Section 5.0

Environmental Assessment

5.0 Environmental Assessment

5.1 Environmental Risk Analysis

An environmental risk analysis has been completed for the Project to identify the key issues that required detailed assessment as part of this EA (refer to **Appendix 3**). The methodology used for the environmental risk assessment was undertaken in accordance with the principles outlined in Australian Standard AS/NZS 4360:2004 Risk Management (Standards Australia 2004). The risk matrix, consequence table and likelihood table used for the assessment are included in **Appendix 3**.

The method used for the environmental risk analysis encompassed the following steps:

- establish context for the risk analysis process;
- identify environmental and community aspects and potential risks;
- analyse risks; and
- evaluate risks to determine the key issues requiring further assessment.

The environmental risk analysis was used to identify the key environmental risks that require further assessment as part of the EA. The outcomes of the risk assessment did not identify any further key environmental issues relative to those identified in the DGR's. Consistent with AS/NZS 4360:2004, environmental risks have been categorised as low, medium or high for the construction and operational phases of the Project. The outcomes of the risk assessment are included as **Appendix 3**, with the identified risks are all rated as low or medium given the characteristics of the Project and relationship to the existing and approved operations with no high or no catastrophic risks identified. The risks identified as being of medium risk for the Project were:

- agricultural/land use impacts – the potential for loss/deterioration of land capability, agricultural suitability and productive topsoil from the areas of additional disturbance associated with the Project (refer to **Sections 5.2**);
- air quality – the potential for particulate emissions from open cut mining activities, surface infrastructure (including TSFs and ore processing/handling) and construction (refer to **Section 5.3**);
- noise – the potential for impacts to noise amenity from open cut mining activities, surface infrastructure including TSFs and ore processing/handling) and construction (refer to **Section 5.4**);
- blasting – the potential for degradation of noise amenity and vibration impacts from blasting associated with open cut mining activities (refer to **Section 5.5**);
- ecology – the potential for loss of native flora and fauna within areas of additional disturbance (refer to **Section 5.6**);
- groundwater – the potential drawdown of aquifers from proposed additional mining activities (refer to **Section 5.7**);
- surface water – the impacts associated with reduction in catchments and risk of pollution to surrounding waterways (refer to **Section 5.8**);

- traffic and transport – the potential impacts from changed traffic conditions associated with construction and changed access arrangements for the Project (refer to **Section 5.9**);

- visual – the potential for visual impact on residential receivers and public places associated with surface infrastructure changes (refer to **Section 5.12**);

- GHG and Energy – specifically the potential for emission of GHGs from the Project (refer to **Section 5.13**);

- socio-economic – the potential for socio-economic impacts on local area, region and State (refer to **Section 5.17**);

- rehabilitation and closure – specifically the development of appropriate strategies and conceptual closure criteria (refer to **Section 2.3.10**); and

- mineral waste – specifically focussed on the handling, emplacement and management of tailings (refer to **Section 5.15**).

In addition to the key environmental risks associated with the Project, the DGR's identify a number of additional key environmental issues, which have been addressed in this EA, as outlined below:

- Aboriginal cultural heritage and archaeology and hhistoric heritage – specifically the potential for disturbance of heritage values or Aboriginal places/objects within additional disturbance areas (refer to **Section 5.10** and **5.11**); and

- hazards – including management processes for onsite chemicals and bushfires (refer to **Section 5.16**).

A detailed assessment of each of the environmental and community aspects identified in the environmental risk analysis and DGR's as requiring further assessment for the Project is provided in the following sections**.**

5.2 Land Resources including Agricultural Impact Statement

The DGR's for the Project identify land resources as a key issue for assessment as part of the EA. The specific requirements of the DGR's in relation to land resources assessment, and where these have been addressed in the EA are provided in **Table 5.1**.

Table 5.1 – DGR's for Land Resources Assessment

Detailed Requirement	Section of EA
Land resources including an Agricultural Impact Statement which includes a detailed assessment of potential impacts on:	**Section 5.2** and **Appendix 5** (refer to **Table 5.2** for details)
• Soils and land capability (including salinisation and contamination).	**Section 5.2.1**
• Landforms and topography, including surface drainage, rock formations, subsidence steep slopes etc.	**Section 5.2.1**
• Land use, including agricultural, forestry, conservation and recreational use.	**Section 5.2.1**

The Department of Primary Industries Office of Agricultural Sustainability and Food Security provided additional guidance on the preparation of Agricultural Impact Statement (AIS) as part of the EA in its submission on the DGR's for the Project. **Table 5.2** provides an overview of these specific requirements and where they have been addressed in the EA.

Table 5.2 – Agricultural Impact Statement Requirements

AIS Requirement	Section of EA
AIS Introduction	**Section 5.2**
Detailed assessment of the agricultural resources and agricultural of the Project Area including: • Soil information. • Slope and land characteristics. • History of agricultural enterprises within the Project Area. • Location and areas of land to be temporarily removed from agriculture. • Location and area of land to be returned to agriculture post project. • Location and area of land that will not be returned to agriculture, including areas that will be used for environmental plantings or biodiversity offsets. • Agricultural enterprises to be undertaken on any buffer and/or offset zone lands in the surrounding locality of the project.	**Section 5.2.1** and **Appendix 5** **Section 5.2.1** and **Section 5.7**
Identification of the agricultural resources and current enterprises within the surrounding locality of the project including: • Agricultural resources within the locality: ▪ Soil characteristics including soil type and depth. ▪ Topography – land capability tabulated. ▪ Agricultural support infrastructure. ▪ Water resources and extraction locations. ▪ Location and type of agricultural industries. ▪ Vegetation. ▪ Climate conditions. • Current agricultural enterprises in the surrounding locality.	**Section 5.2.1** and **Appendix 5** **Section 5.2.1.5** and **Appendix 5**

Table 5.2 – Agricultural Impact Statement Requirements (cont.)

AIS Requirement	Section of EA
Assessment of impacts including: • Identification and assessment of the impacts of the project on agricultural resources or industries: ▪ Effects on agricultural land resources. ▪ Consequential productivity effects on agricultural enterprises. ▪ Uncertainty associated with predicted impacts and mitigation measures ▪ Further risks.	**Section 5.2.2** and **Appendix 4**
• Account for physical movement of water away from agriculture.	**Section 5.9**
• Assessment of socio-economic impacts: ▪ Agricultural land values. ▪ Local and regional agricultural enterprises. ▪ Agricultural support services, local and regional employment. ▪ Regional communities. ▪ Visual amenity, landscape values and tourism infrastructure. ▪ Economic analysis of project scenarios.	**Section 5.2.3** and **Appendix 4** **Section 5.17.1** **Section 5.13** **Section 5.17.2**
Mitigation measures: • Project alternatives. • Proposed monitoring programs to assess predicted versus actual impact as the project progresses. • Trigger response plans and trigger points at which operations will cease to be modified or remedial actions will occur to address impacts including a process to respond to unforeseen impacts. • The proposed remedial actions to be undertaken in response to a trigger event. • The basis for assumptions made about the extent to which remedial actions will address and respond to impacts. • Demonstrated capacity for the rehabilitation of disturbed lands to achieve the final land use and restore natural resources. • Demonstrated planning for progressive rehabilitation that minimises the extent of disturbance.	**Section 5.2.4** and **Sections 5.0** and **6.0** **Section 2.3.10** **Section 2.3.10**
Consultation.	**Section 4.0**

WHK Ivey Agricultural Consultants have completed a detailed Agricultural Impact Assessment (AIA) (refer to **Appendix 5**) in order to identify and assess the potential impacts of the Project on agricultural resources and enterprises within the Project Area and surrounds.

Recently, the NSW Government have introduced a range of Strategic Regional Land Use Plans (SRLUPs), which require detailed consideration of the interactions being mining projects and areas of strategic agricultural significance, broadly terms Strategic Agricultural Land (SAL). It is important to note that there is currently no SRLUP in place for region in which the Project is located, and the provisions of a relevant SRLUP do not apply. As requested through consultation with relevant agencies, the AIA has examined the agricultural resources within the Project Area in the context of existing SRLUPs for the Upper Hunter and New England North-west.

As part of this assessment, it is important to note that all of the agricultural resources and enterprises that are directly impacted by the Project are managed as part of NPM agricultural enterprises. Accordingly there will be no direct effects on agricultural resources and enterprises outside of NPM landholdings. NPM have a strong commitment to the effective management of agricultural production within its landholdings over the life of the Project and have sought to minimise impacts on farming land use as far as practicable.

NPM currently manage approximately 3900 hectares of land resources within and immediately adjacent to, the Project Area for agricultural production focussing on dryland cropping (refer to **Section 5.2.1.5**). NPM have been recognised as leaders in the management of agricultural production in its land holdings, and in particular the integration of these operations with surrounding landholders. NPM's farming operations further support local agricultural enterprises, with operations undertaken on a 100 per cent contract farming arrangement, with planting and harvesting completed by agricultural contractors not by NPM operations staff or fleet.

The farm strategy for agricultural land in the NPM landholdings has included:

- Increase paddock size and eliminate livestock grazing to improve cropping efficiency.
- Use of crop rotation (mainly winter cereals and canola) to help control weeds and disease.
- Use of zero till techniques and stubble retention to improve soil structure and fertility. Conservation farming was implemented across the land holdings in 1998. At this time, adoption of no-till techniques across central west NSW was relatively low at about 35 per cent of farms (Llewellyn and D'Emden 2009).
- Adoption of controlled traffic farming to limit soil compaction.

The NSW Department of Primary Industries established a number of agronomy trials across paddocks within NPM landholdings including large scale agronomy trials (including crop variety and type trials, and long term fertiliser and sowing trials). Trials have also been carried out for private companies and for NPM's own benefit.

5.2.1 Existing Land Resources

5.2.1.1 Topography

The topography of the Project Area is of low relief with gently undulating rises and depressions or drainage lines. Elevations within the Project Area range between 288 mAHD in the west and 301 mAHD in the south-east. The highest topographic point on the Project site is 320 mAHD located centrally in the Project Area.

The surrounding landscape is generally flat with some low undulations ranging from 280 mAHD to 300 mAHD, with some higher peaks. The most significant regional feature in the area surrounding the NPM site is the Goonumbla Hill located approximately 4 kilometres south of the Project Area, which extends to a height of approximately 386 mAHD.

The Project Area is located within the catchment areas of Bogan River, Tenandra Creek, Goonumbla Creek and Cookopie Creek (refer to **Section 5.8**). These watercourses are generally ephemeral and only carry surface water after heavy rainfall events. The watercourses do not form deep channels and appropriate setbacks form these watercourses are maintained through NPM cropping activities. Further details on the surface water resources within and surrounding the Project Area is provided in **Section 5.8**.

5.2.1.2 Soil Resources

Cunningham (2006) as part of the E48 Project identified two soil mapping units within the Project Area, which are summarised below. As outlined in **Appendix 5**, site inspections of the Project Area and soil test results indicate that soils across Project Area are consistent to those described by Cunningham.

Soil Mapping Unit 1 (SMU1)

SMU1 is restricted to the areas of rock outcrops or occurs at relatively shallow depths. The soil is up to 88 centimetres deep, with a surface condition usually firm to hard-setting (Cunningham 2006).

The topsoil is described as loam, sandy clay loam, or clay loam. It has no gypsum, lime or manganese present. There are many roots present, with gravel and stone between depths of 1 to 10 centimetres. It is highly pedal, consistency dry and usually hydrophobic. In addition, the topsoil is slightly dispersive, non-saline, has moderate erodability, and a pH varying between 5.0 and 7.0 (Cunningham 2006).

The subsoil is described as having two subsoil horizons evident. Its texture becomes increasingly clayey with depth; with sandy light clay, light clay, light to medium clay, and medium to heavy clay present. There are some roots present. It has no gypsum and lime, and some manganese at depth. It is highly pedal or massive with very firm to strong consistency dry and is usually not hydrophobic. In addition the subsoil is slightly to moderately dispersive, non-saline, has low to moderate erodability, and a pH varying between 5.5 and 7.5 (Cunningham 2006).

Soil Mapping Unit 2 (SMU2)

SMU2 occurs in midslope, lower slope, level plains and shallow drainage depression zones. The soil is up to 280 centimetres deep, with a surface condition firm or self-mulching and cracked, sometimes loose, soft or hardsetting (Cunningham 2006).

The topsoil is described as usually silty clay, light clay, light to medium clay, medium clay, medium to heavy clay, and rarely loam. Roots are common to many, with no gravel or stones observed. There is no lime, gypsum or manganese present. It is highly pedal, firm to strong consistency dry and sometimes hydrophobic. In addition the topsoil is negligible to slightly dispersive, non-saline, has low to moderate erodability, and a pH generally ranging from 5.0 to 6.5 (occasionally ranging from 4.5 to 9.5) (Cunningham 2006).

The subsoil is described as comprising up to five horizons and having a clay texture throughout, sometimes becoming gritty near bedrock. It is usually highly pedal with mottles increasing with depth. In addition the subsoil is slightly to very highly dispersive, ranges from moderately to extremely saline, has low erodability, and a pH that is sometimes alkaline (Cunningham 2006).

With regards to agricultural land use within the Project Area, the vast majority of the land used for cropping is the deeper, less stony SMU2. The SMU1 areas generally remain as native vegetation, have been planted to tree lots, or remain otherwise uncropped.

Extensive soil testing is undertaken by NPM on a semi-regular basis across properties within the NPM landholdings utilised for agriculture. Extensive soil testing was carried out over the agricultural areas of the NPM landholdings in February 2012, including within and adjacent to the Project Area (refer to **Appendix 5**). The topsoils and subsoils were samples and tested to assist in determining their current agricultural capability and to assess the soils suitability for topsoil stripping and rehabilitation. The soil testing results indicated a number of potential structural issues that are actively managed through agricultural operations (including no tillage, stubble retention and traffic management) and topsoil stripping and management, as detailed in **Section 5.2.4**.

It is noted that there is no SRLUP current for the region surrounding the Project and therefore this does not apply to the Project. In response to consultation with relevant agencies, the AIA has included an assessment of soil fertility against the recently published SRLUP for New England and Upper Hunter. As outlined in the AIA (refer to **Appendix 5**), the assessed soil fertility of the Project Area would be unlikely to meet the requirements of Biophysical Strategic Agricultural Land (BSAL) as defined in the existing SRLUP.

5.2.1.3 Soil Contamination and Salinisation

A preliminary contamination assessment has been undertaken on the site for the additional areas of disturbance associated with the Project. The assessment included a review by the current Northparkes Farm Manager of the history of agricultural practices in the proposed disturbance areas, visual inspection of the portions of the site to be disturbed by the proposed extensions to operations, as well as undertaking a database search of the NSW EPA Contaminated Land Record of Notices.

The assessment indicated that the area has been subject to cropping and grazing only. The area has not supported any sheep dip sites, fuel or chemical storage areas, or machinery workshops/sheds, aside from what has been identified on the NPM contaminated site register. The results of the database search indicated land affected by the proposed disturbance area have no records of notices relating to orders made under Part 3 of the *Contaminated Land Management Act 1997*. As such, no further assessment has been undertaken in regards to this issue.

In addition, NPM maintains a register that records, among other things, the location, establishment, activities, contaminants, records of sampling/inspection, a risk assessment and preventative measures/remedial actions for each site that stores potentially hazardous/contaminating materials with the NPM operations area. At present a total of 59 sites are recorded and managed under the register.

In general soil salinisation is not a significant land management issue within the NPM landholdings given the low yielding water table within the region, the use of dryland cropping techniques and also the absence of identified soil salinity issues (such as evidence of salts in drain bank or cuttings) in the management of NPM landholdings. Related soil management issues, including sodicity, are effectively managed through existing soil management techniques/processes.

5.2.1.4 Land Capability

Land capability is the ability of the land to maintain its productive potential under a specified use, without degradation. Climate, soils, geology, geomorphology, soil erosion, site and soil drainage characteristics and current land use data are all considered in determining land capability (Emery undated). Rural land capability classes for NSW were developed by the then NSW Soil Conservation Service in the late 1980s and are shown in **Table 5.3**. Each class outlines the types of land uses appropriate for a particular area of land and the types of land management practices needed to prevent soil erosion and maintain the productivity of the land.

Table 5.3 – Rural Land Capability Classes

General Capability	Land Capability Classes	Interpretations and Implications
Suitable for regular cultivation.	I	Suitable for a wide variety of uses. Where soils are fertile, has the highest potential for agriculture. Includes 'prime agricultural land'.
	II	Usually gently sloping land suitable for a wide variety of agricultural uses. Includes 'prime agricultural land'.
	III	Sloping land suitable for cropping on a rotational basis. Soil erosion problems are often severe. Generally fair to good agricultural land.
Suitable for grazing and occasional cultivation.	IV	Land not suitable for cultivation on a regular basis owing to limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Comprises the better classes of grazing land.
	V	Land not suitable for cultivation on a regular basis owing to limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Production is generally lower than for grazing lands in Class IV.
Suitable for grazing but not cultivation.	VI	Productivity will vary due to soil depth and fertility. Comprises the less productive grazing lands.
Land best protected by green timber.	VII	Generally comprises areas of steep slopes, shallow soils and/or rock outcrop.
Unsuitable for agriculture or pastoral uses.	VIII	Cliffs, lakes or swamps and other lands unsuitable for agricultural or pastoral use.

The classes identify limitations on the type and intensity of use as a result of interactions between physical attributes (soil type, slope and climate) and the effects of specific land uses. The classification does not necessarily reflect existing land uses, rather, it indicates the potential of the land for different agricultural purposes. A revised rural land and soil capability classification system (Land and Soil Capability (LSC) Mapping for NSW) has been developed by the NSW Department of Environment and Climate Change (now OEH). It builds on the Rural Land Capability system and retains the eight class structure.

The land capability within the Project Area is presented on **Figure 5.1**. The Project Area consists predominantly of Class II and III land. Class II land within the Project Area is concentrated at the floodplains associated with Bogan River and associated tributaries, and is suitable for a wide variety of agricultural land uses. Class III land is suitable for cropping on a rotational basis but is subject to soil erosion difficulties. The areas directly affected by the Project (refer to **Section 5.2.1.5**) are predominantly mapped as class III (approximately 191 hectares) with a small area of class II (approximately 47 hectares). However, there are some areas affected by the Project that would be classified as class IV or V under more detailed mapping.

5.2.1.5 Land Use Including Agricultural Enterprises

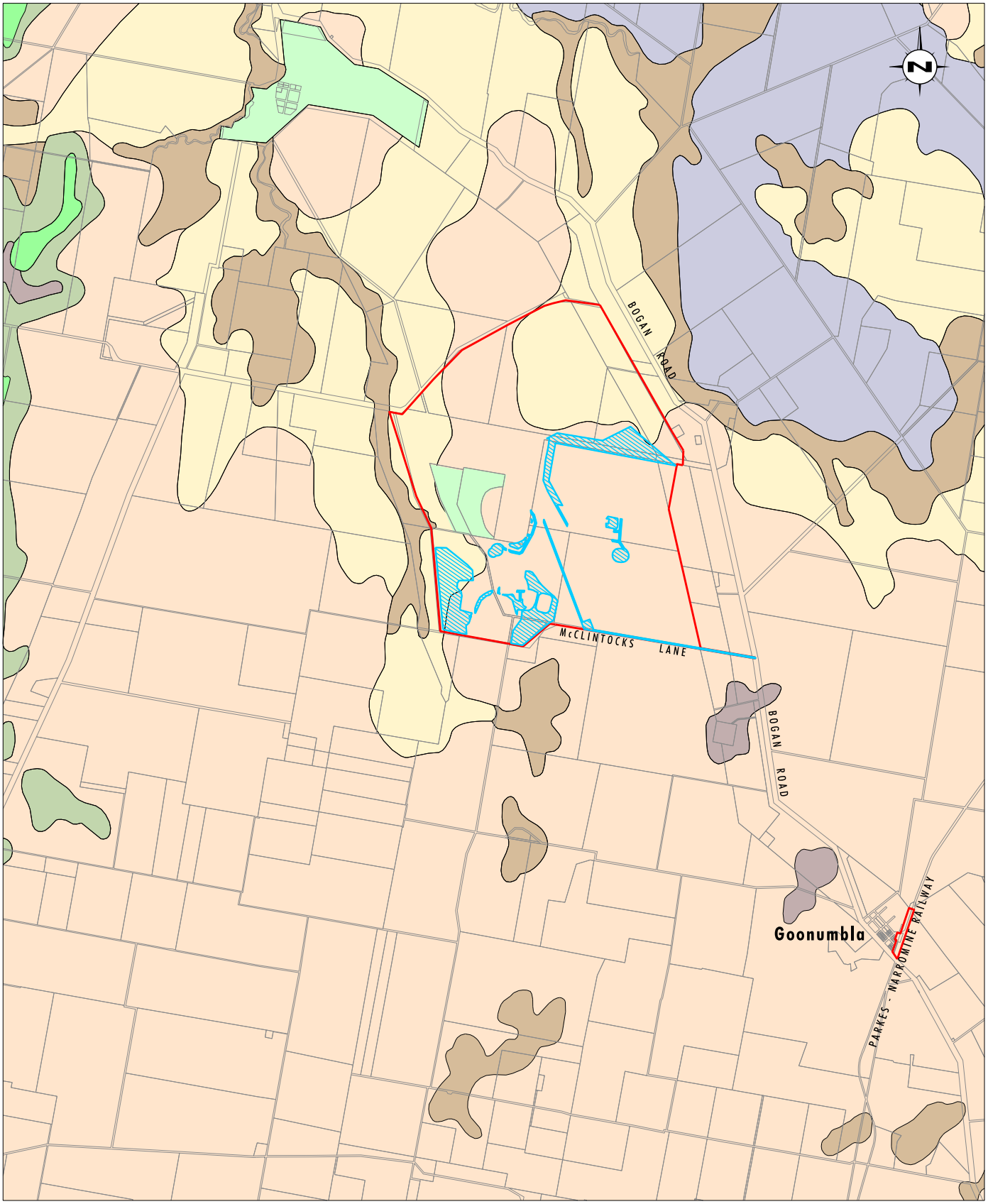
As outlined in **Section 1.2**, the central west region of NSW has had a long history of rural land use and as such a majority of the region consists of cleared land used for agricultural pursuits, with patches of remnant vegetation associated with State Forests. Limestone State Forest is located centrally within the Project Area (refer to **Figure 5.2**) and is managed by NPM through an agreement with Forests NSW. In relation to recreational land use, the closest National park is located approximately 20 kilometres to the east of the Project Area. In addition the Parkes Telescope, an established tourist attraction, is located approximately 10 kilometres to the south-east of the Project Area.

Historic aerial photography indicates that the Project Area has been extensively cleared and dominated by agricultural practices since at least 1958 (the earliest available photograph from the Department of Lands dates to 1958). The known historical context of the area suggests the Project Area and surrounds has been subject to intensive agricultural practices since the early to mid 1800's (refer to **Section 5.11**).

As shown on **Figure 5.2** the Project Area is mapped as a mixture of mining and agricultural land use activities reflecting the establishment of operational infrastructure onsite in 1993, replacing agriculture as the dominant land use within the Project Area. **Figure 5.2** shows the other key land use in the Project Area and surrounds is used for agricultural activities, predominately for pastoral or cropping practices.

In recent years, crops grown on NPM landholdings have included wheat, barley, canola, mustard, chickpeas, field peas and lupins. The largest of these crops has been wheat, barley and canola. This crop mix is typical of other agricultural enterprises in the surrounding area (refer to **Appendix 5**).

A summary of recent crop yields for the mine lease area is provided in **Table 5.4**, while detailed data is provided in **Appendix 5**.



Source: NPM (2013), Department of Natural Resources (2007)

0 1 2.5 5km
1:100 000

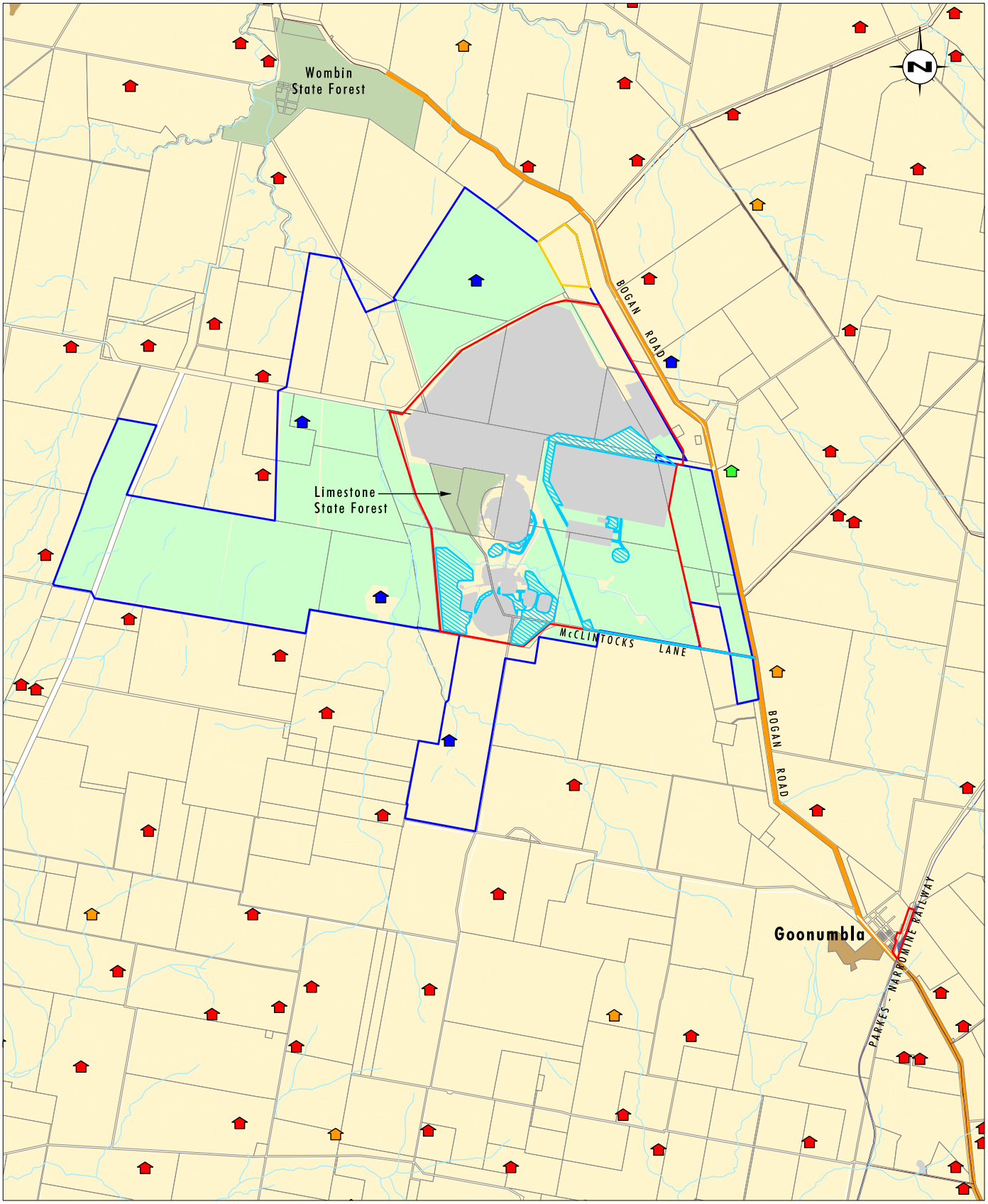
Legend

- Project Area
- Proposed Additional Disturbance Area
- 1. Suitable for regular cultivation
- 2. Suitable for regular cultivation
- 3. Suitable for regular cultivation
- 4. Suitable for grazing with occasional cultivation
- 5. Suitable for grazing with occasional cultivation
- 6. Suitable for grazing with no cultivation
- 7. Other
- State Forest or National Park

FIGURE 5.1

Existing Land Capability

File Name (A4): R10/2949_282.dgn
20130503 14.47



Source: NPM (2013)

0 1 2.5 5km
1:100 000

Legend

- Project Area
- NPM Landholdings Boundary
- Existing Biodiversity Offset Area
- Proposed Additional Disturbance Area
- State Forest
- Active Operational Area
- NPM Cropped Landholdings
- Rail
- Quarry
- Travelling Stock Route/Wide Road Reserve
- Mixed Agricultural Land Use
- Drainage Line
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence

FIGURE 5.2

Surrounding Land Use

Table 5.4 – Summary Recent Crop Data NPM Landholdings

Crop Details	Year		
	2009	**2010**	**2011**
Barley			
Area (ha)	1,014	1,229	862
Production (t)	1,745	2,392	1,829
Yield (t/ha)	1.72	1.95	2.12
Canola and Mustard			
Area (ha)	587	161	749
Production (t)	315	52	703
Yield (t/ha)	0.54	0.32	0.94
Wheat			
Area (ha)	1,089	1,353	961
Production (t)	1,190	3,493	2,569
Yield (t/ha)	1.09	2.58	2.67
Grain Legumes			
Area (ha)	288	60	-
Production (t)	328	90	-
Yield (t/ha)	1.14	1.51	-

A summary of the recent crop data is provided below, with a more detailed analysis provided in **Appendix 5**:

- three of the past four years were considered to be reasonably good growing seasons. The yields achieved by NPM were in general, much higher than the district average over the last 19 years;
- on a year by year comparison, recent cereal yields have been relatively good;
- NPM wheat yields between 2008 and 2011 have averaged 12 per cent more than the Parkes average over the same period;
- NPM barley yields have been 23 per cent than the Parkes average over the same period; and
- conversely, yields achieved by the NPM canola crops have been variable, being 34 per cent higher than the Parkes average in 2009, but 41 per cent lower in 2011.

There are more than 50 stock water dams on the NPM landholdings, and the natural watercourses of the Bogan River, Goonumbla Creek and Tenandra Creek. No irrigation has been undertaken on the NPM landholdings and no irrigation infrastructure is present.

Areas of Land Removed from Agriculture

Figure 5.2 show the areas of the NPM landholdings currently used for farming activities that will be affected by the Project. At present, approximately 3900 hectares of the NPM landholdings (including land within the Project Area) are subject to agricultural activities, with a small proportion of marginal lands comprising native vegetation. Approximately 117 hectares of land currently used for agriculture (approximately 4.3 per cent) will be subject to disturbance by construction of TSF 3, the proposed open cut mine areas, waste rock stockpiles and other associated infrastructure works.

As outlined in **Section 2.3.10**, the final land use for the Project includes rehabilitating large areas of the Project Area to provide for a mixture of areas of native vegetation and ongoing agricultural land use. In general, the areas associated with the subsidence areas, open pit voids, waste stockpiles and TSFs will not be returned for agricultural land use. The subsidence zones and open pit voids will be stabilised and secured upon cessation of mining activities. The rehabilitation of the TSFs and waste rock stockpiles will focus on the establishment of native vegetation with areas of open grassland.

The conceptual closure criteria for the rehabilitation of the Project Area will continue to be refined and monitored over the life of the Project (refer to **Section 2.3.10**). For the purposes of the assessment of impacts on the agricultural resources and enterprises (refer to **Sections 5.2.2** and **5.2.3**) it is assumed that the approximate 117 hectares of agricultural land affected by the additional disturbance associated with the Project will result in a permanent removal of this land from agricultural land uses.

In addition, wildlife corridors have been established that link the Project Area with remnant vegetation on the agricultural properties. The corridors are established or improved along fence lines, roadsides, creeks and drainage lines. This program has involved the planting of approximately 10,000 trees per annum and more than 150,000 trees have been planted to date across the NPM land holdings. A detailed description of the vegetation within the Project Area is provided in **Section 5.6**.

5.2.1.6 Agricultural Support Infrastructure

There is no irrigation infrastructure within NPM landholdings required to support the existing agricultural land uses. Agricultural land uses within and surrounding the NPM landholdings are supported by a range of transport infrastructure and services provided in major towns.

The road network surrounding the Project Area, which services surrounding agricultural areas, is described in detail in **Section 5.9**. As outlined in **Section 5.9**, the traffic impacts associated with the Project are consistent with existing approved operations and will not impact the surrounding road network. Rail services in the surrounding area provide linkages to major population centres and markets, with NPM rail use to remain unchanged as part of the Project.

Parkes provides most support services required by the agricultural industry including sale agents, farming supplies, fertiliser sales, plant and machinery sales, employment services and banking. The Project will not affect the provision of any of the services.

5.2.2 Impacts on Agricultural Resources

As outlined above, the loss of agricultural land will be limited to mine developments in the Project Area including the development of new open cut mining areas, waste rock dumps, a new tailings storage area (TSF 3), the site access road and visitor car park (refer to **Figure 5.2**). These areas will affect approximately 117 hectares of land within the Project Area, which is approximately 4.3 per cent of the landholdings currently subject to farming activities. The direct impacts of the Project to agricultural resources within the Project Area are considered to be highly certain, with no further risks identified.

Potential off site impacts to surrounding agricultural resources are considered to be limited. Detailed assessments, as outlined in the remaining **Section 5.0**, indicate that the potential off site impact of the Project will be minimal and consistent with existing and approved NPM operations. In particular, the Project is not predicted to result in additional air quality impacts on private residences within the surrounding area relative to existing and approved operations (refer to **Sections 5.3**). In addition, for the majority of the Project predicted noise levels will be consistent with current approved operations, and where potential significant

impacts have been identified (refer to **Section 5.4**), NPM commit to active management of operations to minimise impacts on surrounding areas. In addition, NPM currently manage their existing operations to effectively manage weed and feral animals which will be continued as part of the Project.

The AIS guidelines (refer to **Table 5.2**) require an assessment of impacts based on the movement of water away from agriculture. As outlined in **Section 2.2.6**, NPM currently source water for mining operations in accordance with existing approvals and licences, which will continue over the life of the Project. As such the Project will not result in an increased movement of water from agriculture based on existing licences and approvals.

As outlined further in **Section 5.7**, the groundwater aquifer within and surrounding the Project Area is considered low quality with minimal use for irrigation in surrounding areas. There are a number of registered stock and domestic groundwater bores surrounding the Project Area. The potential impacts of the project on groundwater resources are considered to be minimal, and consistent with existing and approved NPM operations. It is noted that there are a number of farm dams utilised for agricultural land uses in the vicinity of the Project Area. As outlined in **Section 5.8** the impacts of the Project on surface water resources will be minimal.

5.2.3 Impacts on Agricultural Enterprises

A reduction in the amount of dryland cropping undertaken at NPM (including wheat, canola and barley) is expected due to the loss of approximately 117 hectares of agricultural land for mining activities as part of the Project. The analysis of impact has been undertaken from the perspective of gross margin forgone based on income and costs for wheat, canola and barley.

Based on a detailed assessment of income and costs for each of wheat, canola and barley over the 117 hectares of agricultural land that will be lost from production (refer to **Appendix 5**), the foregone gross income is estimated at $55,155.00 per annum, while the foregone profit is estimated at $16,736.00 per annum.

The gross average annual value of agricultural commodities in the Parkes LGA is estimated at approximately $140 million. The estimate of forgone gross agricultural income ($55,155.00 per annum) represents approximately 0.04 per cent of the estimate of annual average production in the Parkes LGA.

Given the very small expected impact on gross agricultural income in the region, it is considered that there would be a negligible impact on agricultural production and enterprises within the region.

The Project is not likely to adversely impact on agricultural diversity in the region, given that approximately 97 per cent of NPM's cropping between 2008 and 2011 has consisted of common crops such as wheat, barley, canola, field peas and lupins. By contrast, approximately 3 per cent of the crop area has consisted of less common crops such as mustard and edible beans. This assessment is further supported by the relatively minor loss of agricultural cropping land associated with the Project.

No material changes to agricultural land values are expected due to the effects of the Project. The removal of some agricultural land as a result of the planned physical mine expansion is not expected to affect the value of surrounding agricultural land given it is a continuation of the existing land use in this area located on land entirely owned by NPM. No expansion of mining activities outside land currently owned by NPM will occur as part of the Project.

5.2.4 Mitigation Measures

The Project is expected to have minimal impacts on land resources, agricultural resources and agricultural enterprises within and surrounding the Project Area. NPM are committed to continuation of the management of their land holdings within and outside of the Project Area for agricultural land uses over the life of the Project.

The potential off site impacts on agricultural resources have been assessed through technically robust and accepted methods (refer to **Section 5.0**). In addition, NPM have a range of existing environmental mitigation and monitoring programs designed to assess the impacts of NPM operations on the surrounding area and inform adaptive approaches to changing conditions and monitoring results. These processes are outlined for each relevant issue in **Section 5.0**. As outlined in **Section 6.0**, NPM commit to the ongoing implementation of these measures over the life of the Project.

The existing land resources management practices implemented at NPM will continue over the life of the Project. This includes the existing approved soil management process, management of contaminated land and salinisation, and weed control/feral animal management processes. These controls are outlined in the approved Landscape Management Plan that will continue to be implemented over the life of the Project.

5.2.4.1 Soil Management and Monitoring

NPM has established topsoil stripping and handling procedures, which are outlined in the approved Topsoil Management Plan. The soil management and monitoring techniques outlined in the Topsoil Management Plan will continue to be adopted as part of the Project and include:

- prior to stripping, a Site Disturbance Permit (SDP) will be obtained from the Environment Section by the relevant project coordinator in accordance with the SDP process;
- topsoil will be stripped to a depth of approximately 120 millimetres or until subsoil is observed;
- subsoil will be stripped to a depth of approximately 70 centimetres from, present land surface (i.e. 58 centimetres thick layer) unless rock is encountered, when stripping should cease;
- for the remainder of profile, exclusive of topsoil and subsoil, material will be treated as overburden and mixed with other overburden material;
- where practical, measures will be adopted to minimise the handling of soils through direct replacement onto progressive rehabilitation areas and careful selection of stockpile locations to avoid subsequent movement, to ensure the soil structure is retained as much as possible;
- where possible, soil will not be stripped during periods of high soil moisture (i.e. during or immediately following wet conditions);
- machinery movement over soils will be kept to a minimum during stripping operations to maximise soil aggregation and prevent compaction;
- where practical, weed management will be undertaken prior to stripping and removal;
- all equipment will be cleaned of weed and soil before and after the operation;

- maintaining of the Topsoil Stockpile Inventory, outlining the locations and volumes of stockpiles;
- regular inspections will be conducted for weed and erosion control;
- topsoil stockpiles will be:
  - no greater than approximately 2 metres in height (approximately 3 metres for subsoil) with slopes no greater than 1:4;
  - located in an area designated by the Environment Section, seeking to avoid interference with present and future mining and ancillary operations;
  - located as close as practicable and readily accessible to respreading areas;
  - left with a 'rough' but even surface to assist in runoff control and seed retention and germination;
  - sown with stabilising species as soon as practical after placement;
  - in areas that will allow free drainage and minimal soil erosion; and
  - adequately signposted to prevent vehicle access.

5.3 Air Quality

A comprehensive Air Quality Impact Assessment (AQIA) of potential air quality impacts associated with the Project has been prepared by SKM, in accordance with the Project's DGR's (refer to **Section 1.3**). A summary of the key findings of the AQIA is provided in this section while the full report is provided in **Appendix 6**.

The AQIA has been based on an assumed worst case project design assumptions which include existing operations, proposed open cut mining operations and construction of the proposed TSF 3 occurring concurrently with consideration made to worst case background air quality levels. Accordingly, the single modelled scenario for the AQIA represents a conservative worst case representation of potential air quality impacts associated with the Project, which may occur within the first five to eight years of the 19 year project life.

5.3.1 Air Quality Criteria

The air quality impact assessment criteria adopted for the Project are those recommended by the EPA and specified in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005).

The air quality goals relate both to dust concentration and dust deposition which are discussed further in **Sections 5.3.1.1** and **5.3.1.2**.

5.3.1.1 Dust Concentration

Dust concentration refers to airborne dust and is measured in micrograms per cubic metre ($\mu g/m^3$). Relevant criteria for dust concentration are defined in terms of two classes, total suspended particulates (TSP) and Particulate Matter (PM_{10}).

TSP relates to all suspended particles which are usually in the size range of zero to 50 micrometres (µm). Particle sizes larger than 50 µm typically settle out of the atmosphere too quickly to be regarded as air pollutants, however these particles are measured in dust deposition levels (refer to **Section 5.3.1.2**). The human respiratory system has in-built defensive systems that prevent particles larger than approximately 10 µm from reaching the more sensitive parts of the respiratory system. PM_{10} refers to particulate matter with a diameter less than 10 µm.

Goals for dust concentration are referred to as long term (annual average) and short term (24 hour maximum) goals. Relevant goals for TSP and PM_{10} are outlined in **Table 5.5** in relation to both Project-specific and cumulative goals. The TSP and PM_{10} annual average goals relate to the total dust in the air and not just the dust from the Project.

The relevant long term and short term dust concentration goals for TSP and PM_{10} are specified in **Table 5.5**.

Table 5.5 – EPA Air Quality Goals for Particulate Matter

Indicator	Criterion	Averaging Period	Application
TSP	90 µg/m^3	Annual average	Cumulative
PM_{10} [2]	50 µg/m^3	Maximum 24 hour average	Cumulative
	30 µg/m^3	Annual average	Project Only
Deposited Dust	2 g/m^2/month	Annual average (maximum increase)	Project Only
	4 g/m^2/month	Annual average (maximum total)	Cumulative

There is an increasing body of evidence to suggest that criteria for finer particulate matter (that is, $PM_{2.5}$) may be more important for protecting against adverse health impacts however the EPA has not set criteria for $PM_{2.5}$ that are applied on a project-specific basis.

Although there are no current air quality goals specified for $PM_{2.5}$ in NSW. In 2003, the National Environment Protection Council (NEPC) released advisory reporting standards for $PM_{2.5}$. This standard included a protocol that set out monitoring and reporting guidelines for $PM_{2.5}$. The advisory reporting standards for $PM_{2.5}$ are a maximum 24 hour average of 25 µg/m^3 and an annual average of 8 µg/m^3. It is important to emphasise that the $PM_{2.5}$ advisory standards are not impact assessment criteria.

While no $PM_{2.5}$ predictions have been made specifically for this assessment, other air quality assessments (refer to **Appendix 6**) have shown that the impact zone of $PM_{2.5}$, defined by comparing annual $PM_{2.5}$ predictions with the NEPC standard, were very similar to the impact zone of PM_{10}. The inference is that predicted compliance with the PM_{10} criteria would also result in predicted compliance with the NEPC advisory standards for $PM_{2.5}$.

An assessment of the Project in relation to these criteria is provided in **Section 5.3.6**.

5.3.1.2 Dust Deposition

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces and possibly on vegetation/crops. Dust deposition levels refer to the quantity of dust particles which settle out of the air as measured in grams per square metre per month (g/m^2/month) at a particular location.

[2] In addition to the above criteria, acquisition criteria of 150 µg/m^3 24- hour average has historically been used in development consents in NSW for cumulative PM_{10} levels on residences, that is, total cumulative PM_{10} levels for emissions from the Project in conjunction with contribution from all other sources.

The Department of Environment, Climate Change and Water (now EPA) expresses dust deposition criteria (refer to **Table 5.5**) in terms of an acceptable increase in dust deposition over the existing background deposition levels. For example, in residential areas with annual average dust deposition levels of between 0 and 2 g/m^2/month or an increase of up to 2 g/m^2/month would be permitted before it would be considered that a significant degradation of air quality had occurred.

5.3.2 Climate and Meteorology

NPM operate a continuous recording weather station within the existing mine lease to the east of the active E26 mining area. This weather station collects 15 minute records of temperature, wind speed, wind direction, rainfall, and solar radiation. Annual and seasonal wind roses (refer to **Appendix 6**) prepared from data collected by this weather station indicate the prevailing winds are from the north-east (typically summer and autumn) or south (winter and spring). This pattern of winds suggests that dust emissions from the site will be transported to the south-west in summer and autumn and to the north in winter and spring. It can be seen from the wind-roses that wind patterns a-re similar from year to year. These prevailing meteorological conditions have been used in the modelling undertaken as part of the AQIA (refer to **Appendix 6**). Further discussion of the meteorological conditions at and surrounding the site are included in the AQIA (refer to **Appendix 6**).

5.3.3 Existing Monitoring and Management

NPM understands that air quality is an important issue for the community and the air quality mitigation measures currently employed on the site reflect this. The dust management measures employed at NPM are detailed in existing Environmental Dust Management Plan. Specific measures in the Environmental Dust Management Plan to manage air quality on site are dealt with in the AQIA (refer to **Appendix6**).

NPM has an extensive air quality monitoring network which is illustrated in **Figure 1.4** and consists of:

- two high volume air samplers (HVASs), measuring concentrations for 24 hour periods on a one day in six run cycle, measuring PM_{10} at the Hubberstone and Milpose properties;
- 11 dust deposition gauges, measuring dust deposition rates over the period of one month; and
- one meteorological station.

All available data from the monitoring network has been collated and analysed as part of the AQIA. These monitors measure the existing dust deposition and PM_{10} concentration levels in the air from all sources, including emissions from mining, agricultural activities, vehicle exhausts and natural emissions. TSP concentration is estimated by measuring PM_{10} concentrations, assuming that 40 per cent of the TSP was PM_{10}.

5.3.4 Background Air Quality

Statistics on the measured PM_{10} concentrations from 2009 to 2012 is provided in the AQIA attached as **Appendix 6**. Collected data shows that PM_{10} concentrations have exceeded the 24-hour average criterion (50 µg/m^3) in recent years. However, annual average PM_{10} concentrations have been, and are currently, below the 30 µg/m^3 criterion at the Hubberstone monitoring site. At the Milpose monitoring site, annual average PM_{10} concentrations were above the 30 µg/m^3 in 2009, but have consistently been below 30 µg/m^3 from 2010 onwards. It is unclear from the available data what caused the

unusually high concentrations in 2009 (with the exception of state-wide dust storms in September 2009) but it can be seen from the data that the existing air quality has improved in recent years, in terms of average levels.

Existing 24 hour average PM_{10} concentrations will vary from day to day. The PM_{10} monitoring data described above showed that 24 hour average concentrations can exceed the 50 $\mu g/m^3$ criterion on a number of occasions each year. Such exceedance is not uncommon, with many parts of NSW experiencing a few exceedances each year. Mining does contribute in some locations to these exceedances, but often natural events such as bushfires and dust storms are the main factors. As noted above, the highest 24 hour average PM_{10} concentrations have exceeded the 50 $\mu g/m^3$ criterion in all years on two or more occasions. This complicates the assessment process as projects with quite small PM_{10} contributions may still show exceedances when the background levels are high or when maximum background levels are added to predicted project levels (cumulative impacts). This is specifically addressed in **Section 5.3.6**.

No monitoring of TSP concentrations occurs in the area around NPM operations. Annual average TSP concentrations have been estimated from measured PM_{10} concentrations by assuming that 40 per cent of the TSP was PM_{10}. This relationship was obtained from data collected by co-located TSP and PM_{10} monitors operated for reasonably long periods of time in the Hunter Valley (NSW Minerals Council 2000). Application of this relationship to the existing PM_{10} data (20 $\mu g/m^3$ for annual average PM_{10} from all available data) indicates that annual average TSP concentrations in the area are of the order of 50 $\mu g/m^3$, which is less than the EPA assessment criterion of 90 $\mu g/m^3$.

Details of monthly dust deposition records are provided in the AQIA (refer to **Appendix 6**). The average for the three years of available data across all sites was 2.8 g/m^2/month, which is well within the 4 g/m^2/month criterion. During the recorded period there are five instances where annual average dust deposition levels have exceeded the prescribed criteria.

From the monitoring data discussed above, it has been assumed that the following background levels apply at the nearest sensitive receptors:

- daily varying 24 hour average PM_{10} concentrations, from near zero to up to 284 $\mu g/m^3$ on one occasion;
- annual average PM_{10} concentrations of 20 $\mu g/m^3$;
- annual average TSP concentrations of 50 $\mu g/m^3$ (derived from the PM_{10} measurements by assuming that 40 per cent of the TSP is PM_{10}); and
- annual average dust deposition levels of 2.8 g/m^2/month.

5.3.5 Assessment Methodology

The AQIA follows a conventional approach commonly used for air quality assessment in Australia and outlined in the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC 2005). This modelling approach is accepted by the NSW EPA.

The assessment uses a dispersion model known as CALPUFF (Version 6.263). CALPUFF is a computer based model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap and the serial release is representative of a continuous release. The CALPUFF dispersion model takes

into account the local meteorology and terrain information and uses dust emission factors to predict air quality impacts on a worst case basis (i.e. concurrent construction and operation).

Emissions from each volume source were developed on an hourly time step, taking into account the level of activity at that location and, in some cases, the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

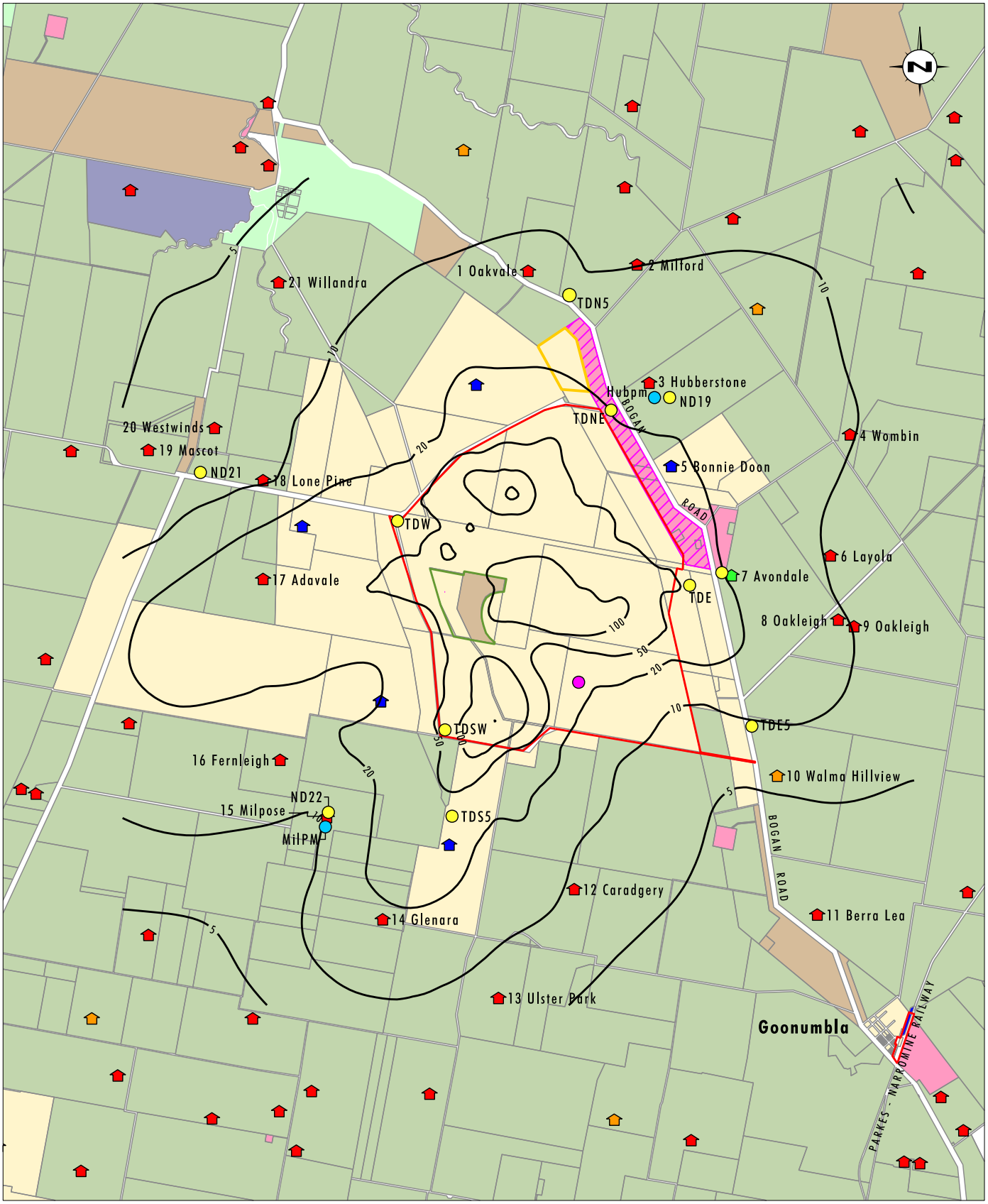
5.3.6 Air Quality Impact Assessment

Model predictions for the four closest residences in the study region are shown below in **Table 5.6** and **Figures 5.3** to **5.6.** Modelling results shown in **Table 5.6** quantify the potential change in air quality resulting from the Project, including emissions from construction and operational activities (including blasting). Copper concentrate is transport in sealed containers and will have negligible potential air quality emissions.

Modelling results indicate that annual average PM_{10}, TSP and dust deposition levels are predicted to comply with the EPA criteria under the scenario which represents the worst-case in terms of material handling and exposed areas.

Table 5.6 – Dispersion Model Predictions at Selected Locations

Residence	Predicted Mine Contribution		Predicted Air Quality		Criteria
	Existing	Proposed (worst case)	Existing (background levels)	Proposed (background levels plus predicted change)	
Predicted maximum 24 hour average PM_{10} concentrations ($\mu g/m^3$)					
Hubberstone	16	28	Variable (0 to 284)	Variable (0 to 295)	50
Avondale	20	43	Variable (0 to 284)	Variable (0 to 295)	50
Milpose	10	35	Variable (0 to 284)	Variable (0 to 295)	50
Lone Pine	10	19	Variable (0 to 284)	Variable (0 to 295)	50
Predicted annual average PM_{10} concentrations ($\mu g/m^3$)					
Hubberstone	2	3	20	21	30
Avondale	2	4	20	22	30
Milpose	1	4	20	23	30
Lone Pine	1	2	20	21	30
Predicted annual average TSP concentrations ($\mu g/m^3$)					
Hubberstone	3	4	50	52	90
Avondale	2	5	50	53	90
Milpose	2	5	50	53	90
Lone Pine	1	2	50	51	90
Predicted annual average dust deposition (g/m^2/month)					
Hubberstone	0.11	0.14	2.8	2.8	4
Avondale	0.13	0.24	2.8	2.9	4
Milpose	0.07	0.20	2.8	2.9	4
Lone Pine	0.02	0.03	2.8	2.8	4



Source: NPM (2013), LPMA (2011), SKM (2013)
Note: Contours µg/m³

0 1 2.5 5km
1:100 000

Legend

- Project Area
- Existing Biodiversity Offset Area
- Limestone State Forest Boundary
- PM10 Contours
- State Forest of NSW
- Mine Owned
- Parkes Shire Council
- Private
- Department of Lands - Crown
- State of NSW
- State Rail Authority of NSW
- Travelling Stock Route
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence
- Depositional Dust Monitoring Location
- PM10 Monitoring Location
- Meteorological Station

FIGURE 5.3

Existing Maximum 24-hour Average PM10 Concentrations (µg/m³)

File Name (A4): R10/2949_286.dgn
20130513 12.50

Source: NPM (2013), LPMA (2011), SKM (2013)
Note: Contours µg/m³

0 1 2.5 5km
1:100 000

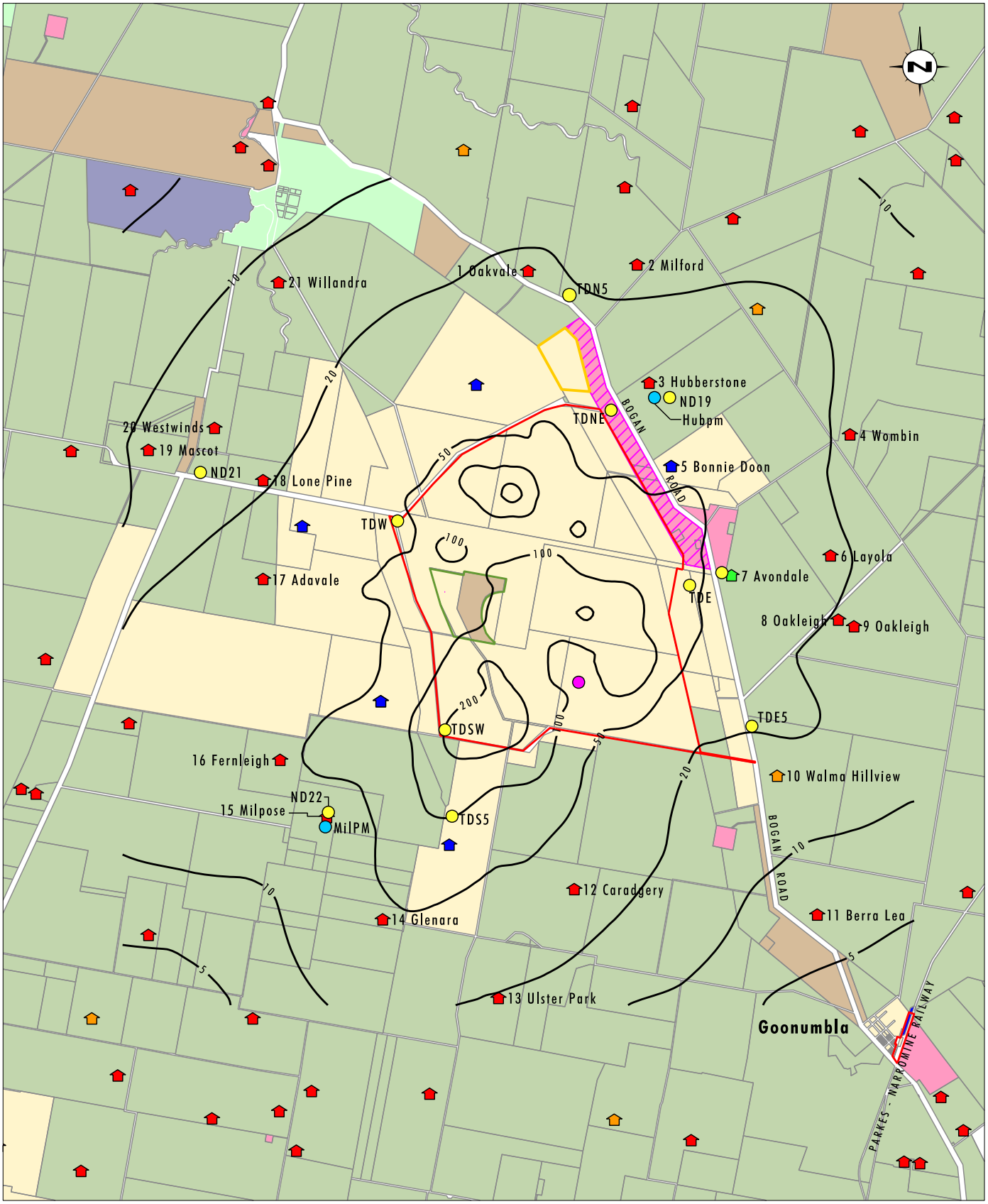
Legend

- Project Area
- Existing Biodiversity Offset Area
- Limestone State Forest Boundary
- PM10 Contours
- State Forest of NSW
- Mine Owned
- Parkes Shire Council
- Private
- Department of Lands - Crown
- State of NSW
- State Rail Authority of NSW
- Travelling Stock Route
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence
- Depositional Dust Monitoring Location
- PM10 Monitoring Location
- Meteorological Station

FIGURE 5.4

Existing Annual Average PM10 Concentrations (µg/m³)

File Name (A4): R10/2949_287.dgn
20130510 15.15



Source: NPM (2013), LPMA (2011), SKM (2013)
Note: Contours µg/m³

0 1 2.5 5km
1:100 000

Legend

- Project Area
- Existing Biodiversity Offset Area
- Limestone State Forest Boundary
- PM10 Contours
- State Forest of NSW
- Mine Owned
- Parkes Shire Council
- Private
- Department of Lands - Crown
- State of NSW
- State Rail Authority of NSW
- Travelling Stock Route
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence
- Depositional Dust Monitoring Location
- PM10 Monitoring Location
- Meteorological Station

FIGURE 5.5

Predicted Maximum 24-hour Average PM10 Concentrations (µg/m³)

File Name (A4): R10/2949_288.dgn
20130510 15.18

Source: NPM (2013), LPMA (2011), SKM (2013)
Note: Contours µg/m³

0 1 2.5 5km
1:100 000

Legend

- Project Area
- Existing Biodiversity Offset Area
- Limestone State Forest Boundary
- PM10 Contours
- State Forest of NSW
- Mine Owned
- Parkes Shire Council
- Private
- Department of Lands - Crown
- State of NSW
- State Rail Authority of NSW
- Travelling Stock Route
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence
- Depositional Dust Monitoring Location
- PM10 Monitoring Location
- Meteorological Station

FIGURE 5.6

Predicted Annual Average PM10 Concentrations (µg/m³)

File Name (A4): R10/2949_289.dgn
20130510 15.21

As outlined in **Table 5.6**, the results of the AQIA indicate that NPM will maintain compliance with the annual average air quality criteria during worst case periods. Accordingly, it is predicted that existing air quality criteria will be satisfied over the life of the Project. NPM will continue to implement relevant air quality management and monitoring initiatives over the life of the Project (refer to **Section 5.3.7**).

The PM_{10} 24 hour results from **Table 5.6** indicate that the mine contribution in both existing and proposed scenarios is less than 50 $\mu g/m^3$ at all sensitive receptor locations, which is compliant with relevant criteria. As outlined in **Table 5.6**, there is a potential risk that emissions from the Project will contribute to exceedances to the 24 hour average PM_{10} criterion, especially where background levels are higher than average.

The potential 24 hour average PM_{10} impacts have been investigated further by examining the predicted frequency of PM_{10} concentrations occurring at the four nearby receptors (refer to **Appendix 6**). Modelling indicates that at the nearest receptors under both existing and proposed scenarios, the 24 hour average PM_{10} concentrations as a result of mining activity will be less 5 $\mu g/m^3$ for the majority of the time.

Existing background PM_{10} concentrations will vary from day to day. On this basis modelling as summarised in **Table 5.7** has been constructed to show the approximate number of days when the cumulative PM_{10} concentration will exceed 50 $\mu g/m^3$ (due to the Project increment) for various background levels.

Table 5.7 – Predicted Number of Days when PM_{10} Concentration Exceeds 50 $\mu g/m^3$

Assumed Background PM_{10} Level ($\mu g/m^3$)	Permitted Contribution from Project Before Exceedance is Predicted ($\mu g/m^3$)	Approximate Number of Exceedances of 50 $\mu g/m^3$ Per Year Due to Project Increment (proposed minus existing)			
		Hubberstone	Avondale	Milpose	Lone pine
10 or less (63% of the time)	40	0	0	0	0
20 (22% of the time)	30	0	0	0	0
30 (9% of the time)	20	0	6	2	0

From the information in **Table 5.7** it can be seen that, as the existing background levels increase, the potential for cumulative impacts (above 50 $\mu g/m^3$) also increases. When the background concentration is above average levels (say, 30 $\mu g/m^3$ or more), which according to the monitoring data in 2012 occurs about 9 to 15 per cent of the time, there is potential that the mining activities will cause two or more exceedance days each year at some locations. It is noted that the predicted exceedance of up to six days per year is at the Avondale property, which currently has a commercial agreement in place with NPM over the life of the Project. Mining activities during the potential worst case operational scenarios will need to be suitably managed to minimise or avoid these events. The monitoring and management commitments outlined in **Section 5.3.7** have been designed to minimise the potential for exceedance of the short term PM_{10} criterion.

5.3.7 Air Quality Management and Monitoring

NPM will continue to implement the approved Air Quality Monitoring Program. The existing Air Quality Monitoring Program will be updated to incorporate the additional operational elements of the Project, should the Project be approved. This will ensure that management mechanisms where applicable are tailored to the specific requirements of the Project. As noted in **Section 5.3.3**, the current onsite monitoring program consists of two high volume air samplers, eleven dust deposition gauges and a meteorological station.

The understanding of 'adverse' meteorological conditions for mining would be improved with the installation of one or more real-time PM_{10} monitors. The real-time monitor(s) would allow NPM to analyse hourly (or finer resolution) variations in PM_{10} levels, which would assist with operations management during periods when the risk of exceedance of short term PM_{10} criterion is high.

Accordingly NPM commits to updating its monitoring network to more accurately identify adverse meteorological conditions through the addition of real time PM_{10} monitors at the existing Milpose and Hubberstone monitoring sites prior to the commencement of construction activities associated with the Project.

5.4 Noise

A detailed Noise Impact Assessment (NIA) has been prepared for the Project by Umwelt and is included as **Appendix 7**. The assessment has been undertaken in accordance with the Department of Environment, Climate Change and Water (now EPA) Industrial Noise Policy (INP) (EPA 2000). The NIA provides details of existing noise levels in the area surrounding the Project, determines noise impact assessment criteria for the Project, predicts noise levels that will be generated by the Project under a range of scenarios, including conservative worst case project and meteorological conditions, and assesses the potential for the Project to cause noise impacts. On the basis of this assessment a number of recommendations in relation to noise monitoring and noise mitigation controls are provided.

The NIA has assessed a number of project scenarios including the assumed worst case project design assumptions. In relation to potential noise impacts, the potential worst case operational scenario includes existing approved operations, proposed open cut mining operations and construction of the proposed TSF 3 occurring concurrently during the evening and night time period. These scenarios have been assessed in the context of representative worst case noise attenuating meteorological conditions including source to receiver winds and temperature inversions. Accordingly, the modelled scenarios within the NIA represent a conservative worst case representation of potential noise impacts associated with the Project, which may occur within the first five to eight years of the 19 year project life.

5.4.1 Existing Noise Environment

NPM currently undertakes regular background noise monitoring as a part of the existing noise monitoring program. Based on these monitoring results at identified sensitive receivers surrounding NPM operations (refer to **Figure 1.4**), it can be reasonably assumed that due to the rural nature of the area surrounding the Project, the existing background noise level is at or below 30 dB(A). In addition to this, and as described in **Appendix 7**, the surrounding land use is dominated by agricultural holdings with no other industrial noise sources in the area surrounding the Project. Therefore the existing industrial L_{Aeq}, period (where period is day, evening or night) noise levels is more than 10 dB below the Acceptable Noise Level as defined by the INP (EPA 2000). Accordingly, for the purposes of defining appropriate noise impact assessment criteria (refer to **Section 5.4.3**), an existing background noise level of 30dB(A) has been assumed.

5.4.2 Meteorological Conditions

The INP requires a noise assessment to consider certain meteorological conditions that may enhance noise impacts. An assessment of the prevailing meteorological conditions in the area has been undertaken based on data sourced from the NPM meteorological station (refer to **Figure 1.4**) for the period between 1 January 2008 to 12 May 2011.

Based on the analysis of monitored meteorological conditions in accordance with the INP, the NIA (refer to **Appendix 7**) has identified three prevailing meteorological conditions that have been included in the assessment of noise impacts being:

- Neutral (to very unstable) conditions with calm wind conditions.
- Neutral (to very unstable) conditions with a 3 m/s wind from the east-south-east to south-south-east associated with autumn evening and night-time periods.
- Temperature inversion conditions of up to 4^{o}C/100 metres (represented by F class stability) with a 2 m/s southerly drainage flow representative of localised inversion conditions during the winter evening and night time periods.

As noted above, the NIA (refer to **Appendix 7**) has used the assumed temperature inversion conditions represented by F class atmospheric stability in accordance with the guidance outlined in the INP. It is acknowledged that the conditions represented by the assumed F class atmospheric stability would be a worst case approximation of the localised inversion conditions measured in the vicinity of NPM operations. Accordingly, the modelled noise impacts under this meteorological scenario are potentially over estimated.

5.4.3 Assessment Criteria

5.4.3.1 Operational Noise Criteria

Where the existing background level in the region surrounding the Project is at or below 30 dB(A) the corresponding Intrusiveness Criteria would be 35 dB(A). This is the minimum possible Intrusiveness Criterion under the INP (EPA 2000) and has been adopted as the Project Specific Noise Level (PSNL) for this assessment. This criterion is consistent with the current Project Approval (PA06_0026), which requires NPM to ensure that the noise generated does not exceed 35dB(A) $L_{Aeq\ (15\ minute)}$ at any privately owned residence (unless a negotiated agreement is in place), which has been maintained as part of the NIA (refer to **Appendix 7**).

The current Project Approval (PA06_0026) also requires NPM to ensure that noise generated does not exceed 45 dB(A) $L_{A1\ (1\ minute)}$ at any privately owned residence, unless a negotiated agreement is place. The NIA (refer to **Appendix 7**) has adopted this current criteria as the relevant criteria in relation to the assessment of sleep disturbance impacts.

Additionally, as there are no other industrial activities located in proximity to NPM a cumulative assessment of noise impacts has not been completed for the Project, with all relevant cumulative considerations for this Project taken into account by the consideration of existing background noise levels in the development of the PSNL.

5.4.3.2 Construction Noise Criteria

The EPA recognises that construction activities could potentially generate higher noise levels than those of an industrial operation. DECCW's (now OEH's) Interim Construction Noise Guideline (DECCW 2009) provides criteria for construction activities as presented in **Table 5.8**, for representative residential receivers surrounding the Project. The criteria are intended to guide the need for and the selection of feasible and reasonable work practices to minimise construction noise impacts.

Table 5.8 – DECCW Construction Noise Management Levels at Residences, dB(A)

Construction Time	Management Level $L_{Aeq, 15\ minute}$
Recommended standard hours Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Noise Affected: Rating Background Noise Level + 10 dB
	Highly Noise Affected: 75 dB(A)
Outside recommended standard hours	Noise Affected: Rating Background Noise Level + 5 dB

Source: Interim Construction Noise Guideline (DECCW 2009).

The construction phase of the Project is limited to the upgrade of McClintocks Lane and the intersection of McClintocks Lane with Bogan Road and the construction of a new access road from McClintocks Lane onto the site. The construction of the access road and upgrade of McClintocks Lane is only anticipated to occur within recommended standard construction hours. Therefore the construction noise management level for all residential receivers surrounding the Project is 40 dB(A).

The Interim Construction Noise Guideline (DECCW 2009) notes that construction activities that relate to or support the mining process are not covered by the guideline and should be assessed in accordance with the requirements of the INP (EPA 2000). Therefore, the construction of the TSF has been considered as a part of the normal operation activity of the Project (refer to **Section 5.4.6.1**).

5.4.3.3 Traffic Noise Criteria

The DECCW's (now EPA's) NSW Road Noise Policy (DECCW 2011) sets out criteria for road traffic noise associated with new developments, new or upgraded road developments or planned building developments. While the proposed Project represents a continuation of existing operations, the Project includes amendment to the alignment of site access, with the existing Northparkes Lane being replaced with an amended access alignment to Bogan Road via McClintocks Lane (refer to **Section 2.3**).

Table 5.9 outlines the criteria relevant for two way traffic volumes due to the Project on the new site access along McClintocks Lane.

Table 5.9 – Road Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria dB(A)	
		Day (7.00 am – 10.00 pm)	Night (10.00 pm –7.00 am)
Local roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1\ hour)}$ 55 (external)	$L_{Aeq(1\ hour)}$ 50 (external)

Source: Table 3 NSW Road Noise Policy (DECCW 2011).

5.4.4 Operational Noise Modelling Scenarios

The INP requires the prediction of noise levels to take into account all possible noise sources that may reasonably be expected when the plant or facility in question is fully operational. Details of equipment inclusions and exclusions is provided in the NIA (refer to **Appendix 7**). The Environmental Noise Model (ENM) has been prepared assuming that all the equipment available is operational for durations of time representative of typical operational scenarios. Sources were located in representative locations based on typical mining operations, mineral handling and processing, and product dispatch (refer to **Appendix 7**).

The noise modelling approach taken to assess impacts at NPM has been to assess a number of relevant operational scenarios that provide for the continuation of existing approved operations (refer to Scenario 1 below), with additional project components that represent reasonable worst case operational scenarios. The operational scenarios modelled as described below were used to determine the worst-case operational noise impacts from NPM.

Scenario 1 represents a continuation of the existing approved 24 hour a day seven days a week operation of the existing ore processing plant, underground mining and associated supporting activities. The loading and dispatch of copper concentrate on road haulage trucks to the Goonumbla rail siding was included with processing plant operations under this scenario. Scenario 1 represents the majority of future mining operations, both prior to and post, concurrent TSF 3 construction and campaign open cut mining.

Scenario 2 incorporates existing approved operations with the proposed open cut mining in E26 and E31 and the associated out-of-pit placement of waste material to the east and west of the E26 open cut. Scenario 2 additionally includes the concurrent construction of the TSF3 on a 24 hour, seven days per week arrangement.

Scenario 3 incorporates existing approved operations with the proposed open cut mining in E26 and E28 and the associated out-of-pit placement of waste material to the east and west of the E26 open cut. Scenario 3 additionally includes modelling of the construction of the Estcourt TSF. It noted that Estcourt TSF is currently approved and operational. The Estcourt TSF activities included in the model include those for the construction of additional lifts to Estcourt TSF relative to that currently approved to be undertaken on a 24 hour, seven day per week arrangement.

As outlined in **Section 2.3**, the potential worst case operational scenarios would only occur for short periods of time during a 12 month construction period within the first five to eight years of the proposed 19 year Project life.

5.4.5 Predicted Noise Levels

The predicted operational noise levels for each of the operational scenarios outlined in **Section 5.4.4**, under representative meteorological conditions are provided in **Appendix 7** and summarised in **Table 5.10**. **Table 5.10** summarises the predicted noise impacts in relation to potential exceedance of relevant PSNL at surrounding privately owned residences.

Table 5.10 – Summary of Predicted Noise Impacts

Meteorological Conditions	Scenario 1: Existing Operations	Scenario 2: Existing Operations Plus		Scenario 3: Existing Operations Plus	
		Mining in E26 and E31	Plus TSF 3 Construction	Mining in E26 and E28	Plus Estcourt Construction
Neutral Calm Conditions – Day, Evening and Night					
No. Properties with predicted exceedance	0	0	1	0	0
Properties affected			Avondale[1]		
Maximum Exceedance	-	-	3 dB	-	-
Gradient Wind – Evening and Night					
No. Properties with predicted exceedance	0	0	1	0	0
Properties affected			Hubberstone		
Maximum Exceedance	-	-	2 dB	-	-
F Class Stability Conditions – Winter Evening and Night					
No. Properties with predicted exceedance	0	3	3	3	3
Properties affected		Hubberstone, Avondale[1] and Adavale			
Maximum Exceedance	-	3 dB	7 dB[2] , 5dB[3]	2 dB	3 dB

Note 1: The Avondale property is subject to an existing commercial agreement with NPM over life of Project.
Note 2: The predicted 7dB exceedance of PSNL is at the Avondale property which is subject to an existing commercial agreement with NPM over the life of the Project.
Note 3: the predicted 5dB exceedance of PSNL is at the Hubberstone property, a privately owned residence.

5.4.6 Noise Impact Assessment

5.4.6.1 Operational Noise Impacts

As outlined in **Section 5.4.5**, continuation of the existing approved underground mining and associated ore handling and processing is predicted to generate noise levels less than the project-specific noise criteria at all residential receivers under all modelled metrological conditions (refer to **Figure 5.7**). This operational scenario represents typical operations for the majority of the Project's 19 year life.

Source: NPM (2013), LPMA (2011)

0 1 2.5 5km

1:100 000

Legend

- Project Area
- Existing Biodiversity Offset Area
- Limestone State Forest Boundary
- Predicted Noise Impact Contour, dB(A)
- State Forest of NSW
- Mine Owned
- Parkes Shire Council
- Private
- Department of Lands - Crown
- State of NSW
- State Rail Authority of NSW
- Travelling Stock Route
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence
- Noise Monitoring Location
- Meteorological Station

FIGURE 5.7

Predicted Noise Impacts for Continued Existing Operations (Scenario 1) Under Southerly Drainage Flow and F Class Stability Conditions

File Name (A4): R10/2949_303.dgn
20130703 11.06

Scenarios 2 and 3 represent worst case operational situations when existing underground mining activities and ore processing are combined with open cut mining and TSF construction. As described in **Section 2.3**, NPM's open cut operations will be conducted on a campaign basis whilst TSF 3 construction will be staged over approximately 12 months within the initial five to eight years of the Project.

The results of noise modelling (refer to **Section 5.4.5**) indicate that the potential for maximum exceedance of the project-specific noise levels would be up to 5 dB at Hubberstone, up to 7 dB at Avondale and up to 1 dB at Adavale. As noted in **Section 5.4.5**, NPM currently have an agreement in place with the owner of the Avondale property over the life of the Project.

The potential maximum exceedance of the PSNLs from the operational noise are predicted to occur during F-Class Stability conditions in the winter evening and night-time periods and are primarily associated with the equipment used in the construction of TSFs (refer to **Figure 5.8**).

To an extent, the potential for short term exceedances of the current noise criterion of 35dB(A) has been previously contemplated and provided for in the provisions of the existing Project Approval (PA06_0026). Specifically, Condition 18 of PA06_0026 provides for the exceedance of relevant noise criteria during the construction of the Rosedale (TSF 3) and the Estcourt TSF in accordance with an approved Construction Noise Management Plan (CNMP). As outlined in **Section 5.4.7**, NPM will commit to extending this process to manage potential noise impacts associated with these activities as part of the Project.

Based on the modelling of the typically transient noises the calculated $L_{A1,\ 1minute}$ noise levels from the operation are expected to comply with the recommended sleep disturbance noise goals at all residential receivers.

5.4.6.2 Construction Noise Impacts

A source to receiver noise model was used to determine construction noise impacts at the nearest residential receiver to the construction activities during standard hours. The construction noise levels at the nearest residential receiver, 12 – Coradgery and 15 – Milpose, is predicted to be at or below 37 dB(A) and less than 30 dB(A), respectively. This is below the construction noise management level of 40dB(A) (refer to **Table 5.8**) for all residential receivers.

5.4.6.3 Road Noise Impacts

An assessment of the road traffic noise impact has been conducted at each of the nearest residential receivers likely to be influenced by movement of light and heavy vehicles including product trucks, travelling to or from NPM via McClintocks Lane. The noise predictions were based on vehicle movements on both McClintocks Lane and Bogan Road. The road traffic noise impacts were modelled at set back distances to the nearest residential receiver of 2.5 kilometres from the centre line of Bogan Road and 2.5 kilometres from the centre line of McClintocks Lane.

The results of traffic noise modelling are presented in **Table 5.11**.

Source: NPM (2013), LPMA (2011)

0 1 2.5 5km

1:100 000

Legend

- Project Area
- Existing Biodiversity Offset Area
- Limestone State Forest Boundary
- Predicted Noise Impact Contour, dB(A)
- State Forest of NSW
- Mine Owned
- Parkes Shire Council
- Private
- Department of Lands - Crown
- State of NSW
- State Rail Authority of NSW
- Travelling Stock Route
- Private Residence
- Agreement Residence
- Mine Owned Residence
- Derelict Residence
- Noise Monitoring Location
- Meteorological Station

FIGURE 5.8

Predicted Noise Impacts for Proposed Operations (Scenario 2) Under Southerly Drainage Flow and F Class Stability Conditions

File Name (A4): R10/2949_304.dgn
20130703 11.04

Table 5.11 – Predicted Day and Night Road Traffic Noise Levels, dB(A)

Source of Road Traffic Noise	Predicted $L_{Aeq, 1hour}$		Assessment Criteria[1]
	Peak AM	Peak PM	Day/Night [2]
Bogan Road	40.0	36.3	55/50
McClintocks Lane	38.5	36.2	55/50
Cumulative Noise Level	42.4	39.3	55/50

Note 1: Criteria for existing residences affected by noise from redevelopment of existing local roads.
Note 2: Day (7.00 am to 10.00 pm) and Night (10.00 pm to 7.00 am).

The results presented in **Table 5.11** indicate the predicted road traffic noise levels from light and heavy vehicles travelling to or from NPM via McClintocks Lane do not exceed the day and night time road traffic noise criteria outlined in the NSW Road Noise Policy (DECCW 2011).

5.4.6.4 Rail Noise

The Project does not propose to increase mine production rates, and therefore the rail traffic movements from the Goonumbla rail siding will remain consistent with approved operations and accordingly the project will have no additional impact from that currently approved.

5.4.7 Management and Mitigation Commitments

As discussed in **Section 5.4.6**, noise modelling indicates that two private residences may experience noise levels from the Project significantly in excess of the relevant project-specific noise criteria. One of these residences (Avondale) is subject to an existing commercial agreement with NPM, in place over the life of the Project, while a second (Hubberstone) may potentially be significantly impacted by the Project, i.e. where PSNL is predicted to be exceeded by 5 dB(A) under worst case operating scenarios.

As discussed in **Section 5.4.6** above, noise impacts at NPM are particularly dependent on meteorological conditions with exceedances only occurring during conditions which exacerbate noise impact. Also as mentioned above, the worst case predicted impacts will occur during concurrent open cut mining and TSF construction and not under the majority of the Project's future mine life when the site will operate as an underground mine and copper concentrate processing facility.

As detailed further in **Section 5.4.7.1**, NPM will undertake additional targeted noise monitoring during construction periods for TSFs, whilst campaign open cut mining operations occur during winter night time operations. This targeted monitoring program will include the use of real time noise monitors and be undertaken to identify situations when meteorological conditions have the potential to exacerbate noise impacts on neighbouring receivers. When these situations are identified, NPM will review its onsite activities (specifically construction of eastern wall of TSF 3 and open cut mining at night) as a means to, where possible, avoid the predicted noise impacts. The specific mitigation options available to NPM will be outlined in a TSF CNMP and may include:

- active management of equipment operations, including positioning of exposed equipment to lower elevations during noise enhancing meteorological conditions and review of design options to incorporate passive noise attenuation measures into the construction process, such as provision for equipment use at lower elevations during winter evening and night periods;

- incorporation of active noise attenuation measures such as bunding and shielding around equipment during winter night time operations; and/or

- implementation of noise mitigation controls at private residences where monitoring indicates that noise generated by the Project is above the PSNL.

The DGR's require evidence that there are no additional reasonable and feasible mitigation measures that need to be included as a part of the Project. The three main strategies used to identify reasonable and feasible noise control/mitigation strategies are:

- **Controlling noise at the source** - There are three approaches to controlling noise generated by the source: source elimination; Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA).

- **Controlling the transmission of noise** - There are two approaches: the use of barriers and land-use controls which attenuate noise by increasing the distance between source and receiver.

- **Controlling noise at the receiver** - There are two approaches: negotiating an agreement with the landholder or acoustic treatment of dwellings to control noise.

The proposed noise management control options are consistent with the reasonable and feasible noise mitigation controls identified above and will be incorporated into the TSF CNMP.

5.4.7.1 Noise Monitoring Program

NPM will maintain an attended noise monitoring program in order to assess ongoing compliance with relevant noise impact assessment criteria over the life of the Project. The noise monitoring program should:

- specifically assesses operational performance against the intrusiveness criteria using a $L_{Aeq,\ 15\ minute}$ descriptor; and

- measure and assesses the transient noise levels due to industrial noise sources using the sleep disturbance criteria descriptor of $L_{A1,\ 1\ minute}$.

The noise monitoring program based around a combination of routine attended noise monitors to assess the performance of NPM as a whole and a targeted noise monitoring program to assess the impacts of specific activities associated with the open-cut mining and construction of the TSFs. The requirements of the monitoring program could be achieved by supplementing existing monitoring programs already operating in the area with strategically targeted monitoring designed to complement the coverage provided by existing monitoring programs. Given the low level of risk of potential significant noise impacts during normal operations, it is proposed that the frequency of the attended monitoring program will be six monthly for the routine attended noise monitoring program covering the day, evening and night-time periods.

NPM will maintain the meteorological monitoring program in order to assess the occurrence of noise enhancing conditions as part of the noise monitoring program. This will include the development of a procedure to determine relative Meteorological Stability Classes and the potential influence that F and G Class stability have on the measured noise levels. This information would then be used for predictive meteorological forecasting as a part of the TSF CNMP.

In addition to predictive meteorological forecasting, the TSF CNMP will include the identification of feasible monitoring and management measures that include continuous real-time noise monitoring and associated alarming when the TSF construction activities are likely to have unacceptable noise impacts on sensitive receptors. The use of the continuous real-time noise monitoring will only be undertaken during the potential worst case operational scenario of concurrent open cut mining and TSF construction.

5.5 Blasting

A detailed blasting impact assessment has been undertaken for the Project by SLR Consulting and is presented in **Appendix 8**. The approach to this assessment has been to identify blast sensitive locations and to assess the impacts associated with blasts representative of the requirements of proposed campaign open cut mining.

The identification of blast sensitive locations was based on:

- mapping of residences and key receiver areas;
- consultation with relevant service providers and surrounding landowners; and
- detailed outcomes of previously completed impact assessment studies for blasting activities associated with historical mining activities.

5.5.1 Proposed Blasting Practices

Blasting practices for the Project will be consistent with blasting activities associated with previous campaign open cut mining at NPM, which most recently included open cut mining of the E22 resource. Accordingly, it is proposed that the frequency of onsite blasting will be typically one blast per day, six days per week. Details of the indicative blast design parameters are provided in **Appendix 8** and summarised in **Table 5.12**.

Table 5.12 – Indicative Blast Design Parameters

Parameter	Open-cut Blasting
Blast hole diameter	89 millimetres
Blasthole depth	7 metres to 8 metres
Blasthole/Burden	3.5 metres by 4 metres
Depth of Stemming	2.5 metres
Area of Blast	2500 m^2
Size of Blast	20,000 m^3
Number of Holes	200
Bulk Explosive Type	ANFO (Emulsion if wet blastholes)
Power Factor	0.5 kilogram/bank cubic metre (BCM)
Maximum Instantaneous Charge (MIC)	50 kilogram
Initiation System	None

5.5.2 Blast Assessment Criteria

The OEH (formerly DECCW) set guidelines for blasting based on human comfort levels. The guidelines have been adapted from the Australian and New Zealand Environmental Council (ANZECC) Guidelines Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC 1990). The ANZECC guidelines are based on human comfort levels and are much more stringent than those based on the potential for damage to structures. The guidelines prescribe fundamental criteria that have been applied to this assessment for private residences and other sensitive locations. The criteria applied are as follows:

- the maximum airblast should not exceed 115 dB for more than 5 per cent of blasts in any year, and should not exceed 120 dB for any blast; and

- the maximum peak particle ground velocity should not exceed 5 mm/s for more than 5 per cent of blasts in any one year, and should not exceed 10 mm/s for any blast.

The criteria outlined in the ANZECC Guidelines are included as Conditions 21 and 22, Schedule 3 of NPM's existing Project Approval (PA06_0026), and it is anticipated that these criteria will remain applicable for future blasting activities under any revised approval issued for the Project.

During previous blasting episodes which corresponded to previous open cut mining campaigns, NPM operated a remote blast monitoring station at Hubberstone, the closest privately owned residence to blasting activities, to assess compliance against Project Approval blast emission limits. The remote blast monitoring equipment was decommissioned in 2010, at the cessation of E22 campaign open cut mining.

The Blasting Impact Assessment (refer to **Appendix 8**) provides review of the environmental performance of blasting activities during the period 2008 to 2012. Previous monitoring indicates no air blast results exceeded the maximum 120 linear decibels (dB(L)) requirement or the 5 mm/s vibration criteria. On single occasion(s) in both 2008 and 2009 monitored blasts exceeded the air blast requirement of 115 dB(L). These exceedances equated to 0.7 per cent and 0.4 per cent of blasting episodes in 2008 and 2009 respectively, a level well within the 5 per cent tolerance levels specified by the ANZECC criteria and existing Project Approval.

5.5.3 Blast Impacts

The ground vibration and airblast blast emission site laws for NPM were previously prepared and presented in the SLR (then Heggies Australia Pty Ltd) Report 651/02 NPM - E48 Project Noise and Blasting Assessment, dated August 2006.

This previously established site law has been updated to include blast monitoring records for the period between March 2008 and October 2010. The resultant blast emissions prediction formulae (refer to **Appendix 8**) has been used to predict the potential airblast and ground vibration levels at the nearest residential receivers as a result of the blasting activities proposed as part of the Project. A summary of these results is presented in **Table 5.13** below.

Table 5.13 – Predicted 5 per cent Exceedance Blast Emissions (50 kg)

Residence Reference/Location	Nearpoint Distance	Predicted Blast Emission Level	
	Blast Site (metres)	PVS Vibration Velocity	Peak Linear Airblast
		50 kg	50 kg
'Hubberstone' Hubberstone	6,520	0.2 mm/s	114.8 dB
'Avondale' Avondale	4,680	0.3 mm/s	117.3 dB
'Milpose' Milpose	3,430	0.4 mm/s	119.6 dB
'Lone Pine'	5,800	0.2 mm/s	115.7 dB

As summarised in **Table 5.13** the results of the blast impact assessment for the Project indicate:

- the 5 per cent exceedance Peak Vector Sum (PVS) vibration velocity at all residences are below the criterion of 5 mm/s;
- the 5 per cent exceedance Peak Airblast Level at Hubberstone is below the criterion of 115 dB(L); and
- the 5 per cent exceedance Peak Airblast Level at Avondale, Milpose and Lone Pine is above the criterion of 115 dB(L), but below the maximum allowable level of 120 dB(L).

NPM will monitor blasts as mining progresses in accordance with previous blast monitoring programs, during campaign open cut mining operations. Monitoring will be undertaken to determine compliance with relevant criteria, and to further refine predicted site laws and future blast designs can be optimised based on more detailed site information. By adopting this approach, in conjunction with the adoption of improved blasting products and methods, as they are introduced, it is anticipated that blast emissions criteria can be met without imposing any significant constraints on blast designs throughout the operation of the Project.

As outlined in **Section 1.2.2**, NPM own and manage large areas within and surrounding the Project Area. This includes all areas of land within the vicinity of proposed blasting practices, which is managed for agricultural uses, primarily cropping. As such there is no risk of blast impacts to livestock. There are small areas of the Milpose private property located within 500 metres of the E26 open cut pit. NPM will consult with this landholder prior to blasting activities to minimise potential blast impacts to this property, including livestock and other agricultural land uses. This procedure will be detailed as part of the revised Noise and Vibration Management Plan (refer to **Section 5.5.4**).

Blasting will occur within 500 metres of McClintocks Lane when undertaken within the proposed E26 open cut mine. NPM will undertake appropriate road closure and traffic management processes along sections of McClintocks Lane where blasting is undertaken within 500 metres of this road.

5.5.4 Blasting Management and Monitoring Commitments

NPM will revise the Noise and Vibration Management Plan, and implement a monitoring program similar to that employed during the E22 open cut operations during the periods of campaign open cut mining as part of the Project. NPM will investigate opportunities to refine blast design to ensure compliance with all relevant airblast impact assessment criteria at surrounding private properties.