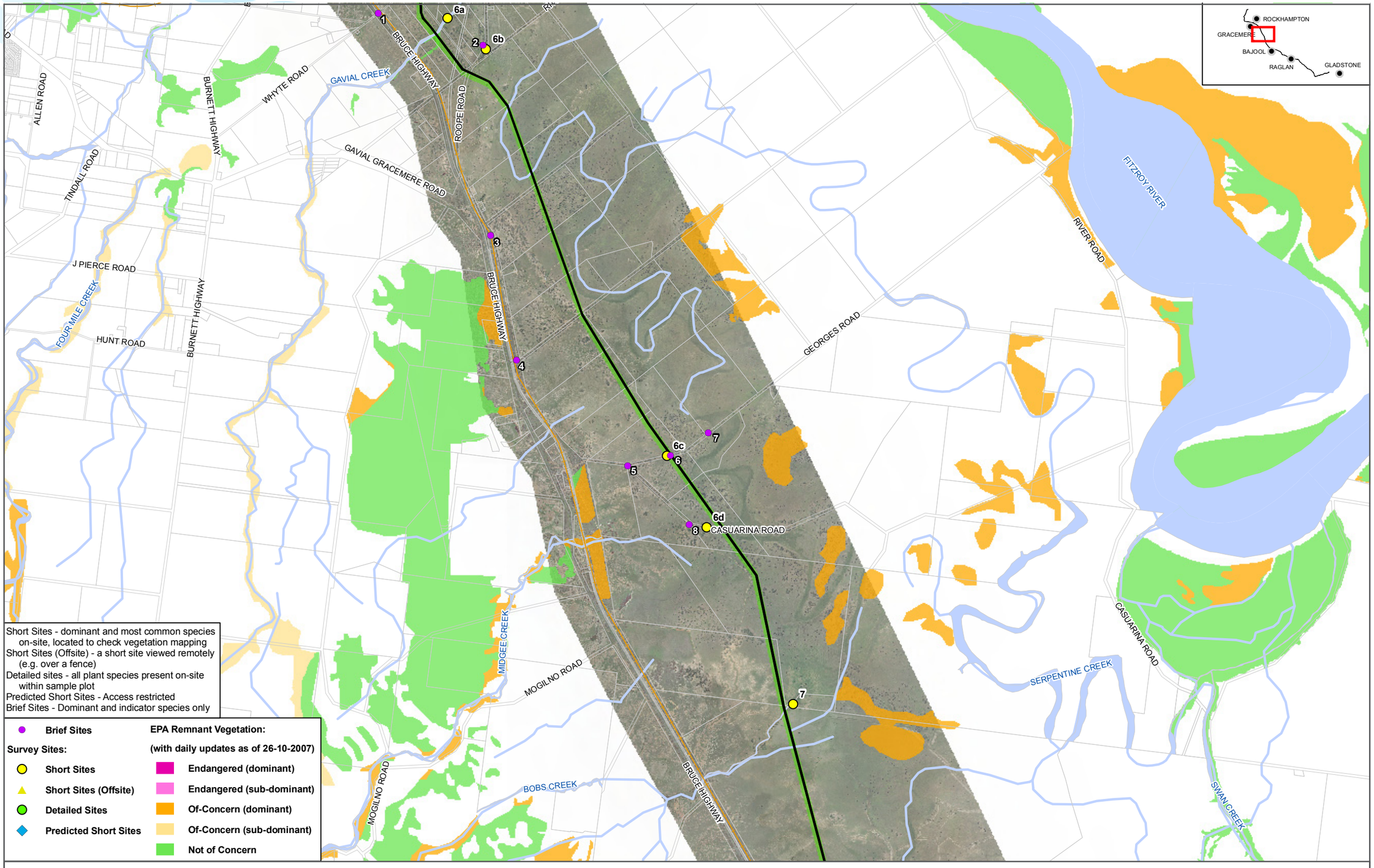

Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 3 of 8

The Right of Way
Project Infrastructure
Railway Line
Waterways
Cadastre
LGA Boundary
SGIC
GSDA

0 1 2 3 4 km

1:50,000 at A3

N

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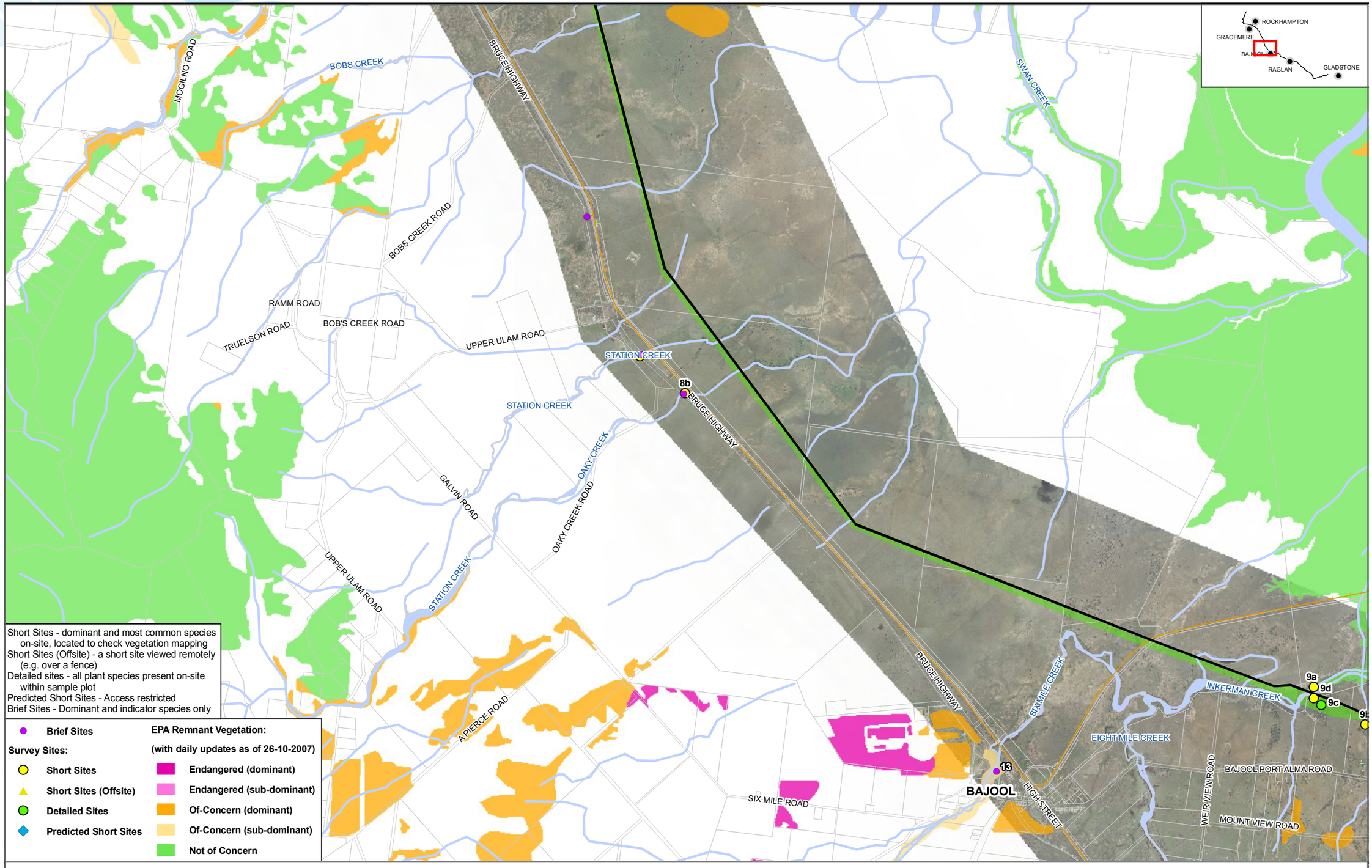

Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 4 of 8

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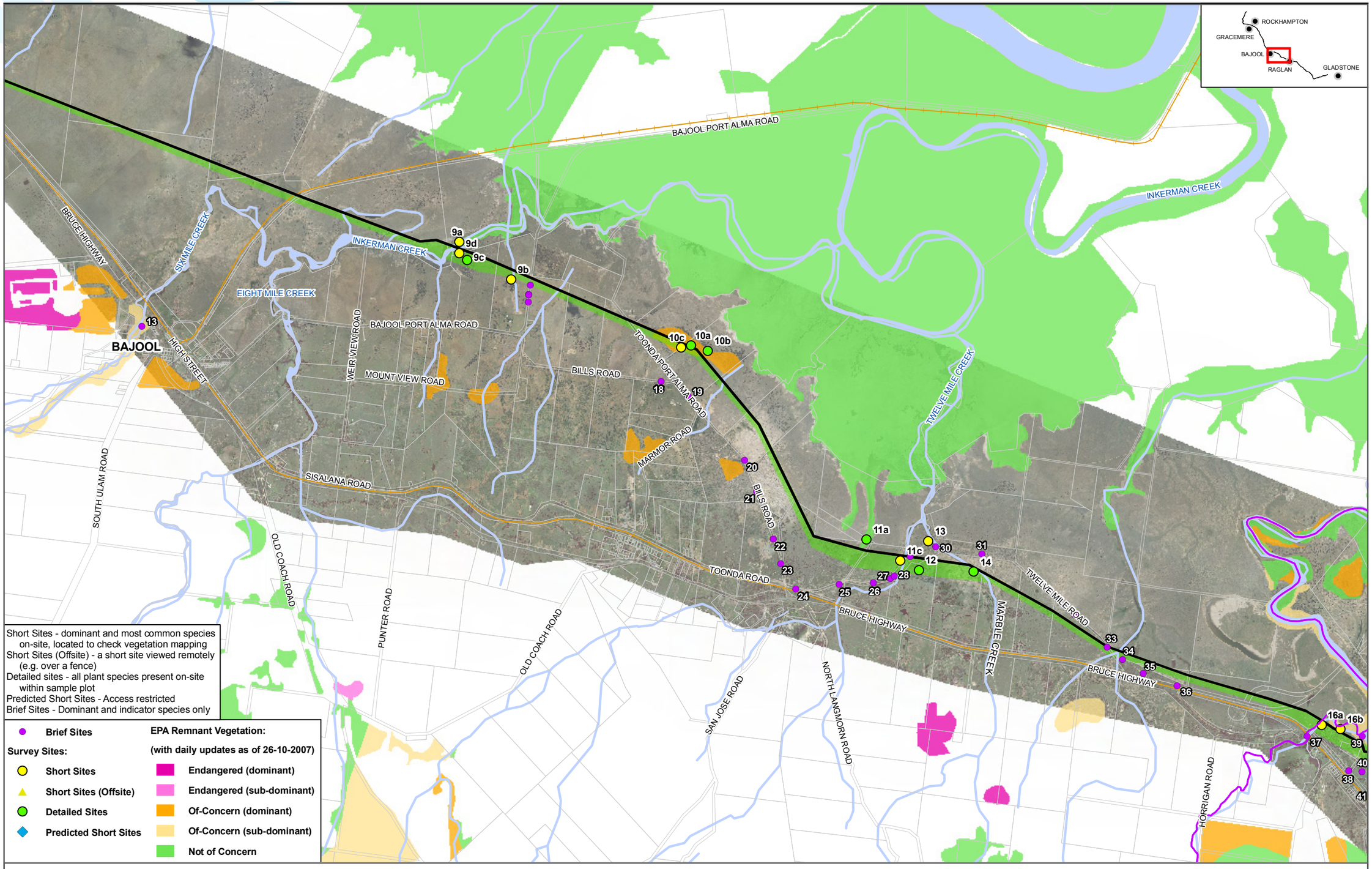

Short Sites - dominant and most common species on-site, located to check vegetation mapping
Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)
Detailed sites - all plant species present on-site within sample plot
Predicted Short Sites - Access restricted
Brief Sites - Dominant and indicator species only

Brief Sites

Survey Sites:

- **Short Sites**
- **Short Sites (Offsite)**
- **Detailed Sites**
- **Predicted Short Sites**

EPA Remnant Vegetation:

(with daily updates as of 26-10-2007)

- **Endangered (dominant)**
- **Endangered (sub-dominant)**
- **Of-Concern (dominant)**
- **Of-Concern (sub-dominant)**
- **Not of Concern**

Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 5 of 8

- The Right of Way
- **Project Infrastructure**
- **Railway Line**
- **Waterways**
- **Cadastre**
- **LGA Boundary**
- **SGIC**
- **GSDA**

0 1 2 3 4 km

1:50,000 at A3

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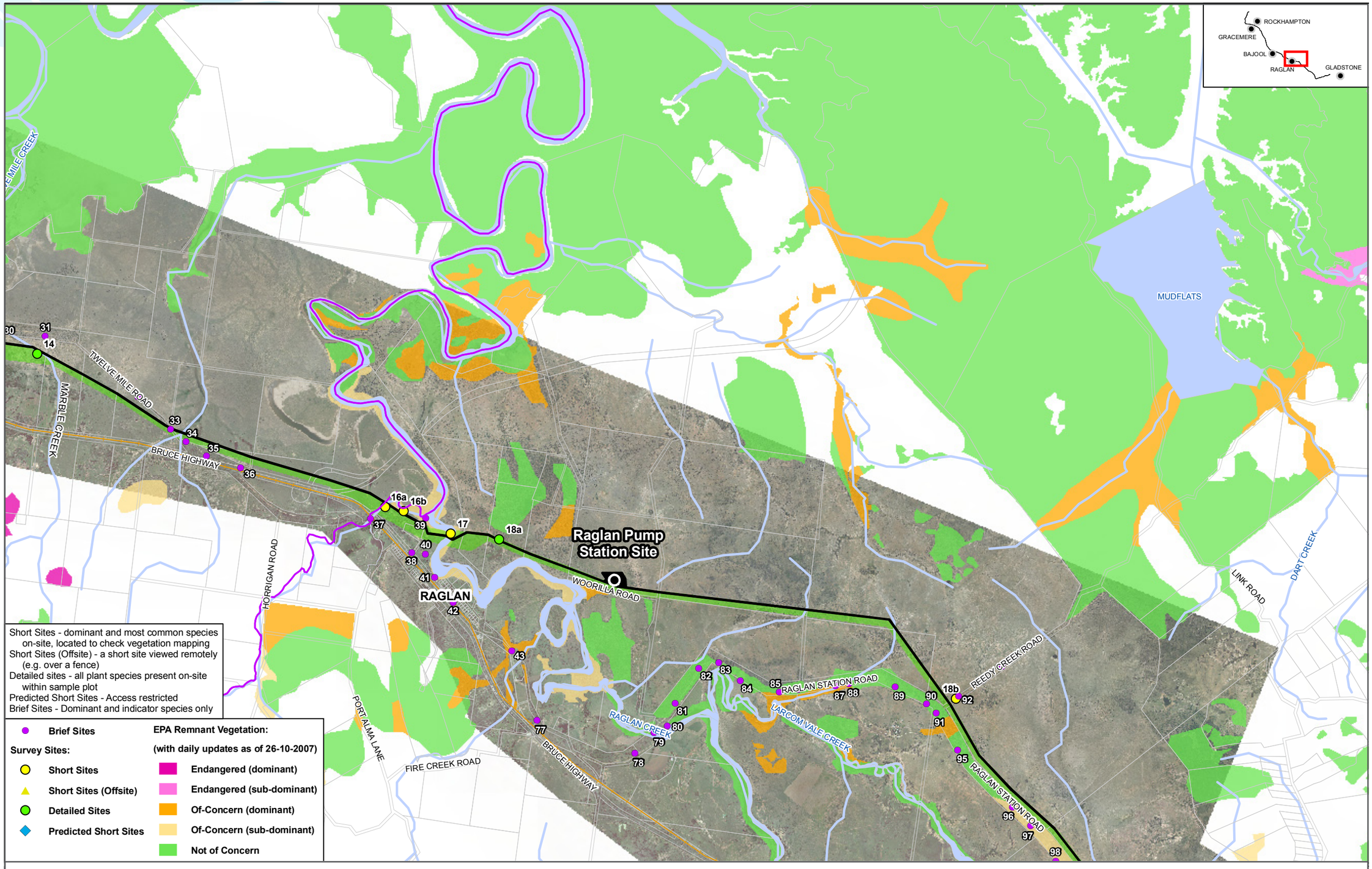

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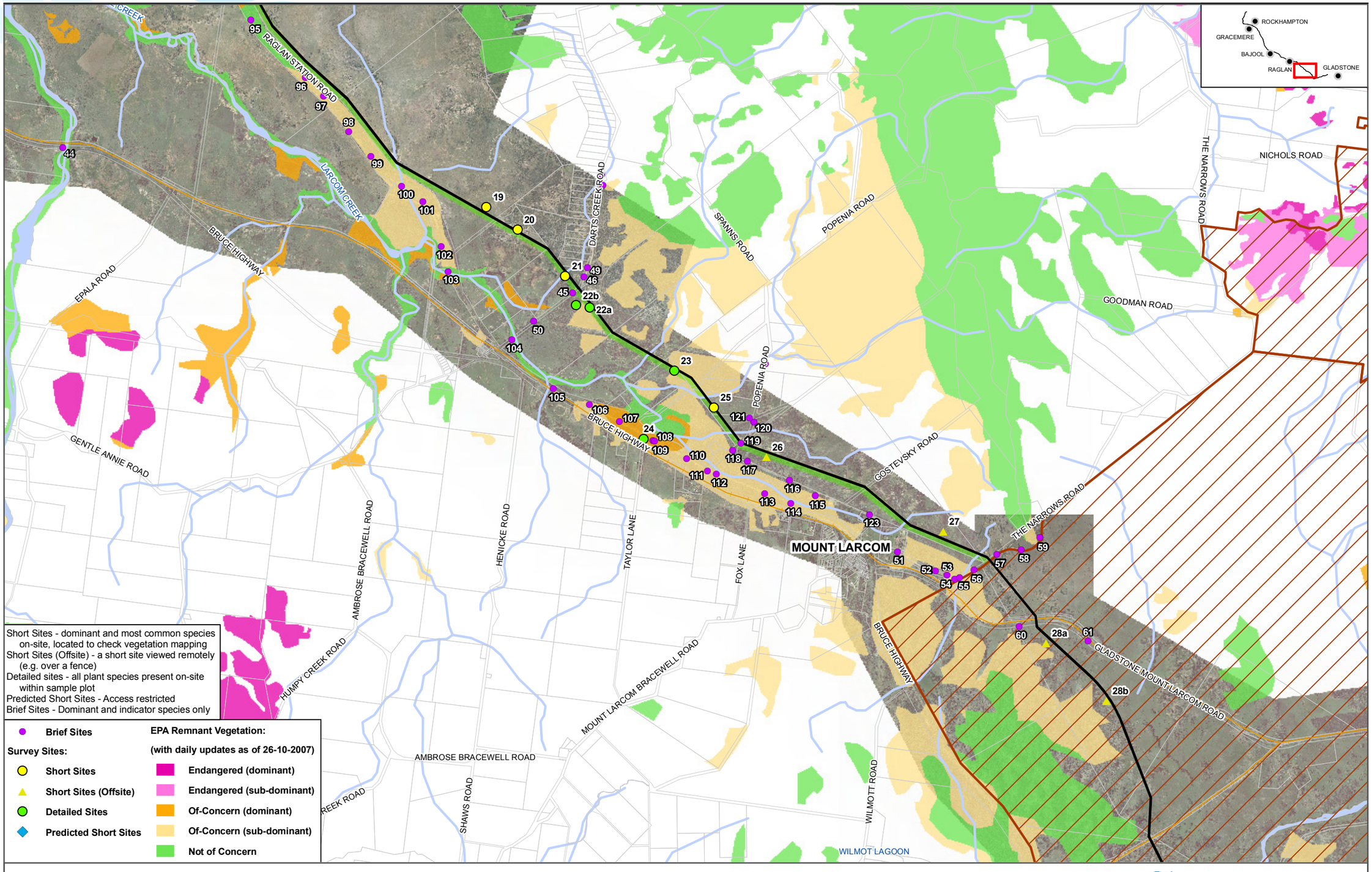

Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 7 of 8

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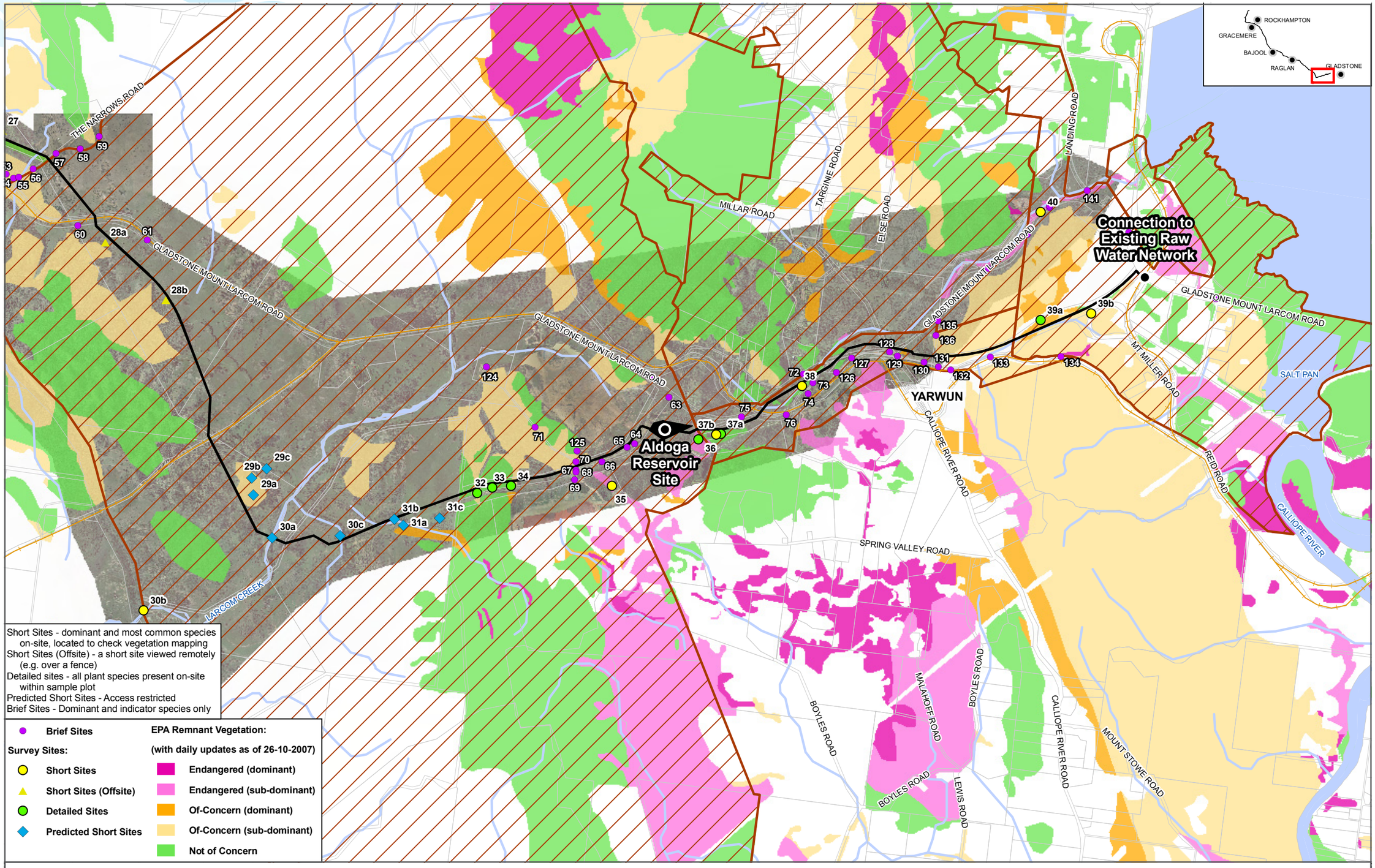

Gladstone - Fitzroy Pipeline Project

Figure 6.1 - Regional Ecosystem Mapping With Site Locations

Sheet 8 of 8

Gladstone Area Water Board

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Table 6.1 Land Zones of Queensland from EPA (2007b)

Land Zone number	Definition (central concept, followed by lay terminology)
1	Deposits subject to periodic tidal inundation Tidal flats and beaches
2	Quaternary coastal sand deposits Coastal dunes
3	Quaternary alluvial systems Alluvium (river and creek flats)
4	Flat to gently undulating Tertiary clay plains Clay plains not associated with current alluvium
5	Plains and plateaus on Tertiary land surfaces, generally with medium-to- coarse-textured soils Old loamy and sandy plains
6	Quaternary inland dunefields Inland dunefields
7	Exposed or shallowly covered duricrusts Ironstone jump-ups
8	Plains and hills on Cainozoic flood basalts Basalt plains and hills
9	Gently undulating landscapes on more or less horizontally bedded fine grained sedimentary rocks Undulating country on fine grained sedimentary rocks
10	Plateaus, scarps and ledges with shallow soils on more or less horizontally bedded medium-to-coarse-grained sedimentary rocks Sandstone ranges
11	Hills and lowlands on metamorphosed sedimentary rocks Hills and lowlands on metamorphic rocks
12	Hills and lowlands on granitic and other pre-Cainozoic igneous rocks Hills and lowlands on granitic rocks

Fitzroy to Bajool

The proposed pipeline corridor from the Fitzroy River through to Bajool consists of alluvial country in the Gracemere and Gavial areas, with dark, high clay content soils, commonly referred to as "black soil". There were a high number of permanent and ephemeral wetlands in these areas. Tree cover was generally sparse as a result of clearing for pasture, and was predominantly scattered Coolabah (*Eucalyptus coolabah*), Blue Gum (*E. tereticornis*), and further south around Bajool, Poplar Box (*E. populnea*).

There were small patches (i.e. less than approximately 1 ha) of remnant scrub within this length of the corridor, with one notable patch in the Gracemere area.

Bajool to Gladstone

Further south around Marmor, the area was slightly hilly, with areas of scrub and Brigalow (*Acacia harpophylla*), which have mostly been cleared. There were small patches (i.e. less than approximately 1 ha) of remnant scrub within this length of the corridor, plus a number of areas of scrub regrowth.

Hills increased in size further south, indicating a change in geology, and the predominant vegetation type around Raglan, Ambrose and Mt Larcom was Grey Box forest (*Eucalyptus moluccana*). Soils tended to be grey and silty, with a lower clay content, and geological parent material was metamorphic or sedimentary, but not generally alluvial like the northern end of the corridor.

The area from Mt Larcom to Gladstone had substantially larger hills of metamorphic origin, which increased slightly in eucalypt species diversity, with species including Narrow-leafed Ironbark (*Eucalyptus crebra*) and Spotted Gum (*Corymbia citriodora*). There were still alluvial areas, but there was a change around Aldoga from the Brigalow Belt South bioregion in the west, to the Southeast Queensland bioregion in the east. This meant the remaining predominant trees on these alluvial plains tended to be Blue Gum (*E.tereticornis*), and not the others described for the northern (and western) end of the corridor.

In most cases the observed remnant vegetation communities were consistent with REs, but appropriate notes were made where there was disagreement. The RE mapping, with site numbers, is shown in Figure 6.1. Detailed site observations (and also Short sites) are shown in Appendix E2.

The mapped REs which occur along the corridor, and the brief descriptions of each RE (EPA 2007b) are shown in Table 6.2.

Table 6.2 Regional Ecosystems that Occur Along the Corridor

RE code	Vegetation management status	Short description from RE description database (EPA 2007b)	General area	Mapping comments
11.1.2	Not Of Concern	Samphire forbland on marine clay plains	Bajool	
11.1.2a	Not Of Concern	Sub-type of 11.1.2. Bare mud flats on Quaternary estuarine deposits, with very isolated individual stunted mangroves such as Grey Mangrove (*Avicennia marina*) *Avicennia marina* and/or Spurred Mangrove (*Ceriops tagal).* May have obvious salt crusts on the soil surface	Bajool	
11.1.4	Not Of Concern	Mangrove forest/woodland on marine clay plains	Raglan Creek	
11.1.4d	Not Of Concern	Sub-type of 11.1.4. Occurs on the landward edge of the tidal flats and in the upper tidal reaches of creeks and rivers where there is a high freshwater influence	Inkerman Creek	
11.3.3	Of Concern	Coolabah *(Eucalyptus coolabah)* woodland on alluvial plains	Gracemere	
11.3.4	Of Concern	Blue Gum (*Eucalyptus tereticornis)* and/or *Eucalyptus* spp. tall woodland on alluvial plains	Gracemere	
11.3.25	Not Of Concern	Blue Gum (*Eucalyptus tereticornis)* or River Red Gum (*E. camaldulensis)* woodland fringing drainage lines	Gavial Creek/ Aldoga	

RE code	Vegetation management status	Short description from RE description database (EPA 2007b)	General area	Mapping comments
11.3.26	Not Of Concern	Grey Box (*Eucalyptus moluccana*)or *E. microcarpa* woodland to open forest on margins of alluvial plains	Ambrose/Darts Creek	Extensive, but may not always be on Land Zone 3, hence would be a different RE
11.3.27	Not Of Concern	Freshwater wetlands	Gracemere	
11.3.27c	Not Of Concern	Sub-type of 11.3.27. Mixed grassland or sedgeland with areas of open water +/- [1] aquatic species. Dominated by a range of species including Spike Sedge (*Eleocharis* spp.), Marsh Wort (*Nymphoides* spp.) and sometimes Common Weed (*Phragmites australis).* Occurs on closed depressions on alluvial plains that are intermittently flooded in inlands parts of the bioregion	Gracemere	
11.3.29	Not Of Concern	Ironbark *(Eucalyptus crebra),* Bendoo (*E. exserta),* Paperbarks (*Melaleuca* spp.) woodland on alluvial plains	Yarwun	More the lowlands east of the corridor
11.11.4	Not Of Concern	Ironbark *(Eucalyptus crebra)* woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges.	Aldoga	
11.11.4c	Not Of Concern	Sub-type of 11.11.4. Grey Box (*Eucalyptus moluccana)* dominated woodland. Other tree species listed for 11.11.4 may occur as sub- or co-dominant species	Aldoga	
11.11.5	Not Of Concern	Microphyll vine forest ± Hoop Pine (*Araucaria cunninghamiana)* on old sedimentary rocks with varying degrees of metamorphism and folding	Aldoga	Not on corridor
11.11.15	Not Of Concern	Ironbark (*Eucalyptus crebra)* woodland on deformed and metamorphosed sediments and interbedded volcanics. Undulating plains	Aldoga	
11.11.16	Of Concern	Northern Blackbutt (*Eucalyptus cambageana),* Brigalow *(Acacia harpophylla)* woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	Marmor	
11.11.18	Endangered	Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	Aldoga	Restricted to very small un-mappable area on corridor
12.3.1	Endangered	Gallery rainforest (notophyll vine forest) on alluvial plains	Boat Creek	
12.3.3	Endangered	Blue Gum *(Eucalyptus tereticornis*) woodland to open forest on alluvial plains	Boat Creek	
12.3.7	Not Of Concern	Blue Gum (*Eucalyptus tereticornis),* Weeping Bottlebrush (*Callistemon viminalis),* River Oak (*Casuarina cunninghamiana)* fringing forest	Boat Creek	
12.11.6	Not Of Concern	Spotted Gum (*Corymbia citriodora),* Ironbark (*Eucalyptus crebra)* open forest on metamorphics ± interbedded volcanics	Yarwun	
12.11.14	Of Concern	Ironbark (*Eucalyptus crebra),* Blue Gum (*E. tereticornis)* woodland on metamorphics ± interbedded volcanics	Yarwun	

The known remnant vegetation communities are discussed in two sections, starting from the extraction point at the Fitzroy River, to an approximate halfway point at Bajool, and then from the halfway point at Bajool, finishing near Gladstone. Unless otherwise specified, all sites are within, or partly within, the proposed corridor. Note that where access permission was withheld or restricted, observations were taken from adjacent to the site, with the use of binoculars.

6.6.2.2 Fitzroy to Bajool

This section describes the baseline findings from the field investigation, from the northern end (at the Fitzroy River) and progressing southwards along the project area alignment.

Short site 1

The extraction point on the Fitzroy River had a narrow strip of remnant riverine forest, consisting mostly of Blue Gum (*Eucalyptus tereticornis),* Coolabah *(Eucalyptus coolabah)* and Carbeen (*Corymbia tessellaris).* The understorey had been removed by grazing and other activities. There was also a Declared Pest Plant (Water Hyacinth (*Eichhornia crassipes*)) seen at this site.

Detailed site 2

There was an area of wetland mapped on RE mapping (EPA 2005b) past the end of Tyrrel Road, which occurred mainly on Lot 102 LN176. Due to restricted access to this property, the adjacent property to the west was sampled (Lot 3 RP843225), with access from the southern edge of the wetland. Aquatic vegetation at the site was in good general condition (i.e. inundated, native aquatic vegetation with limited aquatic weed infestation). However, approximately 100 m north of this location (the northern edge), sampling by aquatic ecologists (2007), found that the banks were infested by fireweed (*Senecio madagascariensis*).

Although clearing has probably occurred around the lagoon, it is possible that riparian trees were originally sparse or absent close to the edge of the lagoon in this area.

Detailed site 3a

An area of Blue Gum (*Eucalyptus tereticornis*) and Coolabah (*Eucalyptus coolabah)* was observed near the T-junction of Malchi Nine Mile Road and Fairy Bower Road, conforming with the representation on mapping as Of Concern RE 11.3.3 (EPA 2005b). This area had few trees, indicating the diffuse edge of the very open woodland, and/or selective clearing. Only a few individual trees occurred in the proposed corridor.

Detailed site 3b

Very large Blue Gum (*Eucalyptus tereticornis*) old growth trees were observed at this site, in conformance with representation on RE mapping as Of Concern RE 11.3.3 (EPA 2005b). Other tree species present included Sally Wattle (*Acacia salicina*) and Coolabah (*Eucalyptus coolabah*). The shrub layer was conspicuously absent, possibly due to clearance for agricultural purposes.

Short site 4

A small, unmapped remnant of softwood scrub is close to the corridor on Malchi Nine Mile Road. This scrub falls into the category of Endangered "semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions", as defined in the EPBC Protected Matters Report. The property name was "Hillview" (Lot 2 RP611138), and was on the western side of the road. Figs (*Ficus* spp.) were observed at the site and indicate a community consistent with a softwood scrub ecosystem.

Detailed site 5

There was a small wetland north of Fairy Bower Road, represented on RE mapping as Not Of Concern RE 11.3.27 (EPA 2005a) about 400 m west of Fogarty Road, on Lot 248 LIV401036. The wetland was a highly disturbed lagoon, with a high degree of weed infestation and limited native aquatic vegetation. Weed infestation was unidentifiable, however were known to be weeds due to invasive growth habit. There was also a lagoon several hundred metres to the east, of similar condition, but it had been dammed, and was not of original wetland form (i.e. artificial water level).

Short site 6a

Large Blue Gum *(Eucalyptus tereticornis)* individuals were observed along the high banks of Gavial Creek. The site was heavily affected by grazing, with a high level of weed infestation.

Short site 6b

An unmapped remnant of Poplar Box (*Eucalyptus populnea*) and Blue Gum (*Eucalyptus tereticornis)* was observed on the road reserve near the intersection of Roope Road and River Road.

Short sites 6c and 6d

Unmapped remnants of Poplar Box (*Eucalyptus populnea*) and some Blue Gum (*Eucalyptus tereticornis)* were observed on the road reserves of Georges Road (Site 6c) and Casuarina Road (Site 6d).

Short sites 7, 8a and 8b

Detailed sites were planned for Bob's Creek (on Lot 5 RP604251), Station Creek and Oakey Creek (on Lot 4 RP600951) (Sites 7, 8a and 8b respectively). Due to restricted access, substitute Brief sites were implemented at upstream crossings on the Bruce Highway (upstream of the proposed corridor) with the same site identifiers. Riparian vegetation on these creeks was generally Blue Gum (Eucalyptus tereticornis) and River Oak (Casuarina cunninghamiana). Weed infestation was high, so native aquatic macrophyte habitat was poor. It is assumed that the vegetation would be similar at the creek crossing locations on the corridor, although there may be some tidal or marine influence, in which case there may be an intergrade into mangrove communities. In this case the River Oak (Casuarina cunninghamiana) would be replaced by Swamp Oak (Casuarina glauca), and the mangrove species would probably be Grey Mangrove (Avicennia marina). Satellite imagery and high resolution aerial photography available at the time of preparation of this chapter suggests that the vegetation away from the riparian zones on these three creeks has been cleared.

6.6.2.3 Bajool to Gladstone.

This section describes the baseline findings from the field investigation, from approximately halfway along the project area alignment, and progressing southwards towards Gladstone.

Short site 9a

Remnant mangroves dominated by Grey Mangrove *(Avicennia marina)* were observed at this site, on Inkerman Creek, west of the Bajool Port Alma Road. There were also patches of saltmarsh. These observations were in conformance with representation on RE mapping as Not Of Concern RE 11.1.2 (EPA 2005b).

Short site 9d

Unmapped Brigalow (*Acacia harpophylla*) was observed at this site, with species composition and structure of this community similar to that of site 9c (refer below).

Detailed site 9c

A 200 m stretch of low-growing Brigalow (*Acacia harpophylla*) with extensive gilgai (a high density of small waterholes or pools, each ranging from about 5 to 10 m in diameter) was observed on the south side of Inkerman Creek on Lot 68 DS141. This patch of vegetation occurred between the tidal interface of Inkerman Creek, and the taller Brigalow further east towards the Toonda Port Alma Road. Brigalow (*Acacia harpophylla*) is a Threatened Ecological Community under the EPBC Act. However, the height of the community on-site averaged approximately 3 m, which does not meet the structural requirements for the definition of remnant Brigalow (11 to 15 m) under the VM Act, and the EPBC Act uses the structural classification of the VM Act (in this case RE 11.3.1 or 11.4.3). If the Land Zone in this area was interpreted as Land Zone 4 (clay plains rather than the alluvials of Land Zone 3), then the RE for this Brigalow would become RE 11.4.3 (which has a defined height of 10 to 16 m under the VM Act). The vegetation at Site 9c Rarely exceeded three metres in height and its remnant status was uncertain. Site 9c was typical of the whole patch. Regrowth can be considered as remnant if it reaches 70 percent of the height of its remnant height defined under the VM Act, but the 3 m height of this Brigalow at Site 9c was too short for this.

Short site 9b

An advanced regrowth patch of Brigalow (*Acacia harpophylla*) was observed approximately 100 m west of the Toonda Port Alma Road (on Lot 69 DS141) and adjacent to the proposed corridor. This regrowth was advanced enough to be considered as remnant. The VM Act considers that regrowth that is at least 70 percent of the accepted remnant height, and at least 50 percent of the accepted remnant cover, can be classified as remnant vegetation.

Detailed sites 10a and 10b, and Short site 10c

RE mapping shows a remnant Of Concern community off the Toonda Port Alma Road of Northern Blackbutt (*Eucalyptus cambageana*) with Brigalow (*Acacia harpophylla*), mosaiced with Grey Box (*Eucalyptus moluccana*) on Lot 98 DS186 and Lot 99 DS186. However, site inspection found that the remnant was mostly low Brigalow (*Acacia harpophylla*) (probably regrowth) and some Belah (*Casuarina cristata*). There was an infestation of Rubber Vine (*Cryptostegia grandiflora*) around much of the edge of the remnant.

Detailed site 11a

Marine drainages north of the Twelve Mile Road were identified for sampling although vegetation appeared sparse on aerial photos. Site 11b was located on a road reserve between Lot 84 DS185 and Lot 85 DS185, along a minor creek with marine influence. Although mapped as Not Of Concern (EPA 2005b), a eucalypt regeneration area, fenced off from grazing stock, was observed at the site. Blue Gums (*Eucalyptus tereticornis)* in this enclosure were a maximum of about 4 m tall, with some scattered mature individuals.

Short site 11c

Riverine vegetation along Twelve Mile Creek on Lot 85 DS185 was observed to be mostly cleared and not remnant. It consisted mainly of scattered Blue Gum (*Eucalyptus tereticornis)* and River Oak *(Casuarina cunninghamiana)*.

Detailed site 12

Tall open forest of Blue Gum (*Eucalyptus tereticornis)* in good condition was observed on the road reserve on Twelve Mile Road. This community was also representative of the adjacent Lot 29 DS37.

Short site 13

A small patch of remnant softwood scrub in good condition was observed adjacent to the corridor, and was initially observed as Brief site 130 in initial reconnaissance. This scrub falls into the category of Endangered "semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions", as defined in the EPBC Act Protected Matters Report.

Detailed site 14

This site at Marble Creek is connected to Short site 13, and was observed to have softwood scrub in good condition, in a gallery along the creek banks on Lot 28 DS37. The scrub along this creek was in good condition and was diverse in species composition. Vegetation away from the creek had been cleared.

Short sites 16a, 16b and 17

In the Horrigan Creek (Short sites 16a and 16b) and Raglan Creek (Short site 17) area, RE mapping identifies extensive areas of Of Concern mangroves, observed to be dominated by Blind Your Eyes Mangrove (*Excoecaria agallocha)* and Grey Mangrove (*Avicennia marina)*. A large area of mangroves in good condition was observed on Raglan Creek at Site 17, in conformance with representation on mapping as Not Of Concern RE 11.1.4. An adjacent unmapped, disturbed area of Narrow-leafed Ironbark (*Eucalyptus crebra)* was observed to be in poor condition due to heavy recreational use and dumping.

Detailed site 18a

The southern end of a large remnant of Narrow-leafed Ironbark (*Eucalyptus crebra*) on Lot 36 DT40169 was observed to be in good condition and was less than 100 m north of an unmapped wetland, which had waterbirds on it at the time of survey. A dam was constructed on the wetland, but much of the wetland appeared to be in good condition.

Short site 18b

The dominant species observed at a road reserve on Reedy Creek Road was Poplar Box (*Eucalyptus populnea*), and the forest structure was narrow but intact.

Brief sites 19 and 21

Regrowth areas of diverse scrub-related species were observed on the northeastern side of the Toonda Port Alma Road, as part of a former understorey of cleared Ironbark (*Eucalyptus crebra*) on Lot 101 DS185 and Lot 102 DS185. This regrowth Rarely exceeded 2 m in height and was not considered remnant. There is the possibility that the Threatened species, listed as occurring in the project area, occur in this area of regeneration. This area has been cleared, and is not regarded as having significant ecological value, because the regrowth consists mainly of suckers less than 1 m in height. If allowed to regenerate, however, it might be found to contain one or more of the listed Threatened species. Further investigation of this area is not practicable until the ROW is finalised.

Approximately 1 km south of Brief sites 19 and 21

Scattered mature gums (generally Blue Gum *(Eucalyptus tereticornis)*) were observed approximately 1 km south of the area of scrub regrowth (mentioned above) on Lot 8 DS185.

Short site 20

A patch of advanced regrowth with some scattered original trees on Lot 162 DS61 was observed to be predominantly Narrow-leafed Ironbark (*Eucalyptus crebra)* with some Grey Box (*Eucalyptus moluccana*), with an understorey of Brigalow *(Acacia* spp*)*. The general structure of this regrowth was of insufficient height and cover to be considered as remnant vegetation, but it was approaching remnant status.

Short site 21 and Detailed sites 22a and 22b

A general change in this area to Grey Box (*Eucalyptus moluccana*), which continued eastward, was observed at Short site 21 and Detailed site 22b, both adjacent to Darts Creek Road. Narrow-leafed Ironbark (*Eucalyptus crebra*) tended to occur on hills and rises, and was observed at Detailed site 22a. Blue Gum (*Eucalyptus tereticornis)* was also present in lower lying areas, as represented on mapping as Of Concern RE 11.3.4.. This area generally had remnant vegetation in good condition because of its intact structure and general lack of weed infestation. The area on the eastern side of Darts Creek Road (Detailed sites 22a and 22b) was in the best condition.

Detailed site 23

Remnant Grey Box (*Eucalyptus moluccana*) forest in good condition was observed on Lot 114 DS256 and Lot 6 RP214228. Refer to Detailed site 24 and Short site 26 for sampling of other areas of this Gum Topped Box (*Eucalyptus moluccana)* forest.

Detailed site 24

A large lagoon (Horseshoe Lagoon) was observed northwest of Mt Larcom, 300 m north of the Bruce Highway (outside the proposed corridor). The trees on the corridor (and within Site 24) were Grey Box (*Eucalyptus moluccana*). The site was observed to be disturbed on either side due to a power line easement and a railway line. The dominant trees around the nearby undisturbed lagoon were large Blue Gum (*Eucalyptus tereticornis*).

Short site 25

A grassland area of several hectares, observed adjacent to Popenia Road, may possibly be natural grassland rather than cleared forest. The western side of this grassland was cleared, and has no remnant grassland value, regardless of the authenticity of the main body of grassland to the east.

Short site 26

Gum Topped Box (*Eucalyptus moluccana*) forest was observed on the north side of Popenia Road. Partial clearing has fragmented the canopy of this community.

Short site 27

Grey Box (*Eucalyptus moluccana)* forest was observed north of Mt Larcom near Brief sites 52 to 54, which were observed as remnant (south of the corridor). To the north of this remnant, communities were predominantly disturbed and/or regrowth. Due to restricted access, this site was observed at the property boundary of Lot 20 DT40124, from the northeast corner of the showground.

Short sites 28a and 28b

These areas extend from Mt Larcom to the east for several kilometres (to Aldoga). RE mapping indicated that remnants on these sites were Grey Box *(Eucalyptus moluccana)* (RE 11.3.26) and Blue Gum (*Eucalyptus tereticornis)* (RE 11.3.4), with some Narrow-leafed Ironbark (*Eucalyptus crebra)* (RE 11.11.15) further east. This occurrence of Grey Box *(Eucalyptus moluccana)* forest was confirmed from off-site using binoculars.

Short sites 29a and 29b

Short sites 29a and 29b confirmed RE mapping of Not Of Concern Grey Box *(Eucalyptus moluccana),* which was in good condition. Note that access permission for this site was not granted, and it was not visible from off-site.

Short Site 29c

Note that access permission for this site was not granted, and it was not visible from off-site.

Short sites 30a and 30b

Larcom Creek was sampled at Short sites 30a and Short site 30b. Note that access permission for site 30a was not granted, and aerial photo interpretation was necessary. At both sites, riverine forest was observed along the creek, confirming the continuity of the community

Short Site 30c

Note that access permission for this site was not granted, and it was not visible from off-site.

Short Sites 31a and 31b

Note that access permission for these sites was not granted, and they were not visible from off-site

Short Site 31c

The edge of the remnant of Site 31c was viewed remotely (approximately 200m with binoculars from fenceline). Short site 31c confirmed that the remnant vegetation in this area was greater in extent than represented by the RE mapping (EPA 2005). The mapped remnant of RE 11.3.4 (Blue Gum (*Eucalyptus tereticornis*) was surrounded by patchy Narrow-leafed Ironbark (*Eucalyptus crebra*) in good condition. It is possible that the RE mapping needs to be revised in this area to account for Narrow-leafed Ironbark (*Eucalyptus crebra*) (most likely RE 11.11.15).

Detailed sites 32, 33 and 34

A large remnant was observed over these three sites, which confirmed that the RE mapping was correct, with predominantly Narrow-leafed Ironbark (*Eucalyptus crebra)* at Site 32 (as Not Of Concern RE 11.11.15), Spotted Gum (*Corymbia citriodora)* at Site 33 (as Not Of Concern RE 11.11.4) and Grey Box (*Eucalyptus moluccana)* at Site 34 (as Of Concern RE 11.2.26).

Short site 35

Vegetation on this site was observed from directly off-site due to restricted access. The RE mapping for the area shows a mosaic of pre-clearing REs. Observations confirmed that only Narrow-leafed Ironbark (*Eucalyptus crebra)* (Not Of Concern RE 11.11.4) occurred at the site (in addition to Spotted Gum (*Corymbia citriodora*)). The mapped Endangered RE was not present at the site, and therefore the only RE observed was Not Of Concern. Access was restricted, so the site data was recorded from off-site observation from a pipeline access track, supported by large-scale (1:10,000) aerial photograph interpretation.

Detailed sites 36 and 37a, and Short sites 37b and 38

Remnant fragments were observed on these sites, and were in poor condition due to structural disturbance and fragmentation. All vegetation represented by these sites was Not Of Concern, with the exception of Short site 37b, which was a very small and un-mappable patch of softwood scrub species, with no remnant structure that can therefore not be classified as Endangered as RE mapping represents. No Threatened Species were found on this site.

Detailed site 39a and Short site 39b

A large area of remnant vegetation was observed East of Yarwun. These sites confirmed that Of Concern RE 12.11.14 and Not Of Concern RE 12.11.6 (respectively) were correctly mapped (the change to REs starting with 12 indicates the Southeast Queensland bioregion, rather than the Brigalow Belt South bioregion). These communities were dominated by Narrow-leafed Ironbark (*Eucalyptus crebra)* and Spotted Gum (*Corymbia citriodora)* respectively. *Macrozamia* sp. were seen in the understorey in places (Brief site 134), but not along the proposed corridor itself.

Short site 40

Endangered RE 12.3.3 composed of riverine Blue Gum (*Eucalyptus tereticornis),* and rainforest on Boat Creek were observed at Short site 40.

6.6.3 Rare and Threatened Species

6.6.3.1 Database Searches

Results of the searches of Wildlife Online (EPA 2007a) and the EPBC Act Protected Matters Report (DEWHA, 2007) are shown combined in Table 6.3.

Table 6.3 Wildlife Online and EPBC Protected Matters Report

Species records, with reported species from the EPBC Act Protected Matters Report that did not occur on the Wildlife Online List at bottom of table	NC Act*	Wildlife Online records*	*EPBC Act**	*EPBC Act* Protected Matters Report (smaller defined area)*
Acacia pubicosta	R	1	.	
Acacia storyi	R	2	.	
Actephila sessilifolia	R	9	.	
Alyxia magnifolia	R	9	.	
Asplenium pellucidum	V	2	V	
Atalaya calcicola	R	6	.	
Atalaya collina	E	3	E	Reported
Atalaya rigida	R	18	.	
Callicarpa thozetii	R	1	.	
Choricarpia subargentea	R	3	.	
Cossinia australiana	E	4	E	
Cupaniopsis shirleyana	V	10	V	Reported
Cycas megacarpa	E	25	E	
Cycas ophiolitica	E	14	E	Reported

Species records, with reported species from the EPBC Act Protected Matters Report that did not occur on the Wildlife Online List at bottom of table	NC Act*	Wildlife Online records*	*EPBC Act**	*EPBC Act* Protected Matters Report (smaller defined area)*
Dansiea elliptica	R	10	.	
Decaspermum struckoilicum	E	10	.	
Denhamia parvifolia	V	1	V	
Eucalyptus raveretiana	V	2	V	Reported
Graptophyllum excelsum	R	15	.	
Hakea trineura	V	1	V	
Hernandia bivalvis	R	18	.	
Livistona drudei	V	2	.	
Macropteranthes fitzalanii	R	4	.	
Macropteranthes leiocaulis	R	13	.	
Marsdenia brevifolia	V	1	V	
Parsonsia larcomensis	V	4	V	Reported
Parsonsia lenticellata	R	12	.	
Philotheca acrolopha	V	1	V	
Quassia bidwillii	V	2	V	Reported
Stackhousia tryonii	R	4	.	
Zieria sp. *(Mt Larcom N. Gibson TOI8)*	V	4	.	
Reported species from the EPBC Act Protected Matters Report that did not occur on the Wildlife Online List:				
Bosistoa selwynii	NAQ	0	V	Reported
Bosistoa transversa	.	0	V	Reported
Bulbophyllum globuliforme	R	0	V	Reported
Corymbia xanthope	V	0	V	Reported
Leucopogon cuspidatus	.	0	V	Reported

** CODES:*

NC Act *indicates the conservation status of each taxon under the* Nature Conservation Act 1992.
The codes are Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) and Not Protected. NAQ is not an original code used by the NC Act*; it has been added here to indicate that this taxon is not held at the Queensland Herbarium according to AVH, and therefore has no status in the* NC Act *at present.*
EPBC Act *indicates the conservation status of each taxon under the* Environment Protection and Biodiversity Conservation Act 1999.
The codes are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct In The Wild (XW) and Vulnerable (V).
Wildlife Online Records *indicates the number of records of the species contained within the database for the area searched.*
Reported by the EPBC Act Protected Matters Report means that this particular species is mapped as occurring within the smaller defined area of the EPBC Act Protected Matters Report search area, in addition to Wildlife Online records.

A search of the Wildlife Online database (EPA 2007a) for Rare and Threatened species listed in the NC Act returned a list of 31 plant species, shown in Table 6.3. The original extract is shown in Appendix E2, and is represented in two halves (west and east) due to limitations in longitudinal range of the database search. It should be noted that the search area specified needs to be a rectangle, and the number of different species is highly likely to be over-represented (i.e. some are not likely to be present in the project area). A total of five species were listed as Endangered, 11 species as Vulnerable, and 15 as Rare (as shown in Table 6.3).

An EPBC Act Protected Matters Report (DEWHA 2007) was generated from a similar search, but with a more narrowly defined search area (search area and results from original extract are shown in Appendix E2) and reported a list of eleven plant species and their conservation status (nine Vulnerable and two Endangered, as shown in Table 6.3). Five species were reported that did not occur on the Wildlife Online list, indicating that these species are expected to occur, but have not been recorded in the search area. For these species, refer to the last five entries in Table 6.3.

6.6.3.2 Investigation Results

No targeted Rare or Threatened plant species were observed during surveys in either section of the corridor. However, one non-target species was observed, although it was a sterile specimen and absolute confirmation of identification was not possible. This was a Vulnerable species (listed under the EPBC Act and the NC Act), and was one individual of (probably) Ooline (*Cadellia pentastylis*) found at Detailed Site 14 (Marble Creek). This constitutes an EPBC Act referral trigger.

Almost all of the species listed as Endangered or Vulnerable under the NC Act, and Threatened under the EPBC Act, are scrub species (i.e. species typically found in scrub). These species were assumed to be most likely to occur within remnant patches of softwood scrub or vine thicket, so targeted survey for these species was restricted to these remnant patches. Partially cleared, or regrowth, areas of scrub were also surveyed as part of the vegetation survey. None of the listed scrub species were found during the surveys. If they were present, they are nevertheless protected by virtue of their habitat (*viz.* scrub), which is protected under the NC Act and EPBC Act.

Black Ironbox (*Eucalyptus raveretiana*) was listed in both databases as Vulnerable (see Table 6.3) and is known to occur in riverine areas that are likely to be intersected by the corridor (see Table 6.4, and Appendix E2 for original Wildlife Online extract). It was not found during the survey, despite being specifically searched for at each of the creek crossings.

Corymbia xanthope is listed under the EPBC Act as Vulnerable (see Table 6.10 Summary of Significant Impact Criteria for Reported EPBC Threatened flora species) and is known to occur north of Rockhampton. It is considered unlikely that this species occurs in the study area, based on collection label details of this species (Botanic Gardens Trust 2004), which indicate it occurs on skeletal soils in association with *Hakea* sp. and *Triodia* sp. This type of habitat was not observed in the project area.

The two cycads *Cycas megacarpa* and *Cycas ophiolitica* were listed in both databases as Endangered, but are not reported in the EPBC Act Protected Matters Report for the project area. They are known to occur in the project area (see Table 6.4, and Appendix E2 for original Wildlife Online extract) and are likely to be in forested areas intersected by the corridor. However, neither of these species was observed during field assessments. It is possible that a young *Cycas* sp. without a trunk may be confused with *Macrozamia sp.*, but nothing that looked like either genus was seen within the corridor (except, at a distance, for the marginally similar *Xanthorrhoea johnsonii*).

The overall findings of survey were also generally in accordance with those of previous survey work in the same general area by HLA Envirosciences (2006). A notable difference is that the two Threatened species found by HLA Envirosciences survey (*Macrozamia serpentina* and Black Ironbox (*Eucalyptus raveretiana*)) were not found in the corridor, but occur in the broader study area used in the HLA survey.

6.6.3.3 Threatened Species and Likelihood of Occurrence

Mt Morgan Myrtle (*Decaspermum struckoilicum*) was listed as Endangered in Wildlife Online, but it occurs in the Mt Morgan area only (AVH search, Centre for Plant Biodiversity Research, Council of Heads of Australian Herbaria (2007) and Harden *et al.* (2006)), and is considered unlikely to occur within the proposed corridor. Struck Oil is the name of the locality where this species was found.

There are many species listed in Wildlife Online as Vulnerable or Rare that are known to occur in the project area or surrounds, most of which were not reported by the EPBC Act Protected Matters Report. These include a variety of species that occur in a variety of habitats. These species are listed in Table 6.4, with their likely habitat or area and likelihood of occurrence within the corridor.

Table 6.4 Threatened Species and Likelihood of Occurrence

Species records, with unrecorded species from *EPBC Act* Protected Matters Report at bottom of list	**Likely habitat or area (rows in this table with scrub species are shaded)**	**Likelihood of occurrence of habitat**
Acacia pubicosta	Mt Morgan area	Low
Acacia storyi	Sandstone plateaux	Low
Actephila sessilifolia	Scrub	Fair*
Alyxia magnifolia	Scrub	Fair*
Asplenium pellucidum	Rainforest	Low
Atalaya calcicola	Scrub	Fair*
Atalaya collina	Scrub	Fair*
Atalaya rigida	Scrub	Fair*
Callicarpa thozetii	Rainforest	Low
Choricarpia subargentea	Scrub	Fair*
Cossinia australiana	Scrub	Fair*
Cupaniopsis shirleyana	Scrub	Fair*
Cycas megacarpa	Coastal ranges	Fair
Cycas ophiolitica	Coastal ranges	Fair
Dansiea elliptica	Scrub	Fair*
Decaspermum struckoilicum	Scrub - Mt Morgan area	Fair*
Denhamia parvifolia	Scrub	Fair*
Eucalyptus raveretiana	Riverine	Fair
Graptophyllum excelsum	Scrub	Fair*
Hakea trineura	Well-drained soils	Low
Hernandia bivalvis	Scrub	Fair*
Livistona drudei	Stream banks on coastal plains	Low
Macropteranthes fitzalanii	Scrub	Fair*
Macropteranthes leiocaulis	Scrub	Fair*
Marsdenia brevifolia	Scrub	Fair*
Parsonsia larcomensis	Scrub	Fair*
Parsonsia lenticellata	Scrub	Fair*
Philotheca acrolopha	Heath	Low
Quassia bidwillii	Scrub	Fair*

Species records, with unrecorded species from *EPBC Act* Protected Matters Report at bottom of list	Likely habitat or area (rows in this table with scrub species are shaded)	Likelihood of occurrence of habitat
Stackhousia tryonii	Serpentinite	Low
Zieria sp. *(Mt Larcom N. Gibson TOI8)*	Scrub	Fair*
Bosistoa selwynii	Scrub	Fair*
Bosistoa transversa	Scrub	Fair*
Bulbophyllum globuliforme	Rainforest	Low
Corymbia xanthope	Skeletal soils	Low
Leucopogon cuspidatus	Heath	Low

Likelihood of occurrence of habitat **only within remaining scrub remnants.*

6.6.4 *EPBC Act* Referral Triggers Identified from Existing Information

Several EPBC Act referral triggers were identified from preliminary data. Those triggers, based on likelihood of occurrence from habitat and distribution data, were:

- The presence of "semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions" (referred to as *scrub* in this chapter), as defined in the EPBC Act Protected Matters Report as Threatened Ecological Communities. A small, unmapped patch of this scrub was observed on the Malchi Nine Mile Road at Brief site 177 (see Short site 4, in Section 6.5.2.2), and is an EPBC Act referral trigger. Also, there is the possible presence of Whitewood (*Atalaya collina,* Endangered under the EPBC Act) in this scrub. This scrub remnant may also contain the EPBC Act-listed scrub species *Quassia bidwillii,* Cossinia *(Cossinia australiana), Cupaniopsis shirleyana* and *Denhamia parvifolia*
- Whitewood *(Atalaya collina*, Endangered under the EPBC Act) could occur in the patch of scrub at Brief site 30 on the Twelve Mile Creek Road, which is closer to Yarwun. Brief site 30 is approximately 200 m to the northeast of the corridor, so a search for this species was made for at least 2 km either side of that patch along the corridor in likely areas of habitat. A simultaneous search was made for the EPBC Act-listed scrub species *Quassia bidwillii,* Cossinia *(Cossinia Australiana), Cupaniopsis shirleyana* and *Denhamia parvifolia*
- The forest communities east of Yarwun, (sampled by Detailed site 39a, Short site 39b, and Brief sites 133 to 136) dominated by Spotted Gum (*Corymbia citriodora) and* Narrow-leafed Ironbark (*Eucalyptus crebra)*, had *Macrozamia* sp. in the understorey in places. As mentioned previously, young Endangered cycads *Cycas megacarpa* or *C. ophiolitica* (i.e. without trunks) could appear to be *Macrozamia* spp. *Cycas megacarpa* or *C. ophiolitica* are Endangered under the EPBC Act and this is a referral trigger
- Riverine crossings along the corridor may possibly have Black Ironbox *(Eucalyptus raveretiana)* in places, which is listed as Vulnerable under the EPBC Act, and is a referral trigger. All river crossings within the ROW (approximately 12 crossings from the extraction point to Yarwun) were inspected for this species where access was granted. This species was not observed in the ROW, but could possibly occur within the corridor.

6.6.5 Biodiversity Planning Assessment Mapping

Biodiversity Planning Assessment (BPA) (EPA 2005c) mapping was used to identify significant areas of biodiversity. These areas are summarised in Table 6.5. BPA mapping is prepared by the EPA using the Biodiversity Assessment Mapping Methodology (BAMM). BAMM provides a consistent approach for assessing biodiversity values at the landscape scale in Queensland using vegetation mapping data generated or approved by the Queensland Herbarium as a fundamental basis.

Table 6.5 Biodiversity Planning Assessment Mapping Summary

Area/Location	Level of significance	Description of criteria*	Sample site if applicable
Gracemere	State	Significant wetland (criteria B1)	2
Area near Bajool	State	Significant wetland (criteria B1)	9a
	Regional	Remnant contains at least one Of Concern RE (criteria B1) Remnant contains Special Biodiversity Values (criteria I). *Note: this criterion is not based on the RE mapping (on Inkerman Creek near Bajool) – instead, it is a condensed area of about 100 ha approximately 2.5 km northwest of Inkerman Creek, along the corridor.* Special Biodiversity Values (criteria I) relate to Yellow Chat habitat	Refer to Chapter 7, Terrestrial Fauna, and discussion on Yellow Chat habitat
	Local	Wetland	
Raglan Creek	State	Significant Wetland (criteria B1)	17
	Regional	Contains at least one RE with < 10% extent remaining or naturally Rare in the sub-region (criteria B2)	
	Local	Remnant contains Special Biodiversity Values (criteria I): Wetland	
Darts Creek area	Regional	Remnant contains at least one RE with 10-30% extent remaining (criteria B2) and remnant is part of a Tract that is one of the largest of its type in the bioregion (criteria C)	22 (a, b)
DIP land southeast of Mt Larcom: 1st remnant south of the highway (proposed flora site 28)	Regional	Remnant contains at least one RE with 10–30% extent remaining (criteria B2) and remnant is part of moderately large tract (criteria C) and vegetation condition is natural (criteria E)	28 (a, b)
DIP land southeast of Mt Larcom: remnant near Larcom Creek (proposed flora site 29)	Regional	Remnant contains at least one Of Concern RE (criteria B1) (in this case 11.3.4)	29 (a, b)
DIP land southeast of Mt Larcom: finger of remnant poking out to the west of main remnant (proposed flora site 31)	Regional	Remnant contains at least one RE with 10–30% extent remaining (criteria B2) and remnant is part of a tract that is one of the largest of its type in the bioregion (criteria C)	31 (a, b, c)
Central Queensland Ports land: near the entrance to the Comalco property (flora sites 32, 33, 34)	Local and or Other Values	Remnant contains Core Habitat for Priority Taxa (criteria H) *Diagnostic data* for additional information,: Non-core habitat for EVR species	32, 33, 34
Rio Tinto land: end of existing overland pipeline (flora site 35)	State	Remnant contains at least one Endangered RE (criteria B1), remnant contains Core Habitat for Priority Taxa (criteria H)	35
Central Queensland Ports land: near the quarry (flora site 38)	Regional	Remnant is part of a tract that is one of the largest of its type in the bioregion (criteria C) and vegetation condition is natural (criteria E) and remnant has Ecosystem diversity in the top quartile (criteria F), remnant contains Core Habitat for Priority Taxa (criteria H) (note that these remnants come in from the north)	38

Area/Location	Level of significance	Description of criteria*	Sample site if applicable
Yarwun area near the crossroads: (westernmost end of remnant)	Local and/or Other Values, and State	Remnant forms part of a bioregional corridor (criteria J)	39a
Yarwun area: (higher part of remnant)	Regional	Contains at least one Of Concern RE (criteria B1)	39a
	State	Remnant forms part of a bioregional corridor (criteria J)	
Yarwun area (easternmost end of remnant)	Local and or Other Values	Remnant contains Core Habitat for Priority Taxa (criteria H)	39a

** BPA Criteria are environmental values that are used internally by EPA for planning purposes. They are explained in Appendix E2.*

The summary of BPA (EPA 2005c) mapping in Table 6.5 is consistent with field observations. Each sample site was located within areas of remnant vegetation identified as homogenous by the BPA.

The consistent values within the Description of Criteria (as outlined in the BPA) for the study area were:

- Wetland
- Significant RE (Of Concern or Endangered present, or RE is poorly represented in the sub-region[3])
- Large tract of vegetation
- Bioregional corridor
- Core Habitat for Priority Taxa.

Note that Core Habitat for Priority Taxa in Table 6.5, that were listed for land belonging to Gladstone Ports Corporation (formerly Central Queensland Ports Authority) and Rio Tinto (as sampled by Sites 32, 33, 34, 35, 38) were scrub species as part of softwood scrub REs (in this case RE 11.11.5 and RE 11.11.18) which were not present within the ROW or the corridor. This is an artefact of the RE mapping, where large pre-clearing vegetation polygons are a mosaic of different REs, and in this case the scrub REs are present elsewhere within other remnant polygons.

The Raglan Creek area, represented by Site 17, had Special Biodiversity Values (Table 6.5), and these relate to wildlife habitat.

The Yarwun area (easternmost end of remnant) represented by Site 39a, has Core Habitat for Priority Taxa (see Table 6.5). This refers to the tree cycads, which may be present in the area (*Cycas megacarpa* and *C. ophiolitica*).

6.6.6 Crops

A variety of crops, particularly annuals, were observed on the "black soil" in the Gracemere area. This land is Vulnerable to weed infestation particularly by Parthenium and Fireweed. Land east and south of Gracemere, as far south as Darts Creek, was predominantly used for grazing. Land south of Darts Creek was hillier and more heavily forested. The cleared areas were used mainly for grazing. There was no intensive forestry industry in the immediate area (except plantation areas southeast of Mt Larcom), and much of the forested areas were observed to be used for residential acreage lots and hobby farms. There was some horticultural activity (e.g. avocadoes southeast of Mt Larcom) but this was not within the corridor.

6.6.7 Weeds

Significant weeds known to occur within the project area and their impacts and management issues are listed in Table 6.6. These are not the only weeds likely to be present in the project area.

3 A sub-region is a subset of a bioregion.

Table 6.6 Significant Weeds within the Project Area

Common name	Botanical name	Declared class*	Problems caused	Distribution and likelihood of occurrence
Parthenium	Parthenium hysterophorus	2	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery	Northern areas on black soil. Heavy infestations around Gracemere
Giant Rats-tail Grass	*Sporobolus* spp. including *S. pyramidalis, S. jacquemontii, S. fertilis*	2	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery	South of Mt Larcom, especially Larcom Creek. Heavy infestations around Larcom Creek
Rubber Vine	Cryptostegia grandiflorus	3	Restricts access. Generally spread by wind	Widespread along corridor, especially in riverine areas and near Brigalow. Bad infestations in the Darts Creek area
Fireweed	Senecio madagascariensis	2	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery	Northern areas on black soil. Heavy infestations around Gracemere
Harrisia	*Harrisia* spp.	2	Injures stock. Mainly spread by fragments	Widespread along corridor, especially in riverine areas and near Brigalow
Prickly Pear	*Opuntia* spp. other than *O. ficus-indica*	2	Restricts access. Mainly spread by fragments	Widespread along corridor, especially in riverine areas and near Brigalow
Mother of Millions	*Bryophyllum* spp.	2	Toxic to stock. Mainly spread by fragments.	Widespread along corridor, often on poorer soils, and often with Grey Box forest
Lantana	Lantana camara	3	Restricts access. Mainly spread by birds	Widespread along corridor, but particularly in forested areas and in riverine areas. Bad infestations in the Darts Creek area
Leucaena	Leucaena leucocephala	n/a	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery. Restricts access	More common in northern areas on black soil. Some infestations around Gracemere

**Declared Pest Plant listed in the* Land Protection (Pest and Stock Route Management) Act 2002*:*
Class 3 plants only need to be controlled if adjacent to an environmentally significant area.

All significant weeds (as listed in Table 6.6), except one, known to occur within the project area, are Declared Pest Plants as listed in the *Land Protection Act.*

Severe weed infestations were not generally observed on the corridor, although Rubber Vine (*Cryptostegia grandiflora*) was observed to be widespread, particularly from Bajool to Ambrose. Fireweed (*Senecio madagascariensis*) was dense and widespread at the time of the second survey in August/September 2007, in the "black soil" country around Gracemere. Parthenium (*Parthenium hysterophorus*) was observed occasionally around the northern end of the corridor. Giant Rats-tail Grass (a number of *Sporobolus* spp.) occurred in particularly large and dense infestations in low-lying areas around Larcom Creek.

Leucaena (*Leucaena leucocephala*) is grown as a crop in the Gracemere area, and small weed occurrences were occasionally seen in that area, including roadsides. Although not a Declared Pest Plant, Leucaena could pose a threat to wetlands in the area, because of the level of disturbance associated with water bodies (Walton 2003). In its early growth stage Leucaena has a general resemblance to two or more native species frequently encountered in wetlands (*viz.* Budda Pea *(Aeschynomene indica)* and Sesbania *(Sesbania cannabina)*) hence assessment of infestation, and planning for control measures, need to be done with appropriate care.

6.6.8 Summary of Ecological Values

The following key vegetation and floristic features of the corridor are those that are of ecological concern due to conservation status under State or Commonwealth legislation, or other value. All sample sites were located on, or as close as possible, to the ROW (generally 30 m width).

6.6.8.1 Fitzroy to Bajool

A wetland of good condition was observed on Lot 105 LN176 (see Figure 6.1, detailed site 2). The wetland was inundated at the time of survey, with waterbirds present, and limited weed infestation. An area of mapped wetland also occurred on Lot 102 LN176.

6.6.8.2 Bajool to Gladstone

- A 200 m stretch of low-growing Brigalow (*Acacia harpophylla*) with extensive gilgai (small waterholes) on the south side of Inkerman Creek on Lot 68 DS141 (refer to Detailed site 9c)
- An advanced regrowth patch of Brigalow (*Acacia harpophylla*) approximately 100 m west of the road (on Lot 69 DS141) may be intersected by the corridor but is likely to be outside of the ROW by approximately 80 m (refer to Brief site 9b)
- A remnant of mostly low Brigalow (*Acacia harpophylla)* (probably regrowth) and some Belah (*Casuarina cristata*) off the Toonda Port Alma Road, on Lot 98 DS186 and Lot 99 DS186 (refer to Detailed sites 10a and 10b, and Short site 10c)
- Marble Creek had softwood scrub in good condition, with diverse species composition, in a gallery along the creek banks on Lot 28 DS37 (refer to Detailed site 14). There was one individual found here, identified as probably Ooline (*Cadellia pentastylis*). As a Vulnerable species (listed under the EPBC Act and the NC Act), this constitutes an EPBC Act referral trigger
- Extensive areas of mangroves occur at Horrigan Creek (refer to Short sites 16a and 16b) and Raglan Creek (refer to Short site 17)
- Land extending from Mt Larcom to the east for an extensive distance (to Aldoga) had restricted access. It is possible that the RE mapping needs to be revised in this area to account for unmapped Narrow-leafed Ironbark (*Eucalyptus crebra)* (most likely RE 11.11.15) (refer to proposed Detailed site 31)
- Riverine Blue Gum (*Eucalyptus tereticornis)* and rainforest on Boat Creek (refer to Short site 40)
- Individual tree cycads (*Cycas megacarpa* and *C. ophiolitica*) may be encountered in the coastal ranges around Yarwun (in the vicinity of Detailed site 39a).

6.7 Description of Impacts

6.7.1 Main Potential Impacting Processes

6.7.1.1 Main Potential Impacting Processes

The main potential impacting processes to terrestrial flora associated with the clearing of the (generally) 30 m wide ROW and construction of the pipeline are:

- Clearing of vegetation remnants
- Reduction of flora species habitat
- Removal of individual species of significance
- Reduction of wildlife corridor functionality
- Remnant vegetation edge effects
- Riparian vegetation disturbance
- Weed introduction.

6.7.1.2 Activities Causing Impacts

The activities which may cause the impacts listed in Section 6.6.1.1 are:

- Felling of individual trees
- Clear-felling of stands of trees, and increasing edge effects such as wind and weed penetration
- Bulldozing of shrubby areas
- Trenching across ephemeral wetlands and creeks, specifically including clearing either side of the trench
- Digging pits on either side of wet creeks for entry and exit of underground boring
- Possible accidental introduction of weeds to a site.

6.7.2 Remnant Vegetation Communities

6.7.2.1 Fitzroy to Bajool

The potential impacts on vegetation remnants along the corridor are listed in Table 6.7.

6.7.2.2 Bajool to Gladstone

With reference to the site numbers in Section 6.6.2.3, the impacts on vegetation remnants along the corridor are listed in Table 6.8.

Table 6.7 Impacts on Vegetation Remnants Along the Corridor (Fitzroy to Bajool section)

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Impact prior to mitigation (not residual impact)
1	Extraction point on the Fitzroy River	Removal of several trees on bank
Brief 160, 161 and 163	Northwest of Rockhampton: Rockhampton Ridgelands Road and Alton Downs Nine Mile Road	Clearing of trees on two road reserves
2	Wetland past the end of Tyrrell Road	Trenching across part of the wetland is likely to cause temporary loss of aquatic plants, and possibly turbidity
3a	Very open woodland near the T-junction of Malchi Nine Mile Road and Fairy Bower Road	Possible removal of several trees
Short 4	Softwood scrub close to the corridor on Malchi Nine Mile Road	Partial clearing of scrub would only occur if the ROW were extended across existing road. If the corridor is located on the other side of the road, and this is the current intention, then no scrub will need to be cleared
Brief 185	Unmapped areas of mostly cleared riverine rainforest on Fairy Bower Road	Possible removal of several trees
5	Small wetland north of Fairy Bower Road off Fogarty Road	Trenching across part of the wetland would cause temporary loss of aquatic plants, and possibly turbidity
Brief 191 and 192	Other wetlands in the Fairy Bower area, just south of the Capricorn Highway	Trenching across part of the wetland, is likely to cause temporary loss of aquatic plants, and possibly turbidity
6a	Gavial Creek	Trenching may involve clearing of some riverine vegetation, mostly trees (Blue Gum (*Eucalyptus tereticornis)* and River Oak *(Casuarina cunninghamiana*))
Short 6b	Road reserve near the intersection of Roope Road and River Road	Possible removal of several trees
Short 6c and 6d	Road reserves of Georges Road and Casuarina Road	Clearing of trees on two road reserves
Brief 10, 11 and 12	Very open woodlands of Poplar Box *Eucalyptus populnea* may be intersected north of Bajool	Possible removal of several trees
Short 7, 8a and 8b (all upstream)	Bob's Creek, Station Creek and Oakey Creek	Trenching may involve clearing of some riverine vegetation, mostly trees (Blue Gum (*Eucalyptus tereticornis)* and River Oak *(Casuarina cunninghamiana*))

Table 6.8 Impacts on Vegetation Remnants Along the Corridor (Bajool to Gladstone section)

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Impact prior to mitigation (not residual impact)
Short 9a	Inkerman Creek	Micro-tunnelling will be undertaken at this site due to clay substrate, tidal drainage and presence of mangrove species. Some vegetation may need to be removed at tunnel entry and exit points, but most or all mangroves will be retained
Short 9b	Brigalow approximately 100 m west of the Toonda Port Alma Road	Pipeline and ROW will not interfere with remnant, but associated construction activities could damage remnant
9c	Low-growing Brigalow on the south side of Inkerman Creek	Complete clearing of vegetation within area needed for pipeline and ROW
Short 10a, 10b, and 10c	Brigalow-belah off the Toonda Port Alma Road, on Lot 98 DS186 and Lot 99 DS186	Pipeline and ROW will probably require clearing at southern end of remnant (mostly low regrowth and Rubber Vine), but associated construction activities could damage remnant
Brief 19 and 21	Regrowth areas of diverse scrub-related species on Lot 101 DS185 and Lot 102 DS185	Complete clearing of vegetation within area needed for pipeline and right-of-way.
Approx. 1 km south of Brief 19 and 21	Scattered mature gums south of the area of scrub regrowth (mentioned above) on Lot 8 DS185	Possible removal of several trees
11b	Eucalypt regeneration area along a marine drainage north of the Twelve Mile Road	Possible removal of several mature trees, and removal of a number of planted juvenile trees in regeneration area
Short 11c	Twelve Mile Creek	Open trenching at this crossing may require the removal of several trees
12	Road reserve on Twelve Mile Road	Possible removal of several trees
13 (Short)	Patch of remnant softwood scrub in good condition on the same road, but adjacent to the corridor	Pipeline and ROW will not interfere with remnant, but associated construction activities could damage remnant
14	Marble Creek	Open trenching at this crossing may require the removal of several trees. (Note: crossing point will be limited to gap in remnant vegetation. This point has been surveyed and no Rare or Threatened species were encountered). Significant vegetation occurs in adjacent areas
Short 16a, 16b and 17	Raglan and Horrigan Creeks	Micro-tunnelling will be undertaken at this site due to clay substrate, tidal drainage and presence of mangrove species. Some vegetation may need to be removed at tunnel entry and exit points, but most or all mangroves will be retained
18a	Corridor runs between southern end of large remnant of Narrow-leafed Ironbark on Lot 36 DT40169, and northern end of wetland	Possible removal of several trees from edge of remnant
Short 18b	Road reserve on Reedy Creek Road	Clearing of trees on road reserve
Short 20	Advanced regrowth with some scattered original trees on Lot 162DS61	Complete clearing of vegetation within area needed for pipeline and ROW
Short 21, Detailed 22a and 22b	Remnant forest around Darts Creek Road	Clearing is proposed to occur at the edge of this remnant, causing further reduction and fragmentation of a large remnant. This would reduce its ecological value in terms of size. Widening of existing fence-line access track, involving complete clearing of vegetation within area needed for pipeline and ROW

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Impact prior to mitigation (not residual impact)
23	Grey Box on Lot 114 DS256 and Lot 6 RP214228	This is a new cleared easement, so the initial damage to an otherwise large intact vegetation remnant is noteworthy. Complete clearing of vegetation within area needed for pipeline and ROW
24	Horseshoe Lagoon	Only affected if corridor follows this optional route, and only then if adjoining forest is cleared, thus reducing buffer and possibly introducing weeds
Short 25	Cleared extension of what could possibly be a natural grassland	No clearing needed, but weeds could be introduced from earthworks
Short 27	Grey Box regrowth northeast of the showground at Mt Larcom	Complete clearing of vegetation within area needed for pipeline and ROW
Short 28a and 28b	Two Grey Box remnants between Mt Larcom Gladstone Road and Larcom Creek	Possible removal of several trees or small clumps from edge of remnant
Short 29a and 28b	Large Grey Box remnant north of Larcom Creek – this one closer to the creek	Possible removal of several trees or small clumps from edge of remnant
Short 29c	Minor tributary on northern side of Larcom Creek	Possible removal of some trees (probably *Eucalyptus tereticornis* and *Casuarina cunninghamiana*)
Short 30a, 30b and 30c	Larcom Creek and minor tributaries	Open trenching at this crossing may require the removal of several trees (probably Blue Gum and River Oak)
Short 31a, 31b and 31c	Remnant Blue Gum, Ironbark and minor tributaries	Complete clearing of vegetation within area needed for pipeline and ROW. Much is already cleared for existing services
32, 33 and 34	Large intact remnant of eucalypt forest	Complete clearing of vegetation within area needed for pipeline and ROW. Much is already cleared for existing services
Short 35	Not Of Concern remnant of eucalypt forest (other parts of remnant elsewhere include Endangered RE)	Complete clearing of vegetation within area needed for pipeline and ROW. Some is already cleared for existing services
Detailed 36, 37a and 37b and Short 38	Eucalypt woodland and very small patch of scrub species northwest of quarry	Complete clearing of vegetation within area needed for pipeline and ROW. Some is already cleared for existing services. Vegetation is in poor condition and group of scrub species does not constitute a community, nor are there any Threatened species present
Detailed 39a and Short 39b	Large eucalypt remnant east of Yarwun	Complete clearing of vegetation within area needed for pipeline and ROW. Some is already cleared for existing services. It is possible that the Endangered tree cycads (*Cycas megacarpa* and/or C. *ophiolitica*) occur within the area proposed to be cleared
Short 40	Boat Creek	No proposals for crossing this creek, but removal of adjacent vegetation would remove buffer

6.7.2.3 Summary of Significant Impact Criteria for *EPBC Act* Endangered Ecological Communities

Table 6.9 lists those relevant Ecological Communities which are classified as Endangered under the EPBC Act and responses to the Significant Impact Criteria as described within the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance (May 2006).* None of the Significant Impact Criteria will be met as a result of the project, but the reduction in area of a low-growing patch of Brigalow may occur. The structural form of this patch of Brigalow does not meet the requirements for classification as remnant under the VM Act, nor the EPBC Act, which uses the structural classification of the VM Act.

6.7.3 Rare and Threatened Species

6.7.3.1 Whole of Right of Way

Endangered (under the NC Act and EPBC Act) scrub species are of greatest concern in regard to the impact of the corridor. These scrub species are most likely to occur in RE 11.11.18, as this defines lowland scrub on metamorphic sediments. Scrub in the project area is not necessarily restricted to this RE, depending on geological substrate and species assemblage. Table 6.4 shows the likelihood of occurrence of targeted Threatened species along the corridor, of which the most likely species are scrub species. Due to the species diversity within scrub remnants, it is not possible to assess the relative likelihood of impact to specific scrub species, without exact knowledge of the proposed location of the pipeline (i.e. within a few metres)[4], and extensive survey of all scrub species along that line. It is considered unlikely that adult (mature) scrub species will be disturbed in the ROW. Scrub on Marble Creek had the greatest likelihood of impact, but the crossing point was surveyed and no Rare or Threatened species were observed at that point. There are areas of scrub regrowth within the ROW that will be cleared, but these species are not advanced in growth (i.e. usually less than 1 m high), and it is unlikely that these will be of sufficient growth form to warrant avoiding.

Black Ironbox (*Eucalyptus raveretiana*) is considered unlikely to occur in riverine locations along the corridor, but it is still possible that individuals may be encountered. These individuals are therefore at risk of removal or damage if not identified before trenching, boring or clearing operations take place.

6.7.3.2 Fitzroy to Bajool

Wetlands are the ecosystems which will be most impacted along this section of the corridor. All wetlands in this area are to be trenched through, rather than bored under, because of their ephemeral nature (and size, in some cases). The wetlands impacted are identified in Table 6.7. No Threatened wetland species were identified for the project area from the EPBC Act Protected Matters Report, nor from Wildlife Online (see Table 6.3).

Scrub species could potentially be impacted along this section of the corridor. Refer to Section 6.7.3.1 for impacts to these species.

6.7.3.3 Bajool to Gladstone

Although Brigalow (*Acacia harpophylla*) regrowth may occur immediately south of Inkerman Creek, it constitutes a Threatened Ecological Community under the EPBC Act (if of sufficient structure), but the species as an individual is not listed as Threatened.

Two tree cycads (*Cycas megacarpa* and *C. ophiolitica*) are known to occur in areas that may be intersected by the proposed corridor. They are Endangered under the NC Act and EPBC Act, and could be impacted through removal and/or disturbance of vegetation.

Scrub species could potentially be impacted along this section of the corridor, through removal and/or disturbance of vegetation. Refer to Section 6.7.3.1 for impacts to these species.

[4] Note that Table 6.4 identifies the likelihood of occurrence of habitat for specific scrub species as fair, but only within remaining scrub remnants.

Table 6.9 Summary of Significant Impact Criteria for EPBC Act *Endangered Ecological Communities*

Endangered Ecological Communities		Response to Significant Impact Criteria						
		#1	#2	#3	#4	#5	#6	#7
Brigalow (*Acacia harpophylla* dominant and co-dominant)		No*	No	No	No	No	No	No
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions		No	No	No	No	No	No	No
*refer to discussion on the classification of Brigalow structure for Site 9c in Section 6.5.2.3								
Significant Impact Criteria								
Criterion 1	Reduce the extent of an ecological community							
Criterion 2	Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines							
Criterion 3	Adversely affect habitat critical to the survival of an ecological community							
Criterion 4	Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns							
Criterion 5	Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting							
Criterion 6	Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • Assisting invasive species that are harmful to the listed ecological community, to become established • Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community							
Criterion 7	Interfere with the recovery of an ecological community							

Table 6.10 Summary of Significant Impact Criteria for Reported EPBC Threatened Flora Species

Threatened Species	Status	Response to Significant Impact Criteria								
		#1	#2	#3	#4	#5	#6	#7	#8	#9
Atalaya collina	E	No	No	No	No	No	No	No	No	No
Bosistoa selwynii	V	No	No	No	No	No	No	No	No	No
Bosistoa transversa	V	No	No	No	No	No	No	No	No	No
Bulbophyllum globuliforme	V	No	No	No	No	No	No	No	No	No
Corymbia xanthope	V	No	No	No	No	No	No	No	No	No
Cupaniopsis shirleyana	V	No	No	No	No	No	No	No	No	No
Eucalyptus raveretiana	V	No	No	No	No	No	No	No	No	No
Leucopogon cuspidatus	V	No	No	No	No	No	No	No	No	No
Parsonsia larcomensis	V	No	No	No	No	No	No	No	No	No
Quassia bidwillii	V	No	No	No	No	No	No	No	No	No
Cadellia pentastylis*	V	No	No	No	No	No	No	No	No	No

Significant Impact Criteria	
Criterion 1	Lead to a long-term decrease in the size of an important population of a species
Criterion 2	Reduce the area of occupancy of an important population
Criterion 3	Fragment an existing important population into two or more populations
Criterion 4	Adversely affect habitat critical to the survival of a species
Criterion 5	Disrupt the breeding cycle of an important population
Criterion 6	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Criterion 7	Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat
Criterion 8	Introduce disease that may cause the species to decline
Criterion 9	Interfere substantially with the recovery of the species

* This species was not originally targeted, but was observed (identified as probably Ooline) during the survey.

6.7.3.4 Summary of Significant Impact Criteria for EPBC Threatened Flora Species

Table 6.10 lists those relevant flora species which are classified as Endangered or Vulnerable under the EPBC Act and responses to the Significant Impact Criteria as described within the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (May 2006). None of the Significant Impact Criteria will be met as a result of the project.

6.7.3.5 Summary of Rare and Threatened Species Impacts

It is unlikely that Rare and Threatened species will be encountered along the corridor, during removal and/or disturbance of vegetation with the possible exception of Ooline (*Cadellia pentastylis*). Table 6.10 shows that none of the Significant Impact Criteria (under the EPBC Act) will be met as a result of the project.

6.7.4 Cultural Impacts

6.7.4.1 Crops

In the Alton Downs easement there are irrigated crops on a property that is crossed by the alignment. Cropping areas around Gracemere may also be adversely impacted in the short term. Cropping will be disrupted over part of each affected property. The majority are annual crops, so cropping within the corridor should return to normal in the following season.

6.7.4.2 Recreational areas

Raglan Creek has a public access area which appears to be heavily utilised. The anticipated loss of a section of mangroves may have adverse medium-term effects on recreational use in terms of aesthetic amenity. The Fitzroy River, however, does not have a public access area in the ROW.

6.8 Mitigation and Residual Impacts

This section discusses the mitigation measures that will be implemented to minimise the potential impacts identified in Section 6.6, including aspects such as design (e.g. pipeline alignment), seeking advice on the construction method from an environmental advisor, and the use of offsets. Further mitigation measures are identified in the Planning Environmental Management Plan (EMP) in Chapter 20, Planning Environmental Management Plan. Residual impacts and the severity of impacts are also identified.

6.8.1 Assessment of Impact Severity

Table 6.11 defines the significance criteria used for assessing impacts and is specifically adapted here to assess impacts on terrestrial flora.

6.8.2 Remnant Vegetation Communities

6.8.2.1 Fitzroy to Bajool

The impacts on vegetation remnants along the corridor are listed in Table 6.12. The severity of the impact on each remnant is also listed, based on the significance criteria in Table 6.11.

Table 6.11 Significance Criteria for Residual Impacts

Significance	Criteria
Major adverse	Extensive or acute disturbance (major impact) occurring at a site of national importance, which results in the lowering of its ecological value. Also, direct or indirect adverse impact on an area (e.g. national park, Threatened Ecological Community under the EPBC Act etc.) to the extent that its designation is potentially compromised, or the populations it supports or represents are materially reduced. Adverse effects on nationally or internationally protected species endangering their conservation status (e.g. Threatened species under the EPBC Act)
High adverse	Irreversible loss or damage to a substantial part of the regional distribution, or the majority of the local distribution of a habitat type, community or population of flora (e.g. Threatened Ecological Community under the EPBC Act, Endangered RE under the VM Act etc.). Long-term disturbance effects to populations or plant species protected by national or state legislation (e.g. Threatened species under the EPBC Act or the NC Act)
Moderate adverse	Extensive or acute disturbance (major impact) to a significant site in a Local Government Authority or equivalent area, resulting in its loss or the permanent lowering of its ecological value. Limited disturbance (moderate impact) to a regional (or equivalent) site where recovery is anticipated following completion of the works concerned. Lesser effects than major adverse on nationally Rare or protected species where mitigation measures are anticipated to alleviate adverse impacts
Minor adverse	Lesser loss or disturbance than moderate adverse (moderate impact) to a locally important site. Limited or temporary effects (minor impact) on National or Regional sites. Minor impacts on protected species, effects on plant communities without special protection, or nationally scarce plant species where mitigation measures are anticipated to alleviate adverse impacts
Negligible	Any impacts on resources considered to be of negligible ecological value, or effects on species or resources of value the effects of which, when they occur, are likely to be imperceptible. For example, loss of recently created artificial habitats (e.g. landfill sites, amenity grassland, intensive farmland, verge planting). Loss of an exotic species of flora
Beneficial	Any measures that are expected to result in an improvement of the quality of ecological resources following their completion. These can, for example, include creation of new habitat features or introduction of measures that would achieve improvements in quality at an existing ecological site. Design features or management activities, which would make a long-term contribution to ecological objectives, or measures to ensure the long-term protection of Threatened species, which may not be adversely affected by the project, are also included in this category

Table 6.12 Residual Impact Severity on Vegetation Remnants Along the Corridor (Fitzroy to Bajool section)

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Mitigation (Refer to Table 6.7 for impacts prior to mitigation)	Residual impact severity
1	Extraction point on the Fitzroy River	Trees cleared from the bank with DBH* greater than 15 cm will be replaced in nearby areas within the same Lot by advanced planting stock of the same or similar species, a minimum of 1 m tall	Minor adverse
Brief 160, 161 and 163	Northwest of Rockhampton: Rockhampton Ridgelands Road and Alton Downs Nine Mile Road	Trees cleared on two road reserves with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse
2	Wetland past the end of Tyrrel Road	When trenching across part of the wetland, topsoil will be stockpiled offsite from the wetland or within the ROW (i.e. not adjacent to the ROW), and replaced after works to enable ground layer species to re-establish. Unnecessary removal of trees with DBH* greater than 15 cm will be avoided, or replaced with tube stock** adjacent to corridor. If the trench is located far enough upstream, or if construction occurs when the wetland is dry in that area, then there may be negligible impact	Minor adverse
3a	Very open woodland near the T-junction of Malchi Nine Mile Road and Fairy Bower Road	Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Mitigation (Refer to Table 6.7 for impacts prior to mitigation)	Residual impact severity
Short 4	Softwood scrub close to the corridor (to the west) on Malchi Nine Mile Road	The ROW is located on east side of the road so it does not impact on the area	Negligible
Brief 185	Unmapped areas of mostly cleared riverine rainforest on Fairy Bower Road	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming no large trees such as figs are removed
5	Small wetland north of Fairy Bower Road off Fogarty Road	Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming the ROW is not extended into wetland
Brief 191 and 192	Other wetlands in the Fairy Bower area, just south of the Capricorn Highway	When trenching across the wetland topsoil will be stockpiled and replaced after works to enable ground layer species to re-establish. Unnecessary removal of trees with DBH* greater than 15 cm will be avoided or replaced with tube stock** adjacent to corridor	Minor adverse
6a	Gavial Creek	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Minor adverse
Short 6b	Road reserve near the intersection of Roope Road and River Road	Any trees cleared on road reserve with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Negligible
Short 6c and 6d	Road reserves of Georges Road and Casuarina Road	Trees cleared on two road reserves with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse
Brief 10, 11 and 12	Very open woodlands of Eucalyptus populnea may be intersected north of Bajool	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible
Short 7, 8a and 8b (all upstream)	Bob's Creek, Station Creek and Oakey Creek	Any trees greater than 15 cm DBH* will be replaced with tube stock** in same paddock but adjacent to corridor	Minor adverse

**DBH tree trunk Diameter at Breast Height (approx. 1.3 m from ground). The outer bark is included.*
***Where tube-stock is available and suitable planting areas are available. Tube-stock are small containers chosen for cost effectiveness and their ability to rapidly catch up in growth to larger stock. They are only suitable in areas where they cannot be disturbed, i.e. by cattle trampling or weed overgrowth. They are protected by tree guards for at least the first year (normally three stakes and a plastic tube-bag).*

The impacts shown in Table 6.12 are mostly of **negligible** or **minor adverse** significance, and further mitigation measures are outlined in Chapter 20, Planning Environmental Management Plan.

6.8.2.2 Bajool to Gladstone

The impacts on vegetation remnants along the corridor are listed in Table 6.13. The severity of impact on each remnant is also listed, based on the significance criteria in Table 6.11.

Table 6.13 Residual Impact Severity on Vegetation Remnants Along the Corridor (Bajool to Gladstone section) See Figure 6-1 for Site Locations and Appendix E2- Terrestrial Flora for further detail of locations.

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
Short 9a	Inkerman Creek	Commence boring/drilling outside of mangrove vegetation zone Minimise clearing width through adjacent vegetation (Brigalow immediately south) Trees (mangroves at this location) will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor. Mangrove removal will be minimised and/or avoided as much as possible	Negligible assuming bore/ drill entry points are located away from trees
Detailed 9c	Low-growing Brigalow on the south side of Inkerman Creek	Minimise width of clearing of vegetation within area needed for pipeline and ROW. There is an existing old narrow vehicle track that will be used for the ROW if possible. Total length of clearing is approximately 200 m, so it will be possible to reduce the clearing width so that two vehicles can pass during construction. Clearing to be strictly kept to a maximum of 15 m, with boundaries clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. If EPA determines that this community is of remnant status, hence Endangered, then all Brigalow plants that are removed will be partially buried in an adjacent waterlogged area to allow suckering and consequent regrowth	Minor adverse, but could be moderate adverse if EPA determines that this community is of remnant status, hence Endangered
Short 9b	Brigalow approximately 100 m west of the Toonda Port Alma Road	Pipeline and ROW are not likely to interfere with remnant. Access will be prohibited to the edge of this remnant to minimise the impact. Boundary of Brigalow ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted	Negligible
10a, 10b and Short 10c	Brigalow-belah off the Toonda Port Alma Road, on Lot 98 DS186 and Lot 99 DS186	It is likely that the pipeline and ROW will only interfere with edge of remnant, which is mostly fragmented or infested with Rubber Vine. Any clearing at the edge of this remnant will need to be minimised. The edge of the area to be cleared will be clearly marked, and access prohibited to the remaining area with poly-web fencing	Minor adverse
Brief 19 and 21	Regrowth areas of diverse scrub-related species on Lot 101 DS185 and Lot 102 DS185	Topsoil will be stockpiled, and replaced after works to help regrowth species to re-establish. Unnecessary removal of trees with DBH* greater than 15 cm will be avoided, or replaced with tube stock** adjacent to corridor	Negligible
Approx. 1 km south of Brief sites 19 and 21	Scattered mature gums south of the area of scrub regrowth (mentioned above) on Lot 8 DS185.	Trees will be avoided wherever possible. Any trees cleared with DBH greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible
11b	Eucalypt regeneration area along a marine drainage north of the Twelve Mile Road	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor. Any previously-planted juvenile trees in regeneration area that need to be removed will be replaced with tube stock of as similar a native species as possible	Minor adverse
Short 11c	Twelve Mile Creek	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming mature trees are avoided

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
12	Road reserve on Twelve Mile Road	The environmental officer (an appropriately qualified member of the construction team, refer to Chapter 20, Planning Environmental Management Plan) will supervise exact trench location here if possible, to eliminate the need for unnecessary tree removal. Any trees cleared on road reserve with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse
Short 13	Patch of remnant softwood scrub in good condition on the same road, but adjacent to the corridor	Pipeline and ROW are not likely to interfere with remnant. Boundary of scrub will be clearly marked along existing fence-line with continuous length of high-visibility poly-web fencing. Access to the areas will be prohibited to prevent risk of fire or other damage	Negligible
14	Marble Creek	Site inspection at the pipeline crossing point found that no significant vegetation would be affected by trenching, although significant vegetation occurs in adjacent areas. Site surveys by a suitably qualified botanist will occur prior to construction commencement. Removal of trees and shrubs will be minimised. Trenching will be confined to already-cleared or open areas wherever possible. Sediment and erosion control measures will be implemented to prevent impacts downstream (if construction occurs in the wet) Weed management plan will be implemented If Rare or Threatened sapling species are identified from samples taken on-site, these will be translocated with a permit from EPA. ROW will be narrowed to a maximum 10 m width across creek and creek banks. Any trees cleared with DBH* greater than 10 cm will be replaced with five tube stock** along same creek bank but in disturbed sections adjacent to corridor. Tube stock will be sourced from a local native nursery to maintain local provenance. Any trees with DBH* greater than 10 cm earmarked for removal will require identification by the environmental officer prior to removal. If the resulting species is EVR status, the pipeline will be slightly diverted to protect the tree. If the resulting species is not EVR, but not available from native nurseries, Greening Australia and local native nurseries will be contacted to be given the opportunity of using the removed tree as a source of propagation material.	Negligible assuming the continuity of the riverine gallery forest is preserved and EVR species are not damaged
Short 16a, 16b and 17	Raglan and Horrigan Creeks	Micro-tunnelling will be done under Raglan and Horrigan Creeks (Sites 16a and 17) due to aquatic ecology values, tidal drainage and presence of mangrove species. Drilling/boring will be commenced outside the riparian zone to avoid removal of mangroves. Open trenching will be done in the Site 16b area between the two creeks, as this is higher ground without mangroves.	Minor adverse
18a	Corridor runs between southern end of large remnant of Narrow-leafed Ironbark on Lot 36 DT40169, and northern end of wetland	Pipeline and ROW are not likely to interfere with remnant, except possibly a few trees at the edge. Boundary of remnant at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage.	Negligible to Minor adverse
Short 18b	Road reserve on Reedy Creek Road	Trees cleared on road reserve with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
Short 20	Advanced regrowth with some scattered original trees on Lot 162 DS61	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Minor adverse
Short 21 and Detailed 22a and 22b	Remnant forest around Darts Creek Road	Clearing at the edge of this remnant will be minimised and the clearing edge will be clearly marked using poly-web fencing to prohibit access. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas. Additional replanting on eastern side cannot reduce impact from moderate to minor because ROW increases the width of the existing dissection of the remnant.	Minor adverse on western side of Darts Creek Road Moderate adverse on eastern side because remnant is in very good condition
23	Grey Box on Lot 114 DS256 and Lot 6 RP214228	Clearing at the edge of this remnant will be minimised, and the clearing edge will be clearly marked using poly-web fencing to prohibit access. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas. Additional replanting on eastern side cannot reduce impact from moderate to minor because ROW dissects the remnant	Moderate adverse
24	Horseshoe Lagoon	If final corridor alignment traverses this area or adjoining forest is cleared, buffer would be reduced and possibly weeds introduced. However, the corridor is not currently planned through this area. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Negligible
Short 25	Cleared extension of what could possibly be a natural grassland	Weed management plan to be implemented. Backfilled trench will be monitored to ensure that weeds do not establish along that section of the ROW to a point where they could spread into the grassland	Negligible
Short 27	Grey Box regrowth northeast of the showground at Mt Larcom	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Minor adverse
Note: GSDA begins here			
Short 28a and 28b	Two Grey Box remnants between Mt Larcom Gladstone Road and Larcom Creek on DIP land	Pipeline and ROW are not likely to interfere with remnant, except possibly a few trees at the edge. Boundary of remnant at the edge of the ROW will be clearly marked will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Negligible to Minor adverse
Short 29a, 29b and 29c	Second of two Grey Box remnants north of Larcom Creek – this one closer to the creek	Pipeline and ROW are not likely to interfere with remnant, except possibly a few trees at the edge. Boundary of remnant at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Negligible to Minor adverse
Short 29c	Minor tributary on northern side of Larcom Creek	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming trees can be avoided

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
Short 30a, 30b and 30c	Larcom Creek and minor tributaries on DIP land	Open trenching to be done here, as riparian vegetation can be avoided to some extent. Trenching will be confined to previously cleared or open areas wherever possible. Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor. Weed management plan will be implemented to ensure spread or establishment of Giant Rats-tail Grass does not occur on terraces surrounding creek.	Negligible assuming mature trees are avoided and Giant Rats-tail Grass infestations do not occur
Short 31a, 31b and 31c	Remnant Blue Gum, Ironbark and minor tributaries at eastern edge of DIP land	Pipeline and ROW are likely to interfere with edge of remnants only. Boundary of remnants at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. No entry to the remnant area will be permitted, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
32, 33 and 34	Large intact remnant of eucalypt forest on Ports Corporation land	Pipeline and right-of-way are likely to interfere with edge of remnants only. Boundary of remnants at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
Short 35	Not Of Concern remnant of eucalypt forest on Rio Tinto land (other parts of remnant elsewhere include Endangered RE)	Pipeline and ROW are likely to interfere with edge of remnants only. Boundary of remnants at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
Detailed 36, 37a and 37b and Short 38	Eucalypt woodland and very small patch of scrub species northwest of quarry	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
Detailed 39a and Short 39b	Large eucalypt remnant east of Yarwun	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas. If individuals of the Endangered tree cycads (*Cycas megacarpa and/or C. ophiolitica*) are encountered, they will be translocated adjacent to corridor (with a permit from EPA), according to translocation protocols in the EMP. The environmental officer will be on-site during construction to ensure that these plants are not damaged or removed	Minor adverse
Short 40	Boat Creek	The riverine forest community will be avoided wherever possible. Boundary of remnant at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Negligible to Minor adverse

**DBH is tree trunk Diameter at Breast Height (approx. 1.3 m from ground). The outer bark is included.*
***Tube stock are small containers chosen for cost effectiveness and their ability to rapidly catch up in growth to larger stock. They are only suitable in areas where they cannot be disturbed by cattle trampling, weed overgrowth etc. They are protected by tree guards for at least the first year (normally three stakes and a plastic tube-bag).*

The impacts shown in Table 6.13 are mostly of **negligible** or **minor adverse** significance, and can be offset by appropriate rehabilitation procedures which are outlined above for specific sites. Further measures are described in the Planning EMP in Chapter 20, Planning Environmental Management Plan, and will be elaborated in the Construction EMP to be developed by the contractor prior to construction.

6.8.3 Rare and Threatened Species

6.8.3.1 General

As discussed in Section 6.6.3, construction (and operation) of the pipeline may impact on Endangered (under the NC Act and the EPBC Act) scrub species that may occur within the proposed corridor, but it is not possible to assess the relative likelihood of impact to specific scrub species without exact knowledge of the pipeline location (i.e. within a few metres)[5]. Mitigation measures that will be implemented to minimise the potential impact to Endangered scrub species include:

- A pre-construction survey of all scrub communities at the time the ROW is surveyed, focusing on the identification of Threatened Species along the proposed ROW (see Chapter 20, Planning Environmental Management Plan, for proposed vegetation clearing practices)
- Areas of remnant vegetation impacted by the alignment will be highlighted on all drawings and clearly marked in the field
- Potential minor realignment of the ROW where possible (i.e. a few metres to go around trees or shrubs)
- Clearing boundaries will be clearly delineated on all drawings and in the field to define the extent of authorised clearing, which will not exceed the construction area.

Where these mitigation measures are implemented, along with the requirements in Chapter 20, Planning Environmental Management Plan, there is likely to be a **negligible** impact to scrub species along the corridor.

Black Ironbox (*Eucalyptus raveretiana*) is considered unlikely to occur in riverine locations along the corridor, but it is still possible that individuals may be encountered. Mitigation measures to minimise the impact will include a pre-construction survey for Black Ironbox individuals, and potential minor realignment of the ROW (i.e. a few metres to go around individual). There is likely to be a **negligible** impact to this species with the implementation of the above mitigation measures.

[5] Note that Table 6.4 identifies the likelihood of occurrence of habitat for specific scrub species as fair, but only within remaining scrub remnants.

6.8.3.2 Fitzroy to Bajool

Wetlands that potentially provide habitat for Threatened wetland species and are likely to be impacted by the construction of the proposed pipeline are identified in Table 6.7 (refer to Table 6.4 for likelihood of occurrence of Threatened species). While trenching is proposed for wetlands in this area because of their ephemeral nature (and size, in some cases), the implementation of the following mitigation measures will minimise the potential impact:

- When trenching across part of the wetland, topsoil will be stockpiled, and replaced after works to enable ground layer species to re-establish; and
- Wetlands will be restored, particularly for Site 2 (refer Table 6.12).

Where these mitigation measures are implemented, along with the requirements outlined in the Planning EMP (see Chapter 20, Planning Environmental Management Plan), there is likely to be a **negligible** impact to Threatened wetland species.

6.8.3.3 Bajool to Gladstone

Section 6.6.3.3 outlines the potential occurrence of, and impact to, Brigalow (*Acacia harpophylla*) regrowth (or possibly stunted remnant) immediately south of Inkerman Creek. While the species (as an individual) is not listed as Threatened, the community may constitute a Threatened Ecological Community under the EPBC Act (if of sufficient structure). Mitigation measures and residual impacts for this community (located at Site 9c) are identified in Table 6.13.

Two tree cycads (*Cycas megacarpa* and *C. ophiolitica*, Endangered under the NC Act and EPBC Act), known to occur within the proposed corridor, may be impacted through removal and/or disturbance of vegetation in the ROW. Mitigation measures to minimise the potential impact on these species includes the avoidance of clearing in remnant vegetation, or where this is not possible, translocation of impacted individuals (as per Forster (2007)). Requirements outlined in the EMP (Section 6.7.5) would also be implemented. Refer also to Sites 39a and 39b in Table 6.13. There is likely to be a **negligible** impact to Threatened cycad species through implementation of these measures.

6.8.3.4 Summary of Rare and Threatened Species Impacts

While it is considered unlikely that Rare and Threatened species along the corridor will be impacted by the proposed project, pre-construction surveys will be conducted. When any Rare or Threatened individuals remain within the construction footprint, these can be translocated (or replacements planted, depending on species) in consultation with EPA, resulting in a **negligible** residual impact.

6.8.4 Cultural Impacts

6.8.4.1 Crops

Cropping areas around Gracemere and in Alton Downs are likely to be adversely impacted in the short term. Cropping will be disrupted over part of each affected property. The majority are annual crops, so cropping within the corridor should return to normal in the following season. There may be a **minor adverse** impact to cropping, but this would more likely be **negligible** subject to financial license arrangements in the SGIC.

No areas of horticulture were observed within the ROW.

6.8.4.2 Recreational areas

Raglan Creek has a public access area and a boat ramp, which both appear to be heavily utilised. Construction activity, and any vegetation rehabilitation barriers that might be necessary, may have adverse short to medium-term effects on recreational use in terms of aesthetic amenity. High-visibility poly-web fencing will be used to discourage public access to these areas, during any revegetation following clearing, with appropriate signage (e.g. "revegetation area, please keep out").

GAWB's priority will be to ensure that restriction of access to the boat ramp at Raglan Creek is minimised, and that the boat ramp will be returned to its original condition or better.

While the Raglan Creek recreation area is currently degraded (there is a large amount of rubbish in the area, and partial clearing of vegetation) this does not appear to deter users. GAWB will ensure that the area is not degraded further.

There is likely to be a **negligible** to **minor adverse** impact to recreational areas in general.

6.8.5 Environmental Offsets

Environmental offsets are a mechanism that can be used in environmental management to compensate for the impacts of developments on ecologically significant features. Offsets are usually available through an environmental impact and approvals process. They are a relatively recent requirement that have been written into several Federal, State and Local Governmental policies. The Federal Government released a 'Draft Environmental Offsets Policy for the *Environment Protection and Biodiversity Conservation Act 1999'* for public consultation in August 2007 (Appendix E2). The Queensland EPA also released a draft offsets policy for review at this time. This has now been made into a policy and came into effect on 1 July 2008. Currently there are three 'specific-issues offsets policies' that sit under the Queensland Government Environmental Offset Policy, these are focussed on remnant vegetation, fisheries and koalas. Other policies are planned for the near future and will include a 'Biodiversity Offsets Policy'. This may be relevant to the project at the time when approvals for operational works are sought, but at this stage the implications of such a policy is not known. Certainly, the offsetting initiative has been in operation prior to the release of the Queensland Government Environmental Offsets Policy and is regularly used to ameliorate impacts of clearing and habitat destruction. The following represents a description of clearing impacts that currently are not obligatory to offset, but may be considered under the pending Federal or State offset policies:

- Approximately 0.6 ha (based on 30 m wide x 200 m long) of low-growing Brigalow immediately south of Inkerman Creek. The stunted Brigalow does not feature on RE mapping, but could possibly be classified as RE 11.3.1 (Endangered), depending on interpretation by EPA. A suitable offset area could be negotiated with the property owner, since the cleared area of the ROW would become useable as pastoral land
- Trenching at Marble Creek will be restricted in width to a maximum of approximately 10 m. The width of the vegetation is approximately 30 m from bank to bank (based on the outer drip-line of the trees). This would result in a maximum area of disturbance of 300 m^2. Bank vegetation may need to be rehabilitated either on the ROW or outside of the corridor. The riverine scrub vegetation is too narrow to feature on RE mapping, but would normally be classified as RE 11.3.11 (Endangered). A suitable offset area further upstream could be negotiated with the landowner, probably without any net loss in agricultural productivity
- Up to 60 m of the length of two tributaries of Larcom Creek (2 m x 30 m of bank vegetation) may need to be rehabilitated either on the ROW, or outside of the corridor. The riverine vegetation is too narrow to feature on RE mapping, but would normally be classified as RE 11.3.25 (Not Of Concern). A suitable offset area further upstream could be negotiated with the landowner, probably without any net loss in agricultural productivity. Larcom Creek is proposed to be crossed by underground boring, so its fringing vegetation will not be affected
- Approximately 2.7 ha of Ironbark, Grey Box and Spotted Gum forest (RE 11.11.4 and RE 11.11.15, both Not Of Concern) in the Aldoga area (based on 30 m wide x 900 m long). A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation
- Approximately 10.5 ha of Spotted Gum and Ironbark forest (RE 12.11.6 Not Of Concern, and RE 12.11.14 Of Concern) in the Yarwun area (based on 30 m wide x 3.5 km long). The Not Of Concern component does not require offsetting under the VM Act, but the Of Concern component does. A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation.

In Queensland, the VM Act is associated with one of the specific issues offsets policies and is administered by DNRW (Appendix E2). The offsets policy allows some areas of remnant vegetation to be cleared for relevant purposes, providing an ecologically equivalent[6] area can be obtained and protected indefinitely elsewhere. The offsets policy can assist to address elements of the assessment code related to Endangered REs, Of Concern REs, threshold REs[7], wetlands, waterways and areas of essential habitat. An offset must be able to satisfy the following criteria:

- It must not be currently protected (i.e. mapped as remnant vegetation, within conservation reserve or protected as a condition of another development approval)
- It must have the same RE or at least have the same conservation status as the area proposed for clearing
- It must be a minimum of 2 ha or capable of being mapped by DNRW as remnant vegetation
- It must demonstrate ecological equivalence
- It must be capable of achieving remnant status within 20 years (maximum).

It is also required that the proponent legally secure the offset, so that the vegetation is protected in perpetuity, and provide DNRW with a copy of a management plan that details how the offset will be managed to achieve remnant status.

Based on the assessment of impacts vegetation offsets may be necessary for the following areas, if they are cleared or significantly disturbed:

- Up to approximately 1.3 ha (nominally 30 m wide x 430 m long) of mangroves (RE 11.1.4 Not Of Concern) at Raglan Creek. The offset ratio will be 1:2 or 1:3 depending on ecological equivalence factors
- Approximately 7.5 ha of Grey Box forest (RE 11.3.26, Not Of Concern) in the Dart Creek to Mt Larcom area. This is based on the following lengths of ROW at 30 m wide. The offset ration will be 1:2 or 1:3 depending on ecological equivalence factors:
  - 670 m at Site 22a (x 30 m = 2 ha)
  - 80 m of minor remnant between Sites 22a and 23 (x 30 m = 0.24 ha)
  - 780 m at Site 23 (x 30 m = 2.3 ha)
  - 500 m at Site 26 (x 30 m = 1.5 ha of partly cleared remnant). Undisturbed remnant equivalent probably about 1 ha
  - 1,000 m at Site 27 (x 30 m = 3 ha of partly cleared remnant). Undisturbed remnant equivalent probably about 1.5 ha.
- A small amount (approximately 0.5 ha) of Blue Gum (RE 11.3.4 Of Concern) in the Aldoga area. The offset ration will be 1:2 or 1:3 depending on ecological equivalence factors. A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation
- Approximately 10.5 ha of Spotted Gum and Ironbark forest (RE 12.11.6 Not Of Concern, and RE 12.11.14 Of Concern) in the Yarwun area (based on 30 m wide x 3.5 km long). The Not Of Concern component does not require offsetting under the VM Act, but the Of Concern component does. The offset ration will be 1:1 or 1:2.5 depending on ecological equivalence factors. A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation.

The arrangements for offsets would be finalised following successful completion of the EIS process and in the context of vegetation clearing applications under the VM Act.

[6] Ecological equivalence is measured by considering the following factors: location (proximity to clearing), strategic position (e.g. corridor, core habitat), area, vegetation community, vegetation condition (e.g. species diversity, weed invasion), regaining remnant status (e.g. stage of regrowth) and landscape context attributes (i.e. how it fits ecologically within locality).

[7] Threshold REs are those that are close to changing status (e.g. Of Concern to Endangered) because their total remnant percentage is close to the threshold of two different conservation status levels.

6.9 Cumulative and Interactive Impacts

The ROW is part of a larger corridor which will accommodate more services in the form of pipelines or cables. GAWB does not have control over these future additional services, and their potential impacts.

It is considered unlikely that impacts on Rare and Threatened flora species will accumulate over time due to additional services being installed. The corridor has been investigated as part of this assessment, and significant new findings are unlikely.

The key problems introduced by the installation of additional services are likely to be:

- Clearing of more vegetation in the form of another ROW, effectively widening the cleared part of the corridor. This will reduce remnant sizes and increase remnant fragmentation
- Introduction of more weeds, either in terms of quantity, or diversity, because of increased activity from construction and subsequent maintenance.

Many of the environmental pressures generated by subsequent services may be greater than the current proposed project because they may occur during the rehabilitation period of this project, when damage could occur more easily to replanted areas. It is beyond the scope of this chapter to assess the cumulative impacts of these subsequent ROWs, but it is recommended that this report be used as a key source of baseline information, and as a guide to further impacts. EMPs developed by other parties for additional services should be aware of the existing EMP proposed by this chapter, so that management practices are coordinated between service operators. For example, a weed management plan including measures such as vehicle inspection and wash down should be coordinated to increase effectiveness, particularly in areas infested by Parthenium and Giant Rats-tail Grass. Chapter 11, Waste, addresses the spread of weeds through testing, operations and maintenance.

6.10 Summary and Conclusions

The construction of the pipeline and clearing of the ROW is likely to have an overall **negligible** to **minor adverse** impact. A trained ecologist will conduct a walkover of the ROW to identify areas where negative impacts on flora communities (in general) and Threatened species are possible. This will occur during pre-construction and this information will be documented in the Construction EMP.

Occasional traffic and other activity that could potentially disturb vegetation are likely to occur infrequently in the ROW during the operational phase of this project. There may be ongoing monitoring of vegetation rehabilitation, and a weed management plan will be implemented. EMPs have been proposed which address these issues.

A summary of key impacts and mitigation measures is shown in Table 6.14.

Table 6.14 Summary of Key Impacts and Mitigation Measures

Refer to key at foot of table for terminology and codes.

EIS Area: Ecology **Feature/Activity**	**Current value + Substitutable Y:N**	**Description of impact**		
		Description in words	Mitigation inherent in design/standard practice mitigation	Residual impact using Significance Criteria
Possibly an Endangered Ecological Community (Commonwealth EPBC Act) Also possibly Endangered RE (State NC Act)	Natural ecosystems; Wildlife habitat Not substitutable	Clearing of 0.69 ha of possibly Endangered RE, depending on interpretation by EPA. Stunted Brigalow south of Inkerman Creek	Minimise clearing by adjusting location and width of ROW. Possible provision of offset, or rehabilitation of adjacent area if necessary, depending on requirements of vegetation clearing permit under the VM Act	Negligible to Minor –ve, D, T, MT
Endangered RE (State NC Act) Also possibly an Endangered ecological community (Commonwealth EPBC Act)	Natural ecosystems; Wildlife habitat Not substitutable	Slight possibility of need to clear 350 m^2 (10 m wide trench) through unmapped Endangered RE along creek bank (Marble Creek)	Minimise clearing by adjusting location and width of ROW. Possible provision of offset, or rehabilitation of adjacent area if necessary, depending on requirements of vegetation clearing permit under the VM Act	Negligible to Minor –ve, D, T, MT
Of Concern REs (State NC Act)	Natural ecosystems; Wildlife habitat Not substitutable	Clearing approximately 12 ha of Of Concern RE in the Yarwun area. Also approximately 0.5 ha in the Aldoga area	Minimise clearing by adjusting location and width of ROW. Possible provision of offset, or rehabilitation of adjacent area if necessary, depending on requirements of vegetation clearing permit under the VM Act	Negligible to Minor –ve, D, T, MT
Not Of Concern REs (State NC Act)	Natural ecosystems; Wildlife habitat; Biodiversity Not substitutable	Clearing of approximately 8 ha of Not Of Concern RE	Minimise clearing by adjusting location and width ROW, avoiding trees, and supervising clearing. Rehabilitation planting where possible.	Negligible to Minor –ve, D, T, MT
Clearing of remnant vegetation	Wildlife corridors. Not substitutable in short term	Clearing of approximately 8 ha of remnant vegetation as above	Minimise clearing by adjusting location and width ROW, avoiding trees, and supervising clearing. Rehabilitation planting where possible.	Negligible to Minor –ve, D, T, MT
Clearing of remnant vegetation	Visual amenity. Not substitutable in short term	Clearing of approximately 8 ha of remnant vegetation as above	Minimise clearing by adjusting location and width ROW, avoiding trees, and supervising clearing. Rehabilitation planting where possible.	Negligible to Minor –ve, D, T, MT
Clearing of remnant vegetation	Weed-free ecosystems. Substitutable	Possible introduction or increase in weeds along the ROW	Weed Management practices during clearing and during pipeline trenching and backfilling	Negligible to Minor –ve, D, T, MT
Clearing of remnant vegetation	EPBC Threatened species, and NC Act Rare and Threatened species. Not substitutable	Clearing of critical sections of remnant vegetation, or unsupervised removal of individual plants	Using the environmental officer to inspect the finalised ROW for EVR species, and to supervise clearing. Translocate EVR species if encountered, with a permit from EPA.	Negligible to Minor –ve, D, T, MT

EIS Area: Ecology Feature/Activity	Current value + Substitutable Y:N	Description of impact		
		Description in words	Mitigation inherent in design/standard practice mitigation	Residual impact using Significance Criteria
Trenching through minor creek tributaries with fringing forest	Natural ecosystems; Wildlife habitat Not substitutable	Clearing of 10 to 30 m of each of two unmapped minor tributaries of Larcom Creek	Minimise clearing by adjusting location and width of ROW. Provision of offset, or rehabilitation of adjacent area	Negligible to Minor –ve, D, T, MT
Trenching through wetlands or creek beds	Natural ecosystems; Wildlife habitat. Substitutable	Excavation of sections of wetland vegetation, and possible resulting erosion and turbidity	Optimise and minimise time taken to do pipeline trenching and backfilling, so as to prevent erosion and turbidity	Negligible to Minor –ve, D, T, ST
Trenching through wetlands or creek beds	Weed-free ecosystems. Substitutable	Possible introduction or increase in weeds	Hygiene practices during pipeline trenching and backfilling	Negligible to Minor –ve, I, T, ST

Key:
Significance Criteria: Major, High, Moderate, Minor, Negligible
+ve = positive; –ve =negative impacts
D = direct; I =indirect
C = cumulative; P = permanent; T = temporary
ST = short-term; MT = medium-term; LT = long-term.

Relative Duration of Environmental Effects
Temporary: Up to one year
Short-term: From one to seven years
Medium-term: From seven to 20 years
Long-term: From 20 to 50 years
Permanent: Period in excess of 50 years.

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(Footnotes)

1 +/- means 'with / without'.

CHAPTER 7

GLADSTONE – FITZROY

PIPELINE PROJECT

Environmental Impact Statement

Terrestrial Fauna

Gladstone Area Water Board

Contents

This information has been prepared by, or on behalf of, the Gladstone Area Water Board (GAWB) regarding the Gladstone-Fitzroy Pipeline Project. Care has been taken to ensure that the information is accurate and up to date at the time of publishing.

Gladstone Area Water Board

Figures

Tables

7. Terrestrial Fauna

7.1 Introduction

This chapter presents a description of existing (baseline) conditions within the project area with respect to terrestrial fauna, an assessment of potential project impacts, and an outline of strategies that will be employed to mitigate these potential impacts.

This chapter was prepared in accordance with Section 3.3.3 of the Gladstone-Fitzroy Pipeline EIS Terms of Reference (ToR) (October 2007).

In this report, the *project area* refers to the land within the Gladstone-Fitzroy Pipeline corridor (i.e. generally a 30 m wide construction corridor plus infrastructure sites) extending from the Fitzroy River (west of Rockhampton) south to Gladstone (see Figure 1.3). The term *surrounding area* refers generally to the lands within 2 km of the project area.

The majority of the project area is located within the eastern extent of the *Brigalow Belt* bioregion. The southern portion of the project area (south of about Yarwun) is located within the extreme northern part of the Southeast Queensland bioregion. These bioregions represent two of a suite of 13 biogeographical areas of Queensland (see Sattler and Williams 1999).

7.2 Methodology

7.2.1 Nomenclature and Terminology

7.2.1.1 Vertebrate Fauna and Habitat

Fauna refers to all vertebrate fauna (excluding fish; see Chapter 8, Aquatic Flora and Fauna) and the nomenclature used in this chapter follows Strahan (2000) for non-flying mammals, Churchill (1998) for bats, Christidis and Boles (1994) for birds and Cogger (2000) for reptiles and amphibians. Common names for frogs follow the nomenclature of Ingram *et al.* (1993). The terms *shorebirds* and *waders* are generic terms used to describe both resident and Migratory species from the following families: Scolopacidae; Burhinidae; Haematopodidae; Recurvirostridae; Charadriidae; and Glareolidae.

7.2.1.2 Conservation Status

Within this chapter, the conservation status of a species may be described as Rare, Endangered (also Critically Endangered), Vulnerable, Near Threatened and/or Migratory. These terms are used in accordance with the provisions of the Queensland *Nature Conservation Act 1992* (Qld) (NC Act) and its regulations and amendments, and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

With regards to Migratory shorebirds/waders, the terms CAMBA and JAMBA refer to the following:

- JAMBA - the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1974
- CAMBA - the Agreement between the Government of Australia and the Government of China for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1986.

The term used in this chapter, *species of conservation significance*, embraces fauna whose status is Critically Endangered, Endangered, Vulnerable, Regionally Vulnerable, Rare, Near Threatened and/or Migratory (as described above). Threatened is a common term used to collectively describe Endangered and Vulnerable species.

7.2.1.3 Habitat Elements

General vegetation type descriptions used (e.g. forest and grassland) are based on the structural types described by Specht (1970). Where reference is made to a *Regional Ecosystem* (RE), this follows the meaning provided by Sattler and Williams (1999), i.e. a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. *Regrowth vegetation* means woody vegetation that is not remnant as defined under the Queensland *Vegetation Management Act 1999* (Qld) (VM Act). A *declared plant* refers to a species declared as a pest under the *Land Protection (Pest and Stock Route Management) Regulation 2002*. An *environmental weed* refers to any plant that survives in a natural area where its presence is undesirable, harmful or troublesome to native biodiversity. *Weeds of national significance* (WONS) are those weeds that have been identified as already causing significant environmental damage (DEWHA 2005).

7.2.2 Existing Information Review

Existing information regarding the fauna of the project area and surrounding area was collated and reviewed. The following documents and database information were considered in the preparation of this chapter:

- Fauna databases of the Commonwealth Government (EPBC Protected Matters database), the Queensland Museum, Birds Australia and Queensland Environment Protection Agency's (EPA) Wildlife Online database. Note: search area based on a 30 km buffer from the extent of the project area
- Fauna data and background information derived from relevant studies for the wider area (e.g. Longmore 1978, Driscoll 1997, Sattler and Williams 1999, Young *et al.* 1999, McFarland *et al.* 1999, CZEWM CRC 2003a and 2003b, DEH 2005d, Houston *et al.* 2004a and b, Jaensch *et al.* 2004, RLMS 2006a and 2006b, HLA 2006, Houston *et al.* 2006, Houston 2006)
- Queensland EPA RE mapping and Essential Habitat mapping
- Aerial photography to identify vegetation in the local area, comparing patterns observed with existing vegetation mapping
- Queensland EPA Brigalow Belt Biodiversity Planning Assessment mapping and database
- Commonwealth Government's Directory of Important Wetlands database.

7.2.3 Target Species

The findings of the desktop assessments indicated that a number of species of conservation significance may use habitats of the project area and surrounding lands. Consequently, consideration was given to these species (termed *target species*) in the design and implementation of the field survey program and habitat assessments. Target species considered as part of these investigations for the project area are listed in Table 7.2 and Table 7.3.

7.2.4 Field Survey Program

The review of existing information assisted in prioritising the variety of habitats and locations for field surveys (e.g. HLA 2006, Houston *et al.* 2006, and Houston 2006). These primarily assisted in the consideration of priority habitat areas for field surveys for Threatened species.

The field survey program was initiated in April 2007 and comprised of the following survey events:

- A preliminary biodiversity investigation undertaken between 1 and 5 April 2007 by Lindsay Agnew and Dr. Ed Meyer
- A series of monthly surveys to monitor known and potential habitat areas for the Threatened Yellow Chat (*Epthianura crocea macgregori*). The program began in June 2007 and continued through until the final monitoring event undertaken in December 2007. These surveys were conducted by Lindsay Agnew and Dr. Ed Meyer
- A spring-season avifauna survey conducted on 2 to 6, 27 and 28 September 2007 by Lindsay Agnew
- A comprehensive target species and biodiversity survey undertaken between 18 and 31 November 2007 by Lindsay Agnew and Dr. Ed Meyer.

The field investigators for this study have had extensive experience in surveying the suite of target species and applying the relevant survey methodologies.

7.2.4.1 Preliminary Biodiversity Surveys

The preliminary biodiversity field survey was conducted between 1 and 5 April 2007 by Lindsay Agnew and Dr. Ed Meyer. The latter part of the program was undertaken in conjunction with the project botanist, Derek Johnson (WBM). This work involved morning and afternoon area searches for avifauna, active ground searches for reptiles and amphibians, census of wetlands for waterbirds, and general searches for indirect evidence of fauna occurrence (e.g. scats, tracks, nests, etc.). The full extent of the project area (including several route options) was covered. The location of each survey site is shown in Figure 7.1 and Figure 7.2.

7.2.4.2 Monthly Yellow Chat Habitat Monitoring

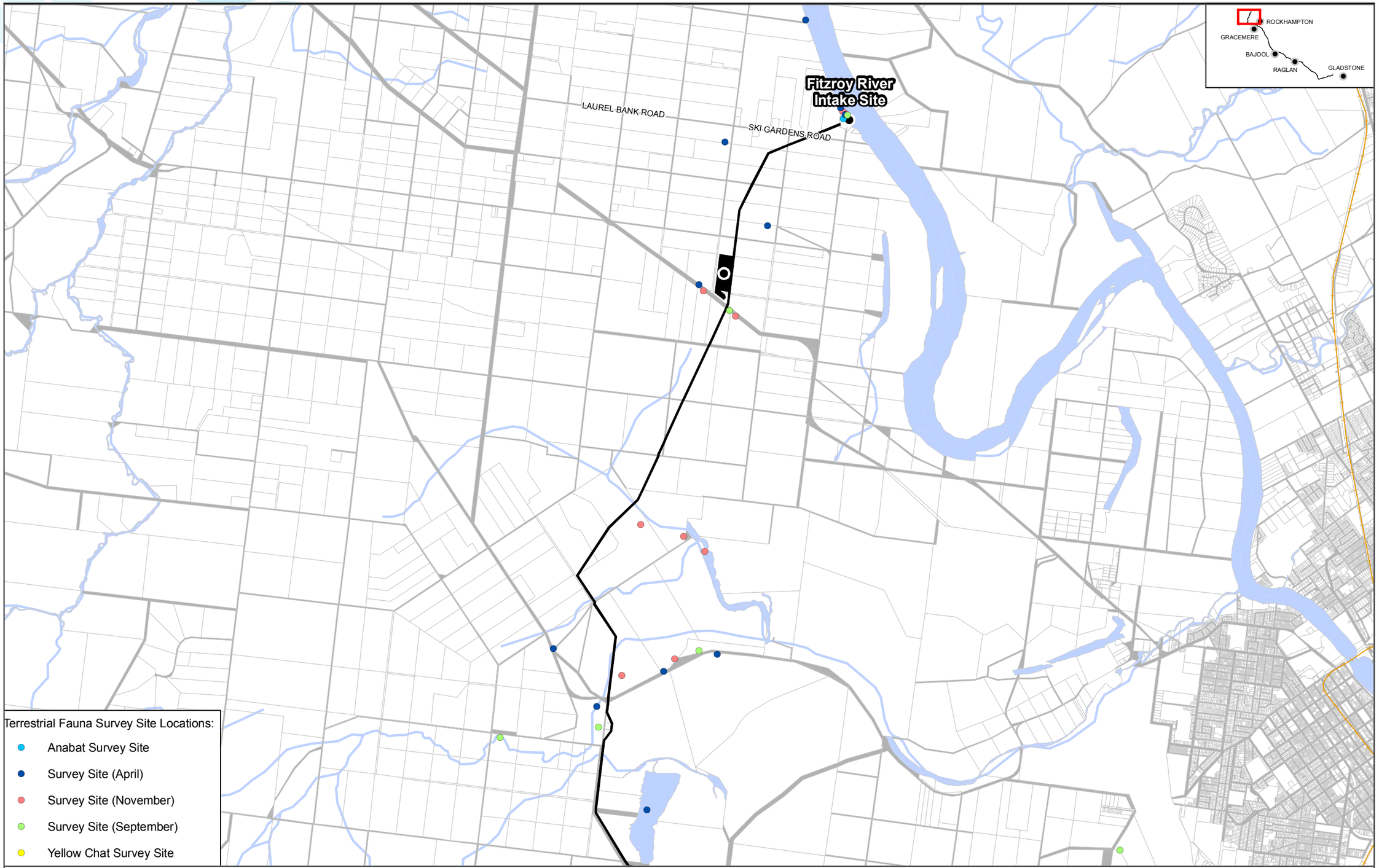
As a result of the existing information review and an initial ground-truthing exercise (April 2007), a number of areas were selected to investigate for the presence of the Threatened Yellow Chat (*Epthianura crocea macgregori*). The areas were either part of a wider area of known Yellow Chat habitat, or were considered as potentially suitable habitat (within the species' known range) based on reference to habitat characteristics and local studies (e.g. Houston (2006) and HLA (2006)).

The monitoring program was undertaken over a period of two to three days each month from June 2007 through to December 2007 (inclusive) to assess any seasonal pattern of habitat usage. The amount of time dedicated to surveying each area varied according to the size of the area, though typically ranged from 30 to 90 minutes. These areas were surveyed using either binoculars and/or a spotting scope. The full extent of each area was surveyed during each monitoring event. These surveys were conducted by Lindsay Agnew and Dr. Ed Meyer.

Table 7.1 identifies each area monitored and the frequency and timing of the monitoring events. A variety of other fauna species were recorded incidental to the survey for Yellow Chat. Those records have been incorporated within the main fauna database results. The location centroid for each monitoring site is provided in Figure 7.1 and Figure 7.2. In addition, areas considered potentially suitable as habitat for the Yellow Chat are provided in Figure 7.1 and 7.2.

Table 7.1 Summary of Yellow Chat Investigation Sites

Site #	Central GPS reference	Summary description	Monitoring events
1	248120E 7404586S	Seasonal wetlands associated with Gavial Creek in the vicinity of Roope and Port Curtis Roads. Adjacent to eastern side downstream of corridor	April, August, September, October, November, December
2	248938E 7403192S - 250173E 7400309S	Seasonal wetlands associated with Serpentine Creek. Adjacent to eastern side and downstream of corridor	No property access granted.
3	253008E 739693S	Seasonal wetland habitat to the near south of Casuarina Road, Midgee. Eastern sectors transected by corridor. The majority of this site is adjacent and to east of corridor. Downstream of corridor	April, August, September, October, November, December
4a	250763E 7395925S	A small, semi-permanent constructed wetland. Approximately 1 km to west and upstream of corridor	April, June, July, August, September, October, November, December
4b	251453E 7394380S	A small, semi-permanent constructed wetland. Approximately 1 km to west and upstream of corridor	April, June, July, August, September, October, November, December
5	256251E 7389205S	Seasonal and semi-permanent wetland habitats associated with Station Creek and its tributary Oakey Creek. Includes constructed and semi-natural wetland features. Adjacent and to east of corridor. Downstream of corridor	No property access granted
6a	261091E 73848155S	Seasonal wetland habitats comprised of a series of swales and depressions to the near north of disused Port Alma rail link. Part of the Six and Eight Mile Creek systems. Corridor transects area, though largest part is east of corridor.	April, June, July, August, September, October, November, December
6b	262895E 7384194S	Seasonal wetland habitats comprising of a series of swales and depressions to the near south of disused Port Alma rail link. Corridor transects habitat area, though largest part is east of corridor	April, June, July, August, September, October, November, December
7	265744E 7384554S	Cheetham drain area comprising estuarine/saltmarsh/clay pan habitat complex. Extends to north and south of Toonda Port Alma Road. Approximately 1.3 to 2 km east and downstream of corridor	April, June, July, August, September, October, November, December
8a	270679E 7379990S	Twelve Mile Creek Reserve. An extensive mosaic of large seasonal pools, clay pans and saltmarsh. Adjacent and to east of corridor. Downstream of corridor	April, June, July, August, September, October, November, December

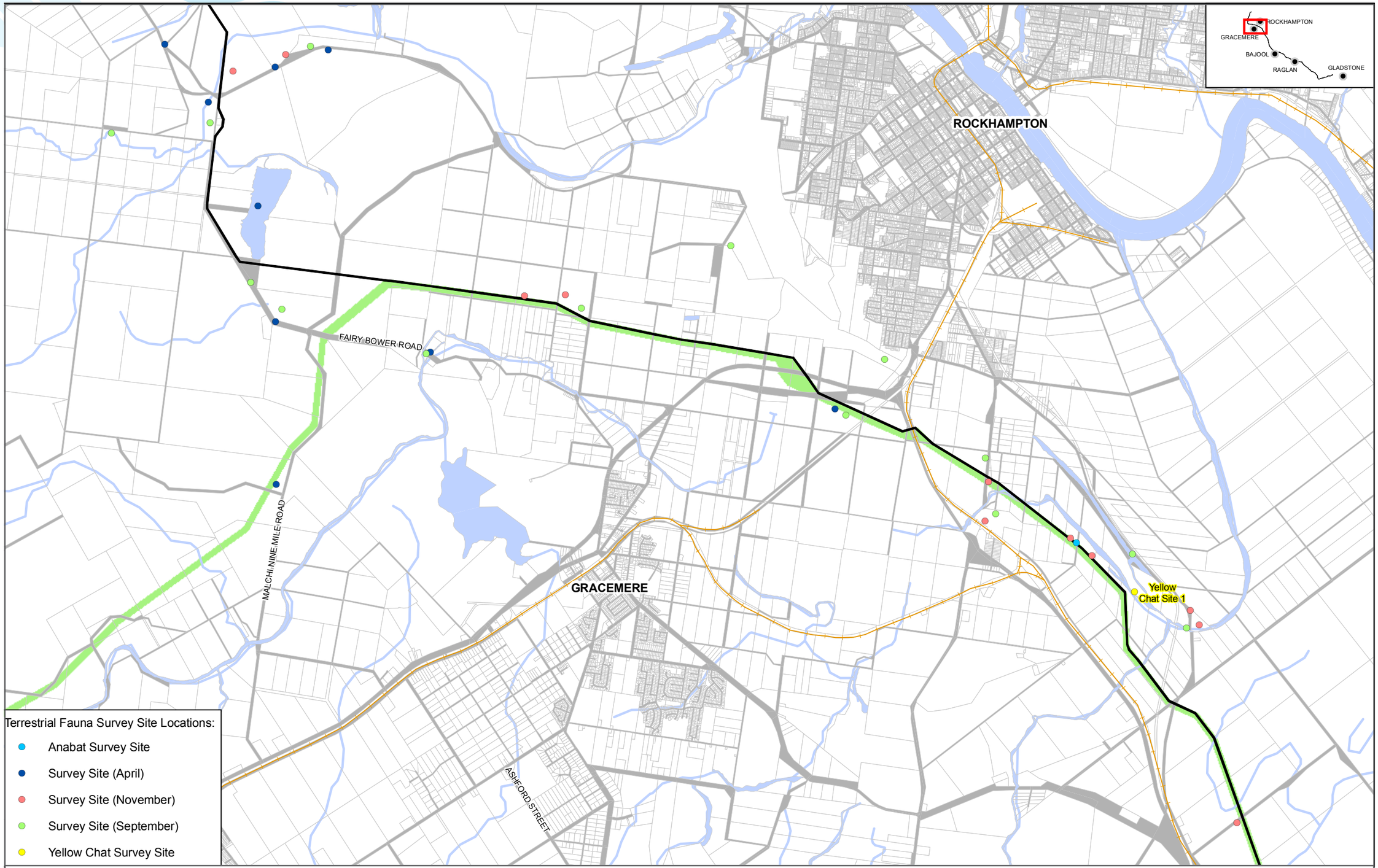


Gladstone - Fitzroy Pipeline Project

Figure 7.1 - Location of Field Survey Sites for the Fitzroy to Bajool Section

Sheet 1 of 4

While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



Gladstone - Fitzroy Pipeline Project

Figure 7.1 - Location of Field Survey Sites for the Fitzroy to Bajool Section

Sheet 2 of 4

Gladstone Area Water Board

ARUP

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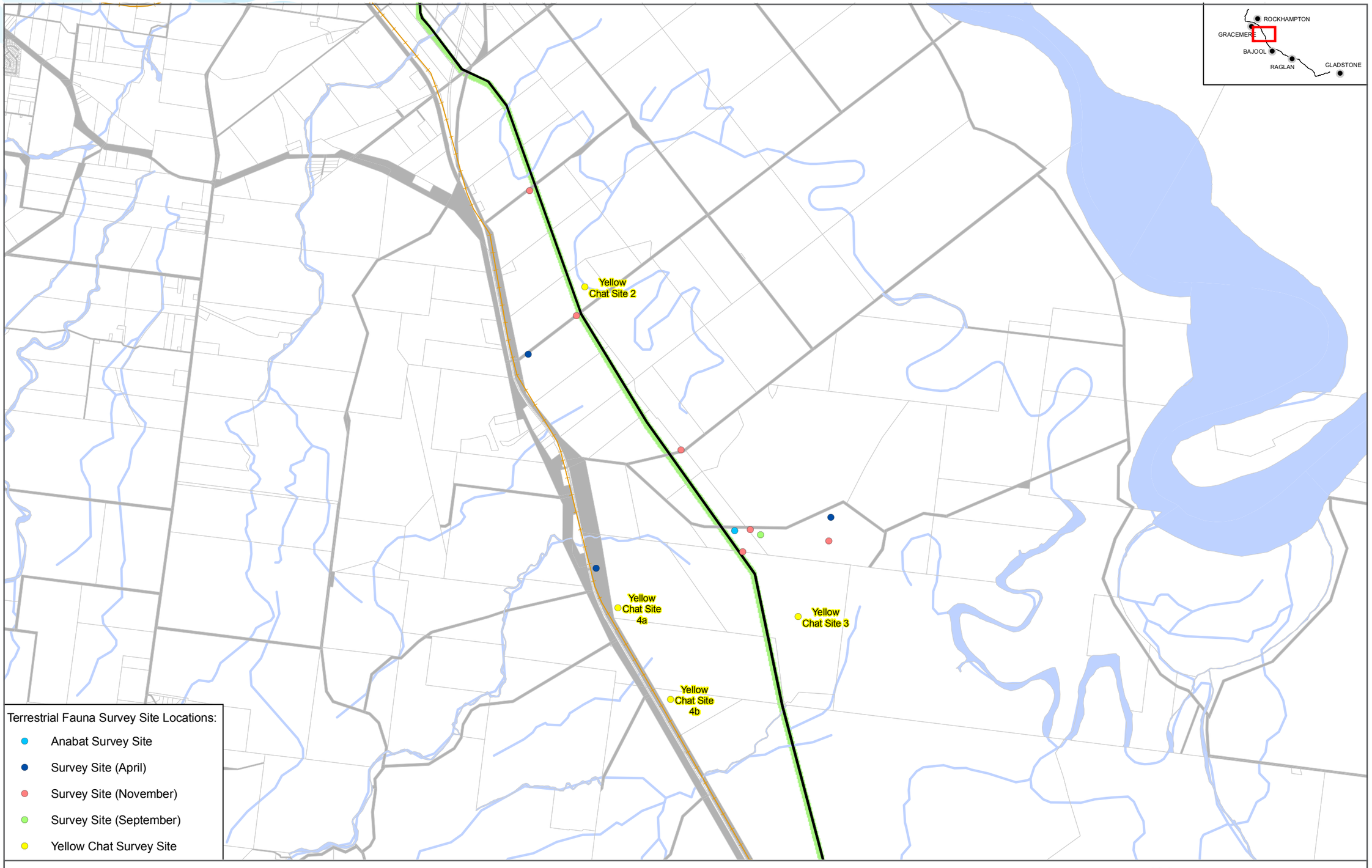

Gladstone - Fitzroy Pipeline Project

Figure 7.1 - Location of Field Survey Sites for the Fitzroy to Bajool Section

Sheet 3 of 4

The Right of Way
Project Infrastructure
Railway Line
Road Reserve
Waterways
Cadastre
LGA Boundary
SGIC
GSDA

0 1 2 3 4 km

1:50,000 at A3

N

Gladstone Area Water Board

ARUP

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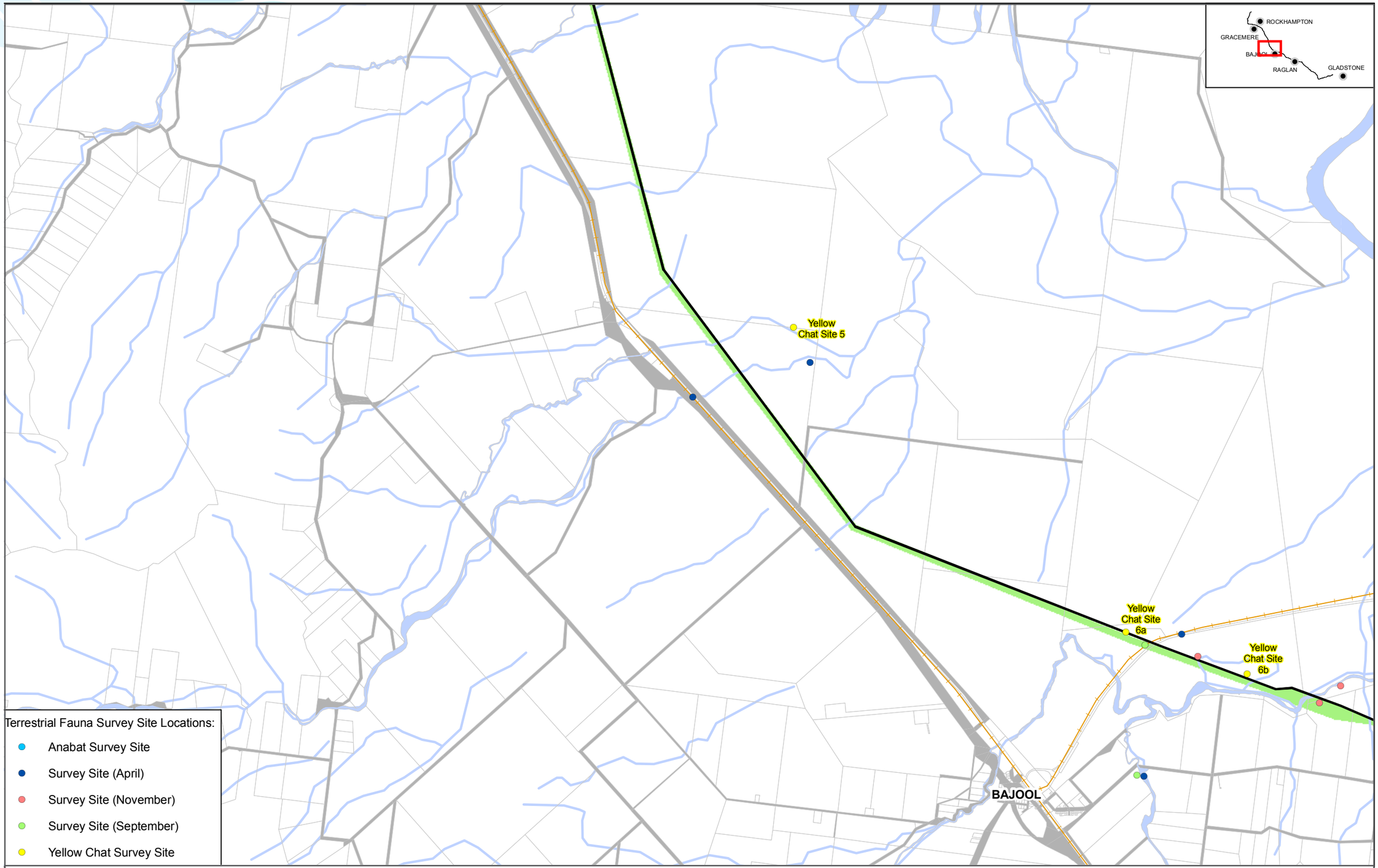

Terrestrial Fauna Survey Site Locations:

- Anabat Survey Site
- Survey Site (April)
- Survey Site (November)
- Survey Site (September)
- Yellow Chat Survey Site

Gladstone - Fitzroy Pipeline Project

Figure 7.1 - Location of Field Survey Sites for the Fitzroy to Bajool Section

Sheet 4 of 4

- The Right of Way
- Project Infrastructure
- Railway Line
- Road Reserve
- Waterways
- Cadastre
- LGA Boundary
- SGIC
- GSDA

0 1 2 3 4 km

1:50,000 at A3

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Gladstone Area Water Board

ARUP

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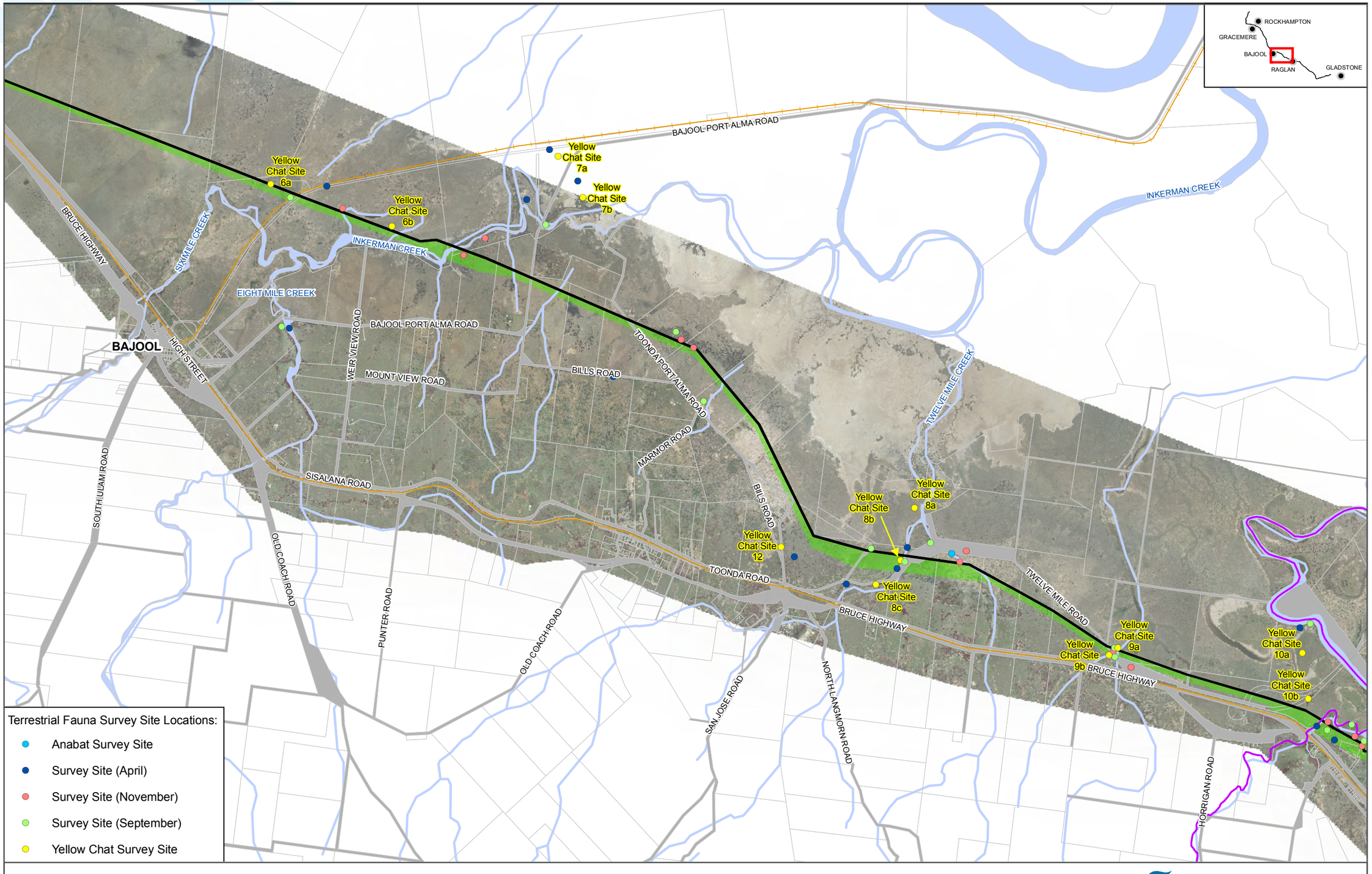

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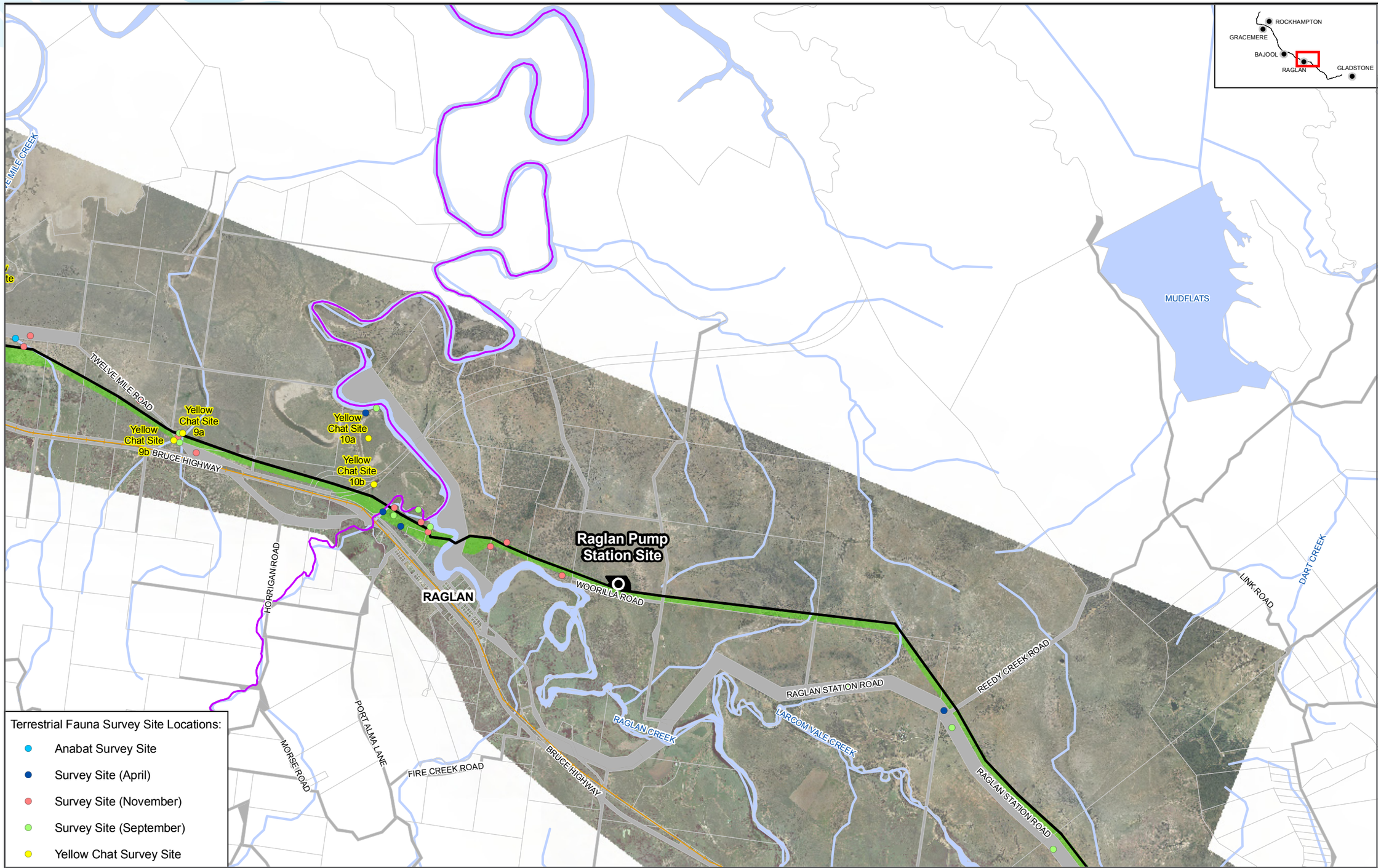

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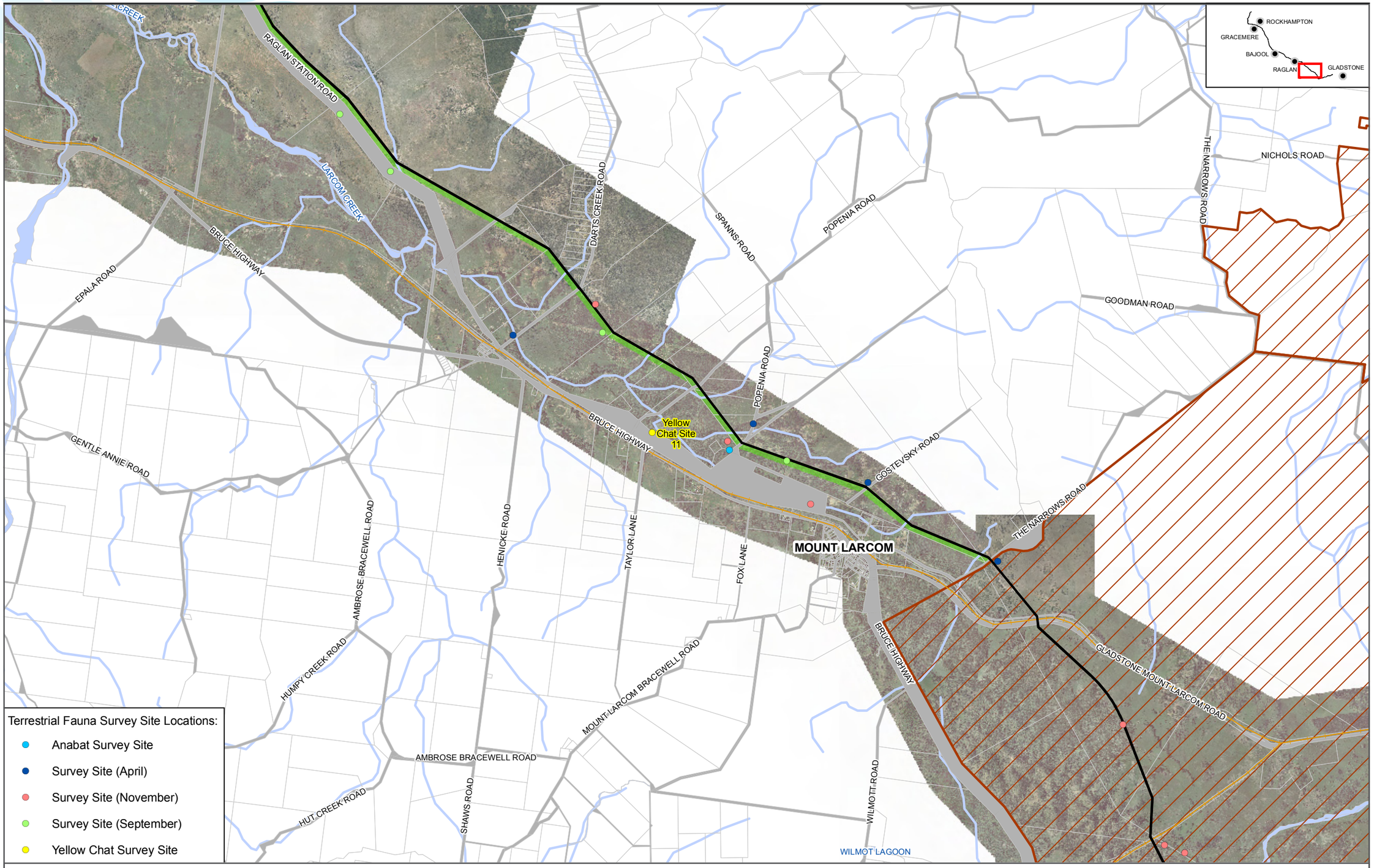

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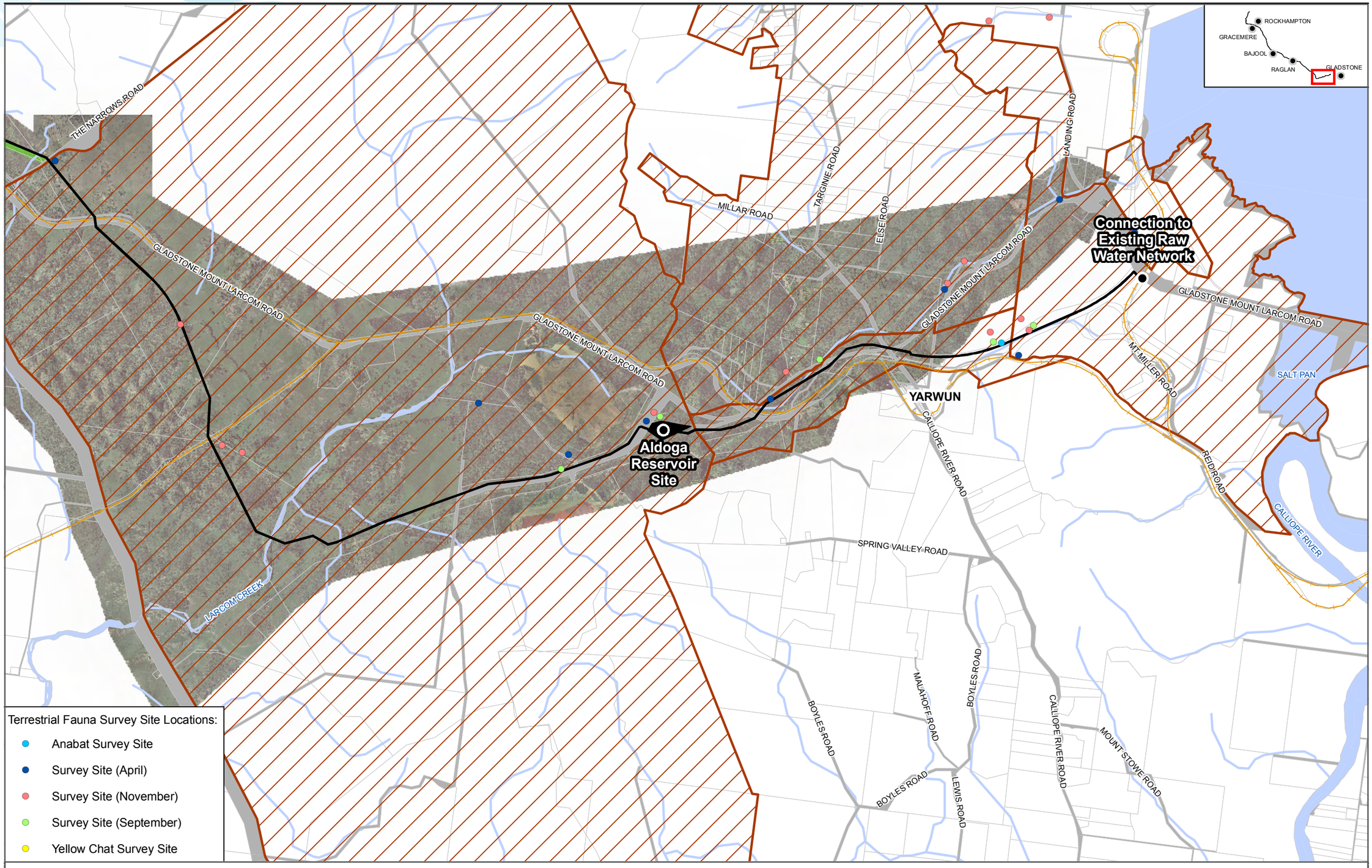

Gladstone - Fitzroy Pipeline Project

Figure 7.2 - Location of Field Survey Sites for the Bajool to Gladstone Section

Sheet 4 of 4

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Site #	Central GPS reference	Summary description	Monitoring events
8b	270530E 7379259S	Bulrush-lined freshwater section Twelve Mile Creek downstream of Twelve Mile Road and contiguous with Twelve Mile Creek Reserve. A series of large pools fringed with Typha and Eleocharis sp. Corridor traverses this habitat area	April, June, July, August, September, October, November, December
8c	270111E 7378801S	Freshwater section Twelve Mile Creek upstream of Twelve Mile Road. Includes pools fringed with Typha and Eleocharis sp. Approximately 800 m upstream of corridor crossing of Twelve Mile Creek	April, June, July, August, September, October, November, December
9a	273668E 7377863S	Seasonal wetlands (both artificial and natural) associated with Pelican Creek. Corridor transects upstream section of wetland. The majority of wetland habitat extends to east	April, June, July, August, September, October, November, December
9b	273585E 7377768S	Small, semi-permanent constructed wetland fringed with Typha and Eleocharis sp. On western side of Twelve Mile Road and approximately 100 m west and upstream of corridor	April, June, July, August, September, October, November, December
10a	276457E 7377847S	Saltmarsh environs associated with the Raglan Creek oxbow. Also includes semi-permanent constructed wetlands, adjacent and to the south and southwest. This site is directly to the north of site 10b. Approximately 600 m north and downstream of corridor	April, June, July, August, September, October, November, December
10b	276551E 7377043S	A series of seasonal wetlands associated with Hourigan Creek. Includes natural saltmarshes and shallow, seasonal natural and constructed wetlands and levees. Corridor traverses eastern edge of area. Downstream of corridor	April, June, July, August, September, October, November, December
11	291225E 7366997S	A large, vegetated semi-permanent billabong associated with Darts Creek. Remnant vegetation surrounds site and includes Eucalyptus tereticornis	April, June, July, August, September and December
12	268699E 7379374S	Two small vegetated freshwater dams adjacent and to the east and west of the Toonda Port Alma Road. Approximately 500 m to west and upstream of corridor	April, June, July, August, September, October, November, December

7.2.4.3 Spring-season Avifauna Surveys

For terrestrial habitats, surveys were undertaken on foot along transects through selected areas representative of the variety of habitat types along the corridor. At each location, surveys were undertaken for a minimum of 30 minutes and the time spent at a location was determined by factors including habitat extent and level of bird activity at the time. Birds were identified from either direct observation and/or their vocalisation. Target species included: Squatter Pigeon (*Geophaps scripta*), Square-tailed Kite (*Lophoictinia isura*), Red Goshawk (*Erythrotriorchis radiatus*), Glossy Black Cockatoo (*Calyptrohynchus lathami*), and Black-chinned Honeyeater (*Melithreptus gularis*).

A variety of wetlands were surveyed for waterbirds. Each census was undertaken using binoculars and/or a tripod mounted spotting scope (25 to 60 times magnification). In the main, visual coverage of the full extent of the site was completed at least once with the survey duration dependent on factors like size of waterbody and number of birds present. At each location, surveys were conducted for a minimum of 20 minutes. Target species included: Black-necked Stork (*Ephippiorhynchus asiaticus*), Cotton Pygmy-goose (*Nettapus coromandelianus*), Radjah Shelduck (*Tadorna radjah*), Yellow Chat (*Epthianura crocea macgregori*) and Migratory waders.

These surveys were conducted by Lindsay Agnew on 2 to 6, 27 and 28 September 2007. The location of each survey site is provided in Figure 7.1 and Figure 7.2.

7.2.4.4 Target Species and Biodiversity Survey

A series of rapid biodiversity assessments and target species surveys were undertaken in a range of representative and/or distinctive habitat types throughout the project area. The survey program was undertaken between 18 and 31 November 2007 and implemented by Lindsay Agnew and Dr. Ed Meyer. Greg Ford provided assistance with Anabat call recording analysis.

The timing of the survey program was designed to coincide with warmer conditions when bioactivity is typically higher for all vertebrate fauna groups. The timing was considered particularly important as it enhanced the ability to detect target species, especially reptiles.

The field survey targeted a full suite of remnant, remnant regrowth and cleared habitats representative of those occurring throughout the extent of the project area. These areas were determined from the results of a review of aerial photography and vegetation mapping and field observations from the previous survey activities (i.e. preliminary biodiversity surveys, monthly Yellow Chat monitoring and spring-season avifauna surveys). The variety of field methodologies deployed and the survey effort applied at each survey area was influenced by the following:

- The presence, extent and condition of preferred habitat types for species of conservation significance
- The potential of an area to support higher biodiversity values, e.g. those areas forming part of a notably larger wetland or forested habitat area
- The potential of an area to support higher fauna movement values, e.g. riparian environments.

Survey activities undertaken to assess target species and biodiversity were applied on each survey night and survey day and included:

- *Diurnal ground searches*. These dedicated searches were undertaken for reptiles at selected sites (of approximately 2 ha (0.02 km^2) in area) and surveyed for a minimum of one survey per hour. Surveys were undertaken mid-morning to mid-afternoon of each survey day. Active ground searches were undertaken to locate active/inactive reptiles. Ground searches included rolling logs and rocks, raking soil at the base of trees and shrubs, searching under exfoliating bark on logs and standing dead or live trees and examination under debris
- *Morning and afternoon bird surveys*. Surveys were undertaken along foot transects through selected habitats, typically for a minimum of a 30 minutes. Surveys were conducted within three hours of sunrise and sunset of each survey day. Birds were identified from either direct observation and/or their vocalisation
- *Call playback surveys*. These surveys were undertaken for owls and a variety of cryptic wetland birds. For nocturnal birds, the procedure included playback of calls in a specified order with each species' call separated by several minutes of listening for responses and visual scanning (in the dark) of the immediate surrounds for birds. After all calls were broadcast, the call site and close vicinity were scanned by spotlight for approximately five to ten minutes. Calls were broadcast through a vehicle's stereo system. Target species included Rufous Owl (*Ninox queenslandica*), Powerful Owl (*Ninox strenua*), Grass Owl (*Tyto capensis*) and Barking Owl (*Ninox connivens*). Once a species was detected, no further calls of that species were broadcast for the remainder of the survey program. For wetland sites, target species included Lewin's Rail (*Rallus pectoralis*), Buff-banded Rail (*Gallirallus philippensis*), Spotless Crake (*Porzana tabuensis*) and Bush Hen (*Amaurornis olivaceus*). The procedure included playback of calls for three to five minutes per species. Each species call was separated by several minutes of listening for responses and visual scanning of the immediate surrounds of the call site. Call recordings for wetland avifauna were sourced from Stewart (1999) and those for nocturnal birds were sourced from Stewart (1998)
- *Anabat ultrasonic call detection surveys*. The survey program for insectivorous bat fauna was undertaken using electronic bat detectors. Remote detection techniques with Anabat II detectors were used to record the ultrasonic signals of active bats. Remote detection (i.e. equipment programmed for unattended, fixed point, overnight detection of microbat calls) was conducted on six survey nights (dusk to dawn)
- *Walking spotlight surveys*. These surveys were undertaken at a variety of potentially suitable forested and wetland sites. Spotlighting surveys on foot were undertaken using 30-Watt spotlights and low-wattage headlamps. Depending on the habitat characteristics, approximately half of the search effort was dedicated to arboreal searches with the remaining time spent on ground searches for nocturnal herpetofauna and ground mammals (e.g. bandicoots). Where applicable, arboreal surveys targeted mammals (e.g. possums and gliders), nocturnal birds (e.g. owls and nightjars), reptiles (e.g. snakes and geckos) and flying mammals (e.g. flying foxes).
- *Driving spotlight surveys*. Driving spotlight searches were undertaken from a four-wheel drive vehicle along the track system within the project area (i.e. driver plus one observer with 100-Watt spotlight). These were conducted for a minimum of 30 minutes on each of the survey nights. Driving spotlight searches were undertaken primarily to survey for larger arboreal and ground mammals (e.g. macropods, foxes, cats and dogs). Additional road transects were also conducted specifically to survey for herpetofauna
- *Waterbody/wetland surveys*. A variety of waterbodies/wetlands were surveyed for waterbirds, waders and freshwater turtles. For avifauna, a census was undertaken using binoculars and/or a tripod mounted spotting scope (25 to 60 times magnification). Visual coverage of the full extent of the site was completed at least once with the census duration dependent on factors like the size of the waterbody and number of birds present. At each site, an additional inspection of the waterbody surface and margins was undertaken to assess the presence of freshwater turtles. Binoculars and/or a tripod mounted spotting scope were used to confirm turtle identification

- *Inferential evidence.* Inferential evidence of fauna occurrence was sought and found throughout the project area. This included: visual inspections of trees for trunk scratches/rubbings; searches for both predator and non-predator scats; fauna tracks; and other signs of fauna occurrence (e.g. feeding debris, shed skins and nests). Only evidence, which could be categorised as definitive, was used to record a species occurrence on the study site. Scats or pellets found were either identified in the field (using Triggs 1996) or collected and sent for identification and content analysis by Barbara Triggs, 'Dead Finish', Victoria (faeces analyst). Results were subsequently categorised into one of three reliability classes: definite; probable; or possible.

The location of each survey site and associated survey activities (e.g. call playback and Anabat surveys) is provided in Figure 7.1 and Figure 7.2.

Queensland EPA was consulted regarding the abovementioned survey program and considered it suitable (including specifically the non-trapping approach) given the nature and condition of habitat within the project area and the nature of the project. Consultation with Queensland EPA was undertaken through the Central Region Planning Division, Queensland EPA Rockhampton.

7.3 Assumptions and Limitations

All habitat assessments and fauna surveys were conducted during the period April to November 2007. Although there were moderate amounts of rainfall in late winter and early November 2007, rainfall coverage was patchy, and only the early November rainfall promoted reasonable vegetative growth (particularly in relation to diversity and biomass of grasses) in areas where rainfall was heaviest. Much of the region still exhibited the effects of having experienced drought conditions for an extended period (more than five years).

Consequently, there was a scarcity of permanent to semi-permanent waterbodies within the project area at the time of sampling and conditions sampled here should not be considered as representative of conditions at other times. In respect of water birds, whilst aquatic habitats were restricted in number and size, recorded species diversity was considered sound, though abundance was considered depressed.

Several native fauna groups were poorly represented within the recorded assemblage and/or in low abundance. These were the arboreal mammals, bats, frogs (arboreal, ground-dwelling and burrowing taxa) and elapid snakes. A variety of factors may be linked to these results and include:

- The effect of prolonged dry conditions on the presence and/or extent of favourable conditions and resources (e.g. very limited areas of surface water and depressed frog activity)
- The condition, absence or scarcity of certain key structural habitat resources in parts of the project area, e.g. suitable tree hollows (arboreal mammals), fallen timber (mainly herpetofauna) and sparse ground cover conditions (small ground mammals and skinks).

Several target species for the field investigations are cryptic and difficult to detect (e.g. crakes, rails, Grey Snake (*Hemiaspis damelii*), Yakka Skink (*Egernia rugosa*)). Under optimal conditions, surveys undertaken at multiple time periods would be required to confirm the absence (or otherwise) of these species from a site. This survey limitation has been minimised by the use of previous records, in conjunction with habitat assessment, to predict which species are likely to occur.

It is probable that additional species would be detected with more survey effort, particularly those species whose activity (and thus chances of detection) is higher during wetter periods. Potential limitations of the fauna survey were primarily associated with:

- Several years of dry to very dry (drought) field conditions prior to survey period. Such conditions are likely to have resulted in generally lower abundance of most fauna groups overall and significantly constrained the opportunity to determine the occurrence of a number of cryptic amphibian and reptile species that are more readily detected at other times of the year or weather conditions
- A low abundance of flowering plants throughout the project area, in particular canopy trees which is linked to the above point. Blossom provides an important source of food (e.g. nectar and pollen) and invertebrate prey for birds, microbats, flying foxes and small glider species. The diversity and abundance of small insectivorous birds (e.g. honeyeaters) are likely to be lower than could be expected as a result.

There were no notable or permanent impediments to accessing the extent of the project area, and where individual property access was not granted, surveys were undertaken at adjacent sites or public areas.

7.4 Relevant Legislation and Policy

Commonwealth and State (Queensland) legislation and policies relevant to this assessment include the following:

- *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
- *National Strategy for the Conservation of Australia's Biological Diversity 1996* (Commonwealth)
- *Nature Conservation Act 1992* and regulations (Queensland)
- *Vegetation Management Act 1999* (Queensland) and QEPA Essential Habitat Maps
- *Land Protection (Pest and Stock Route Management) Act 2002* (Queensland)
- *Coastal Protection and Management Act 1995* and *State Coastal Management Plan* (Queensland)

Australia is committed to a variety of international conventions, which apply generally to the construction and operation of the proposed project and are relevant through the administration of the *EPBC Act*. These are:

- JAMBA: the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1974
- CAMBA: the Agreement between the Government of Australia and the Government of China for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1986
- *Ramsar Convention*: the Convention on Wetlands of International Importance 1971
- *Bonn Convention*: the Convention on the Conservation of Migratory Species of Wild Animals 1979
- *Convention on Biological Diversity 1993*.

The Australian Pipeline Industry Association (APIA) *Code of Environmental Practice – Onshore Pipelines (2005)* identifies a range of best practice techniques and methods presently available to mitigate or eliminate the environmental impact of pipeline construction and operation on the receiving environment. The code aims to provide guidance and direction in the management of the environmental aspects of pipeline planning, design, construction, operation and decommissioning.

See Chapter 6, Section 6.1 for a summary, and Appendix G for an assessment specifically dealing with the project's relevant matters of National Environmental Significance (Threatened Species and Ecological Communities) under the EPBC Act.

7.5 Baseline

7.5.1 Existing Information Review

7.5.1.1 Matters of National Environmental Significance

Matters of National Environmental Significance (NES) are protected under the EPBC Act and include:

- World Heritage properties, i.e. Australian property on the World Heritage List kept under the World Heritage Convention or a property declared to be a World Heritage property by the Commonwealth Environment Minister
- National Heritage places, i.e. a place identified on the National Heritage List, including natural, historic and Indigenous places that are of outstanding national heritage value to the Australian nation
- Ramsar wetlands of international importance, i.e. either an Australian wetland on the List of Wetlands of International Importance kept under the Ramsar Convention or a wetland declared to be a Ramsar wetland by the Commonwealth Environment Minister
- Threatened species and ecological communities;
- Migratory species
- Commonwealth marine areas, i.e. any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, which are not State or Northern Territory waters. Generally, the Commonwealth Marine area stretches from three nautical miles to two hundred nautical miles from the coast
- Nuclear actions.

7.5.1.2 Protected Places

No World Heritage properties, National Heritage places or Commonwealth Marine areas are directly associated with, or adjacent to, the project area and the proposed pipeline does not involve any nuclear action. The Great Barrier Reef (World Heritage property) and Shoalwater and Corio Bays (Ramsar wetlands) are at least 40 km to the east of the project area.

Threatened and Migratory Fauna

The review of existing information sources (including an EPBC Protected Matters database search) for the wider area within 30 km of the project area provided records for a variety of Threatened and/or Migratory species as listed under the EPBC Act. These species, with relevant conservation status and notes on habitat and distribution are provided in Table 7.2 and Table 7.3.

Protected Area Management, Species Recovery and Conservation Plans

The EPBC Protected Matters database search found a number of protected areas, though all are distant to the project area. These include:

- World Heritage Properties: Great Barrier Reef QLD
- Wetlands of International Significance (Ramsar Sites):
  - Shoalwater and Corio Bays Area (Shoalwater Bay Training Area, in part – Corio Bay). The southern boundary is approximately 50 km north of Rockhampton and the majority of the area falls within the Shoalwater Bay Military Training Area (SWBTA)
- Register of the National Estate (Australian Heritage Database):
  - Great Barrier Reef QLD
  - Curtis Island (part), Curtis Island, QLD, Australia. The National Estate area occupies the eastern half of Curtis Island, which is separated from the mainland by a narrow passage
  - Garden Island Environmental Park, Curtis Island, QLD, Australia. A small area of the southern extremity of Curtis Island, 5km north of Gladstone.

There are management plans for the Great Barrier Reef and Curtis Island. In addition, the Southeast Queensland Regional Coastal Management Plan provides management guidelines for these areas.

As at October 2007, there are no recovery plans adopted under the EPBC Act, or any draft recovery plans open for public comment, which are relevant to Threatened or Migratory fauna species known or likely to occur within the project area. Currently, there is a recovery plan in preparation for the Yellow Chat (*Epthianura crocea macgregori*) (August 2007).

In August 2008, a recovery plan for the Yellow Chat (*Epthianura crocea macgregori*) was released by the Commonwealth and Queensland governments (Houston and Melzer 2008). The recovery plan lists the following as threats to Yellow Chats:

1. Lack of knowledge regarding key aspects of Capricorn Yellow Chat ecology and habitat requirements.
2. Construction of barriers such as extensive levee banks for ponded pasture development or road works within tidal areas.
3. Construction of impoundments (weirs and dams or ponded pastures) upstream of areas supporting Yellow Chats.
4. Spread of exotic pasture grasses, particularly aleman grass and Olive hymenachne.
5. Increase in cattle stocking densities where chats currently occur.
6. Uncontrolled fire.

Field survey work undertaken to investigate potential Yellow Chat habitat within the project area will contribute to the understanding of Yellow Chat occurrence and habitat usage (thus support resolution of threat #1). In relation to threats 2 and 3, the project does not involve development of levee banks or impoundments and is supported by a extensive range of impact avoidance and mitigation strategies in relation to construction works within or near wetlands, thus the project will not exacerbate the effects of threats 2 and 3. In relation to threat 4, a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of environmental weeds within the project area (see Chapter 20, Planning Environmental Management Plan). Likewise, there are a suite of project controls designed to eradicate and environmental weeds which may establish within the project area and adjoining land. In relation to threat 5, the project does not involve the introduction of cattle and a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of introduced fauna within the project area (see Chapter 20, Planning Environmental Management Plan). In relation to threat 6, protocols have been prepared to ensure minimal risk of fire emanating from the project area (See Chapter 16, Hazard and Risk; and Chapter 20, Planning Environmental Management Plan).

The Commonwealth has produced a series of Action Plans for mammals (Maxwell *et al.* 1996), reptiles (Cogger *et al.* 1993), frogs (Tyler 1997) and birds (Garnett and Crowley 2000) which include information on a variety of species known or likely to occur within the project area. These are strategic documents review the conservation status of major Australian taxonomic groups against World Conservation Union (IUCN) categories, identify threats and recommend actions to minimise those threats. They are intended to assist government and non-government organisations to establish national priorities for Threatened species conservation.

7.5.1.3 State Matters of Significance

Essential Habitat

Essential habitat is an area of vegetation in which a Rare or Threatened species is known to occur. Essential habitat areas are identified by the Queensland Environment Protection Agency (QEPA) as being crucial for the survival of a species of wildlife which has been listed as Endangered, Vulnerable, Near-Threatened or Rare under the NC Act. Essential habitat is a major constraint and all areas should be avoided in order to minimise any potential disturbance to areas of known ecological value.

Essential habitat mapping was sought from the Department of Natural Resources and Water (DNRW; i.e. the *VM Act* Essential Habitat Map) for an area within 20 km of the project area. There are no areas of essential habitat mapped within or adjacent to the project area. There are two areas of essential habitat mapped within 20 km of the project area. These areas are

upstream and well beyond any direct influence of project area, being approximately 10 km to the west of project area and 4 km south of Bouldercombe.

Wildlife Corridors

State wildlife corridors are areas of vegetation that have been identified by the QEPA as vital habitat for Migratory species in Queensland. Data on the location of wildlife corridors that occur within the project area was obtained from QEPA. Data is provided in Chapter 6, Terrestrial Flora.

Rare and Threatened Fauna

The review of existing information sources (including a QEPA Wildlife Online database extract) for the area within a 30 km radius of the project area provided records for a variety of Rare and Threatened species as listed under the NC Act. These species, with relevant conservation status and notes on habitat and distribution are provided in Table 7.2 and Table 7.3.

Protected Area Management, Species Recovery and Conservation Plans

There are a variety of protected areas in the region, though all are distant to the project area. These include:

- Limestone Creek Conservation Park
- Mount Archer National Park
- Garden Island Conservation Park
- Mackay/Capricorn Marine Park
- Rodds Bay Dugong Protection Area.

Whilst there are no management plans for the specific areas, the Southeast Queensland Regional Coastal Management Plan provides management guidelines for coastal protected areas.

As at October 2007, the *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 – 2016* is the only QEPA management plan relevant to Rare or Threatened fauna species known or likely to occur within the project area.

Table 7.2 List of Rare and Threatened Fauna Derived from Review of Existing Information

Status:	CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory
Legislation:	EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (Cth) NCA = *Nature Conservation Act 1992* (Qld)
Primary Sources:	QEPA Wildlife Online Extract and EPBC Online Protected Matters Report (August 2007)

Species	EPBC status	NCA status	Species profile notes and regional context
Koala (Southeast Qld) (*Phascolarctos cinereus*)		RV	Arboreal folivore occurring in low density in *Eucalyptus* woodland and forest. Riparian habitats likely to be important both as foraging habitat and as movement corridors.
Ghost Bat (*Macroderma gigas*)		V	Highly restricted regional distribution which is influenced by availability of large complex caves or mine adits as roost sites (Churchill 1998).
Semon's Leaf-nosed Bat (*Hipposideros semoni*)	E	V	Core distribution from Cape York Peninsula to Cooktown, though tentative records suggest that it may also occur in disjunctive populations further south in the Mt. Windsor Tableland area, Kroombit Tops National Park, or even as far south as St. Mary's State Forest near Maryborough (Thomson *et al.* 2002, Schulz and de Oliveira 1995, de Oliveira and Pavey 1995, and Coles *et al.* 1996 cited in Thomson *et al.* 2002). Roosts in cavernous sites and may be an obligate cave dweller, though recorded from other man-made structures, e.g. abandoned mines (Hall 1995). May favour rock escarpment country where it roosts under rock overhangs and in shallow caves (Thomson *et al.* 2002). North Queensland habitats described as rainforest, forest, open woodland and vine thickets (Hall *et al.* 2000).
Grey-headed Flying-fox (*Pteropus poliicephalus*)	V		Occurs along the east coast of Australia, from Gladstone to southwest Victoria and within sub-tropical and temperate forests, including rainforest, tall sclerophyll forest and woodlands, heath, paperbark swamps and also occurs within urban and agricultural areas where food trees are cultivated (Churchill 1998, Duncan *et al.* 1999). Favours fruits of rainforest trees, nectar and pollen of *Myrtaceae*, *Proteacea* and rainforest tree species, though also feeds on fruit from introduced species (Eby 1991 Tidemann 2002). Roost sites (camps) are usually traditional, regularly used and occupied when suitable food resources are available in the surrounding area (Hall and Richards 2000).

Species	EPBC status	NCA status	Species profile notes and regional context
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	R	Northern range limits to about Blackdown Tableland/Rockhampton (Hoye and Dwyer 2000). In region, only recorded from extensive areas dry and wet sclerophyll forest, i.e. Carnarvon Gorge National Park (*pers comm.* G. Ford 2004). Cave dwelling species, though also known to roost in mine tunnels and abandoned Fairy Martins nests (Hoye and Dwyer 2000).
Greater Long-eared Bat (*Nyctophilus timoriensis*)	V	V	Known current northern range limits in Theodore/Moura district. Few records in southern Brigalow Belt, mainly from shrubby open forest and woodland habitats (McFarland *et al.* 1999). Roost in tree hollows, fissures in branches, and under sheets of bark (Churchill 1998, Parnaby 2000).
Little Pied Bat (*Chalinolobus picatus*)		R	Occurs in a variety of woodland and shrubland habitats and roosts in caves, mines, rocky outcrops, buildings and tree hollows (Churchill 1998).
Coastal Sheathtail Bat (*Taphozous australis*)		V	Distributed along a thin coastal band (including some off-shore islands) from Shoalwater Bay to Torres Strait (Clague *et al.* 1999). Believed to be unevenly distributed throughout its range due to a reliance on coastal roosts (e.g. sea caves) resulting in a distribution extending no more than a few kilometres inland (Richards 1995a, Churchill 1998, Clague *et al.* 1999). Within its southern distribution, i.e. Shoalwater Bay area, it is has been regarded as abundant to uncommon (Catling *et al.* 1994 in Clague *et al.* 1999). Known to forage in vegetation of sand dune scrub, mangroves, *Melaleuca* swamps, coastal heathlands, open *Eucalyptus* forest and grasslands (Richards 1995a, Clague *et al.* 1999, Hall *et al.* 2000).
Estuarine Crocodile (*Crocodylus porosus*)		R	Inhabits coastal rivers, estuaries and wetlands along Queensland coast south to about Rockhampton (Queensland Museum 2000).
Fitzroy River Turtle (*Rheodytes leukops*)	V	V	Restricted to Fitzroy River catchment. Prefers combination of deep pools connected by shallow riffles, high water quality and extensive beds of Ribbon Weed (*Vallisneria* sp.) on which it feeds (Legler and Cann 1980, Cogger *et al.* 1993).
Collared Delma (*Delma torquata*)	V	V	Endemic to SEQ. Highly restricted, disjunct populations from outer Brisbane western suburbs to Blackwater, central Qld (DEH 2005b). A cryptic reptile known from mainly open, rocky terrain on basalt and lateritic soils with open *Eucalyptus* and *Acacia* woodland with a sparse cover of tussock grass and shrubs or semi-evergreen vine thicket (Wilson 2005a, Ryan 2006).
Brigalow Scaly-foot (*Paradelma orientalis*)	V	V	Endemic to region. Brigalow forest and *Eucalyptus* woodland with tussock grass ground cover (Cogger *et al.* 1993). Ground micro-habitat diversity appears to be an important habitat attribute (Wilson and Knowles 1998).
Anomalopus brevicollis (no common name)		R	Endemic to region. Open sclerophyll forest, vine thicket, rainforest habitats on sandy or cracking clay-based soils and rock outcrops (Cogger 2000, Wilson 2005a).
Yakka Skink (*Egernia rugosa*)	V	V	Lives in communal burrows within dry open forest and woodland, often featuring coarse gritty soils near low rocky outcrops (Cogger 2000, Wilson 2005a).
Common Death Adder (*Acanthophis antarcticus*)		R	Formerly abundant in parts of the Brigalow Belt, though numbers have declined dramatically (Wilson 2005a). In a wide variety of habitats including wet and dry sclerophyll forest, woodland, shrublands and heaths (Wilson and Knowles 1998).
Ornamental Snake (*Denisonia maculata*)	V	V	Endemic to region. Specialist frog predator (Shine 1983). Seasonally inundated areas (esp. gilgai in Brigalow) with deep cracking soils of woodland, shrubland and natural levees (Ehmann 1992, Wilson 2005a, DEH 2005c).
Yellow-naped Snake (*Furina barnardi*)		R	Endemic to region. Taxonomy status and ecology uncertain. A skink predator from dry woodlands and rock outcrops (Wilson 2005a).
Dunmall's Snake (*Furina dunmali*)	V		Few records in region (e.g. Expedition Range National Park; DEH 2005a). Open forest and woodland (including brigalow, belah and cypress pine) on cracking black clay and clay loam soils (Cogger *et al.*1993, Wilson 2005a). *Eulamprus* skinks may form an important component of diet (Shine 1981).

Species	EPBC status	NCA status	Species profile notes and regional context
Grey snake (*Hemiaspis damelii*)		E	Restricted distribution extending from central inland NSW, northeast to coastal districts near Rockhampton (Wilson and Swan 2003). Potentially a frog specialist with crepuscular habits (Shine 1987). Known from floodplains and woodlands, usually on heavier, cracking clay soils (Cogger 2000, Wilson and Swan 2003). May favour woodlands on heavier, cracking clay soils, in association with waterbodies (Wilson and Swan 2003).
Ornamental Snake (*Denisonia maculata*)	V	V	Endemic to region (Cogger *et al.*1993). Specialist frog predator diet (Shine 1981). Seasonally inundated areas (especially gilgai in Brigalow) with deep cracking soils of woodland, shrubland and natural levees (Ehmann 1992, Cogger 2000, Wilson 2005a).
Tusked Frog (*Adelotus brevis*)		V	Known from a variety of rain forest, wet sclerophyll forest, and occasionally from dry forest communities (Czechura 1995a, Meyer *et al.* 2001). It is also known to persist in heavily disturbed sites e.g. pasture land (Czechura 1995a), though the viability of these populations is unknown (Hines *et al.* 1999).
Radjah Shelduck (*Tadorna radjah*)	M	R	Inhabits shallow, freshwater and saline wetlands of coastal and near-coastal areas north from about Maryborough (Marchant and Higgins 1990). Know to use both natural and artificial wetlands and feeds on invertebrates and seeds along shallow wetland margins (Frith 1982b).
Cotton Pygmy-goose (*Nettapus coromandelianus*)	M	R	Wholly aquatic small duck on deeper permanent freshwater wetlands (natural or artificial) which support patches of abundant growth of floating and submerged macrophytes (e.g. pondweeds and waterlilies) in combination with areas of open water (Frith 1982b). Occurs throughout coastal areas of Queensland from about Brisbane to Princess Charlotte Bay, though also on inland waterbodies of Central Queensland (Marchant and Higgins 1990).
Black-necked Stork (*Ephippiorhynchus asiaticus*)		R	Prefers large terrestrial wetlands (though also smaller waterbodies nearby) and forages in shallow water (<0.5m) for a variety of fish and other small vertebrates (Marchant and Higgins 1990).
Square-tailed Kite (*Lophoictinia isura*)	M	R	Extensive areas of open forest and woodland, particularly those on fertile soils with abundant populations of passerine birds (Debus and Czechura 1989, Marchant and Higgins 1993).
Grey Goshawk (*Accipiter novaehollandiae*)	M	R	Secretive predator of small birds in forest habitats that provide the preferred dense shaded tree canopies including rainforests, gallery and wet sclerophyll forest (Marchant and Higgins 1993).
Red Goshawk (*Erythrotriorchis radiatus*)	V & M	E	These raptors require a very large home range. Distribution uncertain in region, though known from the eastern sector. Very large home ranges (e.g. 50 to 220 km^2 (Debus 2001)) including open forests and woodlands, tropical savannas traversed by riverine vegetation (Garnett and Crowley 2000). In partially cleared areas of eastern Queensland associated with gorge and escarpments (Czechura and Hobson 2000).
Grey Falcon (*Falco hypoleucos*)	M	R	Reaches eastern distribution limits within region and likely to only occur as a very Rare, non-breeding visitor (Marchant and Higgins 1993).
Black-breasted Button-quail (*Turnix melanogaster*)		V	Inland to Palm Grove National Park, with records throughout both Dawson and Fitzroy River catchments (Hamley *et al.* 1997). Variety of dry closed forests, particularly semi-evergreen vine thickets, though also recorded from softwood scrubs in the brigalow belt (Hamley *e. al.* 1997). Requires a largely closed canopy, permanent, usually damp leaf litter layer (25 to 35 mm), and annual rainfall (800–1200mm) (Boorsboom and Smith 1997, Garnett and Crowley 2000).
Beach stone-curlew (*Esacus neglectus*)		V	Occurs exclusively within coastal environments using a variety of sheltered and open beaches (sandy, muddy or rocky), often around mouths of rivers and beaches associated with mangroves (Marchant and Higgins 1993, Geering *et al.* 2007). Forages within exposed inter-tidal areas, with nest sites (September to February) typically located landward side of sandy beaches (Marchant and Higgins 1993).
Painted Snipe (*Rostratula benghalensis*)	V & M	V	Occurrence erratic and unpredictable, seldom remaining long in any locality (Marchant and Higgins 1993). Well-vegetated shallow, permanent or seasonal wetlands where it forages on soft muds and in shallow water for invertebrates (Marchant and Higgins 1993, Geering *et al.* 2007).
Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*)	V		Ground-dweller of drier *Eucalyptus* woodland with sparse grass cover in close proximity to permanent water (Frith 1982a). Known to use improved pasture, though allways near permanent water (Garnett and Crowley 2000, Higgins and Davies 1996).

Species	EPBC status	NCA status	Species profile notes and regional context
Glossy Black Cockatoo (*Calyptrohynchus lathami*)		V	Highly restricted distribution in eastern parts of region (Barrett *et al.* 2003). Dependent on seeds of *Allocasuarina/Casuarina* and hollow-bearing trees for breeding in *Eucalyptus* forest and woodlands (Higgins 1999).
Powerful Owl (*Ninox strenua*)		V	Favours large intact remnants of wet or dry sclerophyll forest, and dependent on large tree hollows for breeding and arboreal mammals are favoured prey (though their diet may vary regionally according to local availability of prey species) (Debus and Chafer 1997, Pavey 1994).
Rufous Owl (*Ninox rufa queenslandica*)		V	Occurs in a variety of forest types including gallery rainforest and paperbark thickets along creeks, rainforest and mangrove edges and vine thickets north of Rockhampton (Garnett and Crowley 2000, Queensland Museum 2000). Requires extensive home ranges and large tree hollows to nest (Higgins 1999).
White-rumped Swiftlet (*Collocalia spodiopygius*)		R	An aerial insectivore, spending most of the time feeding and sleeping on the wing over most habitat types, including cleared lands (Pizzey and Knight 2003). Southern range limits to about Mackay (Queensland Museum 2000). May occur as a casual visitor in coastal areas of southern Queensland (Pizzey and Knight 2003).
Painted Honeyeater (*Grantiella picta*)		R	Nomadic and occurring in low densities throughout its range across eastern and central Australia (Garnett and Crowley 2000). A breeding migrant to inland slopes of the Great Dividing Range in NSW, Victoria, and southern Queensland (October to March), with a higher likelihood of being recorded in the northern parts of its distribution during winter (September to February) (Higgins 1999, Pizzey and Knight 2003). A specialist frugivore, favouring fruits of mistletoe (especially *Amyema* spp.) which parasitize *Eucalyptus* and *Acacia* within a wide variety of woodland habitats (Oliver *et al.* 1998, Higgins 1999).
Black-chinned Honeyeater (*Melithreptus gularis*)		R	Distributed throughout eastern Australia to about Rockhampton and known from dry *Eucalyptus* woodland within an annual rainfall range of 400 to 700 mm, particularly associations with ironbark and box eucalypts (Garnett and Crowley 2000, Higgins *et al.* 2001). May also favour timbered watercourses with sparse understorey (Pizzey and Knight 2003). Feeding territories are large making it locally nomadic and research in the southern parts of range indicates that birds tend to occur in the largest woodland patches in the landscape and do not persist in remnants smaller than 200 ha (NSW SC 2001).
Yellow Chat (*Epthianura crocea macgregori*)	CE	E	Endemic to area and known from Curtis Island, the Torilla Plain and Fitzroy River delta, though seasonally mobile and possibly also occurs in other localities (Jaensch *et al.* 2004, Houston *et al.* 2004a). Known from freshwater and saline wetlands on marine plains including swampy grassland, saline herbland, saltmarshes, *Cyperus* sedgelands (Houston *et al.* 2004b). All sites where the Yellow Chat has are known to persist year-round are associated with drainage channels on coastal marine plains connected to tidally influenced wetlands (Houston *et al.* 2004a, Houston 2004). Typical breeding habitat is a network of braided channels flanked by rank vegetation (rushes, sedges or grass) that provides shelter adjacent to muddy substrates for foraging (Houston *et al.* 2004b). Dry season habitat requirements are under investigation and may be critical to the Chat's conservation (Houston *et al.* 2004b, QEPA 2005).
Black-throated Finch (sth. subsp.) (*Poephila cincta cincta*)	E	V	Currently only considered to be locally common near Townsville and Charters Towers (DEC and QWPS 2004). A seedeater known from a variety of grassy savannah woodland habitats dominated by *Eucalyptus* and/or *Corymbia*, though also woodlands dominated by *Melaleuca* and/or *Acacia* tree species (DEC and QWPS 2004, Higgins *et al.* 2006). On the coastal plains, grassy *Pandanus* savannah is also used (Pizzey 1991 in TSSC 2005). An open understorey of seeding perennial and annual grasses and available surface water are essential resources (Zann 1976, Higgins *et al.* 2006). Riparian woodland habitat is thought to be of particular importance (DEC and QWPS 2004, TSSC 2005). Nests in trees, sometimes in hollows (Zann 1976).
Star Finch (sth. subsp.) (*Neochmia ruficauda ruficauda*)	E	E	A seedeater of grassy woodlands and grasslands close to fresh water, though also recorded in cleared or suburban areas such as along roadsides and in towns (Holmes 1996 and 1998). Sites where recent records have been obtained have been dominated by grasses or have been in areas where the native vegetation has been partially cleared (DEWHA 2007a). Studies at nine former sites found that the habitat consisted mainly of woodland and dominated by trees that are typically associated with permanent water or areas that are regularly inundated; the most common species being *Eucalyptus coolabah, E. tereticornis, E. tessellaris, Melaleuca leucadendra, E. camaldulensis* and *Casuarina cunninghamii* (Holmes 1996). Population estimates of about 50 mature individuals in four confirmed sub-populations scattered across central Queensland (e.g. Wowan and Aramac districts) (Garnett and Crowley 2000, DEWHA 2007a).

Species	EPBC status	NCA status	Species profile notes and regional context
Crimson Finch (*Neochmia phaeton*)		V	Inhabits tall grassland with pandanus trees near watercourses on coastal plains, usually in the vicinity of water (Immelman 1982). *Neochima phaeton* subsp. is the nominate sub-species and distributed from the Kimberley (WA) to the Barkly Tableland (northwest Queensland) and on the east coast of Queensland from Princess Charlotte Bay and Broad Sound to the drainage basins of the lower Dawson and Mackenzie Rivers (Dorricott and Garnett 2006, DEWHA 2007b). Race *iredalei* reaches southern coastal limits around Mackay (Pizzey and Knight 2003). Race *evangelinae* occurs on Cape York Peninsula and listed as Vulnerable under the EPBC Act. *Neochmia phaeton* is listed as Vulnerable at the species level in Queensland under the NC Act, where both occur. Under the NC Act, sub-species that are not listed separately are considered to have the same conservation status as the species (QEPA 2007).
Pictorella Mannikin (*Heteromunia pectoralis*)		R	Woodlands with a grassy understorey, spinifex grassland, grassy riverine flats near water (Immelman 1982). Can be locally common inland during suitable wet season conditions, then may move over long distances coastward during the dry season (Pizzey and Knight 2003).

Table 7.3 List of Migratory fauna derived from review of existing information

Status:	CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory
Legislation:	EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (Cth) NCA = *Nature Conservation Act 1992* (Qld)
Primary Sources:	QEPA Wildlife Online Extract and EPBC Online Protected Matters Report (August 2007)

Species	EPBC status	NCA status	Species profile notes and regional context
Magpie Goose (*Anseranas semipalmata*)	M		A variety of wetland habitat types may be used depending on seasonal characters, including artificial waterbodies (Frith 1982b). Typically large wetlands, though also dams which are well-vegetated (particularly rushes and sedges), flood plains and wet grasslands (Frith 1982b, Marchant and Higgins 1990).
Hardhead (*Aythya australis*)	M		A widespread and relatively common duck of permanent freshwater lakes and swamps (natural or artificial), typically on deep, still reaches of open water (Frith 1982b, Marchant and Higgins 1990).
Musk Duck (*Biziura lobata*)	M		Widely distributed in southern Australia, though uncommon in northern parts of distribution, i.e. southern Queensland to Fraser Island (Marchant and Higgins 1990). Favours deep, permanent water with a combination of dense vegetation and open water (Frith 1982b).
Australian Wood Duck (*Cheonetta jubata*)	M		A widespread and relatively common duck of lightly timbered areas near water (natural or artificial wetlands) where there is short grass or herbage beneath trees (Frith 1982b). Highly dispersive in ephemeral habitat with movements localised in better-watered areas (Marchant and Higgins 1990).
Wandering Whistling Duck (*Dendrocygna arcuata*)	M		A widespread and relatively common duck of tropical (though also sub-tropical) regions and associated with natural and artificial wetlands (Frith 1982b). Favours extensive freshwater lagoons and swamps, though also estuarine and littoral habitats (Marchant and Higgins 1990).
Plumed Whistling Duck (*Dendrocygna eytoni*)	M		A widespread and relatively common duck of northern and eastern Australia (Marchant and Higgins 1990). Favours tropical coastal and inland grasslands and occurs on both natural and artificial wetlands (Frith 1982b).
Radjah Shelduck (*Tadorna radjah*)	M	R	Inhabits shallow, freshwater and saline wetlands of coastal and near-coastal areas north from about Maryborough (Marchant and Higgins 1990). Know to use both natural and artificial wetlands and feeds on invertebrates and seeds along shallow wetland margins (Frith 1982b).
Black Swan (*Cygnus atratus*)	M		A widespread and relatively common swan of found on almost any wetland habitat, though more numerous on large permanent waterbodies, either fresh or brackish, natural or artificial (Frith 1982b).

Species	EPBC status	NCA status	Species profile notes and regional context
Cotton Pygmy-goose (*Nettapus coromandelianus*)	M	R	Wholly aquatic small duck on deeper permanent freshwater wetlands (natural or artificial) which support patches of abundant growth of floating and submerged macrophytes (e.g. pondweeds and waterlilies) in combination with areas of open water (Frith 1982b). Occurs throughout coastal areas of Queensland. from about Brisbane to Princess Charlotte Bay, though also on inland waterbodies of Central Queensland (Marchant and Higgins 1990).
Green Pygmy-goose (*Nettapus pulchellus*)	M		Distributed throughout tropical coastal and near-coastal areas north from about Gladstone (Marchant and Higgins 1990). Wholly aquatic and prefers deeper, more permanent freshwater lagoons and waterbodies (either natural or artificial) which support waterlilies and sub-emergent aquatic vegetation (Frith 1982b).
Chestnut Teal (*Anas castanea*)	M		Relatively common and widespread within southern range, though less common in north, i.e. northern NSW and southern Queensland to about Rockhampton (Marchant and Higgins 1990). Occurs on terrestrial wetlands (natural and artificial) and saline habitats including estuaries, mangrove swamps and saltmarsh (Frith 1982b, Marchant and Higgins 1990).
Grey Teal (*Anas gracilis*)	M		A widely distributed and common duck and highly dispersive in response to climatic changes (Marchant and Higgins 1990). Occurs on almost any fresh, brackish, or saline wetland (either natural or artificial), though prefers billabongs, lagoons and floodwaters of inland rivers (Frith 1982b).
Australasian Shoveler (*Anas rhynchotis*)	M		A widely distributed duck of mainly temperate zone terrestrial wetlands of eastern Australia and less common in sub-tropics and tropics (Marchant and Higgins 1990). Known from a wide variety of wetland habitats (natural or artificial), though favours large, deep, permanent lakes and swamps (Frith 1982b). Specialist filter feeder, using open water and soft muds in fertile wetlands with abundant prey (Marchant and Higgins 1990).
Pacific Black Duck (*Anas superciliosa*)	M		A very common waterfowl, widely distributed throughout Australia within most fresh, brackish and sometime saline wetland habitats, either natural or artificial (Frith 1982b, Marchant and Higgins 1990).
Pink-eared Duck (*Malacorhynchus membranaceus*)	M		A widely distributed duck of mainly temperate zone terrestrial wetlands of eastern Australia, though uncommon to scarce in sub-tropics and tropics (Marchant and Higgins 1990). Almost entirely aquatic and specialist filter-feeder requiring open water and soft muds. Favours shallow, turbid inland terrestrial wetlands, though regularly coastal where mean annual rainfall <400 mm (Frith 1982b).
Great Egret (*Ardea alba*)	M		Estuaries and littoral habitats, permanent terrestrial wetlands and nearby flooded grasslands (Marchant and Higgins 1990).
Cattle Egret (*Ardea ibis*)	M		Typically associated with grazing cattle. Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats and drains (Pizzey and Knight 2003).
Glossy Ibis (*Plegadis falcinellus*)	M		Feeds in shallow water or on grassy or muddy verges of coastal and inland freshwater wetlands, also wet grasslands (Marchant and Higgins 1990). Avoids dry ground (Marchant and Higgins 1990).
Pacific Baza (*Aviceda subcristata*)	M		A relatively common raptor of forest, woodland, and treed urban environments in the tropics and sub-tropics (Debus 2001).
Black-shouldered Kite (*Elanus axillaris*)	M		A relatively common small raptor of open woodland, grassland, and farmland with scattered trees and probably benefits from fragmentation of continuous forest as it prefers forest edges (Debus 2001).
Brahminy Kite (*Haliastur indus*)	M		A relatively common, medium-sized raptor of inshore coastal and estuarine waters and adjacent terrestrial habitats, though occasionally occurring over forest or inland rivers in the tropics and sub-tropics (Debus 2001).
Whistling Kite (*Haliastur spenurus*)	M		A relatively common medium-sized raptor of most terrestrial habitats, except denser forests, and often around water, including estuaries, coastlines and inland drainages (Debus 2001).
Square-tailed Kite (*Lophoictinia isura*)	M	R	Extensive areas of open forest and woodland, particularly those on fertile soils with abundant populations of passerine birds (Debus and Czechura 1989, Marchant and Higgins 1993).

Species	EPBC status	NCA status	Species profile notes and regional context
Little Eagle (*Hieraaetus morphnoides*)	M		A relatively common medium-sized raptor of most wooded habitats, though typically avoiding denser forests (Debus 2001). Favoured habitats include woodland of rough hilly landscapes or of river gums in the inland (Debus 2001).
Collared Sparrowhawk (*Accipiter cirrhocephalus*)	M		A relatively common small, solitary and secretive raptor of most well-woodland habitats, including farmland and well-treed urban areas (Debus 2001).
Brown Goshawk (*Accipiter fasciatus*)	M		A relatively common medium-sized solitary and secretive raptor of most woodland habitats, including farmland and well-treed urban areas (Debus 2001).
Grey Goshawk (*Accipiter novaehollandiae*)	M	R	Secretive predator of small birds in forest habitats that provide the preferred dense shaded tree canopies including rainforests, gallery and wet sclerophyll forest (Marchant and Higgins 1993).
Red Goshawk (*Erythrotriorchis radiatus*)	V & M	E	These raptors require a very large home range. Distribution uncertain in region, though known from the eastern sector. Very large home ranges e.g. 50 to 220 km^2 (Debus 2001) including open forests and woodlands, tropical savannas traversed by riverine vegetation (Garnett and Crowley 2000). In partially cleared areas of eastern Qld. associated with gorge and escarpments (Czechura and Hobson 2000).
Osprey (*Pandion haliaetus*)	M		Mainly coastal, using a variety of Marine and littoral habitats (e.g. bays, estuaries, rivers) and terrestrial wetlands, though may also extend inland along larger river systems (Marchant and Higgins 1993). Prefers to forage in shallow water (of low turbidity) which contains sufficient fish stocks (prefers size class of 20 to 40 cm), although small terrestrial vertebrates, seabirds and crustacea have also taken (Clancey 1991, Marchant and Higgins 1993).
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	M		Prefers to hunt over large open waterbodies, though also over adjacent/nearby terrestrial habitats (Marchant and Higgins 1993).
Wedge-tailed Eagle (*Aquila audax*)	M		A relatively common large-sized raptor of most terrestrial habitats except intensively urbanised or cultivated areas (Debus 2001).
Swamp Harrier (*Circus approximans*)	M		A relatively common large-sized solitary raptor of lakes, swamps, grassland, coastal heath and tall crops (Debus 2001).
Spotted Harrier (*Circus assimilis*)	M		A relatively common large-sized solitary raptor of croplands, grasslands, low shrubland and open woodland in inland and northern Australia, though also occurs over coastal grassland, heath or swamps in southern parts of range (Debus 2001).
Brown Falcon (*Falco berigora*)	M		A relatively common, typically solitary medium-sized raptor of most open habits, though avoids denser forests (Debus 2001).
Nankeen Kestrel (*Falco cenchroides*)	M		A relatively common small raptor of most open habitats, though particularly farmland with scattered trees, inland shrublands and woodlands (Debus 2001).
Grey Falcon (*Falco hypoleucos*)	M	R	Reaches eastern distribution limits within region and likely to occur as a very Rare, non-breeding visitor (Marchant and Higgins 1993).
Australian Hobby (*Falco longipennis*)	M		A relatively common, solitary, small-sized raptor of most open habitats, including vegetated urban areas and is characteristic of open woodland and watercourses (Debus 2001).
Peregrine Falcon (*Falco peregrinus*)	M		A small-sized solitary and aggressive raptor occurring in most habitats, though characteristic of cliffs, escarpments and wetlands (Debus 2001).
Brolga (*Grus rubicundus*)	M		Widely distributed throughout northern and southeastern Australia and occurring on shallow vegetated wetlands, floodplains, grasslands, pasture and croplands (Pizzey and Knight 2003).

Species	EPBC status	NCA status	Species profile notes and regional context
Beach stone-curlew (*Esacus neglectus*)		V	Occurs exclusively within coastal environments using a variety of sheltered and open beaches (sandy, muddy or rocky), often around mouths of rivers and beaches associated with mangroves (Marchant and Higgins 1993, Geering *et al.* 2007). Forages within exposed inter-tidal areas, with nest sites (September to February) typically located landward side of sandy beaches (Marchant and Higgins 1993).
Latham's Snipe (*Gallinago hardwickii*)	M		Non-breeding summer migrant occurring in a variety of freshwater and brackish wetlands and feeds on soft wet ground or in shallow water for invertebrates, seeds and vegetation (Higgins and Davies 1996, Geering *et al.* 2007). This secretive wader is usually found close to dense ground cover (Garnett and Crowley 2000).
Little Curlew (*Numenius minutus*)	M		Non-breeding summer migrant. Coastal and inland habitats, occurring in a variety of drier, open grassland habitats including airfields and sports fields (Higgins and Davies 1996, Geering *et al.* 2007).
Whimbrel (*Numenius phaeopus*)	M		Non-breeding summer migrant. Prefers mudflats within mangrove habitats, though also forage at low tide on open tidal mudflats, on sandy beaches, and along banks of tidal rivers and creeks (Higgins and Davies 1996, Geering *et al.* 2007). Roost in mangrove trees, though also on muddy, sandy or rocky beaches (Geering *et al.* 2007).
Marsh Sandpiper (*Tringa stagnatilis*)	M		Non-breeding summer migrant. Forages for aquatic invertebrates in shallow waters of fresh and brackish wetlands (Geering *et al.* 2007). Often highly dispersive, with movements associated with seasonal changes in rainfall and availability of wetlands (Higgins and Davies 1996).
Common Greenshank (*Tringa nebularia*)	M		Non-breeding summer migrant. Forages for aquatic invertebrates in shallow waters of fresh and brackish wetlands (Geering *et al.* 2007).
Wood Sandpiper (*Tringa glareola*)	M		Non-breeding summer migrant, relatively uncommon, occurring mainly on inland freshwater wetlands and Rarely on inter-tidal mudflats (Geering *et al.* 2007).
Common Sandpiper (*Actitis hypoleucos*)	M		Non-breeding summer migrant. Wide range of coastal and inland habitats of varying salinities (Higgins and Davies 1996). Preferred coastal habitats include muddy inter-tidal zones of mangrove-lined estuaries, tidal rivers and creeks (Geering *et al.* 2007). Also muddy margins or rocky shores of wetlands, though large coastal mudflats apparently not favoured (Higgins and Davies 1996).
Red-necked Stint (*Calidris ruficollis*)	M		Non-breeding summer migrant. Occurs in a wide variety of coastal and inland wetland habitats from salt lakes, freshwater swamps, inter-tidal mudflats and sandy ocean beaches (Higgins and Davies 1996, Geering *et al.* 2007). More abundant coastally where it mainly feeds wet or drying mud near waterline on inter-tidal mudflats and roosts on sandy beaches (e.g. spits) (Lane 1987).
Sharp-tailed Sandpiper (*Calidris acuminata*)	M		Non-breeding summer migrant. Coastal and inland habitats, feeding for invertebrates in mud or shallow water along edges of shallow wetlands, lagoons, dams and sewage farms (Higgins and Davies 1996, Geering *et al.* 2007).
Curlew Sandpiper (*Calidris ferruginea*)	M		Non-breeding summer migrant. Occurs on both coastal and inland wetland habitats, though not as widespread as Red-necked Stint and Sharp-tailed Sandpiper (Higgins and Davies 1996). Prefers bare, wet, muddy surfaces and adjoining shallow water margins of fresh, saline, or brackish open waterbodies and wetlands (Higgins and Davies 1996, Geering *et al.* 2007).
Painted Snipe (*Rostratula benghalensis*)	V & M	V	Occurrence erratic and unpredictable, seldom remaining long in any locality (Marchant and Higgins 1993). Well vegetated shallow, permanent or seasonal wetlands where if forages on soft muds and in shallow water for invertebrates (Marchant and Higgins 1993, Geering *et al.* 2007).
Black-winged Stilt (*Himantopus himantopus*)	M		A widespread and relatively common breeding resident occurring on coastal and inland fresh and saline wetlands and on inter-tidal mudflats (Higgins and Davies 1996, Geering *et al.* 2007).
Red-necked Avocet (*Recurvirostra novaehollandiae*)	M		A widespread breeding resident occurring on fresh and saltwater wetlands, though also on inter-tidal mudflats of sheltered bays and inlets (Higgins and Davies 1996, Geering *et al.* 2007).
Red-capped Plover (*Charadrius ruficapillus*)	M		A widespread and common breeding resident on a variety of natural or artificial wetland habitats including sandy beaches, inter-tidal mudflats, shorelines of brackish lakes, saltmarshes, though also along margins of freshwater lakes and rivers (Higgins and Davies 1996, Geering *et al.* 2007).

Species	EPBC status	NCA status	Species profile notes and regional context
Black-fronted Dotterel (*Elseyornis melanops*)	M		A widespread and common breeding resident on a variety of habitats including margins of freshwater swamps and dams, either natural or artificial (Higgins and Davies 1996, Geering *et al.* 2007).
Red-kneed Dotterel (*Erythrogonys cinctus*)	M		A widespread breeding resident on a variety of habitats including margins of shallow, fresh or brackish inland and coastal wetlands (Higgins and Davies 1996, Geering *et al.* 2007).
Masked Lapwing (*Vanellus miles*)	M		A widespread and common breeding resident on a wide variety of habitats ranging from ocean beaches and mangrove-lined claypans to grasslands, pastures and urban open spaces, though usually close to water (Higgins and Davies 1996, Geering *et al.* 2007).
Banded Lapwing (*Vanellus tricolor*)	M		A widespread and relatively common breeding resident associated with drier grasslands and pastures of coastal and inland regions (Higgins and Davies 1996, Geering *et al.* 2007). Favours areas of very short grass or bare ground, including recently cultivated lands, either close to or distant to waterbodies (Geering *et al.* 2007).
White-winged Black Tern (*Chlidonias leucopterus*)	M		Surface feeds for small fish on open waters of Marine and estuarine habitats, freshwater lakes, reservoirs and rivers (Higgins and Davies 1996).
Oriental Cuckoo (*Cuculus saturatus*)	M		Highly restricted distribution (eastern parts of region) (Barrett *et al.* 2003). Prefers open forest habitat and woodland with a diverse, thick understorey. Occurrence is strongly linked to the outbreaks of caterpillars during summer (Pizzey and Knight 2003).
White-throated Needletail (*Hirundapus caudacutus*)	M		An aerial insectivore, spending almost most of the time feeding and sleeping on the wing (Pizzey and Knight 2003). Usually gliding ahead of weather changes, particularly rising air masses that precede summer thunderstorms and low pressure systems.
Fork-tailed Swift (*Apus pacificus*)	M		Non-breeding summer migrant (Pizzey and Knight 2003). As for White-throated Needletail.
Rainbow Bee-eater (*Merops ornatus*)	M		Aerial insectivore in a variety of treed habitats, low woody vegetation and adjacent cleared areas in which they forage aerially for mainly insects (Higgins 1999). Usually close to suitable breeding habitat, i.e. sandy substrates in which to excavate nest chambers (Pizzey and Knight 2003).
Clamorous Reed-warbler (*Acrocephalus stentoreus*)	M		A widespread and relatively common breeding resident of denser vegetation fringing waterbodies and wetlands, including reeds, bulrushes and occasionally crops near irrigation channels (Pizzey and Knight 2003).
Little Grassbird (*Megalurus gramineus*)	M		A widely distributed species within eastern Australia which may be locally common in habitats including dense vegetation (e.g. cumbungi, reeds, cane grass and lignum) associated with terrestrial wetlands, tidal marshes and mangroves, and along drainage lines (Pizzey and Knight 2003).
Tawny Grassbird (*Megalurus timoriensis*)	M		A relatively common breeding resident of densely vegetated habitats including coastal heaths, rank grasslands, cumbungi swamps, grassy dunes and crops (Pizzey and Knight 2003).
Brown Songlark (*Cinclorhamphus cruralis*)	M		A breeding resident widely distributed across central and southern Australia, and occurring in drier habitats, including pastures, cereal crops, and grassy open woodlands (Pizzey and Knight 2003). Highly nomadic, with numbers increasing coastally during inland drought (Pizzey and Knight 2003).
Rufous Songlark (*Cinclorhamphus mathewsi*)	M		A breeding resident widely distributed across mainland Australia and favouring open grassy woodlands and scrublands with dead and live trees (Pizzey and Knight 2003).
Golden-headed Cisticola (*Cisticola exilis*)	M		Common and widely distributed throughout coastal regions and to about 300km inland in suitable habitat (Pizzey and Knight 2003). Occurs in a wide variety of habitats including tall grasslands, rank herbage around wetlands, sewerage farms, overgrown margins of irrigation channels, irrigated pastures, grain crops, etc. (Pizzey and Knight 2003).

Species	EPBC status	NCA status	Species profile notes and regional context
Zitting Cisticola (eastern sub-species) (*Cisticola juncidis laveryii*)	M		Distribution restricted to three coastal regions within northern Australia, including Queensland eastern sub-species distribution from Townsville south to about Curtis Island, Gladstone area (Pizzey and Knight 2003). Inhabits tall grasslands on temporarily inundated coastal plains, margins of mangroves, and saltmarshes (Pizzey and Knight 2003).
Black-faced Monarch *(Monarcha melanopsis*)	M		Favours denser vegetation associated with rainforest, riparian forest, and nearby scrubs and open forest with a dense understorey (Boles 1988).
Spectacled Monarch *(Monarcha trivirgatus*)	M		Favours denser vegetation, though often more dimly lit habitats that Black-faced Monarchs (Boles 1988).
Satin Flycatcher *(Myiagra cyanoleuca*)	M		An uncommon summer visitor within the bioregion where it mainly frequents coastal scrubs and open forest (Storr 1984).
Rufous Flycatcher (*Rhipidura rufifrons*)	M		Tends to be more often recorded from dimmer, thickly vegetated forest (Pizzey and Knight 1998).

7.5.1.4 Regional Context for Biodiversity and Threatening Processes

Queensland has been sub-divided into 13 biogeographical areas to identify biodiversity features at a regional level (Sattler and Williams 1999). This approach attempts to differentiate biodiversity characteristics at a broad and ecologically meaningful level, where differences are considered to be typically most apparent (Thackway and Creswell 1995).

The majority of the project area is located within the eastern extent of the Brigalow Belt bioregion. This includes sections of the project area extending from the Fitzroy River, south to about Yarwun. The section of the project area extending further south to Gladstone is located within the extreme northern part of the Southeast Queensland bioregion.

The Brigalow Belt bioregion extends from the Queensland-New South Wales border to Townsville and encompasses approximately 36.4 million ha (364,000 km^2) of sub-humid and semi-arid environments supporting a diversity of 174 different regional ecosystems (Sattler and Williams 1999, Queensland Government 2007). It is characterised by flora and fauna species of open woodland, including the widespread leguminous tree Brigalow (*Acacia harpophylla*). Other vegetation communities include grassland, dry rainforest, cypress pine woodland, eucalypt woodlands and forests, and riparian and semi-deciduous vine thicket ecosystems (Sattler and Williams 1999).

The *Southeast Queensland Bioregion* extends from the Queensland-New South Wales border, west from the coast and islands to Toowoomba and north to the near Gladstone and encompasses approximately 6.2 million ha (62,000 km^2) supporting a diversity of 151 different regional ecosystems (Sattler and Williams 1999, Queensland Government 2007). A high floristic diversity, in combination with a diversity of regional ecosystems and the Bioregion's unique combination of landform, soil and climate, supports high fauna diversity. Despite this, endemism among vertebrates is relatively low (approximately 3 percent of species largely restricted to the bioregion) (Sattler and Williams 1999).

These bioclimatic zones influence the characteristics of the region's terrestrial biodiversity, resulting in a unique assemblage of temperate, tropical, semi-arid and coastal species (Coastal CRC 2003). The review of existing information for the wider area provides records for 505 vertebrate fauna species. This assemblage includes 89 mammal species, 100 reptile species, 30 frog species, 306 bird species, and a variety of species of conservation significance. The extreme limit of the northern or southern distribution for many of these species occurs within the region and for a few endemic species, central Queensland represents the entire limit of their distribution (Young *et al*. 1999).

The region between Rockhampton and Gladstone has a long history of pastoralism and agriculture (since the 1850s) and is currently dominated by extensive cattle grazing activities. Clearance of native vegetation, pasture improvement and cattle grazing is a land use sequence that has significantly influenced fauna habitat values and the characteristics of the fauna assemblage. The ability of native fauna to adapt to changes in habitat extent and condition varies considerably, and for a variety of taxa, there has been a notable decline in their local and regional distribution and abundance.

The review of existing information indicates that the greatest threats to the native fauna of both bioregions remain grazing by domestic animals, land clearance and the invasion of feral animals and exotic weed taxa (particularly following fire or overly intensive grazing impacts) (Coastal CRC 2003, Christensen and Rodgers 2004, Cook *et al*. 2006, Woinarski *et al*. 2006). Of the introduced fauna and flora known to occur within the wider area,

there is a variety of species either known to, or have a potential to, pose a significant threat to the maintenance of terrestrial biodiversity values (Christensen and Rodgers 2004).

In regards to flora, many species are identified as Weeds of National Significance (WONS, see Thorp and Lynch (2000)). WONS are those weeds which have been identified as already causing significant environmental damage (DEWHA 2005). Relatively widespread and/or abundant weed species (including a variety of WONS) are Parkinsonia (*Parkinsonia aculeate*), Parthenium Weed (*Parthenium hysterophorus*), Rubber Vine (*Cryptostegia grandiflora*), Bellyache Bush (*Jatropha gossypifolia*), Mother of Millions (*Bryphyllum tubiflorum*), Athel Pine (*Tamarix aphylla*), Hymenachne (*Hymenachne amplexicaulis*), Lantana (*Lantana camara*), Mesquite (*Prosopis* spp.), Prickly Acacia (*Acacia nilotica subsp. indica*), Salvinia (*Salvinia molesta*), Water Hyacinth (*Eichornia crassipes*), Water Lettuce (*Pistia stratoites*), Cat's Claw (*Macfadyena unguiscati),* Madeira Vine (*Anredera cordifolia*), and Para Grass (*Brachiaria mutica*).

Buffel Grass (*Cenchrus ciliaris*), is regarded as a very significant production plant for the central Queensland beef industry, though is also a major environmental weed of northern Australia (CSIRO 2007). Impacts include increased biomass and fuel load, potential competition with and displacement of native flora and fauna and potential long-term reduction of soil fertility (Ludwig *et al.* 2000, Franks *et al.* 2000, Franks 2002, Jackson 2004). Whilst a common pasture plant, it also dominates the ground layer of many areas of remnant native vegetation in the Brigalow Bioregion. Leucaena (*Leucaena leucocephala*) is another species regarded as an important production plant in the region (cultivated for cattle fodder), though also regarded as a highly invasive environmental weed in tropical and sub-tropical Australia that forms dense thickets excluding other plants (Walton 2003).

The review of existing information identifies a number of introduced fauna species. The majority of these species have been widely acknowledged as implicit in the degradation of habitat values for both native fauna biodiversity and species of conservation significance through:

- Predation of native taxa, e.g. foxes, cats, pigs and cane toads
- Competition with native fauna for food and shelter, e.g. cattle, goats, rabbits, cane toads and pigs;
- Physical degradation of native fauna habitat through impedance of native vegetation regeneration, disruption of soil structure and soil erosion, changes in plant community composition, and/or facilitation of environmental weed invasion, e.g. cattle, goats, pigs and rabbits
- Transmission of pathogens, e.g. pigs and cats.

Of the introduced species recorded in the region, foxes, feral pigs, goats and rabbits are identified as declared Class 2 pest animals under the *Land Protection (Pest and Stock Route Management) Regulation 2003* (Qld). Furthermore, the EPBC Act lists predation (foxes, feral pigs and cats), competition and land degradation (feral goats, pigs and rabbits) and disease transmission (feral pigs and cats) as key threatening processes to a variety of faunal groups (Environment Australia 1999a,b,c,d and e, and DEH 2005e). Currently, the biological effects, including lethal toxic ingestion, caused by Cane Toads is being considered as an amendment to the List of Key Threatening Processes under the EPBC Act (DEH 2005f).

The most widespread introduced species within the region are cattle. Cattle grazing can result in a loss of understorey vegetation and ground microhabitat diversity, poor recruitment of native plants and provide favourable conditions for weeds to gain dominance over native flora. As effected through changes to soil conditions, native plant diversity and vegetation community structure, habitat modification can result in the decline in habitat suitability for a variety of native fauna species, including species of conservation significance.

These species, to varying extents, wether individually or collectively, add pressure to the maintenance of local biodiversity and species of conservation concern.

7.5.2 Field Survey Results

7.5.2.1 Project Area Overview

The field survey recorded 266 terrestrial fauna species, including 32 mammals, 39 reptiles, 16 frog and 179 birds (see Appendix E3). A large proportion of this recorded fauna assemblage was comprised of species regarded as relatively common and widespread within either bioregion, i.e. the Southeast Queensland and Brigalow Belt bioregions (see Longmore 1978, Roberts 1979, Storr 1984, Czechura 1995a and 1995b, Covacevich and Wilson 1995, Wilson and Czechura 1995, Hall and Martin 1995, Cannon *et al.* 1995, Van Dyck 1995a and 1995b, Agnew *et al.* 2003, Wilson 2005a, and Ecoserve and LAMR 2006). The characteristics of the fauna assemblage and the species diversity are not unexpected given the relatively limited diversity of habitat types, the restricted extent of remnant habitats and the comparatively higher extent of disturbed habitats that do not have the capacity to support a diverse fauna assemblage.

Fauna habitat values within the project area have been strongly influenced by a history of cattle grazing and agriculture. This has resulted in a significant simplification of fauna habitat structure. This is manifest in large, cleared areas and within smaller nodes that support native vegetation. Within the latter, more open ground cover conditions and a poor recruitment of shrubs and trees are common characteristics.

The decline in the structural integrity of the original, more complex habitat is likely to have affected all native fauna groups, though particularly native small ground-dwelling mammal fauna, reptiles and small passerine avifauna. The current, more simple-structured habitats allow greater access and provide more favourable conditions for introduced species as toads, cats and foxes. The presence of these introduced taxa results in increased pressures on native wildlife that find the current habitat structure suitable.

Where native vegetation remains, tree hollows (either trunk or limb hollows) are either absent or Rare. It is apparent in many of these areas, that cattle have had a history of unrestricted access. This has resulted in further simplification of ground cover microhabitat (e.g. fallen timber, native tussock grasses, and to a lesser extent, leaf litter) required by a wide variety of ground-dwelling fauna.

There is also widespread evidence of modifications to local drainage systems through the construction of levees and dams. The extent and prevalence of such work is more evident within lands to the north of Raglan Creek. Whilst continuing to provide habitat for a variety of waterbirds, and waders to a lesser degree, the removal of native flora typically associated with local natural waterways and wetlands has resulted in lower habitat values for a variety of other native fauna (e.g. reptiles, amphibians, some birds such as crakes and rails, and some smaller ground-dwelling mammals).

The results of the survey program provided records for 13 introduced fauna species (nine mammal, one reptile, one amphibian and two bird species). Evidence of these taxa was widespread throughout the project area. These results were not unexpected given the level of landscape disturbance and habitat types present.

Despite widespread habitat disturbance within the project area and surrounding lands, these lands do support habitat areas of value to various species of conservation significance, for fauna movement and maintenance of local biodiversity.

Nine species recorded in the current surveys are listed as Rare, Threatened, or otherwise significant under the provisions of the Commonwealth and/or State legislation. All locations where these species were recorded, with other relevant information, are provided in Table 7.4 and Table 7.6 . Locations and descriptions of habitats of higher fauna habitat value are provided in Table 7.5 and Table 7.7

7.5.2.2 Fitzroy to Bajool

The field investigation program provided records for 185 terrestrial vertebrate fauna species either recorded within the mapped corridor and/or recorded from similar habitats within approximately one kilometre either side of the project area corridor. The recorded assemblage comprises:

- Native fauna: 10 mammal, 19 reptile, 10 frog, and 135 bird species
- Introduced fauna: seven mammal, one reptile, one amphibian and two bird species
- Species of conservation significance:
  - Vulnerable: Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*) and Ornamental Snake (*Daenisonia maculata*)
  - Rare: Cotton Pygmy-goose (*Nettapus coromandelianus*) and Black-chinned Honeyeater (*Melithreptus gularis*).

A summary of each species of conservation significance record is provided in Table 7.4 and locations identified in Figure 7.3. The location of each fauna survey site is provided in Figure 7.1.

A large proportion of this section of the project area, and surrounding land is subject to grazing activities. Within these areas, native fauna habitat values have been greatly reduced. Key habitat resources such as hollow-bearing trees are Rare.

Habitats, which exhibit lower levels of disturbance and/or support higher values to the widest cross-section of the fauna assemblage of this section of the project area, are primarily associated riparian vegetation along the Fitzroy River and smaller waterways, small and scattered patches of native remnant and regrowth vegetation, and wetlands (including variety of large swales and depressions). Key habitat resources and areas of ecological sensitivity are listed in Table 7.5 and depicted in Figure 7.4.

Table 7.4 Rare, Threatened and Migratory Survey Records for Fitzroy to Bajool Section

Status:	CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory
Legislation:	EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (Cth) NCA = *Nature Conservation Act 1992* (Qld)

Species	EPBC status	NCA status	GPS location	Number of individuals	Month	Comments
Ornamental Snake (*Daenisonia maculata*)	V	V	253155E 7397039S	1	November	Sub-adult located under large ground log. Large ground logs common in area; large hollow-bearing *E. coolabah* trees common; cracking clays; adjoining seasonal wetland (southern side of Casuarina Road).
Ornamental Snake	V	V	252815E 7397005S	1	November	Adult foraging within large hollow ground log. Large ground logs common in area; large hollow-bearing *E. coolabah* trees common; cracking clays; adjoining seasonal wetland (southern side of Casuarina Road).
Cotton Pygmy-goose (*Nettapus coromandelianus*)	M	R	235951E 7413617S	13	April	Billabong adjacent to Nine Mile Road.
Cotton Pygmy-goose	M	R	250763E 7395925S	4	April	Small dam adjacent and east of Bruce Highway.
Cotton Pygmy-goose	M	R	264984E 7382627S	2	April	Small dam adjacent to Bajool Port Alma Road.
Cotton Pygmy-goose	M	R	236083E 7413582S	7	September	Vegetated wetland to near north of Nine Mile Road.
Cotton Pygmy-goose	M	R	235618E 7409506S	2	September	Small dam to near north of Fairy Bower Road.
Cotton Pygmy-goose	M	R	250785E 7395964S	5	November	Man-made dam fringed with tall grass and emergent sedges and reeds and lily pads.
Cotton Pygmy-goose	M	R	251303E 7394934S	3	December	Man-made dam east of McLean Road.
Cotton Pygmy-goose	M	R	261108E 7384359S	4	December	Swale with water and sedges to near north of Bajool Port Alma Rail line.
Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*)	V		255069E 7397139S	2	April	*Eucalyptus coolibah* grassy open woodland.
Squatter Pigeon	V		255737E 7388795S	2	April	Open grassland.
Squatter Pigeon	V		261132E 7384477S	3	June	Railway through grazing country with scattered forest red gums and poplar box.
Squatter Pigeon	V		253184E 7396940S	16	June	Seasonal wetland to south of Casuarina Road, fringed with mature hollow-bearing eucalypts. Dry when pigeons sighted. Ground cover sparse, predominantly *Salsola*.
Squatter Pigeon	V		243424E 7408131S	2	September	Pasture to south of Capricorn Highway.

Species	EPBC status	NCA status	GPS location	Number of individuals	Month	Comments
Squatter Pigeon	V		249529E 7399792S	2	November	Alongside bush track in dry swale in open grassland (east of Kime Road).
Squatter Pigeon	V		249137E 7401882S	2	November	*E. coolabah* remnant within road reserve; sparse understorey and grass cover (east of Kime Road).
Squatter Pigeon	V		251647E 7397168S	4	December	Along side dirt Casuarina Road; open paddock adjoins, near homestead.
Squatter Pigeon	V		252947E 7396951S	1	December	Poplar Box remnant fringe along Casuarina Road.
Squatter Pigeon	V		249529E 7399792S	3	November	Alongside bush track; scattered trees along track; open grassland adjoining (east of Kime Road).
Black-chinned Honeyeater (*Melithreptus gularis*)		R	235626E 7413532S	> 2	April	Linear remnant bordering Nine Mile Road.
Black-chinned Honeyeater		R	235735E 7414987S	2	November	*E. tereticornis* woodland bordering wetland (end of Stracey Road).

Table 7.5 Areas of fauna habitat sensitivity associated with the Fitzroy to Bajool section

Area #	GPS reference	Comments	Primary values
1	237768E 7421569S	Fitzroy River riparian habitats.	Fauna movement; habitat for forest birds and microbats; and hollow-bearing trees.
2	235180E 7415401S	Northwestern extension of a series of semi-permanent vegetated billabongs to north of Nine Mile Road.	Habitat for waterbirds and waders, including Rare and Migratory species.
3	234490E 7413765S	Western end of a series of semi-permanent vegetated billabongs. Extends south to Nine Mile Road.	Habitat for waterbirds and waders, including Rare and Migratory species.
4	234227E 7411350S	Western end of a large semi-permanent constructed wetland.	Habitat for waterbirds and waders, including Rare and Migratory species.
5	235178E 7410276S	Corridor traverses centre of semi-permanent wetland. Largely natural form though surrounds cleared of remnant vegetation. North of Malchi Nine Mile Road.	Habitat for waterbirds and waders, including Rare and Migratory species.
6	238744E 7409836S	Billabong of natural form though surrounds cleared of remnant vegetation.	Habitat for waterbirds and waders, including Rare and Migratory species.
7	239640E 7409567S	Billabong of largely natural form though surrounds cleared of remnant vegetation. North of Titman Road.	Habitat for waterbirds and waders, including Rare and Migratory species.
8	247726E 7405458S	Adjacent to Gavial Creek wetlands.	Habitat for waterbirds and waders, including Rare and Migratory species.
9	250022E 7400559S	Small open seasonal wetland – part of Serpentine Creek wetland system.	Habitat for waterbirds and waders, including Rare and Migratory species.
10	251112E 7398611S	Shallow seasonal wetland and part of the Serpentine Creek wetland system – north of Georges Road.	Habitat for waterbirds and waders, including Rare and Migratory species.
11	251788E 7397765S	Shallow seasonal wetland and part of the Serpentine Creek wetland system – south of Georges Road.	Habitat for waterbirds and waders, including Rare and Migratory species.

Area #	GPS reference	Comments	Primary values
12	252472E 7396841S	Seasonal wetland and part of the Serpentine Creek wetland system – south of Casuarina Road.	Habitat for waterbirds and waders, including Rare and Migratory species.
13	253143E 7394318S	Dingo Creek riparian vegetation.	Fauna movement; locally significant habitat corridor.
14	255015E 7389095S	Station Creek riparian vegetation.	Fauna movement; locally significant habitat corridor.
15	255346E 7388666S	Oakey Creek riparian vegetation.	Fauna movement; locally significant habitat corridor.
16	261106E 7384693S	Seasonal wetland system comprising of natural form broad swales. Part of Inkerman Creek wetland system.	Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.

7.5.2.3 Bajool to Gladstone

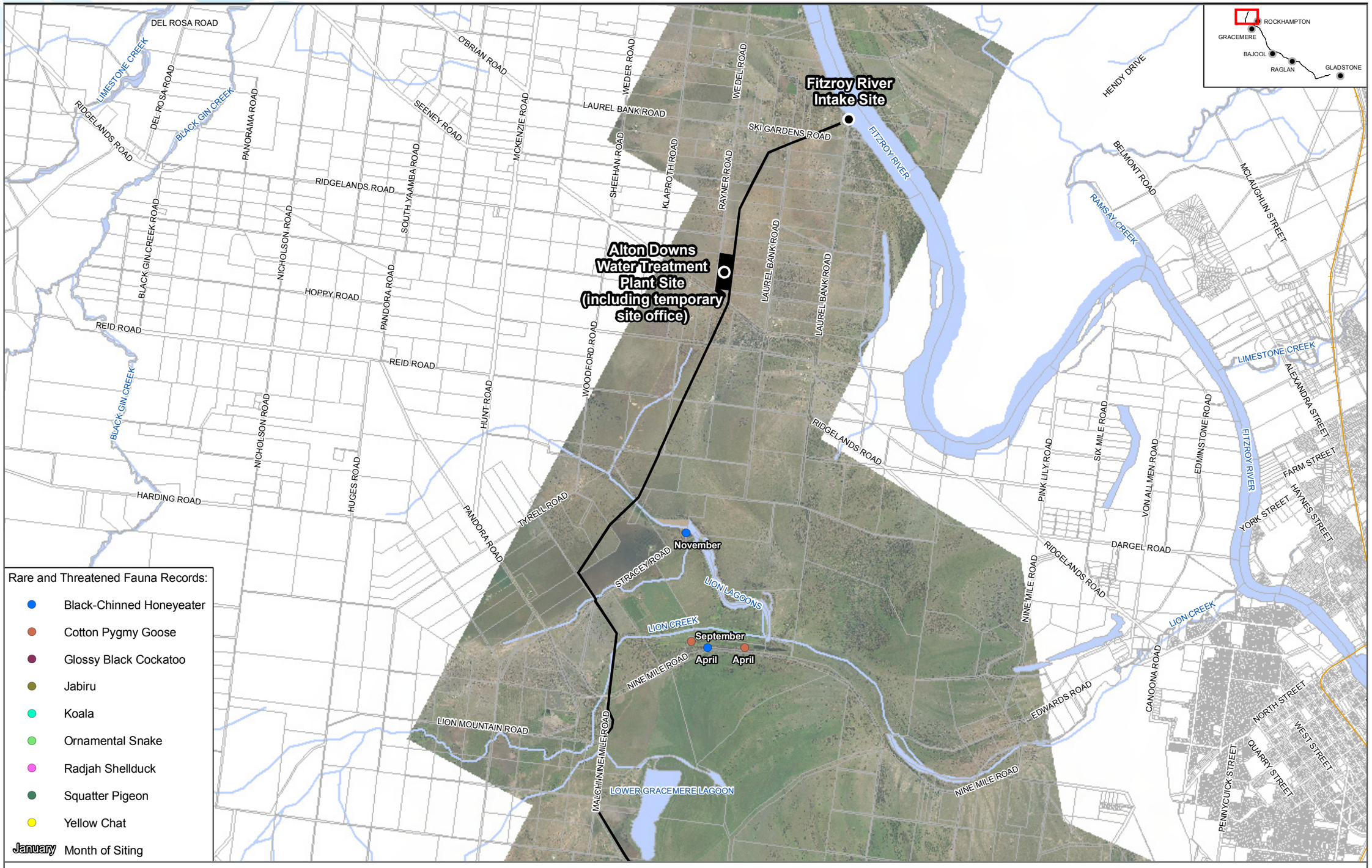
The field investigation program provided records for 245 terrestrial vertebrate fauna species either recorded within the mapped corridor and/or recorded from similar habitats within approximately 1 km either side of the project area corridor. The recorded assemblage comprises:

- Native fauna: 27 mammal, 32 reptile, 13 frog, and 164 bird species
- Introduced fauna: six mammal, one reptile, one amphibian and one bird species
- Species of conservation significance:
  - Critically Endangered: Yellow Chat (*Epthianura crocea macgregori*)
  - Vulnerable: Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*) and Glossy Black Cockatoo (*Calyptrohynchus lathami*)
  - Regionally Vulnerable: Koala (Southeast Qld) (*Phascolarctos cinereus*)
  - Rare: Cotton Pygmy-goose (*Nettapus coromandelianus*), Radjah Shelduck (*Tadorna radjah*), Jabiru (*Ephippiorhynchus asiaticus*) and Black-chinned Honeyeater (*Melithreptus gularis*).

A summary of each species of conservation significance record is provided in Table 7.6 and locations identified in Figure 7.5. The location of each fauna survey site is provided in Figure 7.2.

A large proportion of this section of the project area, and surrounding land is subject to grazing activities. Within these areas, native fauna habitat values have been greatly reduced. This section of the project area supports a greater extent of remnant vegetation in comparison to that recorded for the Fitzroy to Bajool section. The comparatively higher species richness recorded for the Bajool to Gladstone relates to both a wider range of habitat types and the greater extent of remnant vegetation in comparison to that recorded for the Fitzroy to Bajool section.

Habitats, which exhibit lower levels of disturbance and/or support higher values to the widest cross-section of the fauna assemblage of this section of the project area, are primarily associated with riparian vegetation (e.g. Raglan Creek), areas of native remnant and regrowth vegetation, and wetlands including variety of freshwater, brackish, saline habitats. Key habitat resources and areas of ecological sensitivity are listed in Table 7.7 and shown in Figure 7.6.



Gladstone - Fitzroy Pipeline Project

Figure 7.3 - Location of Rare and Threatened Fauna Records Associated with the Fitzroy to Bajool Section

Sheet 1 of 4

Gladstone Area Water Board

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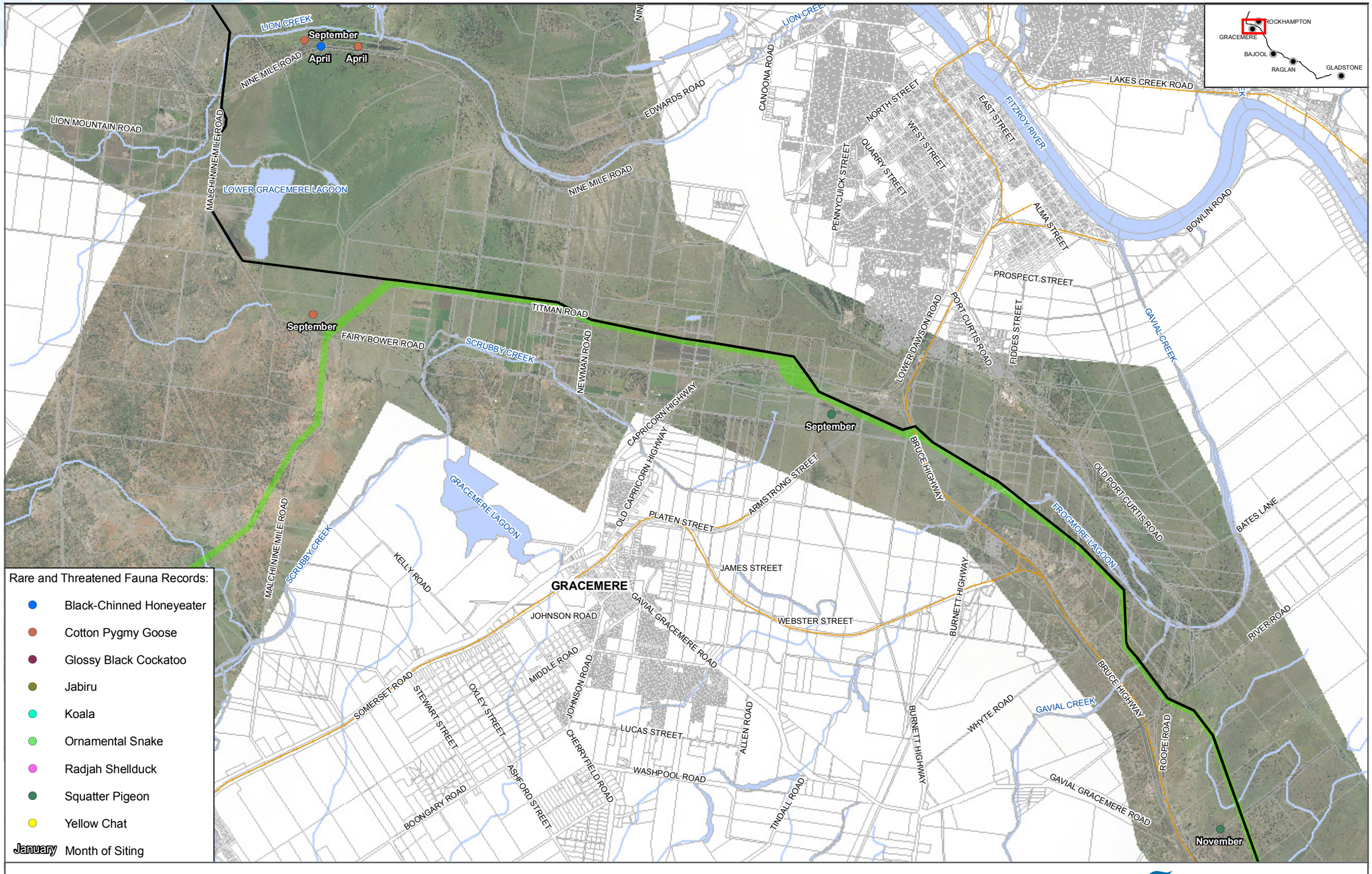

Gladstone - Fitzroy Pipeline Project

Figure 7.3 - Location of Rare and Threatened Fauna Records Associated with the Fitzroy to Bajool Section

Sheet 2 of 4

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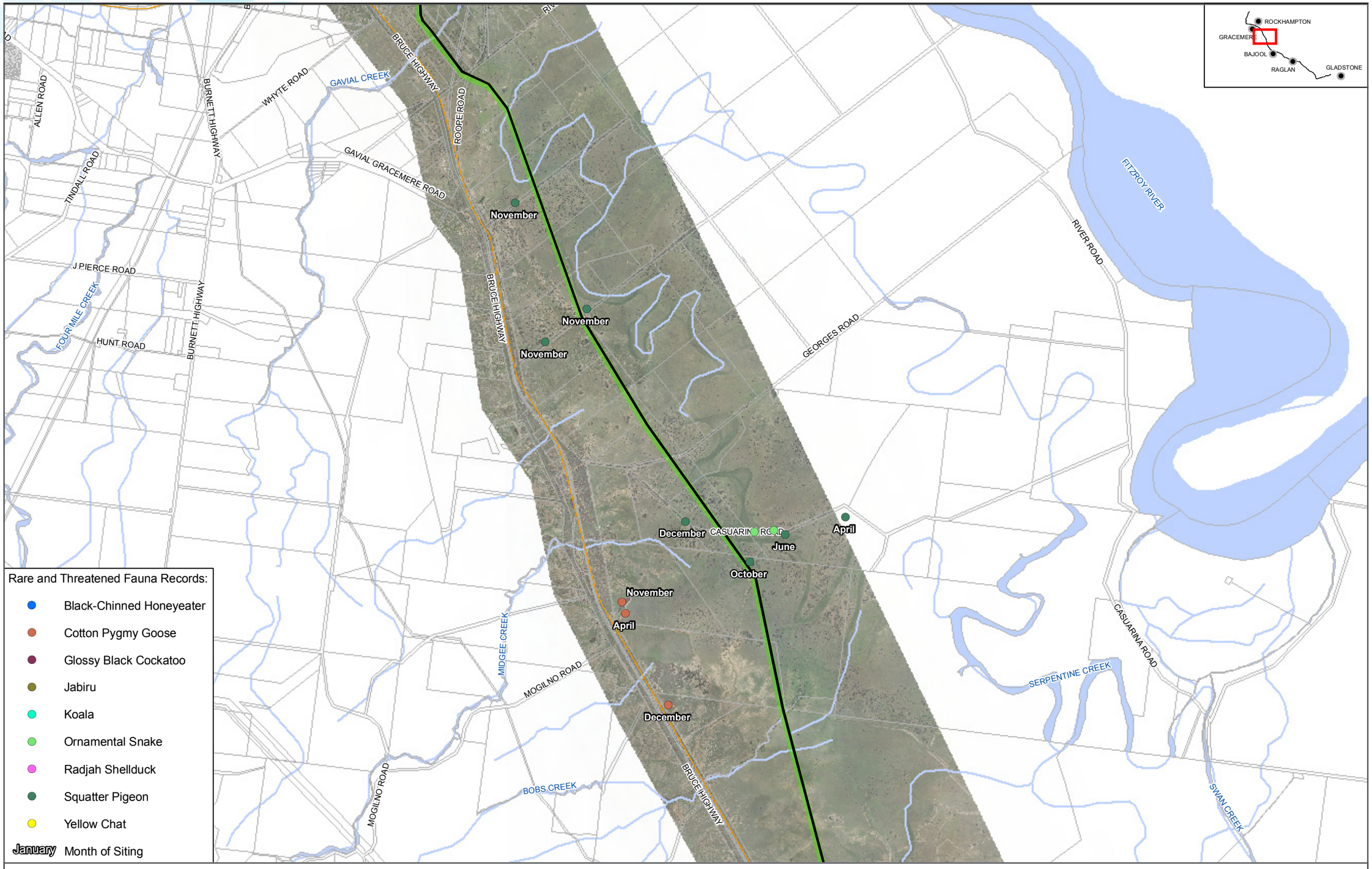

Gladstone - Fitzroy Pipeline Project

Figure 7.3 - Location of Rare and Threatened Fauna Records Associated with the Fitzroy to Bajool Section

Sheet 3 of 4

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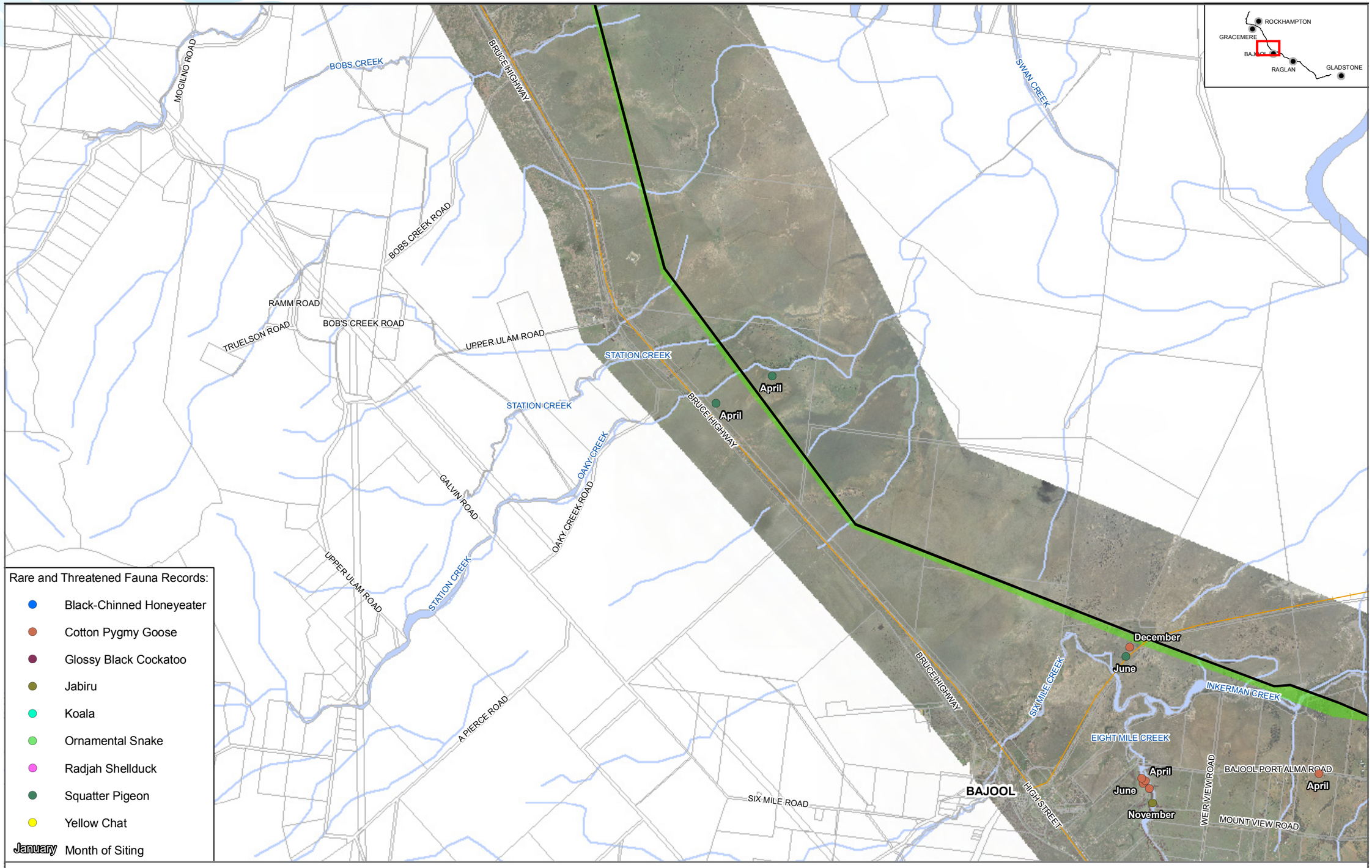

Gladstone - Fitzroy Pipeline Project

Figure 7.3 - Location of Rare and Threatened Fauna Records Associated with the Fitzroy to Bajool Section

Sheet 4 of 4

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Gladstone - Fitzroy Pipeline Project

Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section

Sheet 1 of 4

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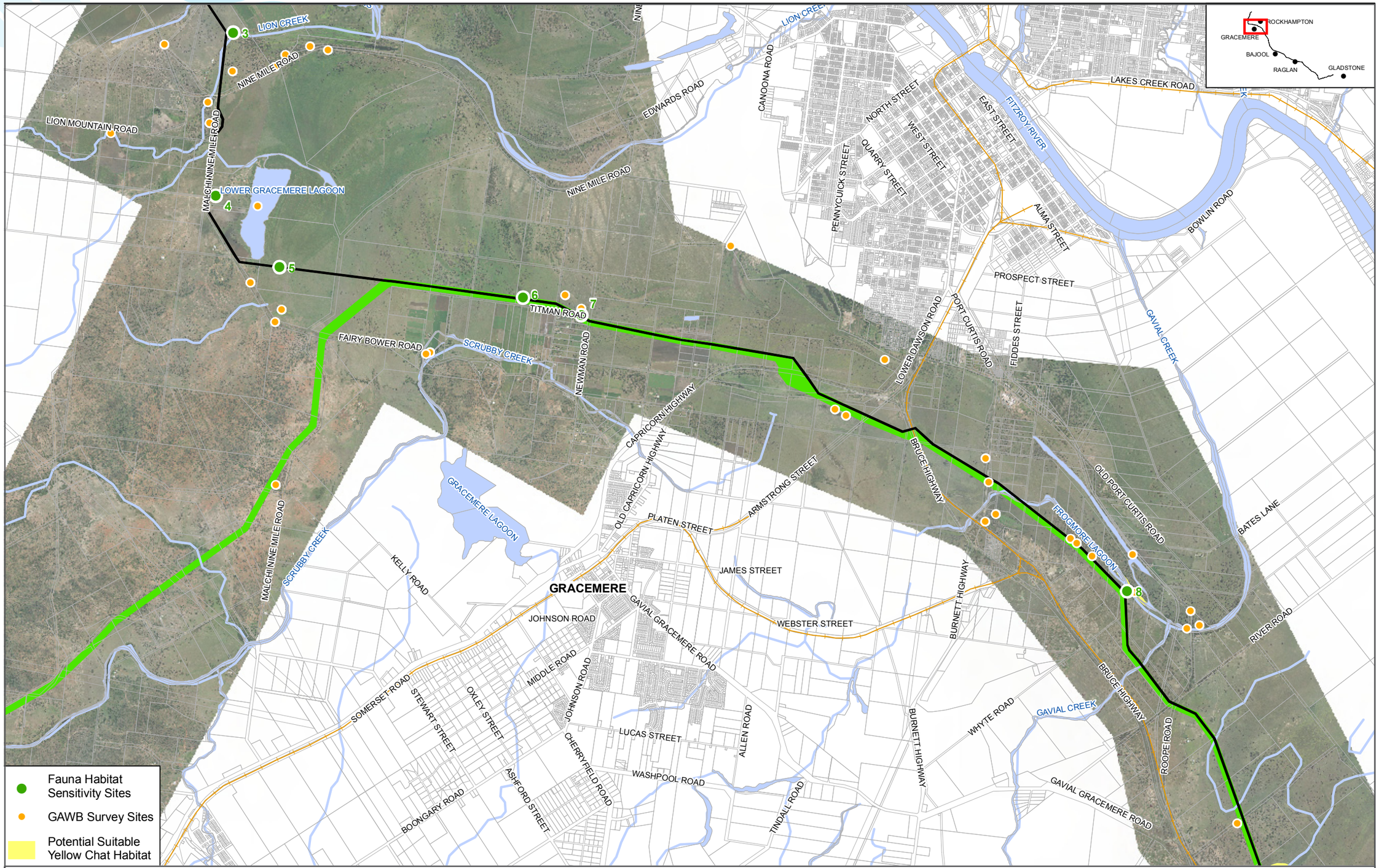

Gladstone - Fitzroy Pipeline Project

Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section

Sheet 2 of 4

The Right of Way
Project Infrastructure
Railway Line
Road Reserve
Waterways
Cadastre
LGA Boundary
SGIC
GSDA

0 1 2 3 4 km

1:50,000 at A3

N

Gladstone Area Water Board

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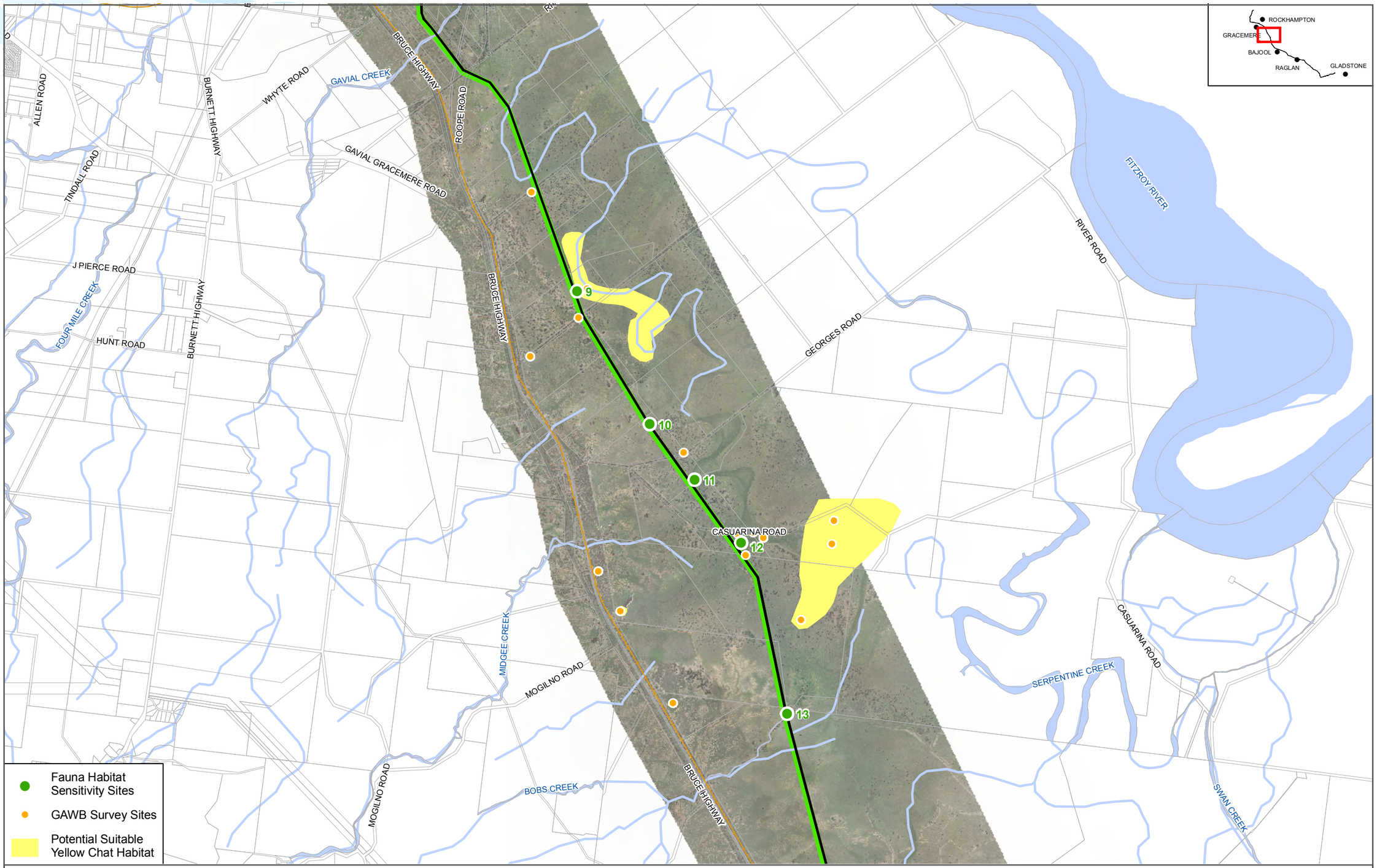

Gladstone - Fitzroy Pipeline Project

Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section

Sheet 3 of 4

The Right of Way
Project Infrastructure
Railway Line
Road Reserve
Waterways
Cadastre
LGA Boundary
SGIC
GSDA

0 1 2 3 4 km

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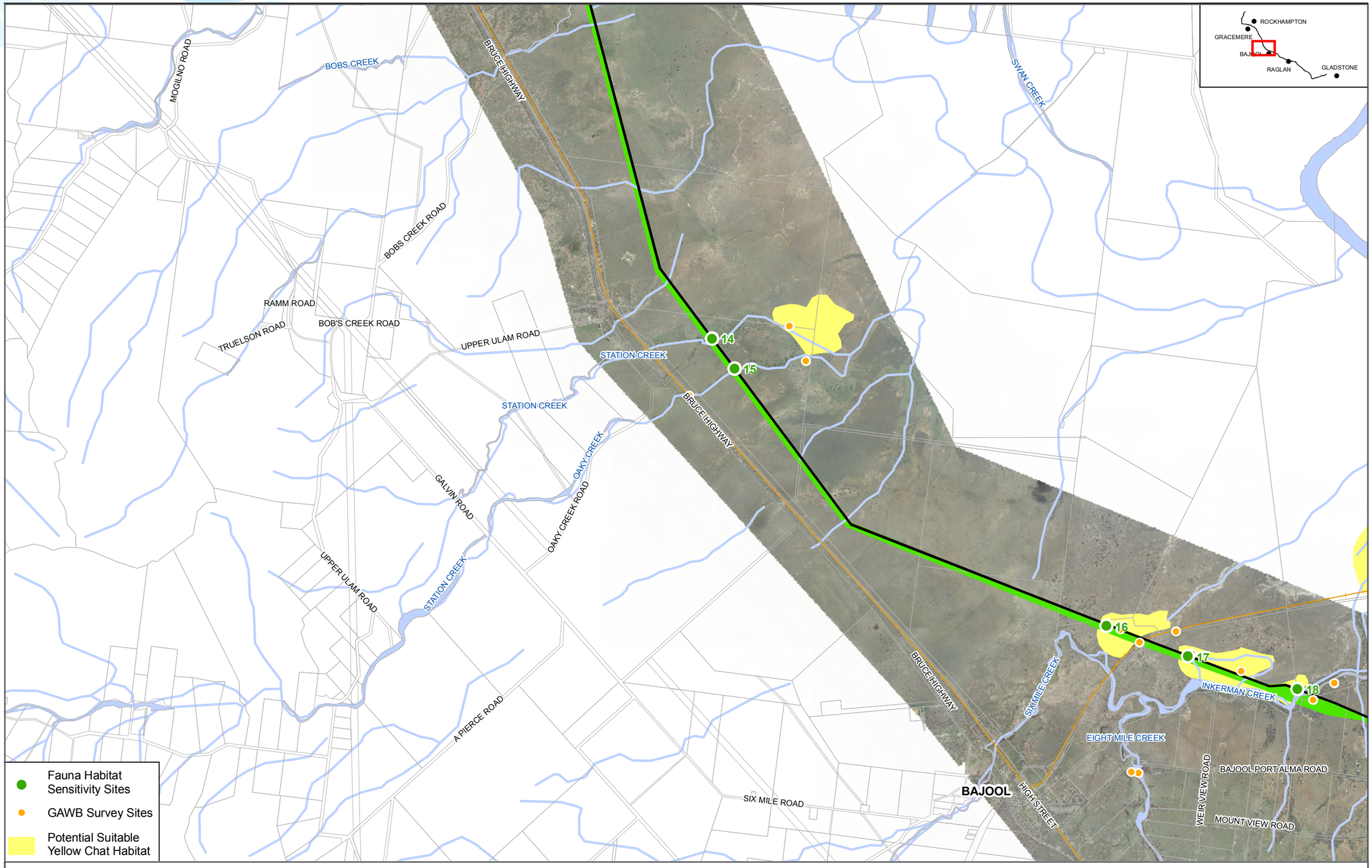

Gladstone - Fitzroy Pipeline Project

Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section

Sheet 4 of 4

Gladstone Area Water Board

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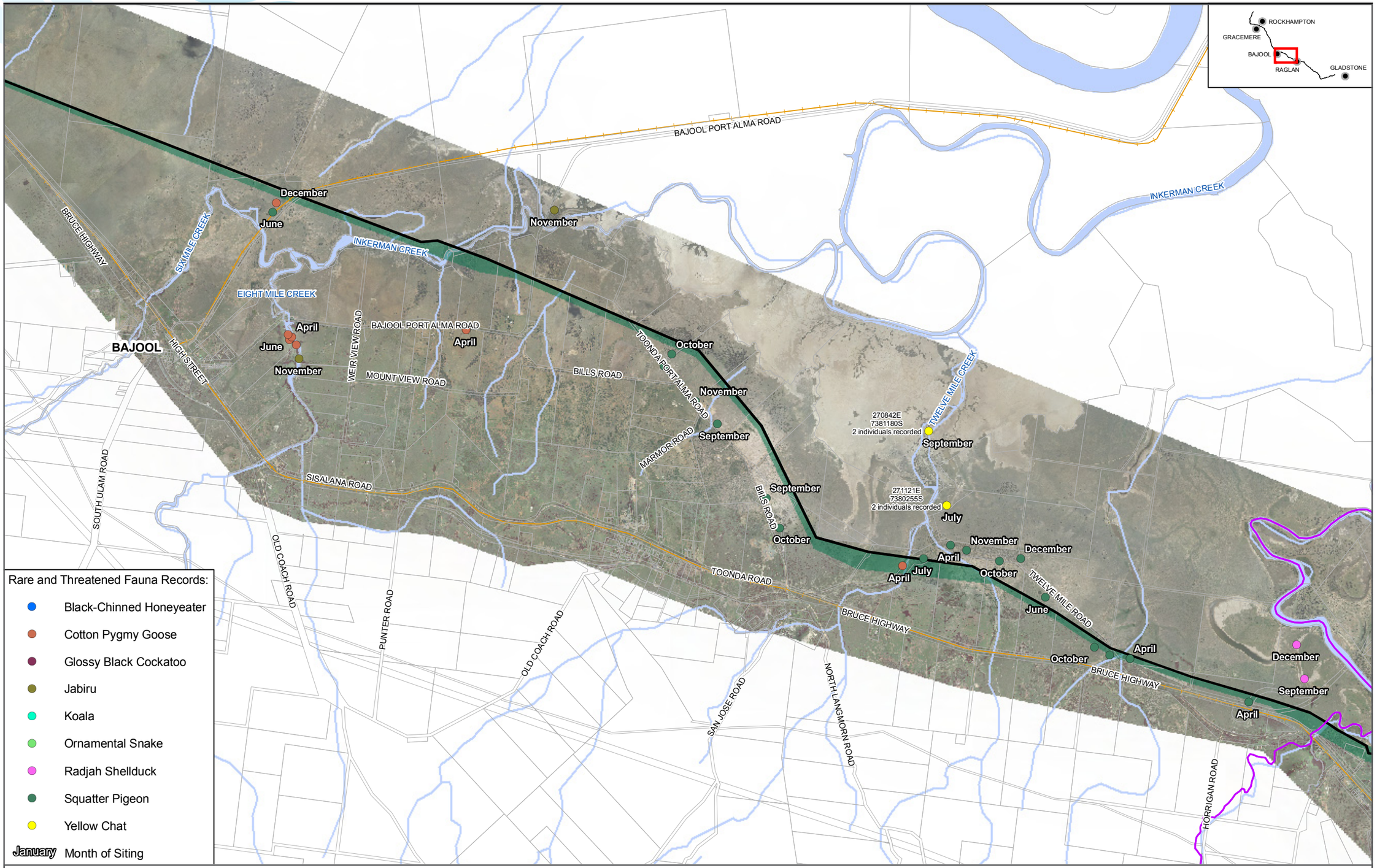

Gladstone - Fitzroy Pipeline Project

Figure 7.5 - Location of Rare and Threatened Fauna Records Areas Associated with the Bajool to Gladstone Section

Sheet 1 of 4

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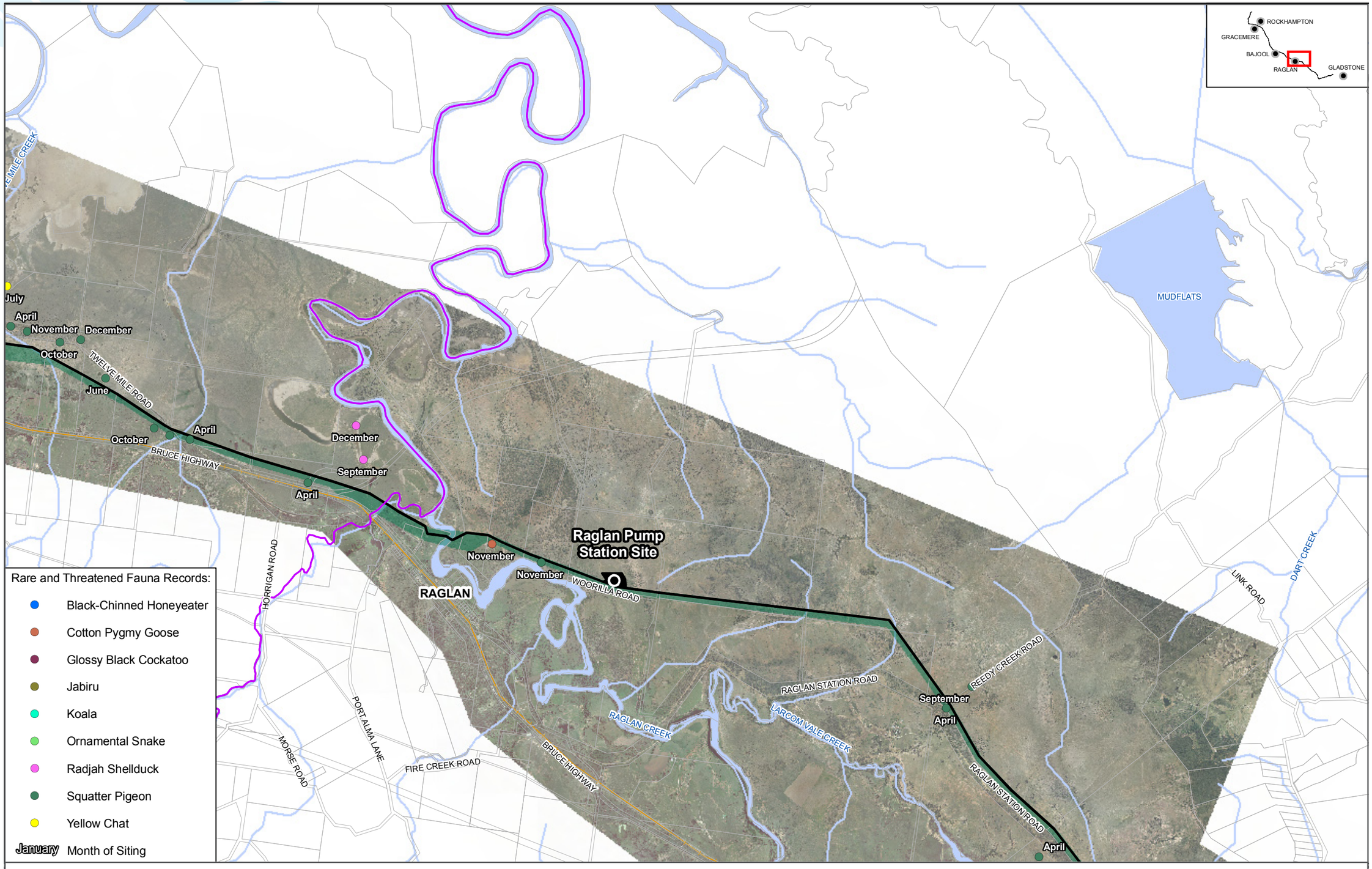

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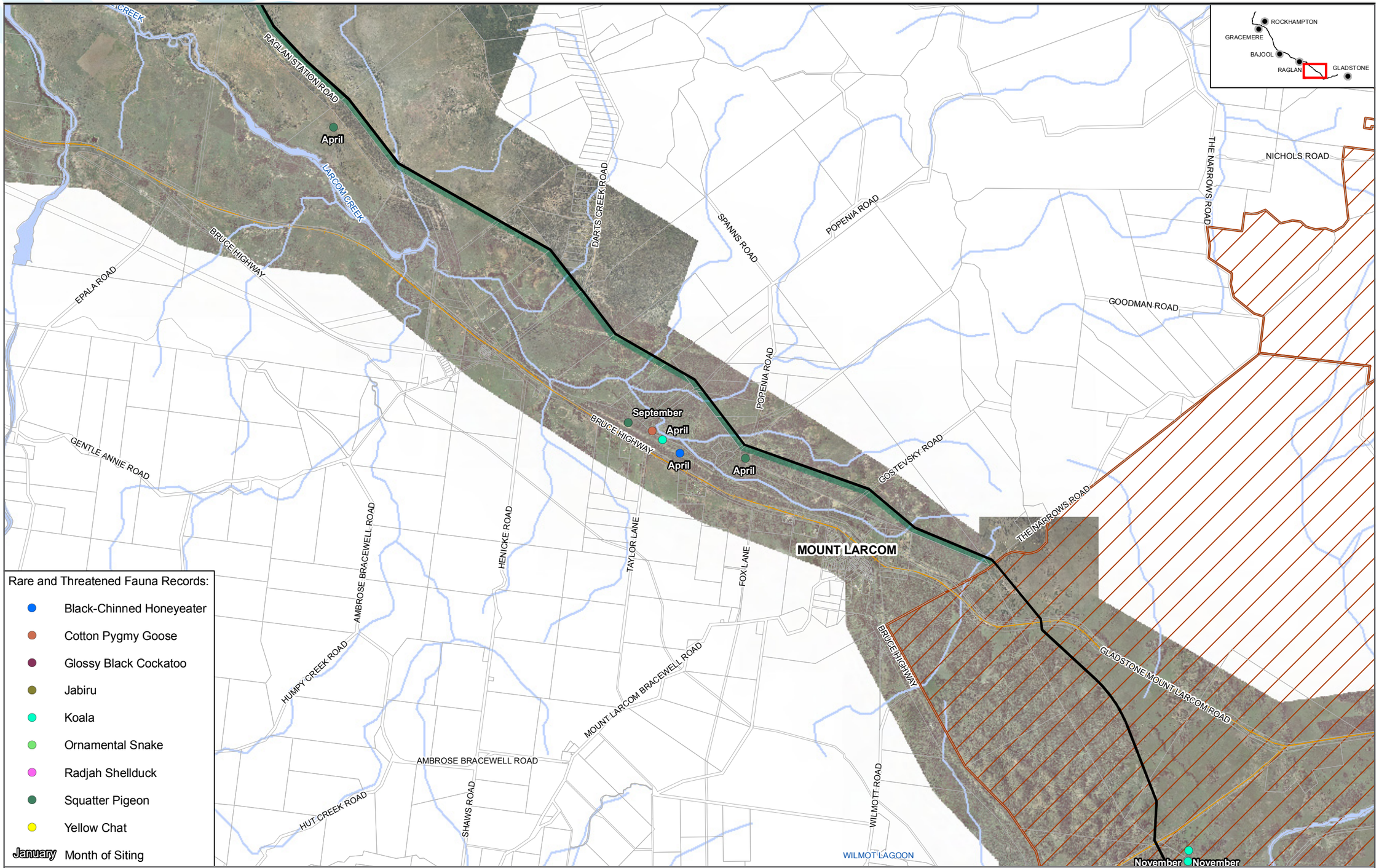

Gladstone - Fitzroy Pipeline Project

Figure 7.5 - Location of Rare and Threatened Fauna Records Areas Associated with the Bajool to Gladstone Section

Sheet 3 of 4

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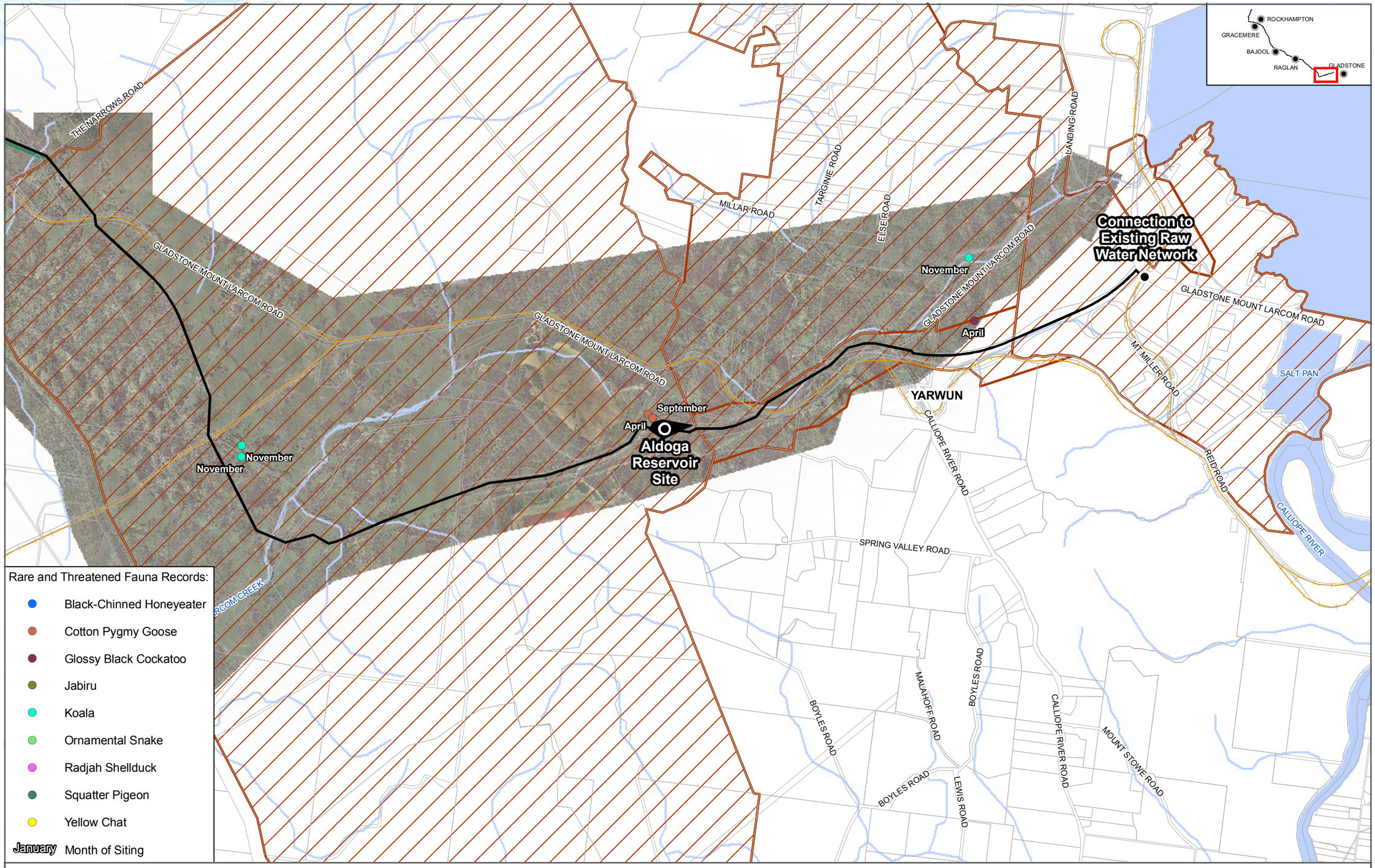

Gladstone - Fitzroy Pipeline Project

Figure 7.5 - Location of Rare and Threatened Fauna Records Areas Associated with the Bajool to Gladstone Section

Sheet 4 of 4

Gladstone Area Water Board

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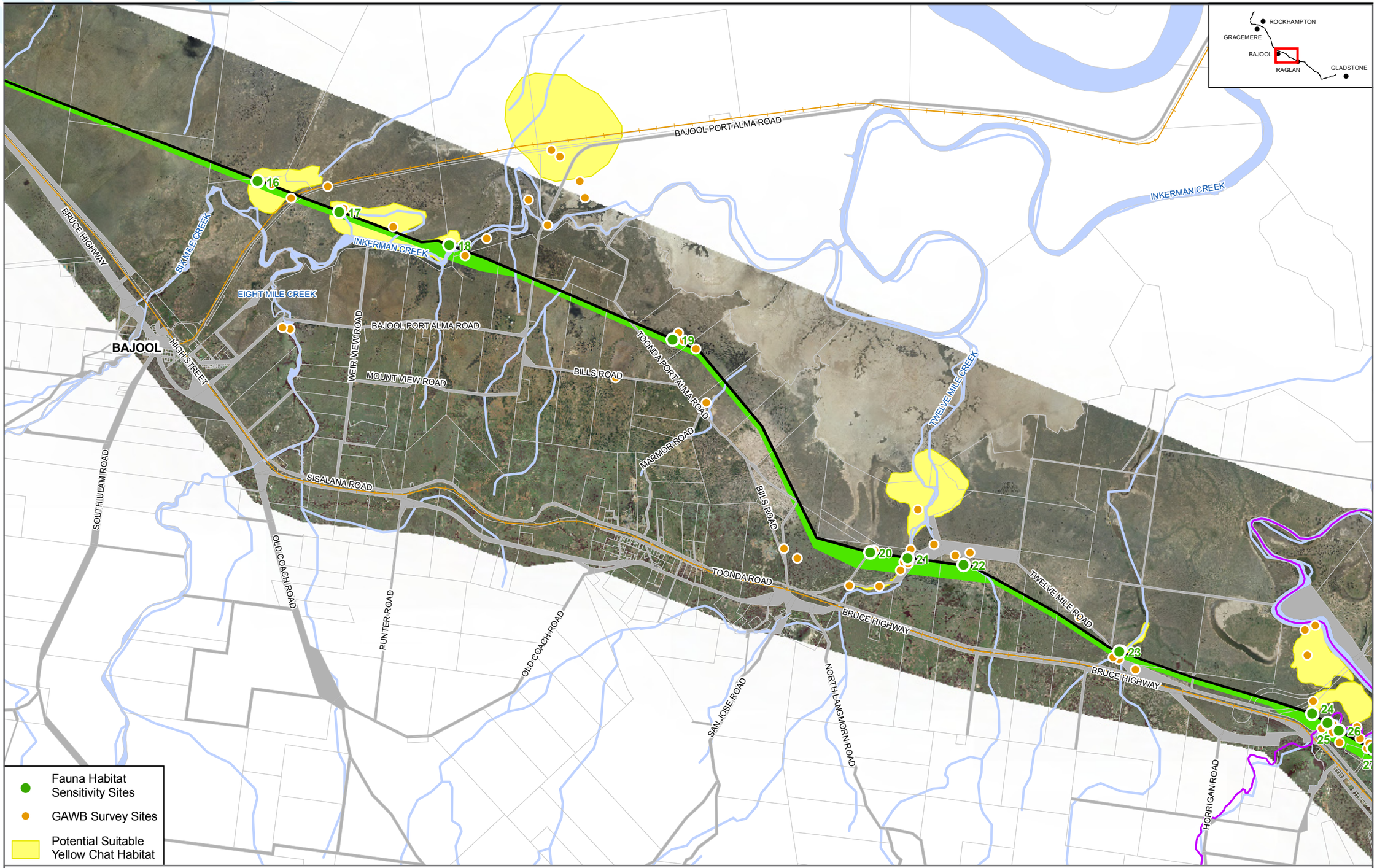

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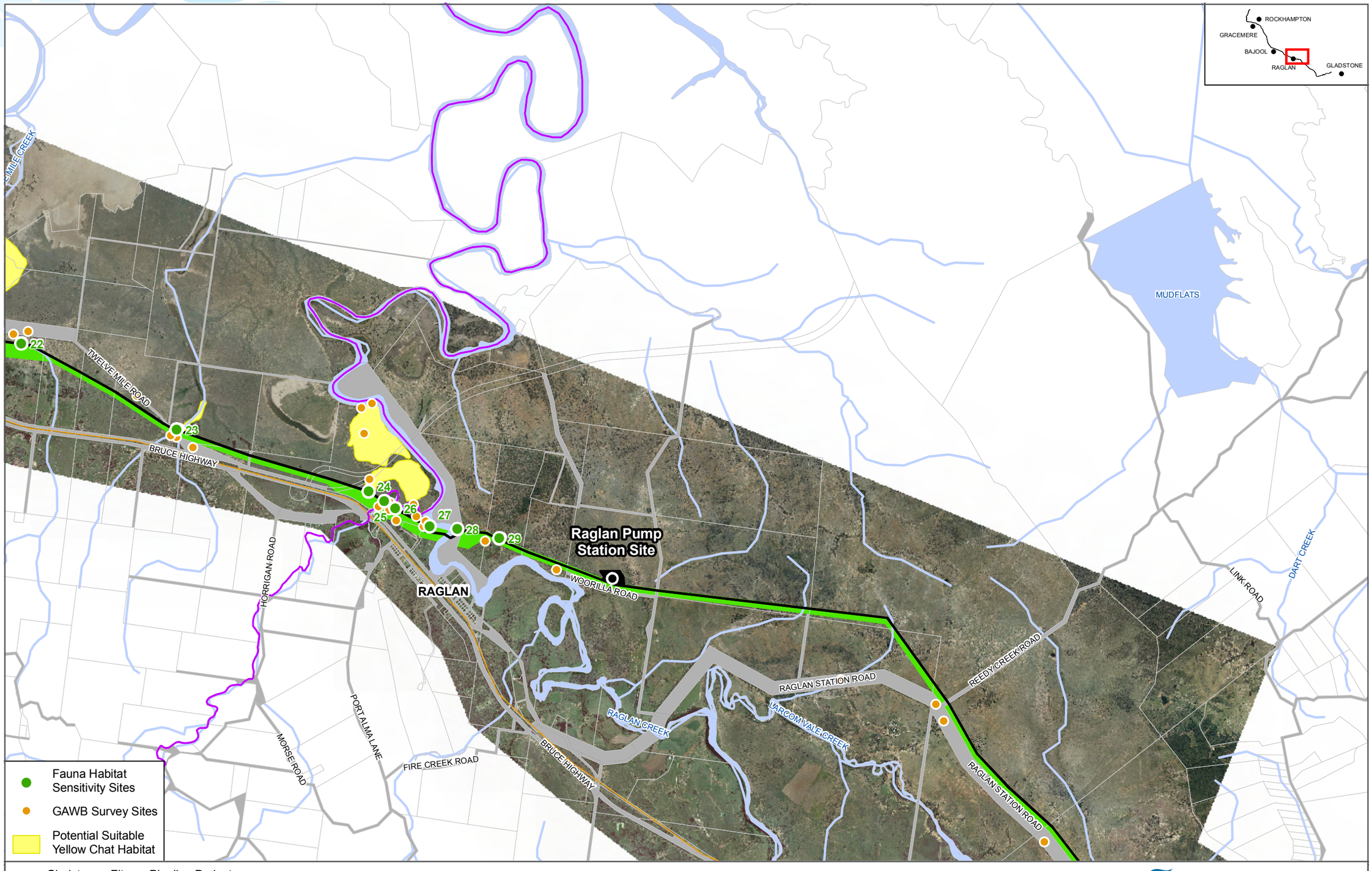

Gladstone - Fitzroy Pipeline Project

Figure 7.6 - Location of Areas of Fauna Habitat Sensitivity Associated with the Bajool to Gladstone Section

Sheet 2 of 4

The Right of Way
Project Infrastructure
Railway Line
Road Reserve
Waterways
Cadastre
LGA Boundary
SGIC
GSDA

0 1 2 3 4 km

1:50,000 at A3

N

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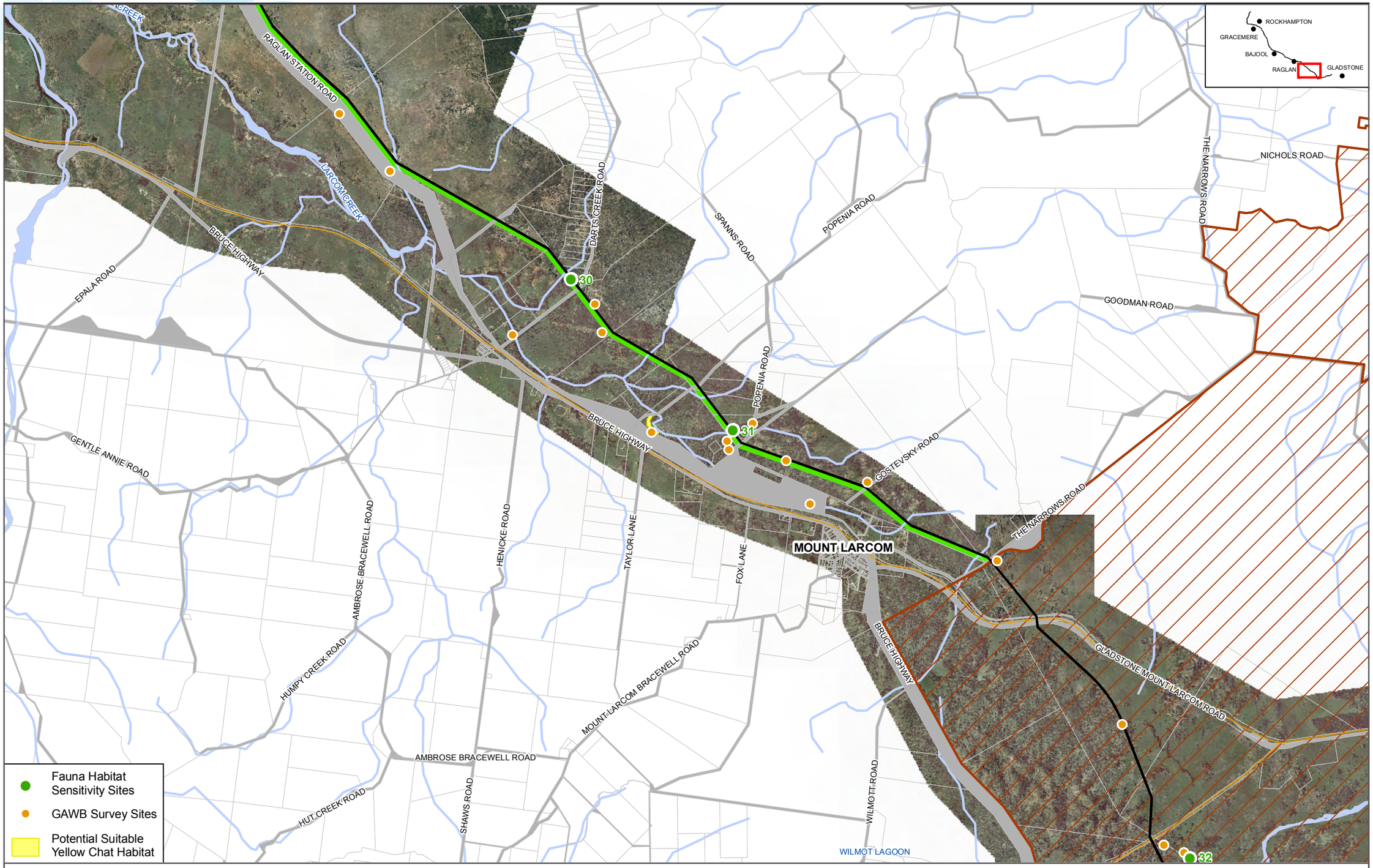

Gladstone - Fitzroy Pipeline Project

Figure 7.6 - Location of Areas of Fauna Habitat Sensitivity Associated with the Bajool to Gladstone Section

Sheet 3 of 4

The Right of Way | Road Reserve | **LGA Boundary**

Project Infrastructure | **Waterways** | **SGIC**

Railway Line | **Cadastre** | **GSDA**

0 1 2 3 4 km

1:50,000 at A3

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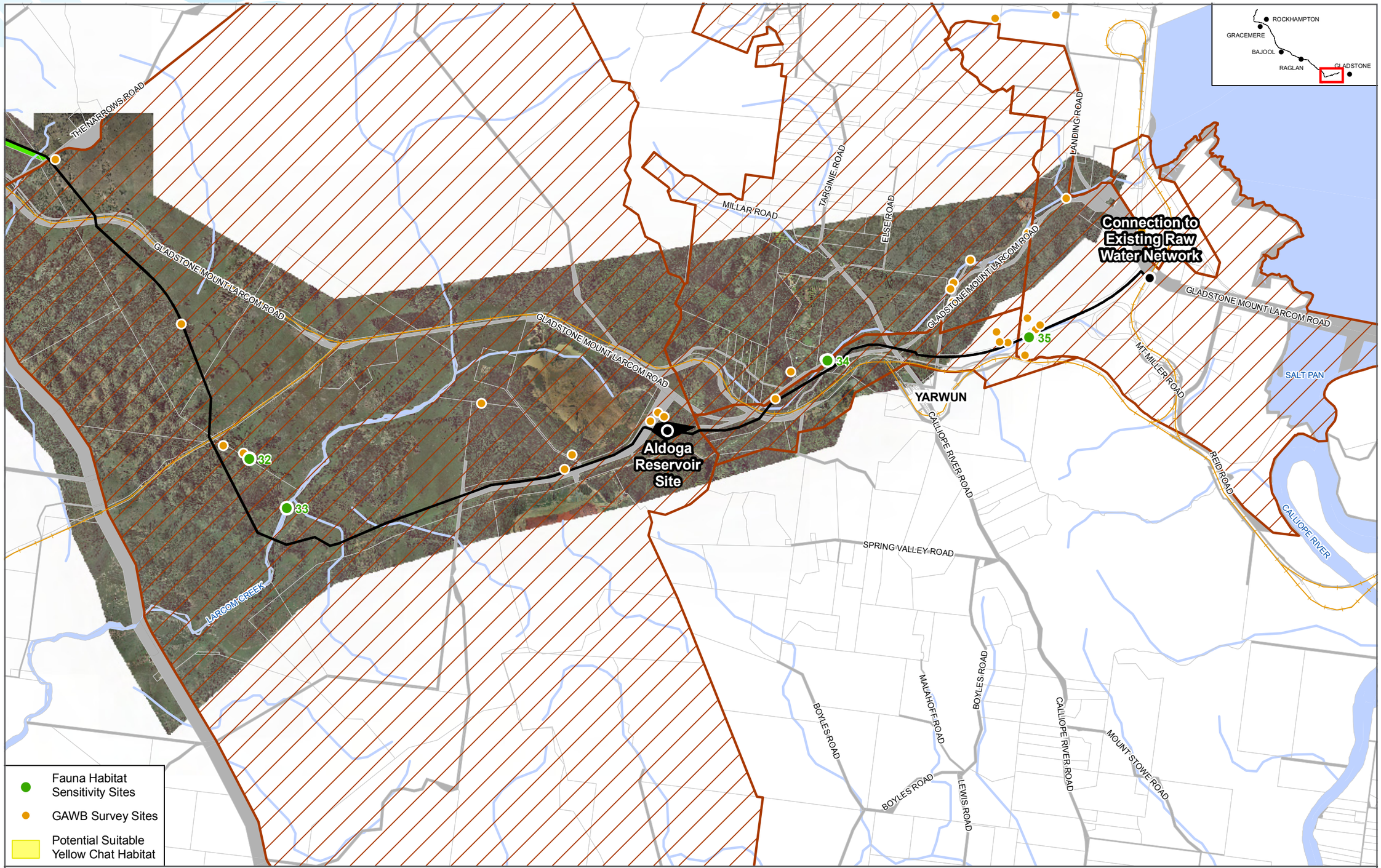

Gladstone - Fitzroy Pipeline Project

Figure 7.6 - Location of Areas of Fauna Habitat Sensitivity Associated with the Bajool to Gladstone Section

Sheet 4 of 4

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Table 7.6 Rare, Threatened and Migratory Survey Records for Bajool to Gladstone Section

Status:	CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory
Legislation:	EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (Cth) NCA = *Nature Conservation Act 1992* (Qld)

Species	EPBC status	NCA status	GPS location	Number of individuals	Month	Comments
Koala (Southeast Qld) (*Phascolarctos cinereus*)		RV	291216E 7366973S	n/a	April	Tree trunk scratches and scats at Horseshoe Lagoon wetland complex on Darts Creek
Koala (Southeast Qld)		RV	299142E 7360825S	n/a	April	Tree trunk scratches and scats on *E. tereticornis* within riparian vegetation of unnamed waterway to near south of rail line.
Koala (Southeast Qld)		RV	299130E 7360661S	n/a	April	Tree trunk scratches and scats on *E. tereticornis* within riparian vegetation of unnamed waterway to near south of rail line.
Koala (Southeast Qld)		RV	310079E 7363586S	n/a	April	Tree trunk scratches and scats on mature, hollow-bearing *E. tereticornis* adjacent to Boat Landing Creek (to near north of Mt. Larcom Gladstone Road).
Jabiru (*Ephippiorhynchus asiaticus*)	M	R	261299E 7382736S	1	November	Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road.
Jabiru	M	R	265205E 7384412S	1	December	Clay pan to north of Cheetham drain wetlands.
Radjah Shelduck (*Tadorna radjah*)	M	R	276393E 7377414S	2	September	Large constructed wetland to near north of Hourigan Creek. Partially filled and wide bare earth margins.
Radjah Shelduck	M	R	276241E 7377941S	1	December	Large constructed wetland to near north of Hourigan Creek. Partially filled and wide bare earth margins.
Cotton Pygmy-goose (*Nettapus coromandelianus*)	M	R	261299E 7382736S	7	April	Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road.
Cotton Pygmy-goose	M	R	270530E 7379259S	2	April	Billabongs along Twelve Mile Creek.
Cotton Pygmy-goose	M	R	305381E 7361325S	6	April	Aldoga Reservoir.
Cotton Pygmy-goose	M	R	261299E 7382736S	5	June	Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road.
Cotton Pygmy-goose	M	R	261299E 7382736S	8	September	Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road.
Cotton Pygmy-goose	M	R	305381E 7361325S	4	September	Aldoga Reservoir.
Cotton Pygmy-goose	M	R	291210E 7367065S	2	September	Large billabong with aquatic vegetation (Horseshoe Lagoon wetland complex) on Darts Creek.
Cotton Pygmy-goose	M	R	261299E 7382736S	5	November	Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road.

Species	EPBC status	NCA status	GPS location	Number of individuals	Month	Comments
Cotton Pygmy-goose	M	R	278241E 7376165S	5	November	Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road.
Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*)	V		271008E 7379403S	5	April	*Eucalyptus tessellaris* grassy woodland.
Squatter Pigeon	V		275732E 7377015S	2	April	Open grassland.
Squatter Pigeon	V		269852E 7378839S	2	April	Open grassland.
Squatter Pigeon	V		284971E 7373708S	6	April	*Eucalyptus coolibah* grassy open woodland.
Squatter Pigeon	V		288112E 7369756S	2	April	*Eucalyptus mollucana* grassy woodland.
Squatter Pigeon	V		291210E 7367065S	4	April	*Eucalyptus tereticornis/E. mollucana* grassy open woodland.
Squatter Pigeon	V		284994E 7373613S	4	April	*Eucalyptus coolibah* grassy open woodland adjacent to Reedy Creek Road.
Squatter Pigeon	V		273188E 7378272S	4	June	Grazing land (cleared poplar box woodland) with narrow linear remnant adjoining dirt road.
Squatter Pigeon	V		270947E 7379412S	2	July	Woodland patch adjacent to Twelve Mile Creek Road.
Squatter Pigeon	V		291210E 7367065S	2	September	Large billabong with aquatic vegetation (Horseshoe Lagoon wetland complex) on Darts Creek.
Squatter Pigeon	V		267674E 7381179S	1	September	Grassy verge of Toonda Port Alma Road. Narrow linear woodland remnant adjoining.
Squatter Pigeon	V		268408E 7380069S	1	September	Grassy verge of Toonda Port Alma Road. Narrow linear woodland remnant adjoining.
Squatter Pigeon	V		272750E 7378616S	2	September	Grassy verge of Twelve Mile Creek Road. Narrow linear woodland remnant adjoining.
Squatter Pigeon	V		273527E 7377745S	2	September	Open grassland adjoining constructed wetland – west of Twelve Mile Road.
Squatter Pigeon	V		273558E 7377878S	1	October	Mixed *Eucalyptus* woodland with grassy/shrubby understorey.
Squatter Pigeon	V		271964E 7379217S	2	October	Poplar box remnant woodland with grassy understorey.
Squatter Pigeon	V		268523E 7379656S	4	October	On unsealed road through mixed *Eucalyptus* woodland with grassy/ shrubby understorey.
Squatter Pigeon	V		267395E 7381524S	1	October	Open grassland alongside unsealed road.

Species	EPBC status	NCA status	GPS location	Number of individuals	Month	Comments
Squatter Pigeon	V		252558E 7397024S	2	October	In dry swale with mid-dense to sparse cover of *Salsola* spp.
Squatter Pigeon	V		267360E 7381568S	2	November	Grassy open drain alongside Marmoor/Toonda Port Alma Road intersection.
Squatter Pigeon	V		271356E 7379366S	2	November	Poplar box woodland remnant with grassy understorey alongside Twelve Mile Road.
Squatter Pigeon	V		270363E 7378971S	2	December	Dirt track through grazed open grassland.
Squatter Pigeon	V		266045E 7381959S	1	December	Road fringed with *Eucalyptus camabageana* and; understorey grassy.
Glossy Black Cockatoo (*Calyptrohynchus lathami*)		V	309443E 7362434S	1	April	Forested ridgeline within a large remnant near the existing slurry pipeline easement.
Black-chinned Honeyeater (*Melithreptus gularis*)		R	291342E 7366828S	6	April	Patch of flowering *Eucalyptus mollucana* adjacent to the power easement to the near north of Mt Larcom township.
Yellow Chat (*Epthianura crocea macgregori*)	CE	E	271121E 7380255S	2	July	Saline wetlands at Twelve Mile Creek. Birds seen in close proximity to one another, out on saline flats; amidst saltwater couch and saltbush fringing inundated clay pan.
Yellow Chat	CE	E	270842E 7381180S	2	September	Twelve Mile Creek Reserve. Saltmarsh adjoining inundated clay pan.

Table 7.7 Areas of Fauna Habitat Sensitivity Associated with the Bajool to Gladstone Section

Area #	GPS reference	Comments	Primary values
17	262098E 7384738S	Seasonal wetland system comprising of natural form broad swales – south of Port Alma railway. Part of Inkerman Creek wetland system.	Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.
18	263729E 7383889S	Inkerman Creek and associated wetlands.	Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.
19	267056E 7382452S	Node of *Eucalyptus moluccana* woodland.	Habitat node in largely cleared landscape.
20	269977E 7379303S	Southern extent of saline wetlands of Twelve Mile Creek Reserve.	Adjacent to potential Yellow Chat habitat.
21	270526E 7379266S	Freshwater section of Twelve Mile Creek – adjacent and upstream of Twelve Mile Creek Reserve.	Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.
22	271347E 7379141S	Twelve Mile Creek tributary – riparian vegetation.	Wildlife movement corridor.
23	273562E 7377895S	Broad seasonal wetland – part of Pelican Creek.	Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.
24	276522E 7376943S	Southern extent of the Hourigan Creek wetland complex.	Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.

Area #	GPS reference	Comments	Primary values
25	276750E 7376802S	Hourigan Creek riparian vegetation.	Wildlife movement corridor.
26	276882E 7376737	Hourigan Creek riparian vegetation.	Wildlife movement corridor.
27	277447E 7376420S	Raglan Creek riparian vegetation (western extent).	Wildlife movement corridor.
28	277783E 7376382S	Raglan Creek riparian vegetation (eastern extent).	Wildlife movement corridor.
29	278466E 7376245S	Remnant vegetation. Also large wetland approximately 100 m to south.	Habitat node in largely cleared landscape.
30	2900029E 7369279S	Darts Creek riparian vegetation – north of Darts Creek Road.	Wildlife movement corridor.
31	292431E 7367021S	Darts Creek riparian vegetation – north of Popenia Road.	Wildlife movement corridor.
32	299229E 7360674S	Larcom Creek tributary riparian vegetation.	Wildlife movement corridor.
33	299783E 7359955S	Larcom Creek riparian vegetation.	Wildlife movement corridor.
34	307772E 7362081S	Boat Landing Creek riparian vegetation.	Wildlife movement corridor.
35	310784E 7362439S	Remnant vegetation to near north of railway line.	Large bushland node.

7.6 Assessment of Impacts

7.6.1 Potential Impacts to Fauna

The alignment of the Gladstone-Fitzroy pipeline was designed to minimise impact to native fauna habitats. In particular, alignment has been strongly influenced by the requirement to avoid traversal of as many wetland habitats (albeit seasonal or semi-permanent) and large and connected areas of native vegetation habitat as possible. This has largely been achieved, though given the length of the pipeline and topographic constraints, it is not possible to avoid all areas that may support fauna habitat.

The potential impacts to fauna species are likely to be limited to direct impacts associated with construction of the proposed pipeline. These impacts may include:

- Vegetation clearing and habitat disturbance
- Habitat fragmentation and disturbance to wildlife movement corridors
- Disturbance to wetlands and waterways
- Trench fall (entrapment of fauna within open trenches during construction)
- Creation of environments favourable to the colonisation and expansion of environmental weeds and pest animals.

The following provides a summary of each of these potential impacts. Where relevant to specific locations or areas, further discussion is provided in Sections 7.6.3 and 7.6.4.

7.6.1.1 Vegetation Clearing and Habitat Disturbance

Structural habitat heterogeneity is an important determinant of terrestrial fauna diversity (e.g. Beattie 1995, Agnew *et al.* 2003). Features that enhance habitat heterogeneity include hollow-bearing trees, a shrubby understorey, ground logs and fallen timber (Gilmore 1985, Bennett *et al.* 1994, Barrett 2000). Generally, greater structural and floristic diversity is associated with areas of remnant native vegetation. The removal of remnant vegetation cover results in the loss of feeding resources and shelter/breeding sites for native fauna and reduced faunal diversity.

The pipeline alignment has been designed to avoid or, where this has not been practicable (e.g. due to topographic constraints), minimise impacts to areas of remnant vegetation. Therefore, the vast majority of the construction footprint traverses cleared and highly disturbed environments and avoids as many areas of regrowth native vegetation as possible.

As a result, impacts to areas of remnant vegetation would not be substantial and the proposed loss of remnant vegetation will be minimal. It is recommended that management practices be implemented that further reduce the loss of vegetation and habitat disturbance associated with the proposed pipeline and disturbance to native fauna (see Section 7.7, Mitigation for details).

As described previously, a large proportion of the project area and surrounding land is subject to grazing and agricultural activities. Within this production landscape, native fauna habitat values have been greatly reduced through either complete clearing of native vegetation cover (and replacement with exotic pasture grasses) or through associated disturbances to remaining patches of native vegetation. Disturbance through simplification of habitat structure (selective clearing, grazing and inappropriate fire regimes) reduces suitable resources and conditions for native fauna and ultimately results in significant reduction in faunal diversity. Often, these simplified habitats support environments more favourable to aggressive, opportunistic native species and introduced predators and/or competitors (e.g. feral cat and cane toad) to the disadvantage of native fauna species that prefer more structurally complex habitats.

A significant threat to a variety of fauna is the potential loss of hollow-bearing trees (Bennett *et al.* 1994). A wide range of vertebrate fauna species are dependent on tree hollows for shelter and breeding, including gliders, possums, microbats, owls, parrots, ducks, and reptiles (Bennett *et al.* 1994, Phillips 2001, Gibbons and Lindenmayer 2002).

Throughout the region, the removal of mature remnant vegetation cover for the development of a production landscape has resulted in a significant reduction in the abundance of hollow-bearing trees. Throughout the project area, mature trees with either limb or trunk hollows were found to be uncommon to Rare. Such trees are generally associated with patches of remnant vegetation, though also as isolated individuals within pastoral land. Those specimens within strips of riparian vegetation (surrounded by cleared lands) are considered to be particularly important in regards to their potential contribution to both habitat values and support for fauna dispersal. Even single or widely scattered mature hollow-bearing trees within a largely cleared landscape can be important habitat (Lumsden and Bennet 2003).

Although native regrowth vegetation occurs within and adjacent to the project area, most trees are too young to form hollows. The majority of this tree cover would require many decades of further growth to reach suitable maturity for hollow formation (e.g. >120 years old to form hollows suitable for occupancy of vertebrate fauna; see data in Gibbons and Lindenmayer (2002)).

All mature hollow-bearing trees will be considered a priority for retention and it is not expected that the construction of the pipeline will require removal of any individuals. A variety of the management strategies are recommended specifically to minimise any potential impacts to hollow-bearing trees within the vicinity of the construction zone (see Section 7.7, Mitigation for details).

As identified previously, ground logs and fallen timber contribute to habitat heterogeneity and species diversity. Ground debris such as fallen logs and timber provide shelter and habitat for a wide range of taxa including native rodents, dasyurid marsupials, bandicoots, snakes, lizards, frogs, and birds (Barrett 2000, Nichols and Reynolds 2000, Grant *et al.* 2001, MacNally and Horrocks 2002, Michael *et al.* 2004). These resources also support suitable habitat for colonising plants and animals (e.g. insects and fungi) which are a source of food for many of these vertebrate species (e.g. Greenslade and Majer 1993, Majer and Nichols 1998).

Impacts to fauna from removal of dead timber will generally diminish over time with natural re-accumulation. Where the pipeline route transects areas of remnant or remnant regrowth vegetation, post-construction management practices will be implemented to minimise impact to ground fauna (e.g. collecting dead timber and redistribution over the alignment after construction) (see Section 7.7, Mitigation for details).

Clearing for infrastructure within areas of remnant vegetation will increase the boundary to area ratio of these communities and therefore increase the potential for edge effects. Edge effects can significantly influence the characteristics of a fauna assemblage. Processes associated with habitat edges may extend well into a habitat area, thus allowing impacts to reach deep into a habitat area (e.g. displacement of small-sized avifauna resulting from the presence of aggressive/competitive birds (Catterall *et al.* 1991)). Edge effects can include the establishment of weeds and alteration to micro-climatic conditions (e.g. greater light intensity, more wind

penetration, lower humidity). A variety of the management strategies are recommended specifically to minimise edge effects on areas of remnant vegetation (see Section 7.7, Mitigation for details).

7.6.1.2 Habitat Fragmentation and Disturbance to Wildlife Movement Corridors

Habitat fragmentation is a reduction in the continuity of a habitat through disturbance or loss. Isolation of fauna populations in small remnants increases their vulnerability to local extinction as a result of stochastic events (e.g. fire, drought and disease) and can decrease their genetic viability in the long-term (Soule *et al*. 1988, Laurence 1990). The capacity of a habitat area to support a range of fauna is also influenced by its extent. Very small habitat areas may be unable to sustain animals with large territories/home ranges, whilst fauna restricted to these and relatively narrow/linear habitats, which support high edge to area relationship, may be exposed to increased predation and competition from species in adjoining areas (Brooker *et al*. 1999).

Throughout the region, habitat areas have been fragmented by vegetation clearing in support of pastoral and agricultural activities. The alignment of the corridor has been designed to avoid large and connected habitat areas and where this has not been possible, to minimise the impact of fragmenting habitat areas.

The survival of species within habitat patches (whether small, large and/or isolated) depends, in part, on their ability to disperse and the capacity to disperse is not equal among species. Discontinuity of suitable habitat linkages may present physical and psychological barriers that can impede or even prevent movement between habitats (Andrews 1990, Catterall *et al*. 1991, Burnett 1992, Brooker *et al*. 1999). The most important and strategically effective initiative in regards to the maintenance of habitat connectivity will be the protection and rehabilitation of native vegetation cover associated with waterways (seasonal or otherwise). Riparian vegetation generally provides a higher diversity of plant species (and therefore feeding resources for fauna) and often denser cover which encourages fauna movement.

Whilst waterway crossings are unavoidable, the pipeline alignment avoids higher quality areas of riparian vegetation. It is recommended that management practices be implemented that further reduce the loss of vegetation and habitat disturbance at these crossing points (see Section 7.7, Mitigation for details). Where it has not been practicable to avoid higher quality riparian vegetation and/or where other habitat sensitivities exist, trenchless creek crossing methods have been selected where possible to avoid impacts to fauna habitats.

Disturbance to Wetlands and Waterways

With the exception of habitats associated with Eight Mile/ Inkerman Creek and Twelve Mile Creek Reserve, natural wetlands throughout the project area have been highly modified by a combination of earth works and/or native vegetation clearing. Bunding works to enhance their capacity to act as ponded pastures under wet summer conditions have significantly altered many of these formerly natural systems. The majority of these wetlands are subject to ongoing disturbance by cattle. Other wetlands have been constructed and are typically small dams.

Despite these disturbances, a variety of these wetlands support habitat values for a wide variety waterbirds and waders, including Rare and Migratory species. South of Midgee, a number of these sites have been monitored monthly over a seven month period in respect to their potential to serve as seasonal refuges for the Critically Endangered Yellow Chat (*Epthianura crocea macgregori*).

As a result of the findings of the field survey program, wetland habitats were identified and the pipeline route adjusted to avoid these whenever possible. In several instances where this was not possible, trenchless crossing methods will be used to reduce the impact to flora and fauna habitat values. Where complete avoidance or trenchless construction methods were not possible, mitigation measures will be adopted that will aim to minimise disturbance to these areas (see Section 7.8, Residual Impact for details). It should be noted that, a distinctly precautionary approach has been adopted in relation to considerations of the pipeline alignment and potential Yellow Chat habitat.

Riparian vegetation generally provides a higher diversity of plant species and often supports mature vegetation and important resources including hollow-bearing trees. Consequently, these areas typically support habitat for a diversity of species and facilitate fauna movement. A characteristic of production landscapes, as is the case within the project area and surrounds, riparian vegetation remains as relatively linear habitats within an otherwise cleared landscape.

Clearing of riparian vegetation should be kept to the minimum required to safely construct the pipeline and meet other environmental requirements (e.g. erosion control, spoil storage). Where possible, construction of waterway crossings should only take place during the dry season (June to September). To avoid impacts to riparian communities, trenchless methods are preferred to cutting an open trench and filling as this reduces the amount of clearing of riparian vegetation. Where trenchless methods are not possible, a variety of other impact mitigation strategies will be implemented, e.g. minimising clearing widths for construction and post-construction rehabilitation (see Section 7.7, Mitigation).

7.6.1.3 Trench Fall

The pipeline will be located underground and trenching is required to accommodate the pipeline. Whilst the pipeline instatement will be progressive (in order to minimise the length of open trenching at any one time), sections of open trench will be present and unavoidable. Open trenching has the potential to form a temporary barrier to fauna movement. In addition, there is the potential for small ground dwelling fauna to fall into the open trench and become trapped and exposed to overheating, dehydration, predation and/or drowning.

Research associated with a variety of major Australian pipeline projects has demonstrated that pipeline trenches can entrap significant numbers of a diverse range of native fauna (including species of conservation significance), particularly reptiles, frogs and small mammals, with the potential for high levels of mortality (Ayers and Wallace 1997, Woinarski *et al*. 2000, Doody *et al*. 2003, Wilson and Swan 2004, and Wilson 2005b). The potential for fauna entrapment and mortality is significant and has been acknowledged as a key environmental issue by the *Australian Pipeline Industry Association Code of Environmental Practice* (APIA 2005).

To help reduce potential impacts from trench fall, the length of open trench will be the minimum practicable at any one time. It is recommended that management practices be implemented that reduce the potential for fauna to enter open trenches and prevent mortality of any individuals which may become entrapped (see Section 7.8, Residual Impact for details).

7.6.1.4 Introduced Fauna and Flora

Vertebrate Fauna

The review of existing information and the findings of field surveys has identified a suite of introduced fauna species which are know or likely to occur within the project area and surrounds. The majority of these species have been widely acknowledged as implicit in the degradation of habitat values for both native fauna biodiversity and species of conservation significance. Threats include predation of native taxa, competition with native fauna, physical degradation of native fauna habitat, and transmission of pathogens to native fauna.

Evidence drawn from field surveys indicates that the occurrence of a variety of pest species was widespread throughout the project area and most are assumed to have resident populations, though their abundance is likely to vary throughout the project area.

As part of the operation of the project, no pest species will be deliberately introduced to the project area and measures will be implemented to reduce accidental introduction.

Invertebrate Fauna

The invertebrate pests of most concern are introduced ants. Red Imported Fire Ants (*Solenopsis invicta*) were first recorded from Australia in 2001 when colonies were found in Brisbane. In 2006, fire ant colonies were found at Yarwun, just west of Gladstone. By September 2006, the Yarwun ants had been eradicated, but the possibility remains that other fire ant colonies may exist around Gladstone or elsewhere in central Queensland.

CSIRO climate model analysis shows that fire ants have the potential to inhabit vast areas of coastal Australia, including natural areas such as world heritage areas and national parks (DPI&F 2007). Fire ants are very aggressive and are voracious feeders and these attributes indicate that fire ants have the potential to impact on native fauna biodiversity, particularly native ground fauna, including invertebrates, skinks, frogs, birds and mammals (DPI&F 2007). There is evidence of these impacts in some fire ant infested bushland in Brisbane's southwest (DPI&F 2007). Fire ants also have the potential effect long-term changes to vegetation communities in natural areas as a result of their habit of eating or damaging native plant seeds and predating/disturbing insects and animals which pollinate native plants (DPI&F 2007).

Red Imported Fire Ants have been declared a notifiable pest under the *Plant Protection Act 1989* (Qld). Landholders are legally obliged to inform the DPI&F if they suspect they have fire ants, and the withholding of this information can result in fines.

The National Fire Ant Eradication Program commenced in 2002 to eradicate the red imported fire ant from Queensland and is part of a nationally coordinated program involving a cooperative approach between the Commonwealth and Queensland Governments (DAFF 2007). Part of the National Fire Ant Eradication Program strategy aims to reduce the spread of fire ants through movement controls, i.e. restrictions on the disturbance or movement of high-risk materials. High-risk materials include soil, mulch, hay, turf and earth-moving machinery/vehicles/equipment.

The extreme southern extent of the project area is included within the area declared as the Yarwun Fire Ant Restricted Area (DPI&F 2007). Regulations apply to commercial activities which involve moving high-risk materials within and out of a fire ant restricted area (e.g. movement of high risk materials must be accompanied by a movement certificate or fire ant declaration form).

Red Imported Fire Ants are very small, only 2 to 6 mm long, coppery brown in colour like beer bottles. They live mainly in dome-shaped nests with no visible entry holes. The nests can be up to 40 cm tall (see illustrations at http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/4790_4549_ENA_HTML.htm), although new nests are often concealed underground or beneath debris with no mound present. Fire ants readily nest in

industrial sites such as outdoor depots, where they can easily be transported along with containers or pipes that have been stored on the ground, especially if soil adheres to the base. They are easily overlooked because they often remain concealed within their nests for long periods, but will storm out when disturbed and sting fiercely. The worker ants vary greatly in size, and this characteristic, plus the lack of visible entry holes in nests, and the stinging behaviour, provides good indications that ants are fire ants. Illustrations can be found on the Department of Primary Industries and Fisheries (DPI&F) website (http://www2.dpi.qld.gov.au/fireants/8294.html). Construction personnel; should not try to identify ants themselves, but should mail samples of any suspicious ants to the Queensland Fire Ant Control Centre. The ants should be killed with insect spray or frozen in a fridge, then sent in a dry condition.

Another invasive ant of concern is the Yellow Crazy Ant *Anoplolepis gracilipes*. Crazy ants have been recorded at various sites along the Queensland coast, including Cairns, Hervey Bay, Brisbane and Logan City. Although crazy ants are not known from the region between Cairns and Hervey Bay, it is considered possible by experts at Biosecurity Queensland that undetected infestations exist (*pers comm.* T. Low, 2007).

Where high populations or super-colonies form, crazy ants can directly impact on a range of native vertebrate and invertebrate fauna and flora (including Threatened taxa), resulting in considerable losses of biodiversity, changes in habitat structure and alterations to the ecosystem processes (DECC 2005, TSSC 2005).

The Yellow Crazy Ant is declared a Class 1 pest under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld). A Class 1 pest is one that is not commonly present in Queensland, and if introduced would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the State. Landowners must take reasonable steps to keep their land free of Class 1 pests. Declaration under state legislation imposes a legal responsibility for control by all landowners on land under their management and without a permit, it is an offence under the *Land Protection Act* to:

- introduce a pest animal to the State
- feed a declared pest animal
- keep a declared pest animal
- release a declared pest animal.

The declaration establishes responsibility with landholders, and gives QNR&M power to take emergency control action, including issuing emergency quarantine notices.

As with fire ants, crazy ants can be transported on vehicles, especially among soil or green waste. A lump of earth attached to a grader, truck or section of pipe could carry a queen ant and enough workers to found a new colony. Vehicle hygiene is thus important. Construction personnel will be trained to report any unusual ants detected around depots or camps.

Yellow imported crazy ants are yellowish tan, about 5 mm long, with long antennae and long legs (see DPI&F website at http://www.nrw.qld.gov.au/pests/pest_animals/declared/crazy_ant.html). Crazy ants do not sting but will spray irritating formic acid from their abdomens when disturbed. This is unlikely to have serious medical consequences. Crazy ants can be spread through transportation with timber and other products, and they have been found inside kitchens on industrial premises in Queensland.

Environmental Weeds

As identified in both this chapter and Chapter 6, Terrestrial Flora, there are a variety of exotic weed taxa within the project area and surrounds. Many of are either known to, or have the potential to pose a significant threat to the maintenance of terrestrial biodiversity values. Weed hygiene and control protocols will be developed and implemented through a construction weed management plan (see Section 7.8, Residual Impact and Chapter 6, Terrestrial Flora).

7.6.2 Potential Impacts to Species of Conservation Significance

As a result of the review of existing information sources, a wide variety of Rare, Threatened and/or Migratory species were initially considered in regards to potential occurrence within the project area (see Table 7.2 and Table 7.3). Habitat suitability assessments and a series of targeted field surveys undertaken for this chapter have provided further assistance to refining the list of taxa to include those known to occur within the project area and close surrounds or those, which have a potential to occur within the project area, and close surrounds.

The findings of that work also indicate that that the project area does not support high quality preferred habitat for the any of those species, though the project area does support areas of comparatively lower quality habitat in which species of conservation significance have been recorded and/or could potentially occur.

In consideration of these issues, it is generally concluded that there is minimal prospect that the development and operation of the project will result in a significant impact to local populations if appropriate impact mitigation measures are implemented (refer to mitigation measures described in Section 7.7, Mitigation).

The following sections identify those species of conservation significance considered in the final analysis and a summary of the potential impact on these species.

7.6.2.1 Rare and Threatened Fauna

The field survey program has detected a suite of Rare and Threatened taxa which have been recorded within the project area or on adjacent land. They are:

- Critically Endangered: Yellow Chat (*Epthianura crocea macgregori*)
- Vulnerable: Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*) and Ornamental Snake (*Denisonia maculata*)
- Regionally Vulnerable: Koala (Southeast Qld) (*Phascolarctos cinereus*)
- Rare: Cotton Pygmy-goose (*Nettapus coromandelianus*), Jabiru (*Ephippiorhynchus asiaticus*), Radjah Shelduck (*Tadorna radjah*) and Black-chinned Honeyeater (*Melithreptus gularis*).

The review of fauna databases and local studies identified a variety of Rare and Threatened species that have been recorded in, or have the potential to occur in, the broader area encompassing the project area. As determined through field surveys, habitat suitability assessments, and knowledge of habitat requirements, the project area does not support examples of quality preferred habitat for many of these species. Whilst the likelihood of occurrence within the project area for many of these taxa was determined to possible, though highly unlikely, a conservative precautionary approach has been adopted and those species have been included in the assessment of potential impacts.

The primary potential impacts to Rare and Threatened taxa include loss of shelter and food resources, loss of breeding sites, trench fall (primarily herpetofauna) and possibly increased predation (primarily small ground mammals and birds) resulting from:

- Clearing of remnant vegetation and riparian communities
- Removal of habitat trees, especially mature hollow-bearing trees
- Removal of ground debris in the construction of the pipeline
- Trenching operations
- Increased ease of access for introduced predators.

Table 7.8 provides a summary of occurrence status and potential impacts and mitigation responses for Rare and Threatened fauna that are known to occur, or have the potential to occur, within habitats of the project area and/or land immediately adjacent.

Table 7.8 Summary of Occurrence Status and Mitigation Responses for Rare and Threatened Fauna

Status:	CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory
Legislation:	EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (Cth) NCA = *Nature Conservation Act 1992* (Qld)

Species	EPBC status	NCA status	Occurrence status and summary of key impact mitigation strategies
Koala (Southeast Qld) (*Phascolarctos cinereus*)		RV	**Known.** Minimise impacts to remnant woodlands and forest and minimise clearing widths through riparian communities. Note: Regionally Vulnerable status only applies to Southeast Queensland bioregion and thus only to the section of the project area south of about Mt. Larcom.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V		**No record, possible.** Northern extent of distribution around Gladstone, though may occur in southern parts of project area. Minimise tree clearing and impacts to remnant woodlands and forest.
Greater Long-eared Bat (*Nyctophilus timoriensis*)	V	V	**No record, possible.** Northern extent of distribution around Gladstone/Mt. Larcom. Minimise impacts to remnant vegetation communities (especially those with a shrubby understorey), micro-tunneling or restricted clearing widths through riparian communities, protection of hollow-bearing trees, and post-construction habitat rehabilitation.
Little Pied Bat (*Chalinolobus picatus*)		R	**No record, possible.** Minimise impacts to remnant vegetation communities (especially Brigalow communities), microtunneling or restricted clearing widths through riparian communities, post-construction habitat rehabilitation and protection of hollow-bearing trees.
Collared Delma (*Delma torquata*)	V	V	**No record, possible.** Minimise impacts to remnant woodland and open forest communities (especially those associated with cracking clays), open trench exclusion fencing, and trench fall rescue protocols.
Brigalow Scaly-foot (*Paradelma orientalis*)	V	V	**No record, possible.** Minimise impacts to remnant vegetation communities (especially those with rocky outcrops at the southern end of the project area), open trench exclusion fencing and trench fall rescue protocols.
Anomalopus brevicollis		R	**No record, possible.** Minimise impacts to remnant vegetation communities (especially those with rocky outcrops at the southern end of the project area), open trench exclusion fencing, trench fall rescue protocols, and post-construction habitat rehabilitation. Species ecology is poorly known.
Yakka Skink (*Egernia rugosa*)	V	V	**No record, possible.** Minimise impacts to remnant woodland and open forest communities (especially those with rocky outcrops at the southern end of the project area), trench fall rescue protocols, and post-construction habitat rehabilitation.
Common Death Adder (*Acanthophis antarcticus*)		R	**No record, possible.** Minimise impacts to remnant woodland and open forest communities (especially those with rocky outcrops at the southern end of the project area), trench fall rescue protocols, and post-construction habitat rehabilitation. Formerly abundant in parts of the Brigalow Belt, though numbers have declined dramatically.
Yellow-naped Snake (*Furina barnardi*)		R	**No record, possible.** Minimise impacts to remnant woodland and open forest communities (especially those with rocky outcrops at the southern end of the project area), trench fall rescue protocols, and post-construction habitat rehabilitation. Taxonomy status and ecology uncertain.
Grey snake (*Hemiaspis damelii*)		E	**No record, possible.** May occur in remnant or native regrowth vegetation, especially patches on heavier, cracking clay soils, in association with waterbodies (northern and central sectors of project area). Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, post-construction habitat rehabilitation, open trench exclusion fencing, trench fall rescue protocols, and trench fall rescue protocols, and post-construction habitat rehabilitation. Species ecology is poorly known.
Ornamental Snake (*Denisonia maculata*)	V	V	**Known.** Recorded from woodland adjacent to wetland (near south of Midgee). May occur in similar habitats to north and south, especially patches on heavier, cracking clay soils, in association with waterbodies. Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, post-construction habitat rehabilitation, open trench exclusion fencing, trench fall rescue protocols, and trench fall rescue protocols, and post-construction habitat rehabilitation.

Species	EPBC status	NCA status	Occurrence status and summary of key impact mitigation strategies
Radjah Shelduck (*Tadorna radjah*)	M	R	**Known.** Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, and post-construction habitat rehabilitation.
Cotton Pygmy-goose (*Nettapus coromandelianus*)	M	R	**Known.** Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, and post-construction habitat rehabilitation.
Black-necked Stork (*Ephippiorhynchus asiaticus*)		R	**Known**. Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, and post-construction habitat rehabilitation.
Square-tailed Kite (*Lophoictinia isura*)	M	R	**No record, possible.** Minimise impacts to remnant woodland and forest (particularly larger patches in southern sector of project area), minimise clearing widths through riparian communities, and post-construction habitat rehabilitation.
Grey Goshawk (*Accipiter novaehollandiae*)	M	R	**No record, possible.** Minimise clearing widths within shrubby remnant forest and denser riparian communities (particularly in the southern extent of project area, e.g. Boat Landing Creek area) and post-construction habitat rehabilitation. Possible seasonal visitor to remnant vegetation of southern extent of project area.
Red Goshawk (*Erythrotriorchis radiatus*)	V/M	E	**No record, possible.** Minimise impacts to remnant woodland and forest (particularly larger patches in southern sector of project area), and post-construction habitat rehabilitation. Distribution uncertain in region and these raptors require a very large home range.
Painted Snipe (*Rostratula benghalensis*)	V,M	V	**No record, possible.** Occurrence erratic and unpredictable, seldom remaining long in wetlands at any locality. Minimise impacts to wetland areas through microtunneling, minimal clearing paths, and post-construction habitat rehabilitation.
Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*)	V		**Known.** Recorded from a variety of locations**,** though mainly within the central sector of the project area. Known to occur in highly disturbed cleared landscapes. Minimise impacts to drier eucalypt woodland and areas where native grasses predominate, and post-construction habitat rehabilitation.
Glossy Black Cockatoo (*Calyptrohynchus lathami*)		V	**Known.** Potentially suitable habitat only occurs within the extreme southern part of project area (to near north of smelter). Minimise impacts to remnant woodland and open forest (particularly those with *Allocasuarina*/*Casuarina* trees), protection of hollow-bearing trees, and post-construction habitat rehabilitation.
Powerful Owl (*Ninox strenua*)		V	**No record, possible.** Potentially suitable habitat only occurs within the extreme southern part of project area. Favours large intact remnants. Minimise impacts to remnant open forest, protection of hollow-bearing trees, and post-construction habitat rehabilitation. Requires an extensive home range.
Rufous Owl (*Ninox rufa queenslandica*)		V	**No record, possible.** Potentially suitable habitat only occurs within the extreme southern part of project area (i.e. riparian forest along Boat Landing Creek), though also mangrove communities along Raglan Creek. Requires an extensive home range. Microtunneling or restricted clearing widths through riparian communities, protection of hollow-bearing trees, and post-construction habitat rehabilitation.
Black-chinned Honeyeater (*Melithreptus gularis*)		R	**Known.** Known from two locations and associated with flowering eucalypts. Minimise impacts to remnant woodland and forest (particularly larger patches), minimal clearing widths through riparian communities, and post-construction habitat rehabilitation. Distribution uncertain in region, locally nomadic and tend to tend to occur in the largest woodland patches in the landscape.

Species	EPBC status	NCA status	Occurrence status and summary of key impact mitigation strategies
Yellow Chat (*Epthianura crocea macgregori*)	CE	E	**Known.** Recorded within one kilometre of project area though not recorded within adjacent areas along ROW (despite a seven-month monitoring program). Five areas of potentially suitable Yellow Chat habitat are traversed by the ROW (see figure 7.4 and 7.6). These include potential Yellow Chat habitat at: Fauna Habitat Sensitivity Site 16 (see Table 7.11), north of Inkerman Creek Fauna Habitat Sensitivity Site 17 (see Table 7.12), at the Inkerman Creek crossing Fauna Habitat Sensitivity Site 21 (see Table 7.12) at the Twelve Mile Creek crossing Fauna Habitat Sensitivity Site 23 (see Table 7.12), at the Pelican Creek crossing Fauna Habitat Sensitivity Site 24 (see Table 7.12), to the west of Raglan Creek Minimise impacts to wetland areas through microtunneling (see Table 7.1 for all monitoring sites), minimal clearing paths, sediment and pollutant controls, rehabilitation of pre-construction drainage patterns, dry season construction scheduling, post-construction habitat rehabilitation, measures to protect rehabilitation such as feral animal controls and weed eradication.

Table 7.9 lists those relevant taxa which are classified as Threatened (i.e. Endangered or Vulnerable) under the EPBC Act and responses to the significant impact criteria as described within the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (May 2006). As a result of the analysis summarised in the following table, it is considered that the proposed action will not have a real chance or possibility of occurring as per the Guidelines noted above.

Table 7.9 Summary of Significant Impact Criteria for EPBC Threatened Fauna

Significant impact criteria
Criteria 1: Lead to a long-term decrease in the size of the population.
Criteria 2: Reduce the area of occupancy of the species.
Criteria 3: Fragment an existing population into two or more populations.
Criteria 4: Adversely affect habitat critical to the survival of the species.
Criteria 5: Disrupt the breeding cycle of a population.
Criteria 6: Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Criteria 7: Result in invasive species that are harmful to an Endangered species becoming established in the species' habitat.
Criteria 8: Introduce disease that may cause the species to decline.
Criteria 9: Interfere with the recovery of the species.
Criteria Source: *EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (May 2006).

Threatened species	Status	Response to significant impact criteria								
		#1	#2	#3	#4	#5	#6	#7	#8	#9
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	No	No	No	No	No	No	No	No	No
Greater Long-eared Bat (*Nyctophilus timoriensis*)	V	No	No	No	No	No	No	No	No	No
Ornamental Snake (*Denisonia maculata*)	V	No	No	No	No	No	No	No	No	No
Collared Delma (*Delma torquata*)	V	No	No	No	No	No	No	No	No	No
Brigalow Scaly Foot (*Paradelma orientalis)*	V	No	No	No	No	No	No	No	No	No
Yakka Skink (*Egernia rugosa*)	V	No	No	No	No	No	No	No	No	No
Red Goshawk (*Erythrotriorchis radiatus*)	V	No	No	No	No	No	No	No	No	No
Painted Snipe (*Rostratula benghalensis*)	V	No	No	No	No	No	No	No	No	No
Squatter Pigeon (sth. subsp.) (Geophaps scripta scripta)	V	No	No	No	No	No	No	No	No	No
Yellow Chat (*Epthianura crocea macgregori*)	CE	No	No	No	No	No	No	No	No	No

7.6.2.2 Alignment with the Yellow Chat Recovery Plan

In August 2008, a recovery plan for the Yellow Chat (*Epthianura crocea macgregori*) was released by the Commonwealth and Queensland governments (Houston and Melzer 2008). The recovery plan lists the following as threats to Yellow Chats:

1. Lack of knowledge regarding key aspects of Capricorn Yellow Chat ecology and habitat requirements.
2. Construction of barriers such as extensive levee banks for ponded pasture development or road works within tidal areas.
3. Construction of impoundments (weirs and dams or ponded pastures) upstream of areas supporting Yellow Chats.
4. Spread of exotic pasture grasses, particularly aleman grass and Olive hymenachne.
5. Increase in cattle stocking densities where chats currently occur.
6. Uncontrolled fire.

Field survey work undertaken to investigate potential Yellow Chat habitat within the project area will contribute to the understanding of Yellow Chat occurrence and habitat usage (thus support resolution of threat 1). In relation to threats 2 and 3, the project does not involve development of levee banks or impoundments and is supported by a extensive range of impact avoidance and mitigation strategies in relation to construction works within or near wetlands, thus the project will not exacerbate the effects of threats 2 and 3. In relation to threat 4, a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of environmental weeds within the project area (see Chapter 20, Planning and Environmental Management Plan). Likewise, there are a suite of project controls designed to eradicate and environmental weeds which may establish within the project area and adjoining land. In relation to threat 5, the project does not involve the introduction of cattle and a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of introduced fauna within the project area (see Chapter 20, Planning and Environmental Management Plan). In relation to threat 6, protocols have been prepared to ensure minimal risk of fire emanating from the project area (See Chapter 16, Hazard and Risk; and Chapter 20, Planning Environmental Management Plan).

7.6.2.3 Migratory Fauna

Table 7.10 lists those species, scheduled as Migratory under the EPBC Act, which are known or likely to occur within the project area. The majority of these are regarded as relatively common and widespread species within the region. Generally, these species can be grouped according their key habitat requirements. The primary ecological groupings are:

- Avifauna associated with freshwater and brackish wetlands e.g. waterfowl, egrets and shorebirds
- Avifauna of remnant woodlands, open forest, remnant regrowth and open timbered country e.g. raptors, cuckoos, flycatchers, bee-eaters and songlarks.

As identified previously, the vast majority of the construction footprint traverses cleared and highly disturbed environments and avoids as many areas of remnant vegetation as possible. Likewise, the alignment has been informed by ecological assessments and has been aligned to avoid as many wetland habitats as possible. Where this has not been possible, impacts will be minimised through the implementation of a wide variety of specific management strategies (see Section 7.7).

Table 7.10 lists those relevant taxa which are classified as Migratory under the EPBC Act and responses to the significant impact criteria as described within the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (May 2006). Through the implementation of a wide variety of specific management strategies recommended herein, it is considered that the proposed action will not have a real chance or possibility of occurring as per the Guidelines noted above.

Table 7.10 Summary of Significant Impact Criteria for EPBC Migratory Fauna

Significant impact criteria
Criteria 1: Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles).
Criteria 2: Destroy or isolate an area of important habitat for a Migratory species.
Criteria 3: Result in an invasive species that is harmful to the Migratory species becoming established in an area of important habitat for the Migratory species.
Criteria 4: Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a Migratory species.
Criteria Source: *EPBC Act Policy Statement 1.1 Significant Impact Guidelines-Matters of National Environmental Significance* (May 2006).

Migratory species	**Occurrence status**	#1	#2	#3	#4
Black-necked Stork (*Ephippiorhynchus asiaticus*)	Known	No	No	No	No
Magpie Goose (*Anseranas semipalmata*)	Known	No	No	No	No
Hardhead (*Aythya australis*)	Known	No	No	No	No
Musk Duck (*Biziura lobata*)	No record, possible	No	No	No	No
Australian Wood Duck (*Cheonetta jubata*)	Known	No	No	No	No
Wandering Whistling Duck (*Dendrocygna arcuata*)	Known	No	No	No	No
Plumed Whistling Duck (*Dendrocygna eytoni*)	No record, likely	No	No	No	No
Radjah Shelduck (*Tadorna radjah*)	Known	No	No	No	No
Black Swan (*Cygnus atratus*)	Known	No	No	No	No
Cotton Pygmy-goose (*Nettapus coromandelianus*)	Known	No	No	No	No
Green Pygmy-goose (*Nettapus pulchellus*)	No record, possible	No	No	No	No
Chestnut Teal (*Anas castanea*)	No record, possible	No	No	No	No
Grey Teal (*Anas gracilis*)	Known	No	No	No	No
Australasian Shoveler (*Anas rhynchotis*)	No record, likely	No	No	No	No
Pacific Black Duck (*Anas superciliosa*)	Known	No	No	No	No
Pink-eared Duck (*Malacorhynchus membranaceus*)	Known	No	No	No	No

Migratory species	Occurrence status	#1	#2	#3	#4
Great Egret (*Ardea alba*)	Known	No	No	No	No
Cattle Egret (*Ardea ibis*)	Known	No	No	No	No
Glossy Ibis (*Plegadis falcinellus*)	No record, possible	No	No	No	No
Pacific Baza (*Aviceda subcristata*)	No record, likely	No	No	No	No
Black-shouldered Kite (*Elanus axillaris*)	Known	No	No	No	No
Brahminy Kite (*Haliastur indus*)	No record, possible	No	No	No	No
Whistling Kite (*Haliastur spenurus*)	Known	No	No	No	No
Square-tailed Kite (*Lophoictinia isura*)	No record, possible	No	No	No	No
Little Eagle (*Hieraaetus morphnoides*)	No record, possible	No	No	No	No
Collared Sparrowhawk (*Accipiter cirrhocephalus*)	Known	No	No	No	No
Brown Goshawk (*Accipiter fasciatus*)	Known	No	No	No	No
Grey Goshawk (*Accipiter novaehollandiae*)	No record, possible	No	No	No	No
Red Goshawk *Erythrotriorchis radiatus*)	No record, possible	No	No	No	No
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	Known	No	No	No	No
Wedge-tailed Eagle (*Aquila audax*)	Known	No	No	No	No
Swamp Harrier (*Circus approximans*)	No record, possible	No	No	No	No
Spotted Harrier (*Circus assimilis*)	No record, likely	No	No	No	No
Brown Falcon (*Falco berigora*)	Known	No	No	No	No
Nankeen Kestrel (*Falco cenchroides*)	Known	No	No	No	No
Australian Hobby (*Falco longipennis*)	Known	No	No	No	No
Peregrine Falcon (*Falco peregrinus*)	No record, possible	No	No	No	No
Brolga (*Grus rubicundus*)	Known	No	No	No	No
Latham's Snipe (*Gallinago hardwickii*)	No record, likely	No	No	No	No
Little Curlew (*Numenius minutus*)	No record, possible	No	No	No	No
Marsh Sandpiper (*Tringa stagnatilis*)	No record, likely	No	No	No	No
Red-necked Stint (*Calidris ruficollis*)	No record, possible	No	No	No	No
Sharp-tailed Sandpiper (*Calidris acuminata*)	No record, likely	No	No	No	No
Curlew Sandpiper (*Calidris ferruginea*)	No record, likely	No	No	No	No
Painted Snipe (*Rostratula benghalensis*)	No record, possible	No	No	No	No
Black-winged Stilt (*Himantopus himantopus*)	Known	No	No	No	No

Migratory species	Occurrence status	#1	#2	#3	#4
Red-necked Avocet (*Recurvirostra novaehollandiae*)	No record, likely	No	No	No	No
Red-capped Plover (*Charadrius ruficapillus*)	Known	No	No	No	No
Black-fronted Dotterel (*Elseyornis melanops*)	Known	No	No	No	No
Red-kneed Dotterel (*Erythrogonys cinctus*)	No record, likely	No	No	No	No
Masked Lapwing (*Vanellus miles*)	Known	No	No	No	No
Banded Lapwing (*Vanellus tricolor*)	No record, likely	No	No	No	No
White-winged Black Tern (*Chlidonias leucopterus*)	No record, possible	No	No	No	No
Oriental Cuckoo (*Cuculus saturatus*)	No record, possible	No	No	No	No
White-throated Needletail (*Hirundapus caudacutus*)	No record, likely	No	No	No	No
Fork-tailed Swift (*Apus pacificus*)	No record, likely	No	No	No	No
Rainbow Bee-eater (*Merops ornatus*)	Known	No	No	No	No
Clamorous Reed-warbler (*Acrocephalus stentoreus*)	Known	No	No	No	No
Little Grassbird (*Megalurus gramineus*)	No record, possible	No	No	No	No
Tawny Grassbird (*Megalurus timoriensis*)	Known	No	No	No	No
Brown Songlark (*Cinclorhamphus cruralis*)	Known	No	No	No	No
Rufous Songlark (*Cinclorhamphus mathewsi*)	Known	No	No	No	No
Golden-headed Cisticola (*Cisticola exilis*)	Known	No	No	No	No
Zitting Cisticola (east. subsp.) (*Cisticola juncidis laveryii*)	No record, possible	No	No	No	No
Black-faced Monarch (*Monarcha melanopsis*)	No record, possible	No	No	No	No
Spectacled Monarch (*Monarcha trivirgatus*)	No record, possible	No	No	No	No
Satin Flycatcher (*Myiagra cyanoleuca*)	No record, possible	No	No	No	No
Rufous Flycatcher (*Rhipidura rufifrons*)	Known	No	No	No	No

7.6.3 Fitzroy to Bajool

During the field survey program, habitats of comparatively higher value were identified and the pipeline route adjusted to avoid these whenever possible. However, where impacts are unavoidable, mitigation measures will be adopted that will aim to minimise disturbance to these areas (see Section 7.7, Mitigation). Table 7.11 lists and describes the areas of fauna habitat sensitivity (see also Figure 7.4) and for each area, a summary of the key impact mitigation strategies which should be implemented.

Table 7.11 Potential Impacts and Primary Mitigation Strategies for Key Locations Within the Fitzroy to Bajool Section

Area #	Habitat and comments	Potential impacts and primary mitigation strategies
1	Fitzroy River riparian habitats. Fauna movement; habitat for forest birds and microbats; and hollow-bearing trees.	Removal of mature hollow-bearing trees; disruption to wildlife movement corridor. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; trench fall management protocols.
2	Northwestern extension of a series of semi-permanent vegetated billabongs to north of Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; measures to protect rehabilitation such as feral animal controls and weed eradication.
3	Western end of a series of semi-permanent vegetated billabongs. Extends south to Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; measures to protect rehabilitation such as feral animal controls and weed eradication.
4	Western end of a large semi-permanent constructed wetland. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; measures to protect rehabilitation such as feral animal controls and weed eradication.
5	Corridor traverses centre of semi-permanent wetland. Largely natural form though surrounds cleared of remnant vegetation. North of Malchi Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
6	Billabong of natural form though surrounds cleared of remnant vegetation. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
7	Billabong of largely natural form though surrounds cleared of remnant vegetation. North of Titman Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
8	Adjacent to Gavial Creek wetlands. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; weed control protocols; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
9	Small open seasonal wetland – part of Serpentine Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; weed control protocols; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.

Area #	Habitat and comments	Potential impacts and primary mitigation strategies
10	Shallow seasonal wetland and part of the Serpentine Creek wetland system – north of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
11	Shallow seasonal wetland and part of the Serpentine Creek wetland system – south of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; weed control protocols; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
12	Seasonal wetland and part of the Serpentine Creek wetland system – south of Casuarina Road. Habitat for waterbirds and waders, including Rare and Migratory species	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling.
13	Dingo Creek riparian vegetation. Fauna movement; locally significant habitat corridor.	Removal of remnant vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. Strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns.
14	Station Creek riparian vegetation. Fauna movement; locally significant habitat corridor.	Removal of remnant vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. Strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns.
15	Oakey Creek riparian vegetation. Fauna movement; locally significant habitat corridor.	Removal of remnant vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. Strict vegetation clearance protocols; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns.
16	Seasonal wetland system comprising of natural form broad swales. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Removal of mature hollow-bearing trees; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.

7.6.4 Bajool to Gladstone

During the field survey program, habitats of comparatively higher value were identified and the pipeline route adjusted to avoid these whenever possible. However, where impacts are unavoidable, mitigation measures will be adopted that will aim to minimise disturbance to these areas (see Section 7.8).

Table 7.12 lists and describes the areas of fauna habitat sensitivity and for each area, a summary of the key impact mitigation strategies which will be implemented.

These mitigation measures will include minimising disturbance widths, microtunnelling, and adopting practices for restoring areas of high habitat values.

Table 7.12 Potential impacts and primary mitigation strategies for key locations within the Bajool to Gladstone section

Area #	Habitat and comments	Potential impacts and primary mitigation strategies
17	Seasonal wetland system comprising of natural form broad swales – south of Port Alma railway. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
18	Inkerman Creek and associated wetlands. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Removal of remnant vegetation; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; post-construction area-specific restoration; microtunneling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
19	Node of *Eucalyptus moluccana* woodland. Habitat node in largely cleared landscape.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; introduction of exotic flora and fauna. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; measures to protect rehabilitation such as feral animal controls and weed eradication; trench fall management protocols.
20	Southern extent of saline wetlands of Twelve Mile Creek Reserve. Adjacent to potential Yellow Chat habitat.	Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; minimal construction clearing path; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
21	Freshwater section of Twelve Mile Creek – adjacent and upstream of Twelve Mile Creek Reserve. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; microtunneling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies.
22	Twelve Mile Creek tributary – riparian vegetation. Wildlife movement corridor.	Removal of remnant vegetation; removal of mature hollow-bearing trees; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
23	Broad seasonal wetland – part of Pelican Creek. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
24	Southern extent of the Hourigan Creek wetland complex. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.

Area #	Habitat and comments	Potential impacts and primary mitigation strategies
25	Hourigan Creek riparian vegetation. Wildlife movement corridor.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
26	Hourigan Creek riparian vegetation. Wildlife movement corridor.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
27	Raglan Creek riparian vegetation (western extent). Wildlife movement corridor.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
28	Raglan Creek riparian vegetation (eastern extent). Wildlife movement corridor.	Removal of remnant vegetation; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
29	Remnant vegetation. Also large wetland approximately 100m to south. Habitat node in largely cleared landscape.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; introduction of exotic flora and fauna. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; measures to protect rehabilitation such as feral animal controls and weed eradication; trench fall management protocols.
30	Darts Creek riparian vegetation – north of Darts Creek Road. Wildlife movement corridor.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.

Area #	Habitat and comments	Potential impacts and primary mitigation strategies
31	Darts Creek riparian vegetation – north of Popenia Road.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
32	Larcom Creek tributary riparian vegetation.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
33	Larcom Creek riparian vegetation.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
34	Boat Landing Creek riparian vegetation.	Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.
35	Remnant vegetation to near north of railway line.	Removal of remnant vegetation; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; weed control strategies; trench fall management protocols.

7.7 Mitigation

The following section identifies the management measures which are recommended in relation to mitigation of the potential impacts to fauna described previously in this chapter. The management requirements listed in this section are common to a number of construction activities. The following guidelines are also included in Chapter 20, Planning Enviromental Management Plan.

Specific mitigation measures for EPBC Act listed Threatened species are given in Chapter 6, Section 6.1 (in summary) and Appendix G (in detail).

7.7.1 General Requirements

All personnel shall attend environmental training prior to entering the work site. As part of this training, all personnel will be briefed about their obligations to protect fauna.

- Fauna shall not be fed and direct contact with fauna is to be avoided. This includes both native and introduced species.

7.7.2 Vegetation Clearing and Habitat Disturbance

- Where possible, minor refinements or narrowing of the ROW that reduce impacts to areas of remnant vegetation, waterway crossings and hollow bearing trees are to be investigated and adopted where possible during final surveying
- No vegetation removal shall occur until relevant approvals have been obtained. All permit approval conditions will be followed
- Clearing boundaries will be delineated on all drawings and in the field to define the extent of authorised clearing
- Installation of vegetation clearance markers (e.g. high visibility poly-web fencing) prior to the commencement of vegetation clearance. No flagged vegetation shall be removed
- Identify and peg out intended vehicle access tracks to and along the right of way (ROW) at the commencement of the construction phase, to prevent the development of multiple access tracks
- Vegetation clearing will be limited to within the construction footprint (ie. the generally 30 m ROW and infrastructure sites). Construction equipment and personnel will not be permitted outside the surveyed areas. Impact to vegetation outside the ROW will be avoided
- Cleared vegetation is to be stockpiled so as not to impede wildlife, surface drainage and avoid damage to adjacent live vegetation
- Locating features such as fill stockpiles, access tracks, site facilities, etc. in areas of existing disturbances
- Within areas of remnant vegetation, limiting clearing along access tracks (except for the access tracks themselves) within the ROW to slashing to a minimum height of 200mm, to allow for the retention of ground layer and understorey vegetation elements in all areas not directly utilised for infrastructure construction or access track purposes
- Where possible, lopping of trees within the clearing zone, in preference to completely removing them
- If required, trimming of branches overhanging the easement will be undertaken using a chainsaw
- All mature hollow-bearing trees are to be retained and protected wherever practicable. Where this cannot be achieved, hollow limbs and/or trunks should be left on the ground adjacent to the ROW (or relocated to within areas of remnant vegetation) to provide habitat for ground-dwelling fauna
- Clearance of ground cover vegetation shall be minimised as much as possible in the construction easement. Cleared or trimmed vegetation shall be stockpiled separately from topsoil
- Where practical timber is to be chipped or stick raked into stock piles for use in revegetation and erosion control
- Prescribed burning will only be undertaken with fire authority approval and only when it is not possible to respread the cleared vegetation (e.g. where material includes a major component of woody weed infestation)
- Construction activities shall be scheduled to minimise the time between clearing and rehabilitating the ROW
- Topsoil and vegetation will be respread as soon as practicable after the completion of construction works
- The surface profile shall be reinstated to ensure maintenance of local surface conditions
- The topsoil shall be stockpiled in a manner so that it can be easily returned during reinstatement (i.e. not placed on uncleared vegetation or against tree trunks). Soil and vegetation stripped from the ROW will be stored immediately adjacent to the site where it originated. No soil or vegetation material is to be transported along the corridor
- Trench spoil is to be stockpiled separately from topsoil. Where practicable, deep top soil from the trench will be stockpiled separately from the subsoil
- A reseeding plan based on soil type and existing local ground layer vegetation characteristics (i.e. native or improved pastures) along the alignment will be implemented
- Local provenance native plant seed is to be used for rehabilitation within any areas of remnant or remnant regrowth vegetation that supports a ground cover of native grasses. Where this is not possible, seed from other parts of central Queensland would be acceptable.
- Monitoring of vegetation reestablishment is to be conducted by a suitably qualified ecologist.

7.7.3 Habitat Fragmentation and Disturbance to Wildlife Movement Corridors

- Constraining corridor clearing widths to the minimum necessary to allow construction of infrastructure (i.e. the minimum required to safely construct the infrastructure and fulfil environmental management requirements, e.g. erosion control)
- Avoiding additional clearing of remnant vegetation for construction vehicle access tracks, truck turning areas and extra workspaces
- Logs and fallen vegetation will be replaced post construction to provide habitat for native fauna
- Where required, trees adjacent to working areas are to be lopped, with complete-to-ground clearing being avoided
- Avoid construction of separate crossings for access tracks, as access would be able to be gained to the crossing area from both sides of all creeks

- Any fencing necessary along the outer ROW boundary should allow passage of fauna from either side of such fencing. For new fencing, the design should incorporate a 30 cm gap between ground level and the first rail or wire strand. A chain-wire fence should also incorporate a 30 cm gap between the bottom of the chain-wire and ground level and the overall height of a chain-wire fence should be limited to maximum of 1.5 m or less. The use of barbed wire should be avoided and used only where essential to exclude stock from adjoining pastoral activities.

7.7.4 Disturbance to Wetlands and Waterways

- Construction in wetlands and waterways should be undertaken during the dry season (i.e. June to September) wherever possible
- Water quality protection measures (e.g. sediment and pollutant controls) are to be installed prior to the main construction works (i.e. trenching and pipeline instatement)
- Disturbance to habitat values have been minimised where possible through trenchless construction methods
- The construction corridor and the clearing of wetland vegetation cover (native or introduced) is to be kept to the minimum required to safely construct the pipeline and comply with other environmental management safeguards (e.g. erosion control, pollutant controls, spoil storage, etc.)
- Surface drainage is to be returned to pre-construction patterns
- Areas disturbed by construction activities are to be rehabilitated to closely reflect pre-construction vegetation floristics and structure where possible
- Monitoring of vegetation reestablishment is to be conducted by a suitably experienced ecologist.

7.7.5 Trench Fall

- Where practical, construction should be timed to take place in the coolest and driest months (i.e. June to September), when activity levels of reptiles and amphibians are lowest and when conditions are most favourable for minimising fauna mortality in open trenching
- Construction activities will be planned so that the excavated trench will be open for the minimum practicable amount of time. Trenching should occur progressively to minimise the period of time the trench is open and the length of open trench
- Specific requirements to minimise fauna entrapment and mortality include:
  - Minimising the length of trench open at any one time
  - Minimising length of trench to be left open over night
  - The ends of an open trench left open outside working hours will be ramped to a gentle incline (< 50%) so as to allow any fauna to escape
  - Escape ramps and trench plugs (with slopes < 50%) are to be established for every 500 m of open trench. Additional methods may be adopted to create 'ladders' at regular intervals to assist small fauna to exit the trench (e.g. branches, ramped gangplanks) see APIA (2005))
  - In addition, two damp, sawdust filled hessian bags (shelter sites) are to placed intermediate to the escape ramps. Provision of fauna refuge areas should be guided by methods successfully employed during construction of the North Queensland Gas Pipeline (NQGP) (see Wilson and Swan (2004))
- Construction personnel will inspect the entire open length of the trench daily from sunrise. If required, wildlife handlers (spotter catchers) will be called to site to attend to fauna issues
- Wildlife handlers will remove wildlife from the trenches, identify, record data and release the captures into nearby vegetated areas. Personnel will be legally permitted, trained in appropriate handling protocols, and will possess the necessary Personal Protection Equipment (PPE) for the handling of animals
- Wildlife handlers must be licensed to euthanase badly injured fauna that are found within the trench. The *Australian National Health and Medical Research Council's Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (2004)* are to be followed when dealing with injured fauna
- A permit to interfere with wildlife from the Queensland Environment Protection Agency will be required for the wildlife handling activities as will the appropriate Animal Ethics Permit from the Department of Primary Industries
- Protocols for extracting fauna with minimal harm from open trenches should follow guidelines provided in Woinarski *et al.* (2000).

7.7.6 Introduced Flora and Fauna

7.7.6.1 Vertebrate Fauna

- The proposed development will not deliberately introduce any invasive species. Companion animals are to be banned from all pipeline construction activities to ensure that no pest species are introduced
- Measures to protect rehabilitation efforts will be implemented as required on specialist advice. For example, measures may include design and implementation of an ongoing systematic monitoring program to detect the occurrence of feral animals and/or weeds
- Implementation of a program to ensure strict litter control throughout the construction site. This is to be supported by: site-wide signage; an adequate number of litter bins (which by design exclude birds and vermin); bin clearance on a regular basis; daily maintenance of crib rooms to ensure cleanliness; educational signage within crib rooms on the linkage between poor waste management practices, increases in pest animal populations and subsequent impacts to native fauna.

7.7.6.2 Invertebrate Fauna

The extreme southern extent of the project area is included within the area declared as the Yarwun Fire Ant Restricted Area (DPI&F 2007). Regulations apply to commercial activities which involve moving high risk materials within and out of a fire ant restricted area (e.g. movement of high risk materials must be accompanied by a movement certificate or fire ant declaration form).

To comply with these regulations, an Approved Risk Management Plan (ARMP) will be developed in consultation with DPI&F. The ARMP will set out strategies to be implemented to reduce the risk of spreading fire ants, including measures to reduce the potential facilities and/or equipment becoming infested with fire ants. The ARMP will include, but not be limited to, the following strategies (after DPI&F 2007):

- A site inspection will be conducted as required by a DPI&F inspector or approved person prior to moving or disturbing any soil
- Vehicles, equipment and pipes will be inspected at depots before they are taken into the field to ensure they are not carrying live ants, and not carrying clods of earth that could conceivably contain ants
- Construction activities will not move fire ant infested material outside the restricted area without the approval of a DPI&F inspector and only to approved disposal sites within a restricted area. Infested soil may only be moved to a DPI&F approved disposal site.
- All high risk materials will be treated before being moved out of the restricted area
- Materials not infested with fire ants may be disposed within the restricted area using approved disposal sites only
- Where the ARMP is not applicable to sub-contractor activities, a Fire Ant Declaration (FAD) form to move high risk materials will be required
- All materials moved from within the restricted area will be accompanied by a movement certificate or Fire Ant Declaration Form.

Whilst there are no known populations of crazy ants within the region, the suite of mitigation measures to address the potential for the introduction of these pests forms a sub-set of those to be applied in respect to fire ants. As such, prevention and control strategies for crazy ants will be incorporated within the Approved Risk Management Plan outlined above, and applied throughout the project area.

7.7.6.3 Flora

- Weed eradication programs will be implemented as required, and a weed management plan will be implemented during construction
- Equipment and material introduced to the region, especially those from interstate, will be screened for pest species
- Workers undertaking the following tasks will be required to fulfil all washdown requirements: surveying; fencing / gating; clearing and grading; and reinstating. The remainder of the workforce will be required to stay on project approved roads or on the construction corridor, where they will not come into contact with weeds
- Ensure all vehicles and machinery that will access the ROW are free from soil/organic matter prior arrival on site
- Identify on drawings and to personnel, entry and exit points to the ROW at which hygiene protocols become effective
- Establish and maintain weed wash down bays where required at designated entry and exit points
- Clean down of machinery when moving from disturbed areas to undisturbed areas during clear, grade and rehabilitation.

7.7.7 Animal Welfare

- Construction personnel to check vegetation prior to clearing and where necessary to engage wildlife assessment/rescue services to relocated wildlife
- Wildlife handlers will follow the *Environmental Protection Agency's Code of Practice - Care and Responsibilities of Orphaned, Sick or Injured Protected Animals by Wildlife Care Volunteers (Nature Conservation Act 1992)* when dealing with injured fauna
- A permit to interfere with wildlife from the Queensland Environment Protection Agency will be required for the wildlife handling activities as will the appropriate Animal Ethics Permit fro the Department of Primary Industries
- Development and implementation of protocols for any displaced fauna to be relocated to more suitable similar habitat within the surrounding area
- Establishment of fauna exclusion fences to prevent fauna inadvertently re-entering the construction areas
- Where possible, the timing of vegetation clearance (particularly areas of remnant vegetation) will be selected in order to minimise impacts (direct and indirect disturbances) to affected fauna habitats during optimum breeding periods (e.g. May to September is the breeding season for Yellow Chat as per the Development Scheme for the Stanwell – Gladstone Infrastructure Corridor State Development Area)
- Establishment of habitat enhancements to retained remnant habitat within the project area (e.g. artificial roost boxes for microbats)

7.8 Residual Impact

As previously described, the majority of the project area is highly disturbed. For these largely cleared and grazed lands, the implementation of the mitigation strategies outlined above will result in the project creating a **negligible** residual impact on terrestrial fauna.

An assessment of the residual impact, after mitigation measures have been implemented, has been undertaken for all key locations described previously. Table 7.13 describes the impact significance criteria employed in that assessment. Table 7.14 and Table 7.15 describe the residual impact significance for each of the key locations (refer to Figures 7.4 and 7.6 for mapping).

That assessment indicates that the residual impact ranges from **negligible** to **minor adverse** for the vast majority of the habitat areas described. The only area which may sustain a higher residual impact is associated with the Raglan Creek crossings (**moderate adverse**). Whilst there is scope to reduce the level of residual impact, the extent to which this can be achieved can only be determined following post-construction rehabilitation. Nonetheless, with the implementation of the mitigation strategies outlined above, it is considered that the development and operation of the project overall, will result in an adverse impact of low significance on terrestrial fauna.

Table 7.13 Project Impact Significance Criteria for Terrestrial Fauna

Significance	Impact significance criteria for terrestrial fauna
Major adverse	Extensive or acute disturbance (major impact) upon a matter of national importance. These effects are generally, but not exclusively, associated with sites, species and/or communities described as matters of national significance under the EPBC Act. The effects, whether direct or indirect, have the potential to result in the designation of a matter of national significance being permanently compromised. Mitigation measures and detailed design for construction work are unlikely to remove all of the impacts upon the affected communities or interests. Significant residual impacts would predominate.
High adverse	These effects (major impact) are likely to be important considerations at a state or bioregional scale but, if adverse, are potential concerns to the project, depending upon the relative importance attached to the issue during the decision making process. Effects are likely to manifest as irreversible loss or damage to a substantial part of the state or bioregional distribution, or the majority of the local distribution of a Threatened habitat type, community or population of flora or fauna as listed under either the EPBC or NC Acts. Mitigation measures and detailed design for construction work are unlikely to remove all of the effects upon the affected communities or interests. Residual impacts would predominate.
Moderate adverse	These effects (major impact) are likely to be important at a sub-regional or local scale, resulting in an extensive or acute disturbance resulting in the loss or the permanent lowering of the area's biodiversity values. In some situations, the impact will result in limited disturbance (moderate impact) to a feature or site of regional importance where recovery is anticipated following completion of the works concerned. The cumulative effects of such issues may lead to an increase in the overall effects upon a particular area or species population. They represent issues where effects will be experienced but mitigation measures and detailed design for construction work may ameliorate/enhance some of the consequences upon affected communities or interests. Some residual effects will still arise.

Significance	Impact significance criteria for terrestrial fauna
Minor adverse	These effects (moderate impact) are likely to be important at a local scale. Lesser loss or disturbance than moderate adverse (major impact) to a locally important site or local biodiversity values. Limited or temporary effects (minor impact) on national, bioregional or regional values. Relatively minor impacts to protected species and/or biodiversity generally, where mitigation measures are anticipated to alleviate short-term adverse impacts. Mitigation and compensation measures are generally effective in ameliorating the consequences upon affected communities or interests.
Negligible	Any impacts on resources considered to be of negligible ecological value, or effects on species, habitats or resources of value are likely to be imperceptible. Effects that result in minimal change or that which is beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
Beneficial	Any effects that are expected to result in an improvement of the quality of ecological resources following completion of works. These can, for example, include creation of new or additional habitat features which are beneficial to native fauna, or introduction of measures that would achieve improvements in quality of existing habitat. Design features or management activities, which would make a long-term contribution to ecological objectives, or measures to ensure the long-term protection of species under threat which may not be adversely affected by the project per se (e.g. measures to protect rehabilitation such as feral animal controls and weed eradication).

Table 7.14 Residual impact significance for key locations within the Fitzroy to Bajool section of the project area

Area #	Habitat and comments	Residual impacts following implementation of mitigation measures
1	Fitzroy River riparian habitats. Fauna movement; habitat for forest birds and microbats; and hollow-bearing trees.	Minor adverse
2	Northwestern extension of a series of semi-permanent vegetated billabongs to north of Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Minor adverse
3	Western end of a series of semi-permanent vegetated billabongs. Extends south to Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species	Minor adverse
4	Western end of a large semi-permanent constructed wetland. Habitat for waterbirds and waders, including Rare and Migratory species.	Negligible
5	Corridor traverses centre of semi-permanent wetland. Largely natural form though surrounds cleared of remnant vegetation. North of Malchi Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Negligible
6	Billabong of natural form though surrounds cleared of remnant vegetation. Habitat for waterbirds and waders, including Rare and Migratory species.	Minor adverse
7	Billabong of largely natural form though surrounds cleared of remnant vegetation. North of Titman Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Negligible
8	Adjacent to Gavial Creek wetlands. Habitat for waterbirds and waders, including Rare and Migratory species.	Minor adverse
9	Small open seasonal wetland – part of Serpentine Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species.	Negligible
10	Shallow seasonal wetland and part of the Serpentine Creek wetland system – north of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Negligible
11	Shallow seasonal wetland and part of the Serpentine Creek wetland system – south of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Negligible
12	Seasonal wetland and part of the Serpentine Creek wetland system – south of Casuarina Road. Habitat for waterbirds and waders, including Rare and Migratory species.	Minor adverse
13	Dingo Creek riparian vegetation. Fauna movement; locally significant habitat corridor.	Minor adverse

Area #	Habitat and comments	Residual impacts following implementation of mitigation measures
14	Station Creek riparian vegetation. Fauna movement; locally significant habitat corridor.	Minor adverse
15	Oakey Creek riparian vegetation. Fauna movement; locally significant habitat corridor.	Minor adverse
16	Seasonal wetland system comprising of natural form broad swales. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Negligible

Table 7.15 Residual Impact Significance for Key Locations Within the Bajool to Gladstone Section of the Project Area

Area #	Habitat and comments	Residual impacts following implementation of mitigation measures
17	Seasonal wetland system comprising of natural form broad swales – south of Port Alma railway. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Negligible
18	Inkerman Creek and associated wetlands. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Minor adverse
19	Node of *Eucalyptus moluccana* and *Acacia harpophylla* woodland. Habitat node in largely cleared landscape.	Minor adverse
20	Southern extent of saline wetlands of Twelve Mile Creek Reserve. Adjacent to potential Yellow Chat habitat.	Negligible
21	Freshwater section of Twelve Mile Creek – adjacent and upstream of Twelve Mile Creek Reserve. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Minor adverse
22	Twelve Mile Creek tributary – riparian vegetation. Wildlife movement corridor.	Minor adverse
23	Broad seasonal wetland – part of Pelican Creek. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Negligible
24	Southern extent of the Hourigan Creek wetland complex. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat.	Negligible
25	Hourigan Creek riparian vegetation. Wildlife movement corridor.	Minor adverse
26	Hourigan Creek riparian vegetation. Wildlife movement corridor.	Minor adverse
27	Raglan Creek riparian vegetation (western extent). Wildlife movement corridor.	Minor adverse
28	Raglan Creek riparian vegetation (eastern extent). Wildlife movement corridor.	Minor adverse
29	Remnant vegetation. Also large wetland approximately 100 m to south. Habitat node in largely cleared landscape.	Minor adverse
30	Darts Creek riparian vegetation – north of Darts Creek Road. Wildlife movement corridor.	Minor adverse
31	Darts Creek riparian vegetation – north of Popenia Road.	Minor adverse
32	Larcom Creek tributary riparian vegetation.	Minor adverse
33	Larcom Creek riparian vegetation.	Minor adverse
34	Boat Landing Creek riparian vegetation.	Minor adverse
35	Remnant vegetation to near north of railway line.	Minor adverse

7.9 Cumulative and Interactive Impacts

The concept of cumulative impacts acknowledges that a development and associated activities can combine and interact with others to cause collective effects and that the resultant effect may be different in nature or extent from the effects of the individual activities alone. Cumulative impacts can result from a number of different elements within a project as well as from a number of different projects with interacting impacts in the same area. Cumulative impacts can be viewed in terms of the relationship between introducing a new development with existing land uses and the further interaction with other developments being planned.

As described previously, fauna habitat values within the project area have been strongly influenced by a history of cattle grazing and agriculture. This has resulted in extensive areas where native vegetation has been cleared. Those areas of native vegetation which remain, though often small and isolated or poorly connected, are of significance in maintaining local biodiversity values, and in some cases, supporting the only remaining habitat for species of conservation significance.

Although, the project has the potential to generate impacts to native fauna habitat, it is considered that the successful implementation of the recommended mitigation measures has the potential to reduce any cumulative and interactive effects to a level of relatively low significance. Whilst the cumulative and interactive effects of the addition of the project to the suite of existing land uses is considered to be of a relatively low significance, this result must be considered in the context of other potential projects which may be implemented within the Stanwell-Gladstone Infrastructure Corridor (SGIC). Other infrastructure projects include gas pipelines, water pipelines, and fibre optic cabling.

Further infrastructure within in the SGIC is likely to result in the following:

- Vegetation clearance, including removal of native and remnant vegetation which may lead to further reduction in habitat areas, habitat fragmentation, and the potential for introduction of feral animals and plants
- Widening of previous waterway crossings or establishment of new crossings with the potential to generate disruption to wildlife movement opportunities and alterations to surface hydrology
- Additional disturbance to seasonal wetlands with the potential to generate disruption to surface hydrology, disturbance to wildlife during key seasonal habitat usage, and the introduction of exotic flora and fauna.

Concomitant with the implementation and operation of each further project, there is the potential for cumulative and interactive impacts on local terrestrial fauna to reach a higher level of significance that that which can be attributed to the current project alone. These effects may result in diminishing the capacity of the local area to support current levels of native faunal diversity and the viability of local populations of some Threatened or otherwise significant taxa.

Many of habitat features within the SGIC (or transected by the SGIC), because of their size and/or context, may be approaching potential thresholds where repeated disturbances to them could result in significant deterioration of values. Any future proposed developments, will be required to address the cumulative impacts of their developments with the impacts of the other existing and the currently proposed developments in the area, and would be considered by the relevant approval authorities.

7.10 Summary and Conclusions

The terrestrial fauna and habitat values of the project area have been assessed through a comprehensive review of existing information and a field program, which has been implemented over a seven month period. The field study identified a diverse range of native fauna, including Rare, Endangered, Vulnerable and Migratory species, and the key areas which support higher fauna habitat values.

The assessment of potential impacts to these values has generated an extensive suite of mitigation measures for the project in keeping with best management practices. With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on terrestrial native fauna will be of relatively low significance.

Although, the project has the potential to generate impacts to native fauna habitat, it is considered that the successful implementation of the recommended mitigation measures has the potential to reduce any cumulative and interactive effects with existing land uses to a level of relatively low significance.

Many of habitat features within the SGIC (or transected by the SGIC), because of their size and/or context, may be approaching potential thresholds where repeated disturbances to them could result in significant deterioration of values. Any future proposed developments, will be required to address the cumulative impacts of their developments with the impacts of the other existing and the currently proposed developments in the area, and would be considered by the relevant approval authorities.

Table 7.16 Summary of Residual Impacts for the Project Area

Feature Description	Current value (+ve/–ve) Substitution (yes/no)	Description of potential impacts	Mitigation measures	Residual impact
Geographic Features				
Fitzroy River riparian habitats	+ve (though disturbed) Substitution: no	Removal of mature hollow-bearing trees; disruption to wildlife movement corridor.	Strict vegetation clearance protocols; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; trench fall management protocols.	Minor adverse
Seasonal wetlands between Fitzroy River and Bajool	+ve (though variable levels of disturbance) Substitution: no	Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora.	Minimal construction clearing path; sediment and pollutant controls; weed control protocols; post-construction area-specific restoration; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; ; trench fall management protocols.	Negligible/ minor adverse
Riparian vegetation habitats (e.g. Dingo Creek, Station Creek, Oakey Creek, Twelve Mile Creek, Pelican Creek, Hourigan Creek, Darts Creek, Larcom Creek, and Boat Landing Creek).	+ve (though variable levels of disturbance) Substitution: no	Removal of native vegetation; disruption to wildlife movement corridor; alteration to surface hydrology.	Strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns.	Negligible/ minor adverse
Inkerman Creek riparian habitat and associated wetlands (south of Bajool-Port Alma rail line) and Raglan Creek riparian habitat and associated tidal wetlands.	+ve Substitution: no	Removal of native vegetation; disruption to wildlife movement corridor; alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora.	Strict vegetation clearance protocols; post-construction area-specific restoration; trenchless construction and/or minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; feral animal and weed control strategies; trench fall management protocols.	Minor adverse
Nodes and patches of native and remnant vegetation between Bajool and Gladstone	+ve Substitution: no	Native vegetation clearance; removal of mature hollow-bearing trees; habitat fragmentation; introduction of exotic flora and fauna.	Strict vegetation clearance protocols; minimal construction clearing path; protection protocols for hollow-bearing trees; respreading of logs, fallen and cleared vegetation; reuse of trimmed limb hollows; feral animal and weed control strategies; trench fall management protocols; post-construction area-specific restoration.	Minor adverse

Feature Description	Current value (+ve/–ve) Substitution (yes/no)	Description of potential impacts	Mitigation measures	Residual impact
Biological features				
Native Fauna Diversity	+ve Substitution: no	Loss of habitat; reduction of habitat patch size; habitat fragmentation; habitat alteration (edge effects); introduction of exotic flora and fauna.	Strict vegetation clearance protocols; minimal construction clearing path; protection protocols for hollow-bearing trees; respreading of logs, fallen and cleared vegetation; reuse of trimmed limb hollows; feral animal and weed control strategies; trench fall management protocols; post-construction area-specific restoration.	Minor adverse
Rare, Threatened or Migratory species	+ve Substitution: no	Loss of habitat; reduction of habitat patch size; habitat fragmentation; habitat alteration; disturbance during refuge or breeding stages; introduction of exotic flora and fauna.	Strict vegetation clearance protocols; minimal construction clearing path; microtunneling for some waterways; sediment and pollutant controls ; weed control protocols; post-construction area-specific restoration; rehabilitation of pre-construction drainage patterns (wetlands and waterways); dry season construction scheduling (wetlands); protection protocols for hollow-bearing trees; respreading of logs, fallen and cleared vegetation; reuse of trimmed limb hollows; feral animal and weed control strategies; trench fall management protocols; post-construction area-specific restoration.	Minor adverse

7.11 References

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CHAPTER 15

GLADSTONE – FITZROY

PIPELINE PROJECT

Environmental Impact Statement

Social Economic Environment

Gladstone Area Water Board

Contents

This information has been prepared by, or on behalf of, the Gladstone Area Water Board (GAWB) regarding the Gladstone-Fitzroy Pipeline Project. Care has been taken to ensure that the information is accurate and up to date at the time of publishing.

Gladstone Area Water Board

Figures

Tables

15. Social and Economic Environment

15.1 Introduction

This chapter describes the social and economic environment in the project area and the potential impacts that could arise as a result of construction and operation of the Gladstone–Fitzroy Pipeline project (the project). The assessment was completed in February 2008.

As social and economic values and potential impacts are not confined to the immediate project area, for the purposes of this chapter the project area (or "local region" or "regional economy") is defined as the local government areas (LGAs) through which the project passes. Prior to the council amalgamations in March 2008, this included Rockhampton City, Fitzroy Shire, Calliope Shire and Gladstone City (refer Figure 1.3 Locality Map), however the new LGAs are the Rockhampton Regional Council area and the Gladstone Regional Council area. The statistical and demographic information for the new LGAs was not available at the time of writing therefore the information used in this chapter has been based on the four original LGAs, for which information is available. The economies and social characteristics of these LGAs may potentially be either directly or indirectly affected by the construction and operation of the project.

The data inputs for the economic modelling have been sourced for the project as a whole and the majority of the potential social and economic impacts of the project are project-wide. For these reasons, this chapter has not been divided into two sections (Fitzroy to Bajool and Bajool to Gladstone) as has been done for other chapters of the EIS.

15.1.1 Structure of this Chapter

The chapter is structured to describe the socio-demographic, economic and accommodation baseline environment in the project area, followed by potential impacts that may arise as a result of the project and measures to mitigate or reduce the identified impacts. The residual impact is then described with use of the significance criteria outlined in Table 15.1. Assumptions and limitations and relevant legislation or policy are also included.

15.1.2 Objectives of the Economic Impact Assessment

The objectives of the economic impact assessment were to analyse and explain:

- The economic make-up of the current catchment area, and the potential for the local residents to fulfil the requirements for employment in the construction and on-going phases of the project
- The economic impact of the proposed pipeline with regard to employment, income and value adding to the regional, state and national economies, and the ability for the industries in the local region (as defined in Section 15.1) to meet the requirements of the project
- The ability of the local region to cater for the accommodation requirements for the construction and the ongoing operation of the project.

15.2 Methodology

15.2.1 Socio-demographic and Economic Baseline

For the purpose of this economic impact assessment, the project area is the LGAs through which the project passes. The information for this assessment was gathered prior to council amalgamations in March 2008 and therefore refers to the former LGAs of Fitzroy, Calliope, Gladstone and Rockhampton. The project is geographically situated within or adjacent to these LGAs (now Rockhampton Regional Council area and Gladstone Regional Council area). Subsequently, their economies are either directly or indirectly affected by the construction and operation of the pipeline.

The social baseline environment has been described with reference to local data available about the local region. This includes but is not limited to information from local government websites, the Australian Bureau of Statistics (ABS), and the Planning Information and Forecasting Unit.

The data for the socio-demographic and economic baseline was sourced largely from the ABS 2006 and 2001 censuses, local government websites, the Planning Information and Forecasting Unit, and in some cases via discussions with Council officers and industry representatives. To meet the requirements stated in the Terms of Reference, the project area was compared to Queensland and Australia.

Information about the properties and land uses in the project area has also been gained during consultation with landowners and other stakeholders as a result of interactions during the detailed design for construction for the project.

15.2.2 Data Collection and Consultation

The collection of data was a vital component of completing the economic and accommodation impact of the project, particularly in obtaining information such as the expected employment and expenditure associated with the construction and maintenance phase of the pipeline project. An analysis of this information allowed the confirmation of the economic benefits that are likely to flow into the local communities and beyond.

Stakeholders such as the local councils, Gladstone Economic and Industry Development Board (GEIDB) and real estate agents were consulted via telephone to ensure important local contextual information was incorporated into the analysis. The GEIDB is the Queensland Government authority established to facilitate investment attraction and project development in the Gladstone State Development Area (GSDA) and the Gladstone Region and is an important point of contact for information about the region.

This enabled a deeper analysis of the potential economic impacts and impacts on accommodation in the area.

15.2.3 Economic Modelling and Analysis

An input-output model was developed and used to determine the impact of the project on the project area's economy. Industry and employment information from the ABS was used as a basis for developing assumptions about the linkages between activities associated with the construction, ongoing operation and maintenance stages of the project, and other industry sectors in the project area. A tailored regional input-output model was built for the purpose of this project, in order to capture economic impacts and multiplier effects.

15.2.3.1 Understanding the Outputs of the Modelling

The purpose of assessing economic impacts is to examine how the project affects the economy of the project area through all of the linkages between all industries in the economy. It is the sum of the direct contribution (or economic stimulus) of the project, and the indirect contribution (flow-on effect) to the economy. The final result is an overall picture of the project's total economic contribution (Figure 15.1).

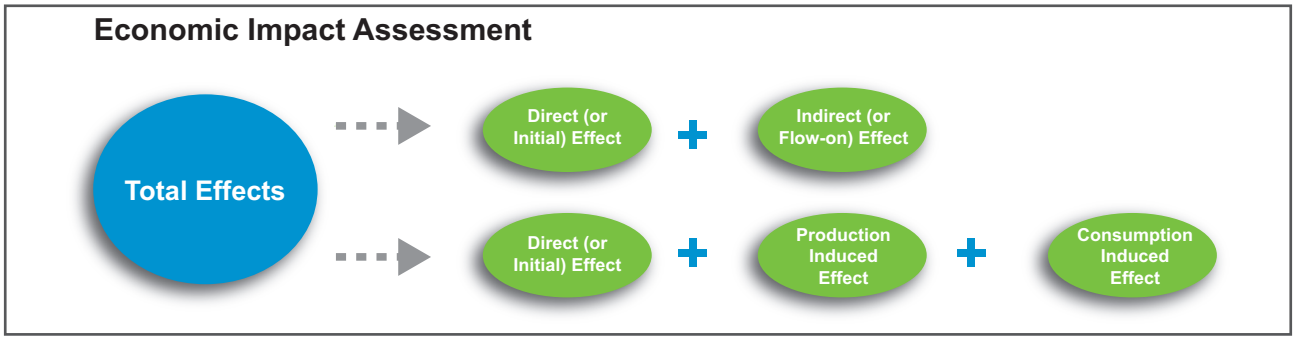
The input-output model produces the following three indicators which together provide the overall picture of the economic impact the project has on the project area economy:

- **Output (or total turnover)** – refers to the value of total expenditure associated with the project
- **Value added** – the equivalent of total turnover less the amount spent on non-labour inputs and imported inputs
- **Employment** – the number of full time equivalent (FTE) jobs supported by the project.

The total impact or contribution is comprised of direct effects (also known as the 'initial effects') and indirect effects (also known as the 'flow-on effects'). The direct effect measures the level of output, employment or value added directly generated through the operations of the business, industry or project. In the case of the project the direct effect of the construction phase would be the total construction cost.

The 'indirect contribution' to the economy of the project area exists because the construction and maintenance of the pipeline would require purchase of inputs from companies who would in turn spend those dollars on their inputs, and so on. Indirect contributions will also be realised through expenditure from, say, construction workers on food and travel locally. The indirect contribution therefore traces the flow of money spent in the local economy[1] and is the measure of the additional value generated in the economy due to the project. Calculation of the total indirect contribution is based on all expenditures associated with the project.

Figure 15.1 Economic Impact Assessment.



1 The "local economy" is used to refer to the economy of the project area comprising of the former Fitzroy, Calliope, Gladstone & Rockhampton LGAs.

These indirect contributions can be measured in terms of the dollars of spending that they generate, in terms of the value added they generate and also the additional jobs they generate in other sectors of the local economy.

In the second (or bottom) equation of this diagram, production induced effects relate to how local upstream industries benefit from the increased demand for their goods and services as a result of winning project related supply contracts (in this case supply contracts awarded as a result of the pipeline project), and their increased local purchasing in servicing these supply contracts. Consumption induced effects relate to the increased regional spending of the pipeline project associated wage and salary earners on items such as food, clothing, housing, etc. and how local suppliers' purchases change in order to meet these demands.

Assumptions and limitations associated with the modelling are outlined in Section 15.3.

15.2.4 Significance Criteria

Based on the information gathered during the baseline phase and on the known characteristics of the project, potential impacts arising from the project were able to be identified and mitigation measures proposed where relevant. An assessment of the residual impact level with the proposed or current mitigation measures in place was then undertaken using the significance criteria shown in Table 15.1.

Table 15.1 Impact Significance Criteria for Social and Economic Environment

Significance	Criteria for Social and Economic Environment
Major Adverse	Irreversible and significant negative change to current amenity, lifestyle and community activities and functioning. Displacement or relocation of several houses or businesses. Severance of many communities in the area from facilities, services or of a community itself. Significant impact to many community facilities and long-term constraints to the regional accommodation market. An 'unhealthy' demographic structure is created in a community. Permanent closure of one or more businesses or industries with resulting detrimental impacts to the regional economy.
High Adverse	Considerable adverse change to current amenity, lifestyle and everyday community activities with limited scope for mitigation. Displacement or relocation of houses or businesses. Separation of a number of communities or residential properties from facilities and services. Impact to a large number of community facilities and significant long-term constraints to the regional accommodation market. Temporary closure of one or more businesses or industries with some resulting detrimental impacts to the local region's economy. Mitigation measures and detailed design for construction work are unlikely to remove all of the significant effects upon the affected communities or interests.
Moderate Adverse	Noticeable adverse change to current amenity, lifestyle and everyday community activities, but with scope for some mitigation. Separation of a small number of residences from facilities and services. Impact to a number of community facilities and some impacts to the local accommodation market. Adverse impact upon businesses, with local economic effects however their operations remain viable.
Minor Adverse	Localised or limited noticeable change to current amenity, lifestyle and everyday community activities, which can be largely mitigated. Some residual effects will still arise. The functional useability of community facilities affected and temporary localised impact to the accommodation market. Localised or limited change to the operation of businesses.
Negligible	Very little change in the current situation. No appreciable impact on local amenity, resident lifestyle and everyday community activities. Imperceptible changes to the amenity of nearby residences. Temporary access alterations to residential properties, businesses, community facilities and recreational areas during construction. Temporary alteration to operation of businesses, community facilities and recreational areas during construction.
Moderate Beneficial (economic only)	Promotion of investment locally. Improvements to the operation of local businesses or industries. Significant direct and indirect contribution to the local region's economy and the creation of jobs in the local region.
High Beneficial (economic only)	Promotion of investment regionally. Improvements to the operation of local and regional business or industries. Significant direct and indirect contribution to the regional and state economy and creation of many long-term jobs in the region.

15.3 Assumptions and Limitations

The economic modelling conducted as part of this study provides an assessment of economic impacts arising from the construction and operation of the project. It provides detailed analyses on the industries likely to be impacted upon and the levels of those impacts. The economic modelling is, however, based on a certain assumptions. The assumptions utilised are carefully considered, as the accuracy of the economic impact assessment outcomes depends on the validity of the assumptions used.

The use of certain assumptions for the modelling process, while appropriate for the current scope of information required, also has limitations with regards to the outputs produced. The general assumptions in the economic modelling process and the limitations on the information available for the project are discussed below.

15.3.1 Modelling Assumptions

The multipliers utilised in this study are from a localised version of a national input-output table, with the base information being the 2001-02 national input-output tables produced by the ABS. These are the latest available national tables. An assumption behind input-output models is that industry dynamics are static, when in reality an economy will evolve over time. It is important to understand the nature of the static input-output tables when interpreting the results of the analysis.

The multipliers are calculated based on sound methodology; however they should be viewed as having a theoretical element. They are estimates of the potential impacts associated with the project, and do not completely reflect phenomenon such as the economy evolving differently as a result of the project and, for example, local industries changing their business operations to better capture the benefits of the impacts. Nonetheless, the results produced by using the multipliers generated by the input-output tables will provide reliable information regarding the impact under current conditions and interactions.

15.3.2 Information Availability Limitation

Although a sufficient amount of data was provided to generate reliable estimates of impact, the availability of information relating directly to the project was limited to some extent, and this is common for these sorts of assessments. The limitations refer to the difficulty in obtaining information on all expenditures associated with the project and the destination location of those expenditures, which enable a non-theoretical understanding of the geographic distribution of the impacts. The outputs associated with the analyses conducted here estimated where workers on the project would spend their money and what the likely housing situation would be for the workers on the project.

A range of assumptions is required to estimate these phenomena as obviously the workforce for the project is not yet present so actual information on expenditures are not known. Instead, these assumptions are based on current generalised patterns within the economy, and this is considered to be appropriate for the level of analysis required.

15.3.3 Pipeline Project Assumptions

Table 15.2 summarises the data utilised in the modelling process specifically relating to the project.

For the purposes of this assessment, the total construction cost of the project is assumed to be $293.2 million (Arup, July 2007) (NB: This figure is an estimate only and could differ from the actual cost of construction) and the component of this being spent locally is assumed to be $57.4 million (Arup, July 2007). This represents almost 20 percent of the total construction expenditure. This is consistent with estimates used in other public processes such as the current Queensland Competition Authority review. A detailed, risk adjusted price is currently being developed in parallel to detailed design for construction, and the real economic impacts will be affected by any differences in this detailed estimate.

Approximately 95 percent of the total construction expenditure (or $278.5 million) is expected to remain within Queensland, while the remaining 5 percent will be spent in the rest of Australia.

With regard to labour requirements, it is expected that 60 percent will be full-time direct hire while 40 percent will be contractors. It is assumed that 60 percent of full-time direct hire staff would be sourced from outside and 40 percent from within the local region, while with sub-contracted staff are expected to be 50 percent local and 50 percent from outside the local region.

In addition to infrastructure sites, it is assumed that the project footprint will be an area approximately 30 m wide and 115 km long. It is anticipated that GAWB will require an additional four to eight workers in order to operate the Alton Downs Water Treatment Plant (WTP).

Table 15.2 Assumptions for the Project Economic Modelling (based on proposed construction program, as of July 2007, which allowed for a 27-month construction program).

Quarter (of the Construction Period)	Expenditure on Construction ($million)	Jobs
Qtr 1	4.9	29
Qtr 2	12.1	72
Qtr 3	34.8	207
Qtr 4	47.6	283
Qtr 5	55.7	331
Qtr 6	55.5	330
Qtr 7	42.6	253
Qtr 8	32.5	193
Qtr 9	7.4	44
Total Construction Cost	**$293.2 million**	%
Local region	$57.4 million	19.6%
Outside region	$235.9 million	80.4%
Within Queensland	$278.5 million	95.0%
Labour and Machinery	$109.5 million	
Local region	$48.2 million	44.0%
Outside region	$61.3 million	56.0%
Materials	$183.7 million	
Local region	$9.2 million	5.0%
Outside region	$174.6 million	95.0%
Other assumed costs:		
WTP chemicals cost (annual)	$6.5 million	
Power costs (annual)	$2.4 million	
General repairs and maintenance cost (annual)	$1.2 million	

Source: Arup, 2007

It is also worth noting that the modelling was based on July 2007 construction cost estimates and as such there is no guarantee that the assumptions outlined above will remain the same in future years, however the modelling is still considered to be a reasonable indication of the economic effects of the project.

15.4 Relevant Legislation and Policy

15.4.1 Queensland Government Building and Construction Contracts Structured Training Policy (The 10 percent Policy)

The Queensland Government Building and Construction Contracts Structured Training Policy has been in place since 1993. The policy requires that on any Queensland Government building or civil construction project (with a value more than $250,000 for a building project or more than $500,000 for a civil construction project) a minimum of 10 percent of the total labour hours be carried out by apprentices, trainees or cadets or used to increase the skill levels of current employees (up to a maximum of 25 percent of the deemed hours). A Local Industry Participation Plan will be developed in consultation with the Department of Tourism, Regional Development and Industry. This policy is applicable to the project and aims to address the skills shortage and to facilitate the employment of apprentices, trainees and cadets in both the building and construction industry. How this policy will be addressed for the project is described in Section 15.7.

15.4.2 Indigenous Employment Policy for Queensland Government Building and Civil Construction Projects

This policy aims to enhance the Queensland Government's reconciliation process and only applies in certain Indigenous communities, none of which are relevant to this project.

15.4.3 Local Industry Policy

The Local Industry Policy aims to make sure Queensland and Australian suppliers have full, fair and equal opportunity to tender for major infrastructure and resource projects. Infrastructure and resource projects worth more than $5 million that are publicly funded are required, under the Local Industry Policy, to prepare Local Industry Participation Plans and implement the use of local content as one of the broad tender evaluation criteria. How this policy will be addressed for the project is described in Section 15.7.

15.4.4 Council Planning Schemes

The local government authorities relevant to the project address social/community issues throughout their respective planning schemes. Commonly these considerations include the provision of open space and community facilities under Desired Environmental Outcomes and through the management of development through the development approval process. The approvals processes for this project are described in Chapter 1, Introduction.

15.5 Baseline Environment

This section presents a socio-demographic and economic baseline of the project area. It outlines the current socio-economic make-up of the project area, the current accommodation situation, relevant to assessing the potential economic impact of the project.

Information in this section is sourced largely from the ABS Census data for 2006 and 2001. Other sources referred to in this section include information from Real Estate Institute of Queensland (REIQ), local council websites, Department of Employment and Workplace Relations (DEWR) and the telephone interviews conducted with Councils, Economic Development Boards and real estate agents.

15.5.1 Socio-Demographic Baseline

In March 2008, council amalgamations occurred to form the Rockhampton Regional Council (including the current Rockhampton City and Fitzroy Shires) and the Gladstone Regional Council (including the current Calliope Shire and Gladstone City). The statistical and demographic information for these new shires is not currently available and the information below has therefore been based on the four original shires, for which information is available.

15.5.1.1 Shire Summary (Prior to Amalgamation of Shires)

- **Fitzroy Shire (now part of Rockhampton Regional Council)** – the majority of the pipeline route (approximately 60 km) including the Fitzroy River intake and WTP will be in this shire. It has a population of approximately 10,000 people with Gracemere and Bajool as its centre. The land use in the shire is predominantly rural agricultural with intensive industrial development around the Stanwell Energy Park. Relevant townships within this shire that are adjacent to the project area include Gracemere (approximately 2 km south of the project area) and Bajool (approximately 2 km west of the project area)
- **Rockhampton City (now part of Rockhampton Regional Council)** – 9 km of the pipeline traverses the edge of Rockhampton City. Rockhampton has a population of approximately 60,000 with a large commercial and business centre surrounded by mining and rural industries. Major industries in this local government area are agriculture, fishing and tourism
- **Calliope Shire (now part of Gladstone Regional Council)** – the southern section of the pipeline route including the Raglan booster station and the Aldoga reservoir in the GSDA (approximately 42 km) is within Calliope Shire. This shire has a population of approximately 16,000 and includes the major urban centres of Tannum Sands, Boyne Island, Benaraby, Raglan, Mt Larcom, Yarwun, Calliope Township and surrounds, as well as other rural centres
- **Gladstone City (now part of Gladstone Regional Council)** – the pipeline route does not enter Gladstone City although the pipeline will connect to GAWB's existing water infrastructure. Gladstone City is in an industrial region and has a population of approximately 27,000. The City is situated between the Calliope River to the north and the Boyne River 14 km to the south, with Port Curtis being the major industrial port in the region and the focus of large scale industrial and resource development.

15.5.1.2 Total Population and Population Change

- At the time of the 2006 Census, the project area had a population of 116,778, as illustrated in Table 15.3. This accounted for 2.9 percent of the Queensland population
- The project area had a lower average annual population growth rate than Queensland but slightly higher than Australia (1.2 percent compared with 2.1 percent and 1.1 percent respectively) over the 2001–2006 Census periods
- Within the project area, Rockhampton had the lowest average annual population growth rate (0.04 percent) over the 1996–2006 Census periods, while Calliope had the largest (2.0 percent).

Table 15.3 Average Annual Change in Growth, Fitzroy Shire, Calliope Shire, Gladstone City, Rockhampton City, Project Area, 1996, 2001, 2006.

	Fitzroy Shire	Calliope Shire	Gladstone City	Rockhampton City	Project area	Queensland	Australia
2001	9,553	15,091	26,835	58,382	109,861	3,655,139	18,972,350
2006	10,310	17,002	29,523	59,943	116,778	4,046,880	20,061,651
Average Annual Change 2001–2006	1.5%	2.4%	1.9%	0.5%	1.2%	2.1%	1.1%
Average Annual Change 1996–2006	0.8%	2.0%	1.10%	0.04%	0.6%	1.9%	1.2%

Source: ABS Census of Population and Housing, 2006 (Historical Data)

15.5.1.3 Age and Sex Structure

The following points provide a summary of the relevant information relating to the age and sex structure of the project area population, which is also shown in Figure 15.2.

- The median age for the project area (34) was moderately lower than that observed in the broader comparative regions of Queensland (36) or Australia (37). This was largely due to a relatively young population observable in Gladstone, with a median age of 32, but it is noted that all other LGAs had a lower median age than Australia
- Changes in population demographics over the 1996–2006 Census periods indicate that the project area is ageing significantly, with proportionate increases in the number of residents aged 45 and older, and a proportionate decrease in residency in all younger age brackets. This trend was reflected across both Queensland and Australia, as well as in all LGAs within the project area
- Nonetheless, over 27.6 percent of the population were of a young working age, aged between 25 and 44.

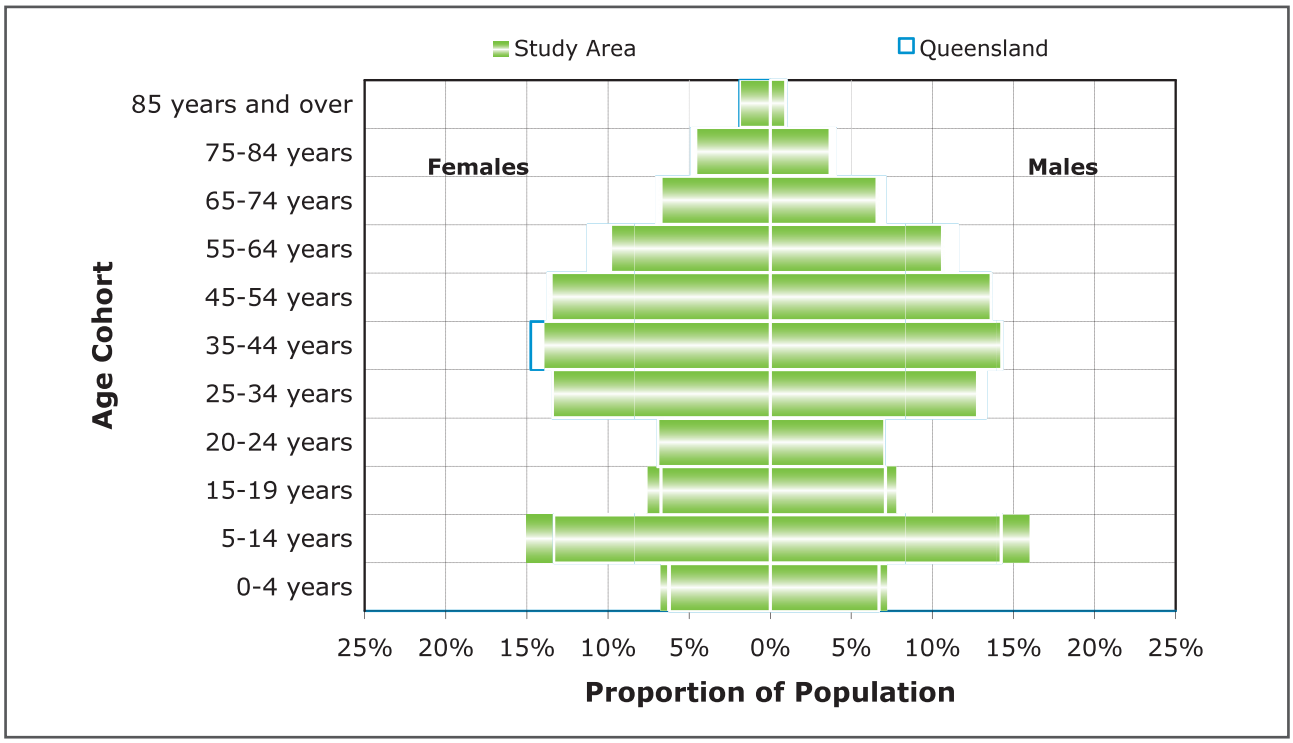


Figure 15.2 Age Sex Structure in the Project Area, Queensland, 2006 Source: ABS Census of Population and Housing, 2006

15.5.1.4 Population Projections

Forecast average annual population growth over the 2006–2026 period was moderately lower in the project area (1.3 percent) when compared against Queensland (2.0 percent). This was largely due to the low forecast average annual growth of 0.2 percent in Rockhampton during this period. Conversely, both Calliope and Gladstone are forecast to outgrow the State's growth, with forecast average annual growth rates of 2.7 percent and 2.4 percent respectively. This is summarised in Table 15.4. Data in this table differs from that presented in Figure 15.2 as ABS provides historical population information, whilst the Queensland Government's Planning Information and Forecasting Unit provides forecasts for local areas.

15.5.1.5 Indigenous Profile

The following points summarise the relevant information relating to the Indigenous profile in the project area:

- Indigenous residents accounted for 4.7 percent of the resident population in the project area. This was moderately higher than the 3.2 percent and 2.3 percent observable in Queensland and Australia respectively
- The project area's Indigenous population was most prominently concentrated in Rockhampton, where Indigenous residents accounted for 5.8 percent of the population, and Fitzroy, where they accounted for 4.9 percent of the LGA's population.

In relation to Aboriginal cultural heritage, the *Aboriginal Cultural Heritage Act 2003* recognises that Aboriginal cultural heritage can be both traditional and contemporary in nature. Sections 9 and 10 of the Act state that a significant Aboriginal area or object is of particular significance to Aboriginal people because of either or both Aboriginal tradition and the history, including the contemporary history, of any Aboriginal party for the area.

Chapter 14, Cultural Heritage, provides background on the Aboriginal history in the project area. During the development of a Cultural Heritage Management Plan (CHMP), the cultural heritage survey (which is an integral aspect of the CHMP) will specifically assess all Aboriginal cultural heritage in the project area, and will define any significant Aboriginal areas or objects. All endorsed Aboriginal parties will be part of the overall assessment. Almost all of the project area is within the external boundaries of two registered native title claims, namely the Darumbal People and the Port Curtis Coral Coast (PCCC) applications. The CHMP and survey will be undertaken prior to the commencement of construction.

15.5.1.6 Family Type

The points below provide a summary of the family types within the project area:

- 'Couple families with children' was the dominant family type in the project area, indicating no significant differences between the project area, Queensland and Australia
- Within the project area, lone persons households were of a similar level to Queensland at 20.9 percent but slightly lower than the Australian level (22.0 percent nationally)
- Couple families with children held the highest share out of any family type in each of the council areas with 40.1 percent of households in Calliope consisting of this household type, followed by Fitzroy at 37.3 percent, 33.6 percent in Gladstone and 27.3 percent in Rockhampton. Rockhampton demonstrated the highest levels of single parent families, lone person households and group households.

Table 15.4 Population Projections for the Project Area, 2006–2026

	Calliope Shire	Fitzroy Shire	Gladstone City	Rockhampton City	Project Area	Queensland
2006	17,538	11,213	31,028	62,610	122,389	4,091,546
2011	18,949	11,303	31,550	61,542	123,344	4,518,093
2016	21,964	12,287	36,666	62,573	133,490	5,027,679
2021	25,709	13,788	43,078	63,864	146,439	5,559,674
2026	29,980	15,138	49,694	65,190	160,002	6,097,144
Average Annual Growth 2006–2026	2.7%	1.5%	2.4%	0.2%	1.3%	2.0%

Source: Planning Information + Forcasting Unit, 2007 (Projection Data)

15.5.1.7 Health Status and Sensitive Groups

The Queensland Health report 'Health Determinants Queensland' provides a health determinants summary for Rockhampton and Gladstone regions and is the most recent public data available (Queensland Health 2004).

This report provides a summary of the key health issues and their causes in the regions. According to this report, the key socio-demographic predictors of health status of a population are the age structure, sex distribution, proportion of Indigenous people and socio-economic profile, and to a lesser extent urban, rural or remote location. In general, socio-economically disadvantaged people experience poorer health and shorter life expectancy than more socio-economically advantaged people, for nearly all disease causes and populations studied. Indigenous peoples in these regions were found to be more likely to live in areas of greater socio-economic disadvantage than the non-Indigenous population.

In summary, compared to Queensland, Rockhampton has:

- Generally a similar age and sex profile to Queensland population
- A higher proportion of Indigenous people
- Evidence of socio-economic disadvantage.

In summary, compared to Queensland, Gladstone has:

- A higher proportion of children
- A higher proportion of younger adults (aged 35 to 44 years)
- A higher proportion of males and projected to increase
- Population growth to affect young people, adult and older population particularly
- A higher proportion of Indigenous peoples.

Considering the whole population in both the Rockhampton and Gladstone regions, the major causes of death and illness were found to include coronary heart disease, stroke, chronic obstructive pulmonary disease, depression and lung cancer (Queensland Health 2004).

15.5.1.8 Properties and Land Uses

Social impacts have been considered during the route and site selection process which is described in Chapter 1, Introduction. As a result, the project area has been selected to avoid towns and residential areas where possible. The majority of properties traversed by the project area are zoned as rural in the relevant planning schemes, with the exception being the Alton Downs zone in Fitzroy Shire and the Gladstone State Development Area in Calliope Shire which has its own zoning classification system. Queensland Land Use data (Department of Natural Resources, Mines and Water 1999) shows that the vast majority (greater than 95 percent) of the project footprint traverses land that is classified as 'production from relatively natural environments'. This land use is further classified as 'grazing natural vegetation'. Chapter 4, Land Use and Infrastructure, provides further detail on the land uses in the project area.

15.5.1.9 Health Facilities

The aim of this section is to provide an overview of the health facilities within the vicinity of the project area and the services that they provide.

The project area is located within the Queensland Government Central Queensland Health Service District. Government hospital facilities identified within 50 km of the project area are shown in Table 15.5.

Table 15.5 Identified Hospitals near the Project Area

Government Hospitals	Services
Rockhampton Hospital Total patients 2005/06: Approx 250,000 Approx 10% admitted	Red Cross Blood Transfusion Service, Emergency Medicine, Anaesthetics, Radiology and Ultrasound, Specialist Outpatient Department review, Central Sterilising Services and Supply, Rehabilitation, Renal, Coronary Care, Intensive Care, Palliative Care & Chemotherapy, Day Surgery Unit, Operating Rooms, General Surgery, General Orthopaedics, Visiting Urology, Visiting Neurosurgical, ENT, General Medicine, Visiting Facio/Maxillary, Obstetrics and Gynaecology, Ophthalmology, Visiting Haematology, Visiting Rheumatology, Visiting Oncology, Paediatrics, including Neonatal (Special care nursery), Visiting Paediatric Cardiology, General Respiratory Medicine.
Gladstone Hospital Total patients 2004/05: Approx 78,000 Approx 7% admitted	Emergency, Outpatients, General Medicine and Surgery (including Day Surgery), basic Orthopaedics, Obstetrics and Gynaecology, Medical Imaging, Pharmacy, Pathology, Central Sterilising.
Mt Morgan Hospital	Emergency Department, Acute Inpatient, Aged Care and Community Health Services.
Yeppoon Hospital and Nursing home Total Patients 2005/06: Approx 22,000 Approx 6% admitted	Emergency Medicine, Acute Inpatient Services, Rehabilitation And Palliative Care, Residential Aged Care, Women & Family Health Programs, Adult Health Programs, Oral Health Services.

There are also private hospitals in the region, including the following

- Mater Hospital Yeppoon
- Mater Misericordiae Hospital Rockhampton
- Rockhampton Surgicentre
- Rockhampton Private Hospital
- Mater Misericordiae Hospital Gladstone.

In addition to the hospitals identified above there are a wide range of other health care facilities in Rockhampton and Gladstone including the following:

- Aged care facilities
- Doctors' surgeries
- Private clinics
- Radiologists
- Optometrists
- Medical centres
- Dermatologists
- Psychiatric and psychological services
- Aboriginal community health service.

These and other facilities currently service the populations of Rockhampton and Gladstone and surrounding smaller communities. Rockhampton appears to have a greater number of facilities.

15.5.1.10 Education Facilities

Childcare

There are a number of childcare facilities located in the Rockhampton to Gladstone region. A desktop review of the Queensland Government Department of Communities website, utilising the Childcare Service Geographic Search tool (Department of Communities, 2008) over the broadly defined project area identified 39 child care facilities. These consisted of nine kindergartens, two family day care services, eight school age care services and one limited hours care service provided by a Police Citizens Youth Club.

Schools

A desktop review was undertaken to determine the number of schools in the Rockhampton to Gladstone region. The number of schools identified from a review of district maps from the Queensland Education Department (Department of Education, Training and Arts, 2007) included 17 primary schools of which several were included with secondary schools, 10 secondary schools and two special schools (one in Gladstone and one in Rockhampton). Six of the identified schools are private schools. A number of the schools offer boarding programs and specialist facilities for students with disabilities. The schools closest to the project area include Bajool State School, Bouldercombe State High School, Marmor State School and Mt Larcom State School all of which are more than 1 km from the project area with the exception of Mt Larcom State School, which is approximately 800 m from the project corridor.

Tertiary and Vocational Education

There are two primary institutions offering tertiary and vocational education opportunities. These are the Central Queensland University that has campuses at both Gladstone and Rockhampton, and Central Queensland Institute of TAFE also with campuses in Gladstone and Rockhampton.

The Central Queensland Institute of TAFE provides a range courses and nationally recognised training for apprentices and trainees. Such training aims to address the current skills shortage in Queensland and contribute to the local economy.

Central Queensland University offers a range of undergraduate and postgraduate courses that include courses accessible both on campus and via distance education. The university has a Cooperative Education Program that formally integrates a student's academic studies with on-the-job experience in cooperating employer organisations (CQU 2008). This program allows both practical and theoretical education to coincide and provides greater employment opportunities for students by allowing them to gain experience whilst studying.

15.5.1.11 Local Government and Public Services

The local governments relevant to the project area include Rockhampton City, Fitzroy Shire and Calliope Shire. Gladstone City, although not within the project area, is adjacent to the south. The local government councils offer a range of public services including environmental services (waste disposal, recycling, mosquito control), planning and development (administered through the shire planning schemes), roads maintenance, sewerage services and water supply.

15.5.1.12 Other Community Services and Facilities

There are a range of community facilities provided by the local authorities in the Rockhampton to Gladstone region. These include:

- Swimming pools
- Community halls
- Skate parks
- Parks and gardens
- Sporting grounds and facilities
- Museums and art galleries
- Libraries
- Cemeteries.

These facilities are located within the towns along the project route and none are located within the construction corridor.

15.5.2 Economic

This section provides the current economic environment of the project area, with relevant comparisons made to Queensland and Australia.

15.5.2.1 School Qualifications

- At the time of the 2006 Census, 33 percent of the project area's population aged 20 or older, had completed their education to a grade 12 or equivalent level. This was relatively low when compared to Queensland and Australia, where 42 percent and 44 percent of similarly aged residents had completed grade 12. This trend was reversed for graduates of a year 10 or equivalent level, where the project area was proportionately over-represented (32 percent compared with 27 percent and 23 percent for Queensland and Australia respectively)
- Gladstone and Rockhampton had the highest proportion of residents within the project area who had completed a year 12 or equivalent certificate, with 35.9 percent and 34.7 percent of residents aged 20 years or older having done so. Both of these were lower than the proportions for Queensland and Australia.

15.5.2.2 Tertiary Qualifications

- Approximately two thirds (62.6 percent) of the project area over the age of 15 did not possess a tertiary qualification, as of the 2006 Census. This is relatively high when compared to the figure for Queensland (49.6 percent) and Australia (47.5 percent)
- The prominent field of tertiary study was Engineering and Related Technologies. This was also prominent in both Queensland and Australia, however was proportionately over-represented in the project area, accounting for 24 percent of tertiary degrees, compared with 16 percent and 15 percent respectively for Queensland and Australia
- The majority of residents with a tertiary qualification held a Certificate, accounting for 42 percent of nominated qualifications. This was proportionately larger than the figures for either Queensland (35 percent) or Australia (31 percent). The project area was under-represented in the proportionate level of Bachelor and Diploma qualifications completed when compared against Queensland and Australia.

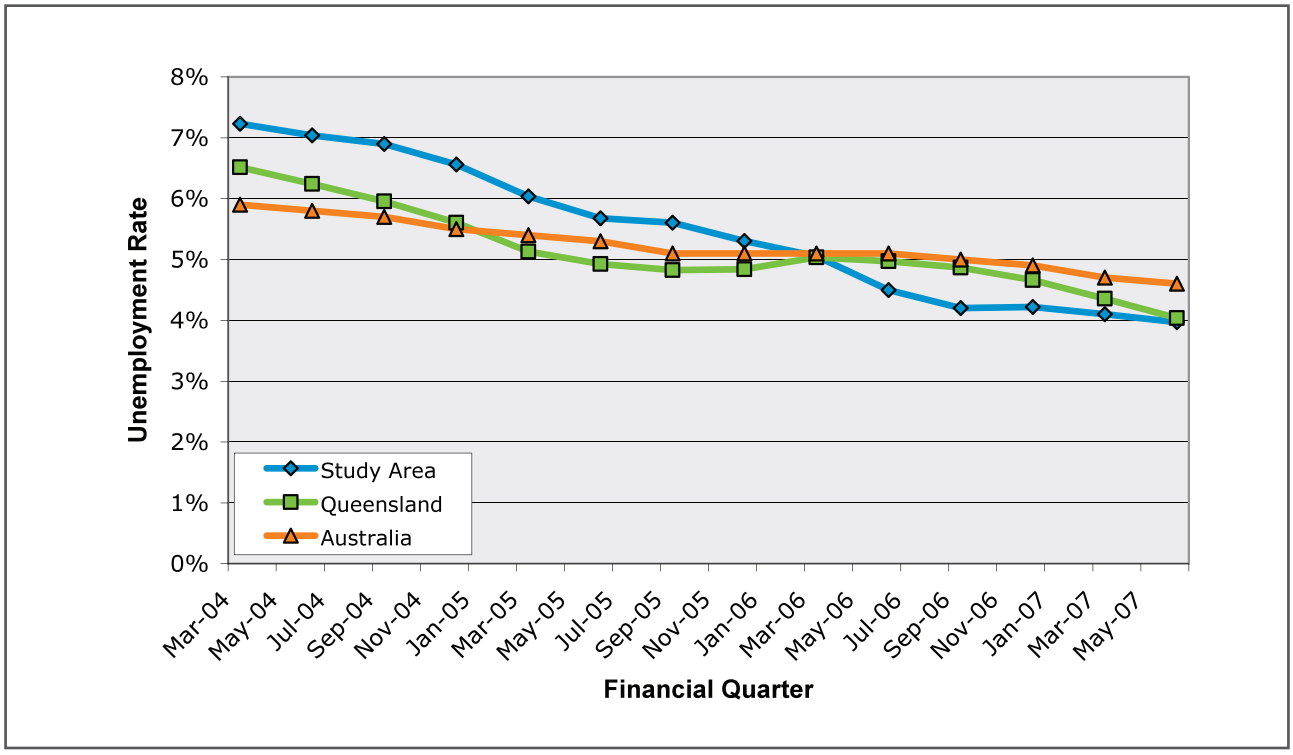


Figure 15.3 Unemployment Rate in the Project Area, Queensland, Australia, 2006
Source: Australian Department of Employment and Workplace Relations Small Area Labour Market Data 2004, 2007

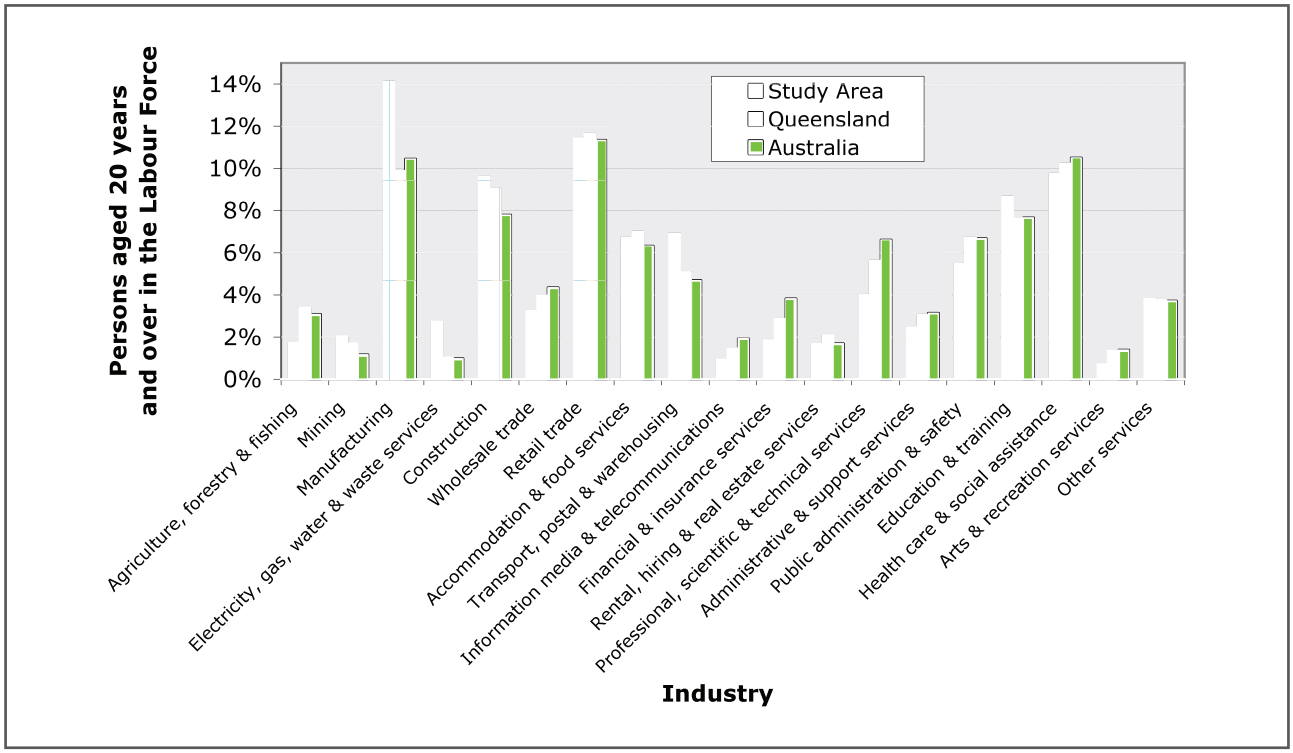


Figure 15.4 Employment by Industry of Working Residents in the Project Area, Queensland, Australia, 2006
Source: ABS Census of Population and Housing, 2006

15.5.2.3 Unemployment

- Both the project area and Queensland had unemployment levels of 4.0 percent as of June 2007. These were both lower than the figure for Australia for the same period (4.6 percent) (Figure 15.3). All three areas showed a decline in unemployment rate over the 2004–2007 period
- Fitzroy had the lowest unemployment rate of the LGAs in the project area, with a rate of 2.0 percent as of June 2007. Conversely, Rockhampton had the highest, with a figure of 4.7 percent.

15.5.2.4 Employment Self-Sufficiency

- The project area had an employment self-sufficiency ratio[2] of 98.0 percent with approximately 52,800 jobs located in the local region. This indicates that the number of labour force residents and jobs in the local region is roughly equivalent, with a slightly higher number of residents in the labour force than positions
- Gladstone and Rockhampton both exhibited self-sufficiency ratios over 100 percent (106.6 percent and 113.9 percent) indicating that they had a surplus of jobs in the region compared to qualified persons. This means that these LGAs attract workers from the surrounding areas[3]
- Fitzroy had a relatively low self-sufficiency ratio of 41.3 percent as of the 2006 Census of Population and Housing. This is consistent with observations in other rural regions
- With 4,074 jobs in construction and 5,068 working residents in the construction sector, the self-sufficiency of the construction sector is around 80 percent.

15.5.2.5 Skills Attraction and Retention

- Based on the stakeholder consultation undertaken for this study, the project area has a skills shortage in accountancy, doctors, builders, planners, plumbers, and engineers. The key factor for the skills shortage was retaining workers in the region.

15.5.2.6 Income

- Median household income as of the 2006 Census was the same across the project area, Queensland and Australia, this being a median income range of $800-999 per week
- Gladstone was the only LGA within the project area to differ from the regional and national trend, with a median household weekly income of $1,000 to $1,199.

2 Self-sufficiency is the ratio of jobs located in the region to workers living in the region.

3 Although it is noted that even for less than 100 percent people could be travelling from outside the LGA to access work

15.5.2.7 Industry Employment and Output

- Technicians and trade workers are the most common occupation in the local region, with nearly 20 percent dedicated to these classifications (also see Figure 15.4). These occupations employed 5,068 workers in 2006
- According to ABS Journey to Work data, 4,070 persons were employed in the construction sector, and manufacturing is the largest employer (14 percent of all jobs in the project area).

The economy of the local region (industry output in the project area) was approximately $12 billion and was clearly dominated by the manufacturing sector, contributing approximately $3.5 billion to the local region's economy. The next most prominent was the construction sector, which contributed $1.2 billion.

15.5.3 Accommodation

This section describes the current accommodation situation in the project area. Existing and future supply for residential, tourist and short-term accommodation has been documented in order to determine the ability of the region to cater for the accommodation requirements during the construction and ongoing operation stages of the project.

15.5.3.1 Resident Accommodation

Table 15.6 provides an outline of the number of dwellings present in each of the LGAs within the project area. It is noted that approximately 8.5 percent of dwellings within the region were unoccupied at the 2006 Census, but that this is declining in more recent times (see vacancy rates below). The number of unoccupied dwellings at 2006 totalled approximately 4,000.

15.5.3.2 Dwelling Types

The majority of occupied private dwellings within the project area were located in Rockhampton (52.5 percent), while Gladstone accounted for 25.3 percent and Fitzroy and Calliope made up the remainder (8.5 percent and 13.7 percent respectively).

The dominant household type in the project area is separate houses, accounting for 87.5 percent of the housing stock in the region. This is significantly higher than the proportion observed in either Queensland (79.5 percent) or Australia (76.6 percent). This proportion was even higher in rural areas of the project area, with separate houses in Fitzroy accounting for 95.7 percent of the LGA's housing stock.

15.5.3.3 Dwelling Tenure

The most prominent form of dwelling tenure across the project area and Queensland, as of the 2006 Census, was dwellings in the process of being purchased. This form of tenure was slightly over-represented in the project area, accounting for 33.5 percent of dwellings, when compared with 31.4 percent in Queensland and 32.2 percent in Australia.

Fully owned houses were the most dominant tenure type in Australia (32.6 percent), while these were marginally less prominent in Queensland (30.4 percent) and the project area (29.9 percent).

State owned housing also made up a larger than average proportions of dwellings in the project area than in Queensland or Australia, accounting for 4.3 percent of dwellings in the project area, compared with 3.2 percent in Queensland and 4 percent in Australia.

15.5.3.4 Vacancy Rates

Vacancy rates for residential housing within the project area have shown a steady increase between December 2006 and September 2007 (except Rockhampton which declined in September quarter 2007), however they declined significantly in the December 2007 quarter. Housing vacancy rates were reported as 1.1 percent for Rockhampton and 1.9 percent for Gladstone as at December 2007.

Vacancy rates for units and townhouses were slightly lower, with Gladstone (2.4 percent) and Rockhampton (2.2 percent).

15.5.3.5 Median Prices

Within the project area, Calliope had the highest median sale price of $412,500 as of sales recorded in the March quarter 2008. Fitzroy recorded a median housing sale price of $360,000. The Gladstone City Council LGA recorded a median housing sale price of $370,000 and Rockhampton city Council LGA recorded the lowest median housing sale price across the LGAs of $304,000.

Conversely, Rockhampton recorded the highest median sale price for vacant land ($235,000). Gladstone followed at a median of $200,000 while the other areas within the project area recorded a significantly lower vacant land median sale price, Calliope and Fitzroy recording $154,000 and $120,000 respectively.

Table 15.6 Occupied Private Dwelling Numbers in former Local Government Areas

	Fitzroy Shire	Calliope Shire	Gladstone Shire	Rockhampton Shire	Project area
Number of Dwellings	3,363	5,462	10,048	20,895	39,768

Source: ABS Census of Population and Housing, 2006

Table 15.7 Weekly Household Rent Payments for former Local Government Areas in the Project Area, 2006

	Fitzroy Shire	Calliope Shire	Gladstone City	Rockhampton City	Project Area	Queens-land	Australia
Median Household Rent Payments	$140- $179	$180–224	$140–$179	$140–$179	$180–$224	$180–$224	$180–$224

Source: ABS Census of Population and Housing, 2006

15.5.3.6 Home Loan Repayments

The median monthly household home loan repayment for the project area was in the $950 to $1,199 range at the time of the 2006 census. This figure was lower than both the Queensland and Australian average of $1,200 to $1,399.

Mortgage repayments in both Calliope and Gladstone were higher than the project area average, at $1,200 to $1,399, while Rockhampton was lower at $750 to $949.

The project area had a higher proportion of monthly home loan repayments between $550 and $1,399 per month than either Queensland or Australia. Nearly one-fifth (18.4 percent) of all home loans in the project area had monthly repayment rates of between $950 and $1,199. This compares to 14.4 percent in Queensland and 13.6 percent in Australia.

15.5.3.7 Rental Payments

Median rental prices in the project area were relatively consistent with both Queensland and Australian figures, with all areas reporting median weekly household rental payments falling in the $180 to $224 bracket. Significantly, Calliope was the only area in the region to fall into this bracket, with Fitzroy, Gladstone and Rockhampton all falling into the lower $140 to $179 bracket.

Rent prices are reported in the 2006 Census, comparing LGAs within the region (Table 15.7). Calliope demonstrated the highest proportion of households in the higher end rent brackets (32.7 percent of rented households paying between $225 and $550 per week) compared to the other LGAs. In Gladstone, proportions of rents in the higher bracket half was 23.8 percent, in Fitzroy 14.1 percent and in Rockhampton 11.6 percent.

Consultation indicated significant demand for rental properties in the region with low vacancy rates recorded for the project area at 1 to 2 percent.

15.5.3.8 Household Size

The project area had a moderately higher average household size (2.9) than either Queensland or Australia (both 2.6). This was primarily driven by higher average household sizes in Fitzroy and Calliope (both 2.9), with Gladstone and Rockhampton both reporting lower average household sizes of 2.7 and 2.5 respectively (Table 15.8).

Table 15.8 Average Household Size for Former Local Government Areas in the Project Area, Queensland and Australia, 2006

	Average Household Size
Fitzroy Shire	2.9
Calliope Shire	2.9
Gladstone City	2.7
Rockhampton City	2.5
Project Area	2.9
Queensland	2.6
Australia	2.6

Source: ABS Census of Population and Housing, 2006

15.5.3.9 Tourist or Short-term Accommodation

While the previous section presented the current situation of permanent accommodation in the project area, this section describes the availability of tourist accommodation. The information provided in this section is sourced primarily from the ABS with confirming information from telephone surveys carried out in February 2008. Ten tourism providers participated in the survey.

As can be seen in Table 15.9, the majority of tourist or short-term accommodation in the project area is of hotel, motel or serviced apartment type. More than four-fifths (84.9 percent) of the tourist and short-term accommodation fell into this category, translating to 11,797 beds within the project area (as at the time of the 2006 Census).

Table 15.9 Tourist and Short-term Accommodation Indicators Summary, Calliope Shire, Gladstone City and Rockhampton City, 2007

	Former Calliope Shire	Gladstone City	Rockhampton City
Hotels, Motels and Serviced Apartments - All - Bedspaces	123	3,204	8,470
Caravan Parks - Sites	453	187	403
Caravan Parks - All - Number of Cabin Flats, Units and Villas	58	62	229
Caravan Parks - All - Bedspaces of Cabin Flats, Units and Villas assuming 2 Persons per Dwelling	116	124	458
Number of hostels	0	1	2

Source: ABS Tourist Accommodation, small area data, June Qtr 2007

15.5.3.10 Accommodation Type

There are significant numbers of caravan parks identified in the project area, with a large concentration of caravan parks found in Calliope. There were 453 caravan parking sites identified in Calliope Shire, or 43.3 percent of the total project area. A further 698 beds were available in cabins, flats, units or villas on site at caravan parks, or 2.51 percent of all accommodation in the region.

The majority of the short-term accommodation within the project area was found in Rockhampton (68.8 percent). Approximately 25.8 percent of short-term accommodation was located in Gladstone and the balance of accommodation found in Calliope (5.40 percent).

Consultation with real estate agents carried out for this study identified that vacancy rates for accommodation types were low all year round, with seasonal effects in the demand for tourist and short-term accommodation being minor. Certain events, however, such as the Beef Expo (Rockhampton), the Brisbane to Gladstone Yacht Race and sales at the Gracemere Saleyards place temporary but further pressure on the already tight existing accommodation market within the project area.

15.5.3.11 Cost of Accommodation

Based on a small sample of tourist accommodation providers interviewed in the project area, the cost of accommodation ranges from $20 per night for a dorm bed in a backpacker hostel to $130 per night in a motel.

The approximate cost of a powered site at a caravan park ranged from $95 to $120 per week in the project area.

15.5.3.12 Demand for Worker Accommodation

According to the telephone interviews, most tourist accommodation providers in the project area were currently providing long-term housing for labourers and workers. In particular, accommodation providers in Gladstone noted that a significant majority of their clients were workers rather than tourists. Some workers were likely to 'fly in and fly out', meaning that they stayed in a tourist accommodation during the week but not on weekends.

Generally, tourist accommodation in the project area is being occupied largely by permanent residents rather than those seeking short-term or tourist accommodation and as noted, vacancy rates are low.

15.5.3.13 Potential for Future Dwellings

This section outlines the major development projects planned in the region and their implications on the accommodation situation in the project area. The information presented in this section has been drawn from the telephone interviews carried out with Fitzroy Shire, Calliope Shire, Gladstone City and Rockhampton City Councils and the GEIDB between January and February 2008 prior to council amalgamations.

15.5.3.14 Zoned Residential Land

Councils in the project area were unable to provide information regarding the amount of residential land zoned under their current planning schemes. However, a desktop review of the planning schemes indicates that the zonal plans for the four councils identify urban and rural residential uses, with some plans identifying urban expansion zones. These zones are in place to accommodate unexpected demand for additional housing that the areas require should an immediate and large scale response be required. From the information provided, it would seem that there is considerable (unzoned and unserviced) land available.

Fitzroy Shire Council was of view that development approvals issued to date had consumed the land bank set aside in the current council planning scheme which was to be in force until the year 2012, denoting the already high demand for residential environments within the area.

15.5.3.15 Development Applications

At the time of this chapter being written (February 2008), there were over 7,500 lots being considered for reconfiguration or residential development in Calliope, Gladstone and Rockhampton LGAs[4]. Based on the information provided by the three councils, key considerations regarding future residential development include:

- In Calliope Shire, the majority of development applications were for lot reconfigurations. A preliminary approval had been issued for a 2,000 dwelling unit master-planned community in Tannum Waters (East Calliope)
- Similarly in Gladstone, the majority of applications lodged to Council were for lot reconfigurations. Applications for multi-unit residential dwellings were found largely in the north and Port area of Gladstone whilst applications for duplex units were found mainly in the southwest area
- In Rockhampton, the majority of residential lot reconfiguration applications were present in northern areas between the upper reaches of the Fitzroy River and the Mt Archer National Park accounting for a total of 5,345 lots. Applications for unit developments, predominantly located closer to the city centre, totalled 294 units and non-residential applications were limited to a 50 unit motel, a shopping centre, a master shopping outlet (which spans the region-dividing creek) and a retail showroom.

The map on the following page (Figure 15.5) presents the number of units and lots under application with Gladstone, Calliope and Rockhampton Councils. It is noted that Fitzroy Shire Council was unable to provide similar data for their LGA within the reporting timeframe.

The information presented in Figure 15.5 suggests that there is the possibility that approximately 1,200 multi-storey units and 9,500 residential lots (urban and rural) could be added to the system, as these are currently under application with Councils in the project area. Should these applications be approved, the housing stock in the project area is likely to increase by approximately 10,700 dwellings. If this figure is multiplied by the average household size for the project area (2.9) and provided that all of the dwellings are approved and constructed, it is estimated that the project area is able to accommodate an additional 31,000 people.[5] It is noted that none of the development applications under assessment are guaranteed to occur, so these figures should be seen as an optimistic view of the likely future housing situation.

15.5.3.16 Major Planned Developments

The telephone interviews conducted with planning officers from Gladstone, Calliope, Rockhampton and Fitzroy Councils revealed the following major planned developments within the project area:

- Motel developments (Fitzroy, Gladstone and Calliope)
- Tannum Waters Residential Community (Calliope)
- A 219 site mobile home park (Calliope)
- A master-planned shopping outlet (Rockhampton).

The interview also revealed that, based on the opinions of the interviewees, North Rockhampton, Yeppoon and Gracemere are becoming desirable places to live due to the increase in lifestyle services and retail offer in the areas. Accordingly, new residential developments are occurring in these areas.

15.5.3.17 Other Major Projects

Information on other major projects within the region was also sought to assist in understanding the *relative* contribution of the project in relation to other major activities in the Region. This information, provided by the GEIDB (February, 2008), is presented in Table 15.10 and assists in determining the likely or potential overall impact of major activities in the region on the housing situation.

4 Fitzroy Shire Council was unable to provide the relevant data.

5 This is likely to be a conservative estimate given that the development applications data for Fitzroy Shire Council were unable to be obtained, thus have been excluded from the analysis.

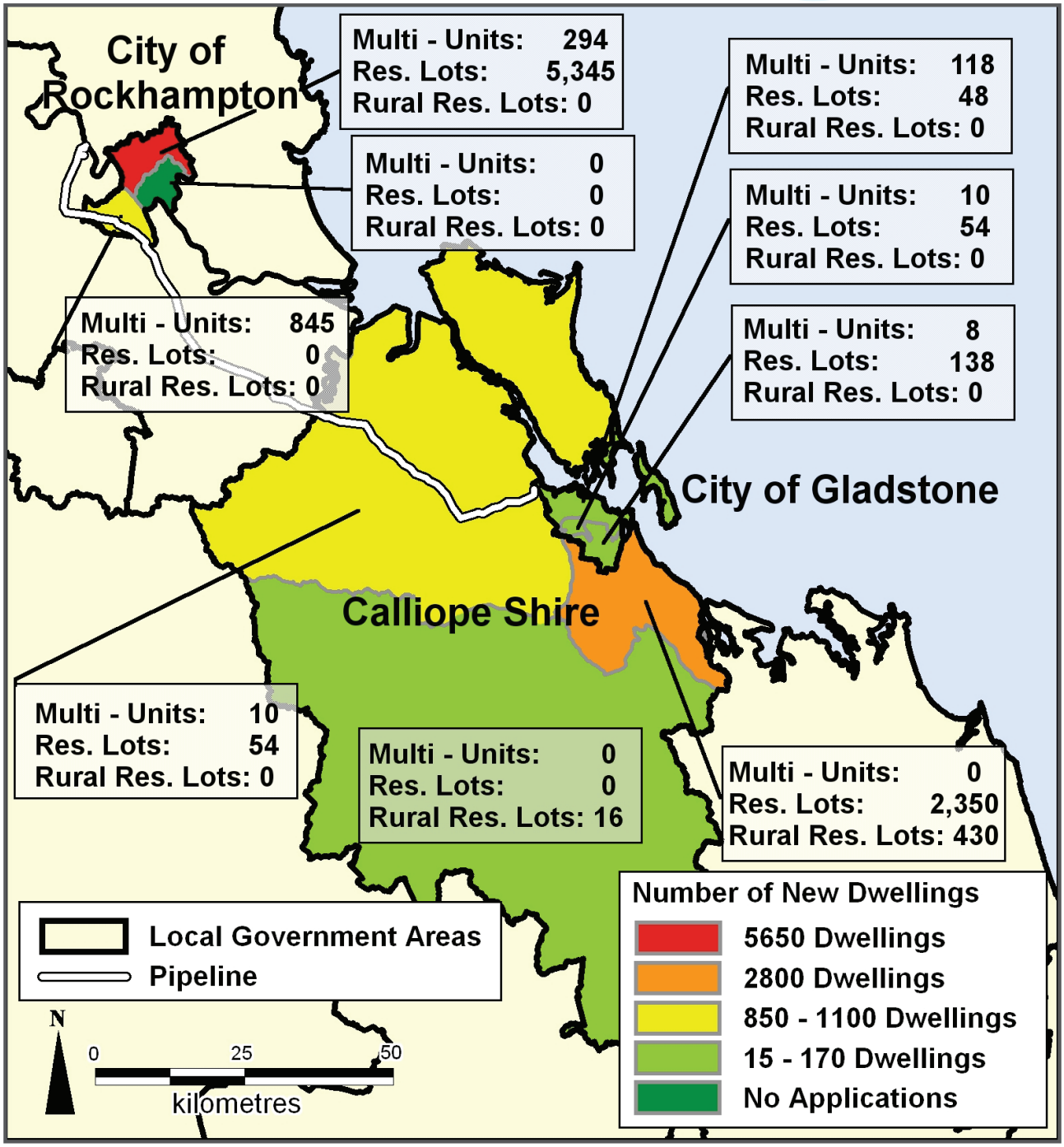


Figure 15.5 Proposed Residential Development, Rockhampton, Gladstone and Calliope LGAs[6]
Source: Rockhampton, Gladstone and Calliope Council Development Applications, January 2008

6 Note: Multi-Units include multistorey units and duplex units. The number of new dwellings was calculated based on the sum of Multi-Units and urban and rural residential lots. As the information is based on development applications, the total number of new dwellings should be interpreted as a number of dwellings currently under application, rather than actual number of dwellings constructed.

Table 15.10 Other Major Projects in the Vicinity of the Gladstone–Fitzroy Pipeline Project

Project	Construction Employment	Operational Employment	Timeline
Central Queensland Ports Authority (CQPA) and Queensland Rail – Proposed Wiggins Island Coal Terminal	Additional 800 contract staff	125	Environmental impact statement completed and approved. Stage one construction is targeted for 2008–2011.
Central Queensland Ports Authority (CQPA) – Fisherman's Loading Wharf	n/a	n/a	Significant project status was announced in October 2005, while terms of reference for environmental impact study were finalised in July 2006. Stage 1 includes land reclamation, revetment wall, capping and three berths. Long-term timeframe subject to demand.
Goondicum Industrial Minerals Project	50	60	Construction commenced August 2006. The plant is currently in commissioning stage and is expected to be in full production shortly.
Rio Tinto Aluminium Limited – Yarwun Alumina Refinery	2200	250	Work commenced in the third quarter 2007. First shipments are due in the second half of 2010.
Alinta Limited – Queensland Gas Pipeline	n/a	n/a	Gas delivery is expected to begin 2010.
Cement Australia – New Cement Mill	100	n/a	Single stage project with commencement expected early 2008.
Powerlink Queensland – Infrastructure upgrades and New Large Network Assets Proposal	n/a	n/a	First four stages are projected to be complete as of early 2010. Planning is underway for fifth stage and sixth stage is expected to run from 2011–2013.
Ergon Energy – Infrastructure Upgrades	n/a	n/a	Project is complete.
Arrow Energy NL and AGL Ltd Joint Venture – Gas Transmission	300	8	Environmental Impact statement completed in fourth quarter 2007. Construction is targeted to finish in 2009 for gas delivery in 2010.
Gladstone Pacific Nickel Limited – Nickel Ore Processing Plant	1600	530	Public response for environmental impact statement has now closed. Financing and construction requirements are being investigated to inform a construction timeframe.
Arrow Energy – Boyne River Coal Seam Gas Exploration and Appraisal Project	n/a	n/a	Application for a petroleum lease has been made. Coal seam gas plant is targeted for 2011.
Transpacific Industries Group – Regional Waste Management Facility	70	n/a	Stage 1 is complete while later stages of development are advised to be dependent on demand.
Australian Inland Rail Expressway	900	n/a	Major project status has been granted. Sector 1 is complete and significant funding has been garnered from state and federal agencies.
LNG Ltd and Arrow Energy – LNG Production Facility	100	12	Financial close is targeted for September 2008 to allow for first deliveries in late 2010.
Santos Ltd – LNG Production Facility	3000	200	Final investment decision by end of 2009 to enable cargo export by 2014.
Queensland Energy Resources Limited – Process Plant	n/a	n/a	Feasibility studies currently underway.

Note: The construction employment figures shown are for peak construction periods.
Source: Gladstone Economic and Industry Development Board, February 2008

The GEIDB was unable to provide the local and non-local employment breakdown for the construction and operational employment shown in Table 15.10. Based on the information contained in the table, three projects have been completed as at February 2008 (and therefore these will not require further housing) but 13 major projects, in addition to the project under consideration here, are expected to be completed over the next five to six years. This information is utilised in the assessment of impacts to assist in understanding the accommodation impacts in the region (refer Section 15.6.4).

15.5.3.18 Constraints to Housing Supply

Interviews with planning officers from councils in the project area identified the following constraints with regard to supplying additional housing in the area:

- It was noted that there is a lack of capacity for building companies in the region to meet the demand for the construction of new dwellings
- That even when developments do occur, given the high level of demand, the timely and adequate provision of utility infrastructure to new residential communities is proving to be difficult.

As noted previously, land availability was not perceived as a constraint to providing new housing in the project area, although much of the land that is available is not zoned or serviced.

15.6 Assessment of Impacts

15.6.1 Social Impacts

15.6.1.1 Affected Landholders

The land required for the pipeline alignment and infrastructure sites is located largely on freehold tenure, the majority of which is rural grazing land. A detailed site and route selection process has been undertaken during the planning of the project to mitigate the social and environmental impacts; this is described further in Section 15.7.

Within the GSDA the pipeline is located on freehold land owned by the State (administered by the Department of Infastructure and Planning [DIP]) and the Central Queensland Port Authority (now known as Gladstone Ports Corporation). GAWB will be granted a licence to construct and operate a pipeline within the GSDA. GAWB will acquire and manage an easement for the pipeline corridor in the Alton Downs area, with land remaining available for use by the landowner under the terms of the easement agreement. GAWB will acquire and own the land required for the Alton Downs WTP, Raglan Pump Station and Aldoga Reservoir. The State Government will acquire and manage easements for the Stanwell - Gladstone Infrastructure Corridor (SGIC).

GAWB's use of the easement is subject to a licence agreement between GAWB and the State.

Temporary impacts to landholders may occur during construction of the pipeline and associated infrastructure, intake and WTP and may include:

- Traffic impacts on local roads as a result of construction vehicles and machinery (see Chapter 13, Transport and Access Arrangements for further detail on these impacts)
- Temporary access delays during pipeline construction across local roads (see Chapter 13, Transport and Access Arrangements for further detail on these impacts)
- Amenity impacts associated with noise and dust generated during construction (see Chapter 10, Air Environment and Chapter 12, Noise and Vibration for further detail on these impacts)
- Disruption to grazing land, fencing and gates, irrigation, farm dams and Good Quality Agricultural Land (GQAL) (Described in Chapter 4, Land Use and Infrastructure and in Chapter 5, Soils and Contamination).

As the project pipeline will be largely underground once it is operational, amenity or access impacts to landowners or the public from the pipeline itself are not expected. However depending on the terms of the easement and license agreement there are likely to be restrictions to the future land uses within the pipeline corridor, because land uses which may damage the pipeline may not be permitted to occur. Pre-existing land operations will be allowed to resume with some restrictions. Maintenance works may also require access by GAWB to different sections of the pipeline during operation and possible disruption to land uses depending on the nature of the required maintenance. Where possible, access for operations and maintenance activities will be via existing roads to minimise the disruption to landowners.

Potential visual impacts to residential properties located in proximity to the WTP are discussed in Chapter 17, Landscape and Visual Impact Assessment.

Possible air quality or noise impacts arising from the operation of the WTP and pump stations to residential properties have been assessed in Chapter 10, Air Environment and Chapter 12, Noise and Vibration.

15.6.1.2 Long-term Implications on Operations and Maintenance within the Gladstone City Local Government Area

The Terms of Reference for the EIS require discussion of this issue where relevant to the project. It is noted that the Gladstone City Local Government Area is now the Gladstone Regional Council area, which also encompasses the former Calliope Shire and Miriam Vale Shires. The Rockhampton City Local Government Area is now the Rockhampton Regional Council area, encompassing the former Fitzroy, Livingstone and Mount Morgan Shires. The southern half of the project area is approximately located within the Gladstone Regional Council Area. As with all aspects of the project, the operations and maintenance requirements will be the responsibility of GAWB and will be managed to ensure the efficient operation of the pipeline and infrastructure, with minimal disruption to landowners and the public. Any necessary approvals required under the provisions of the Gladstone Regional Council planning framework for maintenance or operational works will be obtained by GAWB as maintenance needs arise, and liaison with the Council regarding the project will continue as required.

15.6.1.3 Public Health and Safety

Construction and operation of the project will be managed in accordance with relevant health and safety legislation and with GAWB's and the contractor's health and safety management systems. These have been described in Chapter 16, Hazard and Risk. Also described in Chapter 16 is the Hazard and Risk Assessment (HRA) that was undertaken for the project including consideration of risks to the public and property. The HRA did not identify any risks that cannot be adequately managed through existing or proposed management measures. These measures are described in Section 15.7. Risk identification and review is an ongoing process which will occur throughout the life of the project so that appropriate mitigation measures can be put in place.

Possible impacts to public health and safety may occur during construction at road and rail crossings as a result of disruption to traffic flow and presence of personnel and machinery at the site. Mitigation measures to address this risk are described in Section 15.7.

15.6.1.4 Human Services

As identified in Section 15.5, there are a range of public services in the project area, including schools, hospitals and council facilities. None of these services are located within the project corridor and as such are not expected to be directly affected during either construction or operation. Indirect effects associated with the project may include the increased patronage of these services as a result of the movement of construction personnel to the area. The average workforce for the project during construction is expected to be between 190 and 200 people and less than 10 for the operational phase. Of these workers a percentage (approximately 40 percent of full time staff and 50 percent of contractors) are expected to be from the local area and therefore do not represent an increase as a result of the project. Given the wide range of facilities and services available in the region, the additional personnel moving to the region as a result of the project are not expected to place a significant strain on the capacity of the facilities and services.

15.6.2 Economic Impacts

In this section the potential impacts on the local economy (including employment) and accommodation associated with the project have been identified and assessed.

15.6.2.1 Summary of the Economic Impacts for the Project

Drawing on information summarised in Table 15.10 and tailoring the input-output model to account for the structure and dynamics of the local economy, the economic analysis identifies the interface between the activities associated with the project and all industries in the economy of the project area (the local economy). It estimates the contribution that the project makes to the economy in terms of both the direct contributions - in terms of the output, value added and employment - as well as the indirect or 'flow-on' contributions. The indirect or 'flow-on' contributions result from the additional output, value added and employment generated by other businesses due to the project. It is important to note that the 'flow-on' contribution may not be realised immediately and refers to the generation of output, value added or employment in years to come. However, it is expected that the 'flow-on' contributions would primarily be realised in the earlier years post-construction and diminish thereafter.

Figure 15.6 shows the assumed construction cost broken down by quarter for the construction period. The estimated average quarterly cost of construction throughout the construction stage is approximately $33 million. This is around 12 percent of the total construction output of the region. Note that this is the average quarterly cost and is based on 2008 dollars so does not take into account inflation that would occur prior to and during the construction phase. Estimated expenditure at the start of the construction phase is approximately $5 million per quarter and would then peak in quarters five and six at an estimated expenditure of around $56 million per quarter.

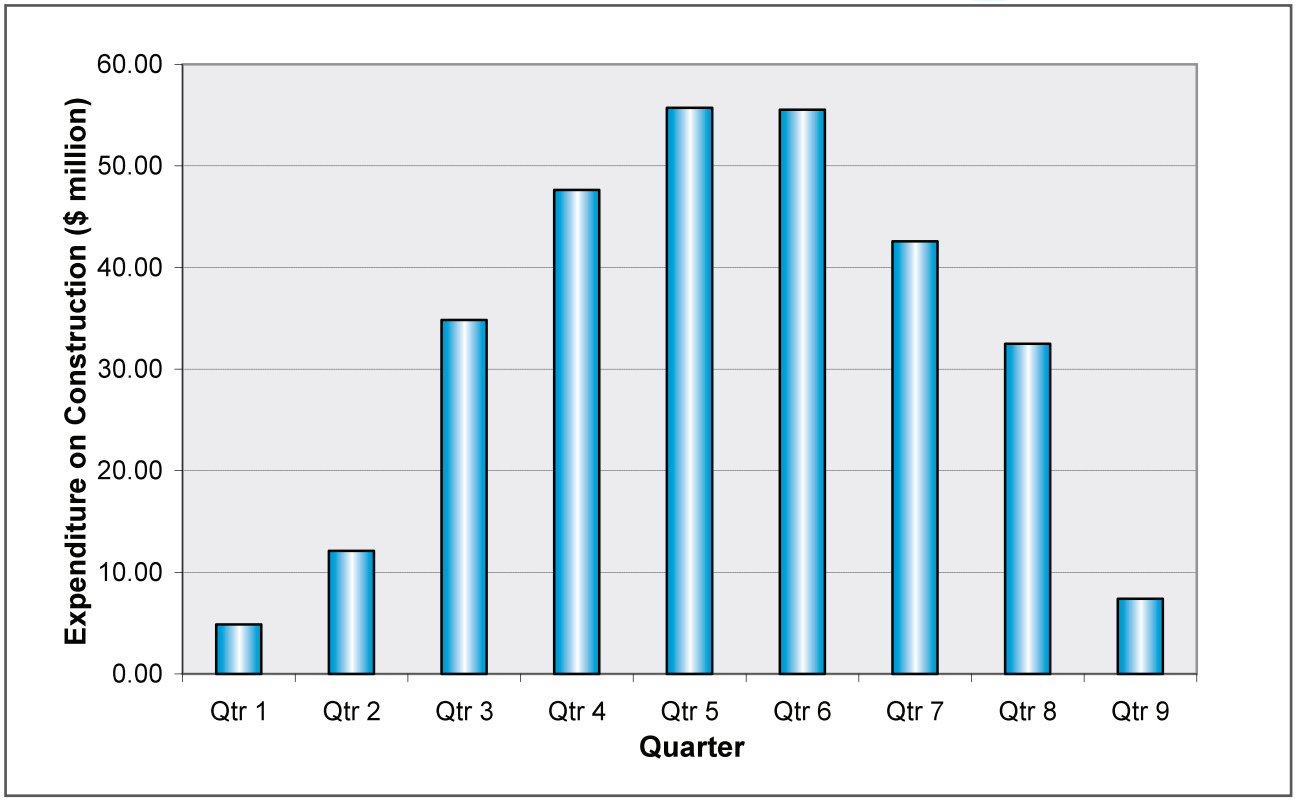


Figure 15.6 Estimated Expenditure on Construction per Quarter
Source: Arup, 2007

Figure 15.7 provides a summary of the economic contribution of the total construction phase of the project to the local economy. The value of output is segregated into various industries. The total construction cost is estimated to be $293.2 million. It is assumed that approximately $57.4 million (or 20 percent) of this would be spent in the local area.

The multiplier for the construction sector in the region is estimated to be 1.98. This implies that as a result of the total direct expenditure into the construction sector, which includes an estimated $57.4 in the local construction sector, other industries in the local economy are estimated to produce an additional $56.3 million worth of output (the indirect contribution to the economy). It is expected that the primary benefits to the economy will be largely channelled through the construction sector.

The total contribution to the economy is the sum of the direct and indirect contributions. The total contribution to the local economy by the construction phase of the pipeline project is estimated at approximately $113.7 million.

These 'flow-on' or multiplier effects will not necessary occur immediately but are expected to be realised over time. It is anticipated that Rockhampton will be one of the positively impacted areas in the short and medium-term.

Economic benefit in Rockhampton will be generated as a result of increased demand in the accommodation, earthmoving and construction sectors. The economic benefit is dependant on the proportion of locally based companies within these sectors.

The ABS information presented in Section 15.5.2 indicates that a range of qualified persons are currently residing in the region (see Figure 15.4). This would suggest that the skills do exist in the region. However, given the current and likely future construction activity in region (when all major projects are considered) it is likely that there will be tight competition for construction workers both for the project and for housing projects to accommodate future workers. Consultation with key stakeholders in the region supported this statement and noted that it is difficult to find suitably skilled contractors, particularly construction workers, who are available. Nonetheless, it is noted that major construction companies are present in the region and that they may have the capacity to increase their workforce, and/or some of their workforce may be wish to take up external opportunities. Given the low unemployment rate in the project area (4.0 percent) and the labour participation rate, which is unlikely to change significantly in the future given the family profile of the region (62.8 percent), additions to the workforce are very likely to be required from outside the region.

The first row of Figure 15.7 shows that the project is expected to produce $57.4 million of direct construction expenditure in the region (or output) and the value added component of that output to the local economy is $23.7 million. Value added is an important measure as it does not focus solely on the size of the expenditure associated with pipeline but highlights the contribution that is going directly into the economy through items such as employee salaries and surplus (as opposed to going back into other industries). It is purely the value added component of the products measured and not the total sale value being recounted as the product moves from industry to industry.

The indirect contribution to the region's value added is $23.1 million. Therefore the total contribution to value added due to the project is estimated at $46.8 million.

The final row of Figure 15.7 outlines the direct and indirect contributions made by the project in the local region. The direct contribution to jobs is purely the average number of employees required to work on the project. The indirect impact is an estimate of the additional jobs that are being generated as a result of the operations of the project. According to data supplied by the project team, the estimated average annual number of jobs for the project is 190 - 200 people. Based on this, it is likely that an additional 207 annual jobs are generated in the remainder of the local economy. The total jobs generated is therefore 397 - 407 at any given time. The additional jobs are generated because the project will generate expenditure in the local economy which, in turn, creates new jobs.

The measure of employment impacts needs to be interpreted carefully. The job generation, either direct or 'flow-on', is not solely the extent of the impact. The nature of the workforce in the regions determines whether the towns must attract the skills and accommodate additional workers or whether the jobs can be absorbed amongst the working residents in the project area. As previously noted based on the statistics and also verified through consultation regions such as Gladstone are seen as 'tradie towns' and have a great deal of experience with development projects. This potentially indicates that the employment requirements have a better chance of being met locally through industry adjustments. This could, in turn, indicate a potentially lower impact on accommodation than what might be expected, if current residents are re-deployed to address employment requirements. It is noted, however, that the employment situation in the local region is currently very competitive.

Given the limitations associated with solely using economic modelling as a basis for understanding the economic impacts of the project, gaining an understanding of the impact of major past projects in the region is very useful. Consultation findings suggest that the construction of the Stanwell Power Station resulted in great economic stimulus to the greater Rockhampton region and brought significant numbers of new people to Rockhampton which was beneficial economically and also from a community development perspective. In terms of scale, the impact of the project on the project area's employment situation is likely to be marginal compared to the Stanwell Power Station project (An $11.6 billion construction project) and compared to the other major projects currently occurring in the region (Table 15.10), but again, it is noted that even with minimal impact, the competition for employment in the region is high.

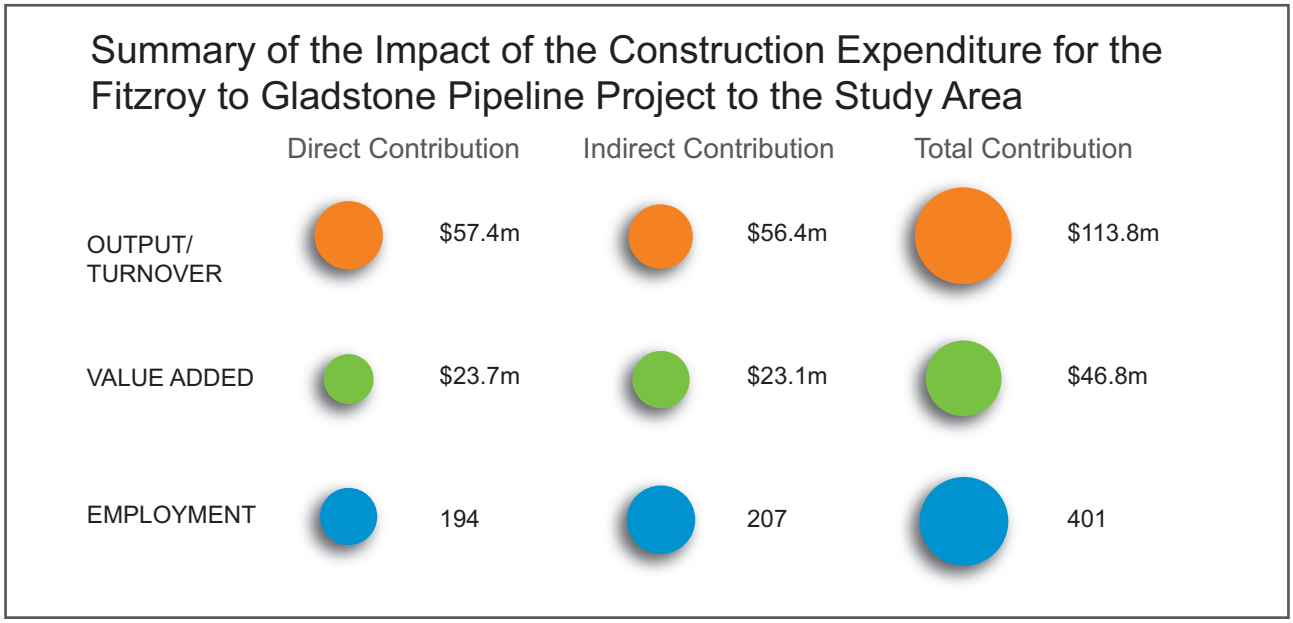


Figure 15.7 Project Area Economic Contribution Summary from Construction Expenditure
Source: SGS Economics and Planning, 2008

The Distribution of the Economic Impacts from the Construction of the Project

Figure 15.8 provides a distribution of these economic contributions across various industries in the local economy. It outlines the key supply chain in the local region. The linkages described are based on ABS one digit ANZSIC industry classifications. An understanding of the activities encapsulated by the industries defined under these classifications is important in accurately interpreting the results.

Figure 15.8 lists the top seven ANZSIC industries receiving the largest 'flow-on' impacts as a result of the construction phase of the project. This is essentially a list of those industries which increase their output the greatest in order to meet the demands of the construction phase of the pipeline project. Figure 15.8 shows that the project's most significant indirect contribution of $12.7 million is to the property and business services sector. This can be interpreted as the property and business services sector would increase their output by $12.7 million in response to a $57.4 million dollar local expenditure from the construction of the pipeline.

Figure 15.8 also indicates that the second most significant impact is calculated to be on the retail trade sector with a contribution of $5.0 million. A large component of this 'flow-on' would be the 'consumption induced impact'. That is, a large part would result from the retail consumption expenditure of the wages paid to construction workers. The remainder of the sectors not listed in the top seven are categorised into "Other Industries" category.

Other Economic Impacts

Figure 15.9 illustrates the calculated economic impacts associated with the annual costs aside from construction associated with the project. The three outlined are WTP chemicals, power costs, and repair and maintenance of the pipeline. They each have different multipliers. The total combined annual impact is estimated at $17.8 million.

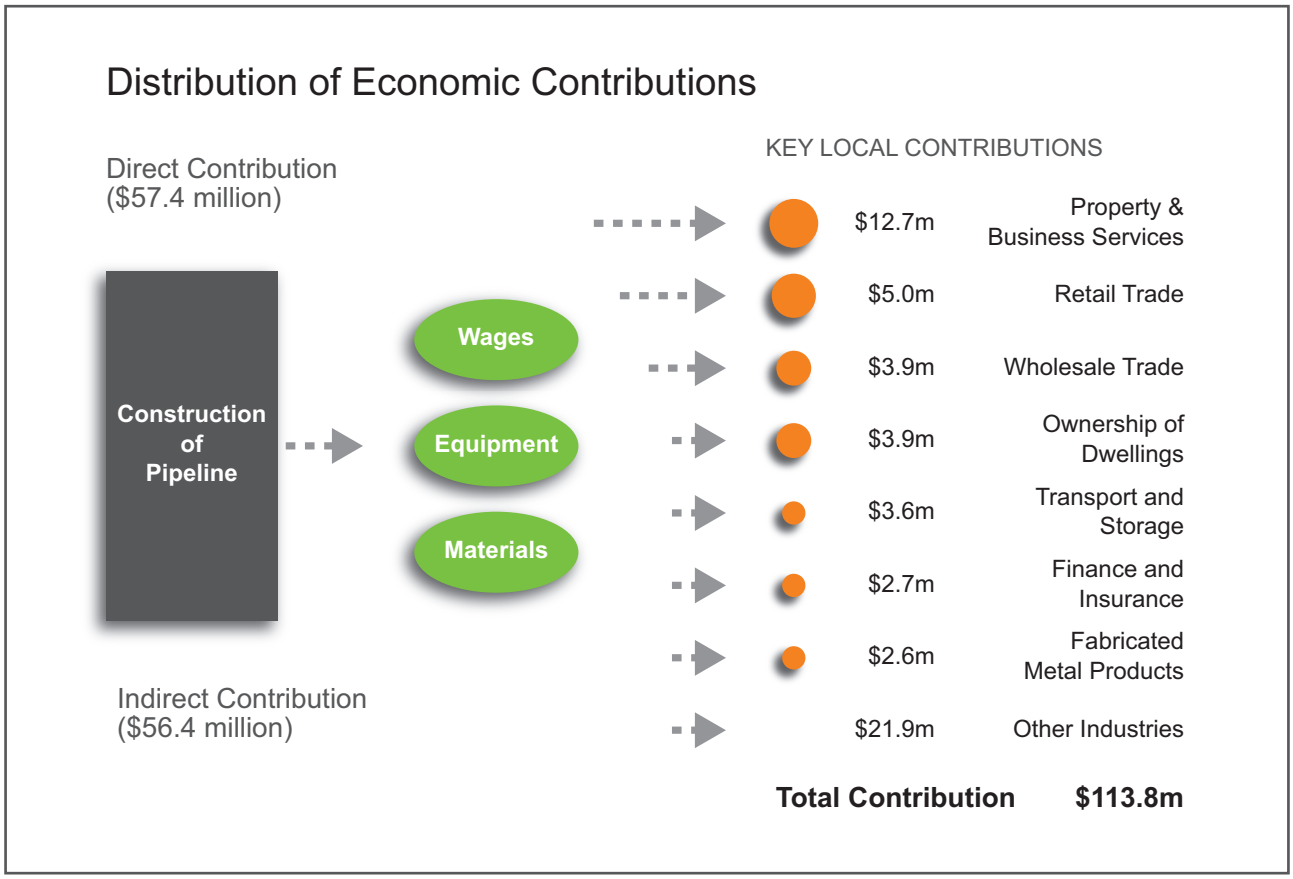


Figure 15.8 Distribution of the Economic Contributions from Construction Expenditure
Source: SGS Economics and Planning, 2008

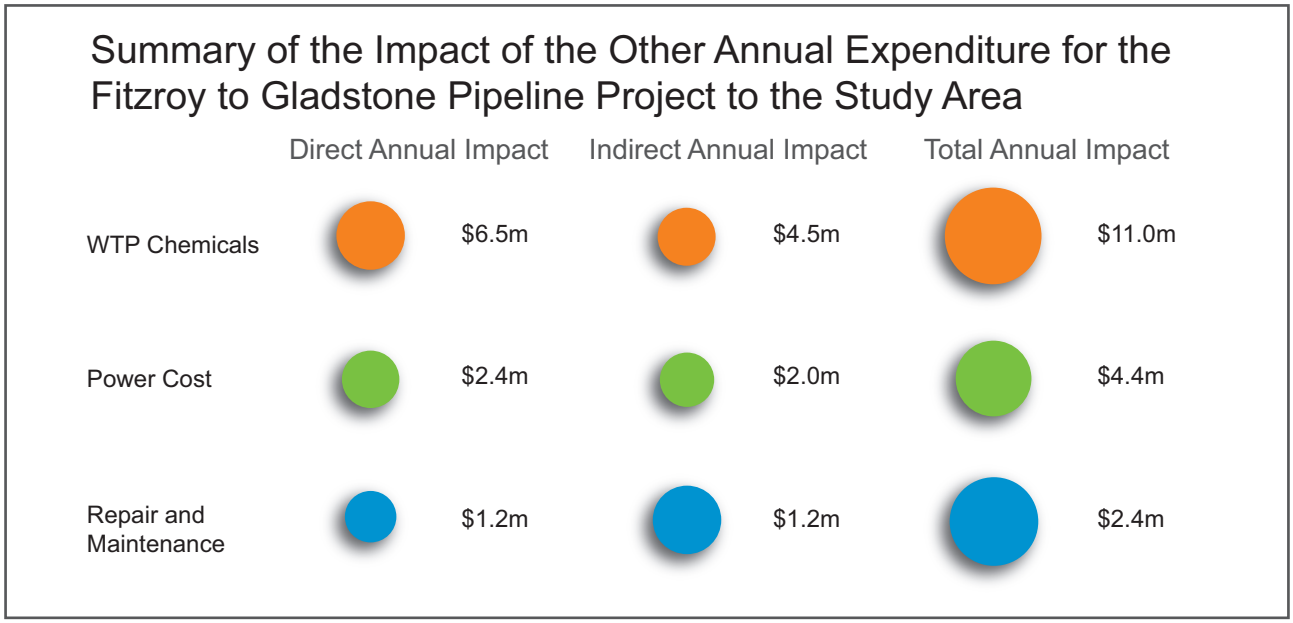


Figure 15.9 Project Area Summary of the Economic Contributions from other Expenditure
Source: SGS Economics and Planning, 2008

Economic Impacts to the Queensland Economy

Utilising the information acquired from the project team, the economic impact assessment model was expanded to assess the State-level impacts. This analysis looks at the contributions made by the project to Queensland. Although it was estimated that part of the materials and labour for the project were to be sourced from the local area, for the assessment it is assumed that the 95 percent of the total construction expenditure will be captured in the Queensland economy. As a result, as evident in this assessment, there are additional direct and indirect contributions once the State economy is being considered as opposed to the local.

Figure 15.10 summarises the economic impacts to the Queensland economy, resulting from the project. The direct expenditure has increased to encapsulate 95 percent of total construction expenditure i.e. $278.5 million. The 'flow-on' or indirect contributions to the State economy are $453.3 million, resulting in a total economic contribution of $731.8 million. This means that approximately $618 million of the total contributions are estimated to be flowing beyond the local project area and into other parts of Queensland.

The project is estimated to contribute $120 million to the State's value added directly. With a 'flow-on' of approximately $180 million, the total contribution to the State economy's value added was calculated at $300.6 million. The indirect jobs generated as a result of the operations of the project was calculated to be 313 jobs. Adding this to the average employment level at any given time during the construction phase (190 - 200 jobs), the total contribution to jobs in Queensland was estimated at 507 jobs per annum.

Figure 15.11 illustrates the calculated economic impacts related to the annual costs of the project on the Queensland economy. The three items have higher indirect components. The total impacts of each are: WTP chemicals $15.5 million; power costs $6.2 million; and repair and maintenance $3.2 million.

15.6.3 Economic Impacts to the National Economy

In this section, the economic impact assessment was extended to the national economy. This analysis looks at the contributions made by the pipeline project to Australia. This assessment is based on the assumption that Figure 15.12 summarises the impacts of the construction of the pipeline to the national economy.

The direct expenditure is full cost of the construction phase, estimated at $293.2 million. With a national multiplier of 3.07, this direct expenditure generated a 'flow-on' contribution calculated to be $606.9 million and therefore a total economic contribution of $900.1 million.

The project is estimated to contribute $128 million to the national value added directly. With a 'flow-on' of approximately $239.7 million, the total contribution to the national economy's value added was calculated to be $367.8 million. The indirect jobs generated as a result of the operations of the project was estimated at 393 jobs. Adding this to the average employment level at any given time during the construction phase (190 - 200 jobs), the total contribution to jobs in Australia is approximately 583 - 593 jobs per annum.

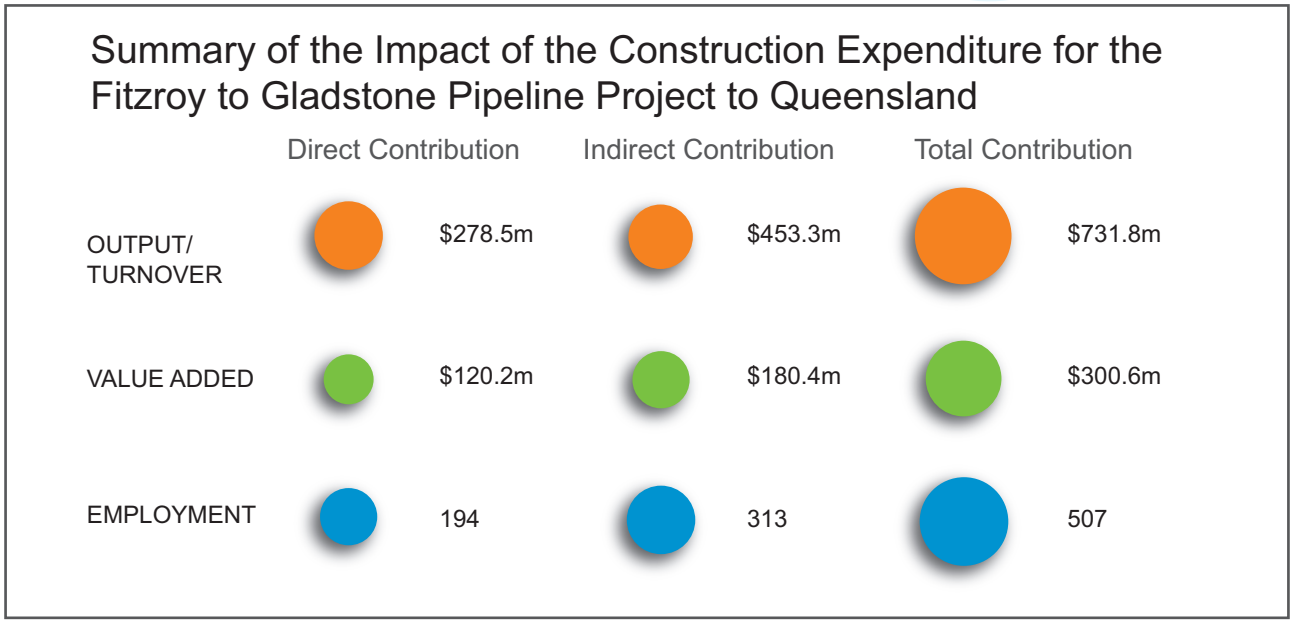


Figure 15.10 Economic Contribution Summary from Construction Expenditure, Queensland Economy
Source: SGS Economics and Planning, 2008

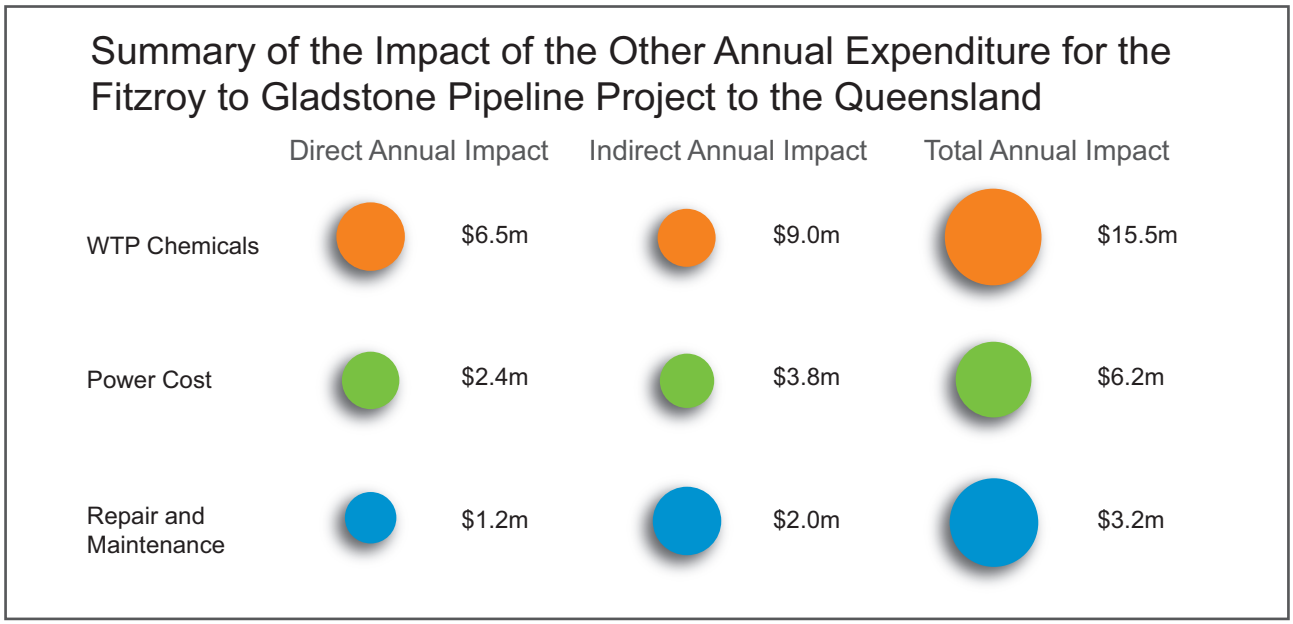


Figure 15.11 Summary of the Economic Contributions from other Expenditure, Queensland Economy
Source: SGS Economics and Planning, 2008

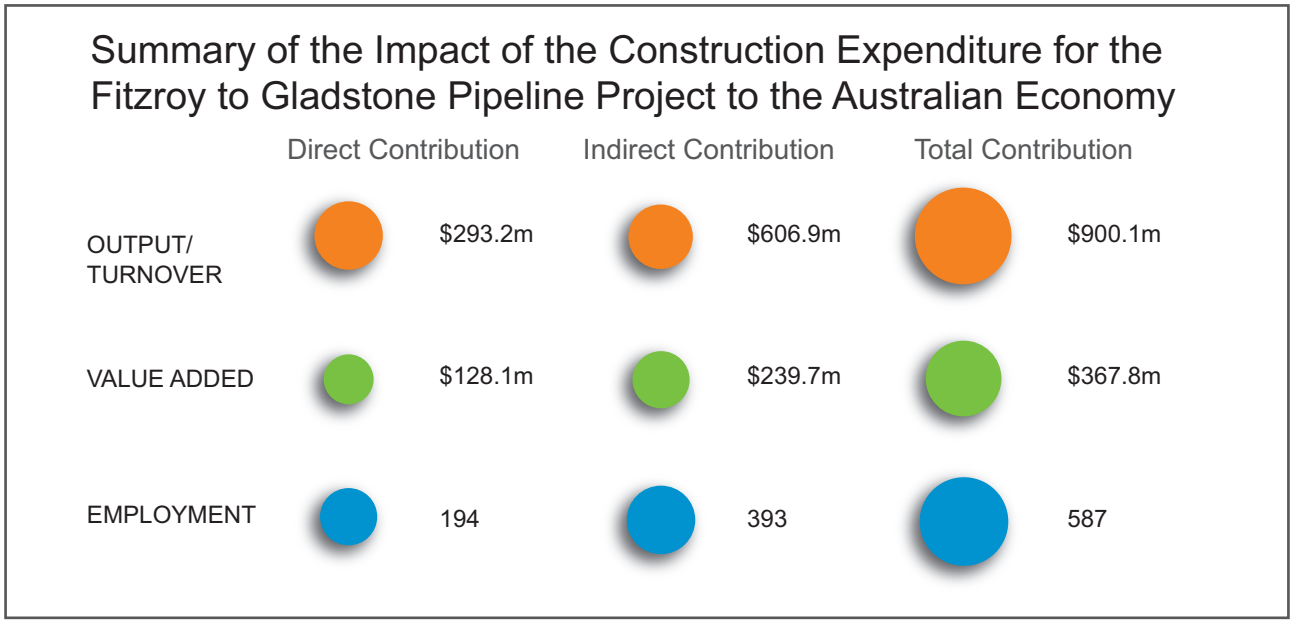


Figure 15.12 Economic Contribution Summary from Construction Expenditure, Australian Economy
Source: SGS Economics and Planning, 2008

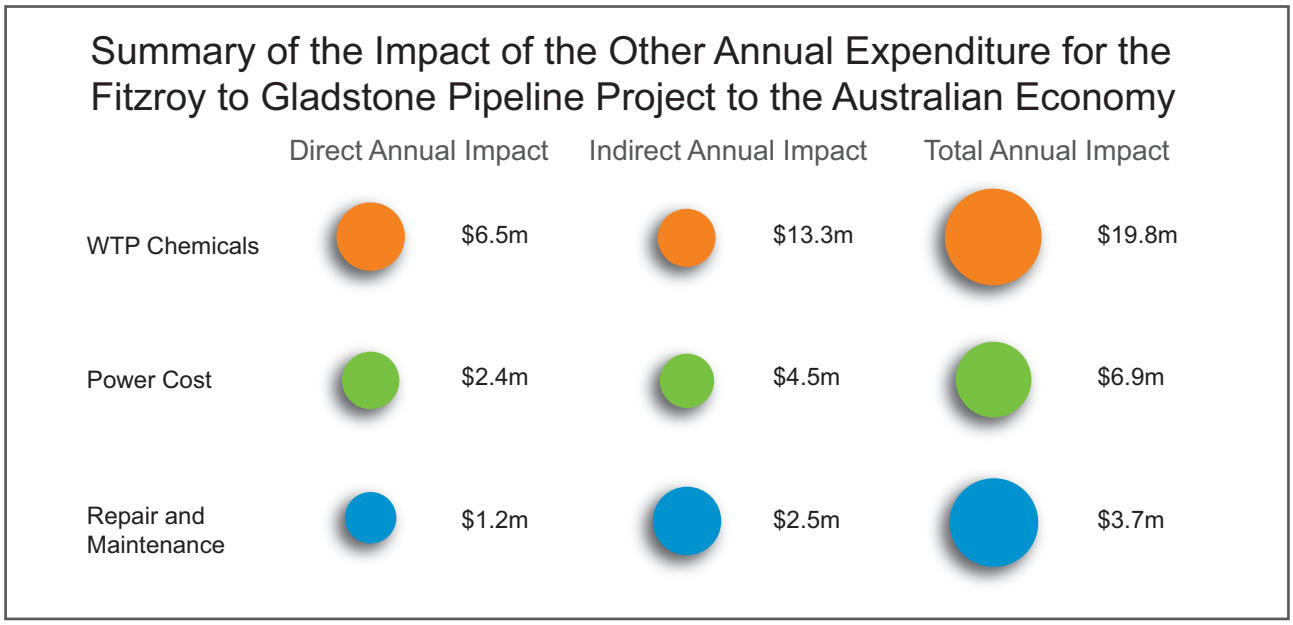


Figure 15.13 Summary of the Economic Contributions from Other Expenditure, Australian Economy
Source: SGS Economics and Planning, 2008

Figure 15.13 illustrates the economic impacts associated with the other annual costs (aside from construction phase) associated with the project to the national economy. The three items have higher indirect components compared to other items as a result of the higher national multipliers. The total impacts of each are: WTP chemicals estimated at $19.8 million; power costs estimated at $6.9 million; and repair and maintenance estimated $3.7 million.

15.6.4 Accommodation Impacts

This section discusses the impacts of the pipeline project on accommodation in the local region. In a sense it is a conservative estimate purely focussing on employment generated housing demand and not impacts associated with other residential migration into the region resulting from other reasons associated with projects such as infrastructure and industry developments in the region.

As noted throughout this chapter, the pipeline project will directly employ between 190 and 200 persons at any given time, and a further 207 employees are likely to result as a consequence of indirect impacts. These employees will need to be accommodated within areas that are accessible to the project area. Some of these employees will already reside in the region, while others are likely to be attracted to the region due to the employment prospects. It is the latter component that has an impact on accommodation in the region.

There a number of factors that needs to be considered to assess the impacts on accommodation in the project area due to the project. Firstly, the skills shortages noted above will impact quite markedly on housing issues. Attracting workers from outside the region implies that there is a need to accommodate these new workers regionally. Often the cycle that occurs is that rentals are firstly sought by new entrants to the region and then, if residents decide to stay for the longer term home ownership may be considered. Given the very low levels of vacancies in the owned or being purchased dwellings, the very low levels of occupancies in the rental markets and the high number of workers already being accommodated in local motels and caravan parks, new persons entering the region are likely to experience difficulties in securing rental housing, at least in the short-term.

The information provided from the former Gladstone, Rockhampton and Calliope Councils suggest that approximately 1,200 units (multi-storey) and 9,500 lots (urban and rural residential) are currently under application (and it is noted that there is no guarantee that all will be approved). Although the project will employ fewer construction workers as compared to other major projects occurring in the region, direct and indirect workers associated with the project will be affected when trying to source accommodation, as supply within the region is already out of equilibrium with demand. Given that Council officers note that it is difficult to keep up with demand due to delays associated with the construction of new housing and infrastructure provision, despite the relatively small impact of the project on the accommodation situation, finding appropriate accommodation is likely to be somewhat difficult. This issue is exacerbated once new residents moving to the region as a result of significant infrastructure and industry development are taken into account.

Discussions with real estate agents across the project area revealed that the housing market is already under strain, and most agreed that, in isolation, the project will not be the impetus for any significant increases in rental prices and/or sale prices. Nonetheless, the project will have a marginal, yet cumulative, impact on the accommodation situation in the project area as other major projects come on line, increasing the demand for housing. If supply cannot match demand, prices are very likely to continue to rise. As such, workers employed for the project are likely to experience difficulties in findings a suitable accommodation in the region. Depending on the family make up and accommodation preferences, this might be exacerbated by the relatively low level of multi-unit dwellings likely to come on stream in the short to medium term.

15.7 Mitigation

15.7.1 Social

15.7.1.1 Route and Site Selection

The focus of the route selection process within the series of easements in Alton Downs (referred to as the Alton Downs easement) has been the minimisation of social and environmental effects. In the Alton Downs easement, the alignment of the route was selected to align with existing easements where possible to minimise the disruption to land uses in this area. Prior to the finalisation of alignments in this area, discussions were held with landowners and changes made to the alignment where possible based on their preferences, for example to reduce impacts to existing irrigation infrastructure. This is discussed in Chapter 1, Introduction.

One of DIP's objectives in establishing the SGIC was to lessen the disruption on individual landowners, surrounding communities and the environment that would otherwise occur if access to multiple pipeline routes was sought on a project by project basis. The route selection process for the SGIC is described in Chapter 1, Introduction, and included consultation with affected landowners. Similarly in the selection of project infrastructure sites, several criteria were used including consideration of land uses and residential areas. The intake structure and pump station have been located within the boundary of the existing SunWater intake property to reduce the impact to adjacent residential properties. The selection of the WTP site has been undertaken through the use of a number of

criteria, which are described in Chapter 1, Introduction. These criteria included the relative distance to residences of the different site options, and the presence of existing infrastructure on the property. Similarly the selection of the Raglan Pump Station site considered different options and used criteria to select the preferred site.

Route selection for this project within the GSDA was undertaken by DIP with consideration of other land uses, topography and existing infrastructure.

Chapter 4, Land Use and Infrastructure further describes the land use and property impacts.

15.7.1.2 Consultation

As described in Chapter 1, Introduction, a consultation program has been ongoing throughout the planning stages of the project. This has included meetings with affected landowners and government representatives, newsletters to relevant stakeholders including landowners within and adjacent to the project corridor and the use of a project specific 1800 number to answer queries or complaints relating to the project.

Consultation is planned to continue during the EIS public display period and during construction. This will keep the public and landowners informed of the project as it develops and provide an avenue for complaints or issues raised to be addressed.

15.7.1.3 Strategies for Local and Indigenous Employment

Local labour and sub-contractors will be used where possible during construction and the Local Industry Policy will be complied with for the project. A project office will be established in Rockhampton which will potentially increase the opportunities for local and Indigenous residents in Rockhampton to gain employment on the project. This is expected to partially mitigate the effects of low unemployment rates in the region and the possible shortage of local labour. Also due to the relatively small labour force required for this project, it is likely that the necessary percentage of local labour will be fulfilled. Other possible measures to secure local labour include strategies such as employment incentives.

15.7.1.4 Strategies Responding To Government Policies

Queensland Government Building and Construction Contracts Structured Training Policy (the 10 percent policy)

Compliance with this policy will be achieved for this project through the following:

- GAWB will include a requirements to comply with the policy in the Construction Contract Agreement
- As the project value is greater than $100 million, the contractor will develop a Skills Development Plan and engage a training coordinator as required by the policy
- A minimum of 10 percent of the total labour hours on the project will be carried out by apprentices, trainees or cadets or used to increase the skill levels of current employees
- The Department of Education, Training and the Arts will be consulted regarding reporting requirements and any further requirements for compliance with the policy.

Local Industry Policy

Compliance with this policy will be achieved for the project through the development of a Local Industry Participation Plan in consultation with the Department of Tourism, Regional Development and Industry.

15.7.1.5 Strategies to Foster Cross Cultural Awareness

Consultation with the traditional owners in the project area, the PCCC and Darumbal people, began in 2007 prior to the commencement of the geotechnical preliminary investigations for the project. Subsequently a Section 23 agreement under the *Aboriginal Cultural Heritage Act 2003* was reached with the Traditional Owner groups and representatives of each group were engaged to undertaken cultural heritage monitoring during the geotechnical works.

Consultation with the traditional owners is ongoing as part of the Cultural Heritage Management Plan (CHMP) process for the project. During this process the traditional owners will undertake a survey of the project route prior to construction to identify items of traditional or contemporary cultural heritage significance.

15.7.1.6 Public Health and Safety

The project is considered to be an efficient and safe means of transporting water and does not have the same risks as those that may be associated with a gas or petroleum pipeline. However as construction will require the crossing of railways, roads and other third party infrastructure, there are some risks associated with these activities. The management of health and safety (for project personnel and the public) during the project is outlined in Chapter 16, Hazard and Risk and also in the Planning EMP (see Chapter 20, Planning Environmental Management Plan). Measures to manage health and safety on the project include the following:

- Adherence to GAWB's and the contractor's Health and Safety Management System
- Preparation and implementation of health and safety plans relevant to the construction and operation of the project
- Preparation of emergency planning procedures for construction, and inclusion of the project in GAWB's disaster management plan for operation
- Preparation and implementation of a traffic management plan(s) for the construction of the project and consultation with relevant infrastructure authorities/owners.

15.7.1.7 Complaints Procedure

The project 1800 number will remain active throughout the construction of the project to provide stakeholders with a channel of communication to the project team. Information updates will be distributed to relevant stakeholders (e.g. adjacent properties) at regular intervals during construction or when disturbance is expected from a particular construction activity.

A queries/incident/complaint register will be in place prior to the commencement of construction (as described in Chapter 20, Planning Environmental Management Plan) and will be used to record the following information:

- Date, time and nature of the incident/complaint
- Contact details of the complainant – where available
- Whether it is a repeat complaint
- Record of communication with the complainant
- Corrective action undertaken and date of action
- The person responsible for investigating/addressing the complaint.

15.7.2 Economic

No economic mitigation measures are proposed for the identified economic impacts as the project is expected to have a beneficial impact to the local and regional economies.

15.7.3 Accommodation

Based on the information collected and analysed for this study, it is clear that the project will place additional pressures on the already tight housing and rental market in the project area. As discussed in previous sections, there are several factors contributing to the impacts on accommodation, including:

- The skills shortages experienced in the project area (as well as in Queensland) which if fulfilled impacts quite markedly on temporary and permanent accommodation opportunities
- The population in the Gladstone–Fitzroy region continues to increase, particularly in Calliope and Gladstone where there is a high level of dwelling activity, but demand is still outstripping supply
- The vacancy rate for owned and being purchased dwellings is very low, currently ranging between 2 to 4 percent in the project area
- The vacancy rate for rental dwellings are also at a very low level, estimated at 1 to 2 percent of total rental dwellings
- A high number of workers are already being accommodated in local motels and caravan parks and vacancy rates in these accommodation types are low.

Based on the above factors, the mitigation measures for addressing the accommodation impacts for the project include:

- Utilising local labour and sub contractors wherever possible (noting that there is low unemployment in the region, strategies to attract local labour will need to be devised as outlined in Section 15.7.1)
- Scheduling the works to avoid concurrent operations where possible
- Where practicable, securing rental properties to accommodate the workers for the duration of the construction phase of the project, particularly in Rockhampton. Given the low vacancy rates in the rental property sector, and not wanting to add to the rental price inflation that can easily occur when 'out-bidding' for existing houses exists, rentals will be sought as far in advance of construction as practicable
- In addition, or in isolation, short-term contractors may also be accommodated in motels or caravan parks within the project area. In such cases, pre-arrangements with these accommodation types would be undertaken to secure accommodation for the duration of the project, and given the low vacancy rates in these types of accommodation, would be actioned as far in advance of construction as practicable.
- Construction camps may be utilised to accommodate staff if required.

15.8 Residual Impacts

The proposed mitigation measures are likely to reduce the impact of the project on socio-demographic and accommodation issues however there may still be some residual impacts which have been assessed minor adverse (in the case of social amenity issues) to moderate adverse (for accommodation impacts). The economic impacts of the project to the regional economy and employment have been assessed as moderate beneficial. The residual impacts have been summarised in Table 15.11, making use of the significance criteria that are described in Table 15.1.

15.9 Cumulative and Interactive Impacts

The cumulative and interactive impacts associated with the aspects noted in this component of the report of the project are applicable to accommodation and labour force issues. As stated in previous sections, the project will directly employ an estimated 190 - 200 persons at any given time with an additional 207 jobs created due to the indirect impacts associated with the project. Despite the low number of jobs expected to be produced by the project when compared to the other major projects occurring in the region, the project's impact on the overall housing situation in the project area is likely to contribute to the already tight housing and rental market, therefore adding extra demand on permanent, long-term and short-term accommodation within the project area. With the housing supply not being able to 'catch up' with the demand created by the growth in the project area's population and mining and related activities, the project will place extra strain on the region's housing and rental market. Consequently, difficulties in finding accommodation for the project's workforce will have implications on attracting and retaining the skilled workforce required for the project. Particularly if the workforce is to be sourced outside the region, the accommodation impact will affect the recruitment and timely mobilisation of workers into the project area. As already noted, the terms of employment for workers of the project will need to be attractive and competitive with other major projects either underway or likely to commence in the near term.

In addition to these, the EIS process has added to the knowledge base of the region over a range of themes (such as the location of Threatened species), bringing it into one publically available document.

15.10 Summary and Conclusions

This section and Table 15.11 provide a summary of the expected social, economic and accommodation impacts of the project.

15.10.1 Social Impacts

The potential social impacts resulting from the construction and operation of the project include:

- Temporary disturbances to land uses during the construction phase which will be minimised through the measures in the Planning EMP (see Chapter 20, Planning Environmental Management Plan)
- Temporary traffic and access impacts as discussed in Chapter 13, Transport and Access Arrangements, which will be managed through the development of construction traffic management plans and through the mitigation measures outlined in the Planning EMP (see Chapter 20, Planning Environmental Management Plan)
- Temporary amenity impacts during construction which are discussed in Chapter 10, Air Environment; Chapter 12, Noise and Vibration; and Chapter 17, Landscape and Visual Impact Assessment
- Acquisition of land for infrastructure siting and for the pipeline easement
- Possible air quality, noise, and visual amenity impacts during the operation of the WTP as discussed in Chapter 10, Air Environment; Chapter 12, Noise and Vibration; and Chapter 17, Landscape and Visual Impact Assessment.

15.10.2 Economic Impacts in the Project Area

The estimated potential economic impacts on the project area's economy (or local region) resulting from the construction and operation of the project are outlined as follows:

- The construction expenditure of the project is estimated at $293.2 million, including an estimated $57.4 million of expenditure being spent in the project area comprising of Gladstone, Fitzroy, Calliope and Rockhampton
- The multiplier for the construction sector in the economy of the project area is 1.98. Therefore the 'flow-on' or indirect contribution of the construction expenditure to the project area is $56.4 million and the total impact is $113.7 million
- The direct contribution of the construction phase to value added is $23.7 million. The indirect component is $23.1 million and the total contribution is $46.8 million
- The average number of jobs at any time of the construction phase is estimated to be 190 - 200. The project indirectly contributes to supporting an additional 207 jobs, and therefore the total contribution is 397 - 407 jobs
- Property and business services are predicted to be the most impacted industry. The indirect contribution to this sector is $12.7 million. The second highest impact is predicted to be to the retail trade sector for $5 million and then wholesale trade for $3.9 million
- Other annual impacts on the project area were calculated as: WTP chemicals $11 million total annual impact; power costs $4.4 million total annual impact; and general repairs $2.4 million.

15.10.3 Economic Impacts on Queensland

The estimated potential economic impacts on the Queensland economy resulting from the construction and operation of the project are outlined as follows:

- The total construction expenditure is the direct impact on the Queensland economy
- The multiplier for the construction sector in the Queensland economy is 2.63. Therefore the 'flow-on' or indirect contribution of the construction expenditure to the project area is $453.3 million and the total impact is $731.8 million
- The direct contribution of the construction phase to Queensland's value added $120 million. The indirect component is $180 million and the total contribution is $300.6 million
- Of the 190-200 estimated average number of jobs during the construction phase the indirect impact on jobs is 313, the total impact is 503 - 513 jobs
- Other annual impacts on the project area were calculated as: WTP chemicals $15.5 million total annual impact; power costs $6.2 million total annual impact; and general repairs $3.2 million.

15.10.4 Economic Impacts on Australia

The estimated potential economic impacts on the Australian economy resulting from the construction and operation of the project area are outlined as follows:

- The total construction direct expenditure of the pipeline project on the national economy is calculated as $293.2 million
- With a national multiplier of 3.07, this direct expenditure generated a 'flow-on' contribution of $606.9 million and therefore a total economic contribution of $900.1 million
- The pipeline project directly contributes an estimated $128 million to the national economy's value added. With a 'flow-on' of approximately $239.7 million, the total contribution to the national economy's value added was $367.8 million
- The indirect jobs generated as a result of the operations of the project was calculated at 393 jobs. Adding this to the average employment level at any given time during the construction phase (estimated at 190-200 jobs), the total contribution to jobs in Australia is approximately 583 - 593 jobs
- The total calculated impacts of other items include: WTP chemicals $19.8 million; power costs $6.9 million; and repair and maintenance $3.7 million.

15.10.5 Impacts on Employment

The following summarises the estimated impacts on job creation in the project area, Queensland and the Australian economy, resulting from the construction and operation of the project.

- The estimated average annual number of jobs for the project is 190-200 people. Based on this figure, it is likely that an additional 207 annual jobs are generated in the remainder of the local region's economy. The total jobs generated is therefore 397 to 407 at any given time
- In terms of employment impacts at the state level, the average number of jobs during the construction phase of the pipeline project (190-200 jobs), the indirect impact on jobs is 313. The total employment impact on Queensland is 503 to 513 jobs
- At the national level, the indirect jobs generated as a result of the operations of the project is 393 jobs. Adding this to the average employment level at any given time during the construction phase (190-200 jobs), the total contribution to jobs in the national economy is approximately 583 - 593 jobs
- The project area is made of LGAs that are affected by the resource boom and hence are seen as 'tradie towns' and have a great deal of experience with development projects. This indicates that the employment requirements have a better chance of being met locally given their historical ability to re-deploy activities to meet general project requirements
- However, given the current and likely future construction activity requirements in the region, the project is likely to require labour from outside the region to ensure that consultation timetables can be met without significant time delays. Consultation findings indicate that currently it is difficult to find suitably skilled contractors, particularly construction workers
- Sourcing of workers from outside the region will also have implications on accommodation demand, especially if a suitable accommodation is not available to house the workers required for the construction of the project.

15.10.6 Impacts on Accommodation

The estimated impacts on accommodation in the local region are outlined as follows:

- The pipeline project will directly employ an estimated 190-200 persons at any given time with an additional calculated 207 persons requiring employment due to the indirect impacts associated with the project. Although this number of employees is low compared to the other major projects occurring in the region, the project's impact on the overall housing situation in the project area is considered to place additional pressures on the already tight housing and rental market
- As the project area undergoes rapid population growth, particularly in Calliope and Gladstone LGAs (now within the Gladstone Regional Council area), coupled with the number of major projects occurring in the region, there is likely to be a stronger demand placed on permanent, long-term and short-term accommodation. The pipeline project is likely to add to the stresses of the housing situation in the project area, albeit marginally
- Despite having approximately 1,200 multi-storey units and 9,500 residential lots (urban and rural) currently under application with Councils in the project area, the lack of capacity within the construction sector to meet the demand for constructing new housing, combined with the delay in the provision of essential infrastructure to service new residential developments will limit the supply of housing stock available for accommodating workers, particularly in the short term
- It is unlikely that project will be the impetus for any significant increases in rental prices and/or sale prices, but the project will have a marginal, yet cumulative impact on the accommodation situation in the project area, particularly as other major projects come on line. If supply cannot match demand, prices are very likely to continue to rise. As such, workers employed for the project are likely to experience difficulties in finding a suitable accommodation in the region. Depending on the family make up and accommodation preferences, this might be exacerbated by the relatively low level of multi-unit dwellings likely to come on stream in the short to medium-term
- In a relative sense, the project is also likely to marginally contribute to an increase in demand for short-term accommodation, with tourist accommodation providers in the project area already servicing labourers and workers more so than short-term visitors and tourists. It is difficult to see how further employees can be accommodated in the current short-term housing markets unless further supply is provided.

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Table 15.11 Summary of Impacts for Social and Economic Environment

EIS Area: Socio Economic Feature/Activity	Current Value + Substitutable Y/N	Description of Impact Description in Words	Mitigation Inherent in Design/Standard Practice Mitigation	Residual Impact using significance Criteria
Regional Economy	Regional Economic Function Partially Substitutable	The construction expenditure of the project is $293.2 million, including an estimated $57.4 million of expenditure being spent in the project area. The 'flow-on' or indirect contribution of the construction expenditure associated with the pipeline project to the project area is $56.4 million and the total impact is $113.8 million. The direct contribution of the construction phase to value added is $23.7 million. The indirect component is $23.1 million and the total contribution is $46.8 million. The project will impact largely on the property and business services industry as the indirect contribution to this sector is $12.7 million. The second highest impact is to the retail trade sector for $5 million and then wholesale trade for $3.9 million. In addition, the project will have impacts on WTP chemicals ($11 million total annual impact); power costs ($4.4 million total annual impact); and general repairs ($2.4 million).		Moderate Beneficial
State Economy	State-wide Economic Function Partially Substitutable	The total construction expenditure of $293.2 million is the direct impact on the Queensland economy. The direct contribution of the construction phase to Queensland's value added was $126.6 million. The indirect component is $190 million and the total contribution is $316.5 million. Of the 190-200 average number of jobs during the construction phase the indirect impact on jobs is 313, the total impact is 503 - 513 jobs. Other annual impacts on the project area were: WTP chemicals $15.5 million total annual impact; power costs $6.2 million total annual impact; and general repairs $3.2 million.		Negligible
National Economy	National Economic Function Partially Substitutable	The total construction direct expenditure of the pipeline project on the national economy is estimated at $293.2 million. The direct expenditure associated with the pipeline project has a 'flow-on' contribution of $606.9 million and therefore a total economic contribution of $900.1 million. The pipeline project directly contributes $128 million to the national economy's value added. With a 'flow-on' of approximately $239.7 million, the total contribution to the national economy's value added was $367.8 million. The total impacts of other items include: WTP chemicals $19.8 million; power costs $6.9 million; and repair and maintenance $3.7 million.		Negligible
Employment	Employment Partially substitutable	The project will directly employ 190-200 persons at any given time with an additional 207 persons requiring employment due to the indirect impacts associated with the project. The total jobs generated for the project area is therefore 397 - 407 at any given time. In terms of employment impacts at the State level, the average number of jobs during the construction phase of the pipeline project (190-200 jobs), the indirect impact on jobs is 313. The total employment impact on Queensland is 503 - 513 jobs. At the national level, the indirect jobs generated as a result of the operations of the project is 393 jobs. Adding this to the average employment level at any given time during the construction phase (190 0 200 jobs), the total contribution to jobs in the national economy is approximately 583 - 593 jobs. Given the low unemployment rate in the project area (4.0%) and the relatively high labour participation rate (62.8%) additions to the workforce are likely to be required from outside the region. Moreover, with other major projects taking place in the region, the project is likely to contribute to the overall skills shortage in Queensland, particularly in construction. Sourcing of workers from outside the project area region will inevitably increase the demand for worker accommodation, placing extra pressures on the already tight housing and rental market.	Pursue terms of employment for employees that are competitive in the region. Works will be scheduled to avoid concurrent operations where possible To address accommodation issues, rental properties will be secured in advance wherever possible to accommodate the workers for the duration of the construction phase of the project, particularly in Rockhampton.	Moderate Beneficial Should employment be able to be fulfilled there will be a positive impact on employment at regional, State and national levels. The higher the local employment ratio, the higher the positive impacts to the region.
Social	Amenity Societal Function Services and Facilities	Temporary disturbances to land uses during the construction phase. Temporary traffic and access impacts. Temporary amenity impacts during construction. Acquisition of land for infrastructure siting and for the pipeline easement. Possible air quality, noise, and visual amenity impacts during the operation of the WTP as discussed in Chapter 10, Air Environment, Chapter 12, Noise and Vibration and Chapter 17 Landscape and Visual Impact Assessment.	Social and environmental considerations in siting of the pipeline and infrastructure. Construction Environmental Management Plan. Construction traffic management plan. Compensation for land acquisition. Social and environmental considerations in siting and design of the WTP.	Minor Adverse
Accommodation	Accommodation Partially substitutable	Although the number of jobs (190-200 workers) expected to be directly produced by the project is low compared to the other major projects occurring in the region, the project will contribute to the overall housing shortage experienced in the project area. With the housing and rental market in the project area being tight, difficulties in providing accommodation will have a negative impact on attracting appropriately skilled workforce for the pipeline construction. As the project area undergoes rapid population growth, particularly in Calliope and Gladstone LGAs, coupled with the number of major projects occurring in the region, there will be a stronger demand for permanent, long-term and short-term accommodation. This will impact on the ability of the project area's accommodation providers to meet the housing needs of the construction workers required for the project. There are currently 1,200 multi-storey units and 9,500 residential lots (urban and rural) under application with Councils in the project area. Even if all of these applications are approved by the Councils, the housing market will be still under strain as the construction sector lacks capacity to meet the demand for constructing new housing and the delay associated with the provision of essential infrastructure to service new residential developments. The pipeline project is also likely to contribute to an increase in demand for short-term accommodation, with tourist accommodation providers in the project area already servicing labourers and workers more so than short-term visitors and tourists.	Explore means to cater for the accommodation needs of workers during the construction phase of the project. Short-term contractors may be accommodated in motels within the project area. In such cases, pre-arrangements with motels are required to secure accommodation for the duration of the project.	Moderate Adverse Although the direct impact of the project on accommodation will be negligible, finding accommodation will be difficult, given the combined with the accommodation impacts resulting from other major projects in the region. Should the options noted in the preceding column be actioned, the residual impact will be Negligible. It is noted, however, that securing accommodation in the existing or even likely near term future market is likely to be difficult.

CHAPTER 17

GLADSTONE – FITZROY

PIPELINE PROJECT

Environmental Impact Statement

Landscape and Visual Impact Assessment

Gladstone Area Water Board

Contents

This information has been prepared by, or on behalf of, the Gladstone Area Water Board (GAWB) regarding the Gladstone-Fitzroy Pipeline project. Care has been taken to ensure that the information is accurate and up to date at the time of publishing.

Gladstone Area Water Board

Figures

Tables