12. Air quality

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12.1 Introduction

12.1.1 Overview

This chapter examines ambient air quality and assesses the potential air quality impacts resulting from the Lower Fitzroy River Infrastructure Project (Project). Methods by which these impacts can be reduced have been identified. The assessment addresses Part B, Sections 5.118- 5.123 of the terms of reference (ToR) for the environmental impact statement (EIS). A table cross-referencing the ToR requirements is provided in Appendix B. Appropriate management measures relating to air quality are used to inform the environmental management plan (EMP) (Chapter 23).

12.1.2 Approach and methodology

Assessment of existing air quality conditions and the potential air quality impacts associated with the Project involved:

- A review of Bureau of Meteorology (BoM) climate data to provide a basis for determining the rate that air-borne pollutants may disperse
- A review of the existing air quality environment within and surrounding areas
- The identification of potential air quality sensitive receptors in proximity to the Project
- An assessment to identify typical air quality emissions associated with the Project which may be experienced during construction and operation
- The development of proposed mitigation measures to minimise any adverse effects on ambient air quality and sensitive receptors.

Baseline air quality monitoring data does not exist for the Project area and new data has not been collected for this assessment. Given the remote rural nature of the Project area, existing pollutant levels are predicted to be low.

Air quality impacts associated with extraction of materials from borrow and/or quarry areas are not included in this assessment. Assessment of these sites, once confirmed, will be undertaken in preparation for approvals requirements for those facilities.

12.1.3 Regulatory framework

12.1.3.1 Commonwealth

At a national level, the National Environment Protection (Ambient Air Quality) Measure 1998 (Air NEPM) is the statutory instrument defined by the Environment Protection and Heritage Council which sets standards and goals in consultation and with agreement from State governments for the following:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Photochemical oxidants (as ozone) (O_3)
- Sulfur dioxide (SO_2)
- Lead (Pb)
- Particles as PM_{10} and $PM_{2.5}$ (particles of 10 µm and 2.5 µm equivalent aerodynamic diameter or less).

The National Environment Protection (Air Toxics) Measure (Air Toxics NEPM) provides monitoring investigation guidelines, principally for large cities with significant traffic emissions, for five compounds classified as air toxics, namely benzene, benzo(a)pyrene, formaldehyde, toluene and xylenes.

The National Pollutant Inventory (NPI) consists of established national goals to assist in the reduction of existing and potential impacts of emissions of pollutants. Additionally the NPI assists government, industry and the community in achieving the desired environmental outcomes of the NEPMs.

Air quality standards, goals and monitoring investigation levels of indicators specified in the Air NEPM and Air Toxics NEPM have been adopted as air quality objectives in the Queensland Government's Environmental Protection (Air) Policy 2008 (EPP (Air)).

12.1.3.2 State

In Queensland the *Environmental Protection Act 1994* (Qld) and the EPP (Air) provide for the management of the air environment. In particular, the EPP (Air) identifies the environmental values to be enhanced or protected within the State. The EPP (Air) nominates a schedule of maximum ambient pollutant concentrations for various substances. These substances include total suspended particulates (TSP), oxides of nitrogen (NOx), particulates, SO_2, CO, O_3 and Pb. Emissions of pollutants not covered by this policy are covered by the NEPMs described above.

Pollutants considered relevant to air quality impacts during construction of the Project are particulate matter of 10 micron sizing or less (PM_{10}), TSP and dust deposition. Air quality objectives for the Project are based on those presented in Schedule 1 of the EPP (Air) (Table 12-1). Air quality objectives for deposited dust are not defined in the EPP Air. However, a dust deposition nuisance guideline of 120 mg/m^2/day, commonly accepted by the Department of Environment and Heritage Protection (DEHP), has been adopted for the Project. This guideline is based on an approximation of the 4 g/m^2/mth dust deposition rate limit prescribed in the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (Department of Environment and Conservation 2001) with rounding down for a conservative objective.

Table 12-1 Project air quality objectives

Indicator	Environmental value	Air quality objective	Period	Number of allowable exceedances
PM_{10}	Health and wellbeing	50 µg/m^3	24 hour average	5 days per year
TSP	Health and wellbeing	90 µg/m^3	Annual average	-
Dust deposition	Amenity	120 mg/m^2/day	Annual average	-

At a local level, local government planning schemes (as defined prior to local authority amalgamation) also seek to protect and enhance air quality values as follows:

- Rockhampton City Plan 2005: A Desired Environmental Outcome is to minimise *'air quality impacts that cause environmental harm or detrimentally effect residential amenity, by implementing measures to control emissions, whether they be air contaminants such as*

dust and particulate matter or odour emission, or the like, such that they do not extend beyond the boundaries of the site' (p. 2-12)

- Fitzroy Shire Council Planning Scheme 2005: A Desired Environmental Outcome is that *'air quality is maintained or enhanced while allowing for ecologically sustainable development'* (p. 33)
- Duaringa Shire Planning Scheme 2007: A Desired Environmental Outcome is to achieve ecological sustainability by, among other things, maintaining air quality (p. 31)
- Livingstone Shire Planning Scheme 2005 does not specifically address air quality however, a Desired Environmental Outcome is that *'development does not adversely affect: (i) the community's health and safety; or (ii) the amenity enjoyed by people in different areas of the Shire'* (p. 2-1).

12.2 Description of environmental values

12.2.1 Overview

This section defines the existing air quality environment for the assessment and provides a review of:

- Potential sensitive receptors that may be impacted by the Project
- Existing ambient air quality conditions within and surrounding the Project
- Previous monitoring assessments within and surrounding the Project.

Existing ambient air quality refers to the concentration of relevant substances that are already present in the environment. These substances may come from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

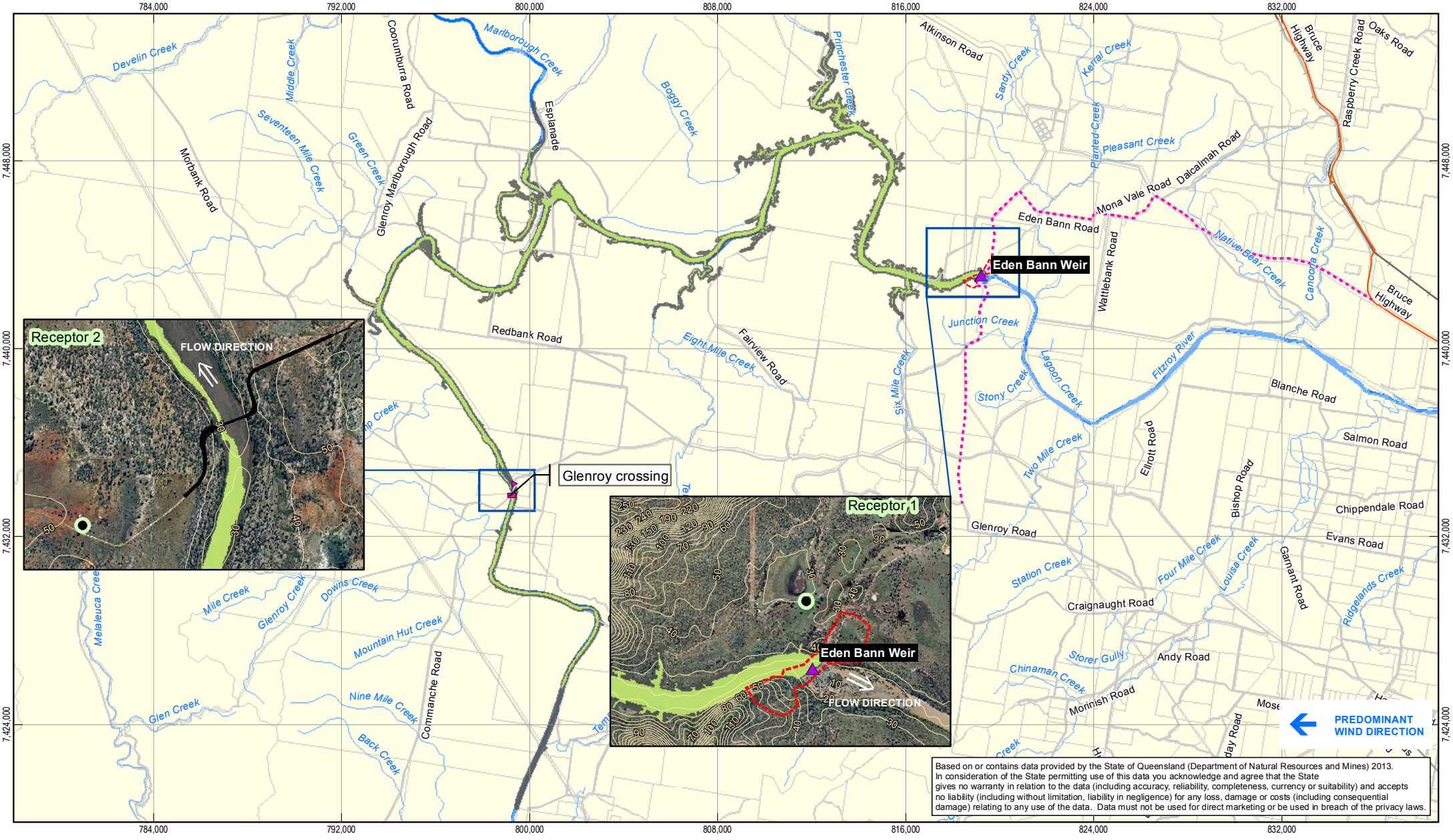
12.2.2 Sensitive receptors

The Project location is rural in nature and relatively isolated and, as a result, there are few sensitive receptors in proximity. The nearest sensitive receptors to construction activities are shown on Figure 12-1 and listed in Table 12-2. There are no sensitive receptors in close proximity to the proposed Rookwood Weir construction area, Hanrahan Crossing or Foleyvale Crossing with the closest homesteads greater than 2 km away. The nearest homestead to the proposed Rookwood Weir is 3.5 km west of the construction area.

There are no sensitive receptors in proximity to the new Eden Bann Weir access road (right bank) with the closest homestead approximately 2 km west of the proposed alignment. The majority of homesteads that occur along existing access roads to the weir sites and river crossings are set back from the road at distances greater than 200 m. Where homesteads exist immediately adjacent to access roads (for example, along Riverslea Road) these sections of the road are sealed.

Construction (and operation) traffic for the proposed Rookwood Weir will exit the Capricorn Highway at Gogango. The Gogango community comprises a small number of residences (less than 10) and a school. Existing access through Gogango comprises bitumen sealed roads.

As a result of construction activities and workplace health and safety requirements, the camping and water reserve area immediately upstream of the proposed Rookwood Weir site will not be accessible during the construction period and is therefore not considered as a sensitive receptor.



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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

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LEGEND

- Weir Location
- Highway
- Major Road
- Waterway
- Property Boundary
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment
- Sensitive Receptor
- River Crossing
- Access Road
- Construction Footprint
- 10m Contours
- Construction Area

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision B
Date 19 Dec 2013

Eden Bann Weir - Air Quality Sensitive Receptors

Figure 12-1 Sheet 1 of 2

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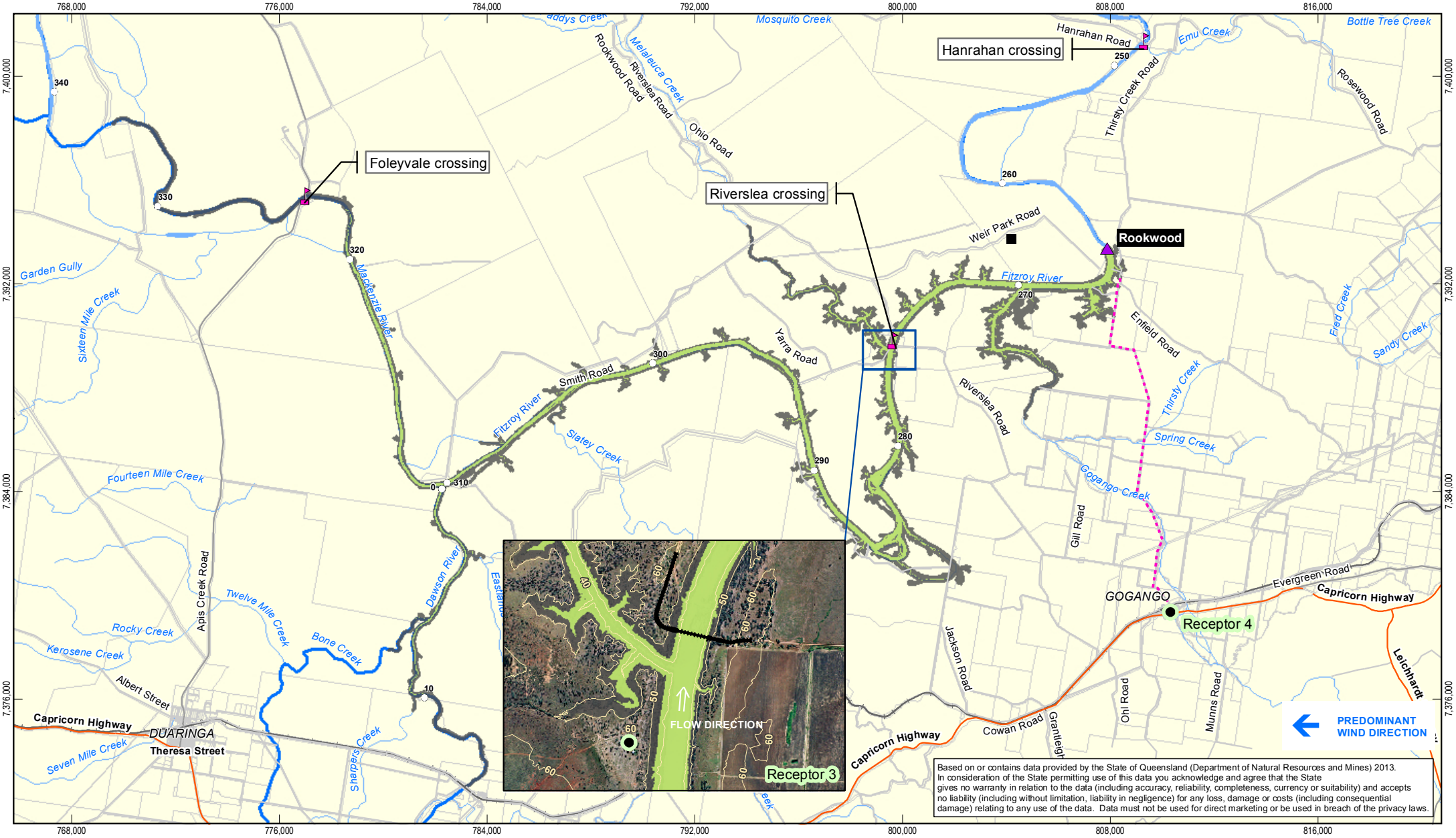
Level 9, 145 Ann Street Brisbane QLD 4000 Australia T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways, Homesteads (2007) © Copyright Commonwealth of Australia; Sunwater: Waterways, Weir Locations - 2008;
DNRM: Railways, Roads, Contours (2010), DCDB (2013); GHD: Construction Footprints (2013), Sensitive Recpetor (2013). Created by: MS *See Appendix for disclaimers and copyrights.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- AMTD (km)
- Weir Location
- Highway
- Major Road
- Railway
- Waterway
- Property Boundary
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Sensitive Receptor
- Homestead
- River Crossing
- Access Road
- Construction Footprint
- 10m Contours

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision A
Date 19 Dec 2013

Rockwood Weir - Air Quality Sensitive Receptors

Figure 12-1 Sheet 2 of 2

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DNRM: Railways, Roads, Contours (2010), DCDB (2013); GHD: Construction Footprints (2013), Sensitive Recpetor (2013). Created by: MS *See Appendix for disclaimers and copyrights.

Table 12-2 Air quality sensitive receptors

Receptor		Nearest construction area/activity	Distance from construction area/activity
No.	Type		
1	Homestead	Eden Bann Weir and existing access road	• 750 m from the existing Eden Bann Weir • 450 m from the existing (and proposed construction) left bank access road
2	Homestead	Glenroy Crossing	700 m
3	Homestead/outbuildings	Riverslea Crossing	700 m
4	Gogango community	Rookwood Weir access and Riverslea Crossing access	<50 m

No onsite accommodation (for example, temporary worker's camp) is proposed at either Eden Bann Weir or Rookwood Weir during construction. However, the onsite construction workforce is considered to be a sensitive receptor for the assessment of human health risk during construction activities.

12.2.3 Meteorological influences

A review of climatic data was conducted to establish the context and dispersion rates of potential pollutants in and around the Project. Wind direction and speed, for example, determines the transportation of an emission, its general dispersion direction and its initial dilution. The climate of the region is described in Chapter 4 Climate, natural hazards and climate change. In summary, the region's climate is:

- Characterised by a humid sub-coastal savannah subtropical climate
- Hot during summer months (November to April) during which the majority of rain falls
- Cooler during winter months with occasional wet but mostly dry periods
- Defined by seasonal irregularity, with long dry spells often followed by intense wet season rainfalls
- South easterly winds dominate in the morning with winds speeds ranging between 7.8 km/h (July) and 14.2 km/h (March). Easterly winds dominate in the afternoon, with monthly wind speeds ranging between 12.7 km/h (July) and 16.5 km/h (January) (BoM 2010).

12.2.4 Existing regional pollution sources

Air pollution sources on a regional scale, ascertained by a search of the NPI, identified that the Rockhampton region's (post code 4700) indicative top pollutant sources for the 2010/2011 reporting period were from:

- Water supply, sewerage and drainage services (ammonia)
- Mineral, metal and chemical wholesaling (toluene, total volatile organic compounds, xylenes)
- Waste treatment, disposal and remediation activities (carbon monoxide and hydrogen sulphide) (DSEWPaC) 2011a).

The largest air pollutant was identified as ammonia (6,400 kg/year) from water supply, sewerage and drainage services, specifically the South Rockhampton Sewage Treatment Plant. This was followed by approximate total emissions of Total Volatile Organic Compounds (VOCs) of 520 kg/yr from mineral, metal and chemical wholesaling (DSEWPaC 2011a).

The NPI search was also conducted for the Ridgelands, Morinish and Glenroy regions (post code 4702), whose post code also encompassed the coal mining towns of Emerald, Blackwater and Moura (DSEWPaC 2011b). This was a broad scale search and while the results are skewed by the influence of coal mining in the region, the influence of Stanwell Power Station on ambient air quality is also evident. Stanwell Power Station is a coal fired power station approximately located 22 km west of Rockhampton, 30 km south of Eden Bann Weir and 30 km east of the proposed Rookwood Weir site. The NPI search identified that the indicative top pollutant sources for the 2010/2011 reporting period were from:

- Electricity generation (24 different substances emitted)
- Coal mining (31 different substances emitted)
- Other non-metallic mineral product manufacturing (23 different substances emitted)
- Sheep, beef cattle and grain farming (8 different substances emitted, primarily ammonia)
- Cement, lime, plaster and concrete product manufacturing (17 different substances emitted)
- Other non-metallic mineral mining and quarrying (53 different substances emitted) (DSEWPaC 2011b).

The largest air pollutant was identified as oxides of nitrogen (approximately 27,750,000 kg/yr) primarily from electricity generation. This was followed by approximate total emissions of PM_{10} µm (approximately 27,440,000 kg/yr) primarily from coal mining. Sulfur dioxide was the third highest air pollutant (approximately 25,000,000 kg/yr) primarily from electricity generation (DSEWPaC 2011b).

12.2.5 Existing local pollution sources

The Project area is remote and rural in nature, not located within or in proximity to industrial, manufacturing or mining zones and are not associated with feedlots of intensive cropping. Land use at both Eden Bann Weir and the proposed Rookwood Weir site comprise broad scale cattle grazing operations. As such the ambient background levels of gaseous pollutants and odours described above is considered to be negligible but the 'natural' dust load is considered to be important for the assessment.

Local anthropogenic sources of air emissions include:

- Dust emissions from cattle grazing operations and associated clearing
- Dust emissions from vehicles travelling on unsealed roads
- Exhaust emissions from vehicles using local roads
- Gases and fine particle emissions from bushfires and controlled burns.

12.2.6 Typical baseline levels

No publically accessible air quality monitoring data is available in proximity to the Project. The DEHP does not conduct air quality monitoring within the Rockhampton area. The closest DEHP

monitoring site is located in Gladstone approximately 130 km southeast of the proposed Rookwood Weir site. The air quality within and surrounding the Project is not anticipated to be significantly impacted by Gladstone's air shed, as such no further analysis of DEHP's air quality monitoring for the Gladstone region is provided.

The background particulate levels adopted for the purposes of this assessment are based on a review of baseline monitoring undertaken for projects in the Bowen Basin. Baseline monitoring for PM_{10} was undertaken in Blackwater (80 km west of the Project footprint) for the Minyango Project EIS (Katestone Environmental Pty Ltd 2013). In addition, the Ensham Central Project EIS reported on a number of dust deposition monitoring sites, one of which showed consistently low deposition rates considered to be representative of places relatively unaffected by coal mining activities (Katestone Environmental Pty Ltd 2006). The latter is considered to appropriately represent background dust deposition rates away from existing mines as experienced within the Project.

Based on the above, typical baseline levels of PM_{10}, TSP and dust deposition rates for the Project area are shown in Table 12-3. To determine background TSP levels, a PM_{10} to TSP ratio of 50 per cent has been adopted (Erbes 1996).

Table 12-3 Typical baseline levels

Indicator	Background value	Period
PM_{10}	20 µg/m^3	24 hour average
TSP	40 µg/m^3	Annual average
Dust deposition	50 mg/m^2/day	Annual average

12.3 Potential impacts and mitigation measures

12.3.1 Overview

This section documents the potential ambient air quality impacts of the Project relative to sensitive receptors within and surrounding the Project area. Measures to mitigate and/or manage potential impacts are described and an assessment is then made of the potential residual impact once these measures have been implemented.

12.3.2 Construction phase impacts and mitigation measures

12.3.2.1 Dust generation and human health risk

Sources of air emissions

Sources of emissions that have the potential to impact ambient air quality as a result of Project construction include:

- Dust emissions from mechanical ground disturbance, excavation of overburden, crushing and screening of aggregate and concrete batching within the construction area
- Dust emissions from construction vehicles travelling over unsealed sections of access roads or localised unconsolidated surfaces
- Dust emissions from exposed disturbed soil surfaces under elevated wind speeds
- Dispersal of blast material and dust releases during blasting

- Emission of NO_x, PM_{10}, VOCs and CO from equipment powered by internal combustion engines.

Emissions associated with motor vehicles, mobile and stationary plant diesel engine exhausts also comprise particulate matter (PM_{10} and $PM_{2.5}$). Engine exhausts include NO_X, CO and trace quantities of SO_2 and VOCs. It is not proposed to establish temporary construction workforce accommodation and no onsite treatment of sewage or water is currently proposed.

Potential impacts

It is not expected that dust generated as a result of construction of the Project will exceed air quality objectives at offsite sensitive receptors. The most intensive dust generating activities during construction will occur at the weir site. Dispersion modelling undertaken for a similar project in the Fitzroy Basin, namely Connors River Dam and Pipelines EIS (SKM 2010), predicted that the 24-hour averaged PM_{10} concentration ranged between 5 and 20 $\mu g/m^3$ within 2.5 km of the dust source. Combined with typical baseline levels, it is estimated that the maximum PM_{10} as a result of the weir construction would be in the order of 40 $\mu g/m^3$. Similarly the annual average dust deposition rate was estimated to range between 5 and 10 mg/m^2/day within 1 km of the dust source. Based on this assessment and combined with typical baseline levels the maximum dust deposition rate associated with the weir construction is estimated at 60 mg/m^2/day, well below the dust deposition guideline value of 120 mg. m^2/day.

Further sensitive receptors in proximity to Eden Bann Weir, Glenroy Crossing and Riverslea Crossing are not located within the path of the predominant prevailing winds and vegetative buffers and topographical features such as higher terrain exist between the construction areas and the sensitive receptors (Figure 12-1).

Dust impacts on sensitive receptors due to vehicle movements along access roads are expected to be negligible as homesteads are either located away from the road or adjacent to sealed sections of the road.

On-site management measures will be implemented to ensure the safety and wellbeing of the workforce (Section 12.3.2.3).

Due to the small scale and transient nature of the construction-related NO_X, CO, SO_2 and VOCs emissions, impacts will be negligible in this regard.

12.3.2.2 Impacts to flora and fauna

Dust emissions have the potential to directly impact flora species and, to a lesser degree, fauna species adjacent to the construction area. Substantial dust deposition on leaves can reduce the photosynthetic quality of the flora, impede plant growth and affect grazing productivity. Such an impact, if large enough, could degrade the health of the flora (native or pasture related). This in turn may reduce food resources for fauna communities.

There are currently no national or international objectives or standards set for the protection of non-human receptors from impacts associated with particulate emissions, such as the protection of agriculture or the health and biodiversity of ecosystems (including for natural, semi-natural or uncultivated areas). An environmental review was undertaken by Connell Hatch (2008) on the impacts of coal dust on flora and fauna, crops and livestock and it was determined that air quality objectives or standards to protect human health and amenity, such as the objectives stated in the Air EPP, were sufficient for the protection of flora, fauna, crops and livestock against dust impacts.

Dust deposition is unlikely to adversely impact on native flora and fauna within the surrounding area given the low deposition rates, short term nature of construction activities and mitigation measures proposed.

12.3.2.3 Mitigation and management measures

Dust generated by construction activities has a limited potential to impact air quality at sensitive receptors within the immediate vicinity of the weir construction areas, crossings and access roads. Nevertheless, measures to mitigate the generation of dust emissions are proposed and used to inform the EMP (Chapter 23):

- Consideration is to be given to climatic conditions during construction (for example avoid high dust generating activities during windy conditions)
- Areas of cleared and exposed soil are to be minimised
- Exposed soils are to be stabilised and/or rehabilitated as soon as possible
- As far as practicable, stockpiles are to be covered or dampened when windy weather is forecast
- Traffic on unsealed roads is to be minimised to reduce dust potential, for example the use of buses to transport workers to and from the site rather than individual transport
- Employ a water truck or similar onsite (where practical) and along access roads (where appropriate) to control dust with water spray
- Cover and/or dampen loads during haulage
- Enforce low speed limits during construction and reduce vehicle access to essential construction vehicles only.

Other measures to mitigate and manage impacts include:

- Regularly maintain all construction equipment and machinery to ensure efficient operation
- Where appropriate, turn off or throttle down all construction equipment and machinery when not in use
- Store paints, thinners, solvents and other volatile organic substances in sealed containers to prevent discharge of compounds to the atmosphere
- Use blasting mats to prevent excessive dispersal of blast material and to reduce dust releases.
- A complaint based hotline will be established along with a complaints handling procedure
- If complaints are received they will be investigated and air quality monitoring undertaken as appropriate to assist quick resolution.

In addition to the above measures, workplace health and safety measures will be implemented such that the onsite workforce is not adversely impacted by reduced air quality during construction activities. This will include personal protective equipment being made be available on site and training provided to personnel in appropriate use.

The mitigation measures proposed above have been incorporated into Chapter 23 EMP. During detailed design and on appointment of the construction contractor, the construction EMP will include a dust management plan. Implementation of the above mitigation measures will adequately manage impacts on ambient air quality and potential health risks associated with construction of the Project.

12.3.3 Operational phase impacts and mitigation measures

During operations potential impacts on air quality are largely limited to vehicles travelling to and from the site for maintenance purposes. Fishways and gates are hydraulically operated by motor drives housed within a control room. A standby diesel generator may be used during operations in emergency situations. Vehicle movements are not anticipated to be more than a few times a week and largely comprise a 4WD utility. Emergency situations during operations are predicted to be rare and of short-duration. The impacts of the resultant minor emissions of NOx, PM_{10}, VOCs and CO are considered negligible.

12.4 Summary

This chapter documents the potential impacts to ambient air quality which may arise as a result of the Project. The Project areas are remote and rural in nature with land use dominated by broad scale clearing to support cattle grazing. Sensitive receptors have been identified at Eden Bann Weir, Glenroy Crossing, Riverslea Crossing and Gogango. Flora and fauna habitat in close proximity to the construction areas has also been considered. During construction, localised dust impacts are anticipated at each weir site, river crossings and along access roads. Management and mitigation measures are proposed and incorporated into the Project EMP (and subsequent Construction EMP) to minimise these impacts and achieve air quality objectives. Potential dust emissions associated with operations are likely to be negligible.