CONTENTS

TABLES

FIGURES

21. TRANSPORT

This transport chapter addresses Section 3.9 of the ToR.

This chapter provides a description of the existing transport infrastructure at the Nathan Dam and Pipeline Project (the Project) site. It details the existing transport infrastructure and facilities, existing traffic and transport operation, transport methods and routes associated with the Project, and the potential construction and operational impacts of project related traffic. It also addresses the required mitigation measures proposed to avoid or minimise adverse impacts on the environment and existing infrastructure.

The Project does not anticipate significant use of air, sea or rail modes of transport; consequently this transport chapter concentrates on the road network only. Project impacts are also considered where there is potential interaction with other projects in the vicinity of the Project area.

21.1. Regulatory framework

21.1.1. Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* (TI Act) is the relevant state legislation concerning the management of transport infrastructure including roads and railways. Where construction and/or maintenance access to government supported transport infrastructure are required, approvals are to be obtained under section 62 of the TI Act and construction approval under section 33 of the TI Act.

Of most relevance to this project is how the TI Act provides for state controlled roads (SCRs). Chapter 6, Part 2 of the TI Act deals with SCRs and management of this comes under the Queensland Department of Transport and Main Roads (TMR).

The Project will affect SCRs and so approval or permits under the TI Act will be required to work in, or interfere with, a state controlled road. In assessing the significance of the Project's effects on state controlled roads, the TMR Guidelines for Assessment of Road Impacts of Development (TMR, 2006) (the guidelines) were used. Impacts on roads managed by the local authorities, Banana Shire Council (BSC) and Western Downs Regional Council (WDRC), have also been assessed in a manner generally consistent with the guidelines. An overview of the guidelines and how they will apply to the Project is presented in Section 21.1.2.

21.1.2. Guidelines for Assessment of Road Impacts of Development

The TMR guidelines provide information about the steps involved in assessing the road impacts of a proposed development project and identify measures to mitigate any road impacts the Project may have. These guidelines have therefore been used as a reference in the assessment of transport impacts presented in this chapter. This approach has been undertaken as a means of providing the relevant authorities with sufficient information to assess the transport impacts of the Project.

For the purposes of the guidelines, the process of compiling and analysing information on the road impacts of development proposals is termed a road impact assessment (RIA). When a project is referred to the TMR as part of the development approval processes, an RIA is considered necessary when the road impacts are likely to be significant.

Principle 3 of the guidelines states that in general, TMR considers a development's road impacts to be insignificant if the development generates an increase in traffic on SCRs of no more than five percent of existing levels. This can be measured either in terms of annual average daily traffic (AADT) or equivalent standard axles (ESAs). These two measures are generally used as a basis for assessing the different types of impacts on roads.

The guidelines separate the RIA process into four stages:

- Stage 1: Development profile and future traffic volumes;
- Stage 2: Scope of assessment and criteria to be adopted;
- Stage 3: Impact assessment and determination of impact mitigation measures; and
- Stage 4: Determination of development conditions or developer contribution required.

The EIS is deemed to address stages 1 – 3. Discussion of how the EIS addresses Stage 1 and 3 is detailed in the following sections. Methodology of the assessment in this chapter is discussed in Section 21.2. The scope of assessment and criteria to be adopted described by Stage 2 of the RIA process is considered to be addressed by the Terms of Reference for the EIS. Stage 4 of the RIA process will be finalised upon the TMR's assessment of the Project as a referral agency through the EIS process. This will likely require the development of detailed traffic management plans.

The TMR guidelines apply in particular to development approvals processes, and do not specifically discuss the use of the EIS process. This chapter, as part of the EIS, is considered to encompass the development proposal and RIA that will be submitted to the Queensland Government and subsequently referred to the TMR. The EIS also contains recommendations for mitigation measures that are considered adequate to address transport impacts associated with the Project.

21.1.2.1. Land Act 1994

The *Land Act 1994* (Land Act), for the purposes of transport, regulates the opening and closing of state and local roads. In general, the relevant local government authority (LGA) manages roads on a day-to-day basis, whereas the TMR manages SCRs. The Department of Environment and Resource Management (DERM), through provisions of the Land Act, is responsible for the land in roads and road reserves. Any infrastructure associated with the Project that is to be developed in state roads or reserves will require tenure permits under the Land Act, including:

- temporary road closure applications (section 99); and
- permits to occupy in unallocated state land, reserves or roads (section 177).

Temporary road closures of SCRs by the Project are unlikely to be required, other than in conjunction with the TMR for any road works needed to address road safety impacts caused by the Project.

Permits to occupy in state road reserves will be required for the construction of the pipeline. The nature of these permits will require negotiation with the relevant state authority to allow for the progressive movement of the occupied site as the pipeline is constructed. Permits to occupy in state road reserves will be used in conjunction with approval under the TI Act to conduct ancillary works.

21.1.2.2. Local Laws

Construction of the dam falls within the Local Government area of BSC, as does a portion of the Leichhardt Highway entering Taroom from the south and the remaining length of the Highway to the north of Taroom. The majority of pipeline construction falls within the area of WDRC.

The following local laws from pre-amalgamation areas are potentially of relevance to the Project:

- Dalby Town Council Local Law 21 (Roads) Part 4 Division 1;
- Chinchilla Shire Council Local Law 11 (Roads) Part 4 Division 1;
- Murilla Shire Council Local Law 21 (Roads) Part 4 Division 1;
- Wambo Shire Council Local Law 21 (Roads) Part 4 Division 1; and
- Taroom Shire Council Local Law No. 21 (Roads) Part 3 Division 1.

These laws relate to the 'alteration or improvement' of local government roads, and generally provide that 'a person (other than the local government) must not make an alteration or improvement to a Local Government road unless authorised by a permit under this Division.'

The Project includes proposals to make alterations or improve local government controlled roads, as set out in Section 21.3.8.1. Permits under the relevant local law will therefore be required to undertake such works.

21.2. Methodology

Traffic and transport impacts have been assessed by:

- describing the existing transport infrastructure relevant to the Project;
- identifying the transport methods and routes associated with the Project, including proposed new or alterations to transport-related infrastructure, and the construction of any project-related plant or utilities;
- identifying the demand, composition, timing and routes, of inputs and outputs of traffic generation for the Project; and
- assessing the potential impacts of project related to traffic on the state and council controlled road network and the required mitigation measures.

The impact on the road network for the duration of the construction of the dam and pipeline was assessed in accordance with the TMR guidelines.

21.2.1. Assumptions and limitations

The following assumptions and limitations apply to this assessment:

- traffic information has been obtained from TMR census data, which include data that has been collected over 12 or 24 hour periods on specific days, and may therefore be affected by weekly or seasonal variations;
- a detailed construction and operation plan for the Project has not been fully developed therefore assumptions on traffic generation and distribution have been made in consultation with the Project designers. The basis of such

assumptions are discussed in detail in this report and where a range of values has been determined, the worst case scenario has been adopted in the assessment; and

- this impact assessment provides an overview of the potential traffic and transport related impacts associated with the Project. Detailed traffic management plans will be developed and submitted for approval as required for each element of the Project during the detailed design phase.

21.2.2. Potential impacts

The potential traffic impacts of the Project include:

- increased vehicle movements on the existing road network associated with the construction workforce and material supply during the construction phase;
- altered traffic patterns and/or travel delays due to partial or full road closures/diversions during the construction phase; and
- altered traffic patterns and journey times resulting from permanent road closures required due to the inundation of some existing roads and the construction of new roads or sections of road.

21.3. Transport methods and routes

21.3.1. Description of existing infrastructure

Both road and rail infrastructure is prominent in the Project area. Figure 21-1 depicts the road and rail network, in particular the SCRs of Leichardt Highway and the Warrego Highway, and the Western Rail Line, which is controlled by Queensland Rail Limited (QRL). Construction and ultimate operational activities for the Project will be mainly dependent on road transport.

There some potential for use of the existing western railway system during the Project construction phase, and will be subject to negotiation with Queensland Rail. It is, however likely that the majority of material will be delivered by road. Use of sea infrastructure is not planned for the Project.

21.3.2. Road network

21.3.2.1. Road hierarchy and function

The Project area is situated within the TMR Darling Downs Region of Queensland. The principal state controlled roads within the Project area are presented in Table 21-1.

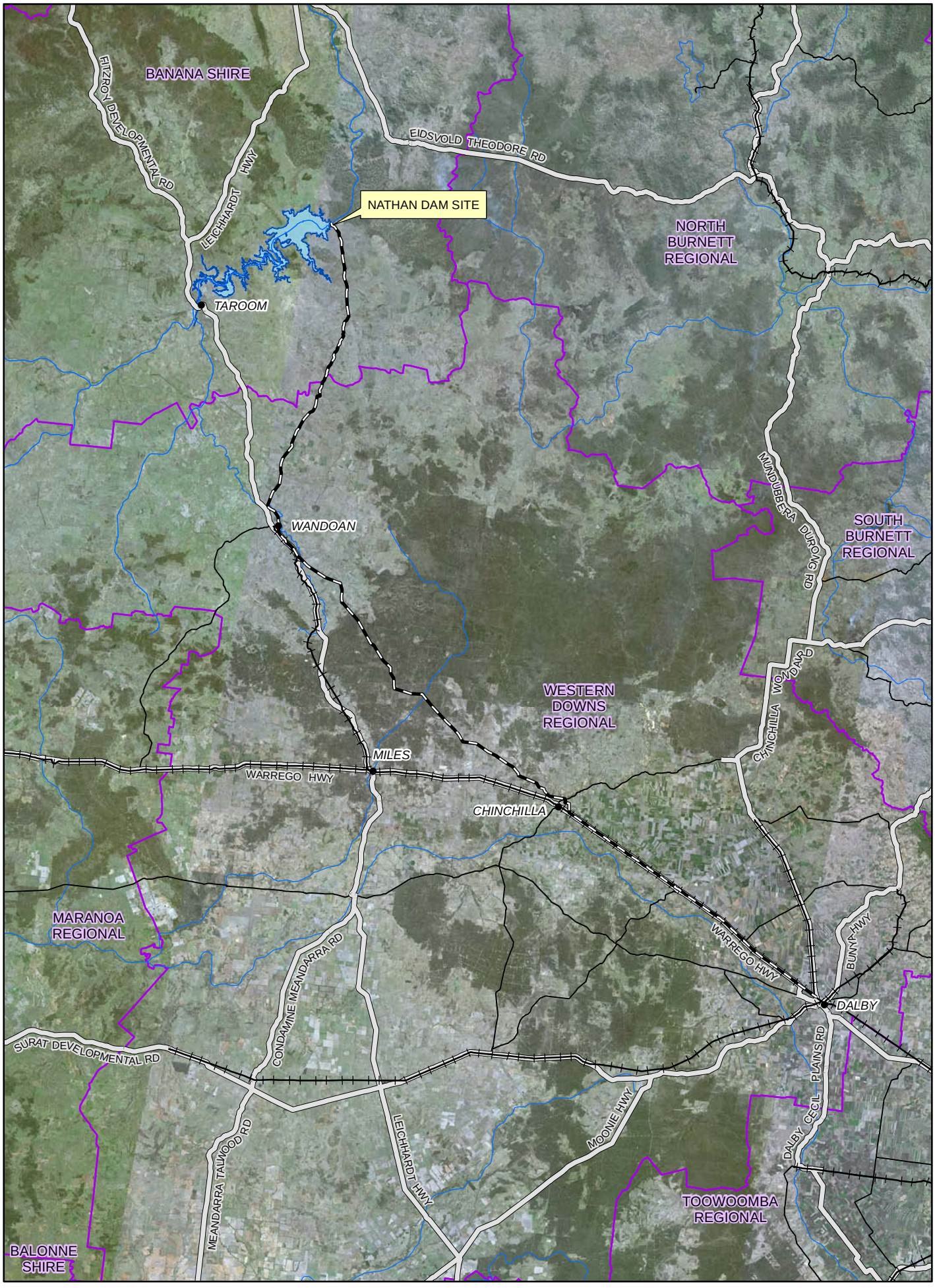
The *Road Planning and Design Manual* (Department of Main Roads, 2004) adopts a four-tier road hierarchy for the state-controlled road network as follows:

- National Highways – major corridors linking Queensland's provincial cities and interstate capitals to Brisbane. They have national as well as state significance;
- State Strategic Roads – complement the National Highway in the primary movement of people and goods throughout the state. They comprise state declared highways and developmental roads linking major regions within the state, interstate regions with regions within the state, and interstate regions with regions in Queensland;

- Regional Roads – cater for movements linking areas of economic importance within the region to one another and to economic areas in adjacent regions; and
- District Roads - serve a localised function. They provide links within a local government area and connect the national, state and regional system to the local road network.

The road network in the Project area is comprised of two types of roads:

- state-controlled roads controlled by TMR; and
- local roads controlled by the local authorities (BSC and WDRC).



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Major Roads
- Railway
- Major Watercourses
- Full Supply Level (183.5 m AHD)
- Local Government Boundaries

Projection: GDA94 Zone 56

Figure 21-1

0 10 20 40
Kilometres

N

Scale 1:1,200,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Location of Nathan Dam and pipeline and surrounding transport infrastructure

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-1_StateControlledRoads.mxd Produced: 29/06/2011

Table 21-1 State controlled roads and multi-combination vehicle permits affected by the Project

Road Name	Existing Road Descriptions /Category	Traffic Composition	Multi-Combination Vehicle Access
Ipswich Mwy and Warrego Hwy to Toowoomba (**18 A**)	▪ Divided carriageway, two lanes each way, bitumen sealed and paved ▪ Road category: AusLink national road network	Light Vehicles: ▪ Local ▪ Travellers and tourist to and from west and north-west Queensland and northern territory Commercial vehicles: ▪ Local ▪ Long distance to and from west and north-west Queensland and Northern Territory	Type 1 road trains, 23 metre B - Doubles only
Warrego Hwy west from Toowoomba (**18 B**)	▪ Two lane bitumen sealed and paved ▪ Road category: AusLink national road network	Light Vehicles: ▪ Local ▪ Travellers and tourist to and from west and north-west Queensland and Northern Territory Commercial vehicles: ▪ Local ▪ Long distance to and from west and north-west Queensland and Northern Territory	Type 1 road trains, 23 metre B - Doubles only
Leichardt Hwy north of Miles (**26 B**)	▪ Two lane bitumen sealed and paved ▪ Road category: State strategic road network	Light Vehicles: ▪ Local ▪ Travellers and tourist to and from west, north-west Queensland and Northern Territory Commercial vehicles: ▪ Local ▪ Long distance to and from west , north-west Queensland and Northern Territory ▪ Oversize vehicles transporting goods and equipment to central Queensland	Type 1 road trains, 23 metre B - Doubles only
Dawson Hwy Gladstone to Biloela (**46 A**)	▪ Two lane bitumen sealed and paved ▪ Road category: State regional and other district road	Light Vehicles: ▪ Local ▪ Travellers and tourist to and from Dawson-Callide, central, north-west Queensland, and Northern Territory Commercial vehicles: ▪ Local Long distance to and from Dawson-Callide, central, north-west Queensland	Type 1 road trains, 23 metre & 25 metre B - Doubles only

Road Name	Existing Road Descriptions /Category	Traffic Composition	Multi-Combination Vehicle Access
		and Northern Territory	
Dawson Hwy Biloela to Leichhardt Hwy(**46 C**)	▪ Two lane bitumen sealed and paved ▪ Road category: State regional and other district road	Light Vehicles: ▪ Local ▪ Travellers and tourist to and from Dawson-Callide, central, north-west Queensland, and Northern Territory Commercial vehicles: ▪ Local ▪ Long distance to and from Dawson Valley, central, north-west Queensland and Northern Territory	Type 1 road trains, 23 metre B - Doubles only
Taroom –Roma Rd (**4397**)	▪ Two lane bitumen sealed and paved ▪ Road category: State regional and other district road	Light Vehicles: ▪ Local ▪ Travellers and tourist to western Queensland Commercial vehicles: ▪ Local ▪ Long distance to and from western Queensland	Type 1 road trains, 23 metre B - Doubles only
Fitzroy development Rd (**85 B**)	▪ Formed earth with gravel in some places and short bitumen sealed and paved sections ▪ Road category: State regional and other district road	Light Vehicles: ▪ Local ▪ Travellers and tourist to and from west ,north-west Queensland and Northern Territory(few) Commercial vehicles: ▪ Local ▪ Long distance to and from central, north, north-west Queensland and Northern Territory (few)	Type 1 road trains, 23 metre B - Doubles only

[1]Source: TMR Queensland's B-Triple Network, May 2009. Accessed 1 October 2010. Available at http://www.tmr.qld.gov.au/Business-and-industry/Heavy-vehicles/Multi-combination-vehicles/B-triple-road-network-access.aspx

[2]Source: TMR Guidelines for Multi-Combination Vehicles in Queensland. Accessed 1 October 2010. Available at http://www.tmr.qld.gov.au/Business-and-industry/Heavy-vehicles/Multi-combination-vehicles/Maps.aspx

All the state controlled roads listed above are permitted to accommodate the 23 metre B-Double and Type 1 road trains with the exception of Dawson Hwy Gladstone to Biloela, which can accommodate the 23 metre and 25 metre B-Doubles.

A number of road/bridge construction and maintenance projects for the state controlled corridors have been completed or are planned in the vicinity of the Project as part of the TMR *Roads Implementation Program (RIP) 2009-2010 to 2013-2014*. The key objectives of these projects include the upgrade of key freight and passenger routes, the reduction of accident-prone areas; the continual upgrade of heavy vehicle stopping areas to combat driver fatigue and the delivery of these projects through engagement with the community and local governments.

These projects are primarily on the Strategic and Regional Road segments, with financial year funding allocation as summarised in Table 21-2.

While no end construction date is specified, the RIP indicates that a number of projects will be commenced in the short term, such as pavement widening along Leichhardt Highway and the Roma to Taroom Road.

Table 21-2 Roads implementation program for local and state controlled roads in the vicinity of the Project

Road Segment	Description	Total Indicative Cost ($'000)	Status and project commencement (financial year)
Nathan Road	Construct to new sealed two lane standard from 37 to 47 km	1,150	Approved 2009-2010 between 42 and 47 km, indicative funding for balance ($234K) from 37 km to 42 km.
Leichhardt Highway (Westwood – Taroom)	Replace bridge at Don River	65,000	Approved 2009-2011, indicative funding of balance ($19M) beyond 2012
	Widen and seal section 156 to 165 km	750	Approved 2009-2010
Leichhardt Highway (Taroom – Miles)	Widen pavement section from 11 to 15 km and 23 to 25 km	3,020	Indicative beyond 2012
Roma – Taroom Road	Pave and seal section 65 to 150 km	15,700	Approved 2009-2011

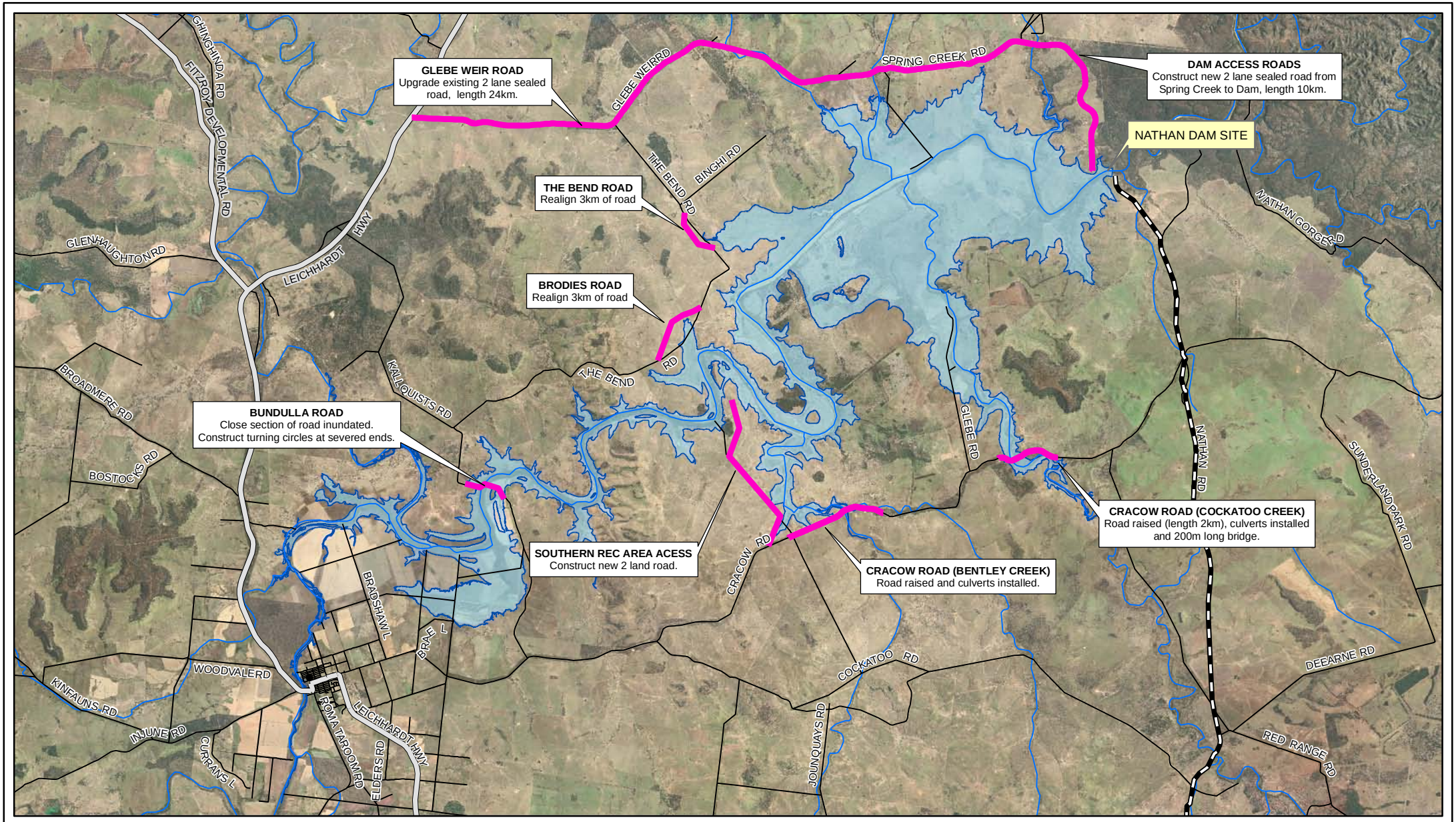
[1]Source: TMR Queensland's Roads Implementation Program 2009-10 to 2013-14. Accessed 1 October 2010. Available at http://www.tmr.qld.gov.au/~/media/1753c157-7884-4aec-9256-0be3675895f2/11fitzroyregion.pdf

21.3.2.2. Local roads

A description and imagery of principal local access roads within the dam and surrounding area are provided in Figure 21-2 and Table 21-3. All local roads including Nathan Road from approximately 36 km north of Leichhardt Highway are within BSC while the southern section of Nathan Road is within WDRC.

Usage of these roads is highly seasonal depending on the rural activities in the areas (e.g. cattle and grain movement) and tourism with increased usage during the winter months by caravans.

Access along Nathan Road and the Taroom-Cracow Road is also severely restricted in wet weather. Heavy vehicle movement is not possible for varying periods following heavy rain.



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- Road Upgrade/Construction
- Watercourses
- Full Supply Level (183.5 m AHD)

Projection: GDA94 Zone 56

Figure 21-2

0 1.5 3 6
Kilometres

N

Scale 1:200,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Location of Nathan Dam and surrounding local access road network

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-2_LocalRoads.mxd Produced: 29/06/2011

Table 21-3 Local access roads in the Project area

Road Segment	Description	Traffic Composition	Figure
Glebe Weir Road	Single lane bitumen sealed and paved with width varying from 3-6 m.	Light vehicles: ■ Local ■ Travellers and tourist to and from Glebe Weir Commercial vehicles: ■ Local	 Glebe Weir Rd looking west
Taroom-Cracow Road	Single lane bitumen sealed and paved for 27 km north-east of Taroom then formed earth with gravel in some places	Light vehicles: ■ Local ■ Travellers and tourist to and from Cracow Commercial vehicles: ■ Local	 Cracow Rd at Bentley Creek
Spring Creek Road	Formed earth with gravel	Light vehicles: ■ Local Commercial vehicles: ■ Local	 Spring Creek Rd looking west
Bundulla road	5 m wide formed earth with gravel path	Light vehicles: ■ Local Commercial vehicles: ■ Local	 Bundulla Rd looking north

Road Segment	Description	Traffic Composition	Figure
The Bend Road	5 m wide formed earth with gravel path	Light vehicles: ■ Local Commercial vehicles: ■ Local	N/A
Kallquists Road	4 m wide formed earth with gravel path	Light vehicles: ■ Local Commercial vehicles: ■ Local	N/A
Red Range Road	Mostly formed earth with certain sections sealed for property access	Light vehicles: ■ Local ■ Occasional travellers to and from Auburn River area Commercial vehicles: ■ Local	 Red Range Rd looking north
Nathan Road	Single lane bitumen sealed pavement north of Leichhardt Hwy and formed earth gravel along other locations	Light vehicles: ■ Local ■ Travellers and tourist to and from Cracow Commercial vehicles: ■ Local	 Nathan Rd looking north

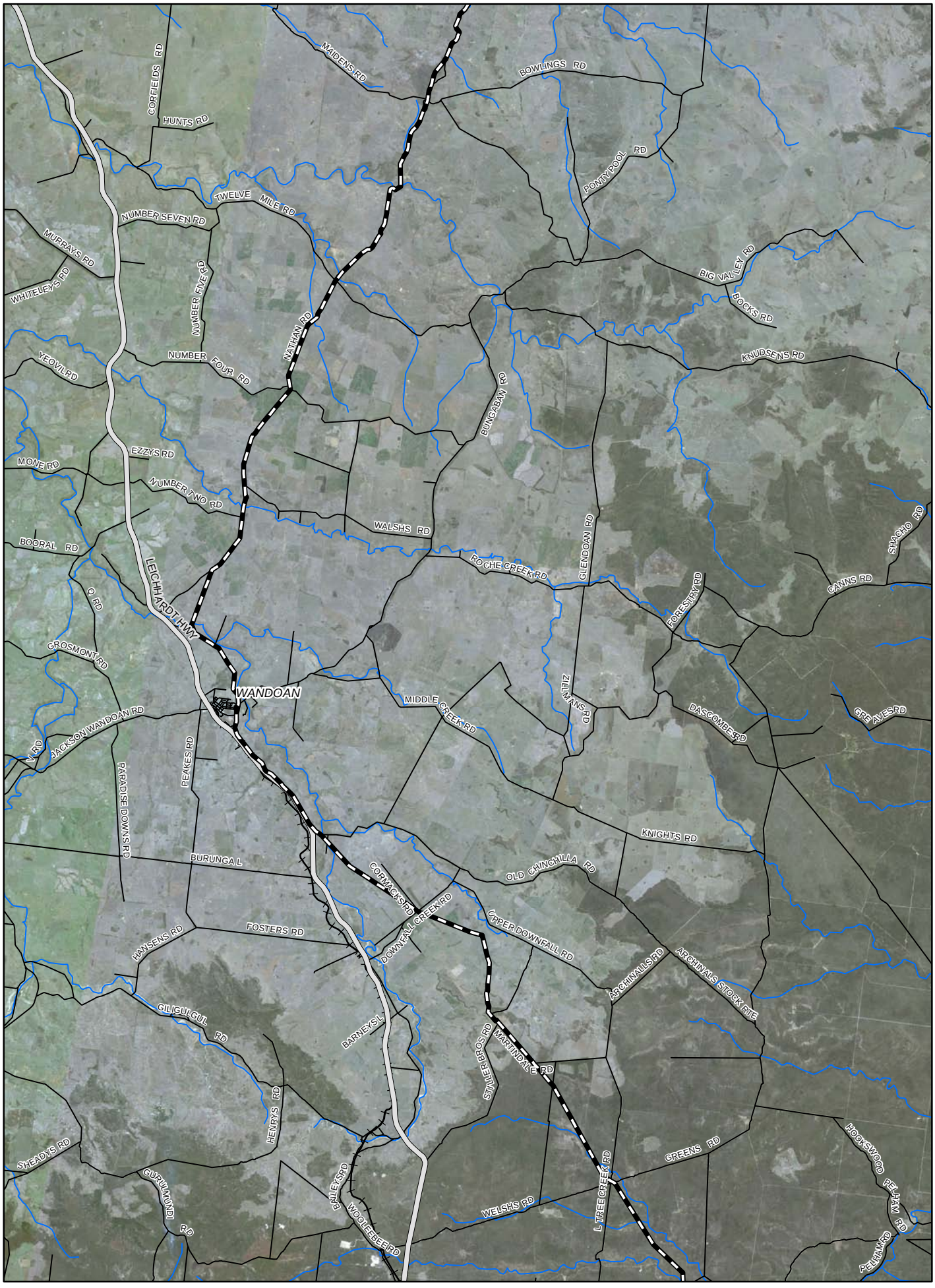
The pipeline will be buried for approximately 80 percent of the 260 km route from Nathan Dam to Dalby. The nominated project areas for the pipeline are as follows:

- Area 1, dam site to Wandoan, approximately 80 km long (Figure 21-3A). The route generally follows Nathan Road in private property and departs Nathan to the north of Wandoan where it diverts to the east around Wandoan. The pipeline will cross both the local roads of Golden Street and Windeyer Road to the east of Wandoan;
- Area 2, Wandoan to Chinchilla, approximately 100 km long (Figure 21-3B). From Wandoan, the pipeline will run parallel to Windeyer Road, then the Leichardt Highway for 20 km before diverting east for 6 km then southeast to Chinchilla. After departing the highway, the alignment traverses private property for some 80 km, again running parallel to existing roads and property boundaries where practical and finishing to the north of Chinchilla township. In the vicinity of Chinchilla, the pipeline will cross the local roads of Auburn Road, Colamba Street, Chinchilla-Wondai Road and Dawson-Gates Road; and

- Area 3, Chinchilla to Dalby, approximately 80 km long (Figure 21-3c). From Dawson Road, just south of Chinchilla, the pipeline will run parallel to the Warrego Highway, predominantly within a former highway reserve on the northern side of QRL's Western railway line. The pipeline crosses a number of local roads in the vicinity of the townships of Brigalow, Warra and Macalister. In the vicinity of Dalby, the pipeline will cross Dalby-Jandowae Road just prior to its terminating location north of Knight Street.

The pipeline will generally require a construction easement 30 m in width (through a 15 m construction width in addition to the permanent pipeline easement). This will be reduced in part at locations where an existing easement can be used for construction purposes.

As shown in Figure 21-2, local roads in the vicinity of the pipeline are controlled by BSC and WDRC. Use of these roads is associated with rural activities and tourism. The creeks traversed by the pipeline near the dam site are tributaries of the Dawson River, and further south form part of the Condamine - Balonne river system. These creeks are subject to irregular large-scale flooding of the surrounding area.



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- Railway
- Watercourse

Projection: GDA94 Zone 56

Figure 21-3A

0 1 2 4 6
Kilometres

N

Scale 1:300,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Location of pipeline and surorunding local access road network

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-3A_LocalRoads_Pipeline.mxd Produced: 29/06/2011

LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- Railway
- Watercourse

Projection: GDA94 Zone 56

Figure 21-3B

0 1 2 4 6
Kilometres

N

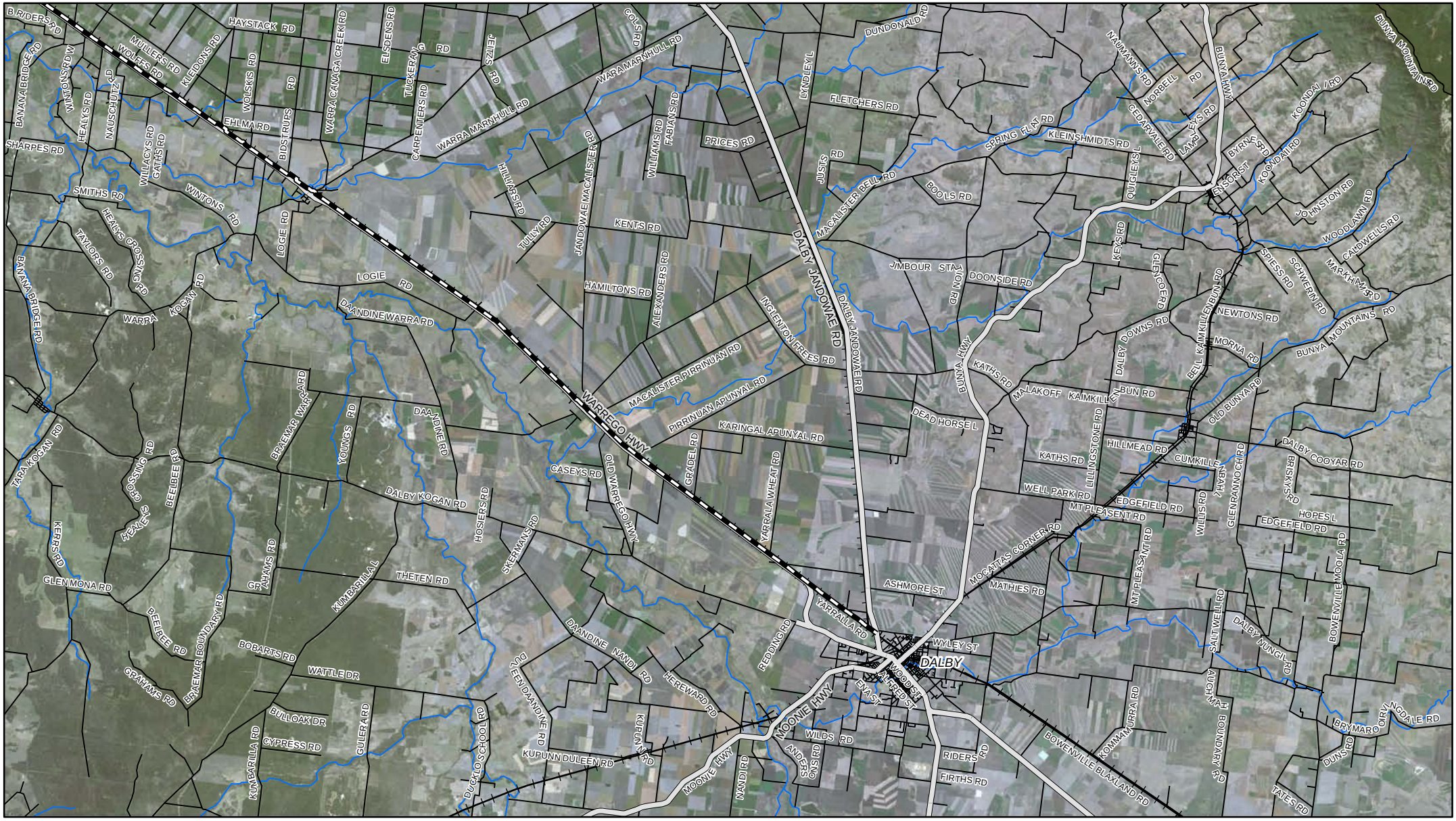
Scale 1:300,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Location of pipeline and surorunding local access road network

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-3B_LocalRoads_Pipeline.mxd Produced: 29/06/2011



I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-3C_LocalRoads_Pipeline.mxd Produced: 29/06/2011

21.3.2.3. Road intersections

To accommodate dam and northern pipeline construction traffic, the intersection between the Leichhardt Highway and Glebe Weir Road will be upgraded to physically accommodate construction traffic in accordance with TMR (Austroads) and Council requirements. Provisions include intersection splays to facilitate swept paths of articulated trucks, realignment of Glebe Weir Road approach to the north to improve intersection geometry and sight lines, and signs and linemarkings for the revised horizontal geometry for the Glebe Weir Road approach.

Other local roads intersect with the Leichhardt and Warrego Highways, including roads listed in Table 21-3, will have intersections that may require upgrades such as turning lanes to enable safe access. Locations of other access roads (for the construction and maintenance of all sections of the pipeline that cannot be accessed from existing roads) will be confirmed in conjunction with the Project Contractor and will be discussed with TMR and / or council during detailed design.

Intersection upgrade requirements of local roads will be determined at detailed Project design through a Road Use Management Plan (RUMP) and associated Traffic Management Plans (TMPs). These are to be developed in consultation with TMR and the local councils once extraction areas, stockpile sites and haulage routes are established.

21.3.2.4. Traffic volumes

Year 2009 traffic volumes on roads in the region were obtained from the TMR Emerald and Roma districts. The Average Annual Daily Traffic volumes (AADT) as vehicle trips per day (vpd) and the percentage of commercial (heavy) vehicles on the key state controlled roads are provided in Table 21-4. Similar data is not available from BSC and WDRC for local roads in the vicinity of the dam and pipeline area.

Table 21-4 Traffic volumes for state controlled roads affected by the Project

Road Segment	AADT	Average daily commercial vehicles (CVs)
Leichhardt Highway (26A)		
1.76 km south of Fitzroy Developmental Road	500	200
Leichhardt Highway (26B)		
North of Jackson-Wandoan Road intersection	700	200
South of Jackson-Wandoan Road intersection	600	200
7.5 km south of Downfall Creek Rd	700	200
Warrego Highway (18C)		
3.46 km east of Leichhardt Hwy Intersection	2,200	400
Warrego Highway (18B)		
Dalby–Road 325 intersection	6,500	1,200
Road 325 intersection–chainage 27.0 km	5000	1,200
Chainage 27.0 km–chainage 10.5 km	12,000	1,700
Chainage 10.5 km–intersection McDougall Street, Toowoomba	10,700	800

Road Segment	AADT	Average daily commercial vehicles (CVs)
Leichhardt Highway (26A)		
400 m south of The Boulevard	800	200
Bowen Street west of Banana	2,100	400
300 m south of Fairview Rd	600	200
100 m north of Woolein Creek	600	200
11 km south of Wowan	700	200
Dawson Highway (46B)		
1 km east of Banana	1,100	200
900 m west of Burnett Highway (41E)	1,500	200
700 m west of Burnett Highway (41D)	5,100	500
Roma-Taroom Road (4397)		
0.14 km north of Wybara Road	100	22
Jackson-Wandoan Road (4302)		0
9.18 km South of Wandoan	100	20
Warra-Kogan Road (3403)		
Estimated, south of Warrego Highway	100	20
Warrego Highway (18D)	0	
Miles side of Leichhardt Hwy intersection	2900	700
4.07 km west of Leichhardt Hwy	1500	400
1.26 km west of Dulacca Nth Rd	1200	400
13.01 km East of Yuleba-Surat Rd	1300	400
1.72 km West of Wallumbilla South Rd	1600	400
0.23 km East of Roma Downs Rd	3900	700
Moonie Highway (35A)		
West of Dalby	6400	300

(*Source: TMR Emerald & Roma district officers*)

Public transport

The TransLink Transit Authority has advised that they do not operate any local public transport scheduled services in the vicinity of the Project area. However, bus and train services operated by Greyhound Australia, Coach Queensland and QRL pass through the Project area and link regional and coastal centres. Greyhound Australia runs services to Mount Isa and Charleville from Brisbane and Coach Queensland runs services from Brisbane to Rockhampton via Miles. There are also a few local transport operators who operate routes on an ad hoc basis for cash fares.

QRL runs a Traveltrain service twice weekly between Brisbane and Charleville via Roma, via the Western Rail Line paralleling the Warrego Highway.

21.3.3. School bus services

The schools in the vicinity of the Project are located within Theodore, Taroom, Wandoan, Gulugaba, Miles and Chinchilla. Near the dam site, the Taroom State School is located along Wolsey Street within Taroom town centre precinct and Theodore State School is located along The Boulevard at the Theodore town centre. The Wandoan, Guluguba, and Miles State Schools are located in close proximity to the Leichardt Highway, and the Chinchilla Primary and High schools are located just to the south of the Warrego Highway. School bus services are currently operational for all schools, with bus routes using local roads and the highways as depicted in Figure 21-4 and Figure 21-5.

21.3.4. Rail and port facilities

The Western Rail Line connects Brisbane to Miles and is a standard Queensland 1,067 mm gauge track with a mix of timber, steel and concrete sleepers. The nearest railhead to the Project is located at Theodore, 60 km north of an existing railway line that extends from Miles to Wandoan, but this line has not been used for nearly four years.

The nearest commercial airports are located at Thangool to the north and Roma and Chinchilla to the south of the Project area. The nearest sea port is at the Port of Gladstone, approximately 200 km to the north-west.

21.3.5. Police and emergency services

The nearest Queensland Police Service (QPS) stations, hospital and Queensland Fire and Rescue Service (QFRS) station to the Project area are located in Taroom, Wandoan, Miles and Chinchilla.

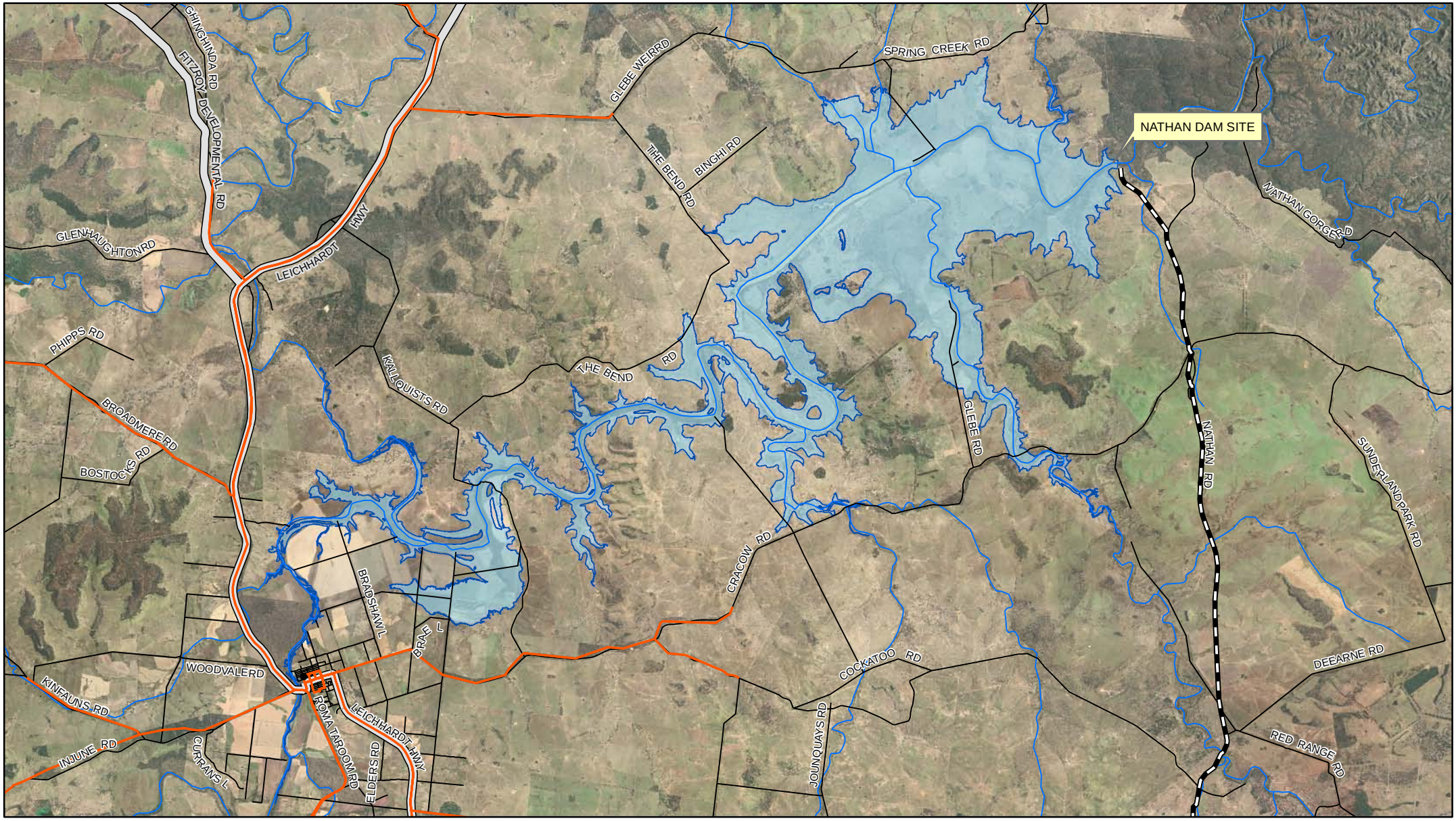
21.3.6. Infrastructure and transport requirements

Details of the Project construction and operation requirements and timing are provided in Chapter 2. The Project requires a combination of new roads and road upgrades to connect to the regional systems and meet transport requirements on-site. The road infrastructure requirements for the Project will be located within the Project site and are expected to be designed and constructed between 2013 and 2014. The Project road infrastructure is detailed in Section 21.3.2 for the dam and pipeline sites.

21.3.7. Timing

The dam and pipeline are likely to be constructed over the same time period, with early works (such as road upgrades) performed in late 2013 with construction on both the pipeline and the dam sites commencing in 2014 with an anticipated commissioning in early 2016.

The total pipeline construction period is programmed for 21 months assuming mobilisation in mid 2013. Both dam and pipeline construction will be programmed around seasonal rainfall. Potential high risk areas such as the river pump station and major watercourse crossings will be targeted during dry months.



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- School Bus Routes
- Watercourses
- Full Supply Level (183.5 m AHD)

Projection: GDA94 Zone 56

Figure 21-4

0 1.5 3 6
Kilometres

N

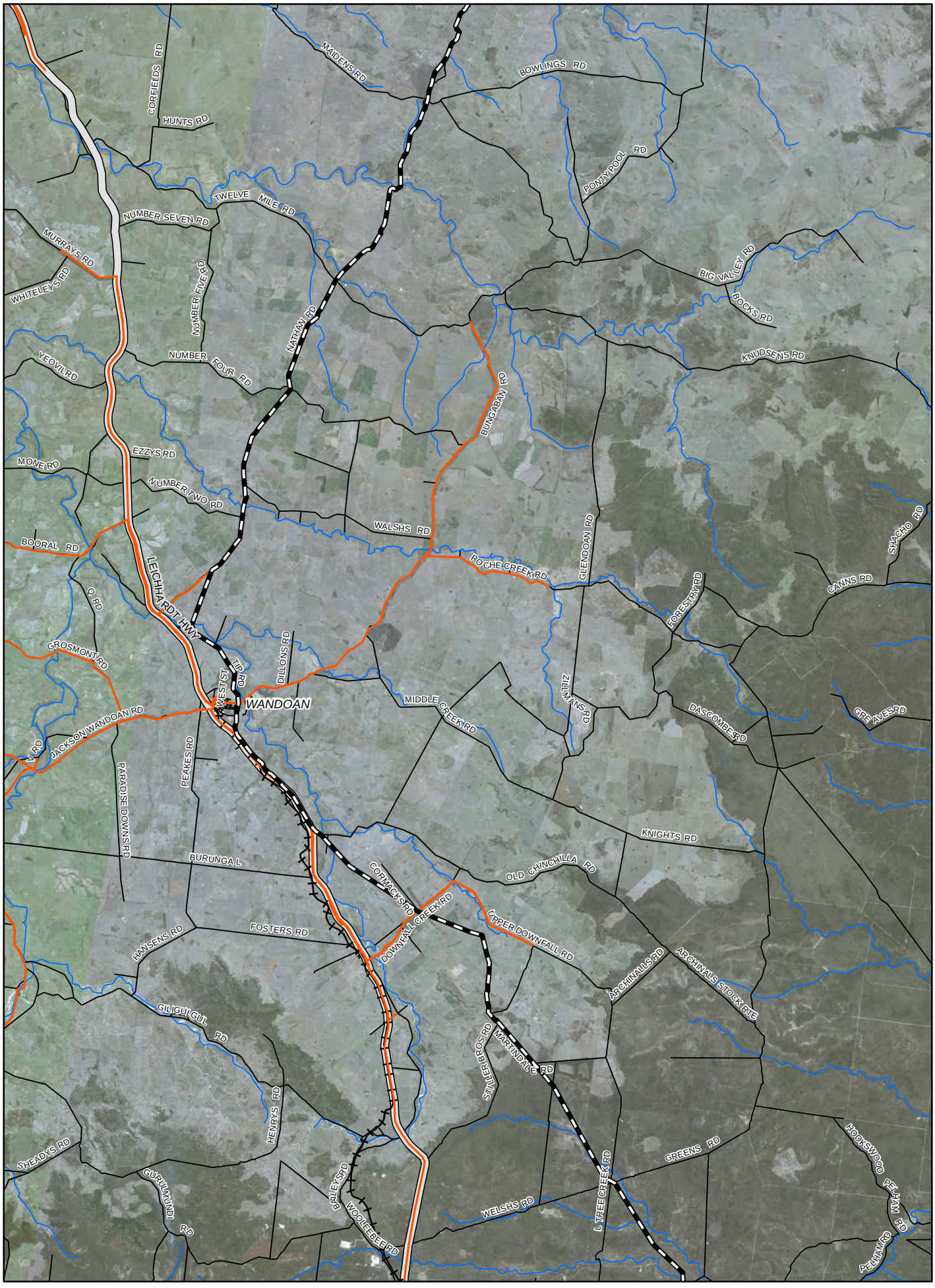
Scale 1:200,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

School bus routes - dam and surrounds

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-4_School_BusRoutes_Dam.mxd Produced: 30/06/2011



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- Railway
- School Bus Routes
- Watercourse

Projection: GDA94 Zone 56

Figure 21-5A

0 1 2 4 6
Kilometres

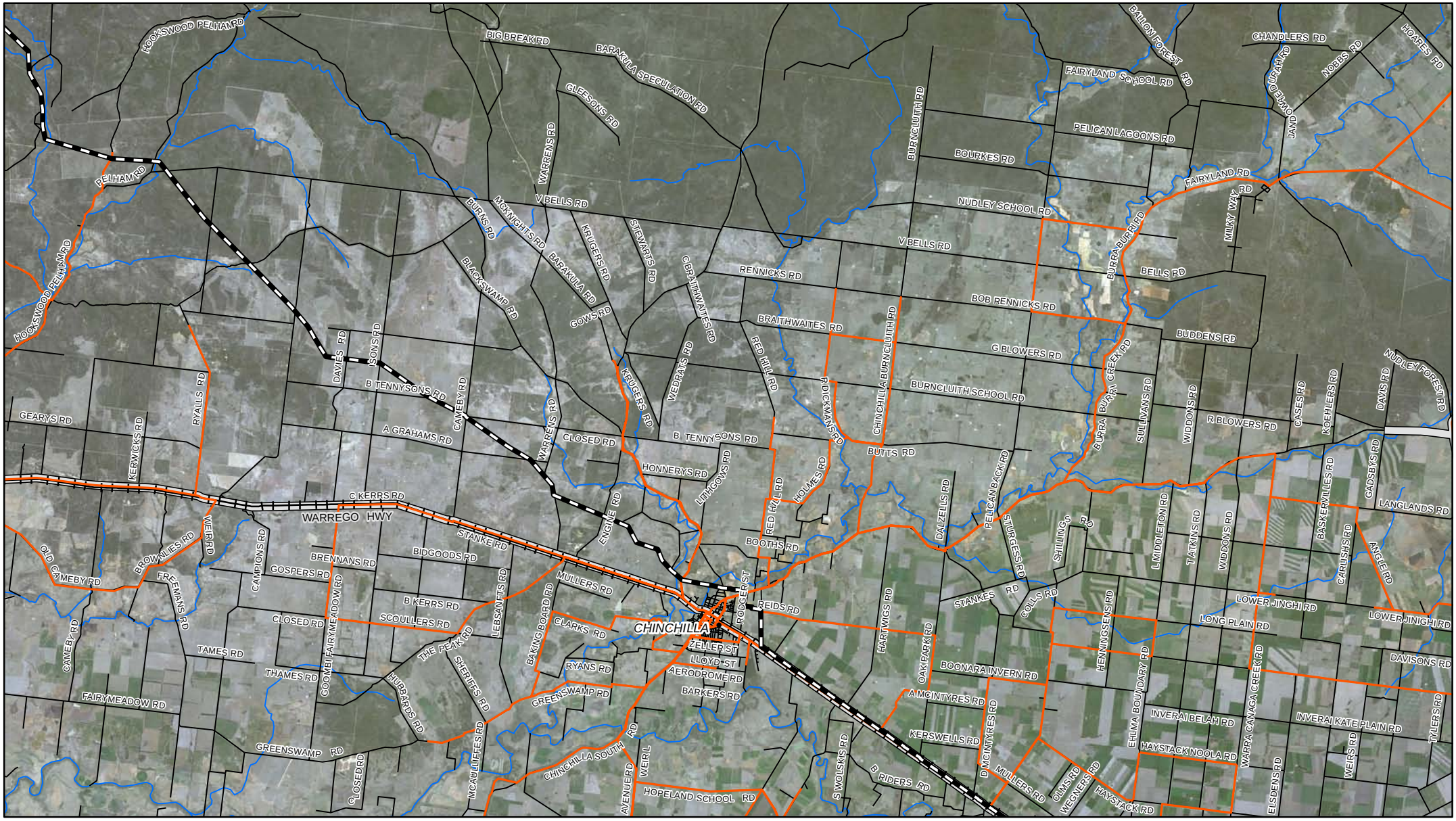
N

Scale 1:300,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

School bus routes - pipeline



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- Railway
- School Bus Routes
- Watercourse

Projection: GDA94 Zone 56

Figure 21-5B

0 1 2 4 6
Kilometres

N

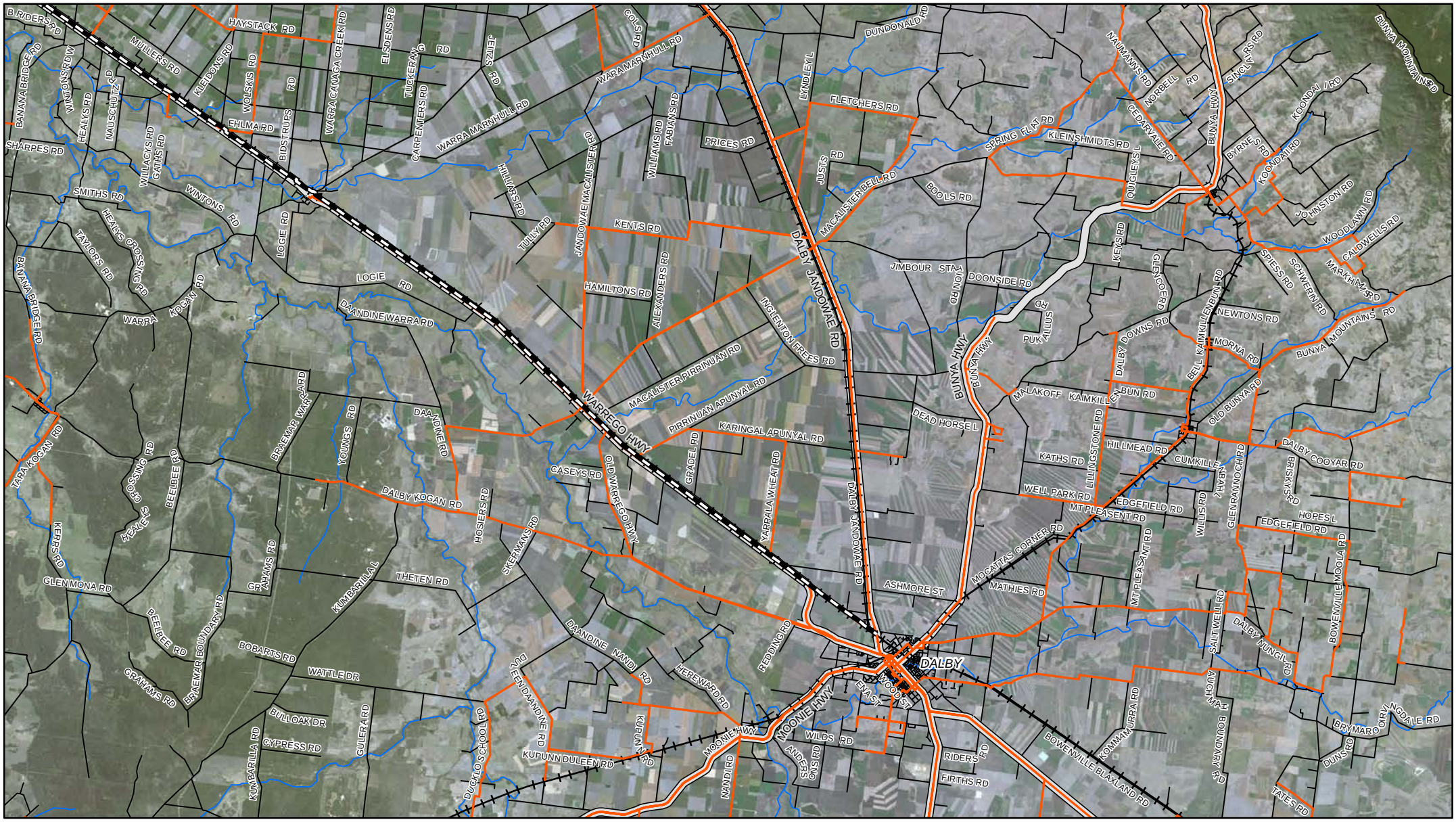
Scale 1:300,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

School bus routes - pipeline

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-5B_School_BusRoutes_Pipeline.mxd Produced: 30/06/2011



LEGEND

- Town
- Proposed Pipeline
- State Controlled Roads
- Local Roads
- Railway
- School Bus Routes
- Watercourse

Projection: GDA94 Zone 56

Figure 21-5C

0 1 2 4 6
Kilometres

N

Scale 1:300,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

School bus routes - pipeline

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-5C_School_BusRoutes_Pipeline.mxd Produced: 30/06/2011

21.3.8. Construction phase

This section details transport methods and routes associated with the Project, including proposed alterations to transport-related infrastructure, the construction of any Project-related plant or utilities, and the demand, composition, timing and routes, of inputs and outputs of traffic generation for the construction phase.

21.3.8.1. Dam site access and routes

The new roads and road upgrades in the dam site are depicted in Figure 21-2. The new roads will be built to provide construction and operational access to the dam site, access to the future recreation areas, and new routes for inundated areas. As outlined in Chapter 2, all roads retained will be raised or realigned as necessary to increase flood immunity.

The changes to the road network surrounding the dam site are:

- upgrade of the existing priority Leichardt Highway/Glebe Weir Road intersection, including realignment of Glebe Weir Road approach to the north to improve intersection geometry and to improve sight lines to and from the highway;
- upgrade of Glebe Weir Road to Spring Creek (approximately 24 km in length) with 6.5 m sealed pavement width;
- extension of Glebe Weir Road from Spring Creek to the left abutment of the dam via a new section of 6.5 m wide sealed pavement;
- realignment to the west of both The Bend Road and Brodies Road along sections where the dam storage cuts across the existing roads; and
- closure of Bundulla Road crossing the Dawson River and construction of cul-de-sacs at the terminus at each side of the river.

Internal haul roads between the batch plants, stockpile sites, the construction site and offices are also within this establishment period. Pavement material for the hauls roads and hardstands would be sourced from scrapes along the Taroom-Cracow Road and the ridge gravels on the left bank ridge and the scrapes are anticipated to be commercially operated by local companies.

The majority of manufactured construction materials and construction equipment are expected to be delivered to the left abutment of the dam via the Leichhardt Highway, turning off onto Glebe Weir Road, subsequently onto Spring Creek Road and to the left abutment. Haul routes along the Leichhardt Highway are expected to come from both the north and south depending on whether goods such as steel, pumps and valves are sourced from the Brisbane or Gladstone areas. It is likely that most goods will come from Brisbane via the Warrego and Leichhardt Highways. Bulk cement may come from the manufacturing plant in Gladstone via the Dawson and Leichhardt Highways while fly ash could come from Gladstone, the Brisbane area, or possibly Kogan.

The sources of other bulk raw materials such as sand, crushed aggregate and crushed rock will be via quarry or extraction sites yet to be determined; a range of sites that may be used have been identified in the vicinity of the water storage area and pipeline route. These potential materials sources are detailed in Section 21.3.8.4. The majority of loads from the extraction sites will utilise Glebe Weir Road to the north of the dam site, and to the south of the dam site, both Cracow Road and Nathan Road.

Other haul routes will be established to the west of the dam site from Robinson and Palm Creek, while construction traffic from Gwambagwine Quarry (to the west), Kianga Quarry (to the north), Bungil Quarry and Warrians Quarry (to the southwest) would utilise existing established roads before linking with haul roads on the northern and southern banks of the Dawson River. .

Some loads destined for the dam works area on the right bank of the Dawson River may travel from the south via Nathan Road or the Taroom – Cracow Road but it is unlikely that appreciable volumes of traffic will approach from this direction unless some quarry materials are sourced from the south or south-east of the site. It is also anticipated that there will be no appreciable traffic to the dam site along the Taroom – Cracow Road from Cracow.

Loads for road works on the left bank of the Dawson River will travel via the Leichhardt Highway and Glebe Weir Road then other roads in the vicinity of the storage as needed while loads for road works on the right bank will travel via the Taroom — Cracow Road and/or Nathan Road as dictated by location of works and raw materials sources.

Wastes will be generated at the dam construction site and will include general waste, oils, tyres, putrescibles and sewage. These will be transported by licensed carriers to the nearest disposal facility licensed to accept that class of waste. It is likely that most waste will be transported via Spring Creek and Glebe Weir Roads and the Leichhardt Highway to Taroom or beyond.

Construction equipment will be transported to the contractor's next project or to a base area on completion of the work for which it is required. Most will be transported via Spring Creek and Glebe Weir Roads and then north or south along the Leichhardt Highway.

There are no vulnerable bridges or structures along Glebe Weir or Spring Creek Roads except for narrow cattle grids on Spring Creek Road. These will be replaced as part of the road upgrade program prior to over-size loads travelling to the dam site.

21.3.8.2. Pipeline site access and routes

The pipeline includes the following infrastructure relevant to transport:

- at area 1: a low-lift pump station at the dam site, a balancing storage tank and re-lift pump station at approximately the 9 km point (from the dam site), and pump station and balancing storage tank at approximately 38 km;
- at area 2: a 150 person capacity workers accommodation camp at Wandoan, and a pump station and a 600 ML balancing storage tank at 110 km, 25 km to the south east of Wandoan; and
- at area 3: a 150 person capacity workers accommodation camp in Chinchilla.

The selection of the final locations of the workers accommodation at Taroom, Wandoan and Chinchilla will be determined at detailed project design with an aim to minimise any impacts on existing vegetation or land use in the vicinity. The locations will require input from the construction contractor and would be negotiated with the respective landholders. Project offices for the pipeline will be established within Chinchilla and Wandoan townships, each to be staffed by 35 people.

The access tracks for construction and maintenance for the pipeline will be graded but unsealed. Road base or gravel will be used where the native material is not adequate, such as in low lying or wet areas. Better formed unsealed roads will be constructed for more highly trafficable areas, such as access roads to the pump stations and lay downs.

Temporary access tracks will be constructed through creek crossings during pipeline construction. These will typically consist of a compacted fill and gravel or road base overlying parallel pipes. The pipes will be sized to allow base flow to pass, with any higher intensity flooding passing over the top.

The following typical construction stages could be expected for upgrade or construction of roads:

- initial survey including location of boundaries and set out of road corridors;
- set up environmental controls;
- clearing of vegetation along the proposed alignment;
- construction of new stock fencing (if required) including gates and demolition of existing;
- set out for road and drainage structures; and
- installation of cattle grids and demolition of existing, as required.

Nine materials lay-down areas will be positioned on private property and located approximately every 30 km along the pipeline route to enable servicing of the construction areas and to keep travel distances to a minimum. The areas are likely to vary in size from about 4 to 9 ha and will only be used during the construction period. Cleared pasture land is anticipated to be used for the lay-down areas with little or no requirement for clearing of vegetation.

Construction of the pipeline will involve a progressively moving work front; consequently distances involved in transport of materials to the work-site will therefore be dynamic throughout the Project. Short access tracks to the pipeline easement or pump stations will require easements, and SunWater intends to acquire ownership of land needed for the larger above ground infrastructure, such as the pump stations and balancing storages.

21.3.8.3. Construction workforce – dam and pipeline

The workforce for the dam construction is expected to average approximately 140 personnel during the peak construction period. Additional construction workforce will include:

- dam construction site professionals and support staff of 20 to 30 and
- a road construction workforce of 35.

The pipeline construction workforce is expected to involve up to 150 personnel at any one time with 15 to 20 personnel at each of four work fronts. Each work front will have mobile facilities that will be relocated as the laying of the pipe progresses. The Wandoan and Chinchilla Project offices will have staff moving between offices as required.

The final location of all camp sites will be determined during project approval and appointment of a contractor, with site selection criteria to include minimisation of: travel distances to/from work areas; impacts on, and direct interactions with, general traffic and public transport; and site impacts.

The camps will be available for transport operators.

The crews working at both the dam and pipeline sites would be bussed or transported in light vehicles from the construction camps and central collection points for local workers.

Current project design anticipates that both pipeline and dam construction will be run on a day shift schedule, notionally 6am to 6pm, Monday to Saturday. The roster used in planning for the Project to date is 11 days on and 3 days off, but this could vary depending on the labour source and negotiated agreement with the selected construction contractor. If a higher proportion of the labour is sourced on a fly-in/fly-out basis, then a longer roster such as 24 days on, 7 days off may be more appropriate.

The majority of the Project workforce will be fly-in/fly-out. This will minimise the number of trips made in private vehicles. It is estimated at least 70% of personnel will be fly-in/fly-out evenly split between the air fields in the Wandoan Coal area, Roma and Chinchilla. A further 20% will likely be drawn from the east coast region (including Gladstone, Rockhampton, Hervey Bay and Toowoomba). 10% of workers are assumed to come from the local region (including Taroom, Theodore, Wandoan, Chinchilla and Dalby). The ability to achieve this proportion of local participation will be reliant on the intensity of mining activity at the time.

The local personnel are assumed to travel to their respective construction camps by light vehicle though workers will be encouraged to use Project provided bus services where possible to reduce traffic demand and risks of driver fatigue. Conservatively assuming a 100 percent use of private vehicles, the estimated vehicle occupancy for these personnel is assumed at 1.5 persons per vehicle (assuming some car pooling is likely to occur). This would result in a total of 40 trips per day for both the dam and pipeline construction. In The work camps are assumed as located in Taroom, Wandoan and Chinchilla. Total daily traffic demand to/from the work camps is estimated as:

- to/from Taroom: 20 trips per day;
- to/from Wandoan: 10 trips per day; and
- to/from Chinchilla: 10 trips per day.

fly-in/fly-out and east coast personnel will travel to/from their respective construction camps to Dalby and Chinchilla by bus at the start and end of their roster. Assuming a single staggered basis for the design daily volume this is conservatively estimated at 10 buses per day. The staggering may be more frequent depending on contractor preferences such that fewer buses per day would run more often.

Each day, workers will be bussed from the camps to the work front, be it at the dam or on a section of pipeline. Pipeline transport will largely be along the construction easement rather than on public roads. Estimated bus movements are based on 40 seat capacity vehicles, and are as follows:

- to/from Taroom: 15 trips per day;
- to/from Wandoan: 4 trips per day; and
- to/from Chinchilla: 4 trips per day.

21.3.8.4. Equipment and materials – dam site

Construction equipment is likely to be transported by road for both the dam and pipeline sites on standard and over-dimensional loads. The over-dimensional loads are anticipated to constitute a small fraction of total demand, delivering mostly indivisible construction equipment. Standard permit approval processes and arrangements for these deliveries, including the requirement for escorting vehicles, will apply on a case-by-case basis.

For the dam construction, the key items to be transported, summarised from Table 21-5 are:

- 380,000 t of material sourced externally, including cement, fly ash and aggregates;
- construction plant, fuel and equipment, camp facilities, and service and sundry sourced externally; and
- 930,000 t of sandstone and clay sourced within the dam site.

Table 21-5 Potential dam raw materials sources, quantities and likely routes

Material	Likely Source	Quantity		Route
		[m^3]	[tonnes]	
Cement	Imported to site from commercial source in Gladstone	1,100	2,300	Dawson Highway and Leichardt Highway, Glebe Weir Road, and Spring Creek Road
Flyash	imported to site from source in Gladstone	300	600	Dawson Highway and Leichardt Highway, Glebe Weir Road, and Spring Creek Road
Concrete aggregate nominal 40mm	Imported to site from either Bungil, Warrian or Gwambagwine	10,000	21,000	From Bungil or Warrian: Taroom — Roma Road, Leichhardt Highway, Glebe Weir Road, and Spring Creek Road: From Gwambagwine: Fitzroy Development Road, Glebe Weir Road, and Spring Creek Road
Concrete aggregate sand	Imported to site from either Wooloobe Creek, or Conloi Creek	5,000	10,500	Jackson-Wandoan Road, Leichhardt Highway, Glebe Weir Road, and Spring Creek Road
Rip rap	Imported to site from either Bungil or Warrian	90,000	189,000	Taroom — Roma Road, Leichhardt Highway, Glebe Weir Road, and Spring Creek Road
Coarse filter material	Imported to site from Cockatoo Creek	50,000	105,000	Red Range Road and Nathan Road
Fine filter material	Imported to site from Wooloobe Creek, Conloi Creek or Glebe Upper Terrace	25,000	52,500	Glebe Road and the Taroom — Cracow Road
Rockfill	Excavated sandstone from spillway cutting	750,000	1,575,000	Site haul road
Core material	Clay from borrow areas upstream of the dam embankment	180,000	378,000	Site haul road
Total imported		**181,400**	**380,900**	
Total sourced on site		**930,000**	**1,953,000**	

Two temporary on-site batch plants will be established during the construction phase, with fuel stored in bulk facilities within the construction lay down area. Based on a standard 20 t payload, materials are estimated to contribute approximately 66,000 loads, 20,000 of which will travel from external sources. To be conservative, it has been assumed that all raw materials will be transported by semi trailers (articulated trucks).

Estimated daily vehicle trips to/from outside the Project site during the dam construction are summarised in Table 21-6.

Table 21-6 Estimated daily vehicle trips during dam construction

Generation type	Daily traffic generation, dam construction [vpd]		
	Light vehicles	**Single unit trucks/ buses**	**Articulated vehicles**
Workforce	40	30 (only at eachroster change)	
Construction materials and equipment		15	52
Service vehicles and sundry items	20	24	

For the purposes of the assessment, the following have been assumed in estimating the design daily traffic generation:

- road upgrades to Taroom-Cracow Road, Glebe Weir Road and Spring Creek Road will take place prior to dam construction;
- materials haulage would be distributed evenly over the dam construction period between 2014 and mid-year 2016, with little or no haulage occurring during the wet seasons between November and March;
- workforce bus demand will occur at the start and end of worker rosters (at a frequency of between 11 or 24 days), with the design daily demand for these movements occurring on a single staggered basis; for the design daily volume this is conservatively estimated at 15 bus trips per day;
- eight trucks per day for plant and miscellaneous deliveries to/from external sources; and
- four trucks per day for service vehicles delivering miscellaneous and sundry items.

The estimated directional distribution of the above estimated vehicle trips (excluding the local workforce trips) during dam construction are as follows:

- 60 percent and 40 percent of workforce roster buses travelling respectively between Toowoomba and Gladstone, and the construction camps;
- workforce light vehicles split between Toowoomba (20 percent) and Gladstone (70 percent) and the construction camps;
- workforce will be bussed to/from the construction camp in Taroom and the dam work site via the Leichhardt Highway, Glebe Weir Road and Spring Creek Road ; and
- 60 percent of service vehicles to/from Toowoomba and the balance to/from Gladstone.

21.3.8.5. Equipment and materials – pipeline

For the pipeline construction, the key items to be transported are:

- construction plant, fuel and equipment, pipes and fittings, above ground structures and camp facilities;
- raw materials, including bedding material (sand), gravel, clay, road base and waste excavated trench material;
- concrete from batching plants in Wandoan, Miles, Dalby and Chinchilla; and

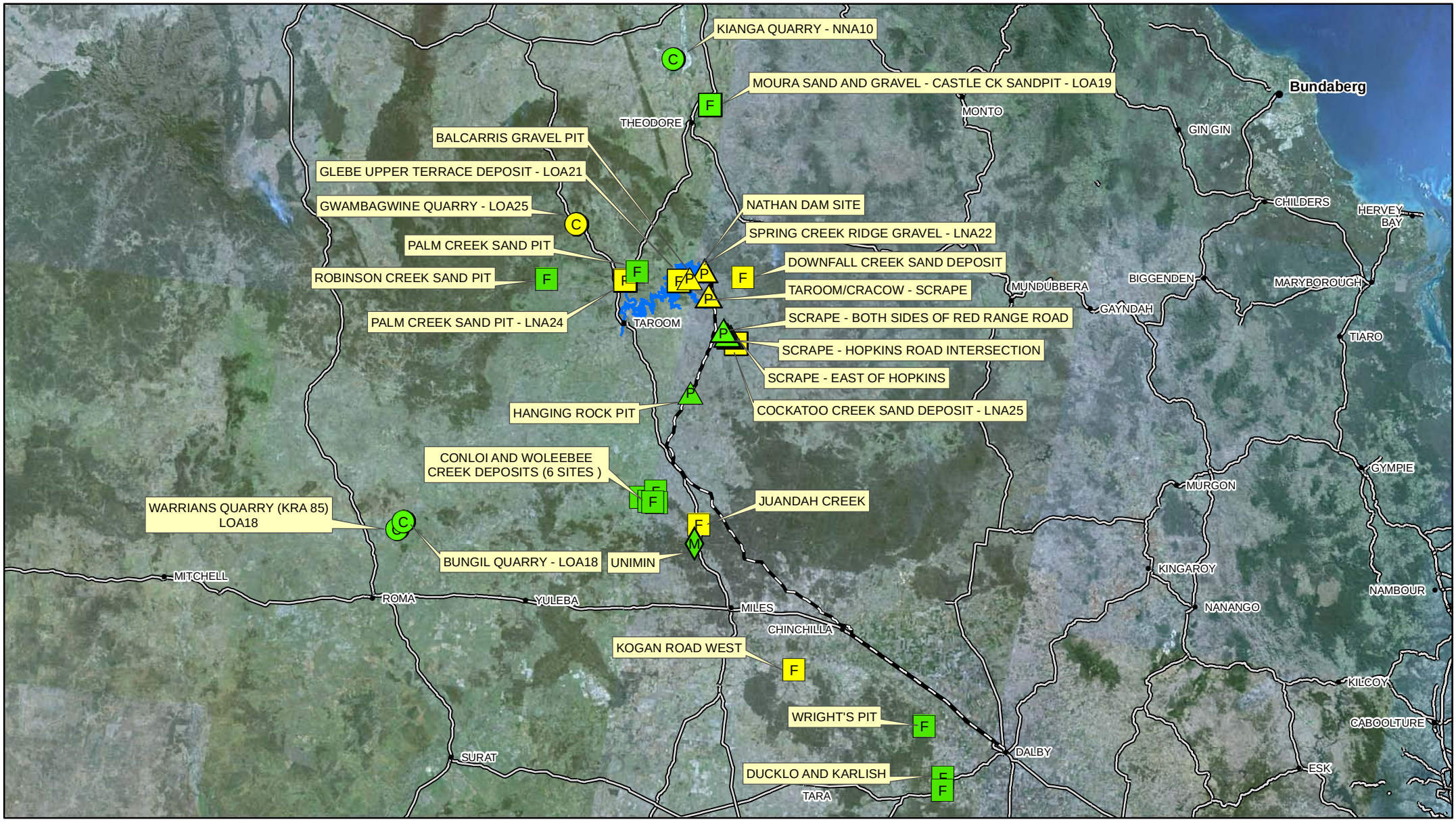
- service and sundry items.

The main transportation activity will occur after establishment of the easement and lay down areas, and will comprise the delivery of the majority of approximately 1 million m^3, or almost 1.5 million tonnes of material to the lay down areas prior to the construction teams arriving to the four work fronts. This will reduce potential conflicts between construction and delivery vehicles, and will spread the traffic demand over time. However, delivery of bedding and other materials is dependent on weather conditions, as unsealed roads and access tracks to work sites may be inaccessible for varying periods. The delivery of bedding material is scheduled to commence in early 2014, prior to the dam construction peak, which is scheduled at the latter half of 2014.

Table 21-7 Indicative Quantities of Raw Materials Required to Construct the Pipeline

Material Location	Likely source	Quantity
Bedding Sand/gravel	Commercial sources - Wandoan, Miles, Dalby, Chinchilla	500,000 m^3
Gravel	Commercial sources - Wandoan, Miles, Dalby, Chinchilla	240,000 tonne
Rock Facing	Commercial sources - Wandoan, Miles, Dalby, Chinchilla	15,000 tonne
Road Base (CBR 2-1 & 2-4)	Commercial sources - Wandoan, Miles, Dalby, Chinchilla	14,000 tonne
Rock Fill	Commercial sources - Wandoan, Miles, Dalby, Chinchilla	20,000 tonne
Clay	Gurulmundi	175,000 m^3
Concrete	Commercial sources - Wandoan, Miles, Dalby, Chinchilla	30,000 m^3

Potential materials sources have been identified in the vicinity of the pipeline and are shown in Figure 21-6. Based on a standard semi trailer 20 tonne payload, the bedding material equates to 52,500 loads. The major sources are potentially Dawson River at the northern end of the pipeline and the Condamine River at the southern end.



LEGEND

- Town
- Proposed Pipeline
- Major Roads
- Full Supply Level (183.5m, AHD)

Material Sources

- Existing - Coarse Aggregate
- Existing - Fine Aggregate
- Existing - Pavement
- Existing - Clay
- Potential - Coarse Aggregate
- Potential - Fine Aggregate
- Potential - Pavement
- Undefined - Pavement

Projection: GDA94 Zone 56

Figure 21-6

0 10 20 40
Kilometres

N

Scale 1:2,000,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Potential resource extraction zones

I:\QENV2\Projects\QE40192\400 - Nathan - Spatial\ArcMXD\Figures\210_TrafficandTransport\Figure_21-6_Potential_Resource_Extraction_Areas_v2.mxd Produced: 30/06/2011

Each work site will operate 8 trucks for the delivery of bedding material. With an average distance of 20 km from source to lay down areas, the number of trips per day is estimated at 80, equating to 160 vpd for each work front.

To be conservative, pipe delivery is assumed to commence as soon as lay down areas are available. Pipes will be 13.4 metres in length and 1.2 m in diameter. A total of 18,750 pipes will be used for the pipeline, equating to 9,700 loads based on two pipes, plus associated fittings and ancillary equipment, per load. Over the 21 month planned pipe laying period and (an assumed) preceding two months of lay down availability, this equates to an average of 14 deliveries per day in total.

The spoil haulage for the 80 km segment between Chinchilla and Dalby will be via the Warrego Highway and will be performed over a 12 month duration, equating to approximately 1,900 loads. For the rest of the pipeline, no additional traffic demand associated with waste trench material is anticipated to use the surrounding road network.

Concrete will be delivered from the dam site, Wandoan, Miles, Chinchilla or Dalby to the required work front. Plant requirements during pipe laying period will total 28, with 11 plant items carried over from the preceding clearing and earthworks stages. Sundry deliveries (including fuel) are minor and included in the above totals.

Estimated daily vehicle trips during pipe laying to/from outside the Project site are summarised in Table 21-8.

Table 21-8 Estimated daily vehicle trips during pipeline construction

Generation type	**Daily traffic generation, pipe laying [vpd]**		
	Light vehicles	**Single unit trucks/ buses**	**Articulated vehicles**
Workforce (total of all work camps)	40	20 (only at each roster change)	
Construction materials and equipment (total of all work fronts)		64	306
Service vehicles (sundry items, total of all work fronts)	32	2	

Similar to the dam site, the estimated directional distribution of the estimated vehicle trips during pipeline construction is as follows:

- bedding material delivery evenly distributed from Dawson River, Cockatoo Creek, Conloi Creek, Woleebee Creek, Juandah Creek, and Condamine River;
- 85 percent and 15 percent of workforce roster buses travelling between Toowoomba and Gladstone respectively, and the construction camps;
- workforce light vehicles travelling between Toowoomba (90 percent) and Gladstone (10 percent) and the construction camps; and
- 100 percent of service vehicles (including those delivering pipes) to/from Brisbane.

21.3.8.6. Road link assessment

The performance criterion for road links is the Level of Service (LOS) as defined in *Austroads Guide to Traffic Management – Part 3 – Traffic Studies and Analysis.* Section 3.2.2 of Austroads defines LOS C as traffic being: 'In the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level'.

In rural areas, LOS 'D' can be considered to be the minimum standard, changes between the LOS ranking below LOS 'D' imply remedial measures to maintain the required LOS.

The Austroads level of service criteria for level terrain, two-lane, two-way roads has been applied using the common industry standard ratio of 0.10 between the design hour volume and the AADT as presented in Table 21-9.

Table 21-9 Austroads level of service criteria

LOS	Austroads criteria (pc/h)[1]	AADT (vpd)[2]	AADT range (vpd)[3]
A	490	4,900	0 to 4900
B	780	7,800	4,901 to 7,800
C	1,190	11,900	7,801 to 11,900
D	1,830	18,300	11,901 to 18,300
E	3,200	32,000	18,301 to 32,000

Source: Section 4.2 of Austroads Guide to Traffic Management – Part 3 – Traffic Studies and Analysis

[1] Passenger car per hour

[2] Based on common industry standard ratio of 0.10 between the design hour volume and the AADT

[3] Vehicles per day

TMR records show the Warrego Highway, Leichardt Highway and the Dawson Highway have had an average annual growth rate of 5.1 percent over the last 10 years in the vicinity of the Project site, while the Roma-Taroom Road has experienced minimal growth. For the purposes of the assessment, an annual growth of 5.1 percent on all assessed roads has been applied to the 2009 AADT to reflect the assumed peak construction period in early 2016.

The results of the assessment and a comparison between the estimated 2016 background traffic volumes, the additional 2016 construction phase traffic and the relative LOS are presented in Table 21-10.

The peak construction period, in terms of transport activity for the entire project, is estimated as during pipe line bedding material delivery concurrent with the delivery of pipes. This would take place during normal (nonpeak) dam construction activity.

The increase in traffic generated by the Project during its peak construction period will not affect the level of service (LOS) experienced by drivers on roads affected by the Project, as summarised in Table 21-10. Peak hour volumes on these roads are low and the priority controlled intersections in the Project area, including the intersection between Glebe Weir Road and the Leichardt Highway, are expected to continue to operate with low delays and acceptable LOS.

The construction works will not affect the range of vehicle types using these state controlled roads, so no change in the geometry of the existing roads will be required.

Table 21-10 Estimated levels of service for affected roads

Road Segment	Background traffic, 2016			Background traffic plus estimated project construction traffic			Proportion of Project traffic to future AADT
	2016[1] AADT [vpd]	Commercial vehicle (CV) [vpd]	LOS[2]	2016[1] AADT [vpd]	CV [vpd]	LOS[2]	[Percentage]
Leichhardt Highway (26A)							
1.76 km south of Fitzroy Developmental Road	660	250	660	730	300	A	9.9%
Leichhardt Highway (26B)							
North of Jackson-Wandoan Road intersection	890	270	890	980	322	A	9.4%
South of Jackson-Wandoan Road intersection	860	290	860	1010	402	A	15.1%
7.5km south of Downfall Creek Rd	910	310	910	1,050	409	A	13.3%
Warrego Highway (18C)							
3.46 km east of Leichhardt Hwy Intersection	2,930	540	2,930	23020	594	A	3.1%
Warrego Highway (18B)							
Dalby–Road 325 intersection	8,860	1,640	8,860	9,080	1,817	C	2.4%
Road 325 intersection–chainage 27.0 km	6,820	1,610	6,820	6,920	1,668	B	1.4%
Chainage 27.0 km–chainage 10.5 km	16,340	2,370	16,340	16,450	2,442	D	0.7%
Chainage 10.5 km–intersection McDougall Street, Toowoomba	14,560	1,150	14,560	14,660	1,208	D	0.7%
Leichhardt Highway (26A)							
400 m south of The Boulevard	1,100	220	1,100	1,230	344	A	10.5%
Bowen Street west of Banana	2,850	600	2,850	2,980	723	A	4.3%
300 m south of Fairview Rd	870	240	870	880	240	A	0.6%
100 m north of Woolein Creek	850	230	850	860	230	A	0.6%
11 km south of Wowan	990	270	990	1,060	330	A	6.1%
Dawson Highway (46B)							
1 km east of Banana	1,540	260	1,540	1,550	260	A	0.3%
900 m west of Burnett Highway (41E)	2,030	330	2,030	2,100	390	A	3.1%
700 m west of Burnett Highway (41D)	6,870	660	6,870	6,910	695	B	0.6%
Roma-Taroom Road (4397)							
0.14 km north of Wybara Road	80	20	A	100	20	A	5.0%

Road Segment	Background traffic, 2016			Background traffic plus estimated project construction traffic			Proportion of Project traffic to future AADT
	2016[1] AADT	Commercial vehicle (CV)	LOS[2]	2016[1] AADT	CV	LOS[2]	[Percentage]
Jackson-Wandoan Road (4302)							
9.18 km South of Wandoan	100	30	A	210	130	A	50.0%
Warra-Kogan Road (3403)							
Estimated, south of Warrego Highway	140	30	A	150	30	A	3.6%
Warrego Highway (18D)							
Miles side of Leichhardt Hwy intersection	3,970	990	A	4,010	990	A	1.0%
4.07 km west of Leichhardt Hwy	1,990	560	A	2,030	560	A	2.0%
1.26 km west of Dulacca Nth Rd	1,690	520	A	1,720	520	A	1.7%
13.01 km East of Yuleba-Surat Rd	1,750	520	A	1,770	520	A	1.1%
1.72 km West of Wallumbilla South Rd	2,170	560	A	2,180	560	A	0.5%
0.23 km East of Roma Downs Rd	5,230	990	A	5,340	1,090	A	2.0%

[1] Background growth based on historical growth rates

[2] Level of Service: A – excellent; B – good; C – satisfactory; D – tolerable; E – congested; F – very congested

Under the TMR Guidelines, traffic impacts need to be considered where development traffic is estimated to equal or exceed five percent of existing traffic levels. The results in Table 21-10 indicate that Project traffic is expected not to exceed this proportion of background traffic on most SCRs, with exception to the Leichardt Highway (26A and 26B), Roma-Taroom Road and Jackson-Wandoan Road. The Project traffic volumes shown in the table are conservative values as the assessment has assumed aggregated trips and has not reduced trips due to spreading and or diversion along alternative access routes.

With addition of (conservatively) estimated Project demands on the affected roads, all roads with total background plus Project traffic demand are still well below operating capacities. The increase in traffic volumes will be most perceptible on the unsealed local roads which will provide access to the pipeline construction easement. As these roads are constructed to a lower standard, sight distances and opportunities to overtake may be limited.

21.3.8.7. Road intersection assessment

Full road intersection assessment and design for the existing and new intersections will be undertaken during the detailed design phase of the Project. SunWater will ensure that all road intersections required for the Project meet appropriate design standards and safely cater for both the construction and operational traffic volumes.

21.3.9. Operational traffic

The dam and pipeline operation will be highly automated. There will be facilities available at the dam for occasional residence of one operator. Access to the dam and northern recreational area will be via –Glebe Weir Road and Spring Creek Road. Access to the southern recreation area will be from Taroom-Cracow Rd. Operational traffic demand associated with the dam operations will be minimal with the operator fleet comprising a small number of vehicles such as utilities, four wheel drive vehicles and tractors/slashers.

Public visitation to the dam is likely and will be highest during weekends and holiday periods; there is presently insufficient data to quantify visitor demand. Traffic demands to/from the recreation areas by visitors are therefore anticipated to have minimal impact during the weekday traffic periods, as is the experience in similar dam sites and at the current Glebe Weir. Traffic demands associated with the pipeline will be in relation to regular inspection traverses, maintenance and repair, and is estimated to not have any significant impact on the surrounding road network.

21.3.10. Consideration of other projects impacting on the road networks

While the impacts of the Project do not adversely affect the LOS of the key haul route of the Leichardt Highway and Warrego Highway during the construction period, the effect of other major projects in the region would be cumulative in terms of impact. Other major projects likely to have cumulative impacts on roads affected by the Project are listed in Table 21-11 (existing projects) and Table 21-12 (planned projects).

Table 21-11 Existing projects, 2010

Wilkie Creek Mine	
Company	Peabody Energy
Description	2.35 Mta thermal coal mine, 45 km north-west of Dalby. 250 km rail line to the Port of Brisbane
Workforce	No data
Darling Downs Power Station Project	
Company	Origin Energy
Description	630 MW gas fired power station located at Braemer, 40 km west of Dalby
Workforce	300
Kogan Creek Power Station	
Company	CS Energy Ltd
Description	750 megawatt coal fired power station approximately 35 km from Chinchilla Linked to the Kogan Creek Mine, supplying 2.8 Mta of coal
Workforce	Mine – 60 people Power station - 70 people

Table 21-12 Planned projects, 2010

Surat Basin Railway – Southern Missing Link	
Company	Surat Basin Rail Joint Venture (Australian and Energy Corridor Pty Ltd (ATEC), Xstrata Coal and Queensland Rail)
Description	210 km railway joining the Surat Basin (at Wandoan) to the Moura Railway system near the township of Banana, facilitating the export of coal to the Port of Gladstone
Workforce	Construction - 1,000
Accommodation	Up to three temporary workers accommodation villages, located in proximity to major work fronts
Construction date	2012
Wandoan Coal Project	
Company	Xstrata Coal Queensland Pty Ltd
Description	Open cut coal mine producing 20 Mta, located directly west of the Wandoan township
Workforce	Construction - 1,375
Accommodation	Accommodation camp in or adjacent to the mining lease area. Construction of some houses in Wandoan
Construction date	2010 Early Works 2011-2013 Construction
Queensland Curtis LNG Project	
Company	Queensland Gas Company
Description	Integrated LNG project comprising expansion of Coal Seam Gas (CSG) operations in Western Downs RC (primarily west of Chinchilla), and the development of a 380 km gas pipeline to Gladstone, transecting through Taroom SLA and Banana Shire Council
Workforce	Construction - 1,000 people (CSG operations) 400 people (export pipeline)
Accommodation	Temporary construction camp adjacent to CSG operations and pipeline.
Construction date	2011-2012
Gladstone LNG Project	
Company	Santos
Description	Integrated LNG project comprising expansion of Coal Seam Gas (CSG) operations near the townships of Roma and Injune, and the development of a 435 km transmission pipeline to an LNG Facility in Gladstone, passing through the Banana Shire Council area
Workforce	Construction - 2,000 people (CSG operations) 1,000 people (export pipeline)
Accommodation	Temporary construction camp adjacent to CSG operations and pipeline
Construction date	2011-2012
Surat Gas Project	
Company	Arrow Energy Ltd
Description	The project proposes to develop a major coal seam gas exploration, development and production project near the townships of Chinchilla, Dalby and Wandoan and the development of a 467 km transmission pipeline to Arrow Energy Ltd Curtis Island Project, starting in Western Downs Regional Council and traversing through Banana Shire Council
Workforce	No Data
Accommodation	No Data
Construction date	2011-2012

Road traffic demands associated with the existing Wilkie Creek Mine, Darling Downs Power Station and Kogan Creek Power Station are included in the AADT data provided in Section 21.3.2.4. Cumulative impacts of these projects have therefore been effectively taken into consideration in the road link assessment in Section 21.3.8.6.

Of the planned projects, the Wandoan Coal Project and the Surat Basin Railway Project are identified as the two projects with the highest potential for cumulative traffic impacts. Should both these projects commence construction concurrent to the Project's construction phase, the surrounding state and local roads would experience a considerable increase in additional traffic demand. The required mitigation measures for cumulative impacts are discussed in the following section.

21.4. Project impacts and mitigation measures

Potential traffic and transport related impacts are considered only for the construction phase of the Project, as this impact assessment has determined that Project traffic demand during the operational phase is insignificant. The identified mitigation measures during the construction phase are summarised in Table 21-13.

Table 21-13 Project impacts and mitigation measures – construction phase

Potential impact(s)	Mitigation measure(s)
Increase in traffic volume during the (concurrent) construction of the pipeline and the dam. Increase in heavy to light vehicle ratio, particularly on the Leichardt Highway, Warrego Highway and the Glebe Weir, Nathan and Cracow Roads during the construction period. Traffic congestion, time delays and potential for safety hazards due to increased traffic movements on state and local roads as materials, equipment and workforce are transported to and from the Project	Traffic impacts will be managed through a Road Use Management Plan (RUMP) and associated Traffic Management Plans (TMPs). These are to be developed in consultation with TMR and the local councils. The RUMPs and TMPs will be developed during detailed Project design and will consider: ▪ Reduction of Project related traffic demand, including transportation of personnel via buses between camp sites and construction sites ▪ Locations of haulage routes ▪ Temporary road closures and traffic detours ▪ Traffic signage and intersection controls ▪ Traffic barriers and lighting ▪ Road deviations ▪ Speed controls through and in the vicinity of work sites ▪ Provisions for pedestrians and cyclists ▪ Maintenance of satisfactory and safe property access ▪ Maintenance of local road connectivity to minimise impact on the local community ▪ Establishing extraction areas and stockpile sites as near as possible to the dam site and easement to minimise transport distances. Specific traffic planning elements to be considered during detailed project design will include using the pipeline construction easement for haulage and deliveries, and the scheduling of deliveries, services and work shifts. Opportunities to use alternative routes, such as maintenance tracks with adjoining easement owners, to avoid bus routes and populated areas should be explored and due consideration given to the scheduling of deliveries outside of commuter and school peak hours
Cumulative project impacts	Liaison with other parties currently or planning to add significant volumes of traffic onto the surrounding road network, through a number of number of planning forums that have been established by Government in the Surat Basin. The Project RUMP and TMPs to consider cumulative traffic movements, in particular to/from the Wandoan Coal and Surat Basin Railway projects. Nathan Road and Red Range Road may require upgrading from their existing earth/gravel formation.
Delay to, and increase travel times for road	Road diversions will be in accordance with the Austroads Guidelines for

Potential impact(s)	Mitigation measure(s)
users due to road realignment and/or road closure	Traffic management and signed in accordance with TMR's manual of Uniform Traffic Control Devices. Diversions will be developed and implemented through the RUMP and TMPs and in consultation with potentially impacted stakeholders. The road closure at Bundulla Road would represent an increase in travel distance to/from Taroom of approximately 19 kilometres from the northern side of the full supply level (FSL) at Bundulla Road. While Bundulla Road currently experiences low traffic demands and is not used as a school bus route to/from Taroom, there may potentially a number of students affected. A number of students presently use Bundalla Road to access a bus stop at Taroom-Cracow Road. Mitigation measures for school travel, such as new/revised bus routes, will be developed in consultation with the affected stakeholders at detailed Project design.
Increased risk of traffic incidents due to greater volumes of heavy vehicles, temporary truck crossings at haul or site accesses, and Project turning movements at intersections.	Safety hazards are to be addressed through the RUMP and TMPs. Ongoing consultation with local stakeholders should be maintained as part of the Project consultation program. Minimum number of site accesses to be allowed along the Leichardt and Warrego Highways.
Safety hazards caused by heavy vehicles standing to turn or travelling at slower speeds, likely to occur on the Leichardt Highway and Warrego Highway.	Access points to be located and placed with adequate sight distances and advance warning signs as per TMR's manual of Uniform Traffic Control Devices.
Disruption to school bus routes through additional volumes and increased risk for children boarding/alighting from school buses.	Brief TMR and school bus operators of any pending traffic changes that may impact on bus operations. Inform haulage and construction plant operators of bus times and routes. Where practicable, reduce haulage operations during school bus hours to reduce the potential risk. Redirect bus routes in accordance with the Project RUMP and TMPs or any route diversions and/or road closures. Ensure bus stops are clear of construction traffic.
Damage to road pavement. Associated safety hazards from vehicles using deteriorated road surfaces.	Undertake condition assessment survey prior to construction and reinstatement of damage to roads that can be shown to be a result of Project activities, to the agreed standards after construction is complete. TMR and the local councils are to be consulted on the agreed standards.
Movement of heavy, oversized loads and/or dangerous goods	Notify the responsible authority and obtain the necessary permits.
Dust and noise generation.	Implement dust and noise management measures, such as the watering of pavement and speed controls, during high dust risk (windy) periods, and if required provision of noise attenuation measures or controls.
Wet weather and flooding impacts on Project traffic	Contingent and emergency planning for wet season/flooding.

The nominated transport strategy and routes will be reviewed with the construction and haulage contractors once they are appointed, and the road impact assessment will then be revised to reflect the actual routes and transport methods to be used. Specific mitigation measures and strategies for their implementation will be determined at detailed project design.

Specific requirements for mitigating impacts by Project works within or in proximity of a road reserve and a railway corridor are discussed below.

21.4.1. Construction within or in proximity to a road reserve

There may be localised traffic disruption associated with constructing the pipeline within or in the vicinity of a road corridor. The appropriate controls will be implemented in consultation with TMR and/or the local councils as appropriate prior to the commencement of these works.

Any construction near, or encroaching on, a road reserve will be agreed with the relevant authority and conform to statutory requirements. In addition, where there is anticipated to be vehicular conflicts between traffic associated with the Project and general traffic (in particular identified 'black spot' locations and travel through these by Project commuters), detailed TMPs complementing the Project RUMP, will be implemented as required. If the road is state controlled, an application for an ancillary works and encroachment permit will be made to TMR.

21.4.2. Construction within or in proximity to a railway corridor

Crossing of a future rail corridor by the pipeline will be at one location – that identified by the Surat Basis Rail Project to the north of Wandoan. In undertaking the Project activities, which include construction and operational/maintenance works, consultation with QRL will include the crossings of future railway corridors and obtaining approvals to undertake these activities and to construct on, over or under (future) QR land.

21.5. Impact assessment and residual risk

The methodology used for risk assessment and management is discussed in Section 1.8. The risk assessment is of the Project as described in Chapter 2, in which SunWater has incorporated a range of risk reduction and mitigation measures. This section assesses the risks relevant to the transport methods and routes for the Project and summarises the mitigation measures proposed to minimise those risks (Table 21-14).Based on this assessment, the following conclusions can be made:

- the majority of traffic impacts can be feasibly managed through the implementation of mitigation measures, environmental management and ongoing consultation and communication with key stakeholders, including local and state agencies, landholders, local communities, businesses and emergency service providers; and
- early and ongoing consultation with directly affected landholders for the Project may address some potential impacts on the loss of amenity due to additional traffic, particularly trucks, on the road network. While this may be significant for residents affected, it is unlikely to be significant in the context of the wider Project given the small number of property owners affected.

Based on this risk assessment, the impacts relevant to transport infrastructure are acceptable and the residual risks can be effectively managed.

Table 21-14 Risk assessment

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk		
				C	L	Current Risk			C	L	Mitigated Risk
Increase in traffic movements and heavy to light vehicle ratio due to the Project		Efficiency of road transport network	Refer to Table 21-14.	Moderate	Unlikely	Medium	Project road use management plan (RUMP) and traffic management plans (TMPs)	Moderately	Minor	Unlikely	Low
		Safety of people and vehicles on roads									
		Damage to road pavement									
		Property access									
		Disruption to school bus routes									
Transport of Project people, materials and equipment		Efficiency of road transport network	Refer to Table 21-14.	Moderate	Unlikely	Medium	Project road use management plan (RUMP) and traffic management plans (TMPs)	Moderately	Minor	Unlikely	Low
		Safety of people and vehicles on roads									
		Damage to road pavement									
		Property access									
		Disruption to school bus routes									

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk		
				C	L	Current Risk			C	L	Mitigated Risk
Wet weather and flooding	Non-project traffic	Progress of construction	Refer to Table 21-14	Moderate	Unlikely	Medium	Project RUMP and TMPs	Moderately	Minor	Unlikely	Low
	Construction vehicles	Safety of people and vehicles on roads	Contingent and emergency planning for wet season/planning								
	Project vehicles on roads										
Dust and noise generated by vehicles	Wet season.	Safety of people and vehicles on roads	Refer to Table 21-14	Moderate	Unlikely	Medium	Project RUMP and TMPs	Moderately	Minor	Unlikely	Low
	Construction schedule		Dust and noise management measures								

21.5.1. Cumulative risks

While the impacts of the Project do not adversely affect the LOS of the key haul route of the Leichardt Highway and Warrego Highway during the construction period, the effect of other major projects in the region would be cumulative in terms of impact.

Should the other major projects (refer to Section 21.3.10), including both the Wandoan Coal and Surat Basin Railway projects, commence construction concurrent to the Project's construction phase, the surrounding state and local roads would experience a considerable increase in additional traffic demand.

SunWater will liaise with other parties currently or planning to add significant volumes of traffic onto the surrounding road network, as well as the local Police. The Project RUMP and TMPs will consider cumulative traffic movements, in particular to/from the Wandoan Coal and Surat Basin Railway projects.

21.6. Summary

Traffic and transport impacts have been assessed by:

- identifying the transport methods and routes associated with the Project, including proposed new or alterations to transport-related infrastructure, and the construction of any project-related plant or utilities;
- identifying demand, composition, timing and routes, of inputs and outputs of traffic generation for the Project; and
- assessing the potential impacts of project related traffic on the surrounding road network, including those related to safety, interaction with other road users (such as buses and emergency vehicles), and special circumstances such as the transport of over dimensional or dangerous goods, and the required mitigation measures.

The assessment has found that peak transport activity for the entire project during pipeline bedding material delivery is expected to be concurrent with the delivery of pipes. This would take place during the later stages of dam construction activity in early 2016. The assessment has found that the increase in traffic generated by the Project during its peak construction period will not affect the level of service experienced by drivers on roads affected by the Project. The construction works will not affect the range of vehicle types using these state controlled roads, so no change in the geometry of the existing roads will be required.

Transportation of over-dimensional loads and dangerous goods will be on state roads under permit and, where necessary, accompanied by safety escorts. In terms of the local road network, the dam site access of Glebe Weir Road and Spring Creek Road will be upgraded, as well as road segments of Taroom - Cracow Road to the south of the dam site. A section of Bundulla Road will be closed due to inundation. Where property access is affected it will be realigned or replaced. Overall, an increase in retrace routeing is estimated for a minor number of anticipated trips. Bundulla Road would become two terminal roadways as a result of the road closure, which would cut off access to the north from a school bus stop in Taroom-Cracow Road. It has been identified that community consultation is required to inform mitigation measures, such as additional bus or alternative arrangements to/from Taroom.

While the potential impacts on health, education and emergency services are expected to be minimal with no significant increases on services required, ongoing consultation, in particular with QPS, QFRS and Queensland Health will be

undertaken to ensure that services are able to accommodate the Project and any associated impacts are addressed. There will be no impact on the accessibility to transport for people with a disability.

A number of mitigation measures have been identified and/or recommended to mitigate impacts to the state controlled roads, local roads and railway corridors. Most of these measures have been determined through project design and will be reviewed in consideration of other projects in the area with the construction and haulage contractors once they are appointed. The road impact assessment will then be revised to reflect the actual routes and transport methods to be used. Specific mitigation measures and strategies to be implemented will be determined at detailed project design.