Part D

Other environmental issues

20 Management of other environmental issues

This chapter considers a number of other issues that have not been identified in the environmental assessment requirements issued by the Director-General of the Department of Planning as key issues. However, they are issues that have been raised as matters of concern in the course of community consultation during project development or have been identified by the project team. As the environmental risk assessment in Chapter 9 has found that these issues do not pose substantial environmental risk, the level of assessment is less detailed than undertaken in the preceding impact assessment chapters.

20.1 Air quality

20.1.1 Existing air quality

The Pacific Highway between Sapphire and Woolgoolga is a two-way, two-lane road with overtaking lanes approximately every five kilometres. The estimated annual average daily traffic volumes (2006) within the study area range from approximately 20,500 vehicles south of Headlands Road at Sapphire, to approximately 11,000 vehicles between River Street and Clarence Street in Woolgoolga. These estimates indicate the typical level of traffic using the road on an average day. In practice, considerable variation in traffic volumes occur, due to the high tourism activity in the study area and broader region, with traffic volumes higher during school holidays and on long weekends.

In order to provide an estimate of the existing air quality in the study area, a monitoring station was established at Korora to monitor the ambient air quality from October 2005 to January 2006 (refer Air Quality Monitoring Report, working paper 8, Appendix F). The station was located on the northern side of the Korora Rural Fire Service shed, immediately to the west of the Pacific Highway, approximately 500 metres from the southern end of the Proposal. To the west of the monitoring station site is Korora Nature Reserve, while Korora Public School and urban residential development extend east from the Pacific Highway.

The posted travel speed on the highway adjacent to the monitoring site is 100 km/h and the annual average daily traffic volume in 2006, around the time of monitoring was approximately 19,700. The monitoring station was set up to monitor a likely "worst case" operational air quality situation. The station was situated approximately 20 metres from a four lane section of the highway that has a gradient of 5.2 per cent with southbound climbing lanes. Monitoring was conducted over the peak traffic period that coincides with the Christmas holidays from November to January.

The air quality station was equipped to monitor the following air quality and meteorological parameters:

- Carbon monoxide (CO).
- Oxides of nitrogen (NO_x).
- Nitrogen dioxide (NO_2).
- Nitrogen monoxide (NO).
- Particulate matter less than 10 microns in diameter (PM_{10}).
- Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).
- Wind speed.
- Wind direction.
- Air temperature.
- Relative humidity.

Due to the proximity of the monitoring site to the existing highway, the concentrations of air quality parameters measured are inclusive of vehicle emissions. Therefore, the concentrations detected are likely to be substantially higher than the ground level exposure for the local area, and provide a worst case scenario of ambient air quality in the area.

Current Australian air quality standards

In setting air quality goals for NSW, the Department of Environment and Climate Change (formerly the Environment Protection Authority) has adopted the National Environment Protection Council of Australia's air quality standards, which are part of the National Environment Protection Measures. While goals have been established for carbon monoxide, nitrogen dioxide and PM_{10}, advisory reporting goals only have been identified for $PM_{2.5}$. Table 20.1 identifies the maximum concentrations detected during the monitoring period and compares the readings with the maximum National Environment Protection Measures recommendations.

TABLE 20.1 KORORA AIR QUALITY MONITORING RESULTS

POLLUTANT	AVERAGING PERIOD	NEPM GOALS		KORORA MONITORING RESULTS		
		Maximum Concentration	Goal within 10 years (Maximum Allowable Exceedence)	Maximum Recorded Concentration	Recorded 90th percentile Concentration	Average Recorded Concentration
National Standards and Goals for Ambient Air Quality						
CO	8 hrs	9.0 ppm (10 mg/m³)	1 day a year	0.2 ppm (0.3 mg/m³)	0.07 ppm (0.08 mg/m³)	0.03 ppm (0.04 mg/m³)
NO_2	1 hr	0.12 ppm (246 µg/m³)	1 day a year	0.037 ppm (69.6 µg/m³)	0.010 ppm (18.81 µg/m³)	0.004 ppm (9.2 µg/m³)
Particles as PM_{10}	1 day	50 µg/m³	5 days a year	37.8 µg/m³	29.8 µg/m³	20.3 µg/m³
Advisory Reporting Goals						
Particles as $PM_{2.5}$	1 day	25 µg/m³	Goal is to gather sufficient data nationally to facilitate a review of the goal	15.4 µg/m³	10.8 µg/m³	7.7 µg/m³

Air quality at Korora

Results obtained from the Korora monitoring station were as follows:

- The maximum 8-hour average carbon monoxide concentration was 0.3 milligrams per cubic metre, compared with the goal of 10 milligrams per cubic metre.
- The maximum 1-hour average nitrogen dioxide concentration was 69.6 micrograms per cubic metre compared with the goal of 246 micrograms per cubic metre.
- The maximum 24-hour average PM_{10} concentration was 37.8 micrograms per cubic metre compared with the goal of 50 micrograms per cubic metre.

The monitoring results indicate that immediately adjacent to the highway, the peak readings, and the commonly used 90^{th} percentile readings, of the regulated emissions were all considerably less than the air quality goals specified in the National Environment Protection Measures.

The highest emission readings generally occurred during holiday periods or at night. On occasions these higher readings could have been influenced by:

- Traffic on the unsealed access track next to the highway.
- Activity around the Rural Fire Service shed.
- Bush fires in the district.

The non-regulated $PM_{2.5}$ was also measured and levels peaked at 15.4 micrograms per cubic metre, compared to the advisory National Environmental Protection Measure reporting goal of 25 micrograms per cubic metre.

The National Environment Protection Measure goals are ambient air quality goals that are intended to be applied at locations away from the influence of significant emission sources. Dispersion would reduce the pollutant levels significantly as the distance from the road increases. For example, compared with the levels measured at 20 metres from the highway (Table 20.1), levels 100 metres from the highway would be closer to ambient levels and would be approximately one tenth of the levels provided in Table 20.1.

As the Proposal is predicted to carry less vehicle traffic than at Korora (volumes reduce with distance north from Coffs Harbour), and have a lower grade than the Korora stretch of highway (maximum grade to be four percent), it is anticipated that during operation, the Proposal would also comply with the National Environment Protection Measure goals.

20.1.2 Potential impact of the Proposal on air quality

Construction phase

Air emissions during the construction of the proposed upgrade would generally comprise dust and vehicular emissions. Dust would be generated as a result of various construction phase activities including:

- Clearing of vegetation and moving topsoil.
- Earthworks including embankments and cuttings.
- Wind erosion of stockpiles and unsealed haul roads and light vehicle access tracks.

Typically large particulate matter emitted into the air would return to the surface closer to the emission source than smaller particulates. Soils within the study area are discussed in Chapter 18 and vary in type and structure size depending on their proximity to the coast. As part of the geotechnical investigations on the preferred route, the majority of the material sampled along the route was classified as slightly dispersive. There is a correlation between the level of dispersion and soil structure, with a highly dispersive soil type typically having a smaller soil particle size and vice versa. Therefore, the majority of the soils that would be exposed during construction would have a larger particle size and pose less of an air quality risk.

The dust levels (total suspended particulates) experienced on any given construction day would relate to the extent of earthmoving activities (including blasting) being undertaken and the area of soil exposed at any one time. Levels of particulate matter are not anticipated to be excessive with the introduction of management measures and are not expected to result in reduced local air quality at the nearest residences.

Consideration of greenhouse gases emitted during the construction process is discussed in Section 20.2.1.

Operation phase

Predicted annual average daily traffic volumes, including heavy vehicle traffic for Proposal and the proposed local access road network were presented in Chapter 10. The predictions indicate that twenty years after the estimated opening of the Proposal (2031), the total annual average daily traffic volume would be almost double that of the 2006 traffic volume along the existing highway (approximately 20,000 in 2006 and approximately 40,000 in 2031). The primary reasons for this increase in traffic local property and land use changes as well as increases in through traffic. The volume of heavy vehicle traffic at 2031 along the same section is expected to be more than twice that of the 2006 heavy vehicle traffic flow (approximately 2350 in 2006 and 4700 in 2031).

The projected increase in vehicle traffic volumes would be offset to a point by the continual improvement in average emission performance of vehicles, with newer more efficient vehicles replacing older less efficient vehicles (DOTARS 2003). Emissions would also be reduced due to more efficient traffic movement (reduced travel times) and less traffic congestion at certain times.

Vehicle emission controls were introduced in the early 1970s and emission limits have been progressively tightened over the past 30 years. These controls have resulted, particularly over the last 10 years, in improvements in a number of air quality indicators and it is accepted that vehicles meeting tighter emission standards have played a major part in the improvement.

The Australian design rules are the principal measure for reducing vehicle emission through the introduction of tighter emission standards of new vehicles. Table 20.2 outlines the exhaust emission standards applicable to 2005 / 2006 model petrol passenger cars, as well as those supplied to the market up to 2010.

TABLE 20.2 SUMMARY OF PETROL PASSENGER CAR EMISSION REQUIREMENTS TO 2010

DATE INTRODUCED[1]	EXHAUST EMISSION LIMITS (PETROL VEHICLES)	
	CO (g/km)	NO_X (g/km)
01/01/05 – 01/01/06	2.3	0.15
01/07/08 – 01/07/10	1.0	0.08

[1] First date applies to vehicle models first produced on or after that date, with all new vehicles required to comply by the second date.

Heavy vehicles are also subject to emissions controls in relation to carbon monoxide, oxides of nitrogen and particulate matter. Table 20.3 provides a summary of the emission standards applicable to diesel heavy vehicles for several time periods. This demonstrates a clear reduction over time, particularly for particulate matter which is expected to have a five-fold decrease by 2011, compared to the 2002 limits.

Research by the Bureau of Transport and Regional Economics (2003) has indicated that total vehicle fleet emissions are generally expected to decline steadily over the next 20 years. This has been calculated on base case assumptions concerning future vehicle travel demand, fuel efficiency, vehicle design, fuel standards and vehicle fleet emission characteristics. The research was based

TABLE 20.3 SUMMARY OF EMISSION REQUIREMENTS FOR DIESEL HEAVY VEHICLES TO 2011

DATE INTRODUCED	EMISSION LIMITS OF SOURCE STANDARD		
	CO (g/kWh)	NO_X (g/kWh)	PM (g/kWh)
01/01/02 - 01/01/03	2.1 (ESC limit) 5.45 (ETC limit)	0.66 (ESC limit) 0.78 (ETC limit)	0.10 (ESC limit) 0.16 (ETC limit)
01/01/07 - 01/01/08	1.5 (ESC limit) 4.0 (ETC limit)	0.46 (ESC limit) 0.55 (ETC limit)	0.02 (ESC limit) 0.03 (ETC limit)
01/01/10 - 01/01/11	1.5 (ESC limit) 4.0 (ETC limit)	0.46 (ESC limit) 0.55 (ETC limit)	0.02 (ESC limit) 0.03 (ETC limit)

ESC limit: European stationary cycle limit, ETC limit:European transient cycle limit.

on vehicle emissions within the eight capital cities of Australia. While the Proposal is not within a metropolitan area, the research is still applicable as the proportion of the heavy vehicle traffic to passenger vehicles is comparable. The research had the following conclusions:

- Metropolitan emissions of carbon monoxide are projected to decline by around 38 per cent by 2020.
- Projected emissions of nitrogen dioxide are expected to decline less than carbon monoxide emissions – decreasing by around 23 per cent between 2000 and 2020.
- Projections for metropolitan emissions of particulate matter from motor vehicle exhausts (for all particle sizes) do not exhibit the declines evident for other major pollutants. The base case projections remain essentially stable over the projection period.
- Emissions of particulate matter from heavy vehicles should decline substantially following the introduction of the above future vehicle design and fuel standards. However, as petrol car particulate matter emissions are unregulated in the new standards, they are assumed to not exhibit emission rate declines of the magnitudes forecast for diesel vehicles.
- Particulate matter projections pose the greatest uncertainty as there has been very limited vehicle testing for such emissions compared with testing undertaken for carbon monoxide, oxides of nitrogen and volatile organic compounds.

In addition to improved vehicle efficiency and design, air quality is also a function of traffic flow conditions, vehicle speed, meteorological conditions and existing background air quality levels. The level of service of a road relates to the efficiency of traffic flow on them. The traffic assessment presented in Chapter 10 indicates that current traffic flow performance is generally unacceptable along the upgrade section and marginally acceptable through Woolgoolga. Intersection performance is defined as acceptable, having a level of service "C" or better. The Proposal would substantially improve highway and intersection performance and therefore traffic flow and efficiency. This would result in improved air quality through vehicle emission reductions compared to the future existing position without the Proposal.

Further air quality improvements would be expected with higher posted travel speeds. The current posted travel speeds along the existing highway vary form 60 km/h to 100 km/h. The horizontal and vertical alignment of the Proposal would allow for a design speed of up to 110 km/h, further improving vehicle efficiency and reducing vehicle emissions compared to the future existing position without the Proposal.

Potential impacts of vehicle emissions on rainwater tanks

Concern was raised during the consultation process for the development of the Proposal regarding the potential effect of vehicle emissions, in particular diesel particles, on the quality of water in rainwater tanks at adjacent residences.

The Commonwealth Department of Health and Ageing (2004) considers that in most parts of Australia, industrial and vehicle emissions are unlikely to cause significant impacts on the quality of rainwater collected in domestic tanks.

Studies of water quality from rainwater tanks have examined a range of parameters including a variety of metals, nitrate / nitrite, sulfate, combustion products and pesticides. However, it should be noted that the amount and quality of data on individual contaminants is variable (Sinclair et al 2005). Overall, the data suggests that levels of these contaminants are unlikely to exceed the Australian drinking water guidelines.

A study undertaken in Maryville and Charlestown in the Newcastle region has some relevance in considering potential risks associated with the Proposal. The study examined two residences located adjacent to the Pacific Highway, both with 9000 litre residential rainwater tanks (Coombes et al 2000). Traffic volumes (axle pairs) in 2004 at the two sites were 22,500 (Maryville) and 32,000 (Charlestown). Both sites were also close to an industrial area. These traffic volumes are broadly comparable to the volumes predicted for the upgrade section of the Proposal, but larger than the volume predicted to use the bypass section. Water quality in the tank at both sites in the Newcastle study, apart from pH, was compliant with Australian drinking water guidelines. A summary of the water quality parameters examined in the study that relate to possible vehicle emissions are shown in Table 20.4.

TABLE 20.4 WATER QUALITY FROM RAINWATER TANKS AT CHARLESTOWN AND MARYVILLE

PARAMETER	UNIT	AVERAGE	MAXIMUM	GUIDELINE LIMIT
Dissolved solids	mg/L	105.00	112.00	500
Suspended solids	mg/L	97.55	178.00	500
Nitrate	mg/L	0.05	0.05	3
Nitrite	mg/L	1.30	1.50	50
Sulfate	mg/L	2.16	3.90	250
pH		6.06	6.51	6.5 to 8.5

20.1.3 Proposed management measures

Based on the desk top air quality assessment, the mitigation measures identified in the draft Statement of Commitments (Appendix A) are confirmed. These are:

(i) Potential dust sources and dust suppression measures will be identified in consultation with the Department of Environment and Climate Change.

(ii) Baseline dust deposition monitoring will be undertaken and dust deposition gauges installed at sensitive locations to determine the effectiveness of dust suppression measures.

20.2 Greenhouse gases

Greenhouse gases affect the balance between the incoming solar energy and losses owing to the radiation from the earth and atmosphere. One of the important factors in determining the amount of radiant energy absorbed in the atmosphere is the concentration of carbon dioxide. Changes in this concentration are likely to cause changes in the temperature of the atmosphere near the earth's surface. Increases in carbon dioxide concentrations are expected to cause increases in temperature.

Greenhouse gas emissions from road transport include carbon dioxide, methane, nitrous oxide, and fluorocarbon species. The photo-chemically important gases (non-methane volatile organic compounds), nitrogen monoxide and carbon monoxide are not direct greenhouse gases, however, they contribute indirectly to the greenhouse effect by influencing the rate at which ozone and other greenhouse gases are produced and destroyed in the atmosphere. There are no specific limits on direct greenhouse gas emissions, with only ozone listed in the suite of National Environmental Protection Measures (Table 20.5).

TABLE 20.5 NATIONAL ENVIRONMENTAL PROTECTION MEASURES

POLLUTANT MEASURES	AVERAGE PERIOD	MAXIMUM CONCENTRATIONS
Photochemical oxidants	1 hour	0.10 ppm[1]
(as ozone)	4 hours	0.08 ppm

[1] Parts per million

In 1990, approximately 11 per cent of the total greenhouse gas emissions in NSW are estimated to be attributable to the transport sector, with this percentage increasing to 15 per cent in 2005 (Department of Environment and Water Resources 2007).

It is estimated, based on current traffic volumes, fuel mix (petrol, diesel and gas), proportion of heavy vehicles and current level of service, that the 25 kilometre stretch of the highway within the study area produces approximately 40 kilo-tonnes of carbon dioxide equivalents.

20.2.1 Potential impact of the Proposal relating to greenhouse gases

Construction phase

The total volume of greenhouse gases emitted during the construction process would depend largely on the quantity of energy consumed during construction, in particular fuel consumption for both construction plant and light vehicles. Another source of energy that would be used is electricity for site compounds (computers, lights etc.). The greenhouse gases emitted during the construction process are unable to be accurately assessed until detailed construction methods have been determined.

The main sources of greenhouse gas emissions are likely to include material production (bitumen, concrete and steel), transport of materials to the site and construction equipment fuel consumption. The removal of vegetation would, to a minor extent, also affect the ability of the surrounding environment to absorb greenhouse gases emitted during construction.

Specific construction methods can only be determined when the detailed design has been completed. Therefore, an estimate of fuel consumption has been made for construction based on the concept design developed for the Proposal. A comparison can be made with estimates from other major road construction projects (Joint EAPA / Eurobitume Industry Report, March 2004) and this indicates that about 2.3 kilo-tonnes of carbon dioxide equivalents would be emitted per kilometre of highway (13 metres wide). Based on a 25 kilometre project length, it is estimated that about 60 kilo-tonnes of carbon dioxide equivalents would be produced during construction. This compares to current emissions during operations of 40 kilo-tonnes of carbon dioxide equivalents.

With respect to removal of vegetation and assuming uniformly dense vegetation up to a maximum of 73 hectares to be cleared and reused (without energy recovery), the release of carbon dioxide is expected to be in the order of 44 kilo-tonnes of carbon dioxide.

Operation phase

There are a number of factors which impact on greenhouse gas emissions during the operation phase of any project. These factors include fuel consumption, traffic volume, vehicle type mix and fuel energy density. Fuel consumption is largely dependent on vehicle speed, with the optimum speed for fuel efficiency for both passenger vehicles and trucks, being approximately 80 km/h. Fuel consumption for vehicles has been carried out by utilising the Australian Greenhouse Office *Factors and Methods Workbook*, and is provided in Table 20.6. The figures presented are only approximate as the driving cycle used to generate them is not known.

TABLE 20.6 TYPICAL FUEL CONSUMPTION PER VEHICLE TYPE

CLASSIFICATION	FUEL CONSUMPTION (L/100km)[1]		
	PETROL	DIESEL	LPG
Cars	10.7	13.9	16.3
Light goods vehicles	12.2	12.2	15.8
Heavy goods vehicles – Rigid	17.1	28.3	24.6
Heavy goods vehicles – Articulated	51	54.2	50.0
Buses	14	27.6	49.3
Motorcycles	5.7	6.0	8.0

[1] Litres per 100 kilometres (based on statistics presented in the Australian Greenhouse Office {2006} *Factors Method Workbook*).

Pavement type and condition is important to vehicle fuel efficiency, with various studies showing differing fuel savings relating to differing pavement types. Efficiency improvements in one study were calculated at 20 per cent for heavy goods vehicles when driving on a concrete versus asphalt pavement (Zaniewski 1989). Other studies identify improvements of between 6 per cent and 11 per cent (National Research Council of Canada 2000) depending on the surface of the road (structure, roughness), truck speed and temperature. The traffic volume and the level of service also impact on fuel efficiency, with the existing highway at a level of service of "C" or "D" depending on mid block location (refer Appendix A of working paper 1, for level of service definitions) which is regarded as unacceptable. By 2011 the future existing level of service (without the introduction of the Proposal) is expected to be typically 'D" while by 2031 it would be typically "F" (refer working paper 1, Appendix F).

The vehicle mix and fuel composition are also significant factors which contribute to greenhouse gas emissions during the operation phase. It was assumed that approximately 70 per cent of vehicles would be petrol passenger type vehicles, while the remaining 30 per cent would be heavy diesel type vehicles.

Emission results are generally given in terms of carbon dioxide (CO_2) equivalent direct emissions – i.e. weighted totals (relative to an equivalent mass of carbon dioxide) which only include gases that directly give off radiation, being carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), and do not include the indirect effects of gases such as carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs).

The energy density (Mega Joules per litre) and emission factors (grams of carbon dioxide equivalents per Mega Joule or kilograms of carbon dioxide equivalents per litre) may be used to estimate greenhouse gas emissions to the environment, and these are listed in Table 20.7.

TABLE 20.7 ENERGY DENSITY AND EMISSION FACTORS FOR FUELS

CLASSIFICATION	PETROL	DIESEL	LPG
Energy density (MJ/L)	34	38.6	25.7
Emission factor (g CO_{2-e}/MJ)	67	70	60
Emission factor (kg CO_{2-e}/L)	2.5	2.7	1.6

By combining the figures in Table 20.7 with vehicle mix and expected traffic volumes, it is possible to determine expected greenhouse gas emissions from the Proposal.

Modelled greenhouse gas emissions are expected to drop below the predicted existing highway greenhouse gas emissions by approximately 2025. However after 2025, greenhouse gas emissions from the existing highway with no upgrade are modelled to climb rapidly, while the greenhouse gas emissions for the upgrade climb at a less aggressive rate. Table 20.8 shows the estimated greenhouse gas emissions per year, for both the future existing (base case) and the Proposal, and assumes the Proposal is operational in 2012. Emissions shown in Table 20.8 do not include those during construction.

TABLE 20.8 COMPARISON OF GREENHOUSE GAS EMISSIONS WITH AND WITHOUT THE PROPOSAL

YEAR	FUTURE EXISTING (BASE CASE)[1]	PROPOSAL[1]
2006	38	Not applicable
2011	47	49
2012	47	50
2013	49	51
2021	61	62
2025	68	68
2031	82	79

[1] Greenhouse gas emissions in kilo-tonnes (rounded to nearest kilo-tonne)

20.2.2 Proposed management measures

The following commitments have been identified (refer Appendix A) to mitigate identified greenhouse gas impacts and minimise energy consumption:

(i) Energy efficient work practices will be adopted to limit energy use. Measures will include conducting awareness programs for all site personnel regarding energy conservation methods and conducting energy audits during the project to identify and address energy waste.

(ii) Plant and office-based equipment (including lights and computers) will be operated in an efficient manner and regularly maintained. If economically available, electrical energy derived from a renewable energy source accredited by the National Green Power Accreditation Steering Group (or equivalent) will be used for the supply of at least 50 per cent of the on-site electrical energy required during construction.

(iii) The energy saving measures implemented will be monitored to determine their effectiveness.

20.3 Contaminated land

20.3.1 Existing environment

A Phase 1 Contamination Assessment (Connell Wagner 2005) was undertaken to identify potential contaminant sources in the vicinity of the preferred route that may have resulted from current and historical land use activities. A Phase 1 Contamination Assessment consists of a preliminary desktop study which identifies the potential for ground contamination within a defined (study) area and the nature of likely contaminants to be encountered during detailed design, construction and operation.

The conclusions of the Phase 1 assessment undertaken for the Proposal were as follows:

- Approximately 14 operational banana plantations which occupy approximately 136 hectares were identified as potentially contaminated areas within the proposed corridor. The potential contaminants of concern for banana plantations include metals (arsenic and lead), and pesticides and herbicides including DDT (dichlorodiphenyltrichloroethane), aldrin and dieldrin. It was recommended that these sites be further investigated primarily for the purposes of materials classification in accordance with the requirements of the then Environment Protection Authority (1999) *Environmental Guidelines – Assessment, Classification and Management of Liquid and non-liquid Waste*. Two sheds within the undisturbed banana plantation sites were identified as potentially contaminated areas. These source areas were also recommended for further investigation for materials classification.

- Approximately eight properties (former banana plantations) were identified as potentially contaminated areas within the proposed road corridor. The zoning of the former banana plantation sites changed to a residential land use prior to commencement of investigations. As such, no investigation (subsequent to the Phase 1 desktop investigation) of these sites was proposed as the change to residential land use would require the land to be validated in accordance with Department of Planning requirements and the requirements of the *National Environment Protection Measure Health Investigation Levels for Residential Development*.
- One mixed-use nursery site, one landscaping business and one service station were identified as potentially contaminated areas within the corridor.
- Based on the findings of assessment and an understanding of the proposed construction activities (refer Chapter 8), the overall likelihood of contamination being encountered during construction was considered to be moderate to high. The areas of key concern were identified as the current banana plantation sites, the service station and the nursery.

The Phase 1 desktop investigation concluded that there was a moderate to high potential to encounter contamination within the Proposal corridor. Consequently, a Phase 2 limited soil investigation (Connell Wagner 2006) involving field sampling and laboratory analysis was commissioned for the Proposal. The purpose of the Phase 2 assessment was to:

- Identify the presence of any potential contaminants of concern in soil at targeted areas along the proposed alignment.
- Assess the results in accordance with the (then) Environment Protection Authority (1997) *Guidelines for Assessing Banana Plantation Sites Human Health Investigation Thresholds for the Primary Contaminants in Banana lands* and the National Environment Protection Council (1999) *Assessment of Site Contamination Measure Health Investigation Level 'F' for Commercial / Industrial Land use*.
- Classify the sampled material in accordance with the (then) Environment Protection Authority (1999) *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* for soil management purposes.

The information collected during the Phase 2 investigation was intended to provide preliminary background information to enable an assessment of exposure risks to human health and the environment and the management of contaminated material at the targeted banana plantation sites during the construction phase of the Proposal should it be approved.

The Phase 2 assessment was limited to targeted areas within the Proposal corridor, based on the assumption that all banana plantation property owners have adopted the same land use practices. One "hotspot", where visual observation indicated the potential for contamination, was also sampled. The sampling frequency adopted for the investigation was designed with reference to the (then) Environment Protection Authority (1997) *Guidelines for Assessing Banana Plantation Sites* and is outlined below:

- Sixteen sampling points per hectare for the undisturbed sites.
- Four sampling points per "hotspot" (ie. sheds, mixing areas, etc) on undisturbed sites.

The Phase 2 soil investigation was limited to collection and analysis of near surface soil (approximately top 10 centimetres) in which most contamination associated with banana plantations is expected to exist. It is considered unlikely that further contamination would exist at greater depths within the banana plantation sites. However, potential exists for additional areas of contamination or 'hotspots' to be present, particularly within the banana plantation sites and at the service station, (operational) nursery and landscaping businesses, which were not assessed as part of the limited Phase 2 investigation.

Based on the results of the limited Phase 2 investigation, contaminant concentrations in all soil samples analysed were reported to be below the adopted site assessment criteria. Adopted site assessment criteria were in the (then) Environmental Protection Authority (1997) *Guidelines for Assessing Banana Plantation Sites Human Health Investigation Thresholds for the Primary Contaminants in Banana lands* and the National Environment Protection Council (1999) *Assessment of Site Contamination Measure Health Investigation Level 'F' for Commercial / Industrial Land use*. This investigation targeted a limited number (four) of the banana plantation sites that would be directly affected by the Proposal. Based on the assumption that all banana plantation property owners have adopted the same land use practices, it is considered that the handling of the soil along the Proposal generally presents a low risk to human health and to the environment.

The soil material sampled at the four banana plantation sites has been classified as 'inert waste' in accordance with the (then) Environment Protection Authority (1999) *Environmental Guidelines – Assessment, Classification and Management of Liquid and non-liquid Waste*. Based on the findings of the Phase 2 investigations, excavated material from these four sites could be disposed of as "inert waste".

20.3.2 Potential impacts of the Proposal

Based on the extent of the Phase 2 limited investigation, the potential risks to human health and to the environment as a result of encountering any contamination during the construction phase is expected to be low. However, a number of potential "hotspots" have been identified, including banana plantations, nurseries and the frontage to an existing service station.

Based on the extent of the Phase 2 limited investigations undertaken, the material encountered at the (four) targeted sites is considered suitable for reuse for the purposes of constructing a road due to its "inert waste" classification. The classification of the excavated material along the remainder of the proposed alignment would be determined as part of further targeted investigations during the detailed design phase.

Taking these findings into consideration, additional management measures have been identified and are described in Section 20.3.3.

20.3.3 Proposed management measures

The following commitments have been identified (refer Appendix A) to manage identified contaminated soil impacts:

(i) Areas of potential soil contamination will be identified, investigated and appropriately managed.

(ii) If contamination is found to pose unacceptable risk to either the environment or human health receptors a remedial action plan will be developed and remediation works will be undertaken.

20.4 Energy and waste

20.4.1 Energy

Energy consumption

Energy would be consumed during the construction process from a range of sources and activities including:

- Procurement and delivery of materials to the site.
- Site establishment, including compound set-up.
- Relocation and protection of services.
- Earthworks including cuttings and retaining walls.
- Construction of bridges, including additional road bridge spans and underpasses.
- Construction of drainage structures including culverts.

Construction plant and equipment would be selected by the appointed contractor. The duration of use of the plant and equipment would depend on the specific conditions encountered. It is estimated that construction would be completed over a period of approximately 36 months.

During construction, the main electricity consumption would be power supply for construction compounds to provide electricity for air conditioning, operation of office equipment etc and external lighting during occasional night-time works.

Excluding road user energy use, it is not expected that there would be substantial energy consumption requirements during operation compared with the construction phase, with small amounts of energy required to carry out regular maintenance activities.

Energy saving measures

Energy saving measures would be employed during construction and are outlined in Section 20.2.2 above.

20.4.2 Waste

This section details the potential waste generation impacts and mitigation measures from activities related to the construction and operation of the proposed project.

Waste Streams

The main waste streams during construction are likely to include:

- Demolition wastes from any existing structures to be demolished including bridges, pipe work, shrubs / trees, pavements and concrete pathways.
- Excavation wastes are minimised as the Proposal has been designed with an approximate cut / fill balance. After further geotechnical investigations at the detailed design stage, some sub soil may require removal and replacement due to engineering unsuitability, but this is not anticipated to generate a significant waste stream.
- Packaging materials associated with items delivered to site such as pallets, crates, cartons, plastics and wrapping materials, all of which need to be disposed of once the product has been utilised. Minimisation of packaging of raw products will be strongly encouraged.
- Wastes would be generated from maintenance of various heavy construction equipment including liquid hazardous wastes from cleaning, repairing and maintenance. Likewise leakage or spillage of fuels / oils during construction would need to be managed and disposed of appropriately.

- Non-hazardous liquid wastes would be generated through the use of workers' facilities such as toilets.
- General wastes including office wastes, scrap materials and biodegradable wastes.

Waste Management

The following commitments have been identified (refer Appendix A) to manage waste and reduce the demand on resources:

(i) The waste minimisation hierarchy principles of avoid / reduce / re-use / recycle / dispose will be applied to all aspects of the Proposal.

(ii) Waste will be handled, stored and disposed of in accordance with relevant guidelines.

(iii) Secondary waste materials, such as fly ash and steel slags will be used in construction materials where reasonable and feasible.

20.5 Hazards and risks

The following commitments have been identified (refer Appendix A) to manage hazards and risks:

(i) Bunded storage areas will be located away from watercourses and will be established for oils and other hazardous liquids in accordance with Australian Standards. Any spillages will be contained and collected for appropriate disposal.

(ii) Activities with the potential for spillage such as refuelling, maintenance of equipment, mixing of cutting oil and bitumen will be conducted in bunded areas or in other areas where suitable containment measures are in place to prevent discharge into watercourses.

(iii) Potentially hazardous and contaminating activities (such as washing construction plant and handling hazardous chemicals) will be conducted in bunded areas away from watercourses or in other areas where suitable containment measures are in place.

20.6 Environmental management

The RTA requires that the environmental impacts of all its activities be well managed and the corporate approach is underpinned by an environmental management system and an environmental policy. Other relevant influences include the RTA Corporate Plan, the *Journey Ahead (2003-2008)*, requirements of the International Standard ISO 14001 and relevant legislation. The RTA has an ongoing commitment to improving its environmental management system

The RTA would require that the appointed construction contractor have an environmental management system in accordance with NSW government requirements guidelines and the RTA *QA Specification G36 Environment Protection (Management System)*.

A construction environmental management plan would be prepared and implemented by the appointed contractor to guide project delivery, ensuring that proposed management measures (as identified in the draft Statement of Commitments) are fully implemented to comply with conditions of approval. Requirements for minimum information to be included within the construction environmental management plan would be identified in contract documentation.

The construction environmental management plan would ensure specific environmental management measures are implemented during construction. The RTA would also coordinate ongoing monitoring and maintenance after commissioning of the project.

20.7 Construction communication and consultation

Communication with local residents and the wider community during the construction period would be undertaken. Stakeholders would be kept informed of planned construction progress through the following measures (refer Appendix A):

(i) Newsletters and media coverage will be used regularly to outline the proposed works schedule, areas in which works are proposed and the construction hours of those works. The newsletters and media coverage will provide contact names and phone numbers of relevant staff.

(ii) An internet site which contains periodic updates of work progress, consultation activities and proposed work schedules will be established and maintained regularly. The internet site will also provide a description of relevant approval authorities and their areas of responsibility and contact names and phone numbers of relevant staff.

(iii) A 24 hour, toll free complaints telephone number will be established for the Proposal and advertised.

(iv) A system to receive, record, track and respond to complaints within a specified timeframe will be established.

(v) Property owners will be consulted about the implementation of mitigation measures that affect their property and any issues raised will be considered where reasonable and feasible.