12

ROADS AND TRANSPORT

ENTER HERE

BACK TO CONTENTS

SUPPLEMENTARY REPORT TO THE EIS

arrow energy
go further

12 Roads and Transport

12.1 Introduction

The SREIS Roads and Transport assessment has been undertaken to validate the impacts previously reported within the Roads and Transport Technical Report (Appendix R) of the EIS following advancement of the Project's field development plan and conceptual design. A detailed description of the Project is presented in the Project Description chapter (Section 3) of the SREIS. The Roads Impact Assessment (Appendix K) of this SREIS presents a strategic assessment of the intensity and context of the potential road impacts associated with the Project.

This chapter provides a summary of the Supplementary Roads Impact Assessment (Appendix K) of this SREIS (SREIS RIA) and includes legislative context, existing road environment conditions, Project traffic generation, and impact assessment which includes both road values significance assessment and traditional traffic engineering assessment.

The SREIS RIA seeks to confirm if there are likely to be any residual road impacts of significant, post-application of typical approval requirements and post-implementation of the planned management strategies that would necessarily preclude approval of the Project.

12.2 Legislative Context

This section outlines legislation and guides used by the State and local government roads authorities to assess road impacts from development in Queensland. The Department of Transport and Main Roads (TMR) and local governments have a role in the implementation of the following:

1. *Sustainable Planning Act 2009.* This is Queensland's primary planning reference guide, which manages the development process through the coordination and development of planning guidelines at a local, regional and state level.
2. *Environmental Protection Act 1994* (EP Act)*.* This Act aims to protect Queensland's environment while allowing for development that improves overall quality of life. Section 3 of the EP Act sets out the EIS process. This requires proponents of development that may affect the environment to assess potential effects.
3. *Petroleum and Gas (Production and Safety) Act 2004.* This Act regulates petroleum and gas development and commenced on 1 January 2005. It does not apply to development carried out under the *State Development and Public Works Organisation Act 1997*. Under this Act, any holder of a petroleum authority must not use a public road for a notifiable road use unless they notify the road authority. A notifiable road use can be:
   - The use of public roads in the proponent's area of authority for transport relating to a seismic survey or drilling activity; and/or

— The use of a public road at more than the Act's specified threshold rates, if haulage relates to transportation of petroleum produced or processed in the proponent's area of authority, or the construction of a pipeline. Threshold rates are 50,000 t/yr for a State-controlled road (SCR) and 10,000 t/yr for any other public road.

Further, it is a condition of each petroleum authority that its holder must not carry out a notifiable road use on a public road unless:

— The holder and the relevant public road authority have signed a compensation agreement for the use;
— The public road authority has given written consent to the carrying out of the use; or
— A compensation application has been made to decide the holder's compensation liability to the public road authority relating to the road.

With regard to receiving such notification, TMR may give a "road use direction", which may advise the petroleum authority holder how they may use the road to meet their requirements. As part of a road use direction, TMR can request an RIA to assess the impacts of the notifiable road use.

4. *Transport Infrastructure Act 1994.* This Act is TMR's primary legislation. It sets out the powers TMR has in relation to managing the SCR network.
5. *Transport Operations Act 1995*. This Act provides broad guidelines for the placement of signage or traffic control devices that may be erected on roads.

12.3 Project Description and Project Schedule

To aid brevity a detailed reproduction of the project description is not included within this chapter. Instead readers who require a detailed description of the Project should refer to the Project Description chapter (Section 3) of this SREIS. Table 12-1 below summarises elements of the EIS project description and changes in the SREIS project description update relevant to the RIA. The Roads Impact Assessment (Appendix K, Section 6) of this SREIS describes the Project's traffic generating activities sufficient to inform assessment of the Project's potential road impacts.

Table 12-1 Project Description Changes and Updates Relevant to the RIA

Project Description – EIS Case	Project Description – SREIS Case
2017 ready for start-up.	2018 ready for start-up.
2016 first construction activity.	2015 first construction activity.
2073 final decommissioning activity.	2056 final decommissioning activity.
• 8,000 km^2 Project development area; • 14 development regions; and • 17 drainage areas (12 km radius).	• 8,000 km^2 Project development area; • 9 development regions; and • 33 drainage areas (6 km radius).
Well count: up to 6,625.	Well count: approximately 4,000.
Estimated total water produced: 276,000 ML	Estimated total water produced: 153,000 ML
• Well type: Surface-In-Seam (SIS) chevrons and multi-seam hydraulically fractured; and • No multi-well pads.	• Well type: horizontal SIS, inclusive Multi Branch Lateral (MBL) and multi-seam hydraulically fractured; and

Project Description – EIS Case	Project Description – SREIS Case
	• Maximum of 12 (6 vertical production plus 6 lateral) wells.
• 4 integrated processing facilities (IPFs); • 3 central gas processing facilities (CGPFs); and • 10 field compression facilities (FCFs).	• 2 CGPFs – with co-located water treatment facilities (WTFs); and • 33 FCFs. Note – there is potential for a third WTF to be constructed in the Blackwater region in Phase 2+ of the Project.
4 central depots located at IPFs.	Marshalling Yard located in Mackay supported by two depots co-located with CGPFs.

A Project schedule has been formulated from the SREIS project description which details potential establishment, operational and decommissioning periods for all wells and facilities associated with the updated project description.

The assessed schedule has been prepared to present a worst-case development scenario from a traffic engineering perspective. In particular, the assessed Project schedule assumes rapid establishment of the wells and facilities supporting the Project. The schedule assumes that the majority of facilities are established in the year prior to the individual facilities commencing operations. In addition, the assessed Project schedule assumes that all 4,000 production wells (approximately) are ultimately established, operated and decommissioned. The number of production wells established may ultimately be less than the 4,000 production wells (approximately) assessed as a result of further optimisation of the Project.

The use of the assessed Project schedule therefore provides conservative (i.e. high) estimates of both the Project's peak traffic demands and the Project's total transport task as derived from the current project description developed for the SREIS. The adopted worst-case assessment approach provides road authorities confidence that the Project's road impacts are unlikely to be worse than that reported herein.

12.4 Assessment Overview and Methodology

Since publication of the EIS for public comment in early 2013, the Project's field development plan and conceptual design has advanced due to an improved understanding of the gas resource in addition to refinement of the planned development and operational process.

The changes to Project planning warrant additional assessment to incorporate changes to the project description that validate the impacts previously reported within the EIS RIA.

The SREIS RIA presents a strategic assessment of the intensity and context of the potential road impacts associated with the Project.

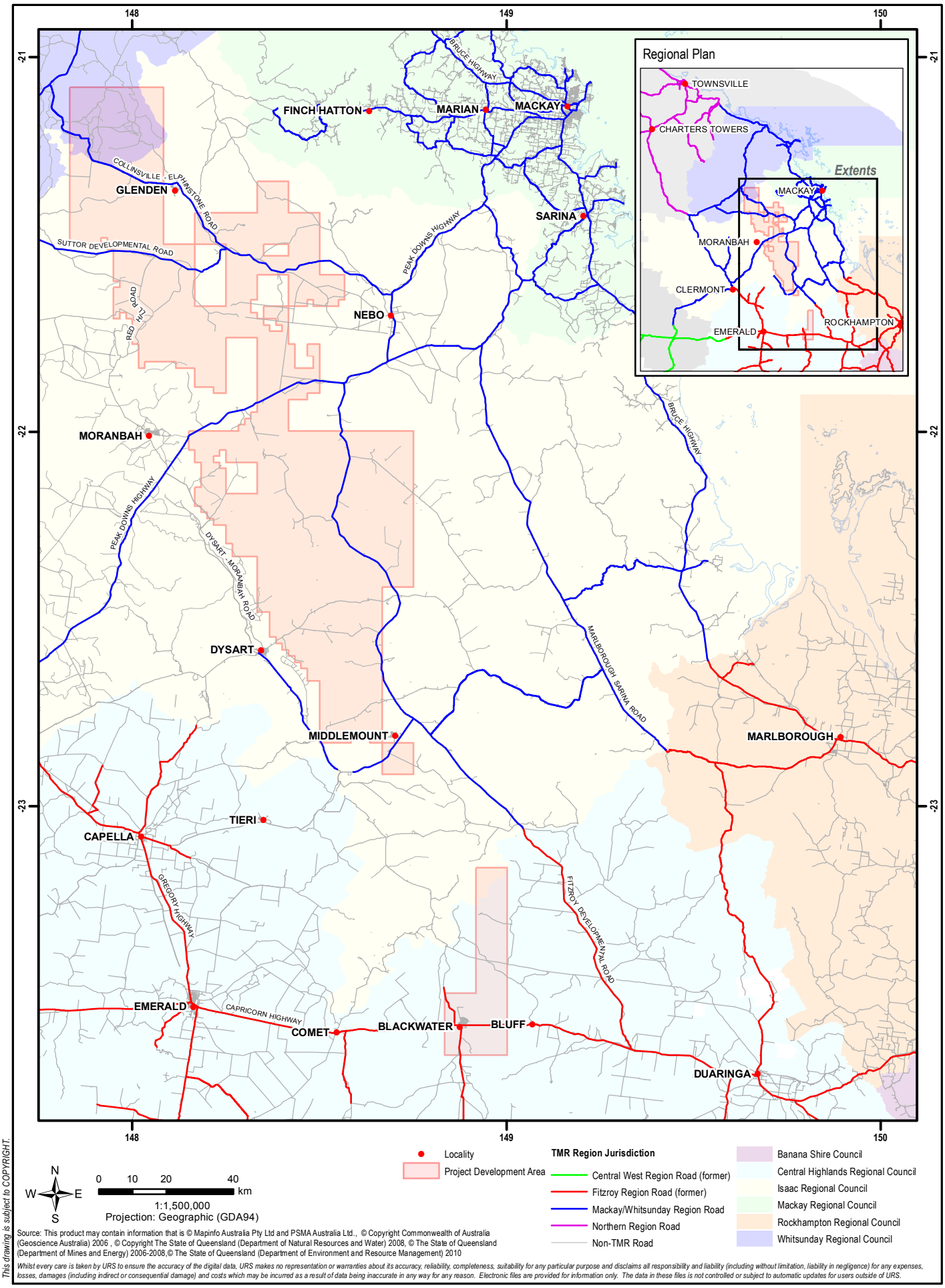
Typical of major projects with dispersed activity, detailed planning including the selection of all Project sites is yet to be finalised. The SREIS RIA therefore seeks to establish if there are likely to be any road impacts that cannot be effectively managed through the application of typical approval

requirements, supported by the implementation of planned management strategies. That is, the SREIS RIA seeks to confirm if there are likely to be any residual road impacts so significant (post-application of typical approval requirements and post-implementation of the planned management strategies) that would necessarily preclude approval of the Project.

Both the intensity and context of the Project's impacts were assessed to establish the significance of the Project's potential impacts. The following key steps were undertaken in preparing the SREIS RIA:

- Collection of updated data from relevant authorities pertaining to existing road conditions including, for example, traffic volumes, traffic growth, vehicle crash history and pavement condition;
- Inspection of the road network potentially servicing case study Project sites to further characterise existing road conditions;
- Review of historical traffic growth and consideration of potential future traffic growth associated with the cumulative impact of other projects;
- Estimation of the number and type of vehicles likely to be generated by the activities associated with establishment, operation and decommissioning of each of the different Project facilities types;
- Estimation of the Project's traffic demands based upon consideration of the activities scheduled to occur in any given year, the traffic generation potential of each of the individual scheduled activities and the location of the activities;
- Formulation of planned management strategies to avoid, minimise and mitigate the Project's potential road impacts; and
- Assessment of the effectiveness of the planned management strategies utilising both a traditional traffic engineering assessment approach and also an environmental values assessment approach.

The SREIS RIA has considered the impact of the Project's traffic on all roads, including both State and council-controlled within the combined spatial extents of TMR Mackay / Whitsunday Region, former Northern Region and former Fitzroy Region. The extents of the SREIS RIA study area are shown on Figure 12-1. The figure presents the TMR regions responsible for the State-controlled road network. In addition, the spatial extents of the council controlled road networks are also shown on Figure 12-1. Former TMR region boundaries have been presented as this aligns with the SREIS RIA study area extents. The updated and expanded dataset identifies that no significant changes to the road authority jurisdictions have occurred since preparation of the EIS RIA apart from the amalgamation of TMR regions.



arrow energy
go further

BOWEN GAS PROJECT SREIS

STUDY AREA AND ROAD AUTHORITY JURISDICTIONS

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ROADS AND TRANSPORT

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12.5 Existing Road Conditions

To inform the SREIS RIA, existing condition data has been sourced for the road network in and within proximity to the Project development area. The data is provided as an update to that previously presented in the EIS RIA for an expanded set of roads. A comparison of the existing road condition data presented within the SREIS RIA as compared to the EIS RIA is provided where relevant to identify any changes that have occurred in the underlying conditions since preparation of the EIS RIA.

12.5.1 Functional Road Hierarchy

Figure 12-2 summarises the functional hierarchy of the road network consistent with the definitions adopted within the EIS RIA being the following:

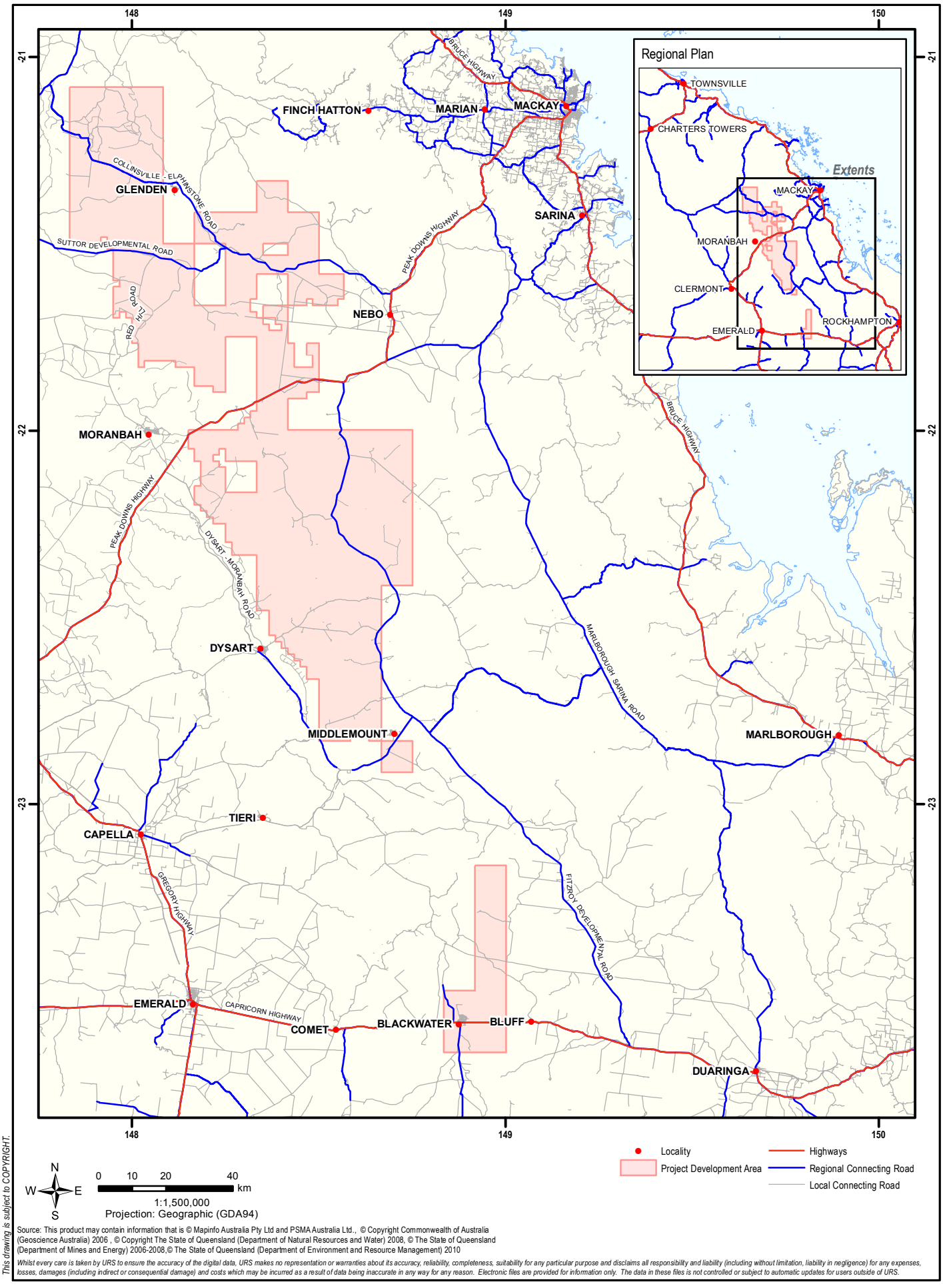
- Highway: a high order road facilitating connectivity between regional centres;
- Regional Connecting Road: a high order road facilitating connectivity between townships; and
- Local Connecting Road: lower order road facilitating connectivity between higher order roads and/or facilitating access.

The definition of two roads has been refined since preparation of the EIS RIA. Firstly, the road previously referenced as Collinsville-Elphinstone Road (north of Glenden) is now referred to as the 'former Collinsville-Elphinstone Road' with the road previously referred to as Newlands Access Road forming what is now known as Collinsville-Elphinstone Road (west of Glenden). Given this, the SREIS RIA considers the former Collinsville-Elphinstone Road to be a Local Connecting Road while Collinsville-Elphinstone Road is considered to remain a Regional Connecting Road. Secondly, Dysart-Moranbah Road has been redefined as a Local Connecting Road due to its lower order nature when compared to alternative north-south routes such as the Gregory Highway and Fitzroy Developmental Road.

12.5.2 Traffic Characteristics

12.5.2.1 Traffic Volumes

Figure 12-3 summarises the 2012 Annual Average Daily Traffic (AADT) volume data supplied by TMR for the State-controlled road network. The data is provided as an update to the 2011 AADT volume data included in the EIS RIA for an expanded set of roads. The updated AADT data is more disaggregated than that presented in the EIS RIA and therefore provides a better representation of the variability of traffic volumes along the various segments of individual roads. In particular, Figure 12-3 more accurately demonstrates the variability of traffic volumes along the Peak Downs Highway between Mackay and Nebo as compared to the EIS RIA. The updated and expanded dataset presented herein identifies that accounting for the increased disaggregation of traffic volume data, no significant changes in recorded AADT have occurred since preparation of the EIS RIA.



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BOWEN GAS PROJECT SREIS

FUNCTIONAL ROAD HEIRACHY

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ROADS AND TRANSPORT

Figure: **12-2**

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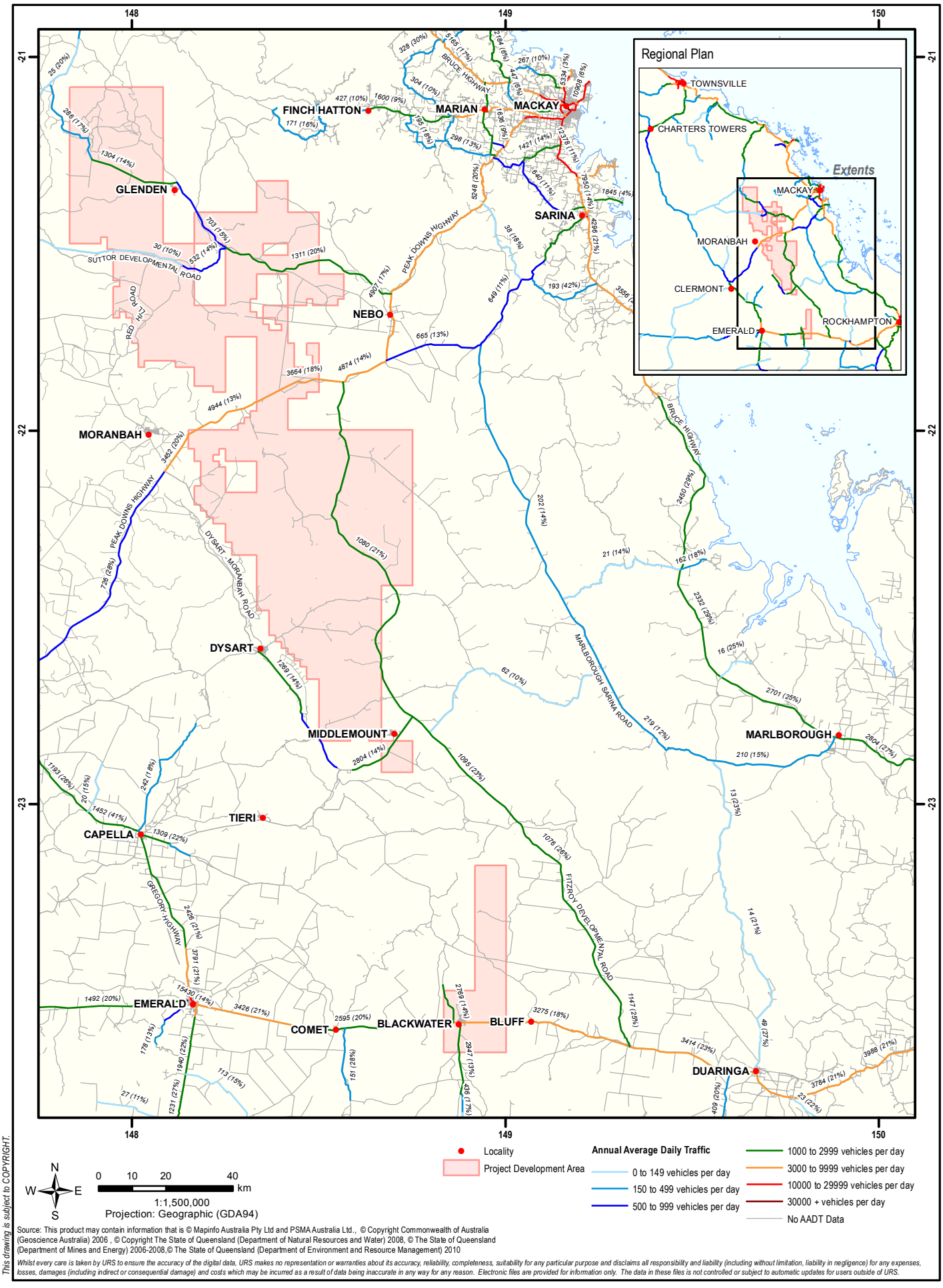

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go further

BOWEN GAS PROJECT SREIS

ANNUAL AVERAGE DAILY TRAFFIC VOLUMES (2012)

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ROADS AND TRANSPORT

Figure: 12-3

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Table 12-2 summarises the vehicle kilometres of travel (VKT) that occurred on the state controlled road network by TMR region during 2012 by vehicle class. These values provide a high level indication of the current (2012) level of transport facilitated by the state controlled road network within the extents of the SREIS RIA Study Area. Similar statistics for the council controlled road networks are not publicly available. VKT data was not previously presented in the EIS RIA and therefore consideration of changes that may have occurred since preparation of the EIS RIA is not warranted.

Table 12-2 SREIS RIA Study Area Transport Demand (2012)

TMR Region	Light Vehicle VKT	Heavy Vehicle VKT	Total VKT
Former Fitzroy Region	1,924 million	451 million	2,375 million
Mackay / Whitsunday Region	1,720, million	284 million	2,004 million
Former Northern Region	1,349 million	174 million	1,522 million
SREIS RIA Study Area	**5,185 million**	**986 million**	**6,171 million**

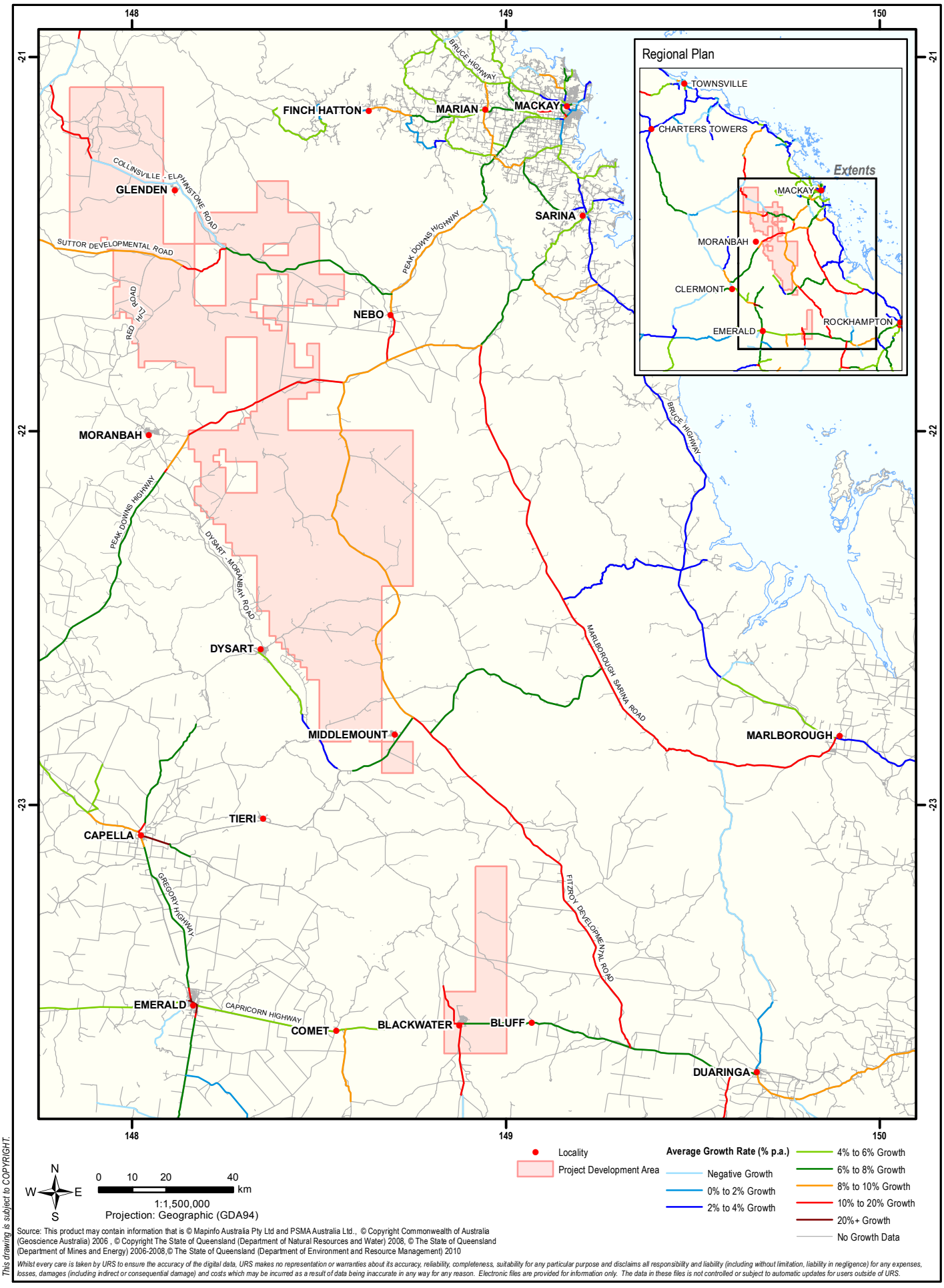
12.5.2.2 Traffic Growth

Figure 12-4 summarises the ten year traffic volume growth data (2002 to 2012) supplied by TMR for the state controlled road network. The recent data is provided as an update to the previously available 2011 ten year growth data presented in the EIS for an expanded set of roads. The newly available updated road condition data provides a better representation of the variability of growth rates experienced across the road network as it is a more disaggregated data set, that is, it is better represented as a breakdown of its component parts. The updated dataset identifies that accounting for the increased disaggregation no significant changes in the level of recorded traffic growth have occurred since preparation of the EIS RIA.

12.5.3 Infrastructure Attributes

A review of various infrastructure attributes that include pavement seal width, road roughness, pavement maintenance, rail infrastructure, and motorist stopping areas was undertaken. Designated road user routes such as multi-combination vehicle routes, school bus routes, stock routes, pedestrian networks, public transport networks undertaken were also reviewed based on TMR data.

Full details of these attributes for all roads considered are contained in the Roads Impact Assessment (Appendix K) of this SREIS.



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BOWEN GAS PROJECT SREIS

10 YEAR ANNUAL TRAFFIC GROWTH (2002 - 2012)

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ROADS AND TRANSPORT

Figure: 12-4

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12.6 Future Baseline Traffic Forecasts

12.6.1 Projects with Potential Cumulative Traffic Impacts

Table 12-3 provides a summary of the projects recently commenced or currently under investigation in and within proximity to the Project development area. The Project data is provided as an update to that presented within the EIS RIA.

Table 12-3 Other Projects Considered within the SREIS RIA

Project	Proponent	Estimated Start Date	Estimated Project Duration
Caval Ridge Mine	BMA	2012	Unknown
Red Hill Mining Lease	BMA	2020	20-25 years
Daunia Mine	BMA	2011	30 years
Byerwen Coal	QCoal and JFE Steel	2012	50 years
Connors River Dam and Pipeline	SunWater	Unknown	Unknown
Ellensfield Coal Mine Project	Vale Australia	2012	20 years
Foxleigh Plains Project	Anglo Coal	2013	15 years
Minyango Project	Blackwater Coal	2014	25 years
Washpool Coal Mine Project	Washpool Coal	2012	16 years
Eagle Downs Coal Project	Bowen Central Coal Joint Venture	2012	47 years
Grosvenor Coal Project	Anglo Coal	2012	50 years
Middlemount Coal Project	Middlemount Coal	2011	Unknown
Eaglefield Expansion Project	Peabody	2012	22 years
Codrilla Coal Mine Project	Macarthur Coal	2012	13-14 years
Saraji East Coal Mine	BMA	2014	25-30 years
Arrow Bowen Pipeline	Arrow	2016	Ongoing
Northern Bowen Basin Transmission Network Reinforcement Project	Powerlink Queensland	2014	Ongoing
Goonyella to Abbot Point Rail Project	BHP Billiton Group	2015	Ongoing
Moranbah South Project	Anglo American Metallurgical Coal	2014	30 years
Central Queensland Integrated Rail Project	Aurizon	Pre 2016	Ongoing

Of the projects listed in Table 12-3, those with a higher traffic generating potential over an extended period of time are generally the larger resource projects predominately associated with gas and coal

production. These projects typically have 20 to 40 year timeframes, extending the likelihood to contribute to traffic growth on the road network over the longer term, and therefore may potentially influence cumulative impacts.

12.6.2 Future Baseline Traffic Demands

For the purposes of the SREIS RIA when forecasting future baseline traffic demands (i.e. in the absence of traffic associated with the Project) it has been assumed that a comparable level of traffic demand increase will continue to occur for the foreseeable future to that which has historically occurred. For example, if traffic demands on a particular road segment have increased by an average of 100 vehicles per year for the past decade, then it has been assumed that the road segment will continue to experience an increase of 100 vehicles per year for the foreseeable future.

The data presented in Table 12-4 identifies that the assumptions adopted for future traffic demands are conservative (i.e. results in high baseline traffic volume forecasts), as the number of projects anticipated to occur over the foreseeable future is substantially less than that which has occurred during the recent mining investment boom. The baseline traffic demand forecasting approach adopted for the SREIS RIA is considered to be more representative than the global growth rate approach adopted for the EIS RIA. The forecasting approach adopted for the SREIS RIA is also expected to provide confidence that a worst-case scenario has been assessed.

12.6.3 Future Baseline Pavement Loadings

For the purposes of the SREIS RIA when forecasting future baseline pavement loadings it has been assumed that existing pavement loadings will increase at 3% per annum (linear). This generic global growth rate assumption is consistent with standard practice in Queensland as documented in TMR's *Assessment of Road Impacts of Development Proposals Notes for Contribution Calculations Version 28*.

The adopted approach to forecasting baseline pavement loadings by utilising a global growth rate is considered to be conservative. The adopted rate of 3% growth per annum is anticipated to result in relatively low estimates of future baseline pavement loadings and therefore result in high estimates of the Project's proportional impact.

The adoption of an alternative forecasting methodology for baseline pavement loadings as compared to baseline traffic demands ensures that worst-case scenarios are assessed for service life and efficiency / safety impacts respectively. The adopted pavement loading forecasting approach is therefore appropriate to inform the SREIS RIA.

12.7 Project Traffic Generation

The traffic generating activities undertaken as part of the Project have been classified by grouping activities into the three phases of the Project's lifecycle. Based upon Arrow's existing operations and strategic planning, the key traffic generating activities likely to be associated with the Project are as follows:

- Construction activities:
  - production well installation;
  - gathering infrastructure installation; and
  - Project facility establishment;
- Operation and maintenance activities:
  - production well operation and maintenance including well workovers;
  - gathering infrastructure operation and maintenance; and
  - Project facility operation and maintenance;
- Decommissioning and rehabilitation activities:
  - production well decommissioning and rehabilitation;
  - gathering infrastructure decommissioning and rehabilitation; and
  - Project facility decommissioning and rehabilitation.

Table 12-4 provides a summary of the traffic generation potential of each of the Project activities. A detailed breakdown of the traffic generating potential of each Project activity is summarised in the Roads Impact Assessment (Appendix C of Appendix K) of the SREIS. These assumptions reflect the refined logistics planning which has occurred since preparation of the EIS RIA.

Table 12-4 conservatively assumes higher levels of heavy vehicle activity associated with most Project activities (i.e. results in higher Project heavy vehicle traffic forecasts) to ensure a worst-case scenario is assessed. The updated estimates also reflect the stated intent to minimise the use of private vehicles by transporting the Project workforce by bus.

For the purposes of the SREIS RIA, activity durations have been identified to ensure that each individual facility is operational for the full life of the serviced drainage area(s). In some instances, the activity duration identified in Table 12-4 is longer than the typical operational life identified in the project description, extending the potential for operational traffic. Therefore, the activity durations adopted are considered to be conservative.

Table 12-4 Traffic Generation Potential of Project Activities

Activity	Quantity	Activity Duration	External Traffic Generation (One-Way Trips per Facility)		
			Heavy Vehicle	Bus	Light Vehicle
Construction Activities (trips are per facility for the duration of construction of each facility)					
Production Wells	4,078 wells	67 days	232	206	28
Gathering Infrastructure	4,078 sections	8 days	95	14	-
CGPFs	2 facilities	52 weeks	2,858	2,730	-
Water Treatment Facility	3 facilities	52 weeks	9,126[1]	764	-
FCFs	33 facilities	26 weeks	1,516	728	-
Village	2 villages	4 weeks	8,390	-[2]	-
Operation and Maintenance Activities (trips are per facility for each year of operation of each facility)					
Production Wells	4,078 wells	23 years	8	4	-
Gathering Infrastructure	4,078 sections	23 years	-[3]	-	-
CGPFs	2 facilities	38 years	104	-	52
Water Treatment Facility	3 facilities	30-39 years	2,200	-	52
FCFs	33 facilities	9-37 years	20	-	52
Village	2 villages	42 years	5,720	260	1,300
Decommissioning and Rehabilitation Activities (tips are per facility for duration of decommissioning of each facility)					
Production Wells	4,078 wells	2 days	42	2	8
Gathering Infrastructure	4,078 sections	2 days	30	-	-
CGPFs	2 facilities	35 weeks	1,190	980	3,268
Water Treatment Facility	3 facilities	32 weeks	680	1,972	6,572
FCFs	33 facilities	17 weeks	424	238	794
Village	2 villages	16 weeks	7,284	-[4]	3,734

[1] This conservatively assumes water for construction of dams is imported rather than using CSG water.
[2] This assumes that temporary camps will support the construction of the first stage of the villages. Following this the temporary infrastructure will be demobilised and the village construction workforce will reside in the initial stage of the villages until the village is fully constructed. This results in a minimum movement of staff.
[3] Traffic associated with Operation activities of gathering infrastructure is included in the production well traffic forecast.
[4] This assumes that staff required for the decommissioning of the accommodation villages will travel by light vehicle and not bus.

12.8 Comparison of EIS RIA and SREIS RIA Project Traffic Demands

The EIS RIA predicted the peak traffic generating year to be 2045. Table 12-5 compares the Project traffic demands previously forecast within the EIS RIA as compared to the Project traffic demands now forecast as part of the SREIS RIA for 2045.

Table 12-5 2045 Project Traffic Demands for the revised SREIS Project Description

Road	Start	End	2045 EIS Project Traffic AADT	2045 SREIS Project Traffic AADT	2045 SREIS as % of 2045 EIS
Peak Downs Highway	Mackay	Nebo	114	22	19%
	Nebo	Fitzroy Developmental Road	72	11	15%
	Fitzroy Developmental Road	Coppabella	72	11-14	15%-19%
	Coppabella	Moranbah	93	14	15%
Capricorn Highway	Rockhampton	Dingo	231	0	-
	Dingo	Blackwater	57	1	2%
Suttor Developmental Road	Nebo	Elphinstone	116	5-25	4%-22%
	Elphinstone	Red Hill Road	265	29	11%
Collinsville - Elphinstone Road	Elphinstone	Glenden	166	13	8%
Collinsville - Elphinstone Road[1]	Glenden	Newlands Mine	166	0	-
Fitzroy Developmental Road	Mount Flora	Middlemount	106	1-5	1%-5%
	Middlemount	Junee Road	214	9	42%
	Junee Road	Dingo	214	1-9	1%-4%
Moranbah - Dysart Road	Moranbah	Dysart	378	18-41	5%-11%
Dysart - Middlemount Road	Dysart	German Creek	357	5-18	1%-5%
	German Creek	Middlemount	320	9	3%

[1]Previously referred to as Newlands Access Road

Table 12-5 identifies that the Project traffic demands forecast as part of the SREIS RIA process are significantly lower at 2045. This difference is largely attributed to the revised project description; including Project schedule, development sequence, change in facility size and layout, and accommodation strategy, assessed as part of the SREIS RIA.

12.9 Impact Assessment

The SREIS RIA expands upon the work previously undertaken as part of the EIS RIA by combining a traditional traffic engineering assessment with an updated environmental values assessment. Both assessments undertaken to support the SREIS RIA seek to determine the significance of the residual road impacts post-application of typical approval conditions and post-implementation of the planned management strategies.

12.9.1 Traditional Traffic Engineering Assessment

12.9.1.1 Overview

The traffic engineering requirements applied in this assessment are consistent with the principles established within TMR's *Guidelines for Assessment of Road Impacts of Development* (GARID). The GARID assessment approach is utilised in Queensland to identify the specific management strategies such as intersection upgrades and proponent contributions towards pavement maintenance that can reasonably be conditioned.

12.9.1.2 Scoping Assessment

A scoping assessment has been undertaken to identify the extent of the road network over which Project traffic demands may potentially significantly increase surveyed traffic demands in accordance with GARID requirements. The GARID states that road impacts should be considered at all direct accesses to the road network. In addition, the GARID stipulates that all intersections and links where Project traffic demands exceed 5% of surveyed traffic demands should also be assessed.

Figure 12-7 identifies the locations at which Project traffic demands are anticipated to increase existing AADT traffic demands (2012) by 5% or more. The SREIS RIA scoping assessment is based upon consideration of the Project's maximum traffic impact on each individual road link for all years of the Project, not for a single Project year as assessed in the EIS RIA. In addition, the SREIS RIA scoping assessment is based upon unadjusted 2012 surveyed traffic demands. That is, the reported proportional impact of Project traffic demands is relative to 2012 surveyed traffic demands not 2045 forecast baseline traffic demands as previously reported in the EIS RIA.

The SREIS RIA scoping assessment identifies that the Project has the potential to increase existing AADT demands on three State-controlled roads being Fitzroy Developmental Road, Collinsville-Elphinstone Road and Suttor Developmental Road if impacts are not mitigated. This finding is generally consistent with the outcome previously documented within the EIS RIA which identified that the Project has the potential to increase baseline AADT demands on a limited number of roads.

It should be noted that the RIA (Appendix K) of the SREIS undertakes an environmental values assessment for a worst-case scenario to confirm the effectiveness of the planned management strategies for potential Project impacts such as those identified above.

The environmental values assessment considers the level of significance of the Project's potential road impacts both pre and post-implementation of the planned management strategies. The assessment has identified that there are unlikely to be residual impacts of higher order significance

post-implementation of the planned management strategies. Furthermore the SREIS RIA has confirmed that application of the planned management strategies will result in intervention works which exceed or at least meet standard traffic engineering practice requirements. A summary of this assessment is further outlined below in Section 12.9.2.1.

12.9.1.1 Level of Service Assessment

Link level of service relates to the operating conditions encountered by traffic. It is a qualitative measure of factors such as speed, trip time, interruptions, interference, freedom to overtake, ability to manoeuvre, safety, comfort, convenience and vehicle operating costs.

The performance of the scoped links were analysed including and excluding project traffic using the link level of service methodology detailed in Austroad's *Guide to Traffic Engineering Practice Part 2 Roadway Capacity*. Table 12-6 identifies the level of service for each scoped link during the future year in which Project traffic demands are forecast to be greatest for each individual link. The level of service assessment accounts for the traffic growth associated with the cumulative impact of other projects.

Level of service is an index of the operational performance of traffic on a given traffic lane, carriageway, road or intersection, based on service measures such as speed, travel time, delay and degree of saturation during a given flow period. It is a qualitative measure describing operational conditions within a traffic stream and the perception of these by motorists.

Table 12-6 Level of Service Assessment for Significantly Impacted Road Sections

Road	Chainage	Baseline Level of Service	With Project Level of Service
Collinsville-Elphinstone Road (5307)	23.124 km to 29.710 km	A	A
	55.116 km to 79.739 km	A	A
Suttor Developmental Road (82A)	0 km to 88.65 km	A	A
Fitzroy Developmental Road (85C)	133.155 km to 147.285 km	A	A
	182.775 km to 192.120 km	A	A

Table 12-6 identifies that all scoped road sections will continue to operate at a level of service "A" irrespective of the presence of Project traffic demands. Level of service "A" is the highest level out of six categories of levels of service (levels A to F), which reflects a condition of free flow where individual drivers are unaffected by the presence of others in the traffic stream. The level of service assessment has therefore identified that while Project traffic demands are likely to increase baseline traffic demands on sections of the road network; this increase is unlikely to affect the level of service afforded by the assessed road network. This finding is generally consistent with the outcome previously documented within the EIS RIA which also identified that the Project would not significantly affect the level of service afforded by the road network.

It is therefore concluded that the scale of traffic demand increases associated with the Project can be effectively managed through the application of typical EIS approval requirements including the obligation to reassess potential impacts during detailed design within post-EIS RIAs.

12.9.2 Significance Assessment

12.9.2.1 Overview

The environmental values assessment approach establishes the significance of the Project's potential impacts through consideration of:

- The sensitivity of each environmental value (namely efficiency, safety and amenity associated with each of the identified road types): determined based on consideration of its susceptibility or vulnerability to threatening processes or as a consequence of its intrinsic value; and
- The magnitude of the Project's potential impact upon the value: determined based on consideration of the impact's severity.

Management strategies have been formulated to manage the Project's potential impacts on the safety, efficiency and service life of the road network. These are detailed in the RIA (Appendix K, Section 10) of the SREIS. The planned management strategies establish responses to common engineering situations which are likely to occur over the life of the Project. To enable the effectiveness of the planned management strategies to be assessed, the level of significance of the potential impacts has been considered both pre and post-implementation of the planned management strategies. The significance of impacts is a function of the sensitivity of the values themselves to change and the magnitude of the change experienced. Table 12-7 summarises the significance of impact given the sensitivity of an environmental value and the magnitude of impact.

Table 12-7 Significance of Impact Matrix

Magnitude of Impact	Sensitivity of Environmental Value			
		High	**Moderate**	**Low**
	High	Major	High	Moderate
	Moderate	High	Moderate	Low
	Low	Moderate	Low	Negligible

The SREIS RIA adopts updated significance of impact definitions from that previously considered in the EIS RIA. The updated significance definitions provide greater definition in relation to the level of Project impact. The impact definitions adopted for the SREIS RIA are as follows:

- Major Impact: Occurs when impacts will potentially cause irreversible or widespread harm to an environmental value;
- High Impact: Occurs when the proposed activities are likely to exacerbate threatening processes affecting the intrinsic characteristics and structural elements of the environmental value;

- Moderate Impact: Occurs where, although reasonably resilient to change, the environmental value would be further degraded due to the scale of the impacts or its susceptibility to further change;
- Low Impact: Occurs where an environmental value is of local importance and temporary and transient changes will not adversely affect its viability provided standard environmental controls are implemented; and
- Negligible Impact: A degraded (low sensitivity) environmental value exposed to minor changes (low magnitude impact) will not result in any noticeable change in its intrinsic value and hence the proposed activities will have negligible impact.

12.9.2.2 Adopted Magnitude Thresholds

The magnitude thresholds adopted for the SREIS RIA have been updated from those previously considered as part of the EIS RIA to reflect input provided through road authority submissions. The updated thresholds also enable assessment of roads for which traffic count data is not publicly available thus enabling a more comprehensive assessment than presented within the EIS RIA. For the SREIS RIA the following magnitude of impact definitions have been adopted:

- High Magnitude: greater than 1,000 AADT increase;
- Moderate Magnitude: 251 to 1,000 AADT increase; and
- Low Magnitude: 1 to 250 AADT increase.

12.9.2.3 Adopted Sensitivity Thresholds

Table 12-8 and Table 12-9 summarise the adopted environmental values and their sensitivities both pre and post-implementation of the planned management strategies respectively. While the sensitivities adopted for the SREIS RIA for each road type remain the same as those adopted for the EIS RIA, some typical observation values have been refined based upon an enhanced understanding of the existing road conditions gained since preparation of the EIS RIA.

In summary, the roads designed for higher traffic volumes are less sensitive to changing traffic conditions than roads designed primarily to facilitate local traffic. Pre-implementation on management strategies, the environmental values of Highways have a low sensitivity to changing traffic conditions; the environmental values of Regional Connecting Roads are moderately sensitive to changing traffic conditions; while the environmental values of Local Connecting Roads have a high sensitivity to changing traffic conditions. Post-implementation of management strategies, the environmental values of Highways and Regional Connecting Roads have a low sensitivity to changing traffic conditions; while the environmental values of Local Connecting Roads would be moderately sensitive to changing traffic conditions.

Table 12-8 Summary of Sensitivity Values Pre-Implementation of Management Strategies

	Characteristic	Value		
		Highway	Regional Connecting Road	Local Connecting Road
Description	Function	A high order road facilitating connectivity between regional centres	A high order road facilitating connectivity between townships	Lower order road facilitating connectivity between higher order roads or facilitating access
Typical Observations				
Efficiency	Volumes	1,000+ vehicles	300+ vehicles	300 or less vehicles
	Pavement	Sealed	Sealed	Sealed/unsealed
	Standard of intersection control	High order	Varies	Low order
Sensitivity of Efficiency		**Low**	**Moderate**	**High**
Safety	Bridges	Common	Common	Uncommon
	Cattle grids	Uncommon	Uncommon	Common
	Standard of rail crossing control	Active	Passive	Passive
	School bus route presence	Present	Present	Present
	Composition of traffic	High proportion heavy vehicles	Moderate proportion of heavy vehicles	Low number of heavy vehicles
	Driver fatigue controls	Present	Uncommon	Uncommon
Sensitivity of Safety		**Low**	**Moderate**	**High**
Amenity	Stock route co-location	Present	Present	Present
	Sensitivity of adjacent land uses	Low	Moderate	Moderate
	Potential for dust nuisance issues	Low	Low	Potential
	Potential for light glare issues	Low	Low	Potential
Sensitivity of Amenity		**Low**	**Moderate**	**High**

Table 12-9 Summary of Sensitivity Values Post-Implementation of Management Strategies

Characteristic		Value		
		Highway	Regional Connecting Road	Local Connecting Road
Description	Function	A high order road of a high standard facilitating linkage between regional centres	A high order road of a high standard facilitating linkage between townships	Lower order road providing links between higher order roads
Typical Observations				
Efficiency	Volumes	1,000+ vehicles	300+ vehicles	300 or less vehicles
	Pavement	Sealed with improvements	Sealed with improvements	Sealed with improvements
	Standard of intersection control	High order	High order	Low order with improvements
Sensitivity of Efficiency		**Low**	**Low**	**Moderate**
Safety	Bridges	Frequent and high standard	Frequent and high standard	Infrequent and high standard
	Cattle grids	Uncommon	Uncommon	Frequent and higher standard
	Standard of rail crossing control	Active	Investigate exposure threshold	Investigate exposure threshold
	School bus route presence	Present with improved awareness	Present with improved awareness	Present with improved awareness
	Composition of traffic	High proportion of heavy vehicles	Moderate proportion of heavy vehicles	Higher number of heavy vehicles
	Driver fatigue controls	Present plus driver fatigue management plan	Uncommon plus driver fatigue management plan	Uncommon plus driver fatigue management plan
Sensitivity of Safety		**Low**	**Low**	**Moderate**
Amenity	Stock route co-location	Present but disturbances managed	Present but disturbances managed	Present but disturbances managed
	Sensitivity of adjacent land uses	Low	Low	Moderate
	Potential for dust nuisance issues	Low but managed	Low but managed	Potential but managed
	Potential for light glare issues	Low but managed	Low but managed	Potential but managed
Sensitivity of Amenity		**Low**	**Low**	**Moderate**

12.9.2.4 Adopted Significance Thresholds

Table 12-10 and Table 12-11 summarise the adopted significance of impact thresholds utilised for the environmental values assessment both pre- and post-implementation of the planned management strategies respectively.

Table 12-10 Significance of Impacts: Pre-Implementation of Management Strategies Matrix

Magnitude of Impact	Sensitivity of Environmental Value			
		High (Local Connecting Roads)	**Moderate** (Regional Connecting Roads)	**Low** (Highways)
	High (1,000+ AADT)	Major	High	Moderate
	Moderate (251-1,000 AADT)	High	Moderate	Low
	Low (1-250 AADT)	Moderate	Low	Negligible

Table 12-11 Significance of Impacts: Post-Implementation of Management Strategies Matrix

Magnitude of Impact	Sensitivity of Environmental Value			
		High	**Moderate** (Local Connecting Roads)	**Low** (Regional Connecting Roads and Highways)
	High (1,000+ AADT)	Major	High	Moderate
	Moderate (251-1,000 AADT)	High	Moderate	Low
	Low (1-250 AADT)	Moderate	Low	Negligible

12.9.2.5 Significance of Impacts Pre-Implementation of Management Strategies

Figure 12-5 spatially summarises the level of significance of the Project's potential road impacts based upon the environmental values assessment approach pre-implementation of the planned management strategies. The figure identifies that in the absence of the planned management strategies being implemented, the traffic demands associated with the Project could result in negligible to moderate impacts on the road environmental values. The highest levels of impacts are typically forecast to occur on the lower order roads providing access to major facilities such as CGPFs.

The EIS RIA previously identified that pre-implementation of the planned management strategies the impact of Project traffic demands on all assessed roads would be negligible with the exception of Suttor Developmental Road which would experience low level impacts between Elphinstone and Red Hill Road. The SREIS RIA has identified higher levels of potential impact pre-implementation of the

planned management strategies as a result of the refined Project traffic demand forecasts and as a result of the updated impact magnitude thresholds adopted for the SREIS RIA.

12.9.2.1 Significance of Impacts Post-Implementation of Management Strategies

It is expected that the magnitude of the Project's impacts will not change as a result of implementation of the planned management strategies as the magnitude is intrinsically linked to the extent of Project activities which the strategies do not influence. Instead it is expected that through the implementation of the planned management strategies, the sensitivity of the road environmental values will typically reduce, thereby resulting in a reduced significance of impacts.

Figure 12-6 spatially summarises the level of significance of the Project's potential road impacts based upon the environmental values assessment approach post-implementation of the planned management strategies. The figure identifies that the Project's potential significance of impact is anticipated to range from negligible to low.

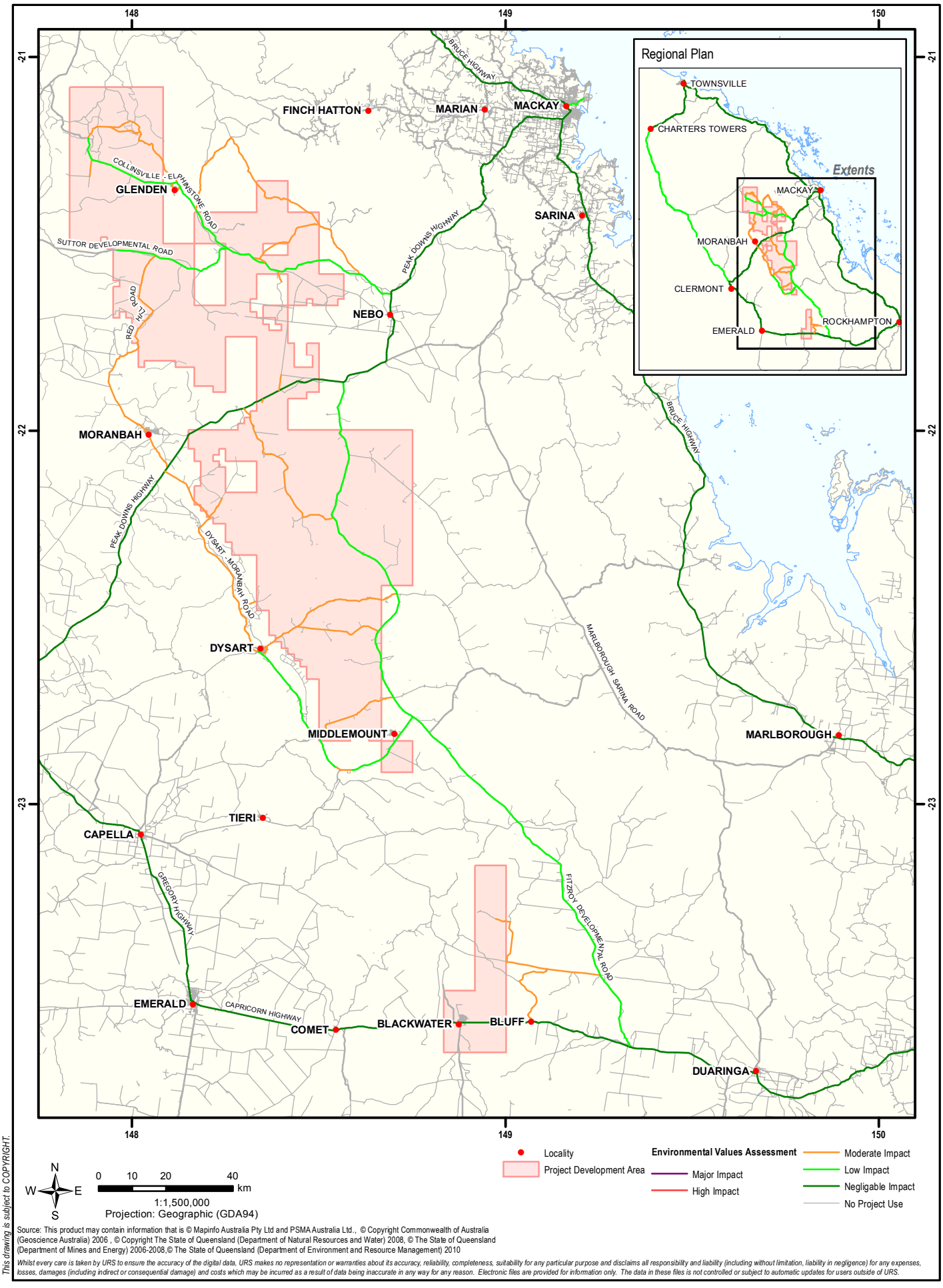
The EIS RIA previously identified that post-implementation of the planned management strategies the impact of Project traffic demands on all assessed roads would be negligible. The SREIS RIA has identified higher levels of impact post-implementation of the planned management strategies as a result of the refined Project traffic demand forecasts and as a result of the updated impact magnitude thresholds adopted for the SREIS RIA. The higher levels of potential impact identified by the SREIS RIA are however still within acceptable limits.

12.9.2.2 Environmental Values Assessment Summary

The environmental values assessment identifies that there are unlikely to be residual impacts of higher order significance (high or major) post-implementation of the planned management strategies. The environmental values assessment therefore confirms that there are unlikely to be residual impacts post-implementation of typical approval requirements and implementation of the planned management strategies that should preclude approval of the Project.

Consistent with the intent of the SREIS assessment phase, the SREIS RIA does not seek to identify a comprehensive list of the proponent funded road works or contributions ultimately required to support the Project. Instead the SREIS RIA seeks to confirm if the planned management strategies are likely to be effective at avoiding, minimising or mitigating all high or major road impacts associated with the Project.

The SREIS RIA environmental values assessment identifies that the planned management strategies will be successful at avoiding major and high road impacts, and minimising or mitigating moderate and low road impacts associated with the Project (see Figure 12-7).



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BOWEN GAS PROJECT SREIS

SIGNIFICANCE OF IMPACTS PRE-MANAGEMENT STRATEGIES

URS

ROADS AND TRANSPORT

Figure: **12-5**

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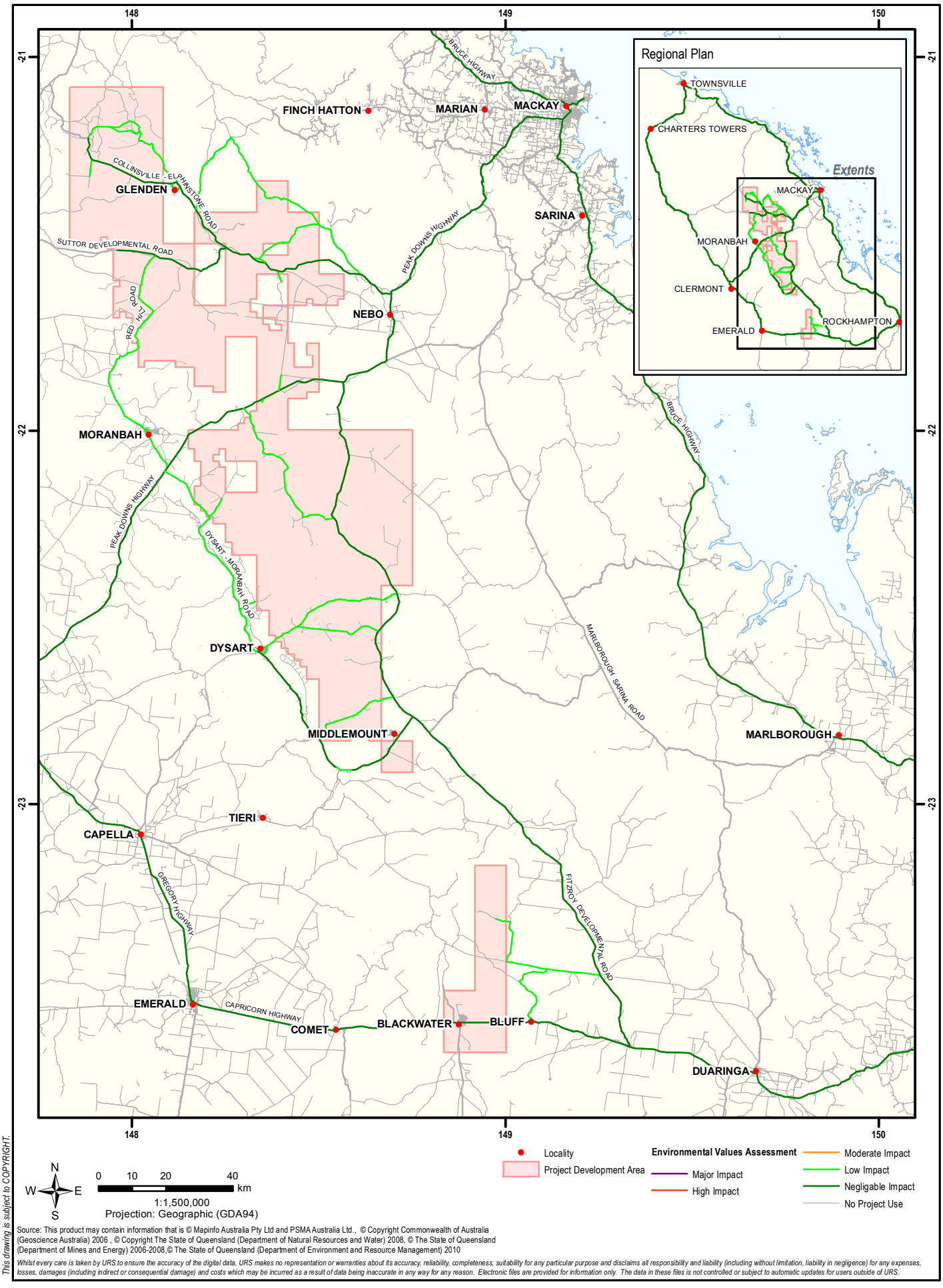

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BOWEN GAS PROJECT SREIS

SIGNIFICANCE OF IMPACTS POST-MANAGEMENT STRATEGIES

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ROADS AND TRANSPORT

Figure: **12-6**

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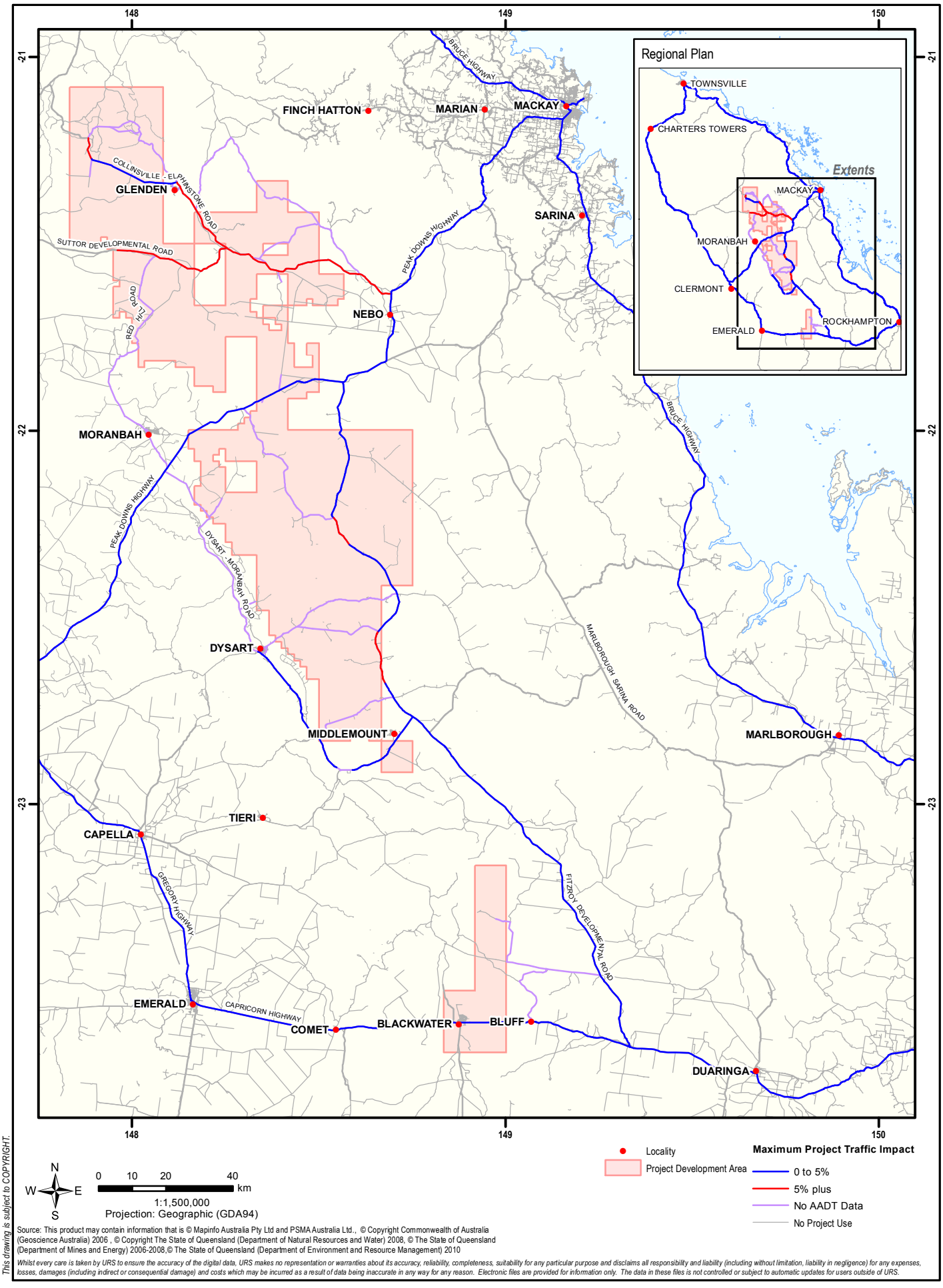

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BOWEN GAS PROJECT SREIS

SCOPING ASSESSMENT

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ROADS AND TRANSPORT

Figure: **12-7**

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12.10 Pavement Impact Assessment

The SREIS RIA pavement analysis indicates that the traffic demands associated with the Project may potentially have an impact on TMR's pavement maintenance and rehabilitation activities over the life of the Project. The RIA (Appendix F of Appendix K) of the SREIS presents further details of the pavement impact analysis.

Post-EIS RIAs and revised traffic modelling will be undertaken as the Project matures in order to identify impacts and what, if any, compensation arrangements are required. An indicative proponent contribution towards pavement activities is not determined as part of the SREIS RIA assessment due to pavement maintenance data not being available for the majority of the assessed state controlled road network.

12.11 Conclusions

The SREIS RIA has sought to establish if there are likely to be any road impacts that cannot be effectively managed through the application of typical EIS approval requirements and the implementation of the planned management strategies. The assessment has identified the following:

- Existing traffic conditions including traffic volumes, levels of traffic growth, the presence of school bus and stock routes remain broadly consistent with that previously considered in the EIS RIA;
- The traffic generation estimates of the various activities associated with the Project have been refined from that presented within the EIS RIA based upon the findings of the updated Project description and recent logistics planning, and to ensure that a worst-case scenario is considered within the SREIS RIA;
- Traffic modelling identifies that as a result of the revised traffic generation assumptions and the updated Project planning, the Project's peak transport task is anticipated to occur earlier than forecast within the EIS RIA;
- An environmental values significance assessment has also confirmed the effectiveness of the planned management strategies to avoid, minimise and mitigate all significant road impacts;
- The traditional traffic engineering assessment has identified that Project traffic demands have the potential to increase baseline traffic demands however this increase is unlikely to significantly affect the level of service afforded by the road network; and
- The pavement assessment has established that Project traffic demands have the potential to increase the required maintenance works and potentially reduce the pavement service life of various road sections. Post-EIS RIAs and revised traffic modelling will be undertaken as the project matures in order to identify impacts and what, if any, compensation arrangements are required.

The SREIS RIA has established that there is unlikely to be any residual road impacts that cannot be managed via infrastructure agreements with road authorities, post-implementation of the planned management strategies, and that residual impacts should not be significant enough to preclude approval of the Project.

Arrow committed to implement a number of avoidance, mitigation and management measures to reduce impacts on values in the Project development areas. The commitments pertaining to roads and transport presented in the EIS are listed in Table 12-12.

These commitments are still valid with respect to the conceptual Project design as presented in the SREIS.

A full list of Project commitments, including those that remain unchanged from the EIS, and details of those that have changed, are included in the Commitments Update (Appendix O) of this SREIS.

Future post-EIS RIAs may identify the need for specific works to provide safe and efficient access to all Project facilities in addition to the contributions required to preserve the service life of the road network. If required, post-EIS infrastructure agreements established with relevant road authorities will capture the value and timing of the identified works and contributions.

Table 12-12 EIS Commitments to Reduce the Significance of Impacts to Roads and Transport Values in the Project Development Area

Commitment Number	Commitment
B570	A RUMP will be prepared to manage and mitigate the risks and impacts of any transport related issues. The RUMP will evolve as detailed design and operation details are finalised, however an outline of the components that the RUMP should include are as follows: • A strategy to safely manage road usage by construction vehicles • Interaction of Project vehicles with school bus routes • Interaction between stock and freight routes • Detail safe driver behaviour and fatigue management protocols • Consideration of specific requirements for over dimensional vehicles • Interaction between Project traffic and at grade road / rail crossings • Dust mitigation strategy • Detail road maintenance and/or road upgrade requirements • Liaise with relevant stakeholders • Define community engagement strategies • Suitability of existing road infrastructure.
B571	Assess and identify works required to manage the increased traffic volumes and road safety issues associated with the Project in road use management plans prepared and regularly reviewed in consultation with the relevant council TMR.
B572	Assess and identify the need to upgrade unsealed roads or widen sealed roads where Project activities and traffic will create road safety issues. Such works will be done in consultation with the relevant council (if a local government road) or TMR (if a state road).
B573	Undertake threshold assessments to determine whether upgrading of rail crossings is warranted.
B574	Implement driver training and fatigue awareness for employees and contractors.
B575	Schedule roster changes to avoid peak traffic times.
B576	Develop Project logistics plans to provide safe movement of people and materials, as well as to minimise traffic volumes.
B577	Develop journey management plans in consideration of high-risk roads.

Commitment Number	Commitment
B578	Use heavy-vehicle routes that avoid unsuitable bridges.
B579	Where assessed necessary, provide protected turning lanes for entry to permanent facilities to address road safety issues.
B580	Ensure access driveways to Project facilities and infrastructure have appropriate sight distances.
B581	Maintain the integrity of private roads and tracks and minimise dust generation, where appropriate, in consultation with relevant landowners and council.
B582	Confine Project traffic to designated roads and access tracks, where practicable.
B583	Limit Project traffic on school bus routes during pick-up and drop-off times on school days or install appropriate school bus infrastructure, e.g., signage or pullover areas where necessary.
B584	Make workers aware of school bus routes, as well as typical pick-up and drop-off times in the vicinity of the work sites.
B585	Coordinate with local law enforcement for movement of heavy or oversized loads.
B586	Implement journey management plans.
B587	Manage Project-related activities in the vicinity of existing stock routes in accordance with the *Land Protection (Pest and Stock Route Management) Act 2002.*
B588	Routinely monitor integrity and amenity on Project-related roads.
B589	Monitor compliance with the Project's road safety requirements through regular review of reports generated by the in-vehicle monitoring system.
B590	Conduct regular safety inspections of Project vehicles.