Appendix 9

Agricultural Impact Statement

Prepared by: Diana Gibbs & Partners and
R.W. Corkery and Co Pty Limited

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AUSTRALIAN ZIRCONIA LTD

(A wholly owned subsidiary of Alkane Resources Ltd)

Dubbo Zirconia Project

Agricultural Impact Statement

Prepared by

R.W. CORKERY & CO. PTY. LIMITED

&

Diana Gibbs & Partners

September 2013

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AUSTRALIAN ZIRCONIA LTD

(A wholly owned subsidiary of Alkane Resources Ltd)

Agricultural Impact Statement

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LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
AIS	Agricultural Impact Statement
ALARP	As Low As Reasonably Possible
AZL	Australian Zirconia Ltd
BOA	Biodiversity Offset Area
BoM	Bureau of Meteorology
CSG	Coal Seam Gas
DP&I	NSW Department of Planning & Infrastructure
EES	Environmental Earth Sciences Pty Limited
EIS	Environmental Impact Statement
EP&A Act 1979	*Environmental Planning and Assessment Act 1979*
EMM	EMGA Mitchell McLennan
JHR	John Holland Rail
LEP	Local Environmental Plan
LGA	Local Government Area
LRSF	Liquid Residue Storage Facility
OASFS	Office of Agricultural Sustainability and Food Security
OEH	Office of Environment and Heritage
OzArk	OzArk Environmental and Heritage Management Pty Limited
MRWP	Macquarie River Water Pipeline
NOW	NSW Office of Water
NSW	New South Wales
PEL	Pacific Environment Limited
PV	Present Value

LIST OF ABBREVIATIONS (Cont'd)

REE	Rare Earth Element
ROM	Run-of-Mine
SAL	Strategic Agricultural Land
SEEC	Strategic Environmental and Engineering Consultants Pty Ltd
SEPP	State Environmental Planning Policy
SRLUPl	Strategic Regional Land Use Plans
SRLUPo	Strategic Regional Land Use Policy
SRSF	Solid Residue Storage Facility
SSD	State Significant Development
SSM	Sustainable Soils Management Pty Ltd
TARP	Trigger Action Response Plan
WRE	Waste Rock Emplacement
WSP	Water Sharing Plan

EXECUTIVE SUMMARY

Introduction

This Agricultural Impact Statement (AIS) has been prepared by Diana Gibbs and Partners in conjunction with R W Corkery & Co Pty Limited, to accompany an application for development consent by Australian Zirconia Limited ("the Applicant or AZL") to develop and operate the Dubbo Zirconia Project (the "Proposal or DZP"). In accordance with the Director General's requirements from the Department of Planning and Infrastructure, an Agricultural Impact Statement is required to be prepared for all State Significant development applications for mining and petroleum and is to be submitted in conjunction with the *Environmental Impact Statement* for the Proposal. This document has been prepared reflecting the guidelines released by the NSW State Government in October 2012 regarding the content of an Agricultural Impact Statement.

This summary introduces the Proposal and provides relevant background information about the agricultural resources, enterprises and infrastructure at three scales, namely the: 'Region', the 'Locality' and the 'Disturbance Area' location. The mine area within the project boundary is referred to as the 'DZP Site'.

An overview is also provided of the proposed design and operational safeguards the Applicant would adopt to minimise impacts on the agricultural issues and the predicted impacts associated with the Proposal upon the surrounding agricultural resources, enterprises and infrastructure.

Proposal Description

The following provides an overview of principal components and activities to be undertaken on the DZP Site.

- Extraction of approximately 19.5Mt of ore at a maximum rate of 1.1Mt per year from a shallow open cut developed to a maximum depth of 32m (355m AHD) (remaining above the groundwater table).
- Extraction and placement of approximately 3.5Mt of waste rock (weathered material or rock containing insufficient grades of rare metals or REEs for processing) within a small waste rock emplacement (WRE) to the southwest of the open cut.
- Haulage of ore to a Run-of-Mine (ROM) Pad for crushing and grinding.
- Processing of the crushed and ground ore by:
  - Sulphation roast of ore and leaching to dissolve sulphated metals.
  - Solvent extraction, precipitation, thickening, washing and drying of the various rare metal and REE products.
- Construction and operation of a rail siding from the Toongi-Dubbo Rail Line and a Rail Container Laydown and Storage Area for the unloading and temporary storage of reagents and loading of products for despatch.
- Mixing of solid residues produced by the processing of the ore with crushed and washed limestone and transportation via conveyor to a Solid Residue Storage Facility (SRSF).

- Pumping of water used in the processing operations, which cannot be recycled, to a Liquid Residue Storage Facility (LRSF), comprising a series of terraced and lined crystallisation cells.
- Recovery and disposal of an estimated 6.7Mt of salt which would accumulate within the LSRF within a series of Salt Encapsulation Cells adjoining the WRE and SRSF.
- Other ancillary activities including equipment maintenance, clearing and stripping of the areas to be disturbed and rehabilitation activities.

The AIS focusses upon the area of disturbance within the DZP Site.

Agricultural Areas of Assessment

In order to adequately assess the agricultural resources, enterprises and infrastructure within and surrounding the Site, three areas, namely the 'Region, 'Locality' and the 'Disturbance Area' were defined to provide relevant background agricultural information and the basis on which to assess the potential impact that the Proposal may have on each area. For the purposes of this document, the Region refers to the Dubbo City Council Local Government Area (LGA).

Regional Agricultural Setting

The Region incorporates the City of Dubbo. Background agricultural information compiled for the Dubbo area shows that the total value of agricultural production from this LGA for the year ending June 2006 (latest available, published Nov 2011) was $42.6 million. Of this total, $16.1 million (38%) was derived from cropping activities, and the balance from livestock slaughterings ($18.5 million) and livestock products ($8.0 million). These agricultural enterprises are serviced by the existing infrastructure, predominantly the Newell and Mitchell Highways, with Dubbo providing numerous agriculture-related businesses.

Toongi Locality Agricultural Setting

The 'Locality' is defined as the area immediately surrounding the DZP Site. In general, land within the Locality consists of grazing agricultural enterprises and operations occurring within the area primarily involving cattle fattening, prime lamb production, with some cereal, and Lucerne also being grown on the more suitable soils along creeks. Obley Road provides the key access routes to the various enterprises and the regional transport infrastructure, with the agricultural businesses being based predominantly in Dubbo.

Environmental Safeguards and Impacts

Water Resources

The DZP Site is located within the Macquarie River catchment that incorporates the smaller Wambangalang Creek and Little River catchments.

Surface water within the DZP Site would be separated on the basis of quality or the nature of the catchment and managed and in accordance with a *Water Management Plan* to ensure no water quality impacts are experienced by downstream agricultural and other users. As much clean water as possible would be diverted away from areas of disturbance, with the sediment-laden water would be collected and, after settling, released from the DZP Site.

The proposed safeguards and mitigation measures, discussed in Section 6.2.1 of this document and Section 4.5.4 of the *Environmental Impact Statement,* conclude that negligible impacts on surface water either on site or downstream are likely to be encountered.

Up to 4.05GL of water is proposed for extraction from the Macquarie River to supply the processing operations. This water would be obtained under licence (either purchased or traded) under the Water Sharing Plan for the Unregulated Macquarie and Cudgegong Rivers.

The DZP Site is located within the area covered by the *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources* which commenced on 16 January 2012. While there would be no direct impact of the Proposal on local groundwater resources as the open cut would not intersect the groundwater table and the residue storage facilities have been designed to prevent seepage or leakage to the underlying aquifers, the Applicant is likely to undertake some groundwater extraction from fractured rock and alluvial aquifers to maintain hydrological balance across the DZP Site. Local groundwater uses in the Lachlan Fold Belt Fractured Rock Aquifer use water for stock and domestic purposed as flow rates and water quality limit its use for irrigation, however, there are more significant uses of alluvial water supplies for agriculture in the region.

On the basis that the entry of the Applicant to water markets within each of the targeted water sources would not restrict access to this tradable commodity to agriculture, it is assessed that the impact of the Proposal on agricultural production (as related to water) would not be significant.

Soils and Land Capability

Based on the proposed rehabilitation plan and implementation of the proposed soil management measures, the likelihood that the soils to be stripped, stockpiled and respread would remain viable for the purposes of rehabilitation and future agricultural production would be maximised.

Some reduction in land capability is predicted, associated with the major changes to topography generated by features of the DZP Site such as the open cut, Solid Residue Storage Facility and Waste Rock Emplacement. It is considered that there are no feasible methods to prevent this reduction in land capability and it is considered that he DZP Site would still provide for a productive site for future agriculture despite this.

Agricultural Industries

A land use model has been developed which allocates land to the appropriate agricultural uses, depending on land and soil capability classes. Via this model (see Section 4.9 for description), the potential value of production from the land to be owned by the Applicant of 3 452 ha has been assessed as $1.46 million per annum. The intent of the Applicant is to continue current agricultural activities on the site wherever possible.

The key impacts of the proposal on current activities are assessed as follows.

- During mining activities, approximately 808ha would be lost to agricultural production. In addition, around 1 020ha will be allocated to biodiversity offset plantings and management of remnant native vegetation. The value of agricultural production lost has been assessed as being in the order of $674,330 per year. Over the 20 year operational “life” of the DZP, this loss can be calculated as having a Present Value (PV) of $5.78 million (at 10% discount rate).
- Following the cessation of mining activities, and rehabilitation of the site, around 1,220 hectares would continue to be unavailable for agricultural activities. This would result in the loss of some $402,910 per annum.

- Over the 20 years of the proposed mining activity, and assuming a further 20 years of production from the rehabilitated site, the total loss of agricultural production from the total project area would have a PV of $6.25 million (at 10%). This total can be compared with an equivalent PV of $4,257 million (i.e. $4.3 billion) for the value of production from the DZP over the 20 year operational life of the Proposal.

Conclusion

As the Proposal has been designed so that the majority of land disturbed is rehabilitated to the current land and soil capability classes (or maintained as biodiversity offsets), the Applicant considers that the Proposal represents an excellent balance between the use of the land for ongoing agricultural uses and nature conservation and acceptance of mining as being a temporary land use.

1. INTRODUCTION

1.1 SCOPE

Australian Zirconia Limited ("the Applicant" or "AZL") proposes to develop and operate the Dubbo Zirconia Project ("the Proposal"), a small scale open cut mine supplying rare metal and Rare Earth Element (REE) containing ore to a purpose developed processing plant near the village of Toongi, approximately 25km south of Dubbo (see **Figure 1**). The area of proposed mining and processing operations, and associated facilities for the storage and management of the various waste by-products of these operations, is referred to as the DZP Site and occurs over parts of seven farming properties ("Karingle", "Glen Idol", "Ugothery", "Grandale", "Toongi Valley", Whychitella" and "Pacific Hill") (see **Figure 2**). The Applicant either owns or holds an option to purchase the affected land of the DZP Site which covers an area of 2 864ha.

Important to the development and operation of the Proposal would be the upgrade of the currently disused Toongi-Dubbo Rail Line, upgrade to Obley Road and Toongi Road, construction of a water pipeline from the Macquarie River, and construction of a natural gas pipeline (from Dubbo). The land affected by the rail line, road upgrades and gas pipeline would occur within existing road or rail easements. The land over which the Macquarie River Water Pipeline would be constructed has been negotiated with the relevant landowner, either by a call option to purchase the property in its entirety, or by negotiation of an easement to access to the land affected (see **Figure 2**).

This Agricultural Impact Statement (AIS) has been prepared as the Proposal is a State Significant Development (SSD), as defined by *State Environmental Planning Policy (State and Regional Development) 2011*, that has the potential to affect agricultural resources and/or enterprises. This document focuses upon describing and assessing the disturbance within the DZP Site given it would be the principal area of disturbance throughout the life of the Proposal. While it is recognised there would be disturbance associated with the Toongi-Dubbo Rail Line, Natural Gas Pipeline and public road network, this disturbance is either minor in nature or located within land zoned specifically for infrastructure, not agriculture. In the case of the Macquarie River Water Pipeline, the area of disturbance would be minimal and the adjoining land would continue to be grazed throughout the life of the Proposal.

This document has been assembled to assist the Department of Planning and Infrastructure (DP&I), in conjunction with the Office of Agricultural Sustainability and Food Security (OASFS), in its assessment of the potential impacts of the Proposal on agricultural resources and/or enterprises.

The information presented in this document has been drawn from a range of sources including the Environmental Impact Statement (EIS) for the Proposal and the supporting Specialist Consultant Studies Compendium, specifically, the groundwater, surface water, soils and ecological assessments. Relevant information drawn from these documents has been summarised, however, has been cross-referenced for readers to gain further information, if required. A substantial amount of data has also been obtained through the Australian Bureau of Statistics (ABS) and the NSW DPI.

The information presented in this document covers the relevant background information, environmental and agricultural settings, as well as the anticipated impacts of the Proposal upon agricultural resources, infrastructure and enterprises. The issues addressed have been ascertained through consultation with government agencies, the local community, surrounding landowners, a broad-brush risk assessment and a diversity of specialist consultants' assessments undertaken for the EIS for the Proposal.

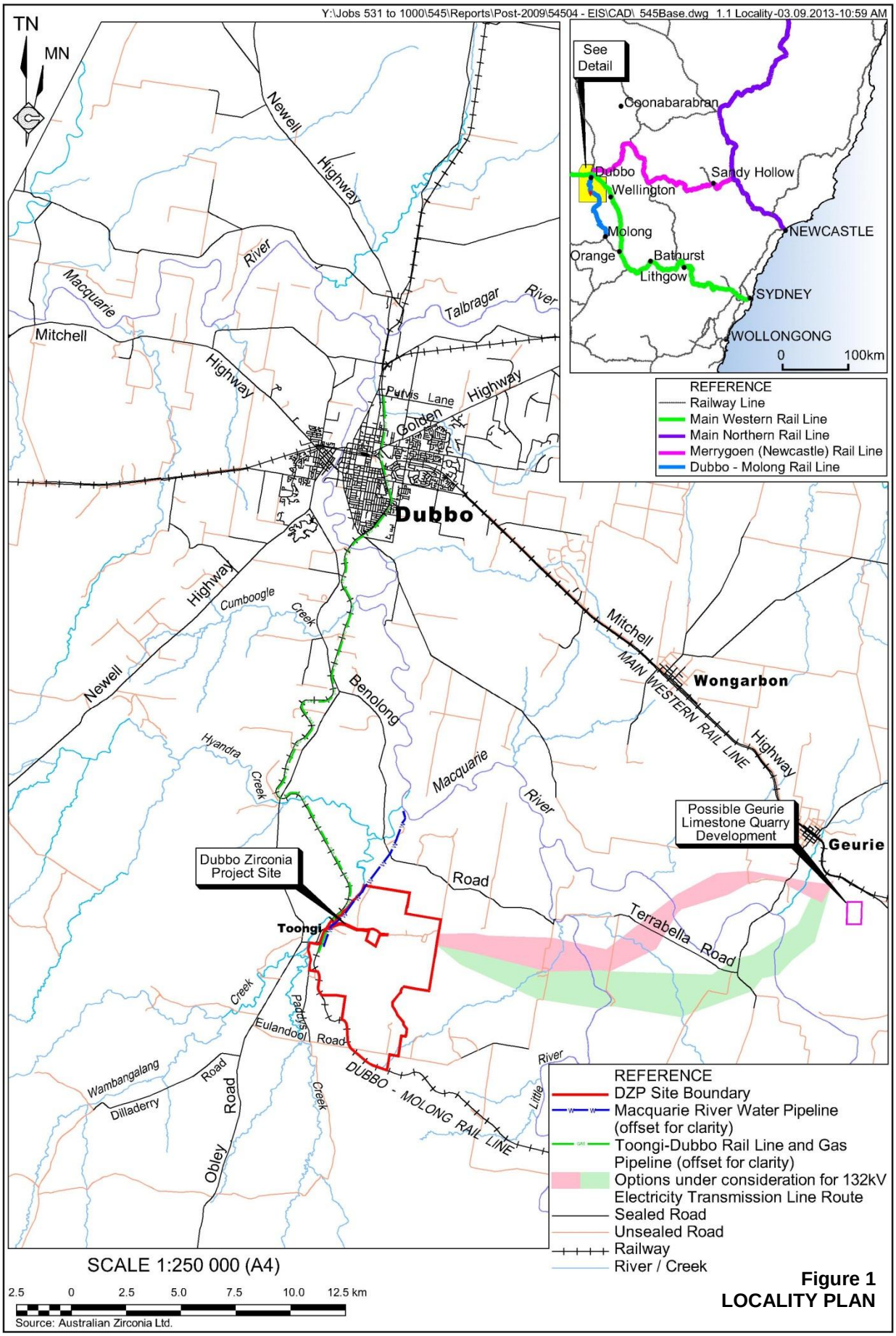


Figure 1
LOCALITY PLAN

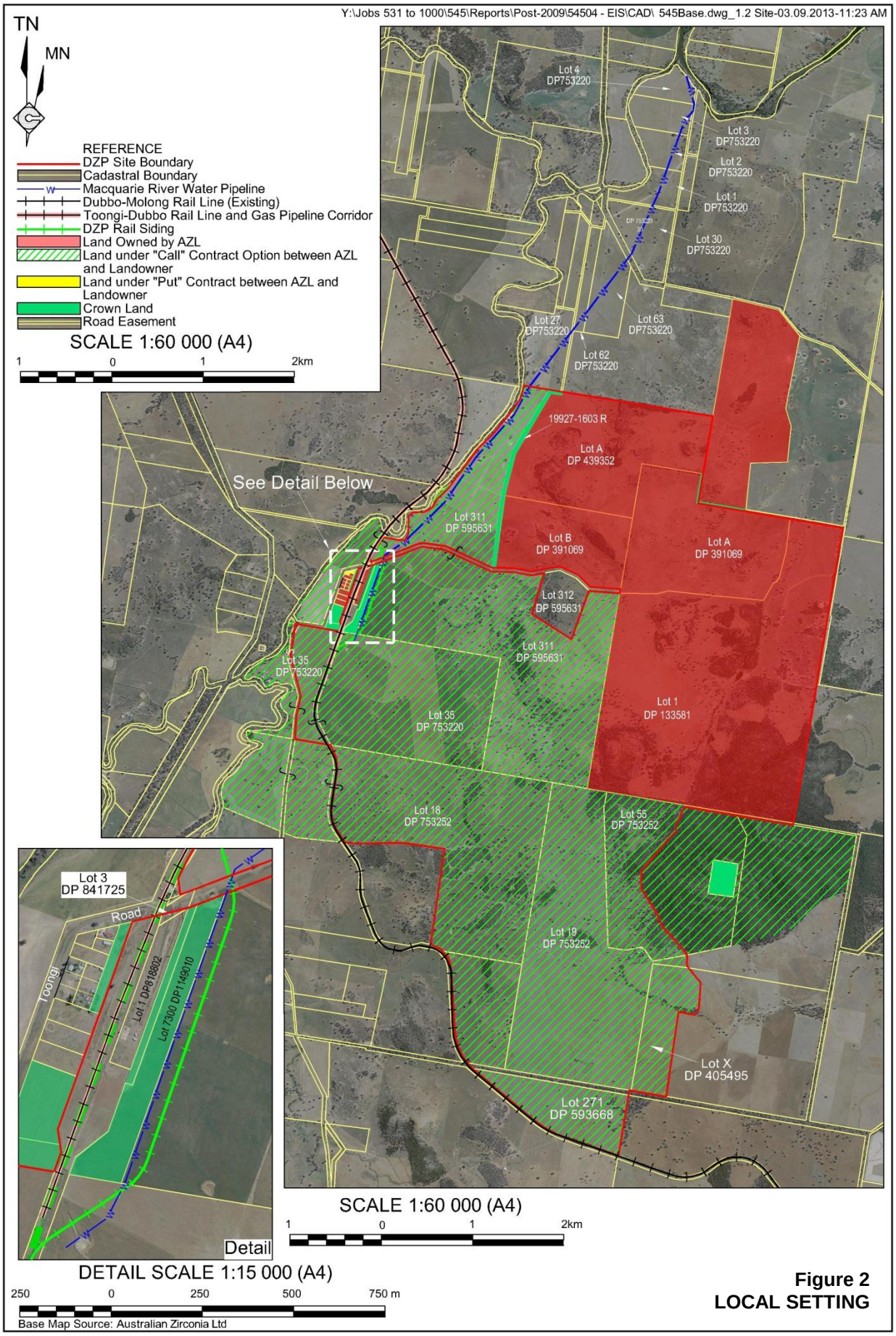


Figure 2
LOCAL SETTING

1.2 DOCUMENT FORMAT

The document is structured in seven sections, as follows.

Section 1: provides an overview of the Proposal, details of land ownership within and surrounding the Site, details of consultation and an overview of relevant planning issues. This section also records the approach to the environmental risk analysis undertaken for the Proposal with respect to the specific agricultural issues.

Section 2: presents a description of the local environment as relevant to agricultural production.

Section 3: presents a description of the historic and current agricultural enterprises of the local setting and specifically the DZP Site.

Section 4: presents a description of the potential impacts of the Proposal on agricultural production and land use. Both direct impacts, i.e. resultant from the altered land use of the DZP Site and indirect impacts, i.e. those influenced by changes to land use or resource utilisation of the Proposal, are identified and considered.

Section 5: provides an overview of the mitigation measures the Applicant proposes to implement to minimise adverse impacts upon agricultural resources and enterprises.

Section 6: provides an assessment of the impacts on agricultural resources and enterprises together with the socio-economic impacts associated with agricultural lands and their interactions with the Proposal.

Section 7: provides a conclusion to the document which justifies the Proposal in terms of its interactions with the various agricultural resources and enterprises.

1.3 COMMONLY USED TERMINOLOGY

For the purposes of this document, three distinct areas have been established for consideration and discussion of agriculture-related issues relevant to the Proposal.

- The "Region", relates to the Dubbo City Council Local Government Area (LGA). The Region covers an area of approximately 3 420km^2, with the City of Dubbo being located approximately 25km north of the Proposal. The region is presented on **Figure 3.**
- The "Locality" is the general area of land surrounding the DZP Site. The Locality is displayed on **Figure 3** and incorporates the 3,452ha which will be controlled by the Applicant and some of which would be removed from agricultural production.
- The "Disturbance Area" is an area of approximately 808ha of land within the Project Site proposed for disturbance during the life of the Proposal all/or part of which would be unavailable for agricultural purposes for various periods during the life of the Proposal **Figure 3**.

Additionally, the following provides a description of some of the commonly used Proposal-related terms.

- The DZP Site: references the land on which the proposed mining, processing and waste management activities would be located (see **Figure 4**). Cadastral boundaries have been used where possible to define the DZP Site boundary.

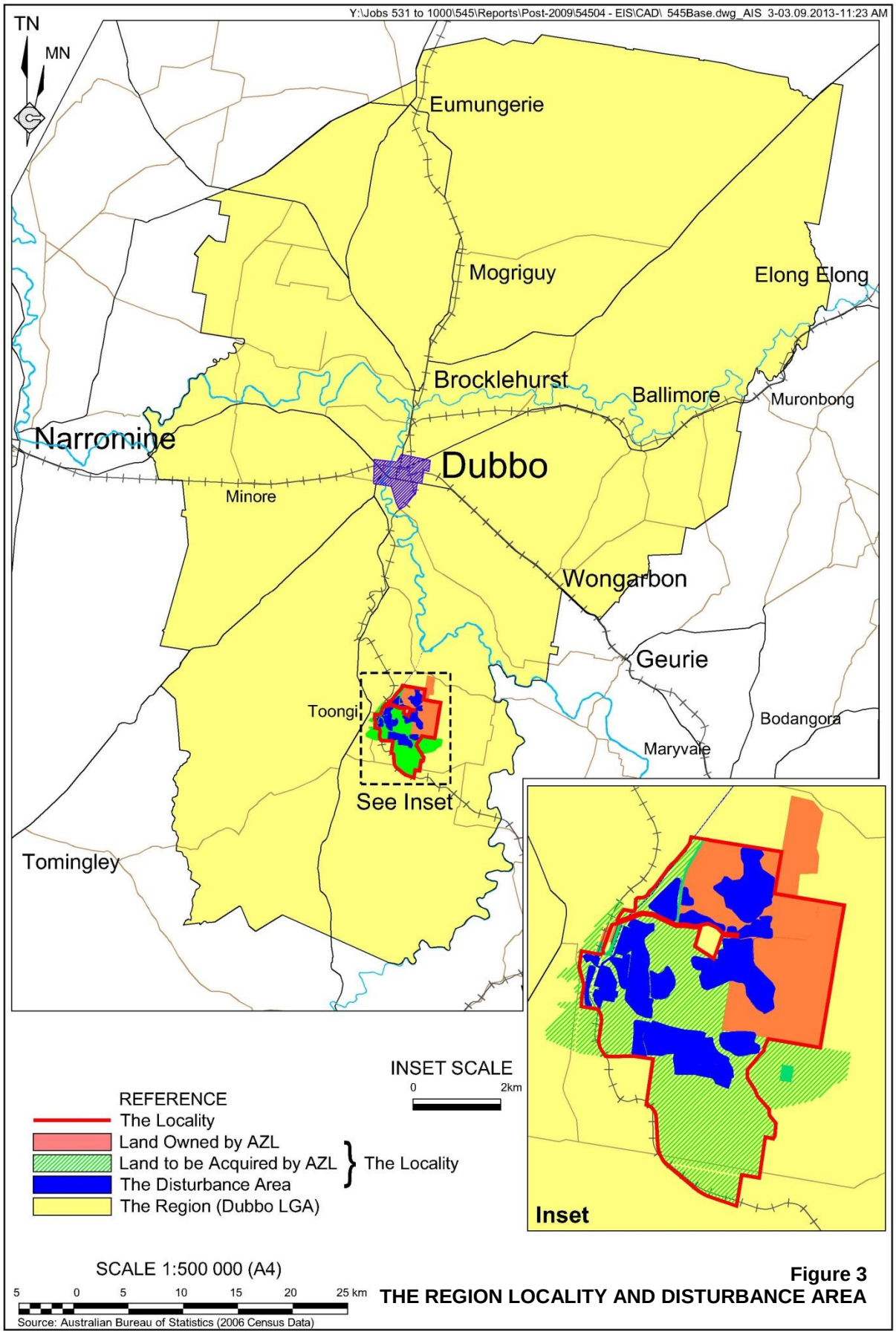


Figure 3
THE REGION LOCALITY AND DISTURBANCE AREA

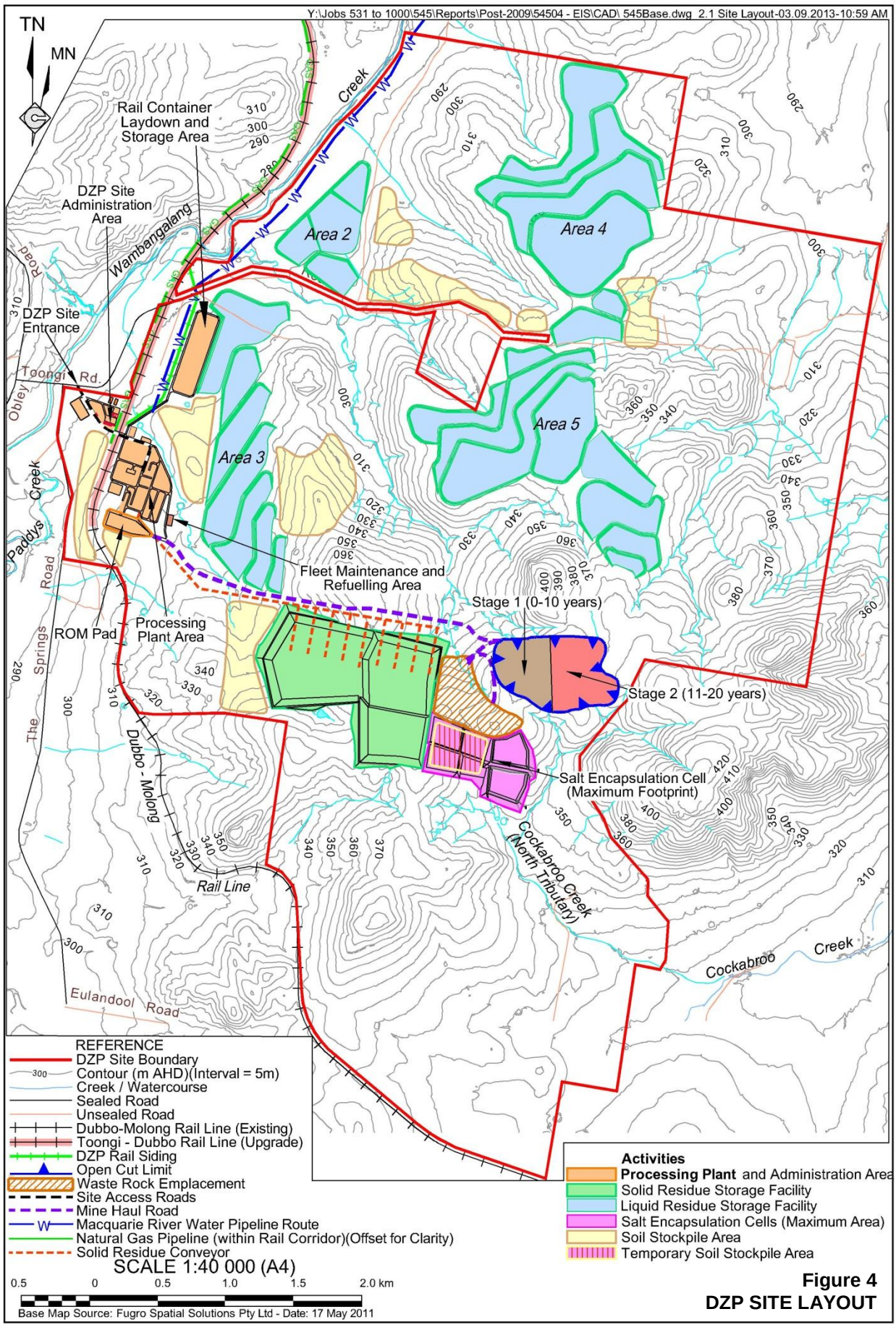


Figure 4
DZP SITE LAYOUT

- the Macquarie River Water Pipeline (MRWP): a 7.6km pipeline of 450mm diameter between the Macquarie River on the "Mia Mia" property and the process water pond of the DZP Site processing plant area is proposed to be constructed (buried) within some agricultural land, however, due to the limited impacts on agricultural productivity, has not been assessed for this AIS.
- Toongi – Dubbo Rail Line and Gas Pipeline Corridor: comprising an upgrade to the Toongi – Dubbo section of the currently disused Dubbo – Molong Rail Line, and the construction of a natural gas pipeline, developed as a spur line from the Central West Pipeline (operated by APA Group) between Purvis Lane, Dubbo and the processing plant of the DZP Site. The gas pipeline would be located within an approximately 30km long, 5m wide corridor within the rail easement. Access to the rail easement has been negotiated with John Holland Rail (JHR).
- Public Road Network: comprising upgrades to Toongi Road and Obley Road required to safely accommodate the arrangement and volume of heavy vehicles that would travel between the Newell Highway and the DZP Site. Upgrades would include the construction of new or upgraded intersections, curve realignments, pavement widening and upgrade, and modification to creek crossings.

1.4 OVERVIEW OF THE DZP

1.4.1 Proposed Operations

The operation of the Proposal would be focused on the development of an open cut mine, processing plant and various structures designed to manage the waste rock and residues generated by the mining and processing operations. The land on which these components of the Project would be located is referred to as the Dubbo Zirconia Project (DZP) Site. The development and operation of the Proposal would also rely on the development of the MRWP, Toongi – Dubbo Rail Line and Gas Pipeline Corridor and public road network. However, as these would have only minimal impact on agricultural lands, the description is restricted to the principal components and activities to be undertaken on the DZP Site only (and illustrated on **Figure 4**).

- Extraction of approximately 19.5Mt of ore at a maximum rate of 1.1Mt per year from a shallow open cut developed to a maximum depth of 32m (355m AHD) (remaining above the groundwater table). At the proposed rate of mining, the open cut design proposed would provide for a mine life of 20 to 22 years.
- Extraction and placement of approximately 3.5Mt of waste rock (weathered material or rock containing insufficient grades of rare metals or REEs for processing) within a small waste rock emplacement (WRE) to the southwest of the open cut.
- Haulage of ore to a Run-of-Mine (ROM) Pad for crushing and grinding.
- Processing of the crushed and ground ore by:
  - Sulphation roast of ore and leaching to dissolve sulphated metals.

  - Solvent extraction, precipitation, thickening, washing and drying of the various rare metal and REE products.

  The sulphuric acid required as part of the sulphation process would be manufactured within the DZP processing plant from imported raw sulphur.

- Construction and operation of a rail siding from the Toongi-Dubbo Rail Line and a Rail Container Laydown and Storage Area for the unloading and temporary storage of reagents and loading of products for despatch.

  Other reagents would be transported to the DZP Site via the public road network, with sections of Obley Road and Toongi Road to be upgraded to accommodate the proposed increase in heavy vehicle traffic.

- Mixing of solid residues produced by the processing of the ore with crushed and washed limestone and transportation via conveyor to a Solid Residue Storage Facility (SRSF).
- Pumping of water used in the processing operations, which cannot be recycled, to a Liquid Residue Storage Facility (LRSF), comprising a series of terraced and lined crystallisation cells.
- Recovery and disposal of an estimated 6.7Mt of salt which would accumulate within the LSRF within a series of Salt Encapsulation Cells adjoining the WRE and SRSF.
- Other ancillary activities including equipment maintenance, clearing and stripping of the areas to be disturbed and rehabilitation activities.

The maximum development footprint on the DZP Site would be approximately 807.7ha (within the Application Area of 2 507ha; see **Figure 4**). Component disturbance areas are as follows.

- Open Cut Mine – 40.3ha.
- Waste Rock Emplacement Area – 20.4ha.
- ROM Pad – 4.2ha.
- Processing Plant and DZP Site Administration Area (incorporating the processing plant and associated reagent storage areas, rail siding and container laydown areas and site offices and administration complex) – 43.3ha.
- Solid Residue Storage Facility – 102.8ha.
- Liquid Residue Storage Facilities (Evaporation Ponds) – 425.4ha.
- Salt Encapsulation Cell – up to 34.6ha.
- Soil Stockpile Areas – up to 156ha.
- Internal Haul Road – 7.3ha

The ore body to be mined is a roughly elliptical stock in shape with outcrop dimension of 600m x 400m. Exploration completed by AZL has identified that the ore body extends below a thin veneer of soil and recent sediments to be approximately 900m (east-west) x 500m (north-south) (surface area of 36ha) and appears to be approximately 100m thick.

While there is limited scope to modify the area of impact associated with the open cut, in order to minimise the impact of the mining operations, the Applicant has designed the mining sequence such that the initial 10 year mine plan develops the western half of the open cut with the eastern half developed and mined during the second 10 year mining period (see **Figure 4**).

The proposed Open Cut is located on a heavily timbered rocky pavement with limited agricultural value. The reason for this staged open cut was a need by the Applicant to manage the conservation of a listed threatened species (Pink-tailed Worm-lizard, *Aprasia Parapulchella*).

The size and location of the other components of the DZP Site have been the subject of more detailed review, with impact minimisation a key consideration.

1.4.2 Proposal Water Requirements and Supply

Whilst improvements in water efficiency of the processing operations are continuously being made, the Applicant has budgeted for worst-case water requirements of 4.05kL of water per tonne of ore processed. At maximum production, this would be equivalent to 4 050ML (4.05GL) per year. An estimated 39.6ML would also be required annually for dust suppression purposes.

Refer to EIS Section 2.8 for further detail on the proposed supply of water to the processing operations.

1.4.3 Proposed Rehabilitation Strategy

Figure 5 presents the proposed final landform. In summary, the final landform would include the following components.

- Removal of all processing plant, office and ancillary infrastructure, including concrete pads (unless required for a future land use). The remaining landform would be profiled to approximate that which existed prior to the establishment of the infrastructure.
- A single appropriately bunded, fenced and signed final void.
- A shaped and revegetated complex of the WRE, SRSF and Salt Encapsulation Cells[1] comprising undulating upper surfaces, outer faces with maximum slopes of approximately 18º (1V:3H) and appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.
- A return to the pre-disturbance landform over areas covered by the LRSFs with the liner removed and disposed of in accordance with relevant guidelines, material contained within the embankments respread over the former evaporation cells and the areas covered with topsoil and revegetated.
- Any vegetated bunds and surface water infrastructure, including sediment basins, would be retained.
- The Macquarie River Water Pipeline and Natural Gas Pipeline would either be excavated and removed or retained depending on the preference of future landowners.
- The rail line infrastructure would be retained.

[1] The potential to encapsulate the salt in the open cut is considered a feasible alternative, however, acknowledging the potential for continued mining of the ore at greater depths an out-of-pit disposal site has been presented.

Landform ultimately influences land use, and vice versa, and so the landform concept presented by **Figure 5** could be modified over the life of the Proposal to reflect any changes to the intended final use of the land. As the regulatory framework within which the Proposal is to be developed places emphasis on offsetting impacts on biodiversity and agricultural land, it is likely that final land use would integrate biodiversity conservation and agriculture and the landform has been presented accordingly. **Figure 6** provides the Applicant's concept for the integration of agricultural land and biodiversity conservation of the final landform.

Where possible, rehabilitation of the disturbed land within the DZP Site would be undertaken progressively throughout the life of the Proposal, however, the nature of the Proposal dictates that the largest areas of disturbance, namely the LRSF, remain active for the life of the DZP and as a consequence the opportunity to undertake progressive rehabilitation on this structure would be restricted.

1.4.4 Proposed Biodiversity Offset Area

The Applicant has committed to creating a Biodiversity Offset Area (BOA) focussing on the remnant vegetation of Dowds Hill to the east of the open cut, linkages to the remnant vegetation of Wambangalang Creek to the west and Benolong Road to the north and conservation and enhancement of habitat critical to the Pink-tailed Worm-lizard, a NSW and Commonwealth listed threatened species with specific habitat requirements. The proposed BOA cover an area of 1 021ha and includes approximately 653.1ha (64%) native vegetation communities in moderate to good condition which requires ongoing weed (including woody weed) and feral pest management, 306.8ha (30%) associated derived grassland communities and 61.1ha (6%) currently cleared land which would require more intensive management to improve the condition of remnant native vegetation community(ies).

Figure 6 displays the boundary of the proposed Biodiversity Offset Area.

1.4.5 Ongoing Agricultural Activities during the Life of the Proposal

Current agricultural activities conducted in the Locality include grazing (cattle fattening and prime lamb production), with some cereal and lucerne production on better soils along creeks.

During the life of the Proposal, and in recognition of the intended final land use of agriculture over parts of the DZP Site, the Applicant intends to continue agricultural activities over selected areas of the DZP Site. **Figure 6** provides an illustration of the proposed ongoing and future land use of the DZP Site and surrounding Applicant owned land.

The following provides a description of the areas selected for a continuation agricultural operations and practices to be adopted to ensure that the operations of neighbouring agricultural enterprises are not disadvantaged.

1. Predominantly on the "Pacific Hill" and "Wychitella" properties, but with smaller areas on the "Toongi Valley", "Karingle", "Ugothery" and "Grandale" properties, agricultural activities would continue throughout the life of the Proposal. The Applicant would employ a property manager or managers, who would be resident on these properties, to integrate grazing, fodder and/or crop production with the DZP related activities of the DZP Site.
2. The proposed areas to be managed for agriculture are located predominantly around the boundary of the DZP Site, adjoining similarly managed land, to maximise the potential of this land and provide a buffer to areas of the DZP Site to be managed for biodiversity conservation.
3. All land owned by the Applicant beyond the DZP Site boundary (on the "Karingle", "Grandale", "Ugothery", "Toongi Valley", "Pacific Hill" and "Wychitella" properties) would continue to be operated as agricultural enterprises.

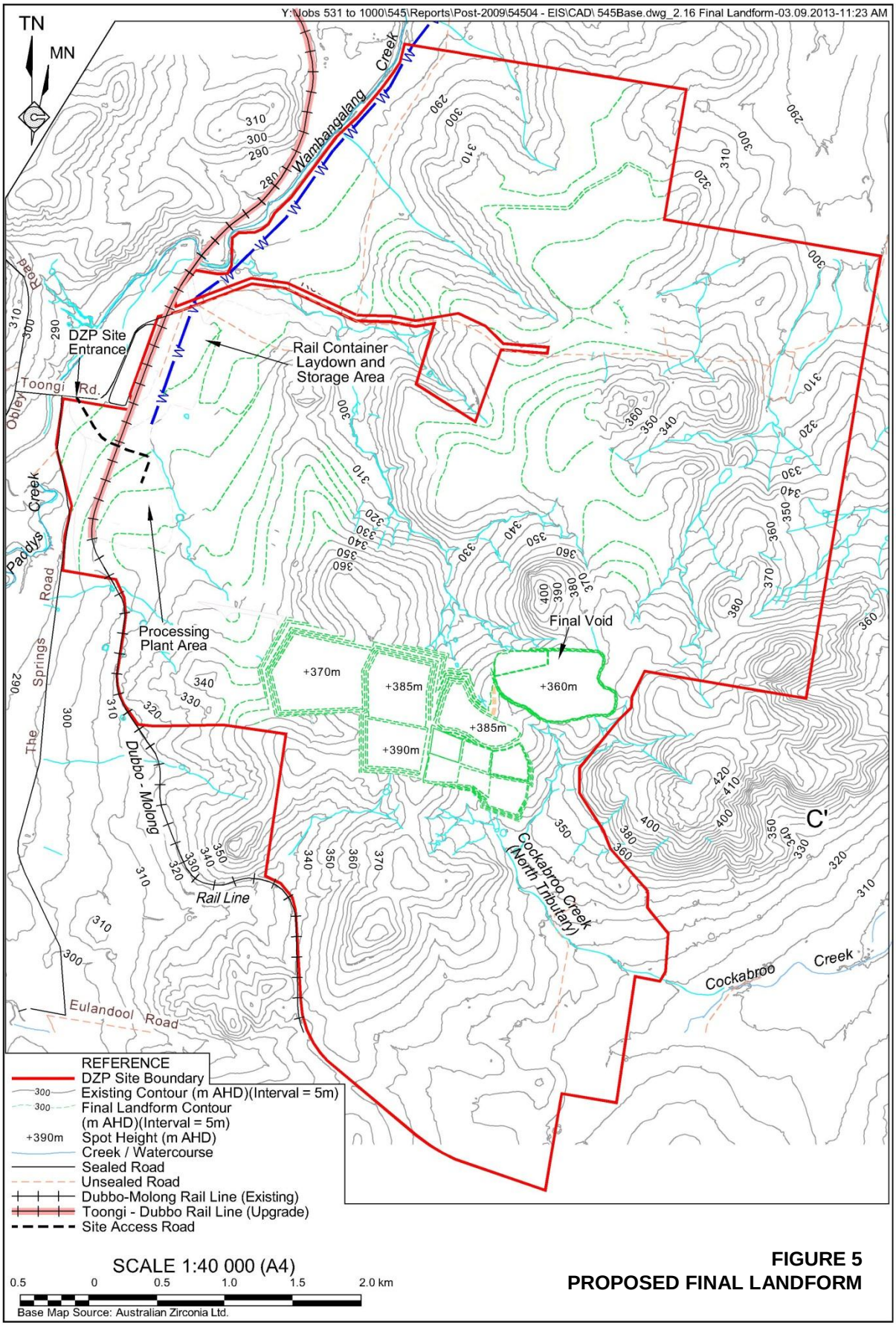


FIGURE 5
PROPOSED FINAL LANDFORM

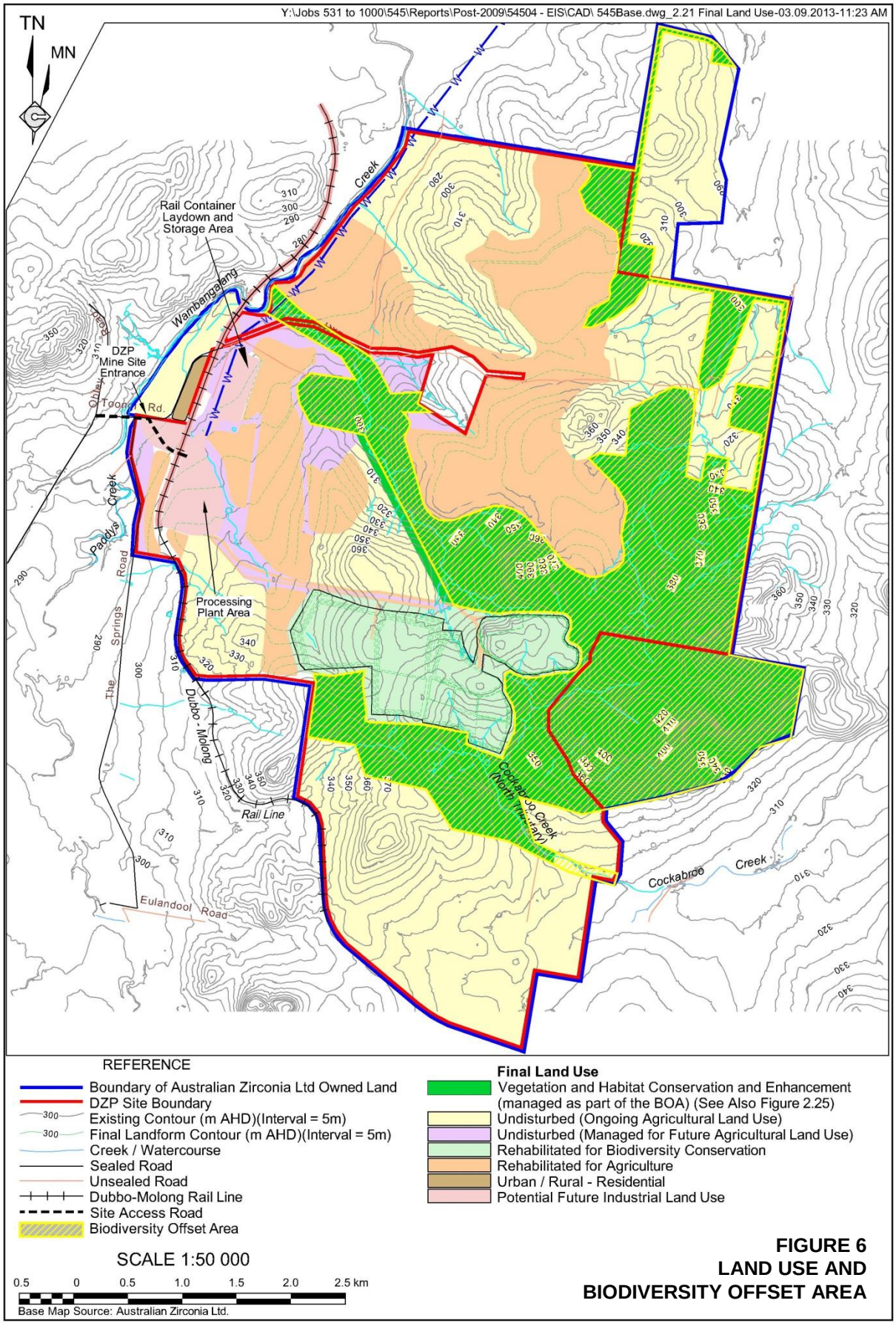


FIGURE 6
LAND USE AND
BIODIVERSITY OFFSET AREA

5. Land with the DZP Site beyond the impact footprint, not incorporated into the BOA, and proposed for a final land use of agriculture would be managed to maintain the agricultural suitability of this land over the life of the Proposal. This would require periodic grazing and weed spraying to prevent encroachment by native shrubs and trees or grasses not conducive to pasture.
6. Grazing on the DZP Site and other Applicant owned land would invariably be limited in the first instance to high intensity, short duration programs which would avoid selective grazing which may affect the botanical composition of the sward, prevent the formation of rank, stemmy growth and assist in the maintenance of a diverse and extensive ground cover.

1.5 LAND OWNERSHIP

1.5.1 DZP Site and Surrounds

AZL either owns or holds an option to purchase the land contained within the DZP Site. Two isolated features of non-Applicant controlled land occur within the larger DZP Site boundary (see **Figure 3**).

- Lot 312 DP595631: owned by B & J Usher who have rejected the Applicant's offer to purchase to date. Access to this property is via Toongi Road, for which Council is the road authority.
- Crown Reserve 753220 (Lot 7300, DP1149010) (for future public recreation) is located to the east of the Dubbo-Molong Rail Line and adjoins the western boundary of the DZP Site. This land is currently licensed for grazing to the landowner of the adjoining land (T & N Rothery – Property 51). The Applicant has expressed an interest in acquiring this reserve and discussions with the Crown Lands division of the Department of Primary Industries – Catchment & Lands (DPI-C&L) have commenced and are ongoing.
- A section of Crown Land paper road which intersects with Toongi Road and runs between the "Grandale" and "Toongi Valley" properties. The Applicant has proposed the acquisition of this paper road with the Department of Primary Industries – Catchment & Lands and there does not appear to be any impediment to this acquisition.

With the exception of the smaller residential blocks within Toongi village and four rural residential blocks located opposite the Toongi Road intersection on Obley Road, the majority of properties within the local context are predominantly agricultural varying in size from approximately 290ha to 605ha.

Properties within Toongi village are located on Toongi Road and currently eight people reside in the four houses in Toongi. The Toongi Quilt Shop is a business run from a home in the village. A community hall, solid waste transfer station and tennis courts are located west of Wambangalang Creek and serve as a focal point for the community and district.

1.5.2 Macquarie River Water Pipeline

The Macquarie River Water Pipeline traverses Lots 1, 2, 3, 4, 27, 30, 62, 63 and 311 of DP753220, and traverses three agricultural properties: "Pacific Hill", "Toongi Valley" and "Mia Mia", as well as several road reserves. The Applicant is finalising negotiations with the landowner of the "Mia Mia" property for the creation of an easement across this property extending between the northern edge of the DZP Site and the Macquarie River. The agreed alignment would cross Benolong Road approximately 2km from the Macquarie River.

1.6 CONSULTATION

1.6.1 Government Agencies

In preparing this Agricultural Impact Statement, consultations have been held with officers of NSW DPI in both Dubbo and Orange. Meetings were held with DPI officers in Dubbo on several occasions during 2011 and 2012 to discuss the requirement of the AIS more generally. A further meeting was held with DPI personnel in Orange in December 2012 to review the specific requirement of an AIS within the setting proposed for the DZP, i.e. non-strategic agricultural land outside areas with current Strategic Regional Land Use Plans issued (see Section 1.7.1.2.

Following the preparation and submission of the AIS for adequacy assessment, discussions were held with departmental economist, Mr Graham Carter on 7 August 2013 to discuss specific requirements of the AIS with respect to agricultural land and water use. The information contained within the AIS addresses the requirements as nominated by Mr Carter.

1.6.2 Surrounding Landowners

During the preparation of the Environmental Impact Statement, personal (face to face) interviews were conducted with each of the landowners whose land would be affected by the DZP. Information was sought as to current enterprises conducted on each holding, although financial information was not sought.

1.7 RELEVANT PLANNING ISSUES

1.7.1 State Planning Issues

1.7.1.1 State Environmental Planning Policy (State and Regional Development) 2011

This SEPP was gazetted on 28 September 2011 and applies to all Projects made following that date which satisfy nominated criteria. One of the purposes of this SEPP is to define those developments of State significance and therefore require Ministerial approval (either directly or under delegation) under the provisions of the EP&A Act 1979.

On the basis that the capital investment value of the DZP exceeds $30M, the Applicant's Proposal is identified under Schedule 1 of the SEPP and hence is declared as State Significant Development (SSD) to which the Part 4 Division 4.1 of the EP&A Act 1979 applies.

1.7.1.2 NSW State Strategic Regional Land Use Policy

The Strategic Regional Land Use Policy (SRLUPo) sets out a range of initiatives to better balance growth in the mining and coal seam gas (CSG) industries with the need to protect important agricultural land and water resources.

The goal of the SRLUPo is to protect valuable agricultural land from any encroachment, and to support the sustainable management of natural resources. The NSW Government is currently completing mapping of Strategic Agricultural Land (SAL) across NSW which when complete will be incorporated into a series of Strategic Regional Land Use Plans (SRLUPl). The mapped land will provide a trigger for the Gateway process, a scientific assessment of the impacts of SSD mining (and CSG) proposals on SAL by an independent, expert panel. If the panel considers that a proposal does not meet the Gateway criteria relating to agricultural and water impacts, it will issue a certificate with conditions which must be fully addressed as part of the development application, including amending the proposal if necessary.

Figure 7, taken from a fact sheet issued by the NSW Department of Planning & Infrastructure (DP&I) on the SRLUPo, provides an overview of the protective measures which cover the entire process from land access and exploration through to planning application and mining.

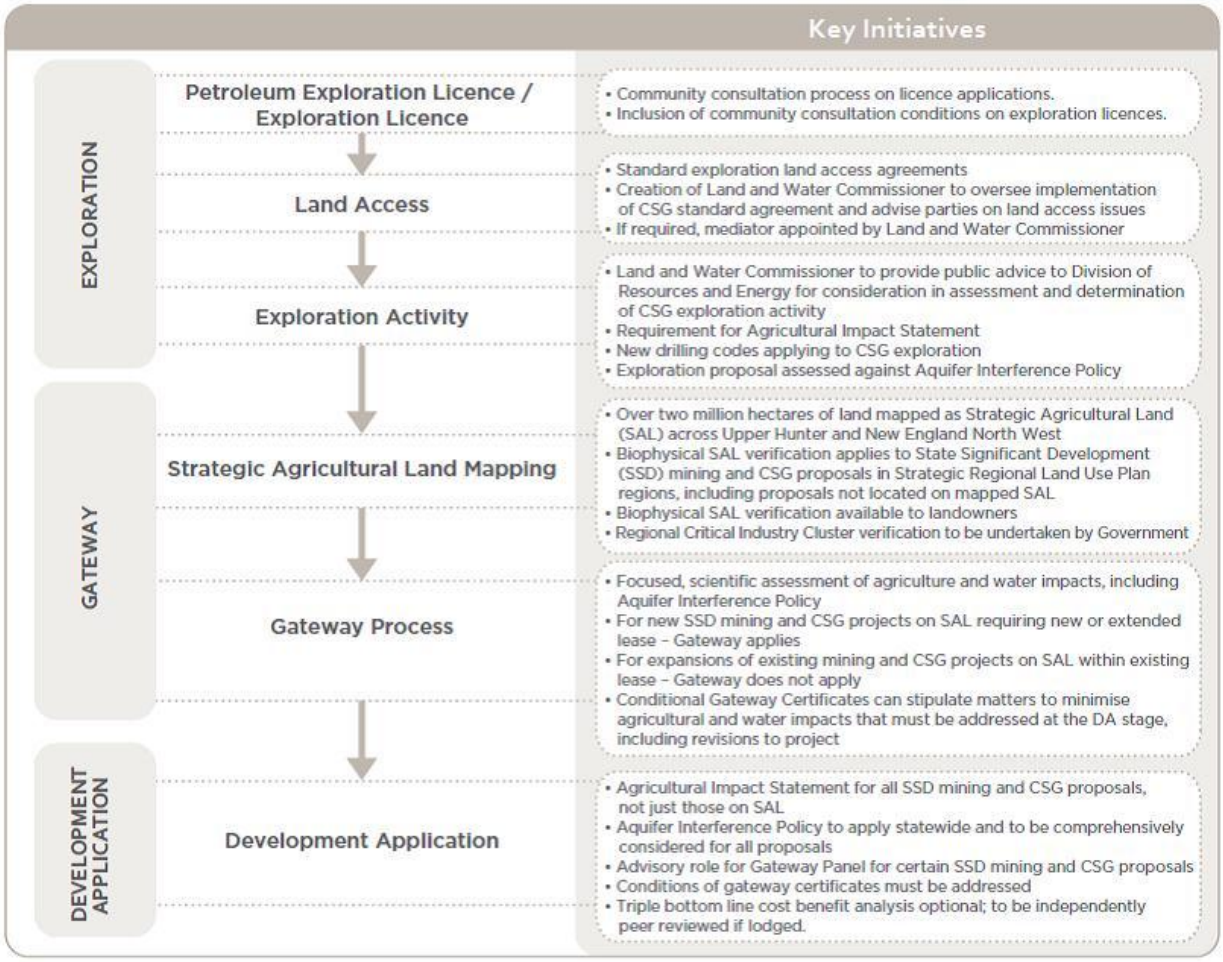


Figure 7
STRATEGIC AGRICULTURAL LAND FLOWCHART PROCESS

The DZP would be within the proposed Central-West SRLUPl, the preparation of which has been commenced but which remains to be completed and lodged for public comment. The Gateway process is therefore not triggered for the Proposal. However, as the DZP represents SSD, an AIS is required to address the potential impact that the Proposal may have on agricultural resources and enterprises in accordance with the AIS Guidelines, released by the Department of Planning and Infrastructure (DP&I) in October 2012 (DP&I, 2012).

This AIS has been prepared in accordance with the *Agricultural Impact Statement Guideline* (DPI, 2012). Detailed discussion on the intent of the Guideline has been held with relevant officers of DPI in Orange.

1.7.2 Regional Planning Issues

1.7.2.1 Strategic Regional Land Use Plan

As noted in Section 1.7.1, at the time of preparation of this document the Central West SRLUPl had not been released by the NSW Government. Notwithstanding this, due to the requirements for an AIS to be undertaken for the Proposal, this document assesses the Proposal and its potential impact on surrounding agricultural land and enterprises.

1.7.2.2 Dubbo Local Environmental Plan 2011

The DZP Site is located within the Dubbo City Local Government Area for which the Dubbo Local Environmental Plan (LEP) 2011 is relevant. A summary of relevant local zoning is as follows.

- With the exception of the Dubbo – Molong Rail Line and a small area of land to the east of the rail line adjacent to the village of Toongi which is zoned SP2 Infrastructure (Railway), the land over which the DZP Site is located is zoned RU1 Primary Production.
- The Macquarie Water Pipeline is located on land zoned RU1 Primary Production. The pumping infrastructure would occur within Zone W2 Recreational Waterways of the Macquarie River.
- The Natural Gas Pipeline and Dubbo-Molong Rail Line are located within the SP2 Infrastructure (Railway) easement of the Dubbo – Molong Rail Line.

The planning objectives of the RU1 Primary Production and SP2 Infrastructure (Railway) Zones are as follows.

The planning objectives of the relevant zones are as follows.

Zone RU1 – Primary Production

The six objectives of the RU1 Zone are as follows.

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To enable uses of an appropriate scale to facilitate the economic sustainability of primary production.
- To enable function centres, restaurants and appropriate forms of tourist and visitor accommodation to be developed in conjunction with agricultural uses.

Open cut mining is permissible within this zone with consent.

Zone SP2 – Infrastructure (Railway)

The two objectives of the SP2 Zone are as follows.

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

Development within this zone for the purpose nominated on the LEP map (Railway) is permitted with consent.

The Applicant sought clarification from Dubbo City Council in relation to the permissibility of the proposed gas pipeline within this zone. Advice received from Dubbo City Council on 9 January 2013 confirmed this activity would be permitted with consent.

Zone W2 – Recreational Waterways

The three objectives of the W2 Zone are:

- to protect the ecological, scenic and recreation values of recreational waterways;
- to allow for water-based recreation and related uses; and
- to provide for sustainable fishing industries and recreational fishing.

A review of the activities permitted with consent includes water reticulation systems, which is considered the activity best describing the proposed construction and operation of the water pumping infrastructure. The installation and operation of this infrastructure, if managed appropriately, would not be detrimental to the objectives of the W2 Zone.

1.8 MANAGEMENT OF INVESTIGATIONS

This document has been prepared collaboratively by Mr Alex Irwin, B.Sc (Hons) Senior Environmental Consultant of R.W. Corkery & Co Pty. Limited (RWC) in conjunction with Mrs Diana Gibbs, B.Sc. (Hons), M.Env.Stud., principal of Diana Gibbs and Partners. Information related to local and DSP Site soil and water resources has been provided by several specialist consultancies engaged by the Applicant to complete specialist assessment for the Environmental Impact Statement prepared for the Proposal. The following sources are acknowledged.

- Sustainable Soils Management Pty Ltd (SSM): who have prepared detailed soil landscape and soil and land capability maps for the DZP Site and surrounds.
- Strategic Environmental and Engineering Consultants Pty Ltd (SEEC): who have provided a detailed assessment of local and regional surface water resources.
- Environmental Earth Sciences Pty Limited (EES): who have provided a detailed summary of regional and local groundwater sources, availability and uses.
- Hennessy Water: who have provided a review of availability and tradability of local water resources within the relevant water sharing plans.

2. RISK ASSESSMENT

2.1.1 Introduction

A broad-brush risk assessment was undertaken for the identified agricultural risk sources; the potential consequences and receptors of the identified risk; the risk rankings assuming standard controls, and the residual risk rankings as a result of implementing additional management, mitigation and control measures. The following subsections present the results of this risk assessment.

2.1.2 Analysis of Environmental Risk

2.1.2.1 Risk Analysis Methodology

Risk is the chance of something happening that would have an impact upon the objectives or the task which, in this case, is the construction and operation of the Proposal. The results of the broad-brush risk analysis incorporated industry-wide standard risk measures and the implementation of the specific control measures for the Proposal to produce a residual risk ranking that accurately summarises the individual risk sources throughout the Proposal. In order to arrive at an appropriate risk ranking, consideration is given to the likely consequence and likelihood of the particular eventuality occurring as follows.

The five qualitative environmental consequence rankings used during the risk analysis are as follows.

1. Severe: The potential to cause regional environmental impact/ecosystem damage with impacts causing mine or business closure, e.g. major off-site release of a contaminant with long term, regional detrimental effects.
2. Major: The potential to cause substantial regional/local environmental damage which could result in major financial loss and/or prosecution, e.g. off-site release of contaminant resulting in local ecosystem damage.
3. Moderate: The potential to cause substantial short-term or minor long-term damage, e.g. a minor water or large hydrocarbon off-site release with outside clean-up assistance required. May potentially result in a legal non-compliance.
4. Minor: The potential for a temporary or minor damage. No legal breach but may be non-compliant with internal environmental target, e.g. Minor hydrocarbon spill.
5. Negligible: No detrimental effect, negligible environmental impact.

Table 1 presents the five qualitative environmental likelihood rankings used during the risk analysis.

Table 1
Qualitative Likelihood Ranking

Level	Descriptor	Description
A	Almost Certain	Is expected to occur in most circumstances.
B	Likely	Would probably occur in most circumstances.
C	Possible	Could occur.
D	Unlikely	Could occur but not expected.
E	Rare	Occurs only in exceptional circumstances.
Source: HB 203:2006 - Table 4(A)		

Table 2 presents the risk rankings calculated from the consequence and likelihood ranking determined as identified above.

Table 2
Risk Ranking

		Likelihood				
Consequence		A - Certain	B - Likely	C - Possible	D – Unlikely	E - Rare
	1 – Severe	1	2	4	7	11
	2 – Major	3	5	8	12	16
	3 – Moderate	6	9	13	17	20
	4 – Minor	10	14	18	21	23
	5 – Negligible	15	19	22	24	25

Low Medium High Very High

ALARP = As Low as Reasonably Possible

Note: Ranking modified after IEC/ISO 31010 2009 – Figure B15

2.1.2.2 Risk Analysis Results

Table 3 presents the identified risk source, the potential consequences, where appropriate, and receptors of the identified risk, the initial risk rankings assuming standard controls, the location of the proposed management and control measures within this document (and Section 4 of the *Environmental Impact Statement*), and the residual risk rankings as a result of implementing the additional management, mitigation and control measures. The standard and residual risk rankings have been determined from **Table 1** as a result of the broad-brush risk analysis and colour-coded appropriately to highlight the overall reduction in environmental risk associated with the Proposal.

It should be noted that in some cases when the adoption of additional management and control measures has been implemented, the residual risk ranking does not change from the predetermined risk ranking with standard controls and is deemed ‘as low as reasonably possible’ i.e. ALARP.

Table 3
Analysis of Standard and Residual Agricultural Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures	Residual Risk
AGRICULTURAL ISSUE – SOILS				
Inappropriate soil management.	Inadequate soil available for rehabilitation purposes leading to less successful rehabilitation and increased rehabilitation costs and maintenance to the DZP Site.	13 (C3)	6.2.1 (2.3.3.2)	17 (D3)
	Degradation of soil in stockpiles leading to less successful rehabilitation and increased rehabilitation costs and maintenance.	13 (C3)	6.2.1 (4.11.3)	18 (C4)
	Erosion of soil stockpiles into the local creeks leading to increased sediment loads.	13 (C3)	6.2.1 (4.5.3.2)	21 (D4)
AGRICULTURAL ISSUE – PRODUCTIVITY				
Alteration of agricultural land capability.	Partial loss of agricultural land capability	9 (B3)	6.4 (2.17.5)	14 (B4)
Alteration of soil productivity	Partial loss of soil fertility and productivity	9 (B3)	6..2.1 (4.11.3)	18 (C4)
Alteration of agricultural land values and productivity	Permanent loss of agricultural land	9 (B3)	6.4 (2.17.5)	17 (D3)
AGRICULTURAL ISSUE – BIOSECURITY				
Fire initiated on or off site.	Fire initiated on site threatening livestock.	13 (C3)	(4.14.5)	20 (E3)
Spread of disease in livestock	Reduced viability of livestock enterprise	13 (C3)	6.3	20 (E3)
Safety of livestock during mining activities	Injured or mortality to livestock	18 (C4)	(4.2.6.5)	24 (E4)
AGRICULTURAL ISSUE – SOCIO-ECONOMIC				
Mining operations.	Equity imbalance in wages / access to resources between miners and other sectors within the surrounding area.	8 (C2)	(4.15.2)	17 (D3)
	Mining operations lead to negative impacts on agricultural support services.	21 (D4)	(4.15.3)	21 (D4) (ALARP)

Low Medium High Very High ALARP = As Low as Reasonably Possible

Table 3 (Cont'd)
Analysis of Standard and Residual Agricultural Risk

Risk Source	Consequence / Hazard	Risk with Standard Control Measures	Proposed Control Measures	Residual Risk
AGRICULTURAL ISSUE – GROUNDWATER				
Interception of surface water infiltration into groundwater within the vicinity of the open cut.	Temporary reduction in groundwater recharge in Cockabroo Creek.	10 (A4)	6.2.2 (4.6.5)	15 (A5)
AGRICULTURAL ISSUE – SURFACE WATER				
Discharge of sediment-laden water.	Adverse impact on users of Wambangalang Creek	17 (D3)	6.2.2 (4.5.3.2)	24 (E4)
Reduction in catchment area.	Permanent reduction in flows in Wambangalang and Cockabroo Creeks as a result of the final landform.	9 (B3)	6.2.2 (4.5.3.2)	20 (E3)
AGRICULTURAL ISSUE – NOISE				
Noise emissions from mining operations (including site establishment and construction).	Reduced productivity of livestock.	17 (D3)	(4.2.6.3)	20 (E3)
AGRICULTURAL ISSUE – AIR QUALITY				
Deposited dust impacting agricultural productivity.	Increased dust load on pastures on surrounding agricultural land.	17 (D3)	(4.3.7)	20 (E3)
AGRICULTURAL ISSUE – BLASTING				
Ground vibration and airblast from blasting activities.	Reduced productivity of livestock.	17 (D3)	(4.2.6.5)	20 (E3)
	Amenity impacts on sensitive receptors.	18 (C4)	(4.2.6.5)	24 (E4)

Low Medium High Very High ALARP = As Low as Reasonably Possible

3. REGIONAL SETTING

3.1 INTRODUCTION

This subsection provides a brief overview of the regional climatic conditions, topography and drainage, groundwater environment, vegetation and soil types. A brief description is also provided on the existing agricultural enterprises and support infrastructure within the region.

3.2 CLIMATE

3.2.1 Data Sources

The closest Bureau of Meteorology (BoM) site that collects climatic information is located at Dubbo Airport, approximately 30km north of the DZP Site. The data are summarised in **Table 4** which presents information on temperature, relative humidity and rainfall.

Table 4
Local Climate Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9am Mean Temperature (^{o}C) and Relative Humidity (%)													
Temp	23.8	22.4	19.6	17.0	12.2	8.6	7.5	9.6	14.0	17.9	20.3	22.8	16.3
Humidity	56	62	64	64	76	86	86	76	67	56	56	52	67
3pm Mean Temperature (^{o}C) and Relative Humidity (%)													
Temp	31.6	30.2	27.6	23.7	19.2	15.4	14.5	16.5	19.9	23.5	27.0	29.7	23.2
Humidity	32	36	36	37	47	57	55	47	43	36	35	30	41
Daily Maximum Temperature (^{o}C)													
Mean	33.0	31.8	28.7	24.6	19.9	16.2	15.4	17.4	21.0	24.5	28.2	30.8	24.3
Daily Minimum Temperature (^{o}C)													
Mean	18.1	17.7	14.4	10.1	6.5	4.3	3.1	3.4	6.2	9.3	13.5	15.7	10.2
Rainfall (mm)													
Monthly mean	52.4	49.7	48.9	35.6	41.1	43.2	41.0	39.4	42.3	49.2	70.5	62.0	576.2
Rain days (Number)													
Mean no. of rain days	4.7	4.8	4.9	3.1	4.1	5.2	5.3	4.2	5.1	5.3	6.0	5.1	57.8
Station number: 065070; Commenced 1946; Currently Operating; Elevation: 284m AHD; Latitude: 32.22; Longitude: 148.58													
Source: PEL (2013) – Table 10													

3.2.2 Temperature and Humidity

January is typically the warmest month of the year with a mean daily maximum temperature of 33°C and mean minimum temperature of 18.1°C being the highest throughout the year. The coolest month of the year is typically July with the lowest mean daily maximum temperature of 15.4°C and coldest mean minimum temperature of 3.1°C.

In both the 9:00am and 3:00pm relative humidity data sets, the highest humidity was recorded in June with 86% and 57% respectively. Again for both 9am and 3 pm, the lowest humidity was recorded in December with 52% and 30% respectively.

3.2.3 Rainfall and Evaporation

Rainfall collected at the BoM Station No. 065070 indicates November has on average the highest rainfall per month within 70.5mm which equates to approximately 12.3% of the total rain falling through the year. April has the least amount of rainfall in the year with only 35.6mm which equates to approximately 6.2% of the total rail falling throughout the year.

Onsite rainfall data was also analysed for the years 2001-2011 and is presented in **Table 5**. The rainfall data collected at the DZP Site meteorological station has been influenced by the predominantly drought conditions during this period of measurement. However, the data does compare to that collected at the BoM Station 065070 in that the highest and lowest rainfall months are similar (November/December and April/May).

Table 5
Average Rainfall (mm) for Toongi 2001-2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	No Data	No data	2.02	2.07	2.00	2.05	1.94	0.72	1.38	2.05	2.17	0.77
2002	0.98	3.84	0.66	0.86	0.94	0.21	0.24	0.17	1.43	0.02	0.6	1.28
2003	1.35	2.54	0.27	1.43	0.12	2.28	0.9	3.3	0.3	1.98	1.29	0.91
2004	1.82	0.66	0.44	0.69	1.79	1.25	1.63	0.76	0.76	1.74	2.33	2.48
2005	1.62	1.4	1.48	0.08	0.08	2.99	1.25	0.75	3.42	2.8	3.66	1.03
2006	2.79	1.36	0.7	0.37	0.02	1.07	2.85	0.12	0.25	0.09	1.97	2.55
2007	0.47	0.89	1.22	0.91	2.34	3.21	0.4	0.58	0.03	0.1	1.81	5.09
2008	2.05	2.64	0.95	0.02	0.6	1.26	0.65	1.14	1.7	1.65	2.69	1.65
2009	0.31	1.68	0.47	1.1	0.3	2.41	0.74	0.28	1.41	1.3	0.38	4.25
2010	0.63	4.77	3.12	2.07	1.46	0.82	1.97	1.57	2.02	1.59	5.41	5.02
2011	0.39	1.1	1.42	1.18	1.57	2.29	No Data	No Data	No Data	No Data	No Data	No Data
Source: PEL (2013) – Table 11												

3.2.4 Wind

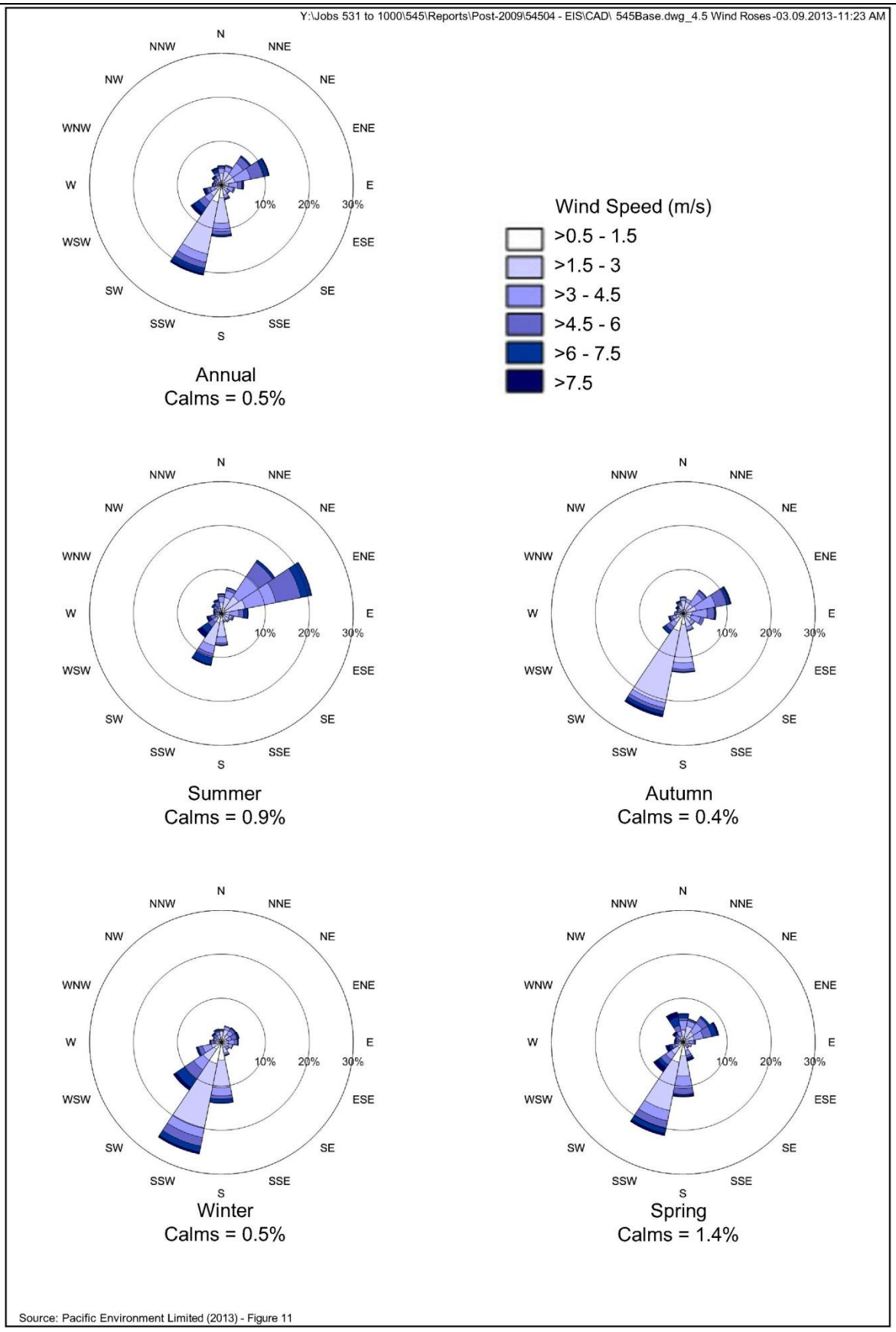
Pacific Environment Limited (PEL) (2013) reviewed wind data collected for three different periods, namely 2003, 2005-2008 and 2010-2012, at the Toongi Meteorological Station and Dubbo Airport AWS. That data was used to inform a model of the local wind environment prepared using the CALMET software, an industry standard software package.

Figure 7 to *14* of PEL (2013) present the wind roses for each of the eight years during which data has been collected. The year 2008 was ultimately selected as representative of the prevailing annual conditions of the local setting by PEL (2013) and **Figure 8** presents the wind roses for this year.

In summary, wind distribution patterns at the DZP Site are dominated by winds from the south-southwest in autumn, winter and spring, with northeasterly winds dominating in summer.

3.3 TOPOGRAPHY

The DZP Site is situated within a transition zone between the ranges and tablelands of the Great Dividing Range to the east, and the Darling Basin plains to the west. It lies within the headwaters of the Macquarie River Catchment, which drains west toward the Barwon-Darling river system.



Source: PEL (2013) – Figure 11

Figure 8
WIND ROSES

3.4 WATER RESOURCES

3.4.1 Surface Water and Drainage

The region is within the Macquarie-Bogan River Catchment with elevation ranges from 1 300m in the mountains south of Bathurst, to less than 100m near Brewarrina in the catchment's far north. Below Dubbo, the valley mainly comprises flat alluvial plains with elevations less than 300m. Burrendong Dam, located on the Macquarie River, is the largest storage in the catchment with a capacity of 1 190 110ML. It provides storage for irrigation, town water, stock and domestic use. The Macquarie-Bogan catchment supports a range of water users including local councils, water utilities, dryland agriculture, livestock grazing and some irrigated agriculture (NOW, 2013).

3.4.2 Groundwater

Groundwater within the regional area is based upon the underlying geology of the region with the igneous, Jurassic age intrusives, known as the Toongi deposit within the wider Dubbo igneous complex and the overlying Tertiary and Quaternary geological strata. These sedimentary rocks are at the edge of the Gunnedah Basin and the derived alluvial plains are water intake beds for the Great Australian Basin, a large Jurassic-Cretaceous basin covering a large part of eastern Australia.

3.5 SOILS

The following soil landscapes are typical of the Dubbo area and are in association with the underlying geological subdivisions.

- Silurian sedimentary rock and metasediments.
- Mesozoic sedimentary rock.
- Quaternary alluvium.
- Jurassic basalt.
- Jurassic trachyte.

Within the Dubbo LGA, sandstone ridge tops carry thin, discontinuous soils with stony, sandy profiles and low nutrient status. Downslope, texture contrast soils (soils that have a sharp increase in texture, i.e. increase in clay content, on passing from surface soil layers to subsoil) are more common and are typically found with harsh clay sub-soils, while in the valley floors sediments tend to be sorted into deep sands with yellow earthy profiles, harsh grey clays, or more texture contrast soils with a greater concentration of soluble salts (OEH, 2013).

3.6 VEGETATION

The Dubbo LGA falls within the southern area of the Brigalow Belt South Region. The vegetation comprises narrow-leaved ironbark, white cypress pine and white box on hills and slopes. Patches of black cypress pine, hill red gum *(Eucalyptus dealbata*), the occasional kurrajong (*Brachychiton populneum*) and scrubby acacia species are present in rocky outcrops. Grey box *(Eucalyptus microcarpa*), yellow box (*Eucalyptus melliodora*) and rough-barked apple occur on valley floors, while river red gum lines larger streams and river oak (*Casuarina cunninghamiana*) the tributaries (OEH, 2013).

3.7 REGIONAL AGRICULTURAL ENTERPRISES

The land use model constructed for this study has assessed the possible value of agricultural production from the locality as being in the order of $1.46 million per annum. This can be compared to the total value of agricultural production for the Dubbo LGA of $42.6 million (year ending June 2006 latest available data). Given that 2006 was in the midst of the Millenium drought (2001-2010), it can be expected that current production from within the Dubbo LGA would currently be much higher.

Dubbo is a base for agricultural support services and activities such as stock and station agents (and selling facilities), farm merchandise suppliers, transport companies, machinery sales and repairs. However, these activities serve a much larger area than just the LGA of Dubbo - the value of agricultural production for the North-Western Statistical Division (incorporating Dubbo, and the statistical sub-divisions of Central Macquarie, Macquarie-Barwon, and Upper Darling) totalled some $1.008 billion in 2006. The loss of $0.674 million per annum (the value assessed as being lost during mining) cannot be considered as risking the continued operation of these agricultural services.

3.8 REGIONAL AGRICULTURAL SUPPORT INFRASTRUCTURE

The area of land which is affected by the DZP does not contain any significant agricultural support infrastructure. This area of analysis is outlined further in the following section.

4. LOCAL SETTING (THE LOCALITY)

4.1 INTRODUCTION

The DZP Site is located in the locality of Toongi. The village is situated in a valley formed by the Wambangalang Creek, which flows northwards and ultimately discharges to the Macquarie River. The DZP is located to the south and east of the village of Toongi. The following provides a description of the existing environment and agricultural activities of the locality, focussing on the DZP Site where the majority of Proposal related disturbance would occur.

4.2 TOPOGRAPHY

Topographic survey of the DZP Site and immediate surrounds generated from an airborne LiDAR survey conducted for the Applicant indicates that there is approximately 100m of relief from the floodplain of Wambangalang Creek near the northern end of the DZP Site and Dowds Hill, which is near the eastern boundary of the DZP Site (see **Figure 9**). The landform essentially consists of a ridge that extends west from the southwestern boundary of the DZP Site in a northeasterly direction to Dowds Hill then north to the northern boundary of the DZP Site. The topography reflects the higher resistance to erosion of the igneous rock than the surrounding sedimentary rock.

The slope surface, derived from the surface topography of the LiDAR survey, indicates that the steepest land occurs around the margins of the igneous rock. The flatter land, with slope less than 7.5%, which is generally more conducive to agricultural production, occurs primarily on the floodplain of Wambangalang Creek on the western side of the DZP Site. There is a second patch of relatively flat land (Paddys Creek flats) to the south of the DZP Site which is intersected by Eulandool Road and Paddys Creek and its tributaries. Other small patches of relatively flat land are present near the centre and northeastern corner of the DZP Site.

The relatively steep landform contributes to the relatively low land capability rating in **Table 6**, and presents constraints on the productivity of the land.

4.3 WATER RESOURCES

4.3.1 Surface Water

The surface water assessment for the Proposal was undertaken by SEEC. The full assessment is presented in Volume 2 Part 1 of the EIS *Specialist Consultant Studies Compendium* and is referenced as SEEC (2013).

Drainage

The Macquarie River, located approximately 4km north of DZP Site, flows in a northwest direction before flowing through Dubbo located approximately 17km north of DZP. It is joined by several tributaries from the south that are located in the vicinity of the DZP which include the catchment areas of Wambangalang Creek, Meadows Creek, Paddys Creek, Cockabroo Creek. Little River, located approximately 7km to east of the DZP Site, is considered a major tributary of the Macquarie River within the locality.

A series of minor watercourses radiate out from a high point near the ore body to four main watercourses (**Figure 9**):

- Wambangalang Creek Catchment – 1,575ha of the DZP Site (55%) drains to Wambangalang Creek (partly by an unnamed stream hereon identified as Watercourse C) and ultimately to the Macquarie River;
- Paddys Creek Catchment – 38ha of the DZP Site (1%) drains to Paddys Creek and then to Wambangalang Creek and ultimately to the Macquarie River;

- Cockabroo Creek Catchment – 590ha of the DZP Site (21%) drains to Cockabroo Creek, then to the Little River and, ultimately, to the Macquarie River; and
- Macquarie River (undefined) catchment – 660ha of the DZP Site (23%) drains to one of two unnamed streams heron identified as Watercourse A and Watercourse D, and ultimately to the Macquarie River.

There are three third-order watercourses on the DZP Site under the Strahler Stream Order System:

- Watercourse D (unnamed) draining northeast within the Macquarie River (undefined) catchment and only achieving third order status just before it leaves the DZP Site;
- Watercourse B (unnamed) draining northwest to Wambangalang Creek. This has a number of small dams on it; and
- A northern tributary of Cockabroo Creek, just south of the ore body.

The remainder of the DZP Site's intermittent drainage lines are first or second order streams (**Figure 9**)

Water Use

The Wambangalang Creek water source is described as non-perennial and often has no flow with water extraction only permissible when the pools are at full capacity. Therefore, any surface water licence (if available) would be 'unsecured' (SEEC, 2013).

There are currently five existing surface water licenses located upstream of the DZP Site with a total entitlement of 165 ML/year. 85% of that water is used for irrigation and 15% for domestic or stock use. Under the Draft Water Sharing Plan (WSP) for the *Macquarie Bogan Unregulated and Alluvial Water Sources* no further licences are permissible.

There are an estimated 64 farm dams which currently capture surface runoff on the lands which are to be owned by the Applicant on approval of the Proposal (see **Figure 9**). These have an estimated combined volume of approximately 82ML with most having a storage capacity of less than 1ML. Two larger farm dams of approximately 16ML and 3ML[2] have been identified on the "Ugothery" and "Karingal" properties respectively. NSW legislation permits landholders to harvest and use a portion of the total runoff from their land without requiring a licence. The legislation is manifested by allowing a total harvestable right capacity for the property.

The Applicant would, following granting of development consent, own approximately 3 450ha within and surrounding the DZP Site. However, the Proposal would result in disturbance and isolation from the various surface water catchments of approximately 640ha. As a result, for the purposes of estimating the harvestable rights capacity, a landholding of 2 810ha has been assumed. Taking into account the relevant harvestable rights multiplier for the DZP Site of 0.065ML/ha, the harvestable right capacity for the land to be held by the Applicant would be approximately 182ML. Therefore, an additional 100ML of storages could be built without exceeding the Harvestable Right.

The Applicant has committed to allowing for the continuation of agricultural activities on large areas of the DZP Site and surrounding land that it would own. As such, the Applicant has committed to not reducing the total availability of water for agricultural activities on these properties.

[2] Dam volumes have been estimated from the aerial survey.

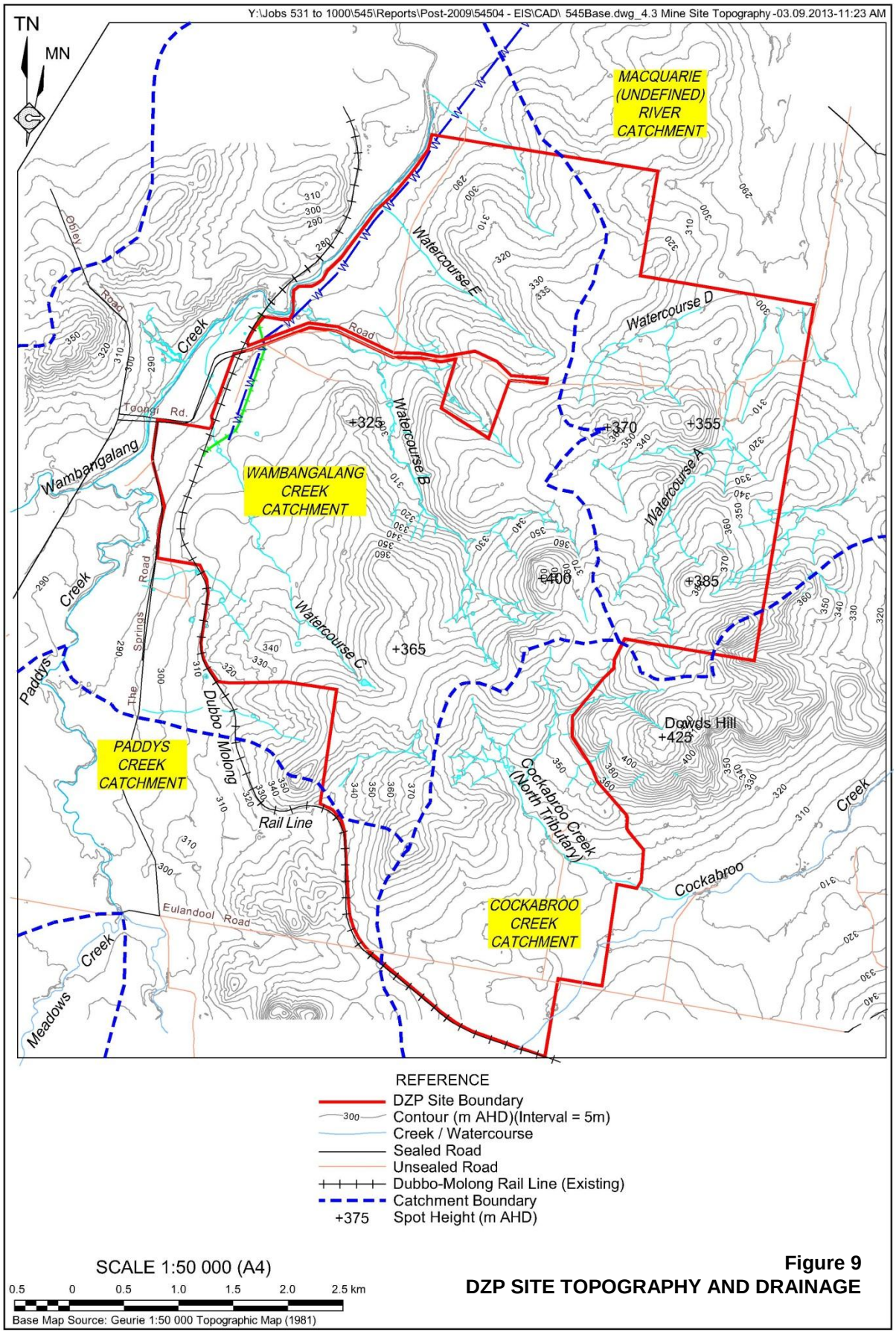


Figure 9
DZP SITE TOPOGRAPHY AND DRAINAGE

Water Quality

The Toongi Catchment is prone to significant salinity with the surface water in the Toongi Catchment described as moderately saline to brackish (Smithson, 2001, SEEC, 2013). Salinity levels recorded average between 2 000µS/cm and 3 000µS/cm but can exceed 6 000µS/cm.

4.3.2 Groundwater

The groundwater assessment for the Proposal was undertaken by Environmental Earth Sciences. The full assessment is presented in Volume 2 Part 5 of the EIS *Specialist Consultant Studies Compendium* and is referenced as EES (2013).

Two broad groundwater systems are reported to exist in the Toongi catchment: a consolidated fractured rock system; and an unconsolidated sedimentary system consisting mostly of alluvium (with minor colluviums and Aeolian deposits). The alluvium overlies the fractured rock system, mostly filling past valleys and drainage lines beneath current day ephemeral creek lines (EES, 2013).

The general concept for groundwater occurrence below the DZP Site is that alluvial groundwater is unconfined and relatively shallow and fresh, as the water-table responds relatively rapidly to recharge via rainfall. Fractured rock groundwater systems have generally been interpreted to be unconfined near the top of the aquifer (water-table surface) but confined at depth, resulting in variations in flow paths (local, intermediate or regional flow systems). Fractured rock groundwater systems have been interpreted to be relatively saline due to longer time periods for geochemical interaction with the aquifer matrix (EES 2013).

Both surface and groundwater flows appear to be controlled by basement geology and there is clear connectivity between the two in the locality. Rainfall recharges the groundwater via the trachyte formations with this water flowing adjacent to surface topography to the main drainage features nominated above. Where there are significant breaks in the slopes of the local landform, minor rises in groundwater incise the surface resulting in ephemeral spring flows. Such springs are evident on Water Course B (to Wambangalang Creek) and the northern tributary of Cockabroo Creek). However, the majority of the groundwater flows towards the alluvial geology of the major creeks.

The salinity of groundwater ranges from 160µS/cm to over 6 000µS/cm, with a general increase in salinity downstream in the catchment.

4.3.3 Dryland Salinity

Groundwater systems of the locality consist of a combination of local, intermediate and regional groundwater. Potential groundwater discharge and saline sites within Toongi and the proposed DZP Site have been identified as surface drainage lines, break of slope and on the valley floors or alluvial flats (Smithson, 2001). Areas at greatest risk of dryland salinity are those where the groundwater table is within five metres of the natural ground surface.

These areas have been mapped for the regional catchments including the DZP Site (Smithson, 2001). Mapping provided by *Figure 6* of Smithson (2001) confirms there are no recorded saline sites on the DZP Site, and *Figure 13* of Smithson (2001) shows that less than 5% of the DZP Site is expected to have water-tables within five metres of the natural ground surface. The groundwater mapping of EES (2013) concurs with the Smithson (2001) mapping. The areas of elevated groundwater table (within 5m of surface) are all along the alluvium of Paddys, Wambangalang and possibly Cockabroo Creeks.

4.4 SOILS AND LAND CAPABILITY

The soil and land capability assessment for the Proposal was undertaken by Sustainable Soils Management Pty Ltd (SSM). The full assessment is presented in Volume 3 Part 10 of the EIS *Specialist Consultant Studies Compendium* and is referenced as SSM (2013).

The DZP Site has been mapped by Murphy and Lawrie (1999) as containing nine soil landscapes (see **Figure 10**). The nine landscapes have been grouped into five land and soil capability classes on the basis of dominant profile form (see **Table 6**).

Table 6
Summary of Soil Landscapes of the DZP Site

Landscape Name	Landscape Summary
Alluvium	
Mitchell Creek mi	Recent alluvial deposits with highly variable soils including sandy Stratic Rudosols and loamy alluvial soils (Brown Dermosols) along Wambangalang Creek. Land and soil capability classes 2 with 6 in drainage lines. River red gum and River she-oak with Rough barked apple. Yellow and Grey box further from the creek.
Chromosols (Duplex, but not acidic)	
Arthurville ar	Gently undulating rises and undulating low hills with mixed sedimentary and volcanics in Cowra Trough. Red Chromosols with Yellow Sodosols along drainage lines. Land and soil capability classes3 to 5. White box and Yellow box in lower lying areas.
Ballimore bm	Undulating low hills on flat lying Napperby formation of sandstone, conglomerates ferruginous material and siltstone. Red Chromosols with Siliceous Sands on steeper scarps and Yellow Sodosols on lower slopes and depressions. Land and soil capability classes3 to 5. Grey box with White pine on upper slopes and Fuzzy box on lower slopes.
Red Podzolics (Duplex and Acidic)	
Belowrie bi	Rises and low hills Jurassic trachyte. Red Chromosols Land and soil capability classes4 with Red Kandosols and Brown Chromosols on more stable lower slopes land and soil capability class3 and Yellow Sodosols on flatter lower areas with Grey box and Blakely's red gum. Shallow Rudosols and Tenosols on rocky crests. Hard setting and acidic surfaces.
Splitters Hill sh	Undulating and rolling hills on Silurian vertically bedded shale and sandstone. Mainly Red Chromosols but a variety of others depending on parent material. Grey box and Yellow box on lower slopes. White box associated with Brown Chromosols on andesites. If sandstones are present the soils can be very acidic and have aluminium toxicity. Land and soil capability classes range from 3 to 6 depending on geology.
Euchrozems (Clayey soil with little shrink/swell capacity)	
Bald Hill bh	Low hillocks with moderately steep slopes. Basalt rock outcrop and shallow Red Ferrosols (land and soil capability class 6) and Brown Ferrosols (land and soil capability classes 4 & 5) on lower slopes. White box and Kurrajong.
Wongarbon wg	Gently undulating and low hills with minor basaltic hillocks. Red Ferrosols and Red & Brown Vertosols with linear gilgais. White box and White pine on upper slopes. Fertile soils.
Nubingerie nb	Undulating low hills mainly andesites from Cowra trough. Red Ferrosols (land and soil capability class 3) and Red & Brown Vertosols (land and soil capability class 2). White box with Yellow box in drainage lines.
Shallow Soils	
Dowd dw	Hills of rock pavements and scarps. Trachyte Volcanic plugs may be sodic. Mainly uncleared Black & White pine forest and bare rock. Shallow soils Leptic Rudosols low fertility not suitable for stripping. Land and soil capability class 7 & some shallow Red Chromosols (land and soil capability classes 6).
Source: SSM (2013)	

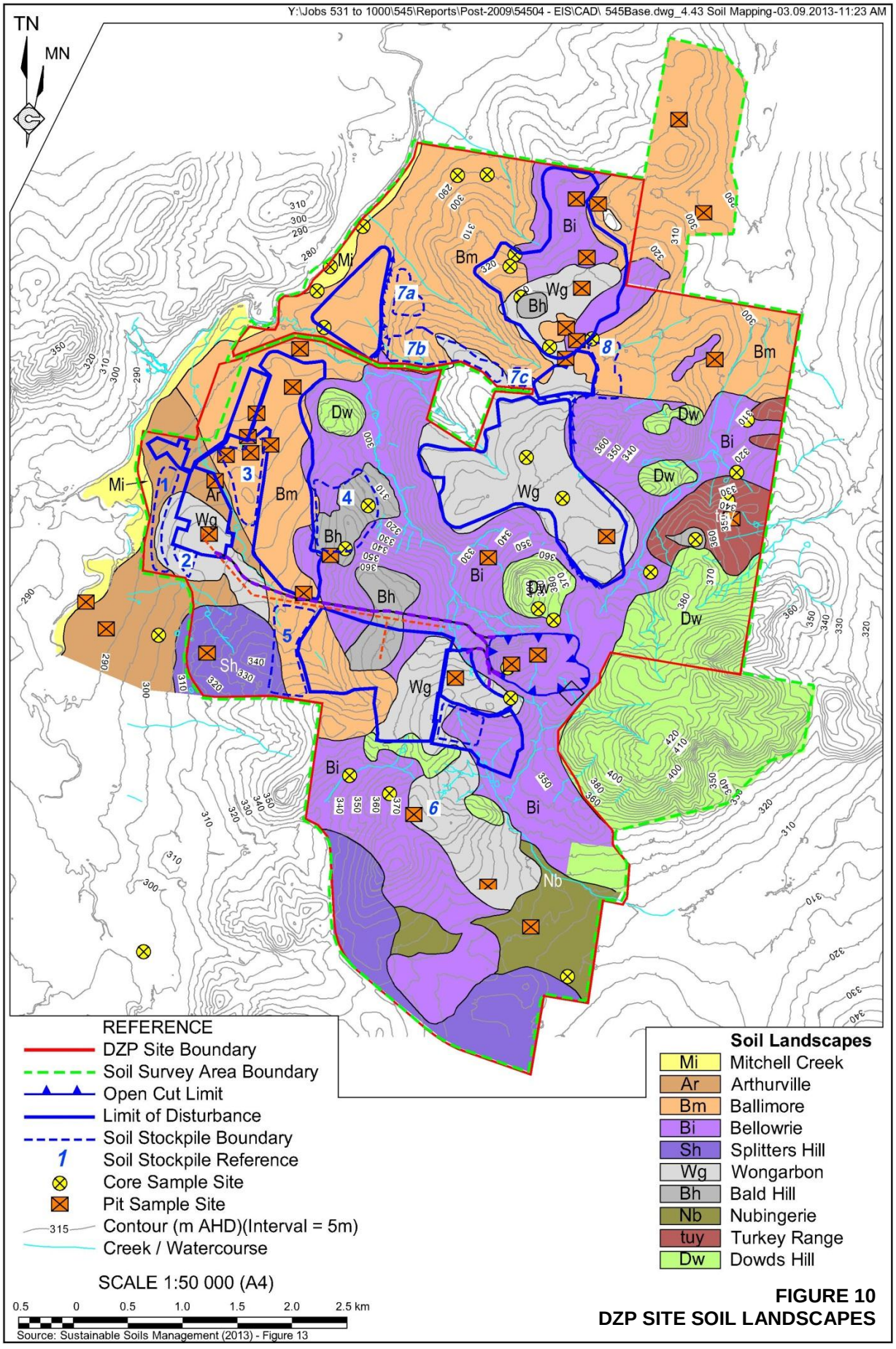


FIGURE 10
DZP SITE SOIL LANDSCAPES

Three of these five classes, Chromosols, Red Podzolics and Shallow Soils form a continuum from deeper soil in the footslopes and depositional parts of the landscape through strongly leached soil (Red Podzolics) in mid and upper slopes to the shallow soil on the crests of hills. The more clayey Euchrozems appear to be associated with the Jurassic basalts in the northern part of the Soil Survey Area, and older volcanic rocks near the southeastern corner of the Soil Survey Area. The alluvial Mitchell Creek landscape was mapped only along the Wambangalang Creek floodplain.

SSM (2013) allocated a range of land and soil capability classes for the soils of the DZP Site and surrounding land to be owned by the Applicant. The dominant land and soil classes are 3 (grazing and regular cultivation) and 4 (grazing and sufficient cultivation to establish improved pasture), which together account for 83% of the area assessed (see **Figure 10**). It should be noted, however, that the broad scale of the assessment will result in patches of lower capability land (higher Land and Soil Capability Class number) within each mapped area class.

A small area of Class 2 was mapped along the floodplain of Wambangalang Creek within the Mitchell Creek soil landscape. This has a deep, loamy textured, fertile soil that is flooded sporadically.

4.5 VEGETATION

The Terrestrial Ecology Assessment for the Proposal was undertaken by OzArk Environmental and Heritage Management Pty Limited (OzArk). The full assessment is presented in Volume 2 Part 6 of the EIS *Specialist Consultant Studies Compendium* and is referenced as OzArk (2013).

The locality can be generally described as supporting a mosaic of Box-Gum Woodland, Fuzzy Box Woodland, Inland Grey Box Woodland, derived native grasslands and cleared/cropped land.

Tumbledown Gum (*Eucalyptus dealbata*), White Cypress Pine and/or Black Cypress Pine, Kurrajong (*Brachychiton populneus*) and White Box (*E. albens*) generally characterise trachyte hills and rocky outcrop knolls. White Box Woodland or derived grassland (derived from White Box Woodland community) occurs on undulating ground. Fuzzy Box (*E. conica*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) occurs on creeks and waterways with River Red Gum (*E. camadulensis*) also occurring along Wambangalang Creek and the Macquarie River. Inland Grey Box (*E. macrocarpa*) associated woodlands also occur on alluvial soil back from waterways on alluvial soils (OzArk, 2013).

Evidence of historic ringbarking and pastoral use within the DZP Site is evidenced by the lack of Mugga Ironbark (popular harvest species for milling) that once would have formed part of the undulating to hill areas of the landscape (OzArk, 2013).

The percentage of weeds on the DZP Site is minimal with only the woody weed white cypress pine monocultures considered as the most significant.

4.6 LAND OWNERSHIP

Negotiations have been completed with the individual landowners who own property within the DZP Site (see **Figure 2**).

The Applicant intends to acquire these holdings, and to continue to operate the relevant land area as a viable agricultural enterprise. These agricultural activities would be conducted around the facilities established to support the mining operation.

4.7 AGRICULTURAL HISTORY

From anecdotal evidence gathered, it would appear that the Toongi area previously consisted of a few large holdings. Production involved some arable crops (and dryland lucerne) on the creek flats, but was focussed on livestock grazing over the hill slopes and timbered areas.

More recently, the area has been increasingly sub-divided, and has become more of a "life style" rural area. Many of the current "agricultural" operators also have jobs in Dubbo, and do not depend solely on income derived from such agricultural production as is still generated.

Other operators are reaching retirement age, and see the DZP (and the associated prospect of selling all or part of their holding at above-market rates) as offering an attractive exit strategy.

None of the farms affected by the Proposal currently have young families living on them. Indeed, most of the current farm owners are grandparents whose (adult) children have moved away. With one exception, the current farm owners all obtain "off-farm" income, as a result of a spouse (or both partners) working in non-farming occupations. Another farm is operated by an owner who lives outside the district and commutes to Toongi as required. The majority of the current holdings are therefore not operated to deliver a sole source of income to the owners, and so cannot be assumed to be operated to full potential production levels.

4.8 AGRICULTURAL ENTERPRISES

4.8.1 Livestock Enterprises

Much of the area is currently involved in grazing activities, with just over half of the relevant land area being classified into land and soil classes 4 to 7. This grazing consists predominantly of cattle grazing, with a focus on "growing out" steers rather than running breeding enterprises.

There is also some grazing of sheep, focused on prime lamb production based on opportunistic dryland lucerne (i.e. lucerne is grown when sufficient rainfall is received).

4.8.2 Other Agricultural Enterprises

While just under half of the area is considered to represent land and soil classes 2 and 3, much of this land is also currently used for grazing. There is little cropping, mainly as a result of the part-time nature of management used. Some wheat is grown, but rarely canola or more intensive crops. Some oats are also grown, as a supplement to pastures, for grazing.

4.8.3 Current Use of Properties

There are six landowners, plus the Applicant, currently involved in the land area affected by the Proposal. As indicated in Sections 4.8.1 and 4.8.2, the current use of these properties is not generally considered to reflect the maximum value of output potentially available from the area involved. Current use of each property (not individually identified for reasons of privacy and confidentiality) can be summarised as:

- Both partners have full-time or part-time employment off-farm. Wheat and oats are grown and prime lamb is produced on improved pastures. Some cattle fattening is also undertaken. Contract labour is used as required, however, there are no employees permanently on the farm. Additional land is owned outside the DZP Site but within the district.
- Both partners work farm full-time, with very little outside labour other than harvest contractor. Cattle are bred and fattened with cover crops to improve pastures. No dependents living on property.

- Long-established family in district with dependents all now living off-farm. One partner gets off-farm employment during harvest while the other has full-time job off-farm. Oats and pasture are grown with some cattle breeding (no sheep). A significant proportion of farm is non-arable.
- Long-established family in the district. Two generations working the farm with younger generation living in Dubbo. Farm used to fatten cattle on improved pastures and oats. The older generation is soon to retire off the farm and holds other land in the district.
- Two generations of long-established family working farm, with younger generation providing most farm labour but commuting to do so. One partner of older generation works in Dubbo. The farm is used for running fat lambs and growing wheat and sale of only a small portion of productive land to the Applicant will provide an opportunity to continue farming.
- Property purchased by the Applicant in December 2012 and leased back to previous owners who run cattle. One partner worked full-time off farm. Previous owners have purchased small acreage closer to Dubbo, with large house and garden, and also own another property in the district. One son, with trade qualifications, currently lives in homestead and provides part-time farm labour.

4.9 VALUE OF LOCAL AGRICULTURAL ENTERPRISES

4.9.1 Estimated Value of Agricultural Production From Site

The consultation phase did not conduct a survey of actual areas allocated to particular agricultural enterprise, nor was any financial data sought from current operators. It is considered that current usage (as described in Section 4.8) does not reflect the potential productivity of the land area involved, owing to the low intensity ("part-time") management being used in the majority of cases, and the fact that commercial production was not necessarily the highest priority for the current owners.

An estimate of the current **potential** (as compared to **actual** usage) value of the land area involved, from an agricultural production viewpoint, has been prepared on the basis of:

- The assessment of land and soil capability classes for the total site area
- Budget ($GM/ha) data available from NSW DPI for selected appropriate enterprises, namely :
  - wheat cropping for land and soil capability classes 2 and 3 (GM $419.12/ha)
  - prime lamb production (based on dryland lucerne) for land and soil capability classes4, 5 and 6 (GM $568.10/ha)
  - no commercial agricultural production being generated from land and soil capability classes 7 and 8. These classes are described as being "unsuitable for rural production" (OEH, 2012).

Table 7 lists the land and soil capability classifications for the DZP Site and surrounding land either owned or to be acquired by the Applicant on the "Grandale", "Ugothery", "Karingle", "Glen Idol" (part only), "Toongi Valley", "Pacific Hill" and "Whychitella" properties (see **Figure 10**).

It should be noted that there is no land within the DZP Site that is considered to be either Class 1, 6 or 8. The following **Figure 11** indicates the allocation of the Locality to various productive capacities, as used in the land use assessment model.

Table 7
Land Capability Classification for the Locality

Land Capability	Area (ha)
1	0
2	74
3	1622
4	1257
5	68
6	0
7	431
8	0
Total	**3452**
Source: Modified after SSM (2013)	

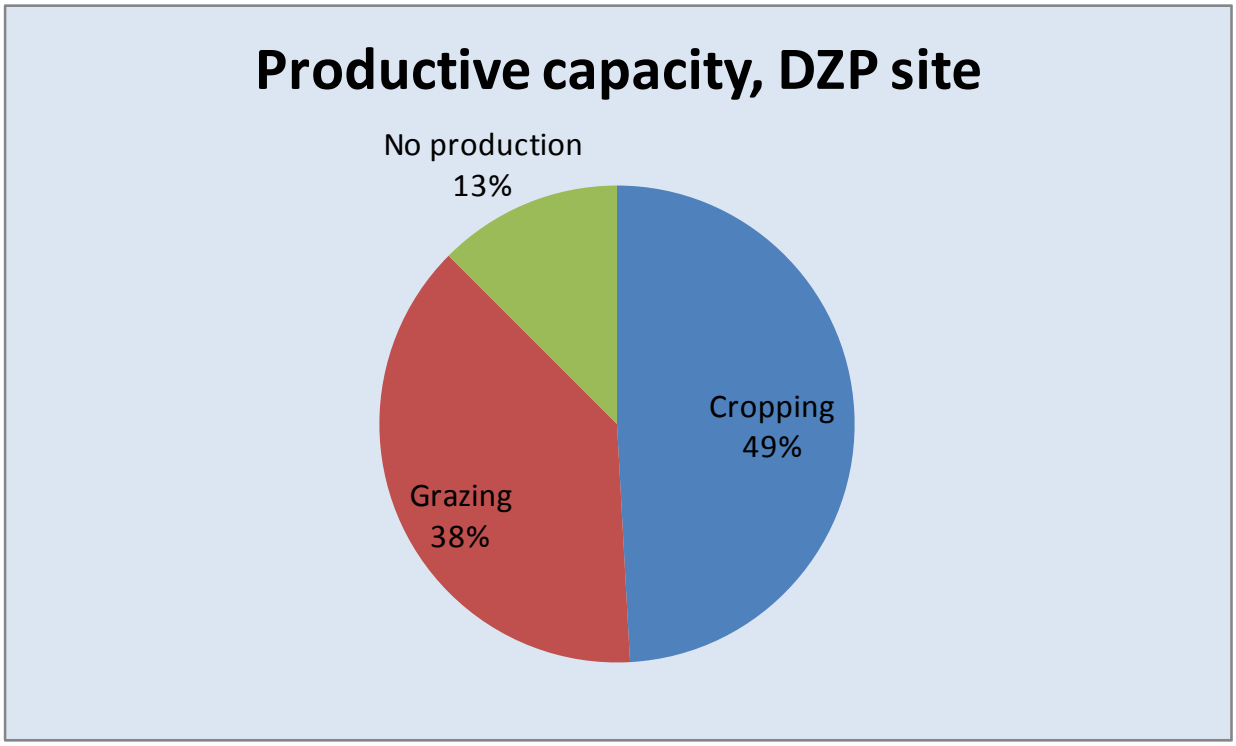


Figure 11
PRODUCTIVE CAPACITY OF THE LOCALITY

Nearly half the land within the Locality is therefore considered to represent land and soil capability classes 2 and 3, and can be used for cropping.

Based on the land and soil capability classes for the DZP Site, and the GM ($/ha) provided from the DPI budgets, the current agricultural production from the DZP Site has been assessed as having a value of **$1.46 million per year**.

4.9.2 Sensitivity Analysis

Australian agriculture is characterised by significant changes in climatic conditions between years, resulting in variability between annual "average" levels of production. In order to explore possible ranges of the value of agricultural output potentially delivered from the DZP Site, a sensitivity analysis was conducted of the assessed value of agricultural production (see **Figure 12**).

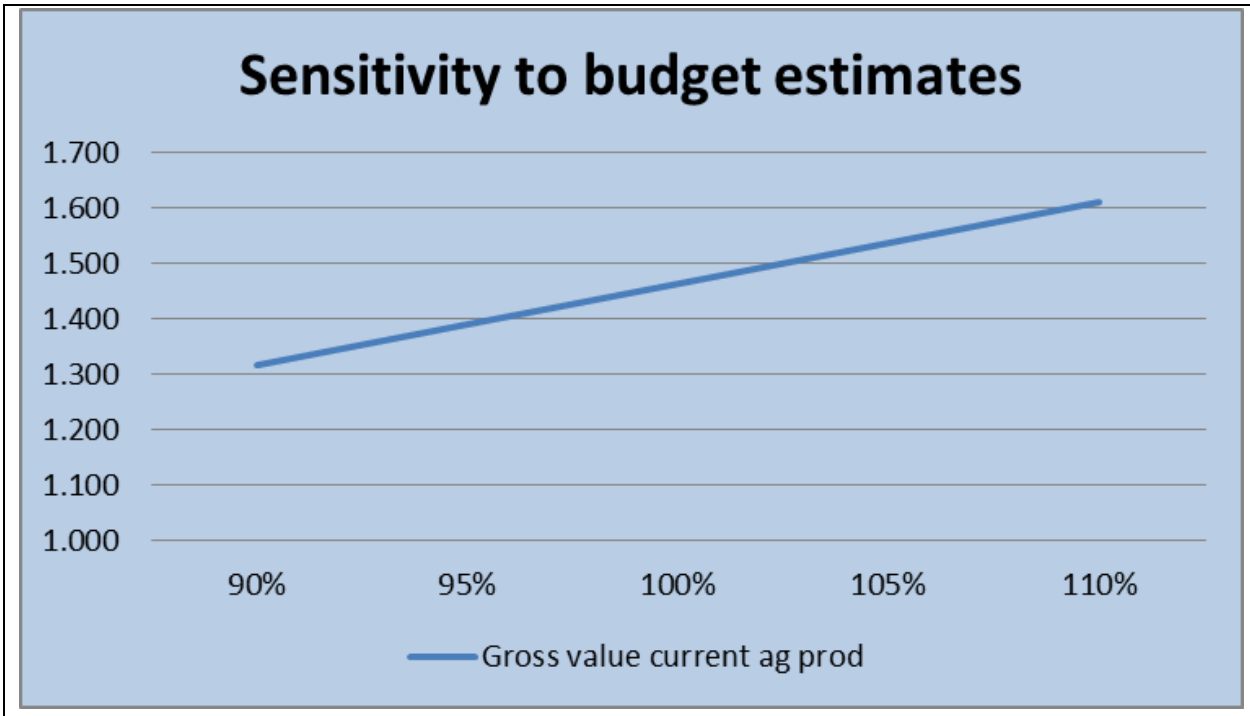


Figure 12
SENSITIVITY TO BUDGET ESTIMATES

As demonstrated in **Figure 12**, the GM budget figures used were varied by up to +/- 10%. If the production is 10% **lower** than assumed in the budget figures, then the total value of production from the DZP Site would be **$1.39 million per annum**. Conversely, if the budget figures were 10% **higher**, then the total value of production from the Locality would be **$1.54 million per annum**.

Another form of sensitivity could involve enterprise selection. The assessment reported above assumes that wheat production would be relevant on the land and soil capability classes 2 and 3 areas within the Locality, and that prime lamb grazing would be relevant for the 4 and 5 areas (there being no 6 areas). It is possible that prime lamb production could be the favoured enterprise over the entire 2 to 5 areas. In this case, the total value of agricultural production from current use within the Locality would be **$1.72 million per annum**.

The assessment of likely current agricultural production from the Locality has concluded that a range of values from $1.39 million to $1.72 million per annum is possible, with the preferred estimate being **$1.464 million**.

5. DZP IMPACTS (DIRECT AND INDIRECT) ON AGRICULTURE AND LAND USEDURING MINING

5.1 INTRODUCTION

An assessment has been made of the extent to which activities relating to the DZP would affect each of the land and soil capability classifications within the site. Based on the remaining areas available for agricultural production, an assessment has then been made of the extent to which activities associated with the DZP would cause a loss in the value of agricultural output from this site.

5.2 AGRICULTURAL AND LAND USE CONSTRAINTS

Activities associated with mining and processing of the resource contained within the DZP (including stockpiles of soil) would occupy a total of 807.7ha, or 23% of the total area of the site. The extent to which the various land and soil capability classes are involved in this area removed is listed in **Table 8.**

Table 8
Activities of the Locality for the Life of the Proposal

Land and Soil Capability	Activity (ha)		
	DZP Operations	Biodiversity Offset Strategy	Ongoing Agricultural Production
1	0	0	0
2	0	0	74
3	613.1	190.4	818.5
4	193.4	332.8	730.8
5	0	68.0	0
6	0	0	0
7	1.2	429.8	0
8	0	0	0
Total area	807.7	1 021	1 623.3

5.3 DIRECT IMPACTS

5.3.1 Agricultural Resources

A total of 1 623 (or 47% of the Locality) would therefore continue to be available for agricultural production during the proposed duration of the Proposal.

It is proposed that the Applicant would make arrangements to continue, wherever possible, current agricultural production of any areas of land within the site. It is most likely that the Applicant would employ a farm manager and workers to ensure that the assets are properly maintained and the site is kept secure rather than lease back to the current (or other) owners/tenants.

A portion of “Karingle” may be leased to an immediate neighbour who has entered into a Call Option over part of their productive land.

5.3.2 Agricultural Enterprises and Production

The nature of the operations proposed to occur within the DZP Site would not impede the types of agricultural activity currently undertaken in this area. During operations, the same enterprises can therefore be carried out on relevant land and soil capability classifications, in all parts of the 1 623.3ha of the Locality that is not involved in activities associated with the Proposal operations or required for incorporation into a Biodiversity Offset Area (1 021ha).

The design of the biodiversity offset area would require corridors to allow the transport of machinery and movement of livestock. Fenced LRSFs would necessitate re-organisation of internal fencing on the AZL property.

Applying the same GM/ha budget figures, for the same enterprises, as were used to prepare the assessment of current agricultural production values for the DZP Site, indicates that when the Proposal is in operation the total value of agricultural production generated from the site would be in the order of $0.790 million per year.

This means that the assessed **loss** of agricultural production from the DZP Site, during operation of the mine, would be **$0.674 million per year**. Over the anticipated 20 year "life" of this Proposal, this loss (at 10% discount rate) has a Present Value (PV) of $5.779 million. The following **Figure 13** indicates the PV of this loss of production, over 20 years, at various discount rates.

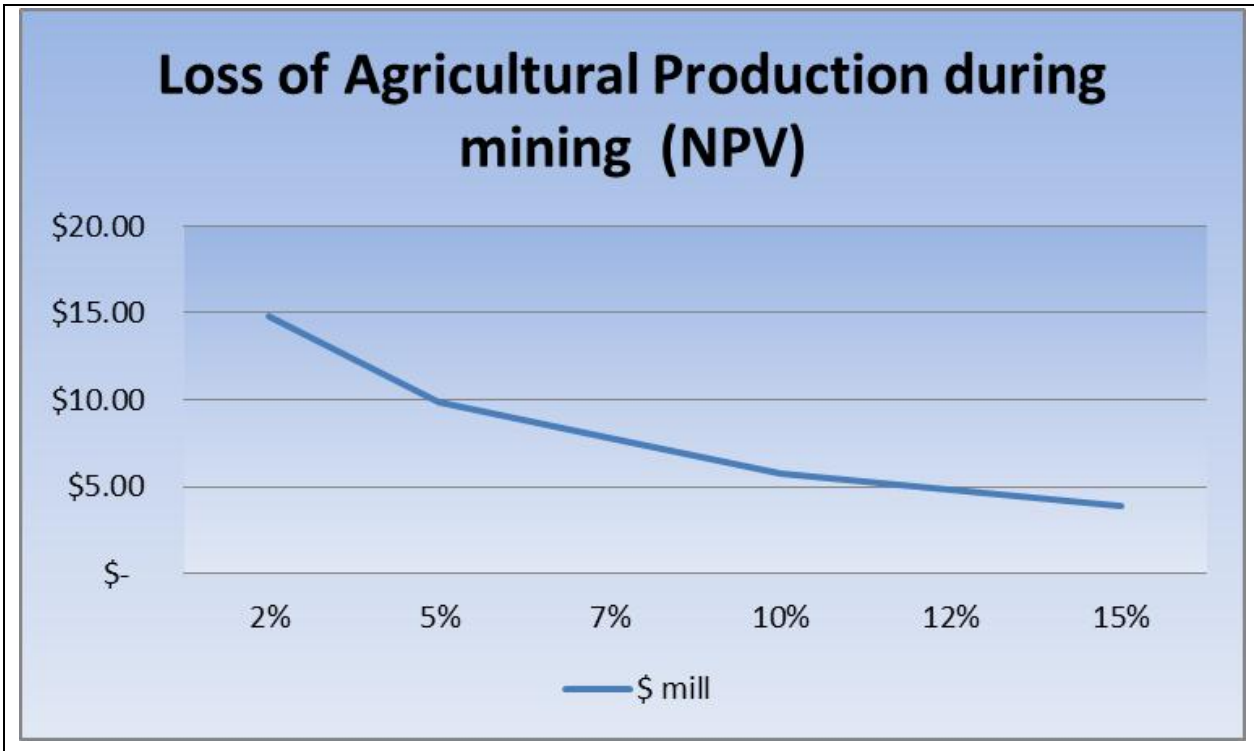


Figure 13
LOSS OF AGRICULTURAL PRODUCTION OVER THE LIFE OF THE PROPOSAL

As with the assessment of current value of agricultural production, it is possible to assume increases or decreases in the DPI budget figures (GM/ha) used for the selected enterprises. If actual production is 10% higher than the budget estimates, the total **loss** of production would be $0.64 million per annum (assuming higher production during mining operations than previously achieved). If actual production during mining is 10% less, then the loss of production could be $0.71 million per annum.

5.3.3 Water and Production

The water required for dust suppression on the DZP Site (39.6MLpa) would be sourced from water collected in sediment basins and retained farm dams on the DZP Site. The combined collection of water on the properties owned by the Applicant would not exceed the Maximum Harvestable Rights Dam Capacity (MHRDC) for these lands and on this basis is considered unlikely to impact on the productive capacity of the DZP Site lands, other land to be owned by the Applicant or surrounding lands.

The water to be used to process 1Mt of ore per annum (4.05GL) would be purchased on the free market in accordance with the water supply strategy nominated in *Table 2.7* and Section 2.8.2 of the EIS. The Applicant currently holds a mixture of high and general security water access licences for 1 500ML under the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source* ("the Macquarie / Cudgegong Rivers WSP"). The remaining allocation of water would be purchased or traded annually under the rules of the Macquarie and Cudgegong Regulated Rivers WSP (for surface water), or from groundwater under licence(s) issued in accordance with the Water Sharing Plans for the *Macquarie Bogan Unregulated and Alluvial Water Sources* ("Macquarie Alluvial WSP") and *NSW Murray Darling Basin Fractured Rock Groundwater Sources* ("Lachlan Fold Belt Fractured Aquifer WSP")

The water to be purchased or traded each year could previously have been used for agricultural production, however, for the following (and other) reasons it is very difficult to allocate a 'value' to production of this water (and therefore the direct impact on agriculture of any 'change in use').

- The former use (if any) of water purchased is not known or nominated as part of the sale.
- The previous use (if any), and therefore productive value, of water traded each year is likely to be different.
- As alluded to above, licences purchased may be classed as 'sleepers', i.e. not currently used for production.

In all cases, water would only be purchased or traded from 'willing sellers', a term coined by the Commonwealth government during its buy-back of water within the Murray Darling Basin referring to holders of surplus or sleeper licences. Surveys conducted by the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) also indicate that 'willing sellers' also include those wishing to sell only part of an entitlement, often as a result of management and enterprise mix changes reducing the water required to maintain current levels of agricultural production. Furthermore, investments being made under the Murray Darling Basin Plan are improving water use efficiencies to the extent that less water can be used to produce the same value of output.

It is recognised that an indirect consequence of the entry of a major water user such as the DZP may be to affect the sale and trade market such that the pricing of water excludes some agriculture which could potentially reduce the production in some agricultural industries. Ignoring the fact that water is a limited resource of which the value should be determined by the most productive use, the Applicant has commissioned Hennessy Water (HW) to review the current and future availability of water within the three water sources targeted by the Applicant to assess the likely influence of the Applicant's entry into the water market. For each water source, HW (2013) (provided in full as Appendix 8 of the EIS) identifies that there would remain significant volumes of tradable water such that the market would not be distorted to the exclusion of efficient and profitable agriculture. A summary of HW (2013) is as follows.

Macquarie / Cudgegong Rivers WSP

Water within the Macquarie / Cudgegong Rivers WSP is allocated as either High or General Security water. There is a combined total of approximately 18 225ML of High Security water and 631 716ML (631.7GL) of General Security water held within 615 Water Access licences [WALs]).

High Security Water

The capital cost of high security water sees it go to high value uses. This is reflected in the agricultural activities using high security water, cotton (1 400ML) and permanent plantings (600ML). Cobborah Holdings Corporation (proponent of a proposed Coal Mine between Dubbo and Dunedoo) holds 3 300ML which it currently trades by temporary transfer back to the market. High Security Water purchased by AZL to date amounts to 846ML. Of the remaining high security water available for sale or trade (~820ML)[3], approximately 60% is held for vineyards and other small farming operations and 40% (330ML) are considered sleeper licences. The information indicates that the purchase of high security water will have minimal impact on agriculture as this is only accessible by the most profitable enterprises able to accommodate the higher capital cost.

General Security Water

The value of General Security Water has been subject to variation over the last few years with the entry and exit to the market by the NSW and Commonwealth governments. The largest holder of water in the Macquarie / Cudgegong Rivers WSP is now the NSW and Commonwealth governments' holding of "Environmental Water" (>40%). It is worthy of note that following the cessation of government buy back, the price of water reduced significantly (by up to $100/ML).

The entry of the Applicant to the market place is unlikely to affect the ability of agriculture to retain or obtain water for production on the basis of the following.

- The target allocation of the Applicant for General Security Water (5 000ML) (refer to *Table 2.7* of the EIS) represents 0.8% of the total allocation, leaving 99.2% of total allocation for existing use.
- PHW (2013) notes that there continue to be enquiries made from sellers that missed the opportunity to sell to the government would (indicating that there are still a number of willing sellers).

Macquarie Alluvial WSP

The groundwater source contains 123 WALs totalling 27 675ML, including (in 2012/2013) 75 (of 14 285ML) considered to be inactive.

Assuming an extraction strategy is developed which does not impact directly on the yields of neighbouring properties from this aquifer, the activation of 1 000ML of this groundwater source will not impact on agricultural production.

Lachlan Fold Belt Fractured Aquifer WSP

This groundwater source covers a huge area of approximately some 18 000 000ha and includes nine management zones. Trading between the zones is allowed under present and likely future water sharing plans and as such the water source can be considered cumulatively.

The Long-Term Average Annual Extraction Limit (LTAAEL) is approximately 917 000MLpa compared with the current issue of only 73 909ML/year licensed ground water entitlement.

[3] Licences which cannot be traded (including Agricultural Research Stations, Councils, golf clubs and other community groups) account for 10 052ML (55%) of all High Security Water.

Recognising the disparity, NOW is undertaking a controlled water release by NOW of 36 375ML. On the basis of the preceding, the targeted allocation (1 000MLpa) under licence from this water source could be easily accommodated without impacting on the access of agricultural enterprises to this water.

On the basis that the entry of the Applicant to water market within each of the targeted water sources would not restrict access to this tradable commodity to agriculture, it is assessed that the impact of the Proposal on agricultural production (as related to water) would not be significant.

5.3.4 Agricultural Support Infrastructure

It has already been stated (see Section 3.8) that the Locality does not contain any significant agricultural support infrastructure. There would therefore be no impact on such infrastructure as a result of the operation of the Proposal. In fact, the proposed reopening of the Toongi-Dubbo Rail Line could in fact provide support to agricultural enterprises in the future.

5.3.5 Biosecurity

Biosecurity risks associated with the Proposal are considered minimal, however, whilst production from the properties which form the Locality is under the control of the Applicant, the following strategies would be implemented.

- *Animal Welfare Strategy*. Procedures on vaccination, checking animals regularly, isolation procedures for ill stock, placement of livestock in preferred paddocks during period of cold weather and the need for secure fencing to isolate stock from mining activities would be implemented.
- *Bush fire Strategy*. The plan would document the emergency management procedures required for the handling of stock during uncontrolled bush fire events.
- Pest and Weed Control. The plan would document the procedures to minimise the introduction of competitive pasture pests and noxious weeds to maintain maximum stocking rates that are applicable.

5.4 INDIRECT IMPACTS

5.4.1 Water Resources

5.4.1.1 Surface Water

Assuming a mean annual rainfall of 643.7mm and a runoff coefficient of 11% (SEEC, 2013), the mean annual runoff from the whole DZP Site (2 864ha) is approximately 2 028 ML/year. The proposed Residue Storage Facilities, Salt Encapsulation Cells, bunded processing areas and the Open Cut represent a loss of approximately 640ha from local stream catchments and so this represents a mean annual runoff loss of approximately 453ML/year (a 22% reduction). The total 453ML/y of losses would be distributed approximately as follows:

- 338ML from Wambangalang Creek.
- 95ML from Macquarie River (undefined) Catchment.
- 20ML from Cockabroo Creek.

At a point just downstream of the DZP Site Wambangalang Creek has a catchment of 34 500ha. With a catchment-wide surface runoff coefficient of 11%, the mean annual flow *attributed to surface runoff* would be approximately 24 430ML. Therefore, the loss of 338ML

represents a reduction in flow *attributed to surface runoff* of about 1.4%. It would be difficult to identify such a small change in the flows in Wambangalang Creek, particularly as it would be further masked by any base flow.

There are no existing Water Licenses on Wambangalang Creek downstream of the DZP Site and so there would be no predicted impacts to licensed users.

Surface flow losses to Watercourses A and D of the Macquarie River (undefined) Catchment would be proportionally larger. The catchment of these within the DZP Site boundary is 660ha and so the existing mean estimated runoff is 467ML. A loss of 95ML represents a loss of 20% from the total flow. This could be noticeable to downstream users, although as noted above there are no registered users of surface water.

265ha of the DZP Site drains to Cockabroo Creek and so the existing mean estimated runoff is 188ML. A loss of 20ML represents a loss of 11% from the total flow. It would be difficult to identify such a small change in the flows in Cockabroo Creek, particularly as it would be further masked by additional flow derived from off-site catchments.

Post mining, the only land quarantined from existing catchments would be the remnant open cut void which would have an area of approximately 40ha. The reduction in surface flow attributed to this area would be (on average) approximately 28ML/year. This would represent a minimal impact on the local ephemeral streams and that impact would be reduced by increased groundwater base flow due to the void's catchment

5.4.1.2 Groundwater

EES (2013) have identified as a result of the open cut not intercepting any groundwater, there would be no adverse indirect impacts on groundwater during mining activities.

5.4.1.3 Dryland Salinty

The Locality is located within the Toongi Catchment of Wambangalang Creek which Smithson (2001) confirmed as displaying areas of dryland salinity.

Whilst the proposed activities on the DZP Site, most significantly the construction and operation of the residue storage facilities, could impact on groundwater recharge, flow (indirectly) and discharge, strategies would be implemented to monitor groundwater levels on the DZP Site and prevent the wetting drying cycles within the soil horizons likely to result in dryland salinity. EES (2013) provides a more detailed review and discussion on this subject matter.

Dryland salinity expertise would be sought to design salt interception plantings across the AZL owned property.

5.4.2 Noise

The noise, vibration and blasting assessment for the Proposal was undertaken by EMGA Mitchell McLennan (EMM). The full assessment is presented in Volume 1 Part 1 of the EIS *Specialist Consultant Studies Compendium* and is referenced as EMM (2013).

EMM (2013) have undertaken conservative predictions of noise and blasting levels at surrounding receptors during three representative years throughout the life of the Proposal. Compliance with the human-based criteria would equally ensure that grazing livestock in the vicinity of the surrounding privately-owned receptors are not adversely affected by noise.

5.4.3 Air Quality

The air quality assessment for the Proposal was undertaken by Pacific Environment Limited (PEL). The full assessment is presented in Volume 1 Part 2 of the EIS *Specialist Consultant Studies Compendium* and is referenced as PEL (2013).

PEL (2013) concluded that the predicted dust deposition levels on properties surrounding the site would be sufficiently low such that the effects of Proposal-related dust on agricultural production would be negligible. References are provided in PEL (2013) to a range of studies supporting their conclusion.

5.4.4 Traffic

The traffic assessment for the Proposal was undertaken by Constructive Solutions. The full assessment is presented in Volume 3 Part 11 of the EIS *Specialist Consultant Studies Compendium* and is referenced as Constructive Solutions (2013).

Constructive Solutions (2013) have undertaken conservative predictions of traffic levels and have determined that the Proposal would not adversely impact on users of the main routes to and from the Proposal.

5.4.5 Local Services, Infrastructure and Human Resources

It is proposed to continue to operate the land within the DZP Site that is not involved in mining and processing activities, under the same productive agricultural enterprises as are currently undertaken. Many of the land holdings in question would continue to be operated by the present owners (until such time as modified arrangement are implemented), who would lease the land back from the Applicant. The impact of the DZP on local services, infrastructure, and human resources would therefore be negligible.

6. PROPOSED MITIGATION AND MANAGEMENT

6.1 INTRODUCTION

Throughout the EIS, a range of environmental, social and economic management outcomes and measures have been identified which would be required to avoid or reduce the potential environmental, agricultural and socio-economic impacts of the Proposal. The Applicant would draw upon the proposed mitigation measures and monitoring procedures identified throughout the EIS to be adopted and implemented within the following applicable management plans to be prepared in consultation with the relevant government agencies.

- *Environmental Management Strategy.*
- *Integrated Land Management Plan.*
- *Water Management Plan.*
- *Air Quality & Greenhouse Management Plan.*
- *Noise and Blasting Management Plan.*
- *Traffic Management Plan.*

6.2 AGRICULTURAL RESOURCE MANAGEMENT

6.2.1 Soil Management

Maintenance of the soil resource on the DZP Site would be of critical importance to minimising the impact on ongoing and future agricultural activities on the DZP Site. To minimise the detrimental affects of soils stripping, stockpiling and rehandling, the Applicant proposes the soil management measures documented in Section 2.3.3 of the EIS).

6.2.2 Water Management

6.2.2.1 Surface Water

The management of surface water to avoid or minimise the adverse impacts throughout the development and operation of the Proposal requires a coordinated and systematic approach that collectively addresses all potential surface water impacts. Section 4.5.4.2 of the EIS provides a detailed Surface Water Management Plan outlining how the Applicant would manage the quantity and quality of surface water encountered within each section of the DZP Site for the initial construction and development phase of the DZP.

In broad terms, the surface water would be managed on site according to quality, namely:

- clean water, namely runoff (typically upslope) that is not affected by any disturbed areas or mine-related activity(ies);
- dirty or sediment-laden water, namely runoff containing only sediment and originating from disturbed or bare areas within the DZP Site; or
- contaminated water, namely water with the potential to contain trace concentration of rare metals or radionuclides, chemicals or salt.

6.2.2.2 Groundwater

As the proposed activities would not impact directly on groundwater resources, the primary management measure would revolve around monitoring for potential changes to water levels and quality surrounding the residue storage facilities. Each would be lined with leakage detention systems in place and the Applicant would implement contingency recovery measures in the unlikely event that leakage or seepage from any of these structures occurs.

6.3 CONTINUED AGRICULTURAL ACTIVITIES AND BUFFER LANDS

The Applicant would own the land holdings of the DZP Site as well as approximately 1 500ha surrounding the DZP Site. In order to maximise the potential recommencement of agricultural activities over the disturbed areas of the DZP Site at the completion of the Proposal, the Applicant proposes to maintain ongoing agricultural activities over approximately 1 623.3ha of the DZP Site. As noted in Section 6.2.1, the Applicant would also occasionally graze the groundcover established on the soil stockpiles to encourage healthy growth of pasture and possible addition of nutrients to the soil by way of livestock manure.

The areas of proposed ongoing agriculture on the DZP Site have been located where possible around and beyond the boundary of the DZP Site. In dong so, a buffer would effectively be created between both the DZP Site operations, as well as the proposed *Biodiversity Offset Area* (BOA), and surrounding agricultural enterprises. Both the DZP Site operations and BOA could result in the possible indirect impacts on surrounding agricultural properties such as weed dispersion, native herbivory, elevated dust and other emissions. By establishing a buffer between these components of the Proposal and surrounding properties, the potential indirect impacts on these would be reduced.

6.4 REHABILITATION AND REINSTATEMENT OF AGRICULTURAL RESOURCES AND ENTERPRISES

6.4.1 Rehabilitation

The Applicant proposes to rehabilitate those areas of the DZP Site subject to relatively minor topographic disturbance, e.g. LRSF, Mine Haul Road, ROM Pad, Processing Plant and DZP Site Administration Area and soil stockpile areas back to a landform suitable for an agricultural land use. While not always achievable, the objective of this rehabilitation would be to return the land form to the pre-disturbance land capability, thereby minimising the long term reduction in agricultural productivity of the DZP Site. Section 2.17 of the EIS provides comprehensive detail on the proposed rehabilitation objectives, landforms, land uses, strategies, methods and assessment criteria.

Areas to be excluded from future agricultural production on the rehabilitated DZP Site would include those component disturbance areas subject to significant topographic modification, e.g. the open cut, Waste Rock Emplacement, SRSF and Salt Encapsulation Cells, where a return to a landform conducive to agricultural production is limited, and areas to be incorporated into the proposed BOA. In both cases, the areas subject to disturbance or incorporated into the BOA are mostly located on areas of the DZP Site of lower soil and land capability and therefore lower agricultural production (refer to *Figure 4.44*of the EIS).

Wherever practicable, the Applicant would undertake progressive rehabilitation of sections of the DZP Site that are no longer required for operational purposes. However, as a result of the nature of the proposed development, it is likely that progressive rehabilitation would be limited to sections of the Waste Rock Emplacement and outer embankments of the Liquid Residue Storage Facility, Solid Residue Storage Facility and Salt Encapsulation Cells as constructed during the period of the active mining and leaching operations.

6.4.2 Reinstatement of Agricultural Resources and Enterprises

Based on the proposed final landform, a significant area of the DZP Site would be returned to agricultural production at the completion of the Proposal. Given the competing objectives of biodiversity conservation and agricultural production, and limitations imposed by some components of the final landform, this represents the largest area which can feasibly be returned to agriculture.

6.5 TRIGGER ACTION RESPONSE PLAN

Rehabilitation completion criteria and indicators would be developed in consultation with the relevant government agencies for the Rehabilitation Management Plan.

Table 9 provides a summary of the actions that would be undertaken, in the form of a Trigger Action Response Plan [TARP]) if monitoring results are not achieving final rehabilitation completion criteria for end land use purposes.

Table 9
Trigger Action Response Plan

Page 1 of 2

Rehabilitation Risk	Monitoring Trigger	Mitigation Measure
Soil is stockpiled too high.	Soil stockpile greater than 2m high for topsoil and 3m high for subsoil.	Reduce height of soil stockpile.
Erosion of soil stockpiles.	Evidence of active erosion on the soil stockpile (to be retained for greater than 3 months).	Install appropriate upslope water diversions (bunding or drain) and seed with native grass seeds.
Inadequate soil resources available for rehabilitation.	Soil inventory shows a deficit of soil.	Review rehabilitation plan to ensure there is enough soil available for rehabilitation and/or conduct rehabilitation trials using alternative growth mediums other than soil.
The proliferation of weeds in soil stockpiles, amenity bund or rehabilitation area.	Presence of noxious weeds.	Control weeds in accordance with the site's weed management protocols and undertake quarterly follow up inspection of treated area.
Water management infrastructure is not constructed appropriately.	- Water management infrastructure constructed in inappropriate location. - Diversion bunds do not meet design standards of the Blue Book (Landcom, 2004) (e.g. longitudinal grade greater than 2%). - Water retention dams do not meet sizing requirements.	Monitor the performance of the water management infrastructure and upgrade if required (e.g. regrade sections of diversion bunds, installation of additional erosion controls, enlargement of dam).
Contaminated sites are present.	Contaminated sites are present.	Remediate contaminated sites in accordance with recommendation of qualified contamination consultant.
Ponding of water is evident on rehabilitated slopes.	Evidence of ponded water over greater than 15% of the rehabilitated area.	Monitor for geotechnical stability and erosion of the landform and remediate if required.

Table 9 (Cont'd)
Trigger Action Response Plan

Rehabilitation Risk	Monitoring Trigger	Mitigation Measure
Rehabilitated slopes are not in accordance with the final landform plan.	Rehabilitated slopes within the exceed 18° and 30° within the box cut area.	Regrade slopes prior to contour ripping and drainage works being installed.
Reshaped landform has not been contour ripped.	Reshaped landform has not been contour ripped.	Contour ripped reshaped landform prior to the placement of topsoil.
Soil has not been spread at appropriate depths on the rehabilitated landform.	Subsoil depth on the rehabilitated landform is less than 250mm in thickness and / or topsoil less than 50mm.	Spread additional soil over the area.
The rehabilitated area does not meet its intended sustainable end land use.	The rehabilitated area does not meet its intended sustainable end land use after 5 years of being in this phase.	Review rehabilitation records. Seek specialist advice and liaise with government agencies to determine a solution to move forward and implement the solution.

7. ASSESSMENT OF RESIDUAL IMPACTS

7.1 AGRICULTURAL RESOURCES

7.1.1 Land Capability

An assessment has been made of the extent to which the Disturbance Area of the DZP Site may remain affected by the Proposal, following the completion of rehabilitation (**Table 10**). After rehabilitation, 6% (198ha) of the Locality (3 452 ha) would be permanently removed from possible agricultural use. A further 30% (1 021ha) would be removed from agricultural production by incorporation into the Biodiversity Offset Area for the Proposal (although only 520.9ha of the BOA incorporates Class 3 or 4 land, i.e. the more productive land). The remaining 64% of the Locality would be available for agriculture at the cessation of the Proposal (2 233ha).

Table 10
Areas Available for Agricultural Production After Rehabilitation

Land Capability	Disturbance Area (ha)	Rehabilitation		Biodiversity Offset Area	Returned to Agriculture
		Not Available for Agriculture	Agricultural Production		
1	0	0	0	0	0
2 & 3	613.1	0	122	190.4	1 014.6
4 & 5	193.4	0	487.6	400.8	1 218.4
6 & 7	1.2	157.8	0	429.8	429.9
8	0	40.3	0	0	0
Total area	807.7	198.1	609.6	1 021	2 233

7.1.2 Soils

With the application of the proposed soil management measures, SSM (2013) conclude that impacts on the soil resources of the Locality would be temporary for the life of the Proposal and not result in any long term detrimental affects.

7.1.3 Agricultural Support Infrastructure

It has already been stated (see Section 3.7) that the Locality does not contain any significant agricultural support infrastructure. There would therefore be no impact on such infrastructure as a result of the mining operations conducted within the Locality, nor from any changes resulting from the completion of rehabilitation work at the site.

7.2 AGRICULTURAL ENTERPRISES

7.2.1 Livestock Enterprises

Much of the area is currently involved in grazing activities, with just over half of the relevant land area being classified into land and soil capability classes 4 to 7. This grazing consists predominantly of cattle grazing, with a focus on “growing out” steers rather than running breeding enterprises.

There is also some grazing of sheep, focused on prime lamb production based on opportunistic dryland lucerne (i.e. lucerne is grown when sufficient rainfall is received).

It is intended that these enterprises would continue both during the Proposal, and following progressive rehabilitation of the Disturbance Area, on appropriate areas within the Locality (as determined by land classifications) and subject to exclusion from the Biodiversity Offset Area.

7.2.2 Other Agricultural Industries

While just under half of the area is considered to represent Land and Soil Capability Classes 2 and 3, much of this land is also currently used for grazing. There is limited cropping, mainly as a result of the part-time nature of management used. Some wheat, oats and barley is grown, but only occasional oilseeds and pulses.

It is intended that these enterprises would continue both during mining, and following rehabilitation of the site once mining has ceased.

7.3 SOCIO-ECONOMIC IMPACTS

7.3.1 Agricultural Land Values

The land within the Locality has either already been purchased by the Applicant or is currently under negotiation for purchase. Prices paid for this land do not reflect productive capacity (either now or in the future), but are all based on a mutually acceptable amount with each individual family enterprise. Having entered agreements to purchase entire properties the Applicant has effectively secured a large enough estate to contain all the project components and have some “agricultural buffer” land. The Proposal has been designed to minimise impacts on all neighbours.

While the DZP property purchase prices are above market value, there is no intent to continue purchasing property other than those already mentioned. The DZP will have caused a one-off jump in Toongi property values but there is no reason to assume that surrounding property prices will be impacted up or down by this proposal.

7.3.2 Regional and Local Agricultural Enterprises

Following the cessation of the Proposal, it is intended that available land should be returned to previous use. Areas which would not be available, following rehabilitation, are the following components of the Disturbance Area and Locality.

- The rehabilitated Solid Residue Storage Facility and Waste Rock Emplacement which would have a rehabilitated land capability of Class 6 (and therefore only suitable for occasional grazing).
- The rehabilitated Salt Encapsulation Cells which would have a rehabilitated land capability of Class 7 (and therefore not suitable for rural use – OEH, 2012).
- The rehabilitated the open cut which would have a rehabilitated land capability of Class 8 (and therefore not suitable for rural use – OEH, 2012).
- The Biodiversity Offset Area which would be conserved for the protection of biodiversity values.

A total of 1 219.1ha (35% of the Locality) would therefore be excluded from future agricultural productive use, after rehabilitation. It is noted that on the basis of land capability class, 431ha [12.5%] of the Locality is already unavailable for agricultural production by virtue of land capability Class 7. The net reduction in land available for production is therefore 788.1ha.

7.3.3 Estimated Production After Mining (Including Sensitivity Analysis)

Following rehabilitation of the Disturbance Area, it is estimated that around 64% of the original area available for agricultural production would either remain unaffected by the mining operations, or would be returned to a suitable state for the continuation of activities temporarily halted by these operations.

Based on the same GM/ha budget data used for the assessment of current value of agricultural production from the site, and using the data on area available (outlined above), it is estimated that the value of agricultural production delivered after rehabilitation of the Disturbance Area would be **$1.061 million per year**. This represents a loss from the current level of production of $0.403 million per year, but compares favourably with the loss of $0.674 million per year expected over the life of the Proposal. The relevant areas available, and values of production estimated to be generated, under current use and then both during mining and after rehabilitation, are set out in **Table 11**.

Table 11
Agricultural Productivity of the Locality

	Current	Mining	After rehabilitation		
INDICATORS :					(units)
Area available for agric use	3,452.00	1,623.30	2,233.00		hectares
Area lost to production	-	1,828.70	1,219.00		hectares
Value production from area	1463.56	789.23	1060.65		$'000/yr
Loss of production	-	674.33	402.91		$'000/yr
Av GM/ha from avail area	423.97	486.19	474.99		$
PV loss at 10% discount*	-	5,778.94	6,250.81		$'000
* assumes 20 yr life of mine, then 20 yrs after rehabilitation completed					

The overall impacts of the DZP – both during the period of operations and following rehabilitation of the Disturbance Area – are summarised in **Table 11**. It is noted that the average production value achieved from the site (in terms of GM/ha) does not remain constant over the whole period observed (i.e. before mining, during mining, and following site rehabilitation). This impact is the effect of different Land and Soil Capability Class areas being available under each of the three production scenarios.

A Present Value (PV) has been calculated of the cash flow (GM of total annual production) delivered by:

- the 20 years of the Proposal; and
- this period of operations, plus a further 20 years of agricultural production after rehabilitation of the Disturbance Area.

It is noted that the additional losses (from current levels of agricultural production) during the "rehabilitated" period add little to the PV assessment, over the losses occurring during the actual mining operation. The total loss of production, in PV terms using a 10% discount rate, over the 20 years of mining operations is $5.779 million. The total loss over the 40 years (mining plus rehabilitation) in PV terms is $6.251 million.

As described previously, the GM/ha budgets can be varied by +/- 10%, in order to assess the degree of sensitivity of results to any factor (such as rainfall) which could cause "non-average" production impacts. If actual production achieved were 10% higher than the budgets, then the loss in production following site rehabilitation would be $0.375 million per year. If actual production were 10% lower than budget, then the loss of production would be $0.431 million per year.

7.3.4 Agricultural Support Services

There would be no discernible impact on local support services to agriculture, as production is not changing to any significant extent.

7.3.5 Local and Regional Agricultural Employment

There is not likely to be any significant change to employment levels, as production from the site would be continued. Some current operators would use the opportunity of having successfully completed sale negotiations with a willing purchaser (the Applicant) to exit the industry. These operators were self-employed, and would either enter retirement or continue agricultural production from other properties.

It is reasonable to expect some local agricultural workers will look to the DZP as a potential new employment opportunity exacerbating the difficulty of larger enterprises to attract and retain farm workers.

7.4 CUMULATIVE IMPACTS

An overall assessment has been made of the annual "cash flow" represented by agricultural production from the Locality, over the period from the current time (year 1) to the end of 20 years of the Proposal, and then with another 20 years of production following rehabilitation. This is represented in **Figure 14**.

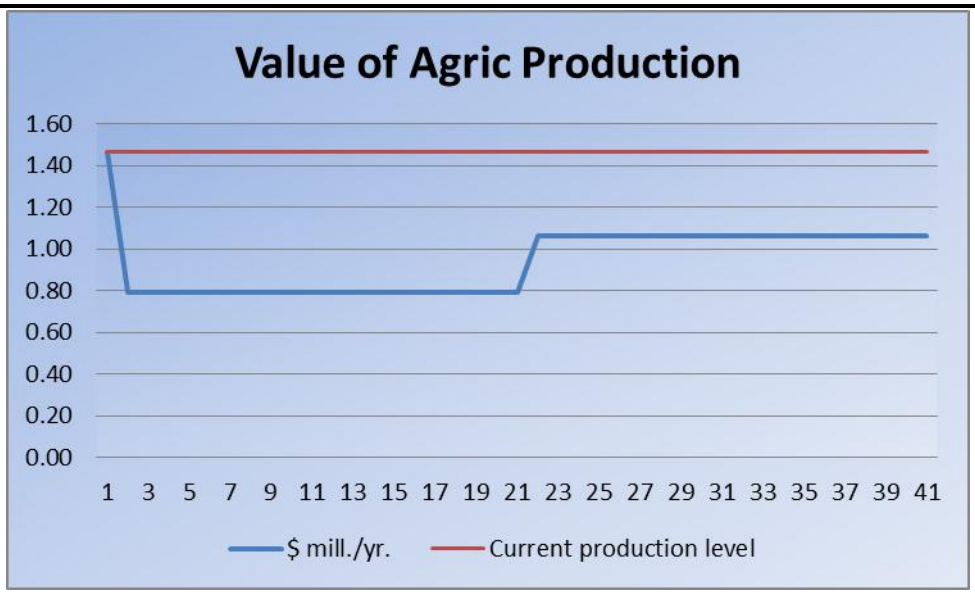


Figure 14
VALUE OF AGRICULTURAL PRODUCTION

From an assessment of **current** production of around $1.46 million (Year 1), production from the Locality would drop to $0.79 million per year for the next 20 years, during operations. For the subsequent 20 years (following rehabilitation of the site), agricultural production is expected to increase to $1.06 million per year.

The horizontal line in the above figure represents current value of agricultural production assessed as being delivered by the Locality. The area between the red and blue lines represents the total value of agricultural production that is expected to be lost from the site as a result of the DZP. It is this "area" that has been assessed as having a PV of $6.25 million, at 10% discount rate.

8. UNCERTAINITY OF IMPACT

Due to the small scale agricultural activities located within the Toongi locality there is negligible uncertainty of the impacts that the Proposal will have on the agricultural industry.

9. CONCLUSION

The key impacts of the proposal on current activities are assessed as:

- During mining activities, some 808 ha would be lost to agricultural production. In addition, around 1 020 ha would be allocated to a proposed BOA. The value of agricultural production lost has been assessed as being in the order of $674 330 000 per year. Over the 20 year operational "life" of the project, this loss can be calculated as having a Present Value (PV) of $5.78 million (at 10% discount rate)
- Following the cessation of mining activities, and rehabilitation of the site, around 1 220 hectares would continue to be unavailable for agricultural activities. This would result in the loss of some $402 910 per annum.
- Over the 20 years of the DZP, and assuming a further 20 years of production from the rehabilitated site, the total loss of agricultural production from the total project area would have a PV of $6.25 million (at 10%). This total can be compared with an equivalent PV of $4 257 million (i.e. $4.3 billion) for the value of production from the DZP over the 20 year operational life of the Proposal

As the Proposal has been designed so that the majority of land disturbed is rehabilitated to the current land and soil capability classes (or maintained as biodiversity offsets), the Applicant considers that the Proposal represents an excellent balance between the use of the land for ongoing agricultural uses and nature conservation and acceptance of mining as being a temporary land use.

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