

GLENCORE

Mount Owen Continued Operations Project

Response to PAC Review Report

May 2016



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GLENCORE

MOUNT OWEN CONTINUED OPERATIONS PROJECT

Response to PAC Review Report

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Mount Owen Pty Limited

Project Director: Barbara Crossley
Project Manager: David Holmes
Report No. 3109/R20/Final
Date: May 2016



Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

www.umwelt.com.au



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Executive Summary



The Planning Assessment Commission (PAC) Review Report (the PAC Review Report) for the Mount Owen Continued Operations Project (the Project) was released in February 2016 following a public hearing in December 2015. The PAC Review Report outlined the PAC's findings and recommendations based on its review of the Project.

Taking account of the recommendations and feedback provided in the PAC Review Report, Mount Owen has refined aspects of the Project and the associated community and environment impact mitigation and offset commitments.

The key updates are primarily in response to the PAC's recommendations regarding final landform and final voids and include:

- removal of coal mining activities in the Ravensworth East Resource Recovery (RERR) mining area from the Project, and rehabilitation of this existing disturbed area which will have the effect of removing a void from the final landform for the Project and reducing noise and air quality impacts during the later stages of the Project
- landform works in the Bayswater North Pit (BNP) final void following closure, which will have the effect of improving the final landform of the BNP void
- refined shape of the proposed North Pit final void to reduce the angular geometric form of the voids to achieve more natural void shapes
- incorporation of additional areas of micro relief in the final landform for areas of Ravensworth East Mine affected by the mining of BNP and rehabilitation of the West Pit tailings facility and
- related updates to water and tailings storage and the progression of rehabilitation and final landform over the life of the Project.

The Project refinements do not alter the disturbance footprint, the overall life of the Project or proposed maximum rates of production but do result in a reduced total coal production from the Project. The Refined Project will produce approximately 86 Mt ROM coal in addition to the existing approved reserves over the life of the Project (down from 92 Mt ROM coal). This reduction is associated with the removal of mining in the RERR mining area from the Project. The Refined Project does not substantially differ from the original development application for the Project in accordance with Section 89F(4) of the EP&A Act.

In addition to the above, Mount Owen has committed to an additional offset area of approximately 144 hectares known as the Mitchell Hills Offset Area in response to both feedback from the Commonwealth Department of

the Environment and a recommendation from the PAC to provide supplementary offsets. Additional management measures are also proposed to further mitigate the Project's potential impacts on habitat connectivity.

This Report includes a detailed response to the recommendations made in the PAC Review Report and contains a consolidated list of mitigation and management commitments that will be implemented as part of the Refined Project. This Report includes relevant updates to the assessment of the environmental and social impacts associated with the Project having regard to the Project refinements and proposed mitigation and management commitments. This assessment has found that the Project refinements have either had little or no change in impacts or for some issues have resulted in reduced adverse impacts. Notably, the Project refinements have resulted in reduced noise and air quality impacts from approximately 2023 onwards as a result of the removal of mining in the RERR mining area for the Project and the final landform will contain one less final void than was originally proposed as part of the Project.

A detailed economic assessment of the Refined Project has also been undertaken. The cost benefit analysis (CBA) undertaken as part of this economic assessment has found the Refined Project:

- has a net economic benefit when externalities (costs of environmental and social impacts) are considered as part of the costs of production. Applying the same market assumptions as used in the original EIS assessment, the net present value (NPV) of the Refined Project is estimated at \$857 Million when using a discount factor of 7 per cent
- the Refined Project will result in significant economic benefits. The economic contribution to the State of NSW in NPV terms is estimated at \$312 million.

The Project refinements have generally resulted in similar or reduced environmental and social impacts from those described in the EIS. The economic assessment of the Refined Project includes a detailed CBA which determined that the benefits of the Refined Project outweigh the negative impacts of the Project. Considering all the assessment to date, it is reasonable to conclude that the economic, social and environmental benefits of the Project outweigh the negative impacts of the Project and overall provide a net benefit to the NSW community.

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1.0 Introduction

1.1 Background

This report provides a response to the recommendations and issues raised in the Planning Assessment Commission (PAC) Review Report (the PAC Review Report) for the Mount Owen Continued Operations Project (the Project) released in February 2016. The PAC Review Report outlined the PAC's findings based on its review of the Project, which included a public hearing and invitations for submissions in December 2015.

Mt Owen Pty Limited (Mount Owen), a subsidiary of Glencore plc (Glencore), currently owns and operates the Mount Owen Complex. Mount Owen lodged Development Application SSD5850 in January 2015, seeking approval for the continued operations at Mount Owen and Ravensworth East mines under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The development application process for the Project has included the following:

- preparation of a comprehensive Environmental Impact Statement (EIS) (Umwelt 2015a)
- response to submissions received during the public exhibition period (Response to Submissions Report A (Umwelt 2015b) and Report B (Umwelt 2015c)) (June and August 2015)
- additional responses to queries raised by relevant government agencies (Response to Agency Queries Report) (November 2015)
- response to the verbal and written submissions received by the PAC through its review of the Project (Response to Submissions to PAC Report) (January 2016).

These reports have been submitted to the Department of Planning and Environment (DP&E) and are available on the DP&E website.

Taking account of the recommendations and feedback provided in the PAC Review Report, Mount Owen has refined aspects of the Project and the associated community and environment impact mitigation and offset commitments. These Project refinements are outlined in **Section 1.3** and detailed in relevant sections of this report.

A number of the PAC recommendations seek further clarification and resolution by DP&E of assessment issues raised by various government agencies or matters that were reported as unresolved at the time of issuing the November 2015 DP&E Secretary's Environmental Assessment Report (DP&E 2015). This report is referenced as the Preliminary DP&E Assessment Report on the DP&E website, and accordingly will be referred to in this manner in this report.

The PAC reference *'the community's frustration with the incomplete nature of the information provided and its concern that the Department appears to have drawn conclusions in the [Preliminary DP&E Assessment Report] before complete information was available.'* The PAC has made a number of recommendations that relate to the DP&E's progress on the assessment process, which has been noted in **Section 1.2**. All issues and matters communicated by DP&E or other agencies to Mount Owen in response to the PAC Review Report, have been addressed as detailed in this report, based on feedback received by 20th May, 2016.

Further, the PAC has noted in the Social and Economic Context of the PAC Review Report that *‘an extension of mining activities in this area would have significant social and other costs, many of which will be borne by the residents of the Hunter Valley’*. Whilst it is acknowledged that the Project has a range of environmental and impacts, these impacts have been comprehensively assessed in the EIS and Social Impact and Opportunities Assessment (SIOA) and it is important to clarify that this Project has not been assessed as having ‘significant social impacts.’ Further details on the extensive community engagement process and key outcomes of the SIOA are detailed in **Section 8.0**.

1.2 Response to PAC Recommendations

The PAC review report makes 24 recommendations for further consideration in the assessment and determination of the Project. **Table 1.1** outlines each recommendation and where this has been addressed as part of this response. As noted in **Table 1.1** there are a number of recommendations specific to DP&E. Where relevant, Mount Owen has consulted with DP&E and has provided additional relevant information to inform the DP&E assessment process.

Table 1.1 PAC Recommendations and Where Addressed in this Document

PAC Review Report Section	Recommendation	Where addressed
Biodiversity	1. That, prior to determination, the Department should progress discussions with, and seek additional information from, the Applicant about establishing supplementary offsets, including an east-west vegetation corridor linking the Stringy Bark Creek Corridor Offset and offsets at the Liddell Coal Mine.	Supplementary Offsets and additional corridor commitments are proposed. Refer to Section 4.2.
	2. That, prior to determination, the Department should seek further comments from : <ul style="list-style-type: none"> • DotE about whether the proposed offsets meet its requirements, particularly in relation to the suitability of foraging resources; and • OEH about whether the proposed expansion of the North Pit would materially affect the proposed vegetation corridors, particularly in relation to the movement and habitat of individual fauna species. 	Further comments have been received from DoE and OEH on these matters, and additional information is provided in Section 4.2.
	3. That the Department considers requiring further research in the recommended preliminary conditions of consent, particularly in relation to regeneration activities in this project, corridor linkages within the project area, and corridor linkages between this project and other nearby mines.	Refer to Section 4.2.
	4. That the recommended preliminary condition of consent relating to the Independent Environmental Audit should be linked to the preliminary Biodiversity Management Plan condition to ensure that regeneration is independently monitored and audited on a regular basis (i.e. within a year of the commencement of development, and every 3 years thereafter).	DP&E to resolve. Recommendation supported by Applicant - see Section 4.2.

PAC Review Report Section	Recommendation	Where addressed
	<p>5. That the recommended preliminary condition of consent relating to the Biodiversity Management Plan should be strengthened to include:</p> <ul style="list-style-type: none"> • salvaging, transplanting or propagating measures for all six threatened flora species known to occur in the region; • monitoring of potential impacts on groundwater dependent ecosystems and specific trigger levels for remedial action; • more specific performance measures and milestones linked to key individual fauna species (for example the relocation and re-use of hollow-bearing trees for the Squirrel Glider, Swift Parrot and Regent Honeyeater); • further details about the specific methods of regeneration, as well as relevant performance measures to assist in monitoring the effectiveness of regeneration; and • further detail about the particular vegetation species that should be promoted, including species from different 'functional groups', such as cycads, ferns, geophytes, rushes and sedges. 	Refer to Section 4.2 and Section 5.3.1
	<p>6. That the Department should review the current membership and operation of the CCC to ensure that it conforms with the Guidelines for Establishing and Operating Community Consultative Committees For Mining Projects (2007) (as updated), and that all relevant interests are represented, including those related to biodiversity, regeneration and rehabilitation.</p>	The applicant agrees this should be included in the relevant approval condition – see Section 4.2.
Air quality Impacts	<p>7. That the Department should forward a copy of the updated peer review of the AQIA to EPA and NSW Health and seek further comments in relation to the residual issues raised in their previous submissions.</p>	DP&E Responsibility. Peer review status outlined in Section 3.1.
	<p>8. That the Department ensures that the key residual issues regarding air quality and the AQIA are resolved prior to determination, particularly in relation to the meteorological data used, the methodology for calculating background levels and calibrating with other mines, and the assessment of cumulative impacts.</p>	A response is provided to the key issues noted by the PAC in Section 3.1

PAC Review Report Section	Recommendation	Where addressed
	9. That the Department make the Applicant 's response to the peer review of the AQIA, as well as any updated peer review, and any other additional information, available online as soon as practicable.	DP&E Responsibility. Refer to Section 3.1
Final Landform and Rehabilitation	10. That, prior to determination, the Department clarifies the number of currently approved final voids and seeks further justification from the Applicant for any additional proposed final voids.	Refinements to the Project include reduced number of final voids and revised final landform. Refer to Section 5.2.
	11. That, prior to determination, the Department seeks further information about alternative post- mining land use options, including the possibility of increasing woodland rehabilitation on slopes and focusing on agricultural species on the flatter areas of land to support grazing activities.	The rehabilitation plan has been refined to address this recommendation – refer to Section 5.2.
	12. That, prior to determination, the Applicant provides a revised mine plan that : <ul style="list-style-type: none"> includes more detailed consideration of the potential minimisation of final voids, with particular reference to the large volumes of overburden material that would be moved over the life of the project; provides more detail about the final void shapes and how these are to be achieved; incorporates micro-relief, with a focus on ensuring that the final landform will be more sympathetic to the surrounding landscape; and includes a more refined composition of proposed vegetation within the rehabilitated areas in order to ensure a diversity of species and appropriate fauna habitat. 	As described in Sections 1.3 and 5.2 , the mine plan and proposed rehabilitation details have been revised to address this recommendation.

PAC Review Report Section	Recommendation	Where addressed
	13. That the recommended preliminary conditions relating to the Rehabilitation Management Plan and/or Revision of Strategies, Plans and Programs are strengthened to take into account the outcomes of any review of the NSW Government's current policy on final voids.	As described in Section 5.2 , consultation with DP&E confirms there is no current NSW Government policy on final voids
	14. That the recommended preliminary condition of consent relating to the Independent Environmental Audit should be linked to the preliminary Rehabilitation Management Plan condition to ensure that rehabilitation is independently monitored and audited on a regular basis.	Agreed – refer to Section 5.2
	15. That the Department reviews intentions to mine existing rehabilitated land and considers options to ensure that proposed rehabilitated areas are not disturbed in the future, through conditions of consent or any other means.	Refer to Section 5.2
Water	16. That, prior to determination, the Department seeks further comments from: <ul style="list-style-type: none"> EPA about the discharge of surplus water from this project; and DPI Water about water licensing and associated issues, particularly in relation to the proposed surface water management system, the significant volume of water proposed to be held in dams that would require licensing under Jerry's Water Source, and the reconstruction and rehabilitation of watercourses in the final landform. 	Section 6.0 clarifies that no discharge of surplus water is proposed from the Project site. Further consultation and clarification in relation to water licensing is also provided.
	17. That the recommended preliminary condition of consent for the Groundwater Management Plan includes consideration of operations at Integra Underground Mine and any associated impacts.	Agreed – refer to Section 6.0
	18. That the recommended preliminary condition of consent for the Surface Water Management Plan should include consideration of the discharge of surplus water from this project.	Refer to Section 6.0

PAC Review Report Section	Recommendation	Where addressed
Aboriginal Cultural Heritage	19. That, prior to determination, the Department consider the findings and any potential implications of the recent court case, LALC v Minister for Planning Infrastructure and Anor (re Calga Sand Mine) in relation to the adequacy of the cultural heritage assessment for this project.	The findings and application to this Project are described in Section 7.0
Socio-Economic	20. That, prior to determination, the Department ensures the cost-benefit analysis for the project has been prepared in accordance with the relevant guidelines (NSW Treasury 2007 & NSW Govt 2012)c	Refer to Section 9.1
	21. That, prior to determination, final advice on the EIS, including on air quality, biodiversity and final landforms should be reflected in the CBA.	Refer to Section 9.1
	22. That, prior to determination, the peer reviewer be given an opportunity to indicate whether the Applicant's response adequately addresses the issues raised in the peer review.	DP&E has issued the final Peer Review outcomes and a response is provided in Section 9.2
	23. That, prior to determination, the Applicant provide additional information on the methodology employed to produce estimates of the value of the project under alternative scenarios, including the sensitivity of individual variations against the base-line assumptions, how the various scenarios for coal prices, carbon prices and extraction volumes relate to one another and under what conditions the project would generate a zero net present value.	Refer to Section 9.1

PAC Review Report Section	Recommendation	Where addressed
Further Public Input	24. That the Department should consider options to ensure that the community has a further opportunity to provide submissions on the Department's final findings prior to determination.	DP&E Responsibility. Mount Owen has planned further community engagement as outlined in Section 8.2.

1.3 Project Refinements

1.3.1 Refined Final Landform

In response to Recommendations 10 and 12 of the PAC Review Report (refer to **Table 1.1**), Mount Owen has undertaken a review of the final landform focussing on the issues raised by the PAC in relation to final void management and final landform. This review has identified amendments to the design of the Project as originally outlined in the EIS to meet the objectives of not creating additional voids relative to current approved Mount Owen operations and incorporating additional micro relief into the final landform for the Project.

The proposed amendments are such that the Refined Project does not substantially differ from the original development application for the Project in accordance with Section 89F(4) of the EP&A Act. The key changes are:

- removal of coal mining activities in the Ravensworth East Resource Recovery (RERR) mining area from the Project, and rehabilitation of this existing disturbed area which will have the effect of removing a void from the final landform for the Project and reducing noise and air quality impacts during the later stages of the Project
- landform works in the Bayswater North Pit final void following closure, which will have the effect of improving the final landform of the BNP void
- incorporation of additional areas of micro relief in the final landform for areas of Ravensworth East Mine affected by the mining of BNP and rehabilitation of the West Pit tailings facility
- refined shape of the proposed final voids to reduce the angular geometric form of the voids to achieve more natural void shapes.

The above revisions to the Project have also necessitated other amendments to the Project as presented in the EIS relating to water and tailings storage and the progression of rehabilitation and final landform over the life of the Project. The Refined Project is shown on **Figure 1.1**, with further detailed description outlined in **Section 2.0**. An environmental and social assessment of the impacts of the Refined Project has been undertaken and is provided in **Section 10.0**. The assessment identified that the changes to the Project result in similar or lower impacts to that comprehensively assessed in the EIS. Key findings of this assessment include:

- As mining in the RERR mining area is located in existing approved operational areas there will remain no change to the disturbance area for the Project.
- The removal of mining operations in the RERR mining area result in reduced air quality impacts in Year 10 of the Project in the vicinity of the RERR mining area and will result in lower predicted air quality impacts at non-mine owned receivers to the south east of the Project area, with Residence R023 no longer predicted to exceed relevant criteria;
- Noise impacts from the Refined Project will be reduced with the removal of RERR mining area operations with an overall reduction of one non-mine owned property predicted to exceed the relevant PSNL for the Project. Further, it is noted that one non-mine owned property is no longer located in the noise affectation area, and four non-mine owned properties are no longer in the noise management area.

- The proposed changes to the final landform and removal of the RERR mining area void will result in similar impacts on water resources to that assessed in the EIS, which will be managed through a revised water management system.
- All other social and environmental impacts are similar to or less than those described in the EIS as a result of the Refined Project.

The comprehensive suite of environmental and social management and mitigation measures proposed as part of the EIS for the Project remain largely unchanged as part of the Refined Project. **Section 11** contains a consolidated list of management and mitigation measures for the Refined Project.

A detailed economic assessment of the Refined Project has also been completed and has found:

- The Project has a net economic benefit when externalities (costs of environmental and social impacts) are considered as part of the costs of production. Applying the same market assumptions as used in the original EIS assessment, the net present value (NPV) of the Refined Project is estimated at \$857 Million when using a discount factor of 7%.
- The Refined Project will result in significant economic benefits. The economic contribution to the State in NPV terms is estimated at \$312 million.

The refinements to the Project design have resulted in no change or a reduction in the environmental impacts from those described in the EIS when considered as a whole. Importantly the Refined Project will not lead to any increases in environmental and social impacts as detailed in the EIS. The economic assessment of the Refined Project includes a detailed cost benefit analysis which determined that the benefits of the Refined Project outweigh the negative impacts of the Project. Considering this finding, combined with the findings of the EIS, Social Impact and Opportunities Assessment and Updated Assessment in **Section 10.0**, it is reasonable to conclude that the economic, social and environmental benefits of the Project outweigh the negative impacts of the Project and overall provide a net benefit to the NSW community.

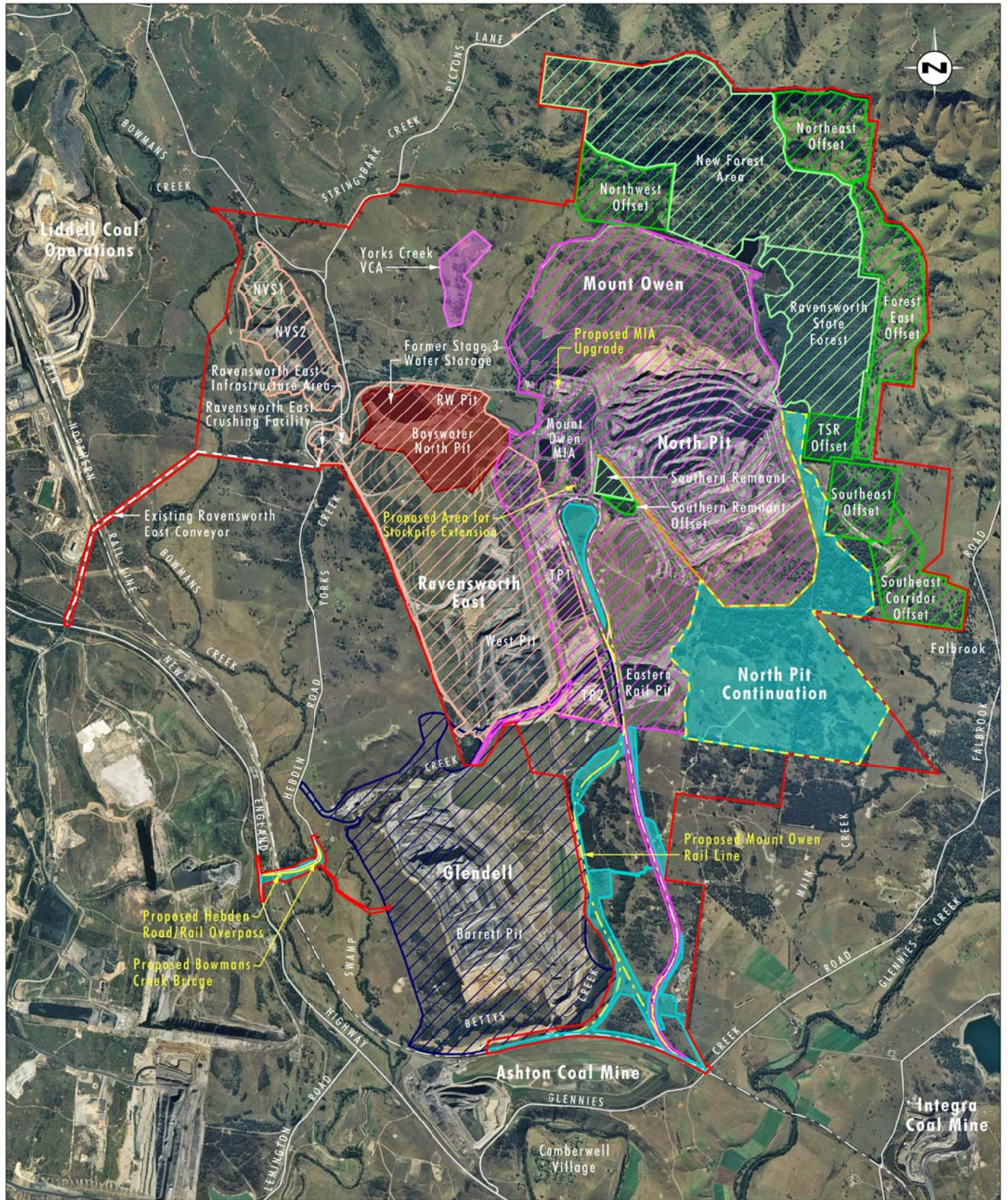


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1 2 3 km
1:60 000

Legend

- | | |
|--|---|
| Project Area | Boyswater North Pit |
| Approved North Pit Mining Extent | Mount Owen Operational Area |
| Proposed North Pit Continuation | Glendell Operational Area |
| Proposed Rail Upgrade Works | Ravensworth East Operational Area |
| Proposed Hebdon Road Upgrade Works | Existing Biodiversity Offset Area |
| Proposed Disturbance Area | Ravensworth State Forest |
| Yorks Creek VCA | |

File Name (A4): R20/3109_1099.dgn
20160516 10.20

FIGURE 1.1

Proposed Refined Mount Owen
Continued Operations Project

1.3.2 General Project Updates

Since the public exhibition of the EIS, Mount Owen has committed to a number of other updates to the Project and / or clarifications to DP&E. For completeness in the final assessment of the Project, details of the following updates to the Project are provided in the sections below.

1.3.2.1 Ravensworth East MOD 6

In February 2016, a modification of the Ravensworth East Mine development consent (DA52-03-99 MOD 6) was approved to permit the receipt and emplacement of piped tailings from Ravensworth Operations and Liddell Coal Operations CHPPs within the West Pit void at Ravensworth East for the period 2017 to 2021. Should the Project be approved, Mount Owen will surrender the existing Ravensworth East development consent with all ongoing operations to be undertaken in accordance with a single consolidated development consent. The incorporation of the approved Ravensworth East MOD 6, which forms part of the Greater Ravensworth Area Tailings System (GRATS), as part of the Project is described further in the Project update in **Section 2.0**.

1.3.2.2 Property Ownership Updates

Mount Owen has completed a number of updates to land ownership within the vicinity of the Project, including a number of Crown road closures. Details of the land ownership changes are outlined below and shown on the updated land ownership **Figure 1.2** (updated Figure 1.6 from the EIS).

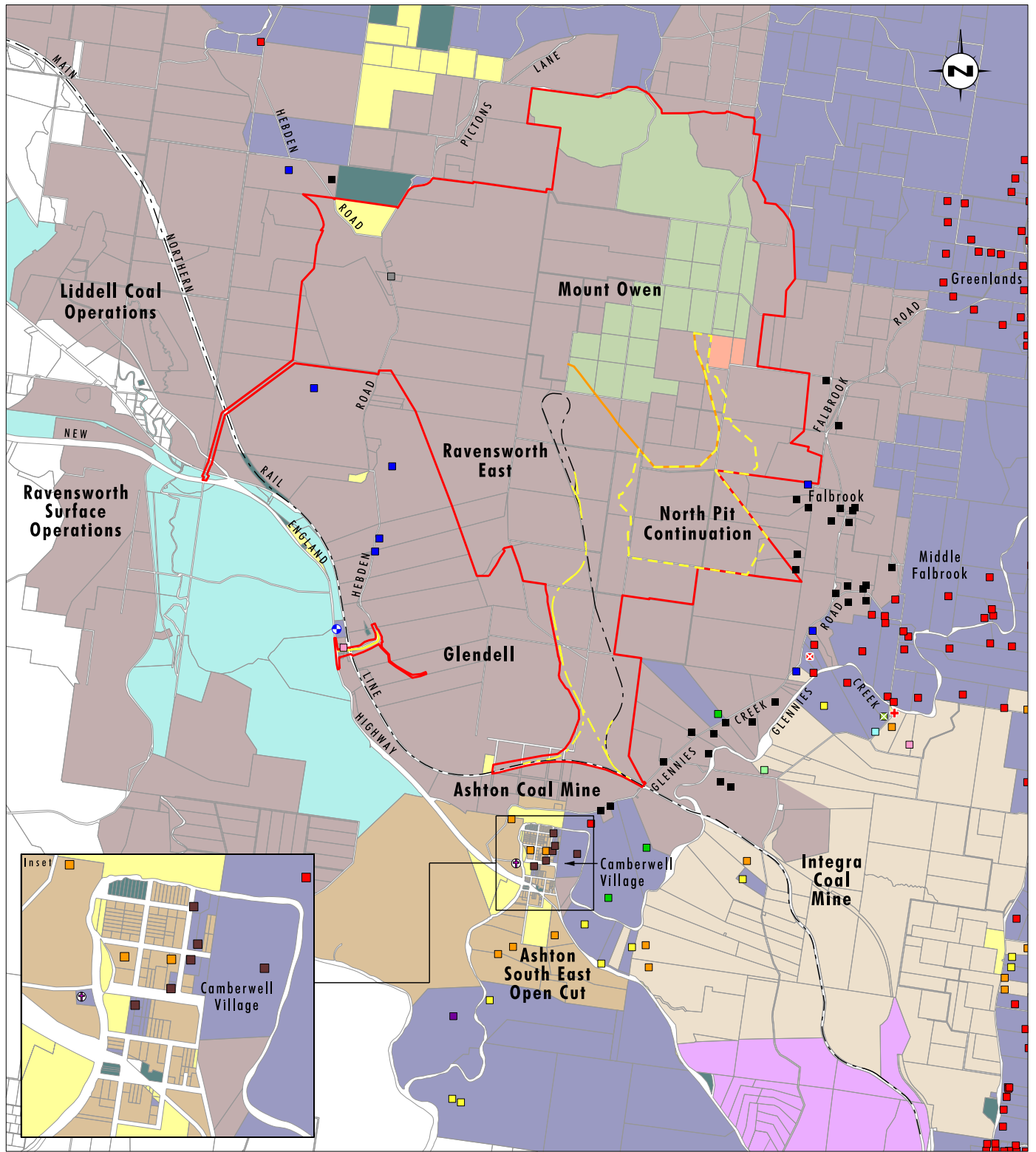
Mount Owen completed the purchase of the property at 797 Middle Falbrook Road, Glennies Creek (EIS Property ID 18). The lots purchased were Lot 13 DP6830 and Lot 1 DP851867, totalling approximately 184 hectares. The property has no dwelling and is vacant land.

Further to this, Mount Owen has purchased EIS Property ID 345 (Lot 5 DP 133183), located on Glennies Creek Road. This Property is a narrow piece of land that is 0.66 hectares in area, has no dwelling and is vacant.

Glencore subsidiary HV Coking Coal Pty Limited purchased the adjacent Integra Underground Operations in December 2015. **Figure 1.2** has been updated to reflect this purchase and the transfer of the Integra Underground Operations and associated landholdings to Glencore entities. The residence mapping has also been updated to reflect the residences with acquisition rights under existing Integra Underground approvals now being the responsibility of Glencore entities.

1.3.2.3 Voluntary Planning Agreement

Singleton Council endorsed Mount Owen's proposed draft Voluntary Planning Agreement at a Council Meeting on 18 April 2016. A copy of the agreed development contribution funding is included in **Appendix 1**, and includes a total funding contribution of \$1,024,000. The endorsed VPA includes a number of items ranging from economic development initiatives, completion of playground equipment, community sponsorships and support for Aboriginal Cultural events.



Data Source: Mount Owen (2014),
Department of Lands (2009)

Legend

- | | | |
|---|--|--|
| Project Area | State Forest | ■ Mine Owned Residence - Vacant |
| Approved North Pit Mining Extent | ⊕ Church | Community Hall |
| Proposed North Pit Continuation | ⊕ Daracon Site Office | Former Hebdon Public School |
| Proposed Rail Upgrade Works | + Glennies Creek Fire Brigade | |
| Proposed Hebdon Road Upgrade Works | x Private No Dwelling | |
| Ashton Coal | Private Acquisition Rights Glencore and other Mines | |
| Crown Land | Currently Subject to Acquisition Rights - Dairy | |
| Crown Land TSR | SEOC Acquisition | |
| Government Authority | Private Residence | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Macquarie Generation | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Glencore | Mine Owned Residence - Glencore | |
| Private | Mine Owned Residence - Other Mine | |
| Rixs Creek Mine | Mine Owned Residence - Derelict | |

FIGURE 1.2
Land Ownership

1.4 Structure of this Response

An overview of the Structure of this report is provided below.

The Executive Summary provides a summary of the response to the matters raised in the PAC Review Report, and a brief overview of the Project revisions, along with the key outcomes of the environmental assessment of the Project refinements.

Section 1.0 introduces the background, refinements to the Project and the intent of this report.

Section 2.0 contains a description of the Refined Project and a summary of the key changes from the Project described in the EIS.

Sections 3.0 to 9.0 summarises the recommendations made in the PAC Review Report, and where these are addressed in this document, or alternatively where Mount Owen understands the matter is being addressed by DP&E. Recommendations and discussion from the PAC Review Report are shown as ***bold italicised*** text with responses to the recommendations or discussion following.

Section 10.0 contains a review and, where relevant, updated assessment of the key environmental, social and economic issues relevant to the Refined Project including a review of noise, air quality, water resources and greenhouse gas assessments.

Section 11 identifies any revisions to the EIS summary of management and mitigation measures proposed to be adopted throughout the life of the Project.

Section 12 lists references cited in the Report.

2.0 Refinements to the Project

This section details the refinements to the Project made in response to the recommendations of the PAC Review Report. The following sections note matters that have been updated in relation to the relevant sections of the EIS for the Project.

The differences between the Project described in the EIS and the Refined Project are summarised in **Table 2.1**. **Sections 2.1 to 2.5** of this Report provide further detail on the aspects of the Refined Project which differ to the Project as presented in the EIS. These sections update and replace the relevant sections of the EIS as noted in the following sections. Those aspects of the Project that are not discussed in this section remain unchanged from that described in the EIS. The key features of the Refined Project are shown in **Figure 1.1**.

Table 2.1 Key Proposed Features of the Refined Project

Key Feature	Project Described in EIS	Refined Project
Mine Life	Consent will be sought for 21 years (from date of Project Approval) to provide for mining until approximately 2030 and contingency for other activities such as rehabilitation and capping of tailings emplacement areas.	No Change
Limits on Extraction	No change in approved extraction rates. North Pit – up to 10 Mtpa ROM. Ravensworth East – up to 4 Mtpa ROM.	No Change
Mine Extent	Continuation of the North Pit footprint to the south of current approved North Pit mining limit.	No change
	Mining within the approved BNP, followed sequentially by mining within the RERR Mining Area within the Ravensworth East Mine.	Mining within the approved BNP within the Ravensworth East Mine. No mining in the formerly proposed RERR Mining Area.
	Mining depths to approximately 300 m (North Pit).	No change
	Total additional mineable coal tonnes of approximately 92 Mt ROM (comprising 74 Mt ROM (North Pit Continuation), 12 Mt ROM (BNP) and 6 Mt ROM) (RERR Mining Area).	Total additional mineable coal tonnes of approximately 86 Mt ROM (comprising 74 Mt ROM (North Pit Continuation), and 12 Mt ROM (BNP).

Key Feature	Project Described in EIS	Refined Project
	Changes to mine water management system.	No change
Operating Hours	No change proposed - 24 hours per day, 7 days per week.	No change
Workforce Numbers	<p>No significant change to workforce numbers is required. Current workforce required to operate North Pit and CHPP fluctuates and peaks at about 660 and the Ravensworth East development consent allows for a workforce of up to 260 to operate Ravensworth East operations.</p> <p>Addition of approximately 330 personnel for construction phase for proposed infrastructure works (approximately 18 months).</p>	No change
Mining Methods	No change to mining methods proposed.	No change
Mount Owen CHPP and MIA	<p>No change to existing approved CHPP capacity of 17 Mtpa ROM.</p> <p>Product stockpile extension;</p> <p>CHPP improvements (including operational efficiencies) to increase processing capacity and tailings management;</p> <p>MIA extensions and improvements;</p>	No change
Existing Mine Infrastructure	Continued utilisation of all existing mining infrastructure, including the existing crushing plant for the crushing of overburden.	No change
Infrastructure Construction Activities	<p>Infrastructure upgrades including:</p> <ul style="list-style-type: none"> provision for a northern rail line turn-out and additional Mount Owen rail line Hebden Road overpass over Main Northern Rail Line; and New Hebden Road bridge crossing over Bowmans Creek. 	No change

Key Feature	Project Described in EIS	Refined Project
Tailings and Coarse Reject Emplacement	Continued use of the Ravensworth East voids for tailings emplacement and co-disposal of coarse reject and overburden within the North Pit Continuation, the West Pit / BNP and the RERR Mining Area as mining progresses.	Continued use of the Ravensworth East voids for tailings emplacement and co-disposal of coarse reject and overburden within the North Pit Continuation and the West Pit / BNP as mining progresses.
	Tailings cells may be constructed and filled within the North Pit Continuation area as required to allow time for consolidation and drying of tailings in the West Pit and the RERR Mining Area.	RERR no longer used for tailings emplacement
	Allowance for the receipt of tailings from other mines.	Allowance for the receipt of tailings from other mines in accordance with relevant approvals including Ravensworth East DA52-03-99 MOD 6. Continued participation (receipt and transfer of tailings) as part of the Greater Ravensworth Area Tailings Scheme (GRATS).
Coal Transportation	<p>No change to current export coal transportation with the exception of the use of the proposed additional rail line.</p> <p>No change to capacity of 17 Mtpa ROM coal.</p> <p>Use of existing rail line for train park up.</p> <p>Transportation of up to 2 Mtpa ROM coal and crushed gravel on an as required basis via the existing overland conveyor to Liddell Coal Operations and the RCT in addition to maintaining the current approval to transport ROM coal to Bayswater and Liddell power stations.</p>	No change

2.1 Conceptual Mine Plans

Consistent with the Project described in the EIS, Mount Owen proposes to continue the existing mining operations within the North Pit to the south beyond the current approved North Pit mining limit. The current approved North Pit will be extended by an additional estimated surface disturbance footprint of approximately 381 hectares. Mining depths within the North Pit Continuation will vary from approximately 180 metres to 300 metres and target seams between the Ravensworth Hebden seams (refer to Figure 2.6 of the EIS). Mount Owen also proposes to continue mining within the BNP down to the Bayswater seam.

Following comments in the PAC Review Report regarding final land form and final voids (discussed further in **Section 5.0**), Mount Owen has refined the Project to remove mining in the RERR mining area. As a result of this Project refinement, there will be no increase in the number of voids in the final landform relative to the currently approved development at the Mount Owen Complex.

The progression of conceptual mining associated with the Refined Project is shown on **Figures 2.1 to 2.3**. **Figures 2.1 to 2.3** also detail the incorporation of micro relief into the progressive rehabilitation over the life of the Project as requested in the PAC Review Report. **Figure 2.4** shows the conceptual revised final landform for the Project showing the reduction in final voids and the further incorporation of micro relief in areas of the rehabilitated landform developed over the life of the Refined Project. Further details regarding rehabilitation and final landform commitments associated with the Refined Project are provided in **Sections 2.3 and 5.0**

2.1.1 Progression of Conceptual Mine Stages

As outlined above, the Refined Project includes conceptual mine plan stage updates in response to recommendations contained in the PAC Review Report as well as updates associated with other changes at the Mount Owen Complex such as the recent approval to receive tailings from other mines as part of the Greater Ravensworth Area Tailings Scheme. This section provides a description of the conceptual mine progression plans associated with the Refined Project.

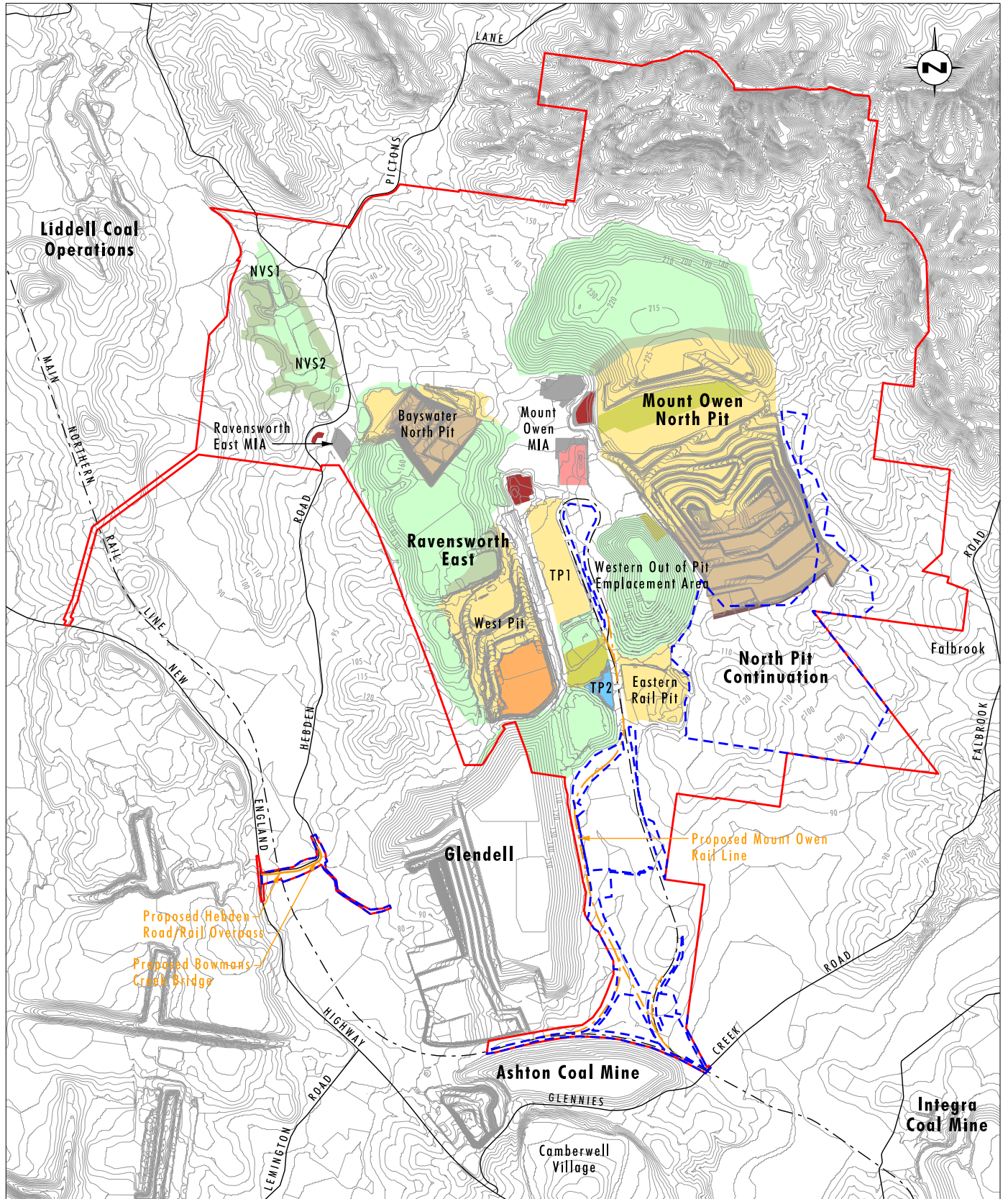
Year 1

Mining associated with the Project in Year 1 is anticipated to commence in 2017 and will include operations at both the North Pit and Ravensworth East. Based on the current production schedules, mining operations within the North Pit are expected to reach the extent of the current approved mining limit in 2016 (refer to **Figure 2.1**).

Tailings from the Mount Owen CHPP will be emplaced into West Pit. The emplacement of tailings from Ravensworth Operations and Liddell Coal Operations will also commence in Year 1 in the West Pit void in accordance with the Greater Ravensworth Area Tailings Scheme (GRATS) (refer to **Section 2.2**).

Mining activities in the Ravensworth East Mine will be operating in Year 1 and include mining of coal within BNP. ROM coal from BNP will be transported via truck to the ROM coal stockpiles for processing within the Mount Owen CHPP. Overburden from BNP will be emplaced in the existing Ravensworth East overburden areas to approximately RL160 m.

Rehabilitation works associated with the ERP and TP1 will be underway. Additionally, co-disposal of coarse reject and overburden will occur within the West Pit overburden emplacement area and the capping of TP1 tailings emplacement area would continue (refer to **Figure 2.1**).



Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3 km
1:60 000

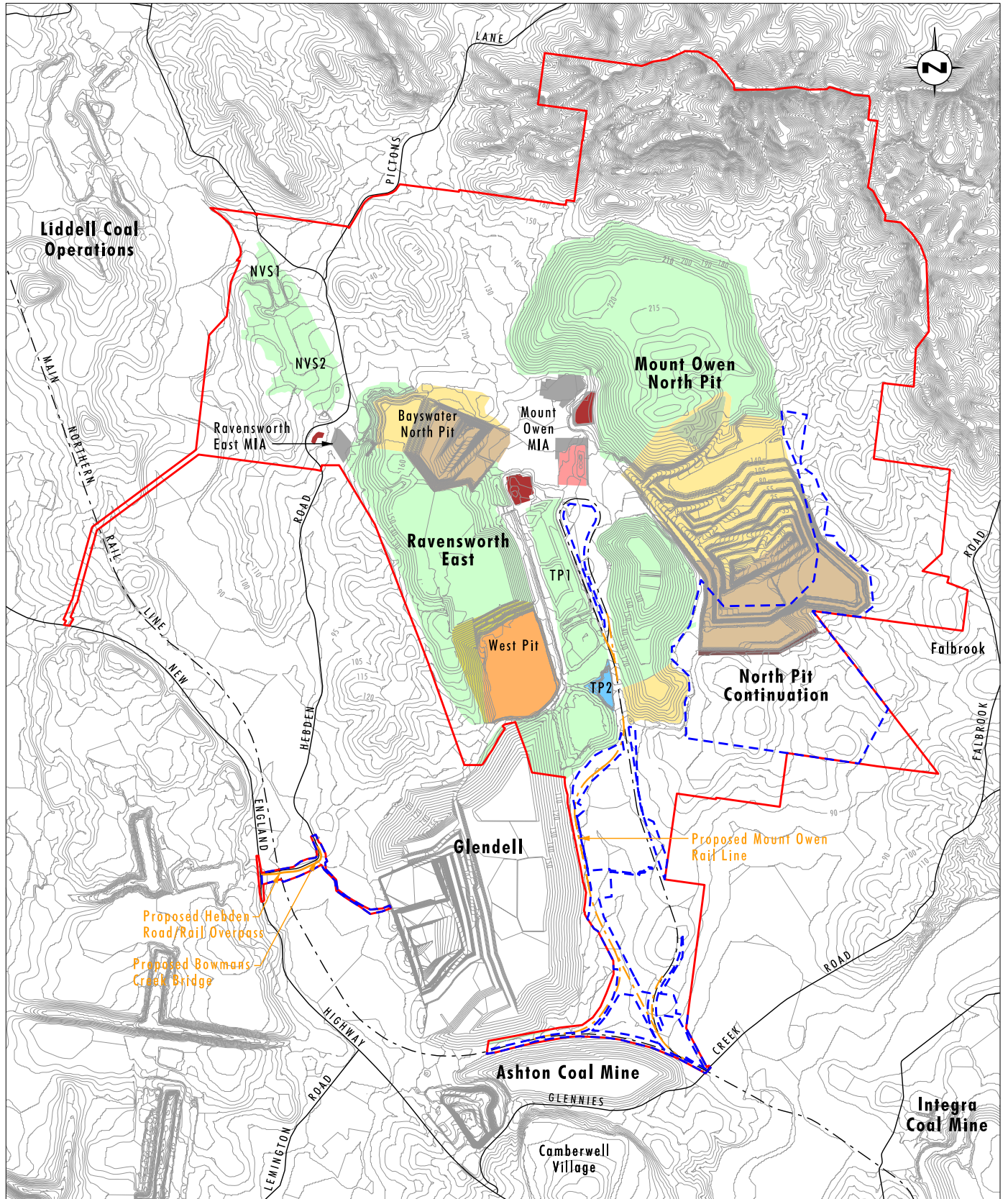
Legend

- | | | |
|--|--|--|
| Project Area | Coal Stockpile - Product | Topsoil Removal |
| Proposed Disturbance Area | Coal Stockpile - ROM | Water Storage Area |
| Proposed Rail Upgrade Works | Infrastructure | |
| Proposed Hebden Road Upgrade Works | Rehabilitation - Complete | |
| Contour | Rehabilitation - Temporary | |
| Active Mining Area | Shaped Not Seeded | |
| Active Overburden Emplacement Area | Tailings Emplacement | |

File Name (A4): R20/3109_1095.dgn
20160516 10.22

FIGURE 2.1

Proposed Mount Owen
Conceptual Mine Plan
Year 1



Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3 km
1:60 000

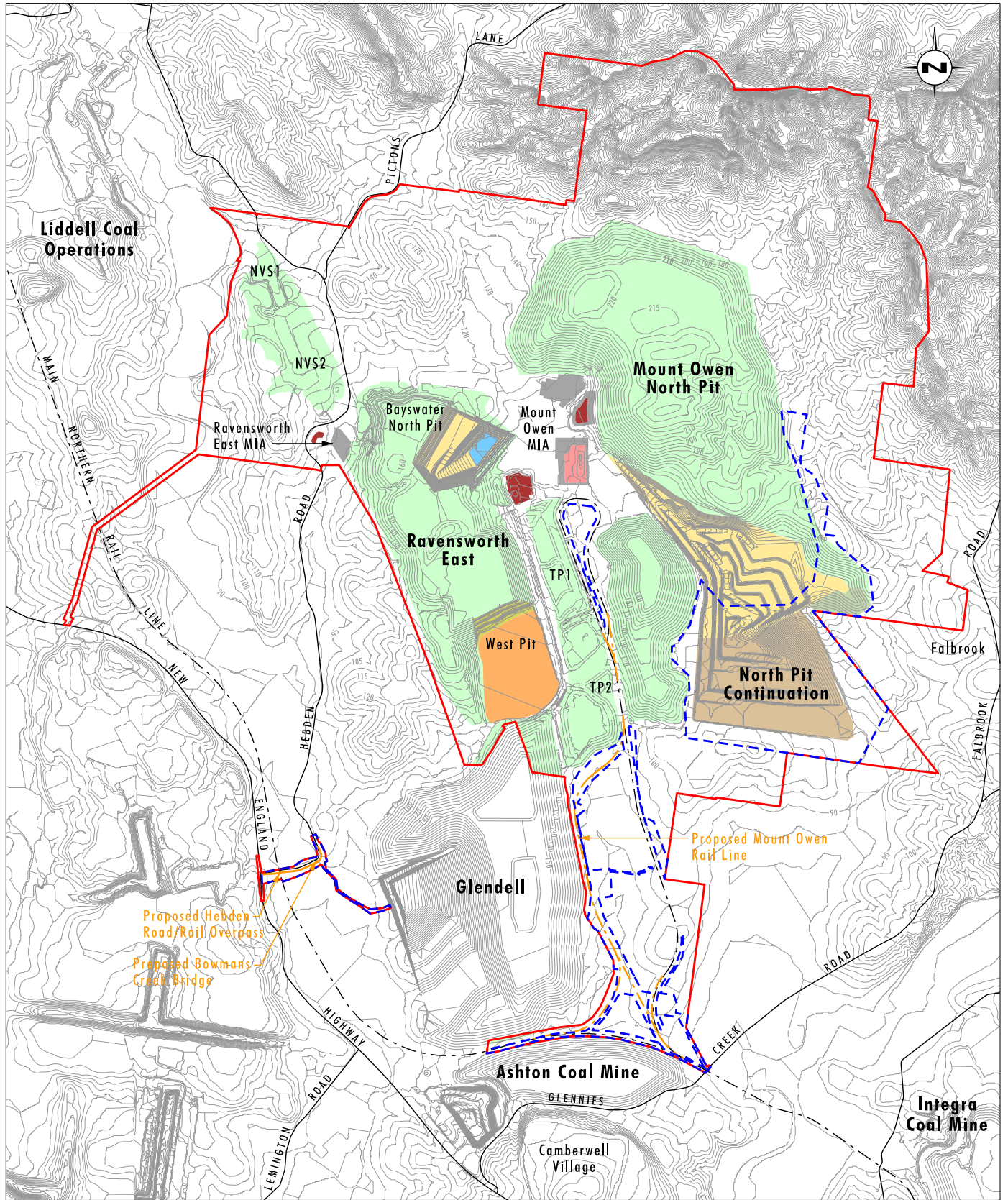
Legend

- | | | |
|---|---|---|
| Project Area | Coal Stockpile - Product | Topsoil Removal |
| Proposed Disturbance Area | Coal Stockpile - ROM | Water Storage Area |
| Proposed Rail Upgrade Works | Infrastructure | |
| Proposed Herben Road Upgrade Works | Rehabilitation - Complete | |
| Contour | Rehabilitation - Temporary | |
| Active Mining Area | Shaped Not Seeded | |
| Active Overburden Emplacement Area | Tailings Emplacement | |

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20160516 10.23

FIGURE 2.2

Proposed Mount Owen
Conceptual Mine Plan
Year 5



Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3km
1:60 000

Legend

- | | | |
|--|--|--|
| Project Area | Coal Stockpile - Product | Topsoil Removal |
| Proposed Disturbance Area | Coal Stockpile - ROM | Water Storage Area |
| Proposed Rail Upgrade Works | Infrastructure | |
| Proposed Herben Road Upgrade Works | Rehabilitation - Complete | |
| Contour | Rehabilitation - Temporary | |
| Active Mining Area | Shaped Not Seeded | |
| Active Overburden Emplacement Area | Tailings Emplacement | |

File Name (A4): R20/3109_1097.dgn
20160516 10.24

FIGURE 2.3

Proposed Mount Owen
Conceptual Mine Plan
Year 10

Year 5

During Years 5 to 10 of the Project, mining operations within the North Pit Continuation will advance in a southerly direction with overburden emplacement continuing within the North Pit Continuation. As mining progresses, rehabilitation of these areas will occur progressively with the landform incorporating micro-relief elements (refer to **Figure 2.2**). In this stage it is expected that mining activities will be undertaken up to the maximum production rate (up to 10 Mtpa ROM) utilising the maximum anticipated number of operational machinery.

Mining activities within the BNP will be continuing, however overburden emplacement within the West Pit overburden emplacement area is anticipated to be complete, with rehabilitation activities within this area well progressed. Overburden from the BNP will be available to be used as capping material for the RW Pit.

Tailings from the Mount Owen CHPP and Ravensworth Operations will continue to be emplaced in the southern portion of West Pit with Liddell Coal Operations having ceased operation. Between Years 5 and 10, the emplacement of tailings from Ravensworth Operations in West Pit will cease with tailings being pumped to the Liddell Coal Operations South Cut Void under the GRATS (refer to **Section 2.2**). Tailings are anticipated to be transferred from Mount Owen CHPP to the Liddell Coal Operations South Cut Void (subject to relevant approvals) in order to allow the West Pit tailings emplacement facility time to consolidate and dry-out prior to capping. The emplacement of tailings from the Mount Owen CHPP in West Pit may still occur during this time to assist with achieving the final landform, and/or for contingency tailings storage, together with in-pit tailings emplacement within tailings cells in the North Pit Continuation. If approval was not granted to emplace tailings from Mount Owen CHPP in the Liddell Coal Operations South Cut Void then tailings would be deposited in the BNP void at the completion of mining in this area.

Co-disposal of overburden and coarse reject within the North Pit Continuation and BNP will continue. Rehabilitation works associated with the ERP and TP1 are expected to be complete. TP2 will continue to be used as an operational water storage up until the completion of mining in BNP, at which time backfilling and shaping will commence in preparation for final rehabilitation.

Year 10

By Year 10, mining in the BNP will have ceased with the BNP void being integrated within the GRWSS and used as an operational water storage to supply the Mount Owen CHPP. Rehabilitation works associated with TP2 will be complete (refer to **Figure 2.3**).

Tailings from the Mount Owen CHPP will continue to be emplaced within the Liddell Coal Operations South Cut Void (subject to relevant approvals). As detailed above, should approval for transfer of tailings to the Liddell South Open Cut void not be approved, tailings from the Mount Owen CHPP will be emplaced in the BNP void. Tailings will also be emplaced in West Pit to assist with final landform development and in-pit within tailings cells in the North Pit Continuation. Co-disposal of overburden and coarse reject within the available mining pits including the North Pit Continuation and the West Pit will continue.

Progressive rehabilitation of the North Pit overburden emplacement area will continue with the incorporation of micro-relief (refer to **Figure 2.3**).

Final Landform

The proposed final landform will result in two final voids, one in the southern area of the North Pit Continuation, and one in the former BNP in the north of the Ravensworth East Mine. It is proposed that on completion of mining in the North Pit Continuation, the BNP void will be decommissioned as an operational water storage with batter angles flattened and high-walls stabilised. The North Pit Continuation void high-walls will also be stabilised following the cessation of mining. If the BNP is required for tailings emplacement, the BNP void would be partially filled prior to final capping and rehabilitation.

The retention of the Mount Owen rail line and workshop facilities will be investigated as part of the closure process for continued use by trains or other alternate land uses post mine closure. In addition, all other infrastructure associated with the Project will be decommissioned and rehabilitated.

The West Pit tailings emplacement area will be capped and rehabilitated. Final landform and rehabilitation activities associated with the Project, including details of closure criteria and objectives, are discussed further in **Section 5.2**.

2.2 Tailings Management

Tailings emplacement within the Project Area is undertaken within disused mining areas in accordance with the Mount Owen Tailings Management Strategy.

Tailings from the Mount Owen CHPP are currently pumped to West Pit. Tailings were previously pumped to the ERP, RW Pit and TP1 (refer to **Figure 1.1**) however these emplacement areas are being capped or prepared for capping and rehabilitation.

NVS2, ERP, TP1 and the RW Pit will be capped and rehabilitated by Year 5 of the Project provided adequate consolidation and drying has been achieved (refer to **Figure 2.2**).

In February 2016, a modification of the Ravensworth East Mine development consent (DA52-03-99 MOD 6) was approved to permit the receipt and emplacement of piped tailings from Ravensworth Operations and Liddell Coal Operations CHPPs within the West Pit void at Ravensworth East for the period 2017 to 2021. This linked system of tailings infrastructure and storage, known as the GRATS, forms part of the approved modification which specifically provides for:

- Construction of approximately 11 kilometre tailings pipeline network connecting both the Ravensworth CHPP and Liddell CHPP to the West Pit Void at Ravensworth East
- Construction of a Flocculant Plant within the vicinity of the West Pit Void at Ravensworth East, to allow for flocculants to be mixed with tailings immediately prior to deposition in the emplacement area, a process known as secondary flocculation
- The staged emplacement of tailings generated from Ravensworth Operations (approximately 12.5 million cubic metres of wet tailings between approximately 2017 and 2021) and Liddell Coal Operations (approximately 2 million cubic metres wet tailings between approximately 2018 and 2020) within the West Pit at Ravensworth East.

Should the Project be approved, Mount Owen will surrender the existing Ravensworth East development consent with all ongoing operations to be undertaken in accordance with a single consolidated development consent for the Project. Accordingly the approved modification of the Ravensworth East Mine development consent (DA52-03-99 MOD 6) will be incorporated as part of the consolidated development consent. The incorporation of the approved GRATS emplacement as part of the Project is detailed below.

Tailings from the Mount Owen CHPP will be emplaced into the southern portion of West Pit. The emplacement of tailings from Ravensworth Operations and Liddell Coal Operations will also commence between Years 1 and 5 in the West Pit void in accordance with the GRATS, as approved as part of DA52-03-99 MOD 6.

Tailings from the Mount Owen CHPP and Ravensworth Operations will continue to be emplaced in the southern portion of West Pit with Liddell Coal Operations having ceased operation in Year 5 of the Project. Between Years 5 and 10, the emplacement of tailings from Ravensworth Operations in West Pit will cease with tailings from this operation being pumped to the Liddell Coal Operations South Cut Void under the GRATS.

Following the completion of the approved tailings emplacement from Ravensworth Operations, tailings from Mount Owen CHPP will also be transferred to the Liddell Coal Operations South Cut Void (subject to future approvals) in order to allow the West Pit tailings emplacement facility time to consolidate and dry-out prior to capping. The emplacement of tailings from the Mount Owen CHPP in West Pit may still occur during this time to assist with achieving the final landform, together with in-pit tailings emplacement.

Should approval to transfer Mount Owen CHPP tailings to the Liddell Coal Operations South Cut Void not be granted then Mount Owen CHPP tailings would be emplaced in BNP. Tailings cells may also be constructed in the North Pit Continuation (as required) to allow for interim in-pit tailings disposal to assist with consolidation and dewatering of tailings in the West Pit and / or as contingency tailings emplacement areas.

The estimated total coarse rejects for the Project is approximately 25.3 Mt. Coarse reject will be trucked back into the active overburden areas associated with the North Pit Continuation, West Pit and BNP.

Following consolidation of tailings, the emplacement areas within the Project area will be capped with overburden to achieve a stable final landform and allow the area to be rehabilitated in accordance with the proposed mine plans and the mine closure and rehabilitation strategy, as detailed in **Section 2.3**.

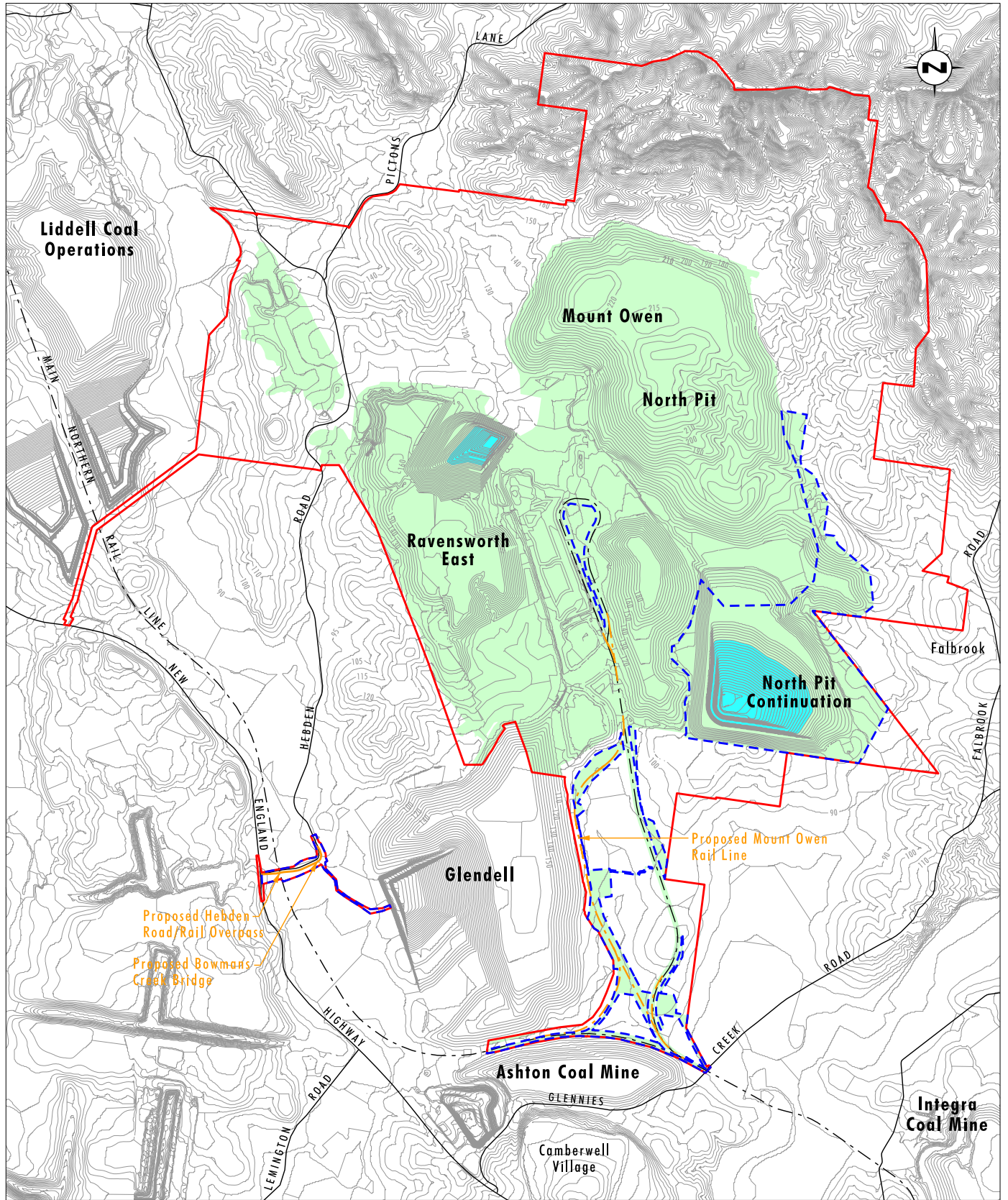
2.3 Final Landform and Rehabilitation

Mount Owen has undertaken progressive rehabilitation throughout the life of the Mount Owen and Ravensworth East Mines. Rehabilitation works have included extensive flora and fauna monitoring and research projects in order to develop rehabilitation techniques and ensure the development and success of the rehabilitation programs in place. Mount Owen intends to continue to rehabilitate all disturbed areas as soon as practicable throughout the life of the Project.

The rehabilitation strategy for the Project is consistent with the existing rehabilitation strategies for the Mount Owen and Ravensworth East Mines which is to create native woodland areas as well as rehabilitated pasture. The native woodland areas will be contiguous with adjacent and existing native vegetation areas with the aim to supplement local and regional linkages to aid the movement of fauna across the local area and throughout the region. Rehabilitated pasture will provide some areas suitable for sustaining potential future agricultural activities such as grazing. The proposed revegetation activities aim to recreate similar ecosystems and vegetation communities removed by mining activities.

Progressive rehabilitation of the Mount Owen and Ravensworth East Mines will consist of the shaping of overburden emplacement areas to create a suitable final landform, incorporating areas of micro relief as shown on **Figures 2.1 to 2.4**. The rehabilitation works will include optimisation of ongoing overburden emplacement and final landform shaping to achieve an undulating natural final landform with adequate surface drainage which is in keeping with the surrounding landscape. Topsoil generally will then be spread over the shaped overburden emplacement areas and revegetation works will commence. Monitoring of the success of the revegetation works will continue throughout the life of the mining operations and also the closure process. Temporary rehabilitation measures such as the planting of a cover crop will also be implemented as required in areas that will not form part of active mining operations for extended periods of time for erosion and sediment control or for dust control. Proposed rehabilitation has been designed to integrate with the currently approved rehabilitation and final land use of other Glencore mines within the greater Ravensworth area.

Further details regarding the proposed rehabilitation strategy and closure process for the Project are contained in Section 5.19 and Appendix 18 of the EIS, and **Section 5.0** of this Report.



Data Source: Mount Owen (2014)
Note: Contour Interval 5m(AHD)

0 1 2 3 km
1:60 000

Legend

- Project Area
- - - Proposed Disturbance Area
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Contour
- Rehabilitation - Complete
- Final Void Water Level

File Name (A4): R20/3109_1098.dgn
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FIGURE 2.4

Proposed Mount Owen
Conceptual Mine Plan
Final Landform

3.0 Air Quality

The recommendations from the PAC on air quality primarily reflected the need for DP&E's air quality peer review process to be completed. An update on the completed peer review process is provided below, together with the Applicant's understanding of the current status of matters that primarily related to DP&E responsibilities in regard to recommendations.

3.1 Air Quality Recommendations

- 7. *That the Department should forward a copy of the updated peer review of the AQIA to EPA and NSW Health and seek further comments in relation to the residual issues raised in their previous submissions.***

The updated and final peer review of the AQIA was completed by Todoroski Air Sciences (TAS), on behalf of DP&E, on the 29 April 2016. This peer review report is available on the DP&E website.

DP&E advise that the updated peer review report will be provided to EPA and NSW Health to seek any further comment.

- 8. *That the Department ensures that the key residual issues regarding air quality and the AQIA are resolved prior to determination, particularly in relation to the meteorological data used, the methodology for calculating background levels and calibrating with other mines, and the assessment of cumulative impacts.***

In recognition of the importance of a thorough and robust air quality assessment, all relevant technical studies for this issue have been subject to extensive peer review. Following completion of the air quality assessment by Pacific Environment further peer review steps have included:

- Technical review commissioned by Mount Owen as part of the EIS key studies assurance program during EIS preparation, and for all responses subsequent to EIS lodgement. This has been completed by a highly regarded air quality expert, Shane Lakmaker (Jacobs).
- Further independent peer review engaged by DP&E during the assessment process. This peer review process commenced following lodgement of the Response to Submissions, and was completed by another experienced air quality expert, Alex Todoroski (Todoroski Air Sciences).

Essentially, this process has culminated in the air quality assessment for this Project having the benefit of the detailed consideration and robust scrutiny of three sets of experienced specialist air quality assessment experts (including Pacific Environment who completed the AQIA), all of which have extensive experience and expertise in the assessment of major coal mining projects in NSW.

At the time the DP&E issued its Preliminary DP&E Assessment Report, the Todoroski Air Sciences (TAS) peer review process was not completed. This timing of the Preliminary DP&E Assessment Report, and commencement of the PAC process, unfortunately created uncertainty for the PAC and the relevant stakeholders involved in the PAC review process. The incomplete status of the peer review process was acknowledged in the PAC Review Report, with the PAC making it clear that it was not in a position to properly consider the potential air quality impacts of the Project until an updated peer review was completed, considering Mount Owen's response to matters raised in the initial peer review report.

The following provides detail on the resolution of key residual issues raised by the TAS peer review.

Meteorological Data Used

The TAS peer review noted some issues with one particular weather station (SX8), which PEL acknowledged in the response of the 3 March 2016, and provided detailed analysis to confirm that there was no material impact on the assessment outcomes. In the updated peer review report, TAS agreed that the *'...modelled meteorological data, used in the assessment to predict dust levels matches the valid measured data and is likely to be representative of the actual weather conditions, at the southeast receptors.'*

Methodology for Calculating Background Levels, Calibration with Other Mines, and the Assessment of Cumulative Impacts

These issues relate to the cumulative air quality assessment and do not apply to the Project specific air quality assessment. These matters all relate to the complexities involved in assessing cumulative impacts in a region that has numerous existing mining operations and multiple approvals in place for further or changing operations in the future. The science and technology for assessing air quality cumulative impacts has evolved considerably over the last decade, but there are still a range of techniques applied amongst the experienced air quality experts, and this is apparent in the peer review process for this Project. By necessity in making their assessments, the experts must make some professional judgements based on best available data and knowledge to interpret the relevant existing background levels that may exist in the absence of existing mining operations. Further, the process of calibration of an air quality model involves complex terrain and meteorological variables as well as many hundreds of individual dust emission sources from the Project, and the existing and approved mining operations located within 14 km of the mine. This calibration process is undertaken in different ways by the experts. In some cases, modelled results are calibrated with existing measured results for the selected 'base case' by consideration and adjustment of assumptions made to the data sources (i.e. adjustment to model inputs), and in other cases calibration factors are applied to the modelled contour results, or to modelled results at specific receiver locations (i.e. adjustment to model outputs); both approaches are designed to improve the correlation between model outputs and monitored air quality levels in the modelled area. The AQIA has applied the latter approach to the assessment of cumulative annual average impacts. It is important to appreciate that in this process, all experts agree that it is essential to apply a conservative approach, with a view to predicting cumulative impacts that are more likely to overestimate cumulative air quality levels in the community, rather than under predict such levels.

The TAS peer review raises detailed matters in relation to the methodology for calculating background levels and calibration with other mines and concluded that in his view, there was potential for underestimation of air quality impacts within a specific area identified to the south east of the mine. Whilst Pacific Environment and Jacobs both have the view that the TAS assessment is overly conservative, and disagree with elements of this assessment, what is important for this Project, the local community, and the approval process, is that there is clarity of assessment outcomes and appropriate conditions of consent are in place to ensure that air quality impacts are minimised with application of all feasible and reasonable controls, and that where there is potential for significant air quality impacts, that those potentially affected are afforded appropriate rights in any development consent for the Project. For this reason, Mount Owen are comfortable for the recommendations provided in the final TAS peer review to be reflected in the development consent conditions for the Project, that is:

1. *That a 10m high weather station be installed in the general vicinity of the cluster of private receptors to the southeast of the Project. This would be a location approximately between or at either of dust monitoring stations SX9 and SX10. The purpose of this condition is to assist the mine to best manage any potential impacts that may arise to the southeast;*
2. *That receptors R114 and R116 be afforded acquisition rights on the basis of likely annual average PM10 impacts in all years; and,*

3. *That an accurate predictive dust management system be operated to minimise the potential dust impacts of the Project, with focus on the receptors to the southeast of the Project.*

It is important to note that R114 and R116 were previously predicted to be afforded acquisition rights due to predicted exceedances of the 24 hour PM10 air quality criteria over more than 25% of the affected landholdings (refer to Section 3.4.2 of the Response to Submission Report A and **Section 10.3**).

In addition, the updated air quality impact assessment for the Refined Project (refer to **Appendix 2** and **Section 10.3**), includes a number of additional sensitivity scenarios for the cumulative assessment to reflect the changing mining operations in the vicinity of the Project. As outlined in **Section 10.3**, the outcomes of the cumulative assessment remain consistent with the assessment completed as part of the EIS.

Notwithstanding the above position on the recommendations of the peer review report, as part of the updated air quality assessment for the Project (refer to **Appendix 2** and **Section 10.3**), Pacific Environment have included an assessment of additional background monitoring data from the Mount Owen and Upper Hunter Air Quality Monitoring Network (UHAQMN) through to 2015. Further to this, additional sensitivity scenarios for the cumulative air quality impact assessment on the basis of the changing mining activities within proximity to the Project have been completed (refer to **Appendix 2**). Importantly, these additional analyses further reinforce that the findings of the original air quality impact assessment remain unchanged from that presented in the EIS.

9. *That the Department make the Applicant's response to the peer review of the AQIA, as well as any updated peer review, and any other additional information, available online as soon as practicable.*

The Applicant's response to the initial draft of the peer review of the AQIA and the updated peer review are available on-line on the Department's website.

Further information in relation to air quality assessment for the Refined Project is provided in **Section 10.3** of this report.

3.2 Other Issues Raised in PAC Review Report

In addition to the matters raised in the recommendations, the PAC Review Report *notes that the latest submissions from EPA and NSW Health express concerns about diesel particulate and blast fume emissions*.

This issue is directly addressed in Appendix B of the Response to Submissions Report A (Umwelt 2015b), the November TAS Peer Review (TAS 2015) and the 14 December 2015 Pacific Environment Response to Peer Review Report (Pacific Environment 2015). It was the considered view of the air quality experts involved in the preparation of the AQIA and the Air Quality Peer Review processes that the separate treatment of diesel particulate emissions from haul activities would not make a material difference to the outcomes of the assessment. It is noted that the AQIA was prepared in accordance with the Approved Methods and neither the DGRs for the Project nor the assessment requirements provided by the EPA specified a requirement for the separate assessment of diesel particulates. It is understood that DP&E and the EPA are currently working towards developing an approach to the assessment and regulation of diesel particulate emissions from mining and other projects which involve off-road vehicles which are not subject to specific regulation of particulate emissions in NSW in the same way that road vehicles are. As noted above however, the consensus view of the experts involved in the assessment of air quality impacts from the Project that specific consideration of diesel particulate emissions from hauling activities will not have a material impact on the outcomes of the AQIA of the Project.

4.0 Biodiversity

The PAC Review Report includes a number of recommendations relating to Biodiversity mitigation and offset commitments, in addition to rehabilitation outcomes. This section addresses the Biodiversity recommendations, whilst **Section 5.0** covers those matters relating specifically to mine rehabilitation. The PAC Review Report variously refers to rehabilitation, regeneration and revegetation in different contexts, and **Section 4.1** provides a definition of these terms as applied to this Project.

4.1 Definitions for Rehabilitation, Regeneration and Revegetation

Rehabilitation is the process of returning disturbed land (in this case, land disturbed by mining activities) to a functioning ecological community through direct intervention in the development of growing medium on a re-established landform, seeding, planting and active management through the establishment phase.

Regeneration is the process of allowing communities to develop from seed banks naturally present in the soils or available from adjacent vegetated areas through transport vectors such as the wind, ants, mammals etc. In the context of the Project, both passive and active regeneration techniques may be used. *Passive regeneration* is the process of allowing woodland communities to naturally develop from seed bank material present through the removal of grazing and management of weeds and other predation factors. *Active regeneration* is the process of supplementing passive regeneration with direct seeding or planting of woodland species and is used where there is a requirement to establish a woodland community earlier, or with greater long-term confidence, than might be achieved through passive regeneration alone or where monitoring of passive regeneration indicates that species recovery may not be optimal due to seed dormancy issues or the seeds of key species are not present in the soil seed bank.

Revegetation, in the context of the Project, is the process of actively planting or seeding species into a previously cleared environment.

4.2 Biodiversity Recommendations

1. ***That, prior to determination, the Department should progress discussions with, and seek additional information from, the Applicant about establishing supplementary offsets, including an east-west vegetation corridor linking the Swamp Creek Corridor Offset and offsets at the Liddell Coal Mine.***

It is assumed that the PAC (and the Preliminary DP&E Assessment Report) is referring to the Stringybark Creek Corridor Offset in their reference to the 'Swamp Creek Corridor Offset' in this recommendation. A 'Swamp Creek Corridor Offset' has not been proposed by Mount Owen.

The response to this recommendation is outlined below in reference firstly to the east-west vegetation corridor, and secondly and more broadly, in relation to the recommendation for supplementary offsets.

Supplementary Offsets

Before dealing with the PAC's request for consideration of supplementary offsets, it is important to clarify some factual issues in the PAC Review Report (and the Preliminary DP&E Assessment Report) in relation to the extent of offsets previously proposed in relation to the predicted biodiversity impacts. In italics below are some key statements in the PAC Review Report, with relevant clarification provided in normal text.

Section 3.1.3, page 8, paragraphs 1 and 2 of the PAC Review Report states that: *The Ecological Assessment in the EIS predicts that the project would result in disturbance of approximately 520 hectares of vegetation, of which 387 hectares of land is listed as endangered ecological communities (EECs) under the NSW Threatened Species Conservation Act 1995 (the TSC Act) or the Commonwealth EPBC Act.*

The 387 hectares of EEC are comprised of approximately 164 EEC woodlands, including 160 hectares of the Central Hunter Ironbark - Spotted Gum - Grey Box Forest (Central Hunter Ironbark) EEC and 4 hectares of other woodland EECs, and a further 223 hectares of native grasslands associated with the Central Hunter Ironbark EEC.

The Proposed Disturbance Area statistics referenced in the PAC Review Report and Preliminary DPE Assessment Report are not consistent with those assessed in the EIS and Ecological Assessment. The EIS and Ecological Assessment state that the Project will result in the removal of a total of approximately 451.5 hectares of native vegetation, of which approximately 163.7 hectares is listed as endangered ecological communities (EECs) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) or the Commonwealth EPBC Act.

Derived Native Grassland occurring in the Proposed Disturbance Area (approximately 223.1 hectares) is derived from Central Hunter Ironbark – Spotted Gum – Grey Box Forest and the Central Hunter Box – Ironbark Woodland communities. The Derived Native Grassland variants of *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC or *Central Hunter Grey Box – Ironbark Woodland* EEC are not included in the final determination for these TECs (NSW Scientific Committee 2010a, 2010b). Therefore the Derived Native Grassland occurring in the Proposed Disturbance Area is not considered an EEC under the TSC Act. This was erroneously referenced in the PAC Review Report and the Preliminary DP&E Assessment Report as comprising an EEC.

Furthermore, the recently determined *Central Hunter Valley Eucalypt Forest and Woodland* critically endangered ecological community (CEEC) listed under the EPBC Act on 7 May 2015, is not applicable to this Project due to the community being listed under the EPBC Act after the issue of the Director-General's Requirements (DGRs) in March 2013.

The PAC also notes *'that a total disturbance of 387 hectares of EECs constitutes a significant impact on biodiversity and agrees that the most effective way to minimise impacts to biodiversity is to avoid direct clearing or disturbance of native vegetation insofar as possible. Where avoidance is not feasible however, the provision of offsets is a key means of mitigating impact.'*

As outlined above, the disturbance statistics referenced in the PAC Review Report are not consistent with those in the EIS and Ecological Assessment. The Project will result in the disturbance of 163.7 hectares (or approximately 164 hectares) of vegetation listed as an EEC under the TSC Act or the Commonwealth EPBC Act.

Mount Owen has incorporated a range of avoidance and impact mitigation and minimisation actions as part of the Project as detailed in Sections 2.5 and 6.0 of the EIS. In addition, Mount Owen has proposed a comprehensive Biodiversity Offset Strategy to mitigate the unavoidable impacts associated with the Project.

The Commission notes that there are only 120.3 hectares of proposed upfront offsets for the 163.1 hectares of disturbed area of EEC woodland, which equates to an offset ratio of only 0.7 to 1. In addition, the like-for-like offset ratio for the key impacted Central Hunter Ironbark EEC is only 0.3 to 1. The relevant 2:1 offset ratio required in the Interim Policy is met by the addition of 465.5 hectares of regenerated offsets, which would increase the overall offset ratio to 3.6:1, though it is not like for-like and requires that regeneration efforts will need to be successful over the long-term.

As stated in the EIS and the Ecological Assessment, the approximate 223.7 hectares of impacts on native forest/woodland vegetation will be offset with approximately 290.9 hectares of existing forest/woodland and 473.7 hectares of derived native grassland to be regenerated to forest/woodland. Both the existing forest/woodland and the actively regenerated grasslands provide a total offset of 764.6 hectares and an offset ratio of 3.4:1, which exceeds the Tier 3 requirement of a 2:1 offset ratio.

In relation to the specific impacts on *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC, as outlined in Table 7.12 of the Ecological Assessment, approximately 159.3 hectares of impact to this EEC will be offset with approximately 51.7 hectares of existing *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC and 359.1 hectares of derived native grassland that will be actively regenerated into the same community. Both the existing 51.7 hectares of forest to be offset and the 359.1 hectares to be actively regenerated are part of the Biodiversity Offset Strategy for the Project, which provides a total offset of 410.8 hectares and an offset ratio of 2.6:1. This exceeds the Tier 3 requirement of a 2:1 offset ratio. Furthermore, the Biodiversity Offset Strategy also includes the protection of other high conservation threatened ecological communities (including *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act at the Esparanga Offset Site). When included in the offsetting ratios for *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC (including regenerated DNG) the offset ratio is 3.3:1 (refer to **Table 4.2** below).

As noted in **Section 5.0** below, almost all of the *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC in the Hunter Valley floor (including the areas to be impacted by the Project) is regrowth from previously cleared agricultural land with much of this regrowth occurring through passive rather than active management. Accordingly, there is a high degree of confidence the grassland areas in the proposed Cross Creek and Stringybark Creek Offset Areas can be actively regenerated to *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC in a relatively short timeframe.

Mount Owen has also had previous success regenerating *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* EEC in mine rehabilitation and the New Forest Area adjacent to the Cross Creek Offset Site and Stringybark Creek Habitat Corridor. The success of regenerating this EEC is detailed further in **Section 5.0**.

Summary – Supplementary Offsets

In relation to the request for supplementary offsets, Mount Owen has proposed additional offsets in the context of the DotE offset requirements as outlined below.

The Project now includes four proposed land-based offsets, including 609 hectares of land proximate to the impact area (Cross Creek, Stringybark and Mitchell Hills Offset Sites) and 303 hectares of strategically located land in the Hunter Valley (Esparanga Offset Site). Mount Owen has proposed the Mitchell Hills Offset Site as an additional offset site to meet the DotE requirement for the Project to provide supplementary offset for mature foraging habitat for the swift parrot (*Lathamus discolor*) under the EPBC Act Environmental Offsets Policy. The Mitchell Hills Offset Site comprises approximately 144 hectares and is located approximately 10 kilometres northwest of the Mount Owen Complex, adjoining offsets established for Glencore's Liddell and Ravensworth mines, being the Mitchell Hills South Offset Site and Hillcrest Offset Site, respectively (refer to **Figure 4.1**). The Manobolai and Mount Owen offset clusters provide the focus of the Glencore strategic offset approach in the Hunter Valley. Of key importance is the location of these offset clusters in relation to key landscape features such as adjoining vegetation remnants, National Parks, Crown Land, government initiatives (such as the Great Eastern Ranges Initiative), and other existing Glencore offset areas.

The proposed Mitchell Hills Offset Site contains five vegetation communities and one TEC listed under the TSC Act. These are outlined in **Table 4.1** and shown in **Figure 4.2**.

Updated Mount Owen
Biodiversity Offset Strategy

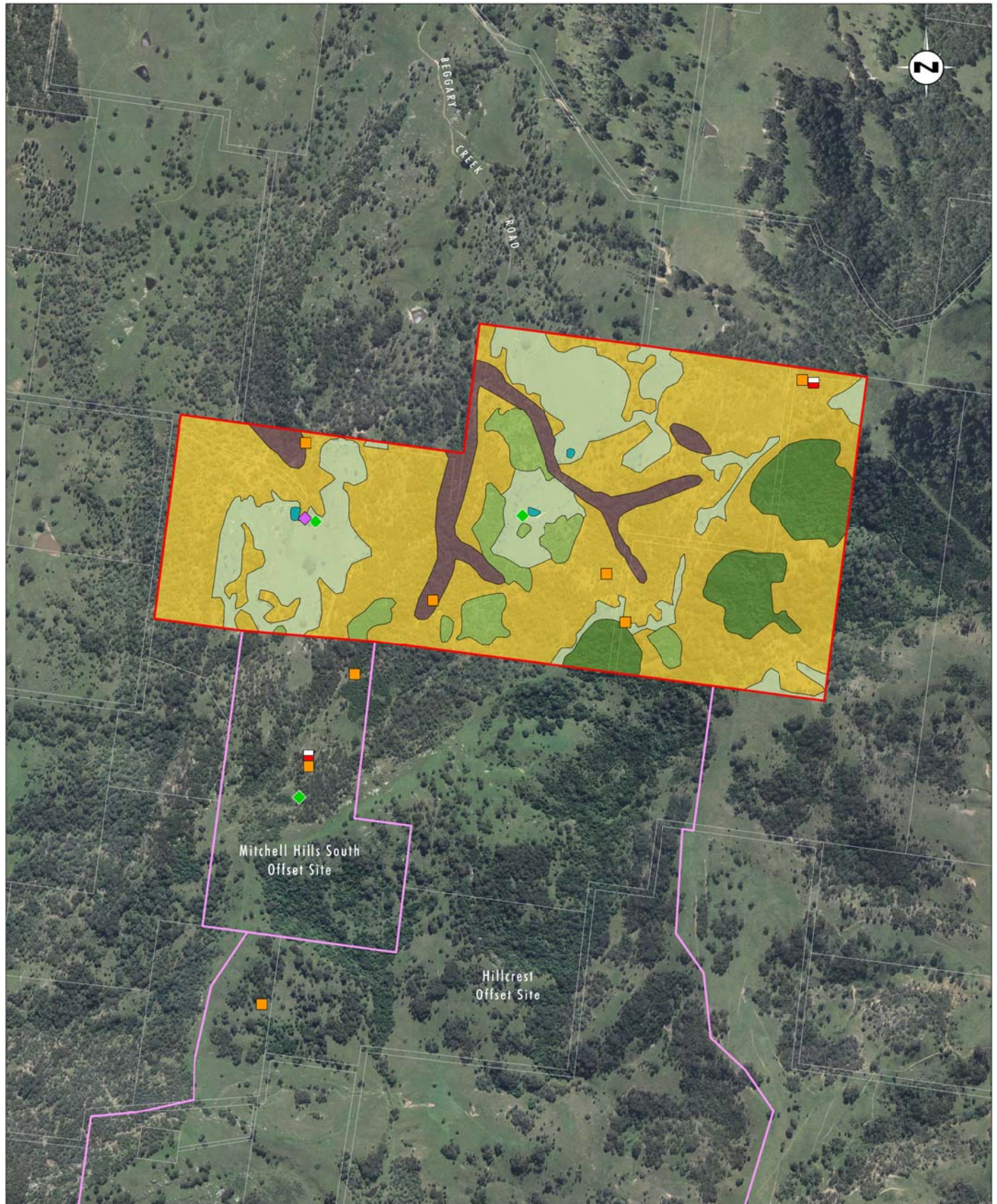


Image Source: AAM (2012)
Data Source: Glencore (2014), Department of Lands (2009)

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Legend

- | | |
|---|--|
| Mitchell Hills Offset | Upper Hunter Hills Sheltered Moist Forest |
| Existing Glencore Offsets | Brush-tailed phascogale |
| Dam | Eastern bentwing-bat |
| Barrington Footslopes Dry Spotted Gum Forest (Derived Native Grassland) | Large-eared pied bat |
| Lower Hunter Dry Rainforest | Spotted-tailed quoll |
| Regrowth | |
| Barrington Footslopes Dry Spotted Gum Forest | |

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FIGURE 4.2
Mitchell Hills Offset Site

Table 4.1 Vegetation Communities and TECs Recorded at the Mitchell Hills Offset Site

Vegetation Community	Conforming TEC	Area (ha)
Barrington Foothills Dry Spotted Gum Forest	N/A	83.1
Barrington Foothills Dry Spotted Gum Forest <i>Derived Native Grassland</i>	N/A	30.6
Lower Hunter Dry Rainforest	Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions Vulnerable Ecological Community	12.4
Upper Hunter Hills Sheltered Moist Forest	N/A	9.5
Regrowth	N/A	7.9
Dam	-	0.2
Total		143.7

The Mitchell Hills Offset Site also contains a range of fauna habitats including sheltered forest, dry sclerophyll forest, grasslands and farm dams that are likely to contain habitat for a range of species also known to occur in the Mount Owen Complex. Two threatened micro-bat species, large-eared pied bat (*Chalinolobus dwyeri* – listed as vulnerable under the TSC act and EPBC Act) and eastern bentwing-bat (*Miniopterus schreibersii oceanensis* – listed as vulnerable under the TSC Act), have been recorded during surveys in 2014 (Umwelt 2014). Two other threatened mammal species, being the spotted-tailed quoll (*Dasyurus maculatus* – listed as vulnerable under the TSC Act and endangered under the EPBC Act) and brush-tailed phascogale (*Phascogale tapoatafa* – listed as vulnerable under the TSC Act), have been recorded at the site through characteristic scats and remote-sensing cameras (Umwelt 2014). **Figure 4.2** shows the locations of these records.

The spotted-tailed quoll, in particular, has been recorded throughout the Mount Owen Complex and the Project is considered likely to have a significant impact on the species under the EP&A Act as per the Assessments of Significance undertaken in Appendix E of the Ecological Assessment (Umwelt 2014). The species is known to occur at the Mitchell Hills Offset Site as well as other proximate Glencore offset sites to the south including Mitchell Hills South, Hillcrest and Mountain Block Offset Areas (refer to **Figures 4.1** and **4.2**) through to the habitats associated with the Bowmans Creek Riparian Corridor and the Mount Owen Complex. The inclusion of the Mitchell Hills Offset Site in the Mount Owen Biodiversity Offset Strategy will provide for the long-term conservation of linking habitats and a corridor for the spotted-tailed quoll and other native fauna from the north, through the Mitchell Hills Offset Site to habitats around Bowmans Creek and the Mount Owen Complex, including the Stringybark Creek Habitat Corridor and the Cross Creek Offset Site.

In summary, the Mitchell Hills Offset Site is a valuable addition to the proposed Mount Owen Biodiversity Offset Strategy because of the following ecological features:

- strategically located in the landscape adjacent to the Hillcrest and Mitchell Hills South Offset Sites, which contributes to the large east-west corridor to the north of the Project Area

- suitable potential foraging habitat for the threatened and migratory bird species regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*), with the presence of large areas of the winter-flowering species spotted gum (*Corymbia maculata*)
- provides known habitat for the threatened spotted-tailed quoll (*Dasyurus maculatus*), brush-tailed phascogale (*Phascogale tapoatafa*) and eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) that also occur within the Mount Owen Complex (refer to **Figure 4.2**)
- provides known foraging habitat for the TSC and EPBC-listed large-eared pied bat (*Chalinolobus dwyeri*)
- contains high quality areas likely to conform to *Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions* Vulnerable Ecological Community (VEC)
- has a low occurrence of weeds and
- provides potential habitat for a range of other threatened woodland birds, large forest owls and arboreal mammals that also occur within the Mount Owen Complex.

Table 7.13 from the Ecological Assessment (Appendix 11 of EIS) has been updated in **Table 4.2** below and provides a revised summary of the Mount Owen Biodiversity Offset Strategy.

Table 4.2 Offsetting Outcomes for Vegetation Communities Impacted by the Project

Impact and Offset Scenario	Impact Area (approx ha)	Cross Creek Offset Site (approx ha)	Esparanga Offset Site (approx ha)	Stringybark Creek Habitat Corridor (approx ha)	Mitchell Hills Offset Site (approx ha)	Total Offset Area (approx ha)	Offset Ratio
Woodland Impacts Offset With Woodland	223.7	51.7	211.4	27.8	112.9	403.8	1.8:1
Woodland Impacts Offset With Woodland and Regenerated DNG	223.7	367	303	94.6	143.5	908.1	4.1:1
Central Hunter Ironbark – Spotted Gum – Grey Box Forest Impacts Offset With EEC [^] and Regenerated DNG Areas to EEC	159.3	367	114.3	43.8	0	525.1	3.3:1

[^] Includes other EECs at the proposed offset sites including White Box Yellow Box Blakely's Red Gum Woodland EEC at Esparanga and River-flat Eucalypt Forest EEC at the Stringybark Creek Habitat Corridor using substitution ratios described in Section 7.2.3.

East-West Vegetation Corridor

As previously outlined in the Response to Submissions Report A (Umwelt 2015b), the intent of the proposed Stringybark Creek Corridor Offset is to improve the habitat linkages between known spotted-tailed quoll habitat in and adjacent to Mount Owen and known habitat along Bowmans Creek including that which is proposed for in-perpetuity conservation as part of the Liddell Biodiversity Offset Strategy. It is acknowledged that there are parcels of land between the western-most portion of the proposed Stringybark Creek Corridor Offset and the eastern-most portion of Bowmans Creek that are not currently proposed for offsetting or revegetation as a corridor. Some of the land in question is within the Project Area, but is not currently owned by Glencore entities. Therefore, Mount Owen is unable to commit to supplementary offsets in this area at this time. However, subject to ownership and potential mining constraints, Mount Owen will continue to investigate the potential to improve the vegetation linkages in this area in the future.

In recognition of the PAC's view that the *'potential east-west corridor to the north of the site would be an important contribution towards the protection of fauna habitat and movements'*, Mount Owen has reviewed and revised the rehabilitation and revegetation plan for the project, to further reinforce the east-west corridor connection to the north of the BNP area. This area, hereafter referred to as the East-West Corridor Management Area (refer to **Figure 4.3**), occurs north of the Mount Owen access road and joins existing scattered woodland habitats from the Mount Owen site office and Yorks Creek. This area will be maintained to retain the native vegetation and connectivity in an east to west direction between Ravensworth State Forest, rehabilitated areas in the northern area of the North Pit overburden emplacement area, and riparian vegetation along Yorks Creek and Bowmans Creek.

The East-West Corridor Management Area currently contains patches of Central Hunter Ironbark – Spotted Gum - Grey Box Forest (EEC), Derived Native Grassland and Central Hunter Bullock Forest Regeneration vegetation which links the Central Hunter Swamp Oak Forest associated with Yorks Creek to the rehabilitation of the North Pit Overburden Emplacement Area. This area is likely to form part of the existing habitat linkages between Mount Owen and Liddell. There are records of spotted-tailed quoll in the mine rehabilitation in the North Pit Overburden Emplacement Area, near the Mount Owen site offices, along the Mount Owen access road to the immediate south of the East-West Corridor Management Area and across to habitats near Yorks and Bowmans Creek. The spotted-tailed quoll is also known to utilise densely vegetated creek lines to traverse their home ranges.

Mount Owen will commit to maintaining the East-West Corridor Management Area to retain and improve biodiversity linkages east-west across the Project Area whilst other opportunities to connect the Stringybark Creek Corridor to Bowmans Creek continue to be investigated. This may include enhancement management actions such as cattle exclusion, weed and pest control, access control and supplementary planting as required. This area is not proposed as a permanent offset. In the event that part or all of the East-West Corridor Management Area is required for other purposes, alternative means for maintaining or enhancing these east-west linkages between the habitats of Mount Owen and Bowmans Creek will be considered having regard to the quality of habitat connectivity provided by progressive rehabilitation of mining areas or natural or enhanced regeneration of other areas. Any potential future impacts on habitat connectivity as a result of any proposed development in the East-West Corridor Management Area would be assessed as part of the development assessment process for future development applications.

The revised rehabilitation and revegetation plan for the Project is further described in **Section 5.0**

2. That, prior to determination, the Department should seek further comments from:

- **DotE about whether the proposed offsets meet its requirements, particularly in relation to the suitability of foraging resources; and**

As outlined above, Mount Owen has proposed the Mitchell Hills Offset Site as an additional offset site for the Project to meet the DotE requirement for the Project to provide supplementary offset for mature foraging habitat for the swift parrot (*Lathamus discolor*) under the EPBC Act Environmental Offsets Policy. The Mitchell Hills Offset Site comprises approximately 144 ha and is strategically adjacent to offsets established for Glencore's Liddell and Ravensworth Operations, being the Mitchell Hills South Offset Site and Hillcrest Offset Site, respectively (refer to **Figure 4.1**).

As noted by the PAC, at the time of the preparation of the review report, there was an unresolved issue for DotE in relation to the suitable range and diversity of foraging resources for the swift parrot, listed as endangered under the EPBC Act. It was acknowledged in Mount Owen's response to issues raised in the PAC hearing (Umwelt, 2016) that this matter was the subject of further discussion with the DotE.

It is important to note that this outstanding issue related only to the swift parrot and all other matters had been resolved with DotE, as outlined in Section 2.14 of the Response to Submissions to PAC Report (Umwelt 2016a). As outlined in their correspondence of 7 October 2015, DotE accepted the adequacy of the Biodiversity Offset Strategy for the koala, spotted-tailed quoll and regent honeyeater, however did not accept the inclusion of some habitats in the offset areas as containing suitable key foraging resources (as outlined in the National Recovery Plan for the Swift Parrot) to offset the impacts of spotted-gum dominated habitat at the impact site. DotE noted that:

"Revised offset calculations indicate that proposed biodiversity offsets meet the requirements of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Biodiversity Offsets Policy (Offsets Policy) for the Koala, Spotted-tailed Quoll and Regent Honeyeater. However, proposed offsets for impacted woodland >30 years do not achieve the required 90% direct offset requirement specified in the Offsets Policy [for the swift parrot]."

In late 2015 and early 2016, there were further meetings and correspondence between Mount Owen and the DotE seeking to resolve the DotE concerns regarding the adequacy of the Biodiversity Offset Strategy in relation to the provision of suitable foraging resources for the swift parrot. According to the DotE assessment, the Mount Owen Biodiversity Offset Strategy presented in the Ecological Assessment had a shortfall under the 100% offset requirement for the swift parrot under the EPBC Act Environmental Offsets Policy using the EPBC Act Environmental Offsets Calculator. This was primarily a result of differing applications of the EPBC Act Environmental Offsets Calculator in relation to the age-classes of impact and offset areas and the interpretation of 'like-for-like' habitat quality over the 20 year ecological offset benefit timeframe.

Most recently, the DotE informed Mount Owen, in a letter dated 21 April 2016, that further offsets would be required for the swift parrot in the form of land-based offsets or the provision of indirect compensatory measures in discussions with DotE.

DotE stated in their letter that "the Department considers that a timeframe of 20 years within which to achieve like-for-like habitat quality equivalence is appropriate for this endangered species and that additional woodland habitat containing key foraging tree species and/or other indirect compensatory measures will be required to meet the requirements of the Offsets Policy. As advised in the meeting of 29 February 2016, the Department would be willing to discuss options for provision of indirect compensatory measures with Mount Owen in lieu of securing additional direct offsets."

Concurrent with this process, Mount Owen engaged Umwelt to investigate appropriate additional land-based offsets on Glencore owned land that may be suitable in the event that supplementary offsets were required. Following a desk top review of available vegetation mapping and targeted reconnaissance surveys of a range of potentially relevant Glencore land holdings, the Mitchell Hills Offset Site was identified as the most suitable offset site to meet DotE requirements. A targeted habitat survey of the Mitchell Hills Offset Site was undertaken by Umwelt ecologists in January 2016 to determine the extent and quality of potential mature key foraging habitat as outlined in the National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011).

Sixteen assessments were undertaken across the site involving a 10 x 10 metre plot surveyed for dominant canopy species, the density in the plot and diameter at breast height (DBHs) measurements. This was recorded to provide an indication of the dominance of swift parrot key feed trees and the age classes of this habitat. Following the survey and application of the EPBC Act Environmental Offsets Calculator, it was determined that approximately 83.1 hectares of Barrington Footslopes Dry Spotted Gum Forest dominated or co-dominated by a key feed tree spotted gum (*Corymbia maculata*) (refer to **Figure 4.2**) provides an additional 43.58% offset for swift parrot as part of the Mount Owen Biodiversity Offset Strategy. This brings the total offset for the species to 105.16% under the EPBC Act Environmental Offsets Policy. This exceeds the minimum threshold of 90% offset and removes the requirement to provide non-land based contributions to reach a 100% offset package.

This advice, including further detail on the Mitchell Hills Offset Site in relation to the application of the EPBC Act Environmental Offsets Calculator, will be provided to the DotE for their consideration.

- ***OEH about whether the proposed expansion of the North Pit would materially affect the proposed vegetation corridors, particularly in relation to the movement and habitat of individual fauna species.***

The PAC review report notes that:

concerns have been raised in public submissions about the width and resilience of the corridors that would be affected by the proposed expansion of the North Pit. OEH indicated that the appropriate width is largely dependent on the particular species that is being supported, and that insufficient information had been provided for the adequacy of the corridor widths to be assessed in this regard. The Commission would also like more clarity around the nature of the north-south corridor available through the period of operation of the mine, to be confident that the effectiveness of the corridor link is maintained throughout the period of disturbance.

In a letter dated 8 March 2016, the OEH have provided a specific response to the issues raised by the PAC in relation the impact of the Project on vegetation corridors. The following information is provided in response to by matters raised by the PAC and the further clarification sought by OEH.

Wildlife Corridors and Habitat Connectivity

A 'wildlife corridor' generally describes a strip of vegetation that differs from the surrounding vegetation and connects otherwise separate areas of habitat (Gleeson and Gleeson 2012). Corridors may include large expanses of intact native landscapes, river systems and floodplains, networks of habitat patches or scattered paddock trees. Connectivity is a critical function of wildlife corridors. These corridors may help to reduce or moderate some of the adverse effects of habitat fragmentation by facilitating dispersal of individuals between substantive patches of remaining habitat.

Wildlife corridors are not necessarily continuous, as currently fragmented or cleared areas can also contribute to overall landscape connectivity (Scotts 2003). These ‘stepping stone’ patches provide connectivity and can function as corridors for mobile species, particularly those willing to cross expanses of cleared land, such as the spotted-tailed quoll (*Dasyurus maculatus*) (Umwelt 2014) or occupy isolated paddock trees such as the squirrel glider (*Petaurus norfolcensis*) (Law *et al.* 2000).

Description of Habitat Connectivity in the Locality

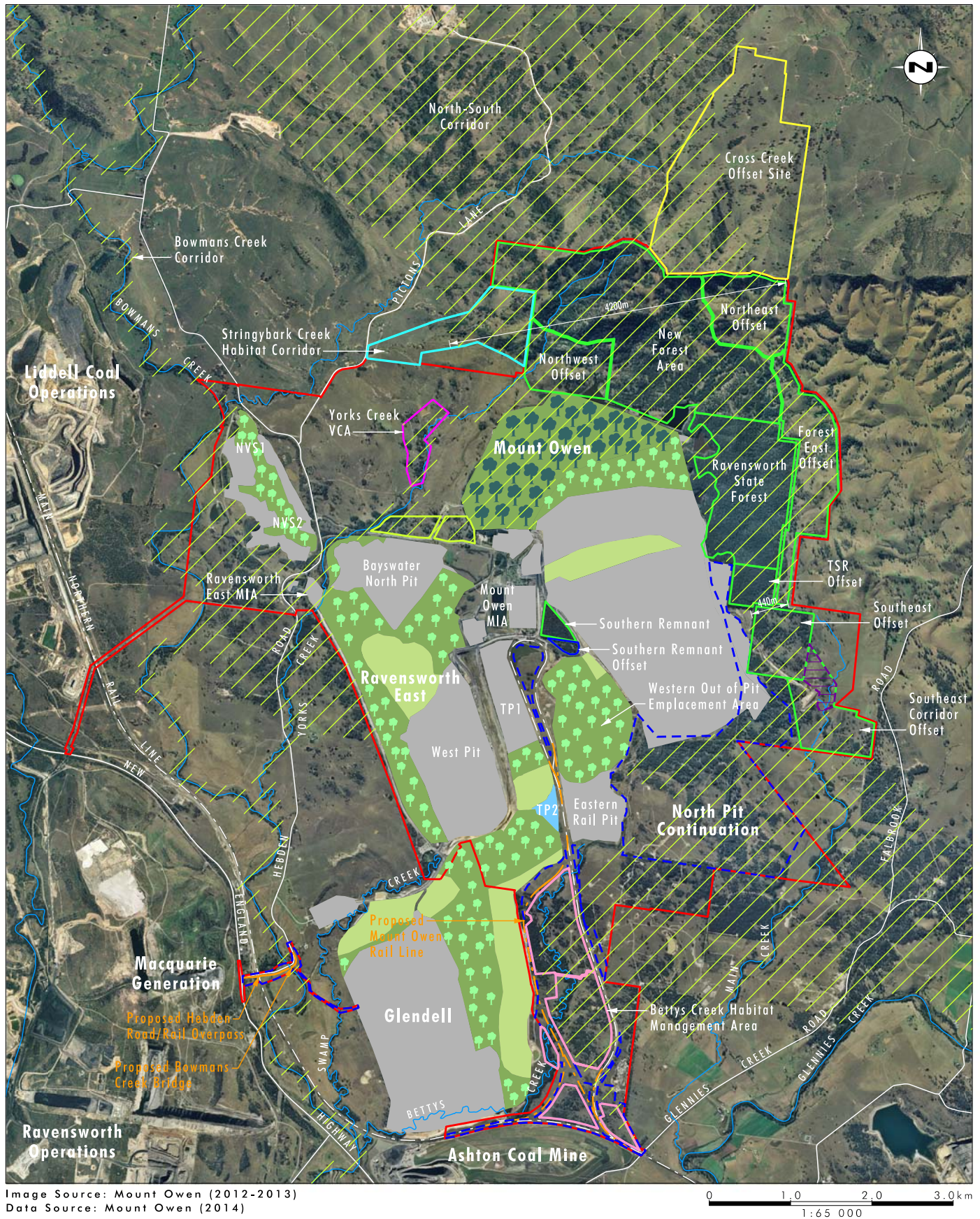
The Project Area and the wider locality contain a range of existing wildlife corridors. This includes two major north-south corridors occurring on the eastern and western boundaries of the Project Area. Firstly, a wide vegetated corridor runs from the northeast to the south of the Project Area associated with the well-connected habitats of the New Forest Area and Ravensworth State Forest (refer to **Figure 4.3**). The corridor south of Ravensworth State Forest is currently connected through regrowth woodland vegetation that is generally less than 30 years old, based on the outcome of historic aerial photograph analysis (refer to **Section 5.1.1**). Mature vegetation occurs along the riparian zones to the south associated with Bettys Creek, Main Creek and Glennies Creek. This corridor varies in the order of 4.2 kilometres wide in the north in the New Forest Area to approximately 440 metres wide near the boundaries of the TSR and Southeast Offset where the corridor becomes more fragmented and associated with stepping stone habitat to the south towards Main, Bettys and Glennies Creeks to the south and east. This corridor is currently effectively severed for the majority of fauna species movement further south by the New England Highway and the Main Northern Rail line.

Secondly, a narrow riparian corridor occurs along Bowmans Creek to the west of the Project Area, connecting habitats to the north of Lake Liddell around Muscle Creek to fragmented landscapes near Ravensworth and either side of Hebden Road (refer to **Figure 4.3**). Other vegetated areas within this broader corridor occur along Yorks Creek (including the Yorks Creek VCA area), with some regrowth woodland occurring in adjacent lands providing some stepping stone connectivity, however much of this area is currently managed for agricultural purposes.

Impacts to the North-South Corridor

It is acknowledged that the proposed extension of the North Pit will partially remove some connecting habitats. The area to be impacted occurs primarily within regrowth within the Proposed Disturbance Area.

Table 4.3, in conjunction with **Figures 4.3 to 4.6**, outlines the changes to the landscape during the period of operation of the Project including the minimum and maximum corridor widths in the wider Project Area. While it is clear that minimum corridor widths will change in this area through the construction and operation of the Project, the overall north-south corridor will be maintained throughout the period of disturbance.



Legend

- | | | |
|---|---|--|
| Project Area | Stringybark Creek Habitat Corridor | Habitat Connectivity |
| Proposed Disturbance Area | Disturbed Land | East-West Corridor Management Area |
| Yorks Creek VCA | Rehabilitation Woodland Advanced | Additional Active Revegetation Area |
| Existing Biodiversity Offset Area | Rehabilitation Woodland Early | |
| Proposed Cross Creek Biodiversity Offset Area | Rehabilitation Grassland | |
| Bettys Creek Habitat Management Area | Water Storage Area | |
| Southern Remnant Biodiversity Offset Area | Drainage Line | |

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FIGURE 4.3

Conceptual Habitat
Connectivity
Year 1

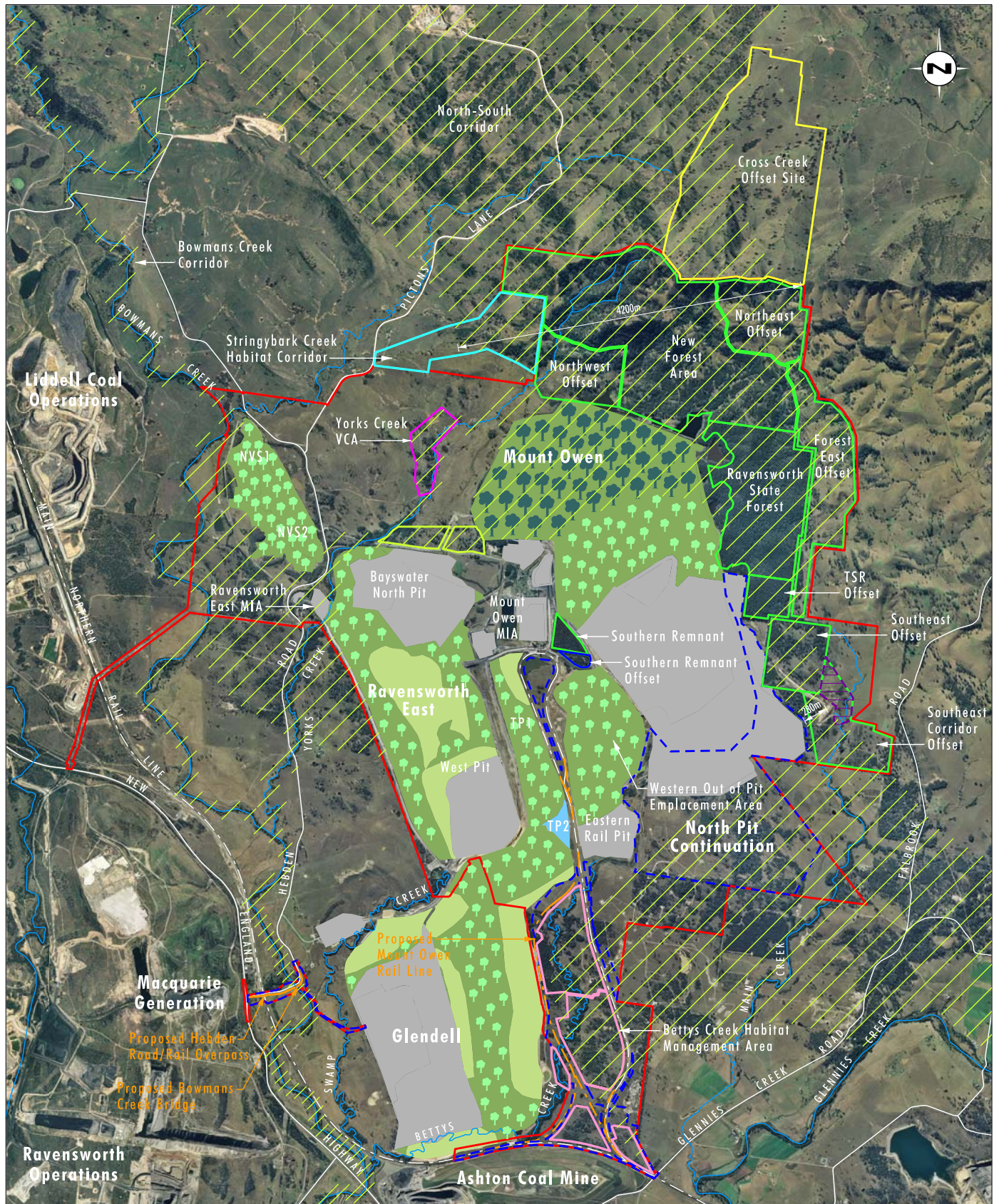


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1.0 2.0 3.0 km
1:65 000

Legend

- | | | |
|---|---|--|
| Project Area | Stringybark Creek Habitat Corridor | Habitat Connectivity |
| Proposed Disturbance Area | Disturbed Land | East-West Corridor Management Area |
| Yorks Creek VCA | Rehabilitation Woodland Advanced | Additional Active Revegetation Area |
| Existing Biodiversity Offset Area | Rehabilitation Woodland Early | |
| Proposed Cross Creek Biodiversity Offset Area | Rehabilitation Grassland | |
| Bettys Creek Habitat Management Area | Water Storage Area | |
| Southern Remnant Biodiversity Offset Area | Drainage Line | |

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FIGURE 4.4

Conceptual Habitat
Connectivity
Year 5

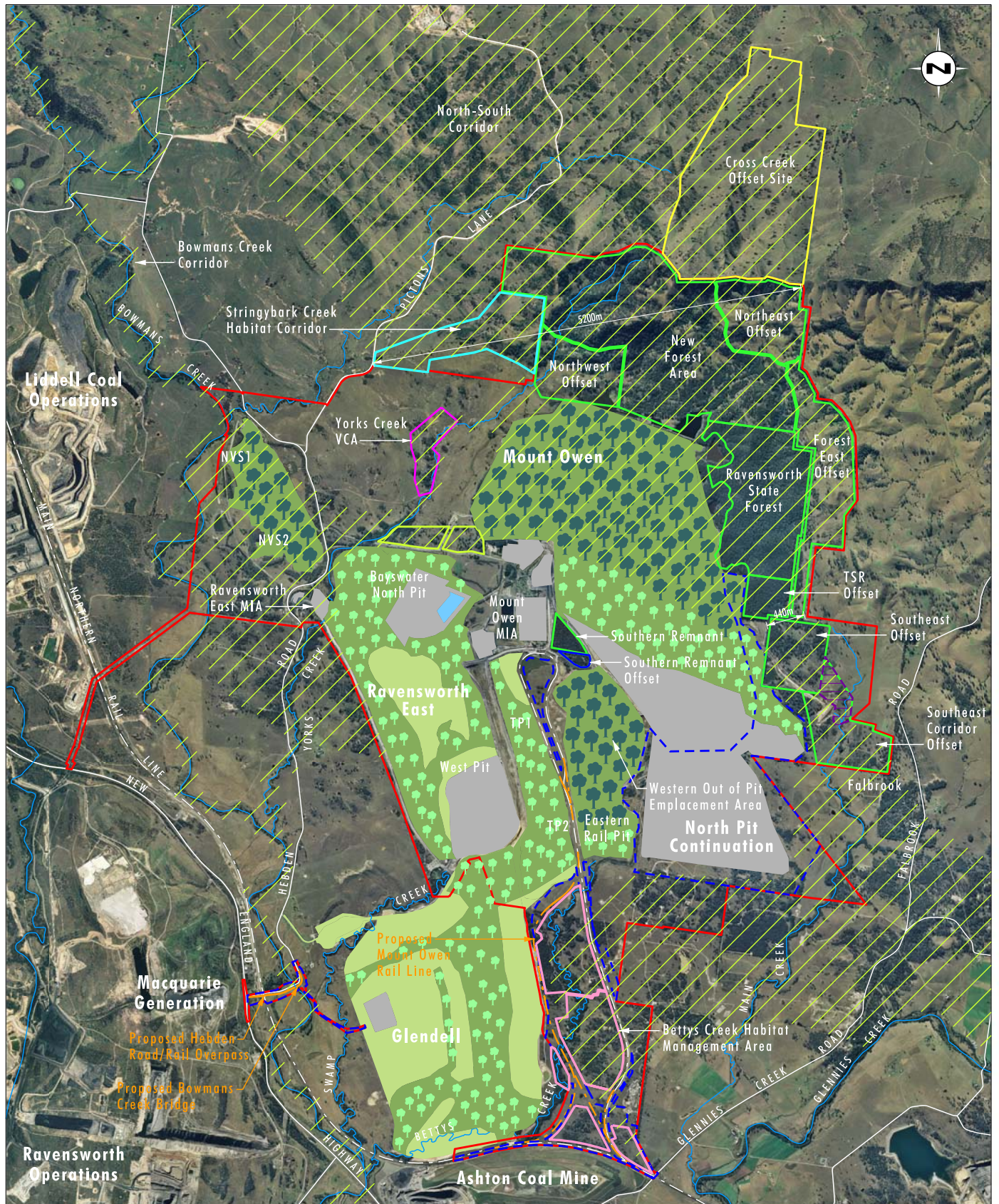


Image Source: Mount Owen (2012-2013)
Data Source: Mount Owen (2014)

0 1.0 2.0 3.0 km
1:65 000

Legend

- | | | |
|---|--|--|
| Project Area | Stringybark Creek Habitat Corridor | Habitat Connectivity |
| Proposed Disturbance Area | Disturbed Land | East-West Corridor Management Area |
| Yorks Creek VCA | Rehabilitation Woodland Advanced | Additional Active Revegetation Area |
| Existing Biodiversity Offset Area | Rehabilitation Woodland Early | |
| Proposed Cross Creek Biodiversity Offset Area | Rehabilitation Grassland | |
| Bettys Creek Habitat Management Area | Water Storage Area | |
| Southern Remnant Biodiversity Offset Area | Drainage Line | |

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FIGURE 4.5

Conceptual Habitat
Connectivity
Year 10

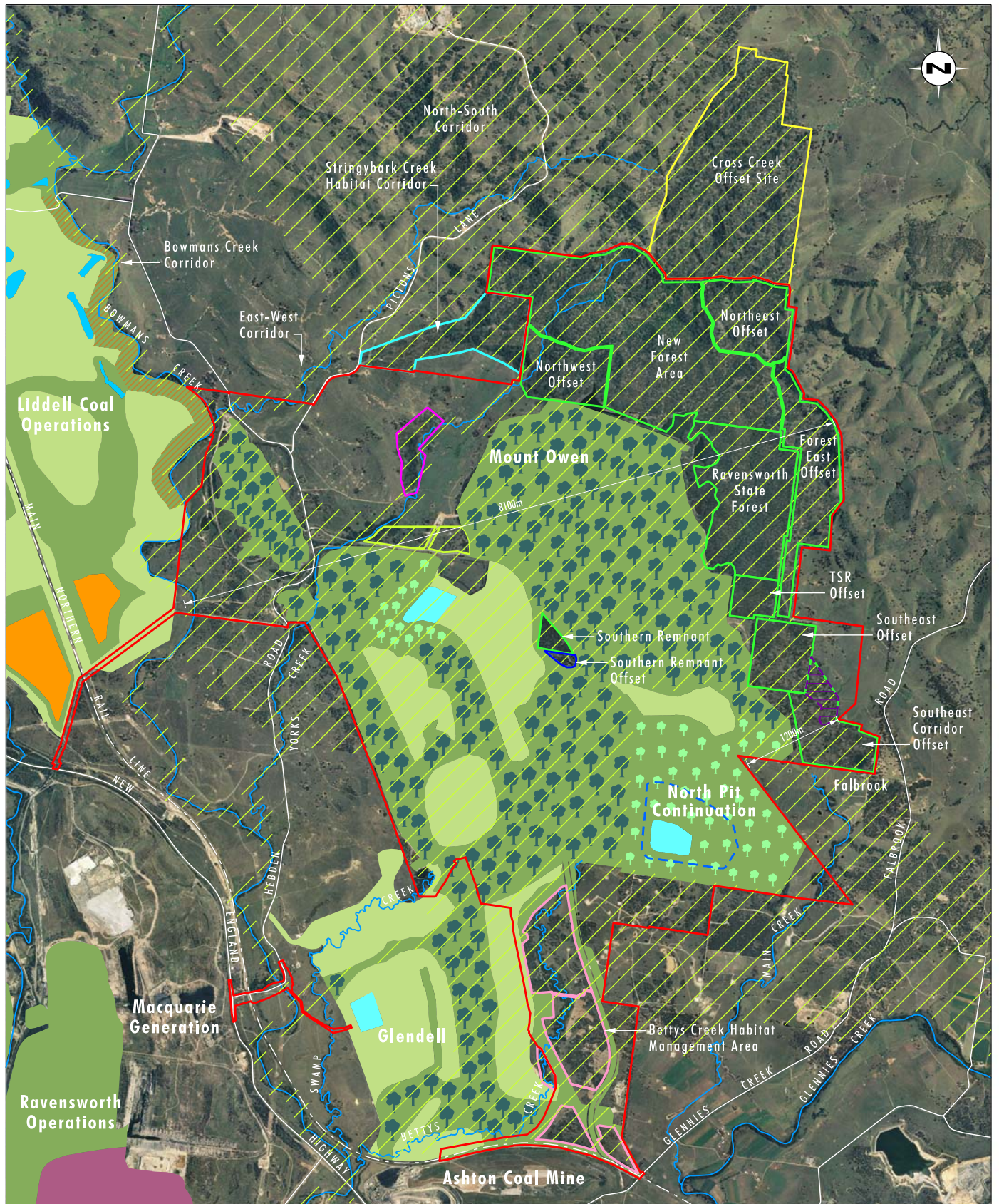


Image Source: Mount Owen (2012)
Data Source: Mount Owen (2014)

0 1.0 2.0 3.0 km
1:65 000

Legend

- | | | |
|--|--|--|
| Project Area | Proposed Corridor Habitat Enhancement on Non-Mined land (Liddell Coal Operations) | Grazing |
| Yorks Creek VCA | Existing Biodiversity Offset Area | Drainage Line |
| Pit Lake | Proposed Cross Creek Biodiversity Offset Area | Habitat Connectivity |
| Rehabilitation Woodland Advanced | Bettys Creek Habitat Management Area | Additional Active Revegetation Area |
| Rehabilitation Woodland Early | Southern Remnant Biodiversity Offset Area | |
| Rehabilitation Grassland | Stringybark Creek Habitat Corridor | |
| Grassland for Stabilisation (Liddell) | East-West Corridor Management Area | |
| Maximum Pit Lake Water Level | | |

FIGURE 4.6

Conceptual Habitat Connectivity
and Conceptual Final Landform
Year 20

Table 4.3 Changes to Habitat Connectivity in North-South Corridor throughout the Life of the Project

Timeframe	Description of Change	North-South Habitat Connectivity Widths and Location in the Project Area	
		Maximum	Minimum
Current	North-South corridor extending from north of the New Forest Area to the south to Bettys Creek and Glennies Creek.	Approx. 4200 m (Stringybark Creek Habitat Corridor, New Forest Area, Northwest Offset and Northeast Offset)	Approx. 440 m (Between the TSR and Southeast Offset)
Year 1	Small areas of clearance in the proposed disturbance area for the North Pit Continuation and progression of rehabilitation in the original North Pit. North-South corridor narrowed south of the Southeast Offset, however narrowest point remains unchanged and habitat connectivity maintained through to Main and Glennies Creek (refer to Figure 4.3). Additional supplementary planting commenced in the Active Revegetation Area (refer to Figure 4.3 and commitment below).	Approx. 4200 m (Stringybark Creek Habitat Corridor, New Forest Area, Northwest Offset and Northeast Offset)	Approx. 440 m (Between the TSR and Southeast Offset)
Year 5	Further clearance in the proposed disturbance area for the North Pit Continuation and early and advanced rehabilitation in the original North Pit. North-South corridor narrowed south of the Southeast Offset, but habitat connectivity maintained through to Main and Glennies Creek at the Southeast Corridor Offset North-South habitat connectivity maintained through to Bettys Creek Habitat Management Area from the connecting habitats associated with Main Creek (refer to Figure 4.4). Additional supplementary planting established in the Active Revegetation Area (refer to Figure 4.4).	Approx. 4200 m (Stringybark Creek Habitat Corridor, New Forest Area, Northwest Offset and Northeast Offset)	Approx. 280 m (Southeast Corridor Offset)

Timeframe	Description of Change	North-South Habitat Connectivity Widths and Location in the Project Area	
		Maximum	Minimum
Year 10	<p>Further clearance in the proposed Disturbance Area for the North Pit Continuation and Rehabilitation woodland (Advanced) in the original North Pit. Rehabilitation woodland (Early) available in the northeast corner of the proposed disturbance footprint near the Southeast Corridor Offset. North-South habitat connectivity maintained through to Bettys Creek Habitat Management Area from the connecting habitats associated with Main Creek (refer to Figure 4.5).</p> <p>North-south connectivity available through advanced woodland rehabilitation of the Eastern Rail Pit, Western Out of Pit Emplacement Area and original North Pit (refer to Figure 4.5).</p> <p>Additional supplementary planting established in the Active Revegetation Area (refer to Figure 4.5).</p>	Approx. 5200 m (Stringybark Creek Habitat Corridor, New Forest Area, Northwest Offset and Northeast Offset)	Approx. 440 m (Between the TSR and Southeast Offset)
Year 20 (final landform)	<p>Early rehabilitation in the North Pit Continuation and advanced rehabilitation in the North Pit Overburden Emplacement Area and Ravensworth East. North-south corridor strengthened through further revegetation and regeneration in the Southeast Offset and Southeast Corridor Offset (in the south), including the supplementary planting in the Additional Active Revegetation Area, and the Cross Creek Offset Site and Stringybark Creek Habitat Corridor (in the north) (refer to Figure 4.6).</p> <p>North-south connectivity also available through advanced woodland rehabilitation in the Eastern Rail Pit, Western Out of Pit Emplacement Area, and Ravensworth East (refer to Figure 4.6).</p>	Approx. 8100 m (Bowmans Creek, East-West Corridor Management Area, mine rehabilitation, Ravensworth State Forest, Forest East Offset)	Approx. 1200 m (North Pit Continuation Rehabilitation (Early-Advanced). Southeast Corridor Offset)

The most substantial change for the overall north-south corridor will be at Year 5 of the Project where clearance in the proposed disturbance area progresses to the south of the Southeast Offset (refer to **Figure 4.4**) and at this time, the narrowest point of this corridor will be approximately 280 metres of woodland occurring within the Southeast Corridor Offset. Despite this impact, the Project will not sever connectivity in the north-south corridor. The existing Biodiversity Offset Areas to the south of Ravensworth State Forest (TSR Offset, Southeast Offset and Southeast Corridor Offset) will not be directly impacted as a result of the Project, thereby retaining connectivity from the New Forest Area and Ravensworth State Forest in the north to woodland habitats along Main and Glennies Creek in the south. The broader north-south corridor in the region, Ravensworth State Forest to Main Creek and Glennies Creek near Falbrook

that then connects to habitats to the south through to Bridgman and Dyrring, will not be impacted by the Project.

Corridor Widths and Resilience for Fauna Species Movement

Maximising the widths of corridors is one of the most effective ways of increasing corridor effectiveness for wildlife conservation by reducing the impacts of edge effects, increasing diversity and providing habitat for species with larger home ranges (Bennett 2003). There is limited information for the minimum requirements for maintaining or creating effective natural habitat linkages for particular species in Australia (Gleeson and Gleeson 2012). There is no minimum effective width or stepping stone patch size that can be generically applied to all different scenarios due to differences in species requirements, habitat types and the landscape.

An accepted guidance is that the linkage needs to be wide enough to maintain connectivity for the species or assemblage of animals for which it is intended (Bennett 2003). The Project will impact a range of species known to occur in the locality. Broadly, this includes highly mobile species such as woodland birds and micro-bat species, but more specifically the threatened spotted-tailed quoll (*Dasyurus maculatus*) and squirrel glider (*Petaurus norfolcensis*), which are known to utilise corridors throughout the landscape.

As outlined in the Ecological Assessment, the Project is considered likely to result in a significant impact on the spotted-tailed quoll (*Dasyurus maculatus*) and squirrel glider (*Petaurus norfolcensis*) and a potential significant impact for a range of threatened woodland bird and micro-bat species under the TSC Act.

A range of threatened woodland birds and micro-bat species that are predicted to be potentially significantly impacted by the Project are known to occur in the highly fragmented and regenerating components of the Project Area. Although these species are generally highly mobile, connected woodland vegetated habitats may be used as flight paths, foraging or roosting resources. Edge effects in narrow corridors and fragmented landscapes (such as the aggressive exclusion of birds by noisy miners (key threatening processes under the TSC Act)) are known to reduce woodland bird diversity. For micro-bat species, remnant areas and structural complexity are likely to provide habitat for higher diversity of species, although some appear to be tolerant of fragmentation (Law *et al.* 1999), as evidenced by the range of micro-bats and birds recorded in the fragmented portions of the Project Area (refer to Figures 4.3 and 4.5 of the Ecological Assessment). Annual fauna monitoring of the Mount Owen Complex shows that regeneration and rehabilitation sites provide habitat for a range of threatened bird species including the speckled warbler (*Chthonicola saggitata*) and grey-crowned babbler (*Pomatostomus temporalis temporalis*), and threatened micro-bat species such as east-coast freetail-bat (*Mormopterus norfolkensis*) and eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), however habitats within the densely vegetated Ravensworth State Forest contained greater species diversity (Umwelt 2013).

Regular records of the spotted-tailed quoll have been recorded between 1995 and 2014 in Ravensworth State Forest and surrounding woodland, forest and rehabilitation communities. Radio-tracking at Mount Owen has identified a male spotted-tailed quoll occurring in Ravensworth State Forest and mine rehabilitation and regeneration communities in the north of the Mount Owen Complex, and regularly in remnant vegetation associated with Main Creek to the east of Mount Owen Complex and at five locations within the Proposed Disturbance Area. Other known local occurrences include a breeding record from a den in the narrow Bowmans Creek riparian corridor in 2012 (Umwelt 2008 and 2013). The species is known to move through both the densely vegetation landscape and also through grassland and fragmented woodlands within the Project Area.

The squirrel glider has been regularly recorded within the Project Area during fauna monitoring from 1994 to 2014 (Forest Fauna Surveys and Newcastle Innovation 2015). The species is often recorded in Ravensworth State Forest, but has also been observed in woodland habitat in the Proposed Disturbance Area. The mean home range of the squirrel glider at Mount Owen is 33 hectares, with an average density of 0.09 gliders per hectare (Xstrata Coal and Thiess 2006). Squirrel gliders are also known to occupy paddock trees in agricultural landscapes (Law *et al.* 1999) and the species does not depend exclusively on densely connected habitats.

Each of the threatened species that are predicted to be significantly or potentially significantly impacted by the Project have been recorded in fragmented, regenerating or rehabilitated habitats within the Project Area. The reduction in minimum corridor width identified in **Table 4.3** above as a result of the Project was considered during the impact assessment process and contributes to the likely and potentially significant impact findings. The temporary reduction in minimum corridor width between years 5 and 10 of the Project is not expected to result in the severing of the north – south movement corridor for those threatened fauna species identified as being adversely impacted by the Project.

In terms of corridor design and planning, although no minimum benchmark has been identified, widths of 500 metres for regional corridors and 300 metres for sub-regional corridors have been applied in the preparation of the Key Habitats and Corridors for Forest Fauna (Scotts 2003) and further applied in the Fauna Corridors for Climate Change Report for the Hunter Central Rivers Catchment Management Authority (HCRCMA) (DECC 2007). For the Project, the north-south corridor meets the minimum widths of a regional and sub-regional corridor until Year 5 where the corridor is reduced to approximately 280 metres in width near the Southeast Corridor Offset.

Noting the impacts to the north-south corridor outlined above and the associated impacts related to fauna movement in these areas, Mount Owen further propose to:

Prioritise strategic active revegetation in the Additional Active Revegetation Area located in the Southeast Corridor Offset commencing in Year 1 of the Project, to minimise the impacts of corridor width reduction in this area. The Biodiversity Management Plan and Landscape Management Plan will be updated to include a revised schedule of active planting including ongoing performance criteria to ensure effective habitat restoration in these areas.

The Additional Active Revegetation Area is shown on **Figures 4.3 to 4.6**.

3. That the Department considers requiring further research in the recommended preliminary conditions of consent, particularly in relation to regeneration activities in this project, corridor linkages within the project area, and corridor linkages between this project and other nearby mines.

Refer to **Section 5.0** regarding comments on further research in relation to the regeneration activities for the Project.

As noted above, further commitment has been made by Mount Owen to active strategic regeneration in the North-South Corridor by active revegetation in the Southeast Corridor Offset areas. The implementation of the East-West Corridor Management Area will also ensure connectivity from Ravensworth State Forest, through the rehabilitated North Pit Overburden Emplacement Area, is maintained and enhanced. The conceptual final landform and land use design for the Refined Project has also been developed to improve north-south and east west habitat connectivity through the landscape, as discussed in **Section 5.0**.

- 4. That the recommended preliminary condition of consent relating to the Independent Environmental Audit should be linked to the preliminary Biodiversity Management Plan condition to ensure that regeneration is independently monitored and audited on a regular basis (i.e. within a year of the commencement of development, and every 3 years thereafter).**

Mount Owen agrees that this is an appropriate consideration for DP&E to include in the conditions of consent.

- 5. That the recommended preliminary condition of consent relating to the Biodiversity Management Plan should be strengthened to include:**

- **salvaging, transplanting or propagating measures for all six threatened flora species known to occur in the region;**

The DP&E has specifically referred to orchid species in the recommended preliminary conditions, which covers two of the six threatened flora species that may occur in the Project Area. However, we understand from this recommendation that the PAC considers that salvaging, transplanting or propagating measures should explicitly apply to all six threatened flora species known to occur in the region.

In considering this recommendation, it is important to understand that none of the species identified in the Ecological Assessment as occurring in the wider locality were recorded within the proposed disturbance area during the extensive ecological surveys undertaken for this assessment, despite these species being easily detectable.

The Ecological Assessment identified two threatened flora species and three endangered flora populations that have been previously recorded in the locality but not within the proposed disturbance footprint. These were:

- Slaty red gum (*Eucalyptus glaucina*) – vulnerable under the TSC and EPBC Acts
- *Ozothamnus tessellatus* – vulnerable under the TSC and EPBC Acts
- Tiger orchid (*Cymbidium canaliculatum*) in the Hunter Catchment – endangered population under the TSC Act
- Weeping myall (*Acacia pendula*) in the Hunter Catchment – endangered population under the TSC Act and
- River red gum (*Eucalyptus camaldulensis*) in the Hunter Catchment – endangered population under the TSC Act.

Furthermore, the orchid species identified by OEH in their submission (*Pterostylis chaetophora*) was not recorded in the Project Area. As outlined in the Response to Submissions Report A (Umwelt 2015), although a *Pterostylis* sp. was recorded within the Kunzea Shrubland vegetation community during the surveys undertaken for this assessment, the specimen had “very small flowers, basal and cauline leaves”, features which are not consistent with the description of *Pterostylis chaetophora*. *Pterostylis chaetophora* is associated with seasonally moist, dry sclerophyll forest with a grass and shrub understorey (NSWSC 2014). OEH stated in a letter dated 19 August 2015 (following the release of the Response to Submissions Report), that “the description of the greenhood orchid found for surveys for this species from the Kunzea Shrubland do not match the vegetative features for *Pterostylis chaetophora*. Thus it appears that this species is not present in the development footprint.”

As outlined above, none of these species were recorded within the proposed disturbance footprint during the extensive ecological surveys undertaken for this assessment despite these species being easily detectable. Mount Owen are committed to minimising the potential impacts on ecological values through the implementation of a comprehensive mitigation strategy, including targeted pre-clearance surveys designed to identify any sensitive flora and fauna features prior to clearing operations.

It should be noted that salvage, translocation and/or propagating may not be suitable for a range of threatened species. For example, little is known about the reproductive biology of the Hunter Valley population of weeping myall (*Acacia pendula*) and it is likely to be challenging to translocate or propagate the species with natural occurrences in the Hunter Valley not recorded setting seed (OEH 2013). Weeping myall commonly occurs in rehabilitation mixes which may provide some opportunities for dispersal. It is acknowledged that tiger orchid (*Cymbidium canaliculatum*) is known to be able to be successfully salvaged and translocated, with Glencore successfully translocating the species at Mangoola Mine, in the Upper Hunter, NSW (Umwelt 2011). Only one specimen of *Ozothamnus tessellatus* has been recorded in the locality (in Ravensworth State Forest) and the species is otherwise restricted to a few locations north of Rylstone and near Denman. The translocation or propagating ability of this species is unknown and furthermore likely to be difficult or with limited potential for successful seed collection in the locality.

The current Biodiversity Management Plan includes a procedure for seed collection and propagation in relation to the regeneration and rehabilitation activities across the Mount Owen Complex and a requirement that, for any threatened species or populations newly located in the Mount Owen Complex, appropriate conservation and management strategies will be developed and implemented. Seed collection may be suitable for species such as slaty red gum (*Eucalyptus glaucina*) and river red gum (*Eucalyptus camaldulensis*), however this is unlikely to be feasible for the other locally-occurring threatened flora species as discussed above.

The Preliminary DP&E Assessment Report notes that due to the relatively limited extent of potential impacts on threatened flora species and populations, the DP&E is satisfied that the established pre-clearance surveys and management measures in place at the Mount Owen Complex, combined with the proposed Biodiversity Offset Strategy, would be sufficient to mitigate the likelihood of any significant impacts on these threatened flora species and populations as a result of the project.

Mount Owen do not consider it warranted to provide a specific process for salvaging, transplanting or propagating for species that have not been recorded and/or are unlikely to occur within the proposed disturbance footprint. A more suitable recommendation for the consent conditions would be that in the event that any threatened flora species or populations are identified within the proposed disturbance footprint, the suitability of salvage, translocation, or propagation to minimise the impacts on these species would be considered.

- ***monitoring of potential impacts on groundwater dependent ecosystems and specific trigger levels for remedial action;***

We note that the PAC Review Report states that:

‘While the Department has recommended preliminary conditions requiring the monitoring of GDEs as part of the Water Management Plan, there are no requirements relating to GDEs in the recommended Biodiversity Management Plan preliminary conditions’.

As detailed in Section 2.5.1.4 of Response to Submissions Report B, it is proposed that the Surface Water and Groundwater Response Plan will be updated to include requirements for monitoring of the ecological condition of vegetation communities potentially impacted by changes in alluvial groundwater levels. This plan will also include analogue sites in areas of the alluvium that are not predicted to be impacted by the

Project as well as upstream locations where the community is present in areas where there is minimal alluvium.

In the event of an observable impact, reasonable and feasible management options would be implemented. These management options would be focused on improving the resilience of existing riparian vegetation and the maintenance of habitat connectivity generally and may include:

- Planting of tree species less reliant on groundwater
- Additional vegetation planting adjacent to creek lines to reduce reliance on riparian vegetation for connectivity and/or
- Fencing of riparian vegetation to remove grazing pressures on ground and understorey species during dry periods.

The selection of management measures associated with any observed impact to riparian vegetation should have regard to the nature of the identified impact and its cause and any potential lag time between impact and effectiveness of the proposed management measure(s).

The monitoring and management measures that may be required in response to any potential groundwater impacts on the Main Creek and Bettys Creek alluvial systems (including TARPS) will be developed in consultation with relevant government agencies and finalised and implemented prior to any predicted impacts on alluvial ground water levels (Year 5 of the Project).

Mount Owen has no objection to these monitoring and management requirements also referenced in the consent conditions for the Biodiversity Management Plan.

- ***more specific performance measures and milestones linked to key individual fauna species (for example the relocation and re-use of hollow-bearing trees for the Squirrel Glider, Swift Parrot and Regent Honeyeater);***

The PAC Review Report notes that:

'it is concerned that the removal of mature hollow-bearing trees and foraging resources may have adverse impacts on other fauna species, including the Spotted-tailed Quoll and Squirrel Glider. The Commission also notes that the loss of nesting sites may have adverse impacts on the Regent Honeyeater, and the loss of tree hollows and particular foraging resources may adversely affect the Swift Parrot.'

The PAC also recommends that the Department consider the relocation and re-use of hollow-bearing trees, particularly in relation to providing habitat for the Squirrel Glider, Swift Parrot and Regent Honeyeater.'

The Ecological Assessment acknowledges that the Project will result in the loss of a substantial and important area of habitat for a range of woodland-dependent threatened fauna species recorded in the Proposed Disturbance Area and wider Project Area. As detailed in Section 5.7.5 of the EIS, the Project is considered likely to result in significant impact (under the EP&A Act, but not the Commonwealth EPBC Act) on the spotted-tailed quoll (*Dasyurus maculatus*) and squirrel glider (*Petaurus norfolcensis*).

The relocation of hollows is a commitment in the currently approved Mount Owen Complex Biodiversity Management Plan (2014) which will be updated to apply to the Project. The existing Biodiversity Management Plan provides for the implementation of compensatory habitat for the squirrel glider (*Petaurus norfolcensis*), in the form of the "installation of poles for attachment of hollows in revegetation

areas devoid of trees of sufficient size, but adjacent to woodland". In addition, habitat enhancement is undertaken in the form of nest box installation in surrounding revegetated landscapes.

Benchmark performance targets (or benchmark values) are also provided for specific fauna groups (including squirrel glider) for the monitoring of hollows and nest boxes in Table 19 of the approved Mount Owen Complex Biodiversity Management Plan (2014), with the density of nest boxes/hollows installed targeted at 8-10 per 30 hectares of woodland or forest parcels.

Furthermore, the reinstatement of fauna habitat is a critical component of the proposed woodland and forest regeneration initiatives that are proposed to maintain or improve the biodiversity values of the Biodiversity Offset Sites in the long term. A number of targeted fauna habitat reinstatement measures have been identified to specifically target those threatened fauna species that are expected to be impacted by the Project. As outlined in the Section 7.5.2 of the Ecological Assessment, the following measures are proposed to directly reinstate fauna habitat in the offset sites:

- the provision of supplementary and augmented habitat for the spotted-tailed quoll in the Stringybark Creek Habitat Corridor including the emplacement of salvaged trees from the proposed disturbance footprint as log piles and the salvage of large rocks and boulders as denning habitat
- the installation of nest boxes to supplement arboreal fauna habitat to offset impacts to hollow-dependent threatened fauna species. Once regenerated communities are structurally mature, nest boxes will be installed in similar densities to those in unaffected vegetation on the site. Nest box design will consider the full range of hollow-dependent species known or expected to occur in the offset sites, in particular hollow-dependent threatened fauna species such as the squirrel glider (*Petaurus norfolcensis*) and
- placement of salvaged tree hollows in rehabilitation areas, where practicable. The reinstated density of salvaged tree hollows and nest boxes in rehabilitation areas will be carried out taking into consideration the carrying capacity of the rehabilitated vegetation in which the boxes are being established.

It is considered unnecessary to specify performance measures in relation to hollow resources for species such as the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*). The swift parrot nests in hollows in their breeding habitats that only occur in Tasmania. In the winter months, the species migrates to mainland Australia to forage primarily on flowering eucalypt species. Although it is acknowledged that roost site characteristics for the species on mainland Australia is relatively unknown (Saunders and Tzaros 2011), the species is not known to depend on hollows for roosting during their overwintering in NSW. Observations of the species indicate that flocks will roost communally in tree branches in proximity to foraging resources (Birdlife 2016, Saunders and Tzaros 2011).

Furthermore, the regent honeyeater is not a hollow dependant species. The regent honeyeater nests in the canopy of forests or woodlands, often in rough barked trees (e.g. ironbarks, rough barked apple (*Angophora floribunda*) and she-oaks (*Casuarina* sp.)) (DotE 2015). The species has not been recorded within the proposed disturbance area or the locality. The closest breeding records for the species occurs approximately 55 kilometres to the southeast near Kurri Kurri and Werakata National Park (*Friends of Tumblebee Incorporated v ATB Morton Pty Limited (No 2) [2016] NSWLEC 16*). It is highly unlikely, based on the many years of targeted survey during the Mount Owen Annual Fauna Monitoring Program, that the species occurs or utilises any potential nesting resources within the Project Area and, specifically, not hollow-bearing tree habitat.

For the purposes of this Project, Mount Owen consider it unnecessary for the conditions of consent to include the requirement for performance measures for the re-use of hollow resources for species (the swift parrot and regent honeyeater) that are not known to use these resources in the Project Area or the locality.

As noted above, specific performance measures and hollow translocation is an existing commitment for the squirrel glider in the approved Mount Owen Complex Biodiversity Management Plan (2014) which will be updated for use for the Project.

It is acknowledged that no specific measures for swift parrot are included in the approved Mount Owen Complex Biodiversity Management Plan (2014). The Biodiversity Offset Strategy has specifically considered the inclusion of high quality key foraging resources for the swift parrot, including existing mature woodlands and the active revegetation of grassland to woodland habitats. It is recommended that the consent condition should more appropriately reflect the comment that:

The revegetation of grassland habitats at the offset sites and mine rehabilitation will be targeted to provide habitat resources for the threatened swift parrot, regent honeyeater and squirrel glider, such as the planting of known key foraging species (e.g. spotted gum (Corymbia maculata)) for swift parrot and regent honeyeater, and habitat augmentation relocation hollow resources and nest boxes for squirrel glider. The Biodiversity Management Plan will be updated to include suitable performance measures and benchmarks for these management measures in relation to the Project's new offset sites and mine rehabilitation.

- ***further details about the specific methods of regeneration, as well as relevant performance measures to assist in monitoring the effectiveness of regeneration; and***

Refer to **Section 5.3.1**.

- ***further detail about the particular vegetation species that should be promoted, including species from different 'functional groups', such as cycads, ferns, geophytes, rushes and sedges.***

Refer to **Section 5.3.1**.

6. ***That the Department should review the current membership and operation of the CCC to ensure that it conforms with the Guidelines for Establishing and Operating Community Consultative Committees For Mining Projects (2007) (as updated), and that all relevant interests are represented, including those related to biodiversity, regeneration and rehabilitation.***

Mount Owen agrees that this approach is appropriate.

4.3 Other Issues Raised in PAC Review Report

While the Commission acknowledges the difficulty in finding like-for-like options within the Hunter Valley, it agrees with the concerns raised by OEH and various public submissions about the proposed heavy reliance on the regeneration of EECs from equivalent derived grassland communities for offsetting purposes.

It should be noted that while the OEH submission states that the “revegetation of derived native grasslands and rehabilitation of post-mined landscapes to recognisable woody vegetation communities forms a large part of the offset package for this project”, it also acknowledges that “Mount Owen has revegetated a sizeable part of their mining lease and has been working in conjunction with researchers for ways to improve the outcomes of revegetation”. Overall OEH “accepts all of the components of the offset package as being suitable matches to the biodiversity of the development footprint”. Specifically, OEH’s ‘concerns’ as outlined in their submission were more related to the rehabilitation of the post-mine landscape and the inclusion of a greater variety of groundcover species used in rehabilitation.

The issue of regenerating EECs from grasslands is further discussed in **Section 5.0** below.

The Commission acknowledges that areas of regeneration may be considered areas of 'environmental gain' (as opposed to areas that require rehabilitation to repair damage from mining operations). However, overall the Commission believes, on the basis of current evidence and recent research, that there is considerable uncertainty about the ability to effectively regenerate offset areas, and rehabilitate other previously mined areas. On its site inspection with the Applicant and OEH officers, for example, OEH emphasised, and the Commission observed, that while canopy and shrub species have been successfully re-introduced, a diversity of ground cover species is noticeably lacking.

The conservation value of regenerated land is extensively addressed in the CSIRO report to the NSW Scientific Committee: *'The Conservation Value of Regrowth Native Plant Communities: A Review'* (Doherty, 1998). As discussed in that report, many vegetation communities in parts of NSW are heavily modified from their pre-European state and, in some instances, the remnants with conservation values identified as being worthy for conservation are themselves, first, second or even later generation regrowth.

Consistent with the findings in Doherty (1998), the regeneration of existing grassland communities to woodland communities is a highly desirable outcome and will provide significant ecological gains in the offset sites which will offset the removal of like vegetation communities in the proposed disturbance area. As discussed further in **Section 5.1**, much, if not all of the remnant vegetation present in the floor of the Hunter Valley, including the woodland vegetation to be impacted by the Project is itself regrowth following past agricultural, mining and/or forestry activities. There is a high degree of confidence, based on previous regeneration activities in other offset locations such as the New Forest Area, that the offset areas proposed as part of the Biodiversity Offset Package for the Project can be successfully returned to woodland habitats similar to that which will be impacted by the Project.

The regeneration of derived native grasslands should not be confused with the rehabilitation of the post-mine landscape. Several forms of ecological rehabilitation and restoration have been undertaken to date at Mount Owen, comprising:

- rehabilitation on mine spoil
- revegetation (active management) of grasslands through plantings and
- passive regeneration of grasslands where adequate canopy seed sources are located nearby.

Section 5.0 below contains further clarification regarding mine rehabilitation and the regeneration of offset sites.

In order to address the uncertainties around effective regeneration, the Department has recommended a preliminary condition requiring the development of a strategy for the regeneration of woodland areas within the offset areas as part of its biodiversity offsets management plan.

It should be noted, as discussed above, that there is abundant evidence that, in disturbed environments where soil seed banks and nearby vegetation provide adequate propagules, recovery of native habitats can be optimised through minimising intervention. The regeneration of habitat at Mount Owen occurred across large parts of the Project Area through unplanned and unassisted means (now forming most of the higher quality habitat to be impacted by the Project). The extensive natural regeneration of vegetation across most of the Hunter Valley that has been previously cleared (including at all of the proposed offset sites), demonstrate with a high degree of confidence that the proposed regeneration of vegetation in suitable parts of the offset sites will be successful. Provided that propagules are available, weeds and pests are managed, and adaptive management (such as targeted supplementary planting) is ensured, the recovery of the native habitat can be readily achieved.

The proposed vegetation community and fauna habitat re-establishment at each of the four land-based offset sites will include the following restoration actions:

- All planting or seeding within revegetation areas will be designed with structural and floristic diversity suitable to meet the benchmark vegetation community targets.
- Where practicable, revegetation will involve the use of local provenance seed that will either be utilised for direct seeding or for the propagation of tubestock for planting.
- Revegetation areas will be subject to a formal care and maintenance program that will be developed to include the control of weeds, replacement of failed plantings, bushfire protection etc.
- Revegetation areas will be subject to a formal monitoring program (success/failure, as well as floristic monitoring) that will be developed to include a feedback loop to achieve continual improvement in the methodology and results.

To aid in the planning of revegetation and rehabilitation management actions and reflect the intensity of revegetation works required, the offset sites will be divided into the following distinct domains based on the biodiversity values recorded and the target vegetation communities that have been identified in the regeneration strategy:

- Benchmark - refers to mature vegetation communities that are the benchmark to which the revegetation works across the offset sites will be compared to. Minor ongoing management actions (weed/feral animal management, grazing control) will be required
- Revegetation (Low Intensity) - refers to areas allowed to naturally regenerate. These areas exhibit significant natural regeneration potential and are close to sources of natural recruitment (such as seed sources and encroachment from adjoining vegetation) and/or comprise high quality derived native grasslands. Minor ongoing management actions (weed/feral animal management, grazing control) will be required and
- Revegetation (Moderate to High Intensity) - refers to areas requiring a moderate to high level of revegetation works to return disturbed vegetation to its target community. Planting of tube-stock and/or seeding may be required in target areas; however natural regeneration will also be encouraged where possible. Minor ongoing management actions such as additional fencing, weed management, feral animal and bushfire control and supplementary planting via direct seeding and/or tubestock will lead to the development of a self sustaining natural ecosystem.

The Biodiversity Offset Management Plan will include adaptive management measures and specific rehabilitation performance indicators which are proposed to include targets relating to vegetation health, flora species composition/biodiversity, vegetation structure and fauna utilisation tailored for 5, 10, 15 and 20 year milestone targets.

Natural regeneration sites will be monitored to determine if natural regeneration is likely to lead to successful habitat restoration based on these indicators. In the event that monitoring results reveal that natural regeneration actions alone are not resulting in the performance indicators and completion criteria being met (or trending towards being met), corrective actions will be imposed and implemented. **Table 4.4** below is an example of potential performance risks and corrective actions that will be considered for the Biodiversity Offset Management Plan, consistent with other recent projects.

Table 4.4 Example of Risks and Recommended Corrective Action Measures

Risk to Success of Regeneration of DNG Areas	Recommended Corrective Actions
No regeneration of plants, or indicator species missing	<ul style="list-style-type: none"> • assess fencing and ensure there is no un-authorised stock access; • adapt weeds and pest management strategies to reduce competition; and • consider the need for active regeneration techniques including direct seeding or tubestock planting, following appropriate ground preparation such as weed control, ripping and augering.
Low species diversity	<ul style="list-style-type: none"> • targeted weed control; and • consider the need for active revegetation techniques including direct seeding or tubestock planting, following appropriate ground preparation such as weed control, ripping and augering.
Exotic annual grasses dominate	<ul style="list-style-type: none"> • targeted weed control; • investigate suitability of strategic conservation grazing for weed suppression; and • dense tree revegetation to shade out weeds, followed by thinning.
Exotic broadleaf weeds abundant or dominant	<ul style="list-style-type: none"> • targeted weed control; and • investigate suitability of strategic conservation grazing for weed suppression.
Patches of perennial grass weeds occurring	<ul style="list-style-type: none"> • targeted weed control, including spot spray or dig out small clumps; and • investigate suitability of strategic conservation grazing periodically for weed suppression and to stimulate native pasture.
Patches of annual grass weeds	<ul style="list-style-type: none"> • investigate suitability of strategic conservation grazing or slashing in spring to stop seed set of annual grasses; and • light grazing in autumn and winter to maintain native grass vigour.
Dense stands of colonising tree or shrub species dominant regeneration areas	<ul style="list-style-type: none"> • assess whether thinning is necessary; • leave if patches are small and plants are native; and • thin manually if appropriate.
Scarcity of key habitat features present in relation to reference sites	<ul style="list-style-type: none"> • add logs or branches; • increase the number of vegetation layers in the patch; and • establish nesting boxes for target species.

5.0 Final Landform and Rehabilitation

5.1 General Comments on Rehabilitation and Regeneration

The PAC has made a number of general statements regarding the apparent lack of research in rehabilitation of mine sites in the Hunter Valley, uncertainties about the ability to rehabilitate disturbed mining areas or regenerate previously cleared areas in proposed offset areas. Examples of these comments are set out below.

The Commission acknowledges that effective mine rehabilitation is difficult to achieve and mine closure planning is still considered a relatively new science. While restoration of agricultural land has been successfully achieved, ecosystem restoration is certainly more difficult to achieve.

and

The Commission acknowledges that areas of regeneration may be considered areas of 'environmental gain' (as opposed to areas that require rehabilitation to repair damage from mining operations). However, overall the Commission believes, on the basis of current evidence and recent research, that there is considerable uncertainty about the ability to effectively regenerate offset areas, and rehabilitate other previously mined areas. On its site inspection with the Applicant and OEH officers, for example, OEH emphasised, and the Commission observed, that while canopy and shrub species have been successfully re-introduced, a diversity of ground cover species is noticeably lacking.

and

For example, the Department has recommended preliminary conditions requiring the promotion of a range of canopy, sub-canopy, understorey and ground strata, and the direct seeding or planting of underrepresented vegetation species. The Commission believes these preliminary conditions could be strengthened and recommends that the Department should consider including further detail about the particular species that should be promoted, including species from different 'functional groups' such as cycads, ferns, geophytes, rushes and sedges.

In the context of these comments, it is important to clarify the relevant information that is available regarding some of the research undertaken in the Hunter Valley and NSW regarding the rehabilitation of mine sites. While it is acknowledged that there is limited published research on rehabilitation of mine sites to woodland communities in the Hunter Valley, there is an extensive body of unpublished work; much of which has focussed on rehabilitation undertaken at Mount Owen and other Glencore sites. This research is further discussed in **Section 5.1.1.3. Appendix 3** contains a synopsis of some of the most relevant research into rehabilitation, which has been, and continues to be undertaken at Mount Owen.

The rehabilitation at Mount Owen, also known as the Ravensworth State Forest Vegetation Complex, was listed as a “highly commended” site on the Global Restoration Network of the Society for Ecosystem Restoration in 2009.

Additionally, rehabilitation objectives need to be understood in the context of the nature of vegetation communities in the Hunter Valley and the long history of vegetation disturbance associated with various land uses in the Hunter Valley which has contributed to the current composition and structure of these vegetation communities.

The following sections contain further background information regarding the matters which are relevant to some of the comments made by the PAC and the recommendations regarding rehabilitation and final landforms.

5.1.1 History of Vegetation Communities around Mount Owen

The following section provides some background to the native vegetation communities present in the Project Area, and surrounding area, and particularly the Ravensworth State Forest. The re-creation of these communities is the focus of rehabilitation efforts at Mount Owen. The Project includes a commitment to re-creating woodland communities in the Proposed Disturbance Area the Mount Owen and Ravensworth East mining areas in locations which will improve habitat connectivity in the post mining landscape. Grassland communities will also be established in areas of the rehabilitated landform that are considered to be more suitable for grazing. The purpose of this section is to identify the ecological features which need to be considered in both the establishment and development of the woodland communities to be re-created in the post mining land form and the setting of appropriate performance criteria.

The key ecological communities present within the Project Area and the existing and proposed Offset Areas in the immediate surrounds are identified in the Ecological Assessment for the Project. The key communities are:

- Central Hunter Ironbark – Spotted Gum – Grey Box Forest and associated derived native grassland (DNG)
- Central Hunter Grey Box – Ironbark Woodland and DNG (Primarily to the South of Mount Owen)
- Barrington Foothills Dry Spotted Gum Forest (primarily located to the North of Mount Owen)
- Central Hunter Swamp Oak Forest (along creek lines and in alluvial areas such as Main Creek and Betty Creek)
- Hunter Lowland Red Gum Forest (primarily along creek lines)

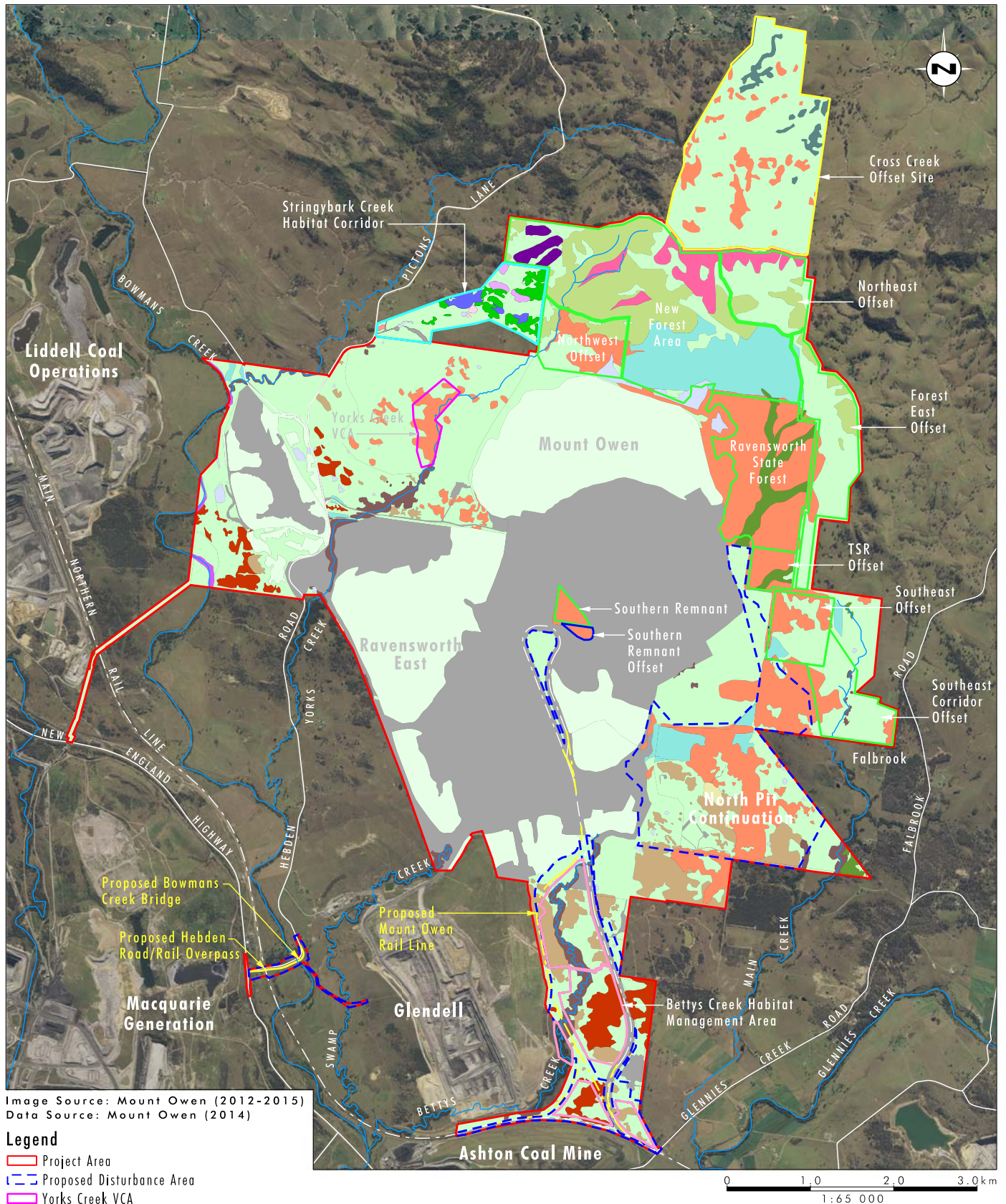
The following communities are also found in the locality:

- Hunter Valley River Oak Forest
- River Flat Eucalypt Forest
- Dry Rainforest (primarily in sheltered south-facing gullies and slopes north of Mount Owen)

Section 4.1.3 of the Ecological Assessment contains detailed descriptions of the vegetation impacted by the Project.

A kunzea shrubland was also mapped as occurring in the Proposed Disturbance Area however, as is noted in the Ecological Assessment, this community is the result of past disturbance and is not identified as being a key native vegetation community present in the Hunter Valley (Peake, 2006).

Figure 5.1 shows the vegetation communities mapped as currently occurring in the Project area and proposed offset areas.



Appendix 4 contains extracts the structure and florist details of the key communities from *The Vegetation of the Central Hunter Valley, NSW*, (Peake, 2006). As noted in Section 5.19.6 of the EIS and Section 7.6 of the Ecological Assessment, the key rehabilitation objective for the Project is to return the site to woodland and grassland communities generally consistent with the key vegetation communities impacted by the Project and present in adjacent Ravensworth State Forest.

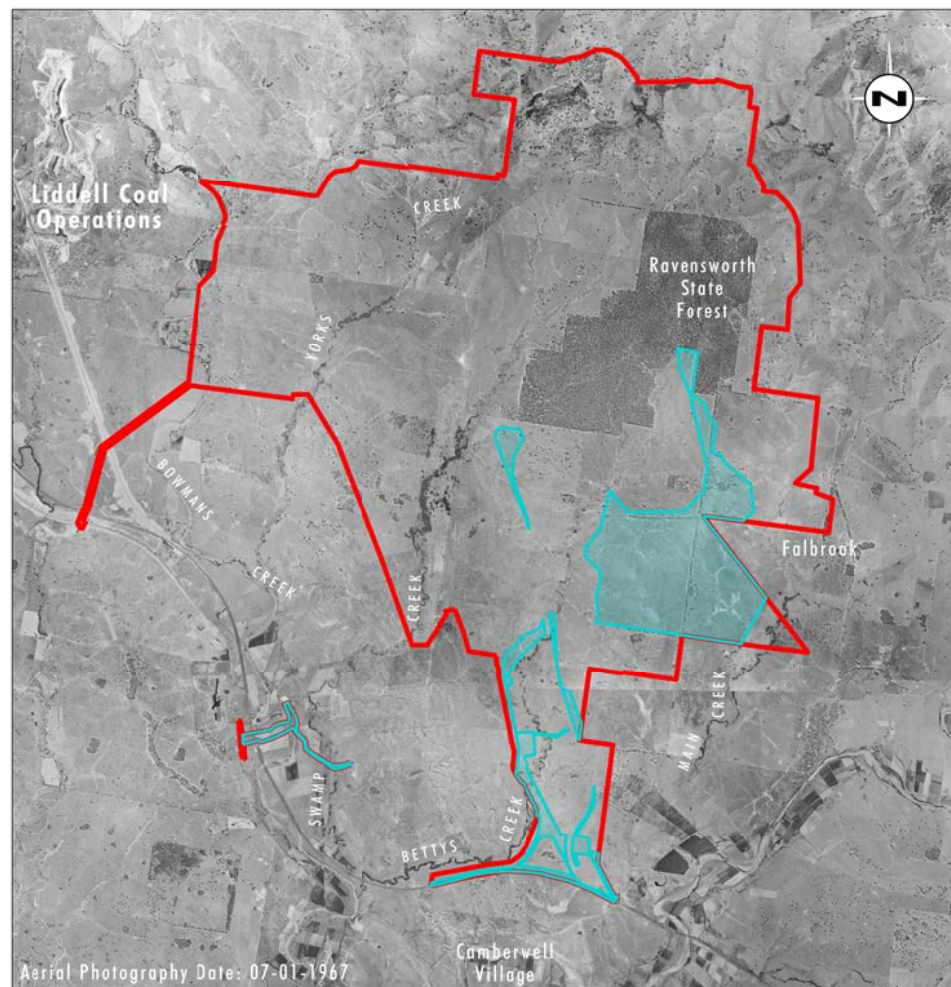
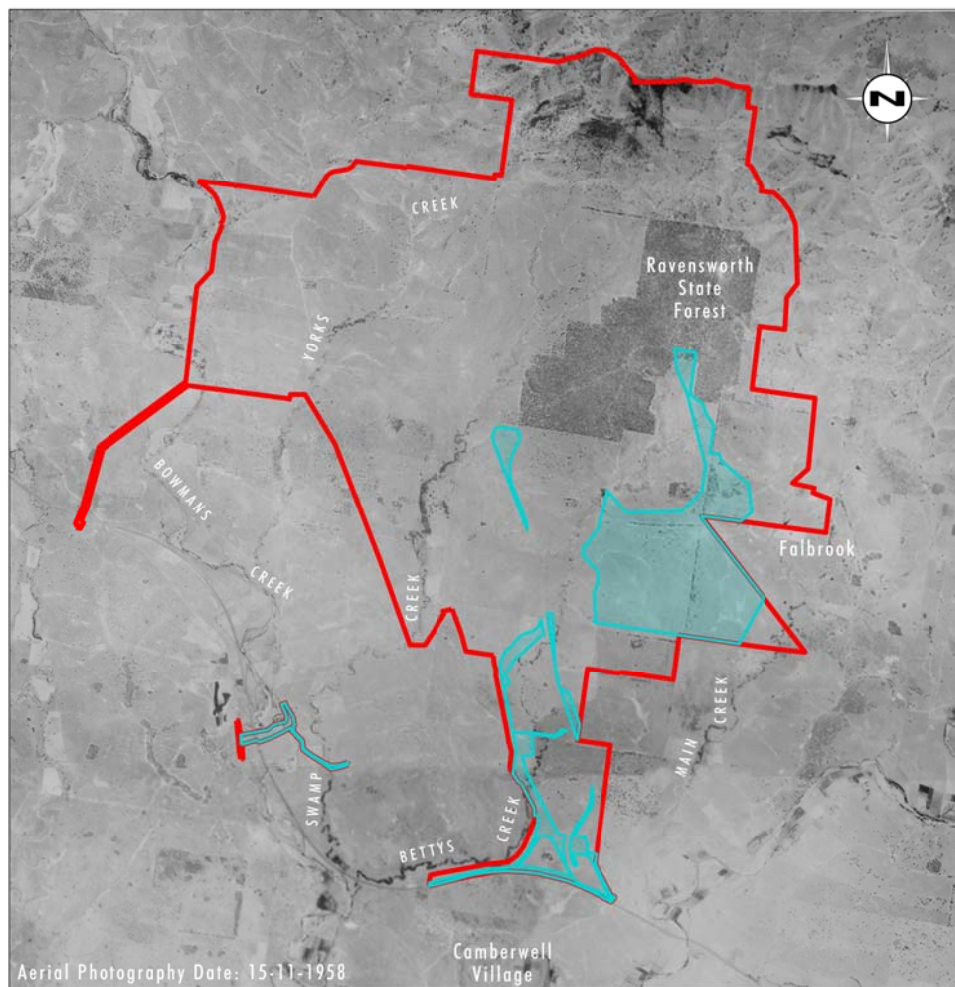
It is noted that these descriptions in **Appendix 4** relate to mature examples of these communities but they also provide a summary of the variation within these communities.

As noted in the Ecological Assessment, all of the woodland vegetation to be disturbed by the Project is regrowth. Indeed, as noted in Peake (2006) almost all of the remnant vegetation present in the Hunter Valley was, at one time, cleared post European settlement, this includes some of the larger remnant areas such as Ravensworth State Forest. Bell and Russell (1993) estimated that as much as 99 per cent of the native vegetation of the Hunter Valley Floor had been removed or altered at one time. The consequence of this is that the vegetation communities that can be observed in the Hunter Valley today are almost certainly different to those which were present pre-European Settlement. As discussed in Peake (2006), prior to European Settlement, much of the lower valley floor, particularly the alluvial areas, is thought to have been open woodland with relatively low stem densities. Vegetation on the poorer quality soils away from the more fertile river flats were more heavily forested (Benson and Redpath, 1997, see also discussion in Peake 2006). The structure and floristic composition of the pre-European vegetation in the Hunter Valley was almost certainly influenced by Aboriginal burning regimes with a number of early accounts indicating that Aboriginal people burnt vast areas of the Upper Hunter Valley, particularly woodland and open forests with grassy floors (Brayshaw 1996).

Post European Settlement, agriculture has had the greatest impact on the structure and floristics of vegetation in the Hunter Valley with the better quality alluvial areas cleared, cultivated, irrigated and grazed. The slopes were also cleared to 'improve' pasture for grazing animals (Peake 2006). The effect of this is that there is little remnant vegetation remaining in alluvial areas and the soils on the slopes have been heavily eroded through exposure of soil and the effects of stock grazing. The effect of the soil degradation on the slopes has been to reduce the grazing value of the land and the lower returns from this land have seen previously cleared areas return to woodland. This can be seen in the aerial photographs of the area around Mount Owen in **Figures 5.2a to 5.2b** which show that in 1958, only the Ravensworth State Forest area and creek lines were vegetated. As can be seen from the aerial photos, the vegetation to the south-east of the Project Area, including the vegetation in the Proposed Disturbance area was all cleared in 1958 and has regenerated to woodland, or was in the process of reverting to woodland, over the past 60 years with the biggest improvements having occurred since 1983. **Figure 5.2c** shows the progression of revegetation to the east and south-east of the Project area since 2002, much of which has been facilitated by either direct replanting activities by Mount Owen or changed management practices to improve natural regeneration.

While it is not clear whether Ravensworth State Forest was fully cleared following European settlement, the structure and floristics of the vegetation in Ravensworth State Forest has been heavily impacted by both logging and changed fire regimes post European settlement.

As shown in **Figures 5.2a to 5.2c**, there is strong evidence that land cleared for and impacted by agriculture will naturally regenerate to woodland communities which are likely to broadly resemble the woodland communities which occurred there prior to disturbance. The evidence to date indicates that rehabilitation of disturbed areas to woodland communities similar to those found elsewhere in the Hunter Valley is achievable. This is discussed further in **Section 5.1.2.3** and **Appendix 5**.



Note: Mining commenced in the Project Area in the late 1960s

Legend

- Project Area
- Proposed Disturbance Area

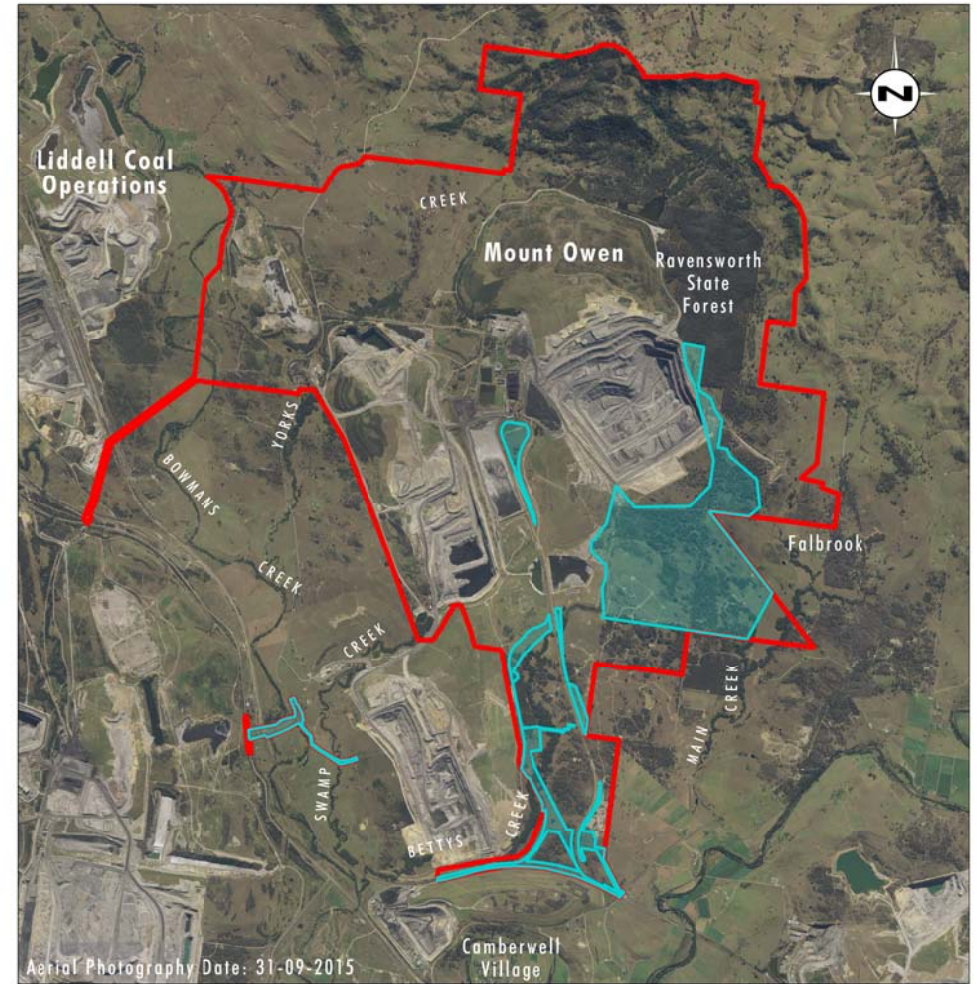
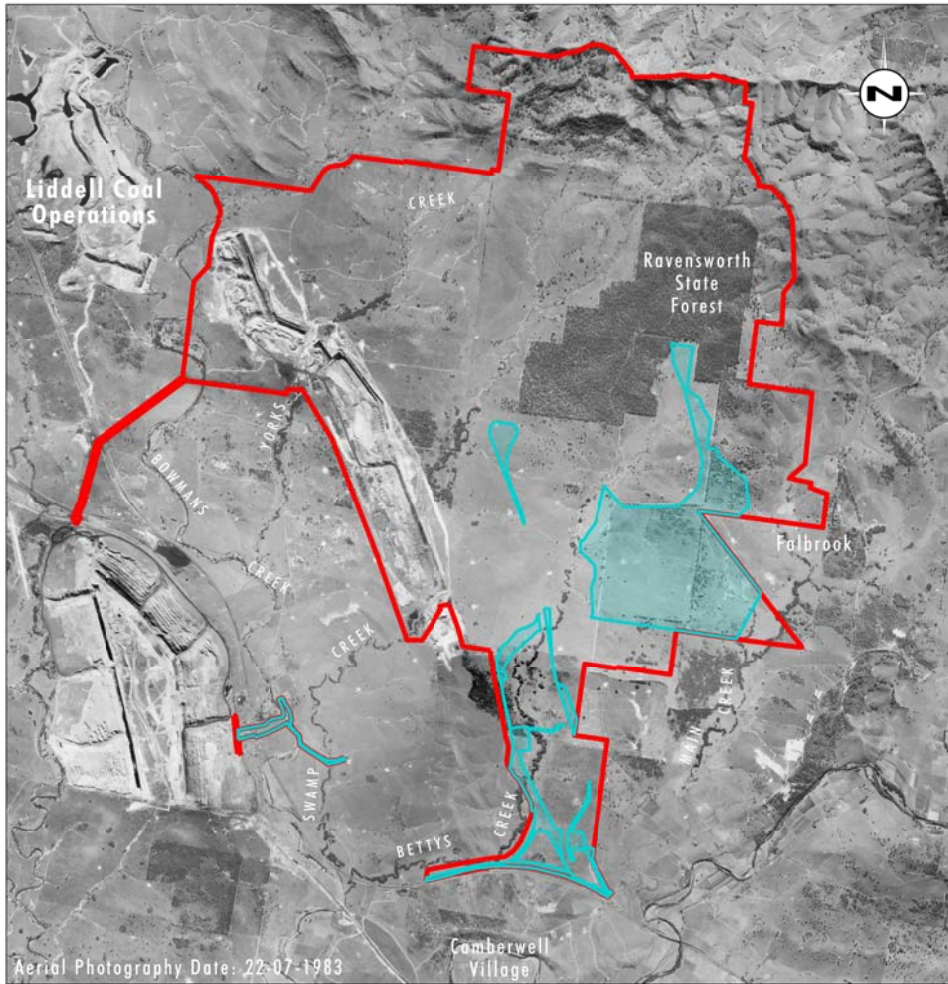
0 1.0 2.5 5.0 km
1:100 000

Image Source: Land and Property Information (1958, 1967)

File Name (A4): R20/3109_1112.dgn
20160502 16.47

FIGURE 5.2a

Mount Owen Aerial Photographs
1958 and 1967



Legend

- Project Area
- Proposed Disturbance Area

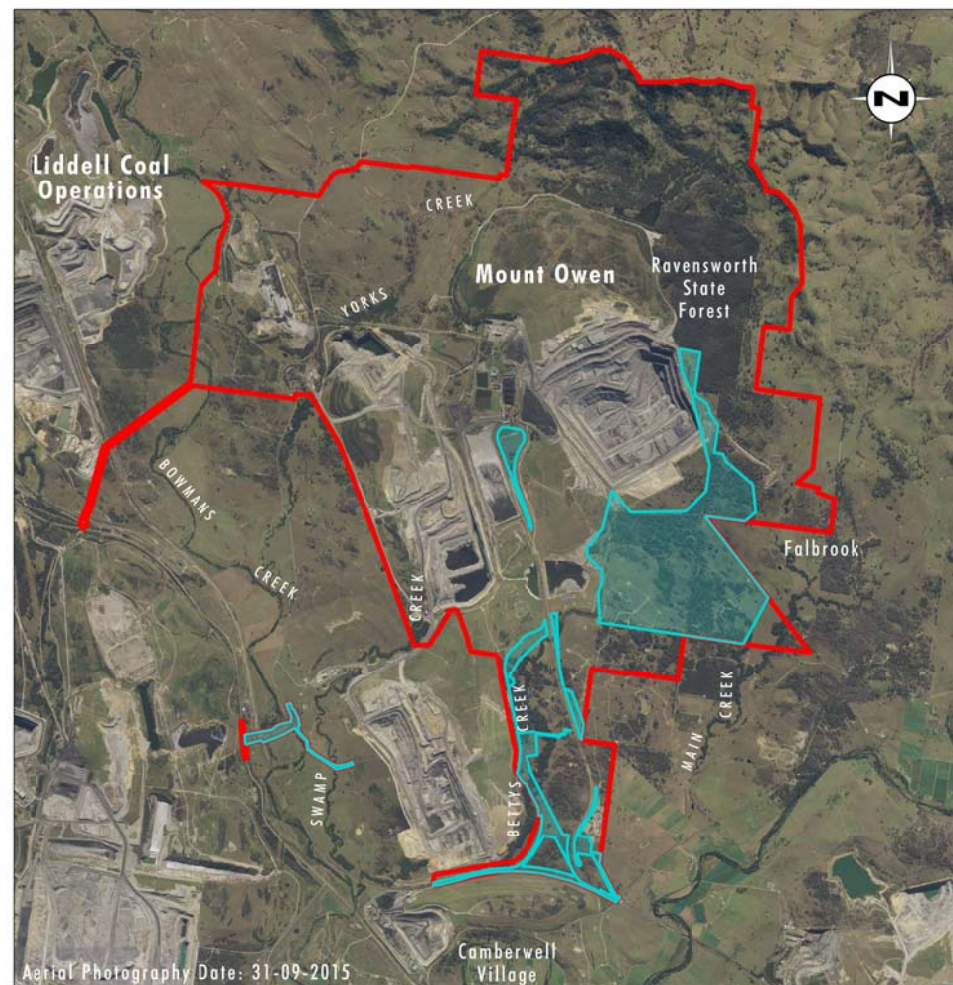
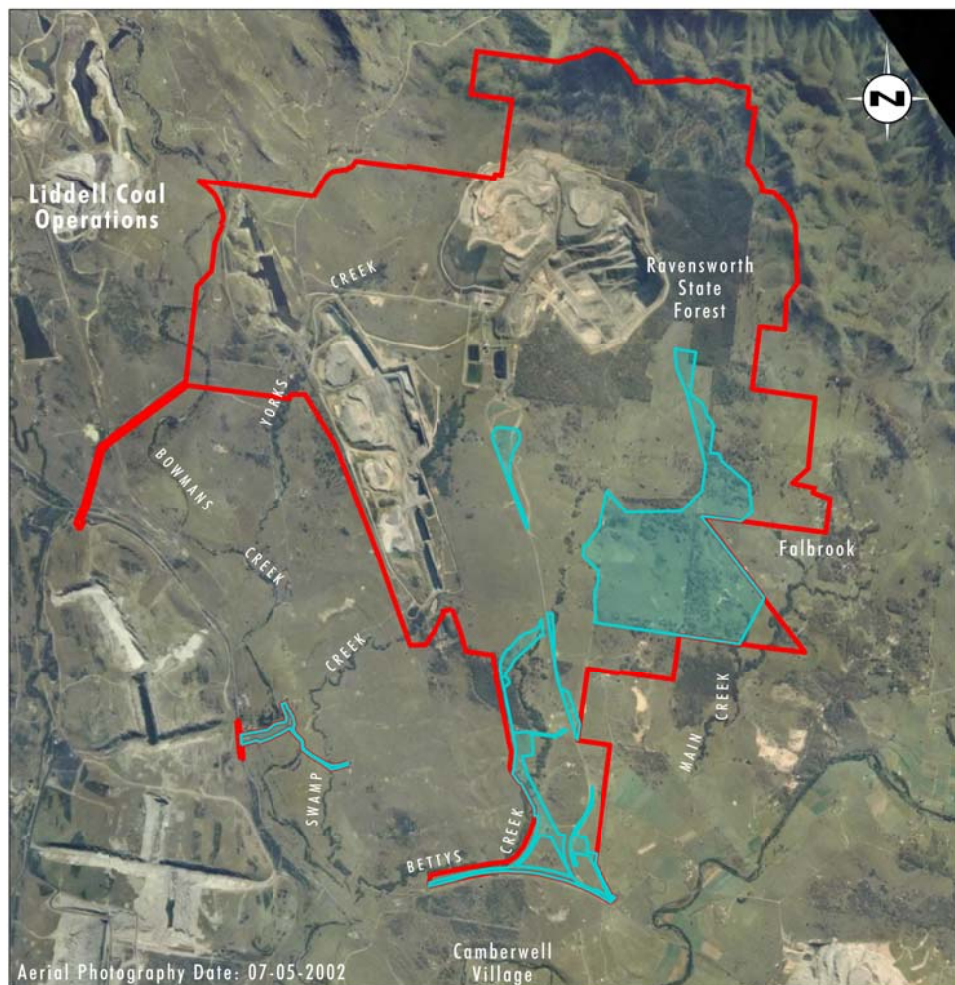
0 1.0 2.5 5.0km
1:100 000

Image Source: Land and Property Information (1983), Mount Owen (2015)

File Name (A4): R20/3109_1113.dgn
20160503 9.27

FIGURE 5.2b

Mount Owen Aerial Photographs
1983 and 2015



Legend

- Project Area
- Proposed Disturbance Area

0 1.0 2.5 5.0km
1:100 000

Image Source: Land and Property Information (2002), Mount Owen (2015)

File Name (A4): R20/3109_1114.dgn
20160503 9.30

FIGURE 5.2c
Mount Owen Aerial Photographs
2002 and 2015

Based on the above discussion of communities and land use history, several key issues need to be considered in the assessment of the Biodiversity Offset Strategy proposed for the Project:

- The natural communities seen in the Hunter Valley today, including Ravensworth State Forest, are unlikely to be the same as those that existed pre-European settlement. There are very few examples of old trees present in remnant vegetation and stem densities are likely to be higher than existed pre-European settlement, largely as a result of regrowth from land previously cleared for farming.
- Fire regimes in the Hunter Valley are likely to have changed significantly over the past 220 years of settlement in the Hunter Valley. Remnant areas are rarely burned and this will have an impact on species composition, particularly in the shrub and ground layer.
- The shrub layer in the Central Hunter Ironbark – Spotted Gum – Grey Box Forest community can range from being sparse or absent to moderately dense but is typically reasonably sparse (typically 5-10 per cent cover). Ground cover can also range from being sparse to moderately dense (40-60 per cent) and consists of numerous forbs; fewer grass species and a limited number of ferns, sedges or other herbs (Peake 2006).
- The soils present in cleared areas on the slopes and areas that have regenerated over the past 30-50 years are highly degraded through erosion and compaction from hooved animals.
- Notwithstanding the degraded nature of the soils, cleared areas will naturally regenerate back to woodland communities likely to broadly resemble the pre-disturbance communities. The structure and floristics of these communities will vary depending on the seed bank within the soils and proximity to remnant vegetation (and the quality of that vegetation). All of the woodland vegetation within the Proposed Disturbance Area has regenerated from cleared agricultural land over the past 50 years to a level where it conforms to the EEC listing for the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC under the TSC Act. Similar recovery can be expected in other cleared areas with the removal of grazing and management of invasive weed species.
- There is little research or documentation of the succession of vegetation communities in the Hunter Valley.

5.1.1.1 Project Commitments

Section 5.19.6 of the EIS details the rehabilitation objectives and post mining land use design for the Project. These commitments also apply to the Refined Project, however the regeneration and revegetation commitments regarding the offset areas have been further clarified in **Section 4.2**. As detailed in Section 5.19.6 of the EIS, the commitment to rehabilitate areas disturbed by mining activities back to woodland communities will focus on the re-establishment of Central Hunter Ironbark – Spotted Gum – Grey Box Forest and, in selected areas, grassland for grazing. The rehabilitation strategy will also include the establishment of other communities in appropriate parts of the terrain such as Hunter Lowland Red Gum Forest, primarily along drainage lines and potentially areas of dry rainforest or wetter variants of Central Hunter Ironbark – Spotted Gum – Grey Box Forest with dry rainforest species in more sheltered areas of the final landform.

5.1.1.2 Consideration of Succession Pathways

As discussed in the Response to Submissions to PAC Report (Umwelt 2016a), both the regeneration of grazing land and the rehabilitation of areas disturbed by mining should have regard to the natural succession pathways of the communities being established. Succession is the ecological process of ecological communities moving from one state to another. This may involve the recovery of a community from an impact (such as fire or a major storm event) to the natural evolution from one community type to another over time as a result of changes in external forces (such as changes in fire regimes or climate change). Unfortunately, there is little published research regarding the succession pathways in vegetation communities in the Hunter Valley, either from disturbed environments such as mine sites, derived grassland communities resulting from agricultural clearing or even from one community to another as a result of changes in fire patterns. Despite the lack of published research, there is no reason to suspect that the succession pathway for these communities differs significantly from other eucalypt woodland communities in eastern Australia. **Figure 5.3** (adapted from research by Connell & Slatyer, 1977 and Wikipedia Contributor, 2016) graphically illustrate the succession pathway that would be expected for a eucalypt woodland recovering from a major disturbing event. During the early stages of recovery from a disturbance, ground storey species (forbs and grasses) initially flourish however these are replaced by fast growing pioneer species such as acacias which typically dominate the mid strata and canopy in the early to mid stages of recovery. These acacias typically have soil biota relationships which increase soil nutrient levels, particularly nitrogen (refer to **Appendix 5**). During this mid stage, it is not uncommon for there to be low densities of shrubs and ground layer species. The acacia species typically die back and thin out within 5 to 15 years, depending on the species, with some lasting for several decades. The decline of these species increase soil carbon levels and returns nutrients to the soils. As the pioneer species thin out, other canopy species, such as the eucalypts, grow, increase in dominance and occupy a greater percentage of canopy. The existence of the pioneer species during the early years of canopy species growth also encourages the eucalypt and other canopy species to grow in height.

As illustrated in **Figure 5.3**, in rehabilitated areas (and heavily disturbed environments), until pioneer species have started to die back, there is little light available in the lower storeys and typically a consequential low species richness in ground and shrub layers; as the pioneer species die out and canopy height increases, an increased species richness can be expected to develop in the understory. Ultimately however, the abundance of grasses and shrubs in established communities will depend on the community and other disturbance facts such as fire prevalence. As noted in **Section 5.1.1**, the shrub layer in the Central Hunter Ironbark – Spotted Gum – Grey Box Forest community can range from being sparse or absent to moderately dense but is typically reasonably sparse and ground cover can also range from being sparse to moderately dense (Peake 2006).

As shown in **Figure 5.3**, the floristic and structural composition of the vegetation changes over the course of the succession process with grasses and pioneer species such as acacias initially dominating and then declining in abundance as canopy species increase in dominance and obtain a competitive advantage in terms of access to light and nutrients. The early succession stages (dominated by grasses and shrubs) help establish the soil structure, healthy soil biota, nutrient levels through soil biota relationships and organic matter levels necessary for the canopy species to establish and survive. These early succession processes are particularly important in primary succession (e.g. rehabilitation of disturbed overburden spoil) where there is likely to be little organic material or soil biota present in the growing medium and nutrients may be in a form which is unable to be easily accessed by plants. In secondary succession environments (e.g. recovery from fire or clearing), many of the key ingredients for successful establishment of canopy species may already be present however early stage succession species still play an important role in the recovery of these communities through erosion control, improved water filtration, soil aeration, nutrient cycling, improving organic matter levels and providing protection to canopy species from predation during their juvenile stages. These lower canopy height but relatively species rich and dense floristic environments also provide habitat for pioneer fauna species. As shown in **Figure 5.3**, early stages of succession have high

species richness, sometimes greater than that present in the mature communities. The primary reason for this is the increased abundance of short lived but fast growing species and a corresponding increase in pioneer fauna species such as ants and other insects, small mammals and birds which feed on the fruits and often softer leaves of the pioneer species. There can also a corresponding, but delayed) increase in predator fauna species which increase in numbers in response to the increased food source in these early successional phases. Many of the fauna and flora species which are abundant in early successional phases are less abundant or even absent in mature communities.

5.1.1.3 Rehabilitation Research at Mount Owen

Research into rehabilitation techniques and processes has been undertaken at Mount Owen Mine since 1996, initially through The University of Newcastle and now *CSEER RESEARCH*. Four key themes are present in this research, relating to sustainable rehabilitation issues important for the mine to achieve its consent conditions and relinquishment. The four themes are:

- Sustainable Plant Nutrition
- Topsoil Substitutes
- Reconstructing Soil Function
- Diversification and Success of Rehabilitation Areas

This research (some of these results of which are detailed in *Establishment of Native Vegetation* (Nussbaumer, Castor & Cole, 2012) available at <http://hdl.handle.net/1959.13/937756>) has focussed on the establishment and development of growing mediums which are capable of maintaining woodland communities with little or no external management inputs. A key focus of this research has been soil biota and its role in nutrient cycling. A synopsis of the work undertaken to date and its progress is set out in **Appendix 3**.

This research is supplemented by the regular flora and fauna monitoring undertaken at Mount Owen, the results of which were discussed in detail in Appendix B of the Response to Submissions to PAC Report (Umwelt 2016). As discussed in Appendix B of the Response to Submissions to PAC Report, the current ecological structure of the rehabilitated land is consistent with what would be expected in a disturbed landscape transitioning back to woodland. The research has identified soil biota and species relationships present in Ravensworth State Forest and has also demonstrated that these soil biota and vegetation relationships have been successfully re-established in the Mount Owen rehabilitation areas, particularly where topsoil from areas of forest disturbed by earlier mining as used in the rehabilitation. **Appendix 5** provides a summary of species present in RSF and rehabilitated areas and their relationships with soil biota and their roles in ecosystem health. The research also indicates that successful soil biota can be established in rehabilitated areas where topsoil from forest areas is not available through inoculation of seeds and other processes. The research has demonstrated that these soil biota and vegetation communities can be established with little or no fertiliser inputs. While there is only limited research into the natural succession processes which occur in vegetation communities in the Hunter Valley, the research being undertaken has created a much clearer understanding of the nutrient cycling processes that occur in these communities and the roles different species play in this process. The rehabilitation processes at Mount Owen has evolved over the past two decades to include learnings from this research and the observed succession pathways in the rehabilitation at Mount Owen is, in turn, shedding additional light on the natural succession pathways which occur in the natural communities and the regeneration of grassland communities to woodland communities.

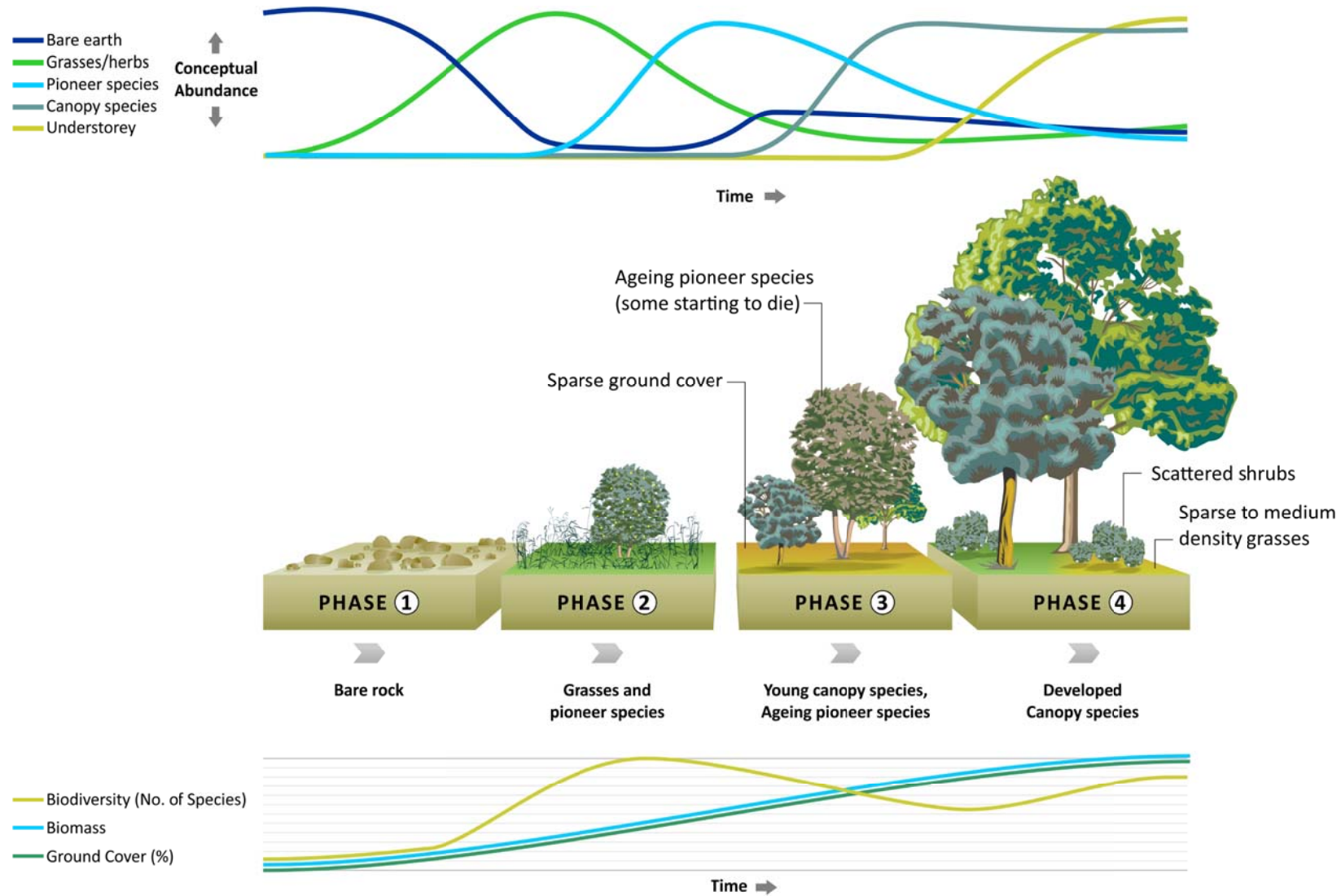


FIGURE 5.3

Succession Process in
Open Forest with
Scattered Understorey

5.1.2 Regulation of Rehabilitation and Detailed Mine Planning

Rehabilitation of mine sites is regulated by both the development consent issued under the EP&A Act and the Mining Operations Plan (MOP) required under the terms of the Mining Leases. The development consent sets the rehabilitation outcomes or objectives while the MOP, which is reviewed at least every seven years, provides details regarding the monitoring and managing of rehabilitation towards the rehabilitation objectives identified in the development consent.

The MOP must be prepared in accordance with guidelines developed by DRE. The guidelines require that the MOP identifies rehabilitation objectives which are specific, measurable and demonstrate that proposed outcomes are achievable and realistic within a given timeframe. The MOP must identify the rehabilitation activities that will be undertaken during the term of the MOP and identify measurable performance indicators and completion/relinquishment criteria for each of the key stages of rehabilitation (Active Mining, Decommissioning, Growth Medium Development, Landform Establishment, Ecosystem and Land use Establishment Ecosystem and Land use Sustainability and Relinquished Lands). The MOP must also identify hazards or threats to achieving the rehabilitation objectives and include trigger action response plans (TARPs) which set out contingency strategies to be implemented in the event that nominated completion criteria aren't achieved. MOPs are reviewed by DRE and must be approved before works can be undertaken under the mining lease. Security held by DRE is linked to the rehabilitation set out in the MOP.

Mine sites are required to report against compliance with the MOP and progress against criteria in the Annual Environmental Management Report (AEMR)/ Annual Review required under the development consent and Mining Leases.

As discussed in Section 2.3.5 of the EIS and **Section 2.1**, the stage plans showing the development of the mine (refer to **Figures 2.1 to 2.4**) are conceptual only and represent the most likely staging of the development based on current plans. The actual development of the mine within the defined mining and disturbance footprint is subject to a range of factors that may affect the progression of mining development (e.g. geological constraints, weather, commodity prices, equipment breakdowns etc.). The approved MOP will include detailed mine plans covering the term of the MOP (up to seven years) which must be adhered to; these plans must be consistent with the overall project approved.

The regulatory interplay between the development consent (which defines the overall project and approved mining and disturbance area footprints, rehabilitation commitments etc.) and the MOP (which contains the detailed mine plan for the term of the MOP as well as proposed rehabilitation works to be undertaken during the term of the MOP) provides a flexible regulatory framework which has regard to the dynamic nature of mining whilst also providing sufficient detail to ensure the mine is developed in an appropriate manner to realise the optimal value from the resources for the State. The progressive approval of MOPs over the life of a project also ensures rehabilitation commitments are implemented in a timely and realistic manner. This regular review of MOPs also enables rehabilitation techniques and performance criteria to be updated (and approved) as further knowledge regarding the constraints and opportunities for rehabilitation of the site is obtained.

5.2 PAC Final Landform Recommendations

10. *That, prior to determination, the Department clarifies the number of currently approved final voids and seeks further justification from the Applicant for any additional proposed final voids.*

The existing development consents applicable to the Project Area (DA 14-1-2004 (Mount Owen Consent) and DA 52-03-99 (The Ravensworth East Consent)) contemplate two final voids remaining in the final landform in the Project Area. The Project design described and assessed in the EIS had allowed for three final voids, two in Ravensworth East and one in Mount Owen.

However, the refined Project proposes two final voids (with the removal of the RERR mining area) in line with the existing development consent and these voids are associated with the Mount Owen North Pit and the BNP. As discussed in **Section 1.3.2**, the recently approved Modification 6 of the Ravensworth Consent has approved the filling of the West Pit void in the Ravensworth East consent area with tailings from both Mount Owen and other Glencore operations.

12. *That, prior to determination, the Applicant provides a revised mine plan that:*

- *includes more detailed consideration of the potential minimisation of final voids, with particular reference to the large volumes of overburden material that would be moved over the life of the project;*
- *provides more detail about the final void shapes and how these are to be achieved;*
- *incorporates micro-relief, with a focus on ensuring that the final landform will be more sympathetic to the surrounding landscape; and*
- *includes a more refined composition of proposed vegetation within the rehabilitated areas in order to ensure a diversity of species and appropriate fauna habitat.*

Void Minimisation

As discussed in **Section 2.1**, the mine plan has been revised to address this recommendation. The proposed final landform will now result in only two final voids, one in the southern area of the North Pit Continuation, and one in the BNP in the north of the Ravensworth East Mine.

Table 5.1 compares the existing approved voids with the voids proposed in the EIS and the voids now proposed as part of the Refined Project.

Table 5.1 Currently Approved and Proposed Final Voids (Mount Owen and Ravensworth East)

	Currently Approved		EIS Project		Refined Project	
	Void Catchment (approx. ha)	Pit Lake Area (Max) (approx. ha)	Void Catchment (approx. ha)	Pit Lake Area (Max) (approx. ha)	Void Catchment (approx. ha)	Pit Lake Area (Max) (approx. ha)
North Pit	130	44	240	88	240	87
Bayswater North Pit	33	2	33	2	60 [#]	8
RERR Mining Area	0	0	39	11	N/A	N/A

[#]Increase in Void Area of BNP is associated with additional battering to improve landform.

Final Void Shape and Micro-relief

The option of battering the upper bench of the North Pit Void (refer to Part 7 of the Response to Agencies Report) has been incorporated into the final landform (refer to **Figure 5.4**). The North Pit Continuation void high-walls will be stabilised following the cessation of mining. The upper bench of the western highwall (facing east) of the North Pit Void will be battered back to stable slopes of approximately 18 degrees. The upper bench of the southern highwall (facing north) will be battered back to between 18 and 25 degrees depending on constraints imposed by the mining lease boundary. This will remove a section of the highwall which was potentially visible (at a distance of approximately 3.5 kilometres) from the intersection of Glennies Creek Road and Middle Falbrook Road. In addition, this reshaping will improve the geotechnical stability of the material in the upper weathered zone and will reduce the potential for further deterioration of the upper section of the highwall post mining, improving the safety of this feature into the future.

Lower sections of the highwall will remain as cliffs with the benches replanted to woodland. The southern and western facing in-pit overburden slopes and low walls will be shaped to approximately 18 degrees and replanted to woodland. A pit lake will form in the bottom of the void as the result of groundwater inflows and surface water run-off. As discussed further in **Section 10.4**, the level of the pit lake will progressively rise over an extended period and modelling indicates that the pit lake level will reach a maximum height of 20 metres AHD approximately 200 years post closure. Transects A and B in **Figure 5.5** show the cross sections of the terrain through the retained highwall and the battered upper sections of the western and southern highwall. The location of these transects are shown in **Figure 5.4**.

As discussed in **Section 2.1.1**, it is proposed that on completion of mining in the North Pit Continuation, the BNP void will be decommissioned as an operational water storage (or tailings facility) with in-pit overburden batter angles flattened and high-walls stabilised. Slopes will be rehabilitated to woodland. The level of the pit lake in the BNP void will progressively rise over an extended period and modelling indicates that the pit lake level will reach a maximum height of 10 metres AHD approximately 100 years post closure. The size of the BNP pit lake is larger than that contemplated in the EIS Project design due to the additional battering now proposed around the void. The maximum pit lake level is also lower due to the evaporation associated with the larger surface area. Under the smaller void area design contained in the EIS Project design, the BNP was predicted to act as a groundwater sink until the water level in that pit exceeded 37 metres AHD, above which point water movement was predicted to move back into the hard rock aquifers via the coal seam. The BNP void proposed as part of the Refined Project is now predicted to operate as a permanent hydraulic sink and will not reach a pit lake level where water will move from the pit lake back into hard rock aquifers, post the cessation of mining. This is discussed further in **Section 10.4**. Transect C in **Figure 5.5** shows an east-west cross section through the BNP final void.

The West Pit tailings emplacement area will be capped and rehabilitated as grassland. As shown in **Figure 5.4** micro-relief features will be incorporated into the rehabilitation of the North Pit overburden emplacement area, West Pit emplacement area and rehabilitation of the TP1 and TP2 mining areas. Transect B in **Figure 5.5** shows a cross section through part of the capped West Pit and indicative micro-relief features to be developed in the terrain to the north of the capped tailings facility.

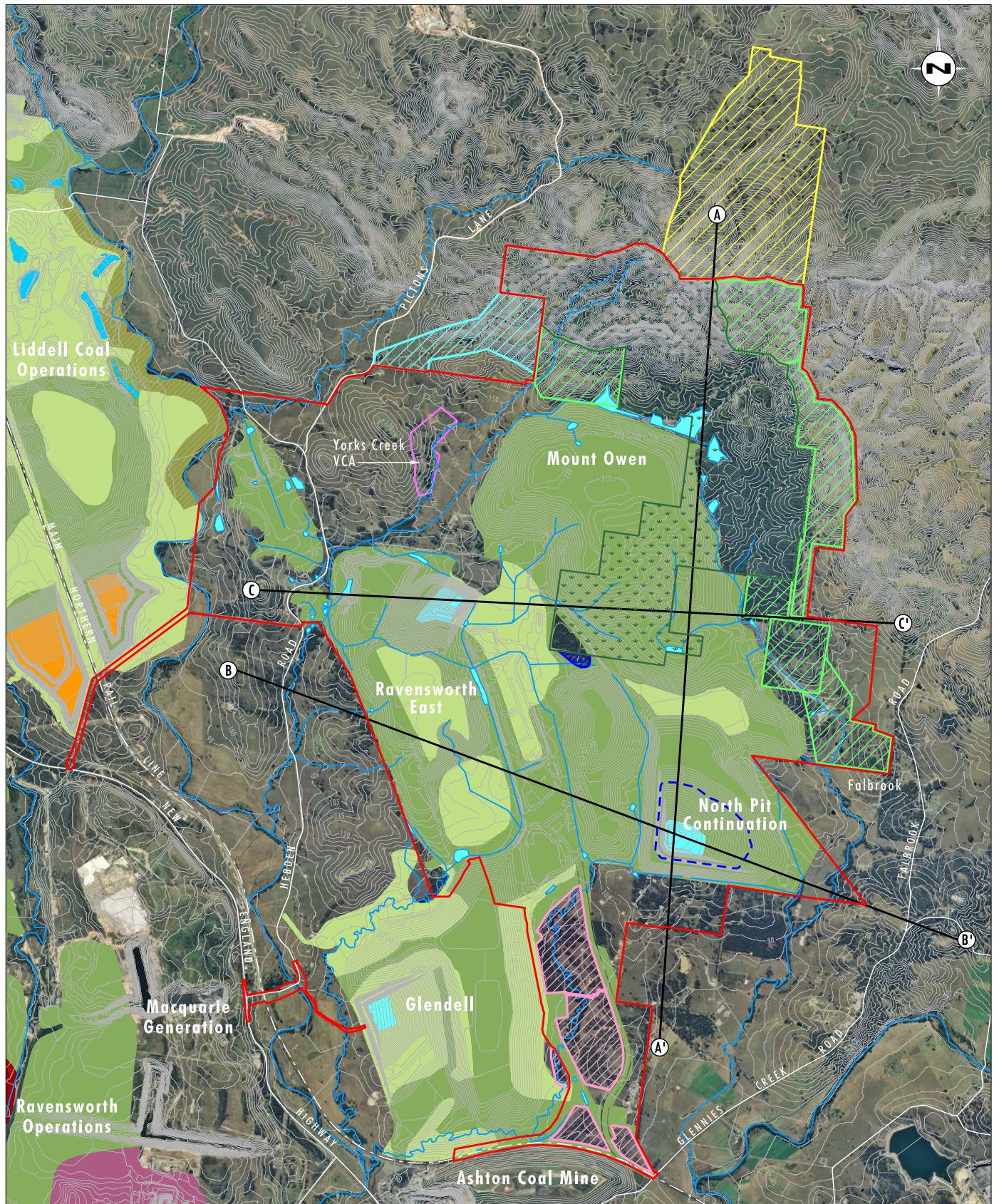


Image Source: Mount Owen (2012-2013)

Data Source: Mount Owen (2014), Ravensworth Operation Vegetation: Umwelt (2010),

Liddell Coal Operations Vegetation: Umwelt (2016)

Note: Contour Interval 5m(AHD)

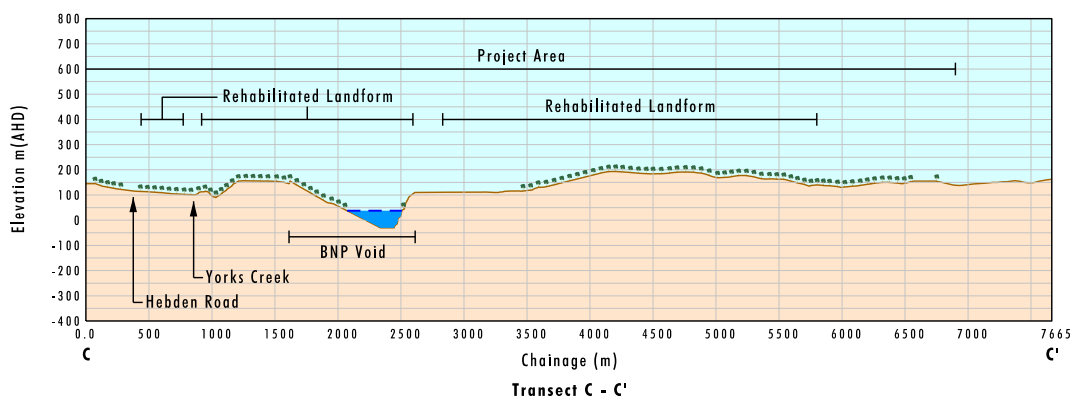
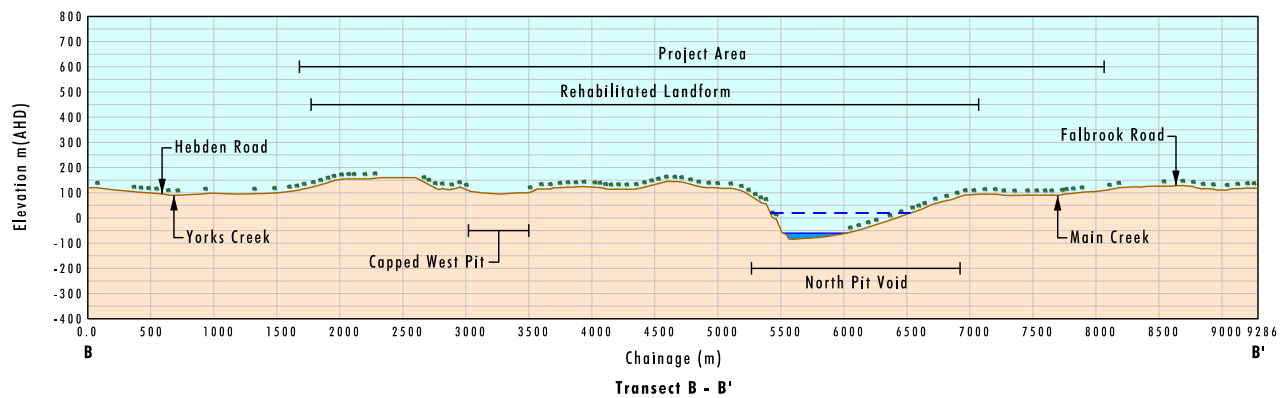
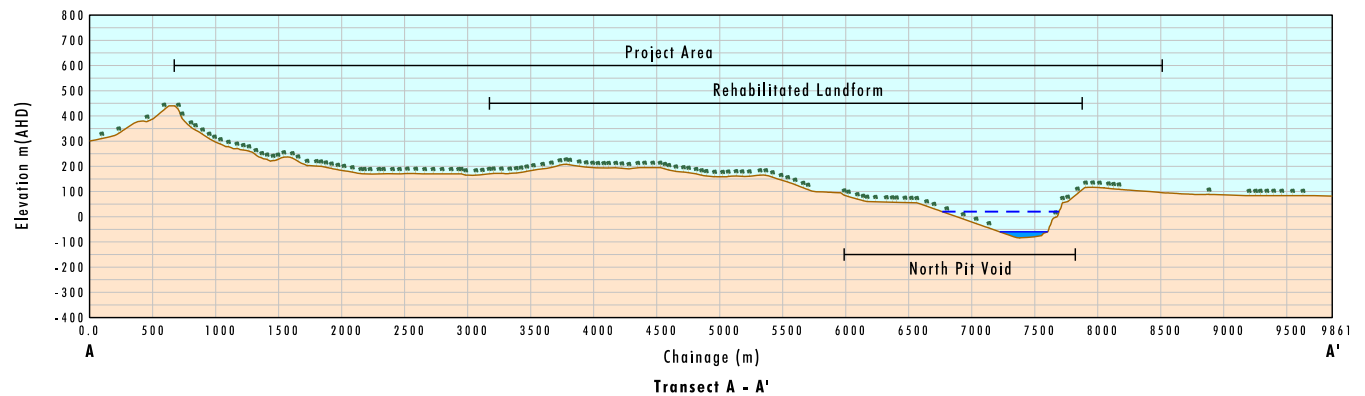
Legend

- | | | |
|--|---|--|
| Project Area | Ravensworth State Forest | Stringybark Creek Habitat Corridor |
| Yorks Creek VCA | Proposed Corridor Habitat Enhancement on Non-Mined land (Liddell Coal Operations) | Grazing |
| Pit Lake | Existing Biodiversity Offset Area | Riparian / Wetland |
| Native Woodland | Proposed Cross Creek Biodiversity Offset Area | Maximum Pit Lake Water Level |
| Open Grassland (Potential grazing areas) with pockets of Native Vegetation | Bettys Creek Habitat Management Area | Drainage Line |
| Grassland for Stabilisation (Liddell) | Southern Remnant Biodiversity Offset Area | Section Line |

File Name (A4): R20/3109_1100.dgn
20160527 11.15

FIGURE 5.4

**Mount Owen Continued
Operations Project Conceptual
Final Landform**



Legend

- Final Landform Surface
- Maximum Pit Lake Water Level
- Pit Lake
- Woodland

Note: Vertical Exaggeration 2:1

File Name (A4): R20/3109_1102.dgn
20160520 10.08

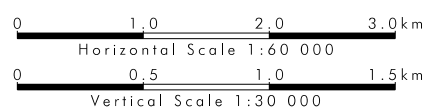


FIGURE 5.5
Final Landform
Cross Sections

As discussed in the EIS, areas of the final landform progressively developed through the life of the Project will incorporate micro-relief features. The process of designing the micro-relief landform features and incorporating them into the rehabilitated landform is closely linked to the detailed mine planning process. The conceptual mine plans shown in **Figures 2.4** and **5.4** provide the commitment to achieving micro-relief in the final landform developed through the life of the Project. Transects A, B and C in **Figure 5.5** provide indicative cross sections showing these micro-relief features. Due to the need to develop the micro-relief features around discrete catchment areas, the detailed design and incorporation of the micro-relief features in the landform is heavily dependent upon mine development. The actual elevation and size of overburden emplacements at the scale that can influence detailed micro-relief designs can alter in practice due to such variables as overburden swell factor, changes to detailed mine plan sequencing due to marketing requirements, the performance of different plant and equipment and operational constraints from weather conditions. Based on learning's from Glencore's Mangoola project, the successful implementation of micro-relief in rehabilitated landforms is best achieved by developing the detailed design of the micro-relief features progressively as part of the detailed mine planning process undertaken for each mining sequence. It is important however to incorporate the conceptual final landform designs into the bulk overburden emplacement designs to ensure sustainable final design outcomes can be achieved. The details of the micro-relief features are then identified in the MOP approved by DRE and are implemented in accordance with those plans.

Void Vegetation Species Mix

The highwall benches and void slopes will be planted to open woodland vegetation using a species mix similar to that used for other woodland areas however the shallow depth of cover on benches and some parts of the void slopes which align with the extent of mining will require the seeding of species with shallower rooting depth. The woodland on the lower slopes will be progressively inundated as the pit lake rises however the incorporation of organic matter in pit lakes has been shown to have beneficial effects on the biological health of pit lakes (Lund, et al, 2013).

13. That the recommended preliminary conditions relating to the Rehabilitation Management Plan and/ or Revision of Strategies, Plans and Programs are strengthened to take into account the outcomes of any review of the NSW Government's current policy on final voids.

Mount Owen understands that there is no current NSW Government policy on final voids. Glencore has engaged with DP&E during the development of the Integrated Mining Policy (IMP) throughout 2015 and 2016, and will continue to participate in consultation processes should the Government develop a policy on final voids as a component of the IMP. Glencore is also an industry participant in the process of ongoing research into final voids through the ACARP process which is currently researching several aspects of final voids and their potential for different post mining land uses. Furthermore, Glencore is a member of the Upper Hunter Mining Dialogue which has run community workshops with subject experts to discuss and review future land use options for final voids in the Upper Hunter.

In terms of regulatory control of mine void and rehabilitation designs, the MOP process regulated by DRE will require the continual review and approval of detailed mine plans and rehabilitation strategies throughout the life of the Project. The MOP incorporates the rehabilitation commitments and objectives set out in the Rehabilitation Management Plan required by the development consent. This process will incorporate any changes in void management policy into the rehabilitation strategy developed for the Project. In addition, as detailed in Section 5.19 of the EIS, Mount Owen is committed to the development of a detailed mine closure plan within two years of planned closure with the planning and stakeholder consultation process for this plan being commenced at least 5 years prior to planned closure. This detailed mine closure process will have regard to any NSW Government policies relevant to voids.

5.3 PAC Recommendations regarding Rehabilitation

5.3.1 Biodiversity Recommendations related to Rehabilitation and Revegetation

5. *That the recommended preliminary condition of consent relating to the Biodiversity Management Plan should be strengthened to include:*

- *further details about the specific methods of regeneration, as well as relevant performance measures to assist in monitoring the effectiveness of regeneration; and*
- *further detail about the particular vegetation species that should be promoted, including species from different 'functional groups', such as cycads, ferns, geophytes, rushes and sedges.*

Note: additional issues raised in recommendation 5 are addressed in **Section 4.2**.

Regeneration methods and, performance measures

As discussed in **Section 5.1**, regeneration will be used as the primary vegetation improvement strategy in the previously cleared areas of the proposed offset areas. This regeneration will primarily rely on passive regeneration techniques which rely on the seed bank present in the derived grassland communities in the offset areas as well as natural seed dispersal from remnant areas through fauna and wind borne transfer mechanisms; stock will be removed from regeneration areas during the early establishment phases. Active management of weeds will be maintained through the regeneration process. There is strong evidence that passive regeneration will be successful in re-establishing healthy woodland communities similar to those found in other areas of the valley as this has been the primary mechanism for the establish of most, if not all woodland areas found in the Hunter Valley at present. In the unlikely circumstances that regeneration is not successful or succession stages are not progressing as quickly or as successfully as might be expected, active measures such as targeted species plantings or seed dispersal may be used.

Completion criteria and performance measures for the successional phases expected in the regenerating woodland will be developed and included in the Biodiversity Management Plan. These criteria will be similar to those included in the MOP but modified to reflect the differences between regenerating woodland from existing grassland communities to rehabilitation of areas directly impacted by mining. Performance measures will rely heavily on comparisons with analogue sites. The regeneration process will be informed by the research currently undertaken at Mount Owen in community establishment and will evolve as further information or improved understanding of rehabilitation becomes available.

Inclusion of 'functional groups', such as cycads, ferns, geophytes, rushes and sedges,

As noted in **Section 5.1**, the PAC made the following observation regarding the rehabilitation at Mount Owen:

while canopy and shrub species have been successfully re-introduced, a diversity of ground cover species is noticeably lacking.

The above recommendation is understood to relate to this observation.

The rehabilitation and regeneration objectives for both the areas disturbed by mining and the offset areas to be regenerated are the establishment of sustainable woodland communities consistent with those present in the locality. Achieving these objectives will require the establishment of species from all functional groups typically present in these communities.

The key species and structural groups present in the different communities being targeted for rehabilitation and regeneration activities are detailed in **Appendices 4 and 5**. The research being undertaken at Mount Owen has greatly improved the understanding of the role that different species in these key communities play in the development of successful soil biota (refer to **Appendix 5**).

As discussed in **Section 5.1.2.3** and shown in **Figure 5.3**, the abundance of groundcover species is heavily dependent on the successional phase in which the community is undergoing. Much of the rehabilitation at Mount Owen is in the early to middle stages of succession towards a functioning woodland community. During these phases, ground storey species would be expected to be less abundant due to the dense shrub and early canopy species growth which have a high demand for nutrients and also dominant lower storey species in their competition for light. As also noted in **Appendix 4** and **Section 5.1.1**, ground cover in the Central Hunter Ironbark – Spotted Gum – Grey Box Forest community can range from sparse to moderately dense (Peake 2006). Further, as noted in the discussion in **Appendix 3**, early successional species cope well with the poor chemical and physical soil conditions, particularly where overburden is used as the growing medium. These species would typically be more abundant in early successional phases in naturally disturbed environments and have physiological relationships with mycorrhizal bacteria and fungi which improves nitrogen and phosphorus levels in the soil which enable later successional phase species to establish. Indeed, as noted in **Appendix 3**, later successional phase species often fail if planted directly into rehabilitation environments in early successional phases. As soil conditions improve, later successional species will be expected to increase in abundance. The introduction of these species can occur naturally through vectors such as wind, insects or mammals or be enhanced through direct intervention via seeding or planting. Accordingly, as most of the rehabilitation is in the early to mid-successional phases, the low density or species richness observed in the ground cover in some areas of the rehabilitation at Mount Owen is neither unexpected or an issue of concern. Indeed, as shown in **Appendix 4**, the density of shrub and ground storey vegetation in communities can be absent or sparse in mature examples of the communities being targeted in the rehabilitation at Mount Owen. Ongoing monitoring of rehabilitation and comparison with analogue sites will continue to be undertaken and the MOP and Biodiversity Management Plan will include TARPs which cover unexpected deviations from the expected successional pathways in regeneration and rehabilitation areas.

5.3.2 Other PAC Recommendations regarding Rehabilitation

- 11. *That, prior to determination, the Department seeks further information about alternative post mining land use options, including the possibility of increasing woodland rehabilitation on slopes and focusing on agricultural species on the flatter areas of land to support grazing activities.***

The conceptual final land use and landform have been further refined following the Project mine plan changes associated with the removal of the RERR Mining Area from the Project and the amended landform associated with the use of the West Pit void for managing tailings disposal from other mining operations in the Greater Ravensworth Area (refer to **Section 1.**). These revisions have taken into consideration the comments raised by the PAC and the Preliminary DP&E Assessment Report. **Figures 2.4 and 5.6** shows the conceptual final land form and land use within the Project Area following these revisions. While the Glendell mining operations do not form part of the Mount Owen Continued Operations Project the rehabilitation commitments in relation to the Glendell operations have been considered in the development of the rehabilitation strategy for the Project.

Woodland and Agricultural Considerations

Table 5.2 updates Table 2 in the response to DP&E's rehabilitation queries contained in Part 4 of the Response to Agency Queries Report (Umwelt 2015d) and compares the areas of the different landscape features that will be present in the final landform under the currently approved Mount Owen Complex development and the Refined Project (including Glendell). The calculations include existing offset regeneration and revegetation commitments and include the proposed offset regeneration and revegetation commitments.

Table 5.2 Comparison of Landscape features between Refined Project, EIS Project and Existing Approved Development

	Landscape Feature/Proposed Rehabilitation				
	Woodland (approx. Ha)	Grassland (approx. Ha)	Treed Rehab (approx. Ha)	Pit Lake (approx. Ha)	Other (approx. Ha)
Refined Project	3,462	1028	N/A	117	13
EIS Conceptual Final Land Use Plan (Response to Agency Queries Report)[#]	3266	1228	N/A	113	13
Existing Approved Development[*]	2010	2,215	294	66	32

[#] Includes Mitchell Hills Offset Area

^{*}Calculations assume vegetation in proposed offsets will remain as it is at start of Project.

As can be seen from **Table 5.2**, the Refined Project will result in approximately 1452 hectares of additional woodland area in the rehabilitated final landform relative to what would be present as a result of the existing approved development. As can be seen in **Figure 4.6**, the additional woodland vegetation in the Refined Project final landform and the regeneration in the proposed biodiversity offsets will contribute to significantly improved habitat connectivity outcomes in the broader region.

Table 5.2 details the amount of each feature that would be present in the proposed rehabilitated landscape associated with the Refined Project and the areas these features are located. The numbers in brackets indicate the area previously identified for each landscape feature in the Conceptual Final Landform and Land Use Plan in Part 4 of the Response to Agency Queries Report (Umwelt 2015d).

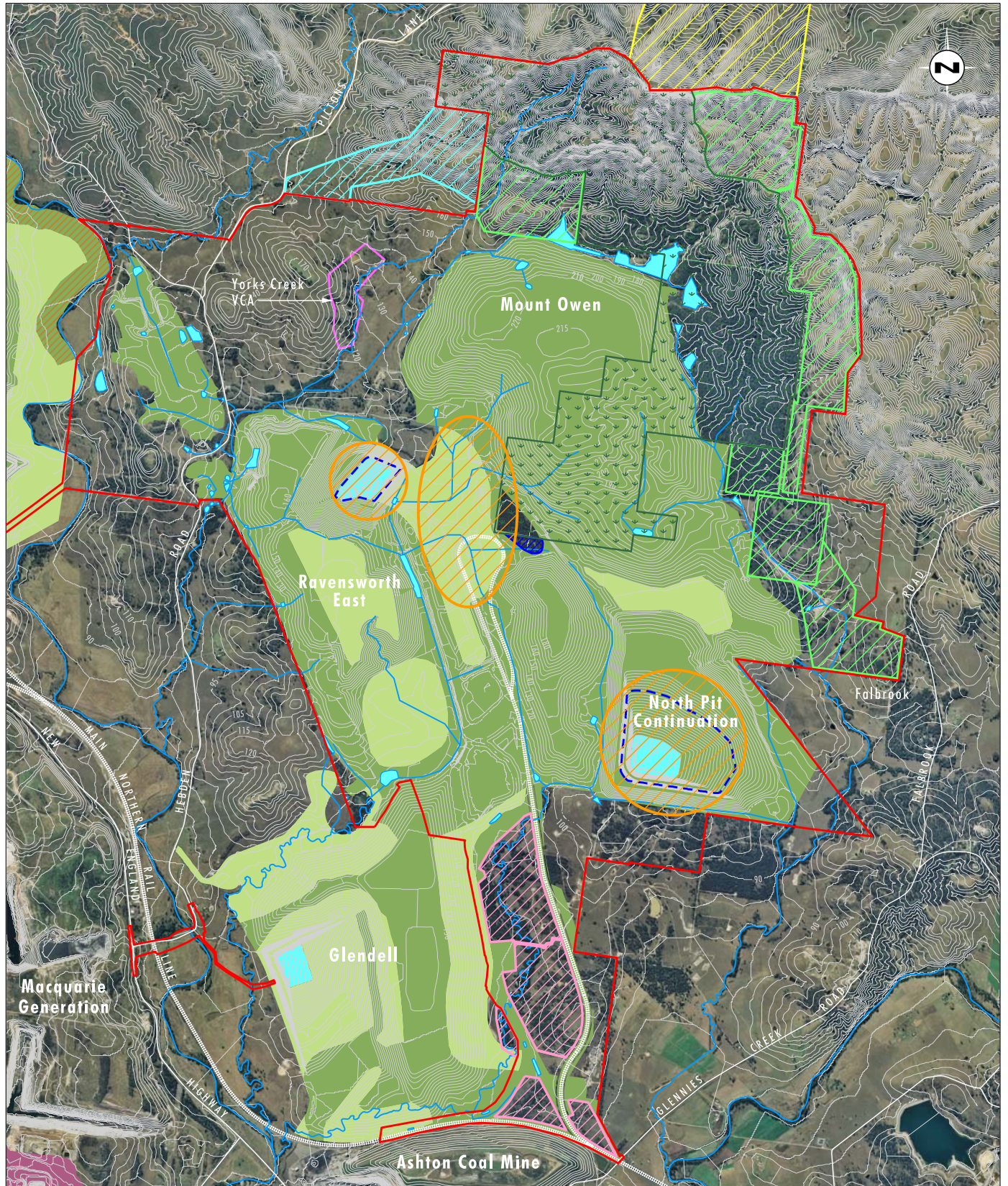


Image Source: Mount Owen (2012-2013)

Data Source: Mount Owen (2014), Ravensworth Operation Vegetation: Umwelt (2010),

Liddell Coal Operations Vegetation: Umwelt (2016)

Note: Contour Interval 5m(AHD)

0 1.0 2.0 3.0 km
1:55 000

Legend

- | | | |
|--|---|---|
| Project Area | Ravensworth State Forest | Bettys Creek Habitat Management Area |
| Yorks Creek VCA | Proposed Corridor Habitat Enhancement on Non-Mined land (Liddell Coal Operations) | Stringybark Creek Habitat Corridor |
| Pit Lake | Areas with Highest Potential for Industrial or Intensive Agriculture Uses in Post Mining Landform | Drainage Line |
| Native Woodland | Existing Biodiversity Offset Area | |
| Open Grassland (Potential grazing areas) with pockets of Native Vegetation | Proposed Cross Creek Biodiversity Offset Area | |
| Grazing | Southern Remnant Biodiversity Offset Area | |
| Maximum Pit Lake Water Level | | |

FIGURE 5.6

Mount Owen Continued
Operations Project Potential
Final Land Use Options

Table 5.3 Vegetation in Proposed Rehabilitated Landform for the Project and Mount Owen Mining and Offset Areas

Area where Rehabilitation/ Regeneration undertaken	Area in Rehabilitated Landform (approx. Ha) ¹				Comment
	Woodland	Grassland	Treed Rehab	Pit Lake/ Dams	
Proposed Rehabilitation for Refined Project					
Mount Owen	1,170 (1153)	170 (180)	N/A	N/A	
Proposed Disturbance Area	372 (347)	13 (37)	N/A	88 (88)	Excludes approximately 13 hectares of continuing disturbance area associated with Hebden Road works
Ravensworth East	495 (347)	158 (321)	N/A	17 (2)	Grassland area for previous calculations included area identified as grassland for stabilisation around void.
Glendell (excludes TP2)	344 (364)	435 (438)	(0)	12 (23)	Existing approvals commit Glendell to being rehabilitated to Grassland and ‘Treed’ areas.
Vegetation in Approved and Existing Proposed Offset Areas ⁺					
Existing Approved Offset Areas					
Northwest Offset	45	23	0		
Northeast Offset	32	52	0		
Forest East Offset	25	86	0		
Travelling Stock Reserve (TSR) Offset	24	1	0		
Southeast Offset	16	58	0		
Southeast Corridor Offset	27	31	0		
Southern Remnant Offset	4	0	0		
Proposed Offset Areas**					
Esparanga	303	0	0		
Cross Creek	367	0	0		
Stringybark Creek	95	0	0		
Mitchell Hills	144				
Project Total – Ravensworth East/Mount Owen (inc. proposed offset areas)	3118	593	13	105	Excludes approximately 13 hectares of disturbance associated with Hebden Road works
Total – Mount Owen Complex (inc. offset areas)	3462	1028	13	117	Excludes approximately 13 hectares of disturbance associated with Hebden Road works

* Excludes woodland vegetation below maximum pit lake water level

⁺ Does not include Bettys Creek Rehabilitation Area

** Areas of vegetation proposed as part of proposed Biodiversity Offset Strategy

[^] Includes 4.7 hectares Kunzea Shrubland

¹ Numbers in brackets in Table 5.3 differ to those in the table in Part 4 of the Response to Agency Queries Report because RERR Final Void and surrounding area were counted as part of Glendell Mining Area in calculations in Part 4 of the Response to Agency Queries Report.

The PAC has highlighted the importance of early consideration and planning of rehabilitation and final landforms. As noted by the PAC, mining is a temporary land use, and planning for post-mining land uses has been shown to lead to the highest levels of long-term success (Lamb et al, 2015; Goodbody, 2013; and Gardner & Bell, 2007). The progression of mining and resulting landform places a number of constraints on the suitability of the site for different land uses. The baseline physical and chemical properties of both the existing soil resources in the area and the rehabilitated landform also pose constraints to the use of the rehabilitated landform for different land uses. The pre-mining landscape within the Mount Owen Complex is considered to be suitable only for low intensity grazing. As is noted in Section 5.3 of the Agricultural Impact Statement for the Project (Appendix 11 of the EIS), the returns from grazing are typically poor and improved biodiversity outcomes are considered to be a higher value land use for this area, particularly given the proximity to Ravensworth State Forest.

The conceptual final landform has been developed to optimise the potential options for use of the post mining landform. Whilst the conceptual final landform and land use plan has been developed around improved biodiversity outcomes through both habitat creation and improved connectivity between vegetated areas (refer to **Section 4.3**), selected areas within the landscape that have potential to be sustainably (both environmentally and economically) managed for grazing purposes have been identified as being returned to grassland communities (refer to **Figure 5.6**). As shown on **Figure 5.6**, sloped areas and areas considered less suited to be returned to sustainable agricultural production have been identified as being returned to woodland vegetation communities.

Consideration of Alternate Land Uses in the Closure Process

The availability of access to rail through the rail loop and water in the voids, as well as the large separation distances from adjoining landholders may also lend parts of the site to being suitable for industrial or intensive agricultural (e.g. poultry, piggeries, mushroom composting and farming) uses in the future. The areas most suitable to these other land uses are those where the mine infrastructure is currently located and the final voids themselves. These are the areas that will be rehabilitated following the cessation of mining (refer to **Figure 5.6**). The progressive rehabilitation of overburden emplacement areas at Ravensworth East and Mount Owen can continue throughout the life of the Project without compromising opportunities for other high value land uses which will primarily be limited to the areas which will not be rehabilitated until mining has ceased such as infrastructure areas, final voids, railway lines and access roads. This approach to progressive rehabilitation and final mine closure planning is consistent with the current rehabilitation practices being implemented by Mount Owen.

As previously discussed, the detailed mine closure process for Mount Owen will commence at least five years prior to planned cessation of mining with a detailed closure plan finalised no less than two years prior to planned cessation of mining. This detailed closure process will focus on the rehabilitation of mine infrastructure area and the final aspects of landform development in the final void areas and around the infrastructure areas and water management infrastructure. The areas and infrastructure which are the primary focus of the detailed closure planning process are also the areas and infrastructure with greatest potential for being suitable for industrial or intensive agricultural use. It is noted that potential land uses that may be viable in these areas cannot be identified at this early stage of mine planning and the detailed mine closure process closer to the end of the life of mining operations provides sufficient time to develop a closure strategy for the site that considers the potential for these areas and existing infrastructure to be used for alternate land uses and identifies a process for obtaining approval for and transitioning to these land uses. Key matters to be considered in this process include:

- Potential future uses of existing infrastructure (buildings, water storages and associated infrastructure, road and rail access, electrical infrastructure etc)
- Decommission of works not required for end land uses identified

- Rehabilitation of areas following decommissioning
- Regulatory approval requirements and
- Long term management/disposal of land.

As discussed in Section 5.19 of the EIS, the detailed mine closure planning process includes consultation with key stakeholders including local government, State Government and the local community.

As has been demonstrated at Mount Owen, overburden emplacement areas are progressively rehabilitated through the life of the mining and this will continue for the life of the Project. This progressive rehabilitation is guided by the conceptual land use plans developed for the site as part of the mining process and is reflected in further detail by both the Land Management Plan and Mining Operations Plans which provide further detail about both ends land use planning and progressive rehabilitation. These plans are regularly reviewed and approved by regulators and provide a strong regulatory framework for site rehabilitation.

14 *That the recommended preliminary condition of consent relating to the Independent Environmental Audit should be linked to the preliminary Rehabilitation Management Plan condition to ensure that rehabilitation is independently monitored and audited on a regular basis.*

The rehabilitation at Mount Owen is regularly monitored and the results of this monitoring are reported in the annual review submitted to DRE and DP&E.

DRE and DP&E also conduct regular site inspections which include inspections of the rehabilitation at Mount Owen. These agencies have extensive investigation powers which would allow them to ascertain if the appropriate monitoring was not being undertaken; these powers include the ability to require a proponent to undertake further audits.

As evidenced by the Ravensworth State Forest Vegetation Complex, being listed as a “highly commended” site on the Global Restoration Network of the Society for Ecosystem Restoration, Mount Owen is one of the better examples of rehabilitation of disturbed areas back to woodland vegetation in NSW and, as discussed earlier, of furthering the research into successful rehabilitation techniques for Hunter Valley woodland communities. Mount Owen agrees that independent audits required under either the Mining Act or EP&A Act should include the auditing of compliance with rehabilitation plan and MOP commitments (including an audit of whether monitoring identified in those plans has been undertaken) and provide an independent overview of the progress of rehabilitation. Any further independent monitoring of rehabilitation over and beyond that already occurring at present should only be required if as part of this audit regime there is evidence that the monitoring program is inadequate or being undertaken improperly.

15. *That the Department reviews intentions to mine existing rehabilitated land and considers options to ensure that proposed rehabilitated areas are not disturbed in the future, through conditions of consent or any other means.*

In relation to this recommendation, the PAC also noted the following:

The Commission is concerned that some 100 hectares of previous rehabilitation are now proposed to be mined again. The Commission points to the increased uncertainty this causes regarding the long-term status of both existing and proposed rehabilitated areas. Indeed, submissions by the community suggest that the proposed ‘re-mining’ of rehabilitated land has reinforced the general lack of confidence and scepticism regarding the likely success of rehabilitation.

The Commission recommends that the Department investigate options to ensure that proposed rehabilitated areas are not disturbed in the future.

The NSW Framework for Biodiversity Assessment applies to any future development at the Mount Owen Complex and requires the biodiversity values of rehabilitated land to be offset in the same way it applies natural or regenerated vegetation. In this regard, impacts on the biodiversity values of rehabilitation will be considered in the assessment of any future Projects, irrespective of whether they are rehabilitated, regenerated or natural communities. The application of the policy is underpinned by the governing objective of no net loss of biodiversity values over an acceptable timeframe. The whole NSW biodiversity assessment policy is an example of using market based mechanisms to achieve ecologically sustainable development.

Further, it is noted that extending these commitments to all rehabilitated woodland has potential to create perverse incentives for proponents to:

- commit to lower biodiversity rehabilitation outcomes (such as exotic grassland communities) in order to avoid sterilising resources either below or adjacent to approved resources or
- mine previously undisturbed areas due to the prohibitions being place on disturbing woodland rehabilitation.

Both outcomes are considered to be contrary to the principles of ecologically sustainable development and are likely to result in poorer overall biodiversity outcomes.

The removal of any habitat by mining projects should be minimised to the maximum extent possible however it should be noted that not all habitats are of equal value and, as discussed above, the re-mining of areas where rehabilitation has previously been undertaken may be preferable to accessing areas not previously disturbed. The removal of the RERR mining area avoids mining of some rehabilitated areas, however, the Project includes some disturbance of previously rehabilitated areas (approximately 45 ha). The rehabilitation of these areas proposed as part of this Project will restore these areas to woodland communities which are found in the local area, providing an improved habitat value as an outcome. The overall conceptual final land use plan for the site (refer to **Figure 5.6**) increases the overall level of woodland vegetation in the existing approved disturbance areas relative to the currently approved development. Further, the location of woodland areas has been specifically designed to improve habitat connectivity in the landscape (refer to **Figure 4.6**). Accordingly, as this Project illustrates, there can be ecological benefits associated with disturbance of past rehabilitation by improving the overall quality of rehabilitation through improved commitments relative to what may be required under older consent conditions.

Mount Owen is committed to implementing legal mechanisms to ensure that the biodiversity offsets identified for the Project, namely the five offset properties Cross Creek, Esparanga, Mitchell Hills and Stringybark Creek, are conserved in perpetuity. Mount Owen is also committed to re-establishing woodland ecosystems in the areas disturbed by mining and managing the East-West Corridor Management Area to enhance habitat connectivity. These latter commitments however do not include an intention to in-perpetuity conservation. Whilst there is no current plan to re-mine rehabilitation areas or the East-West Corridor Management Area, there are known coal resources and active exploration in the vicinity of the proposed rehabilitation and East-West Corridor Management Area that may necessitate some disturbance of these areas in the future. It is also noted that condition 17 of the Mining Leases for the Project specifically contemplate the re-mining of areas within the lease to obtain recoverable resources within the area (extract below). Complying with a direction issued under condition 17 may necessitate the disturbance of areas which have been, or are in the process of being rehabilitated.

17. Resource Recovery

- (a) Notwithstanding any description of mining methods and their sequence or of proposed resource recovery contained within the Mining Operations Plan, if at any time the Director-General is of the opinion that minerals which the lease entitles the lease holder to mine and which are economically recoverable at the time are not being recovered from the lease area, or that any such minerals which are being recovered are not being recovered to the extent which should be economically possible or which for environmental reasons are necessary to be recovered, notice in writing to the lease holder may be given requiring the holder to recover such minerals.
- (b) The notice shall specify the minerals to be recovered and the extent to which they are to be recovered, or the objectives in regard to resource recovery, but shall not specify the processes the lease holder shall use to achieve the specified recovery.
- (c) The lease holder must, when requested by the Director-General, provide such information as the Director-General may specify about the recovery of the mineral resources of the lease area.

As noted above it would be expected that any future development proposals which impact on rehabilitated land would need to consider the biodiversity impacts associated with such an impact and be subject to relevant approvals.

It is therefore strongly recommended that any review of policy or approach regarding the permissibility of disturbance of rehabilitation areas consider the specific habitat values of the area proposed to be disturbed,, and recognises the potential perverse outcomes that such a moratorium may have.

5.4 Other Issues Raised in PAC Review Report

Conceptual Nature of Mine Plans

Concerns were raised in submissions from the public and various agencies (including the Department of Primary Industries - Water (DPI Water), OEH and DotE) about the conceptual nature of the final landform and the absence of a detailed rehabilitation mine plan.

The Commission understands that only a conceptual mine plan has been provided for this project, which creates a number of uncertainties in terms of the final landform and the effectiveness of rehabilitation (Figure 4). The Commission notes that the Department intends to seek further information about the mine plan and final landform prior to determination.

The Commission agrees with the Department that the mine plan needs to be more clearly articulated, that matters such as micro-relief should be addressed, and more detail provided regarding the final void shapes, including measures to ensure that they are more sympathetic to the surrounding landscape.

As discussed in **Section 5.1.3**, the development consent sets the overall framework for the development and defines the closure objectives for the site. While the Project must be undertaken generally in accordance with the development described in the EIS, the nature of mining necessitates a flexible approach to the progressive development of the mine which allows it to adjust to factors which includes unforeseen geological constraints, weather, market fluctuations and other external factors that can affect production. The proposed conceptual mine plan stages provided in **Figures 2.1 to 2.4** represent the optimal progression of mining and the factors outlined above may necessitate a departure from this staging at some stage during the life of the Project. The Project would, however, remain bound by the impact constraints identified in the development consent and all development must be limited to the Project Area with surface disturbing activities covered by the development consent limited to the disturbance footprint, and the mining areas limited to those identified as being part of the Project described in the EIS.

While the development consent allows for a degree of flexibility in mine design and development, the MOP requires the development to be carried out in accordance with the detailed mine and rehabilitation plans contained in the MOP. These plans are reviewed and approved by DRE before they can be implemented and mining and rehabilitation activities cannot be undertaken otherwise than in accordance with an approved MOP. As discussed in **Section 5.2**, the next phase of detailed design of the micro relief to be developed as part of the final landform will be detailed in the MOP. Where necessary, MOP plans may be varied to incorporate changes driven by unforeseen events or improved technologies or rehabilitation techniques that would improve the economic viability of the Project and/or improve the Project in achieving performance objectives. This flexibility is not only necessary from an operational perspective but assists in the implementation of improved economic, social and environmental performance measures which may evolve over the duration of the Project.

The Department has recommended a set of stringent preliminary conditions that are largely based on these key elements, including requirements for both a rehabilitation strategy and a rehabilitation management plan, as well as a specific condition relating to progressive rehabilitation. However, the Commission recommends that these preliminary conditions are strengthened.

As discussed extensively in this response, the research into successful rehabilitation techniques at Mount Owen continues to improve the understanding of both rehabilitation of mine sites as well as the natural succession pathways and the complex interaction between species in the target communities. A degree of flexibility is therefore necessary in the development of the rehabilitation strategy to provide for continuous improvement for the Project. The existing regulatory framework is considered to be an appropriate regulatory structure to ensure high quality rehabilitation outcomes are achieved provided the rehabilitation objectives for the Project are clearly articulated at the outset.

As discussed above, Appendix 19 of the EIS includes a comprehensive Mine Closure and Rehabilitation Strategy for the Project. This strategy is developed around the regulatory framework discussed in **Section 5.1.3** and includes a detailed set of closure criteria and performance measures for the rehabilitation stages regulated by the MOP process.

The Commission notes that recent reports by the NSW and Queensland Auditors-General have identified the risks for taxpayers and communities arising from the failure of mining companies to successfully stabilize and rehabilitate former mining sites (Audit Office of NSW, 2012; and Queensland Audit Office, 2014). The Audit Office of NSW pointed to "many thousands of hectares of degraded and contaminated land where mining companies abandoned mines without cleaning up or stabilising the sites." The Queensland Auditor-General noted that environmental rehabilitation at the expense of those in the mining industry whose activities cause the damage remains an "unrealistic aspiration".

While Mount Owen notes that this is largely an issue for Regulators to manage, it is noted that the findings in relation to NSW operations relate to legacy issues associated with past mining which was undertaken

under a different regulatory system than applies at present. NSW has a comprehensive regulatory system in place with mining being closely regulated under the EP&A Act, POEO Act and Mining Act 1992, all of which are administered by regulatory authorities with strong enforcement measures available to them. Rehabilitation of mine sites is primarily regulated by mining leases under the Mining Act, in particular, the MOP. This plan details both short and long term rehabilitation commitments for mines and rehabilitation cost estimates based on the works detailed in the MOP are required to be provided to the NSW Department of Primary Industries, Division of Resources and Energy (DRE). Lease holders are required to provide security to DRE in the amount prescribed by the DRE (based on the rehabilitation cost estimates) to cover future rehabilitation liabilities in the event that the lease holder defaults on their obligations under the Mining Lease. These regulatory arrangements and security requirements are significantly more onerous than existed for legacy projects which were the focus of the NSW and Qld auditors reports.

The linking of the security to rehabilitation commitments in the MOP assist in driving high quality rehabilitation outcomes as completion of rehabilitation activities reduces the security requirements for an operation and assists in freeing up capital for future development.

At present, DRE hold security for the rehabilitation of the Mount Owen Complex in the form of a bank guarantee. The security has been assessed by DRE as being sufficient to cover the estimated rehabilitation costs for the Mount Owen Complex and includes a contingency allowance. Should the Project be approved, a variation to the MOP will be required and an updated rehabilitation cost estimate submitted which includes rehabilitation commitments associated with Project related works.

6.0 Water

16. ***That, prior to determination, the Department seeks further comments from:***

- ***EPA about the discharge of surplus water from this project; and***

As stated in the EIS and Appendix 9 Surface Water Assessment, Mount Owen will share water with other local Glencore operations under the Greater Ravensworth Water Sharing Scheme (GRWSS). Where the GRWSS is in surplus to requirements for all operations, discharges from the GRWSS may be required. These discharges will occur via the existing licensed discharge points at either Ravensworth Operations or Liddell Coal Operations which are also part of the GRWSS, in accordance with the regulatory arrangements which apply to those sites. It is noted that no discharges have occurred from the Mount Owen Complex water management system (WMS) over the last 10 years.

As stated in the Response to Submissions Part B, the Project will not require any alteration to the existing regulatory arrangements at other sites and will not result in any increase in discharges over what is already permitted to occur from Glencore's operations which collectively operate within the GRWSS. It should be noted that prior to the implementation of the GRWSS, Mount Owen had an approved licensed discharge point which was never used to discharge water via the HRSTS. Connectivity to the GRWSS has enabled the removal of this licensed discharge point, which occurred in November 2014. There has been no corresponding increase to the approved discharge capacity at either Liddell or Ravensworth Operations and no increase is planned as a result of the Project. The linking of Mount Owen to the GRWSS has therefore resulted in an overall net reduction in approved licensed discharge capacity at these Glencore operations as a result of the water sharing and utilisation flexibility provided by the GRWSS.

- ***DPI Water about water licensing and associated issues, particularly in relation to the proposed surface water management system, the significant volume of water proposed to be held in dams that would require licensing under Jerry's Water Source, and the reconstruction and rehabilitation of watercourses in the final landform.***

DPI Water provided further clarification of issues associated with appropriate licensing and accounting for water management structures in the final landform in its correspondence dated 7 March 2016. Mount Owen undertook further consultation with DPI Water to clarify and respond to the matters raised on 15 April 2016. In addition to a number of specific issues raised, the key requirement from DPI Water as detailed in its correspondence of 7 March 2016 is outlined below.

DPI Water request that further design of the final landform management system be included in Water Management Plans for consideration of DPI Water. This should include specific consideration of individual dams their specific purpose, their capacity and under what mechanism they are proposed to be accounted for.

Mount Owen commits to inclusion of further information on the design of the final landform water management system as part of the revised Water Management Plan for the Project. This aligns with Mount Owen's previous commitments to design the final landform water management structures to comply with the relevant licensing and accounting framework applicable to the Project at completion.

In practical terms, this commitment requires the final design of water management structures in the final landform to be within the licensable allocation that exists at the completion of rehabilitation expressed either as volumetric or water take allocations. As required, this would be achieved through rationalisation of the conceptual final landform water management system as identified in **Appendix 6**. By linking this to the Water Management Plan required under any development consent for the Project, this enables appropriate regulatory review, consultation and endorsement to occur periodically over the life of the Project and prior to the completion of any water management works in the final landform.

In order to provide a conceptual framework for the consideration of final landform water management design over the life of the Project, a conceptual licensing and accounting framework has been developed as shown on **Figure 6.1**. This licensing and accounting framework is based on the current regulatory regime provided by the Harvestable Rights provisions and water access licensing for the unregulated Jerrys Plains and Glennies Water sources. The conceptual framework enables the consideration of the applicability of the relevant allocation provisions from these regimes that can be applied across the life of the Project. Specifically, the conceptual framework will be applied to progressive landform design over the life of the Project to ensure that the contemporary regime is applied at the relevant stages of the Project. As shown on **Figure 6.1**, the conceptual framework includes:

- Consideration of available water allocation calculated in accordance with the Harvestable Rights provisions and the applicable Water Access Licence availability over the life of the Project
- Consideration of the relevant applicability criteria and exemptions that occur for water management structures under these regulatory regimes
- Accurate delineation of water allocation based on volume (Harvestable Rights) and water take (WAL) to correctly design water management structures within this framework
- Conceptual licence and accounting framework which includes consideration of final void water licensing requirements to ensure that all relevant water management structures and features in the final landform are captured in an integrated manner.

The conceptual licensing and accounting framework was developed in consultation with DPI Water, following the meeting on 15 April 2016. DPI Water has been provided with a copy of the conceptual licensing and accounting framework.

17. *That the recommended preliminary condition of consent for the Groundwater Management Plan includes consideration of operations at Integra Underground Mine and any associated impacts.*

The regional groundwater model developed for this Project EIS includes modelling of the ongoing operation of the Integra mine including groundwater extraction.

Mount Owen agrees with the recommended condition of consent incorporating consideration of the Integra Underground Mine. As outlined in **Section 1.3.2.**, the Integra Underground Mine is now in Glencore ownership.

- 18. That the *recommended preliminary condition of consent for the Surface Water Management Plan should include consideration of the discharge of surplus water from this project.***

As outlined in the response to recommendation 16, it is not necessary for the Surface Water Management Plan to include consideration of the water discharge from the site as water will be managed through the existing GRWSS. The Surface Water Management Plan will provide a detailed description of the Water Management system for the Mount Owen Complex and its linkages to the GRWSS. As detailed in the EIS, the management of operational water through participation in the GRWSS will continue over the life of the Project.

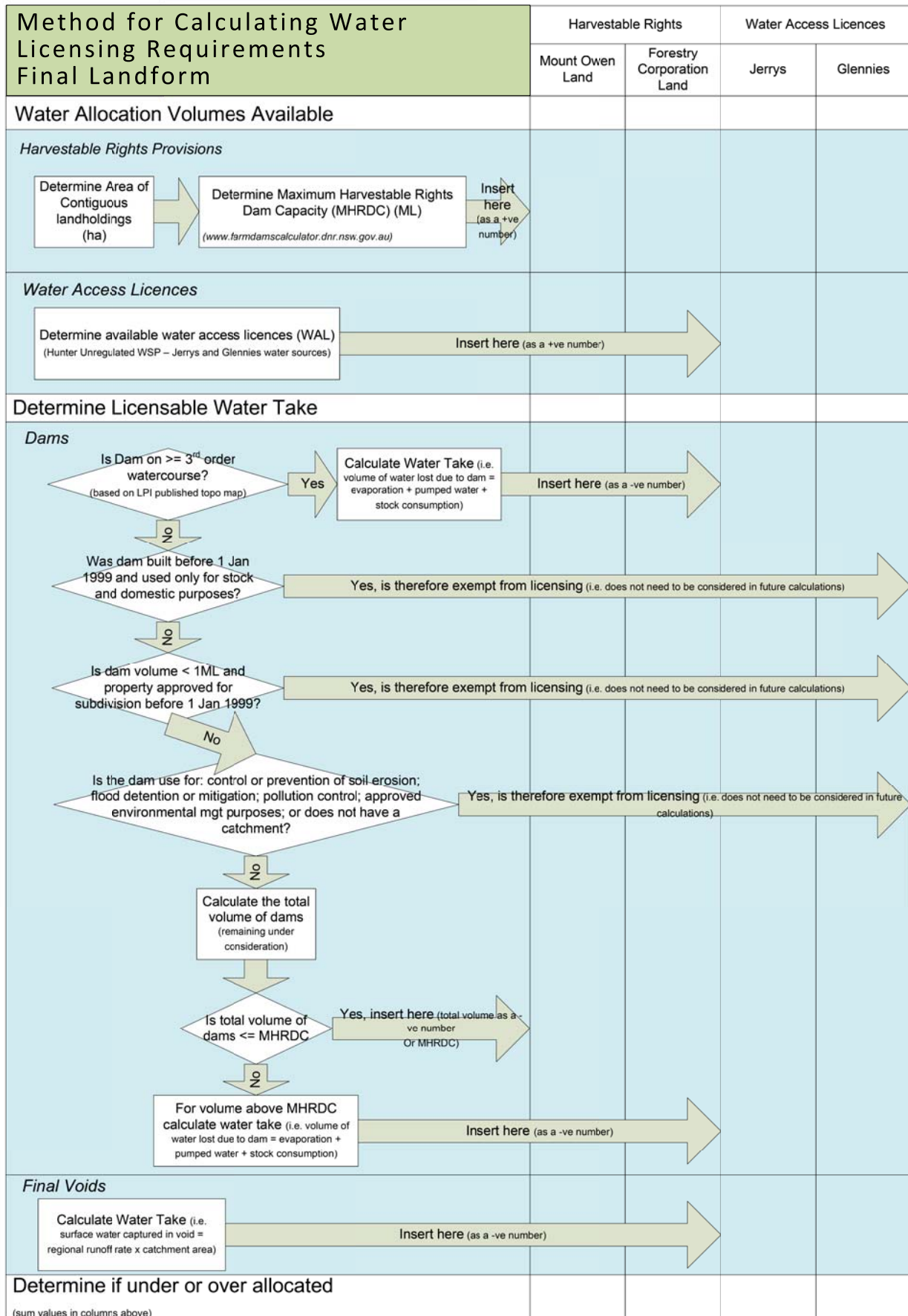


FIGURE 6.1

Conceptual Final Landform
Water Licensing and
Accounting Framework

7.0 Aboriginal Cultural Heritage

- 19. *That, prior to determination, the Department consider the findings and any potential implications of the recent court case, LALC v Minister for Planning Infrastructure and Anor (re Calga Sand Mine) in relation to the adequacy of the cultural heritage assessment for this project.***

Summary of Case Findings

The case of Darkinjung Local Aboriginal Land Council v Minister for Planning and Infrastructure related to an application to extend an existing Calga sand quarry to the south of the current operations and was refused by the court. In relation to cultural heritage issues the critical question for the court was whether there was sufficient, credible information upon which to assess the impacts of the Project and make a decision. The court determined that it did not have this necessary information.

The court held that it was premature for the court to approve the application because there is insufficient information before the court to assess the application. Despite the consultation undertaken, the archaeological reports prepared and the cultural management plan (CMP) drafted, the court held that the level of information required to assess the significance of cultural heritage was inadequate and incomplete. Despite the respondent's claims that a CMP will address any sites or places identified during the Stage 4 process, the court agreed with the applicants that the 'approve now and assess and consult later' with respect to the unidentified sites and places was not an appropriate outcome given the level of uncertainty about what artefacts may be destroyed.

The decision highlights that where a proponent has arranged for cultural assessments to be undertaken as part of the project approval process, and where cultural heritage sites or places have been identified, particularly sites or places that are of high significance, there is an expectation that thorough investigations be undertaken to confirm that there are no additional sites or places within the area (that are either culturally significant in their own right or linked to an existing significant site/place). If there is a concern raised by either the State or the RAPs that there have been inadequate investigations undertaken, the consultation process was not complete or there is the potential that significant sites or places have not been identified or included in appropriate management and/or mitigations measures, this may impact on whether project approvals are given.

Glencore's Approach

Statutory Consultation Requirements

The consultation process required to inform the cultural heritage assessment of projects such as this Project must be undertaken in accordance with the NPW Regulations 2009, (Clause 80C) and guidelines prepared by OEH, consistent with the Director Generals Requirements for the Project. Key elements of this formal process include the following steps:

Identify Registered Aboriginal Parties and Consultation

Proponents are responsible for ascertaining the names of Aboriginal people who may hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places. The guideline and the Regulations specify sources of this information. In accordance with these statutory processes, Mt Owen wrote to the bodies or persons nominated in the NPW Regulations requesting the names of any Aboriginal persons who may hold knowledge relevant to any relevant Aboriginal objects or Aboriginal places.

Mt Owen then wrote to the Aboriginal people whose names were obtained from these sources to notify them of the proposed project. Also, in accordance with the statutory requirements, Mt Owen placed a notice in the local newspaper circulating in the general location of the proposed project explaining the project and its exact location, inviting Aboriginal people to register their interest in the project. As an outcome of these statutory processes, 60 Aboriginal Parties formally registered with Mt Owen for the Project. The Registered Aboriginal Parties identified through these statutory processes were then consulted in the ongoing cultural heritage assessment processes for the Project. Evidence of compliance with these requirements was provided in Appendix 13a and Appendix 13b of the EIS. Glencore also identifies Knowledge Holder groups as being those groups with current or former registered Native Title Claims in the region.

Cultural Heritage Assessment

A Cultural Heritage Assessment is required to be in accordance with the National Parks Regulations 2009 (Clause 80D) consistent with the Director General's Requirements for the Project. Key aspects of the Cultural Heritage Assessment for the Project involved thorough assessment of cultural values and significance of Aboriginal sites, including detailed archaeological investigations, based on the extensive involvement of Registered Aboriginal Parties and identified Knowledge Holders.

The three Knowledge Holder Groups were engaged by Mt Owen to undertake their own Cultural values assessment, which is a key component of the detailed ACHA processes undertaken by Glencore for all projects in the Hunter Valley. In addition, Glencore provided workshops and site visits to other Registered Aboriginal Parties who were not affiliated with these Knowledge Holder groups, including members of the Wannaruah Local Aboriginal Land Council, to inspect the proposed mining area and provide their input on cultural values of the Project area and surrounding landscape context and the significance of sites located in areas to be disturbed.

Further, Knowledge Holder groups and Registered Aboriginal Parties were provided the opportunity to participate in archaeological surveys of the area and received copies of the draft Archaeological Survey report and the Cultural Heritage Assessment Report for comment prior to their finalisation.

This thorough approach satisfies the requirements of the Project Director General Requirements as well as the *National Parks and Wildlife (NPW) Regulation 2009, Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC 2005a), *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010) and the principles of *The Burra Charter* (Australia ICOMOS 1999).

Of note in the ACHA, the views of the three knowledge holder groups, and other registered Aboriginal parties, agreed that there were no items of high or moderate significance in the disturbance footprint of the proposed Project. Moreover, as outlined in Section 5.9.4.1 of the EIS, the Project Area has lower cultural significance than the surrounding region. However, the regional landscape is of significance to all groups and contains a number of significant sites. In response, as discussed with all groups, Mount Owen has committed to assisting with the preservation and protection of those sites in the vicinity of the Project through a range of on-site cultural heritage management measures, as well as a number of off-site cultural heritage programs identified by the Knowledge Holder groups and other registered Aboriginal parties to assist with Aboriginal cultural development in the Upper Hunter. These commitments are detailed in the Section 5.9.7 of the EIS.

Unlike the circumstances in the Calga case, the detailed cultural values assessments provided by the Knowledge Holders, and extensive consultation undertaken with the other RAPs for the Project did not indicate that there were items or places of high significance within the Project disturbance boundary, nor was there a high probability that further cultural heritage may be identified in the Project area that had not yet been the subject of investigation. Furthermore, Mount Owen has completed appropriate and thorough investigations of cultural heritage on the site and unlike the Calga case; Mount Owen has not deferred any sites or places for later assessment and consultation. The consultation process has not identified the possibility for any additional significant sites that have not been properly assessed and managed as part of the Project.

8.0 Social Impacts

As noted in **Section 1.0**, the PAC has noted in the Social and Economic Context of the PAC Review Report that:

‘an extension of mining activities in this area would have significant social and other costs, many of which will be borne by the residents of the Hunter Valley’.

The following section provides an overview of the consultation process completed as part of the Project and the key findings of the SIOA.

8.1.1.1 EIS and Ongoing Consultation Process

Consultation with the community and government agencies is a key component of the EIS process and is documented in detail in the EIS for the Project. As outlined in the EIS, the Project design has taken into account issues raised during extensive stakeholder consultation and studies, to minimise environmental and social impacts.

Community engagement for the Project involved a four phase program completed over three years prior to lodgement of the EIS, and ongoing during the current assessment process. Phases 1 and 2 (2012-2013) sought stakeholder feedback on key issues and aspects of the Project design. Phase 3 (2013) presented results and outcomes of the assessment and engagement process, and sought feedback on predicted impacts and proposed mitigation measures. Phase four (2014 and ongoing) provided further information to stakeholders regarding changes to the Project and also presented results and outcomes of the updated assessment.

A range of mechanisms were used to engage the community and other stakeholders. Community consultation mechanisms included individual meetings with surrounding landholders, Community Information Sheets, presentations to stakeholder and community groups, community information sessions, information presentation on the Mount Owen website and a number of briefings to the Mount Owen Community Consultative Committee (CCC). Other stakeholders consulted included the Aboriginal community, various State and Commonwealth government agencies, Singleton Council, infrastructure providers, neighbouring mining operations, Mount Owen workforce and local service providers. Coupled with this, agency stakeholder engagement commenced in 2012. Agency consultation included Project briefings with all key government agencies at various stages of the Project to discuss key issues and outcomes of key studies, and proposed management measures.

Concurrent with the project specific engagement since 2012, operationally Mount Owen continue to regularly engage with the community and stakeholders through a range of avenues including community newsletters and a dedicated environment and community enquiry line. This enquiry line also enables Mount Owen to receive and effectively manage issues raised by the community in relation to its ongoing operations. To date in 2016, there have been 3 enquiries raised by the community and effectively responded to by Mount Owen.

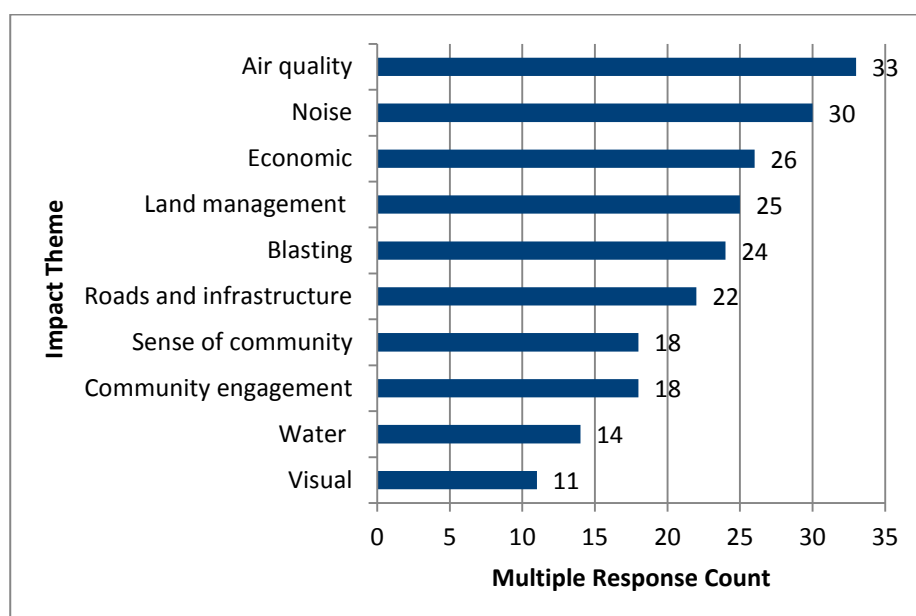
Section 4 of the EIS outlines the phases of consultation which occurred throughout the Project and EIS development stages. Since that time, consultation has continued, specifically with Mount Owen’s near neighbours who made submissions in relation to the Project. Mount Owen has also held an on-site Land Management Forum, to which all landholders who expressed an interest in land management matters such as weed and feral animal control were invited to attend. There has also been continued information provided to the wider community about the Project via inclusion in the Glencore Greater Ravensworth Area Newsletter and continued discussion at CCC meetings.

Broadly, to date, consultation for the Project has comprised:

- 257 one-on-one meetings with various stakeholders, including ongoing communication with 57 of the nearest neighbours to the Project
- 59 phone discussions with community members
- 48 email or other correspondence exchange with community members
- 13 public forums
 - 9 CCC meetings
 - 1 mine open day
 - 2 Community Information Sessions
 - 1 presentation to an open session of Singleton Council and
- 7 Project Newsletters, Community Information Sheets (including updates on the Project contained in the Greater Ravensworth Area Community Newsletter) distributed, with opportunity for feedback and further enquiry.

The key issues raised in the community, agency and stakeholder consultation completed for the Project EIS is outlined in **Chart 8.1** and detailed comprehensively in Section 4 of the EIS.

The most common perceived impact themes identified by landholders associated with the current Mount Owen and other mining operations in the local area, related to cumulative air quality and noise, with approximately 70 per cent of landholders identifying one or both as a current issue. These issues were followed by economics (60 per cent), land management (58 per cent), blasting (55 per cent), and roads and infrastructure (51 per cent) (refer to **Chart 8.1**).



Note: Includes both positive and negative issues / impacts. Multiple responses permitted.
Source: Coakes Consulting (2013)

Chart 8.1 Perceived Impact Themes identified by Neighbouring Landholders

Whilst some of the perceived impacts were raised in terms of direct attribution to the existing Mount Owen operation, the majority were discussed in cumulative terms with residents reporting difficulties in fully distinguishing issues and impacts associated with individual mining operations, given their proximity to multiple mines.

Less prominent issues related to other environmental impacts, such as water and visual amenity, as well as more socially oriented concerns such as sense of community, community contribution and community engagement. The latter were discussed mainly in terms of positive impacts or opportunities.

The Project team considered this community feedback in refining the Project design to address these issues. **Table 8.1** contains a summary of the aspects of the Project that address the top five issues raised by stakeholders in the consultation process.

Table 8.1 Top 5 Stakeholder Issues and Key Project Aspects

Issue	Key Project Aspects
Air Quality	<p><u>Mine Planning and Design:</u></p> <p>As discussed in Section 5.2 of the EIS, mine design was subject to an optimisation process to reduce the potential impacts on local landholders. Mine plan refinements included minimisation of haul road length, design of select haul roads below natural surface, and identification of areas that would be temporarily treated to reduce potential for air quality impacts.</p> <p>A review of Best Practice Management procedures was completed to enable the adoption of management options to reduce potential impacts.</p> <p><u>Air Quality Monitoring and Management:</u></p> <p>As discussed further in Section 5.2 of the EIS, a range of air quality controls and monitoring exist, and are proposed, for the Project. This includes an extensive real time monitoring network which collects data that is fed back into existing operations.</p>

Issue	Key Project Aspects
Noise	<p><u>Mine Planning and Design:</u></p> <p>As discussed in Section 5.3 of the EIS, mine design was subject to an optimisation process to reduce the potential impacts of noise to local landholders. Mine plan refinements included design of selected haul roads below natural surface, and inclusion of bunds on well established and exposed long term haul roads.</p> <p>Selected mining equipment currently in use at Mount Owen and proposed as part of the Project will have appropriate levels of attenuation as a noise design control.</p> <p>The location and scheduling of equipment within the proposed North Pit Continuation during certain times of the year was reviewed with the objective of designing the mine such that when the likelihood of noise propagation increased (winter nights), equipment would be operating where maximum shielding could be achieved.</p> <p><u>Noise Monitoring and Management:</u></p> <p>As discussed further in Section 5.3 of the EIS, a range of noise controls and monitoring exist and are proposed, for the Project. This includes the maintenance of the existing performance based management and monitoring system. Mount Owen has an extensive noise monitoring network that collects real time noise data which feeds back to operations. Mount Owen also monitors the predicted weather conditions daily to understand and plan operations to reduce likely noise impacts on a daily basis.</p>
Economic	<p>The economic impact of the Project is positive. Mine planning and design has been undertaken to enable efficient extraction of coal to ensure the Project is an economically viable operation which will allow for continued employment of the Mount Owen workforce and Ravensworth East workforce for an additional 12 and 6 years, respectively. The results of the Cost Benefit analysis completed as part of the Project indicate that the Project would have a net benefit and add approximately \$312 million (NPV terms) to the economy of the State of NSW.</p>

Issue	Key Project Aspects
Land Management	<p><u>Mine Planning and Design:</u></p> <p>As discussed in Section 5.19 of the EIS, the Project has been designed to be progressively rehabilitated. Moreover, the Project is seeking to optimise the final landform design to achieve an undulating and more natural looking landform.</p> <p><u>Mine Closure Planning and Rehabilitation:</u></p> <p>As outlined in Section 5.19 of the EIS mine closure and rehabilitation considerations:</p> <ul style="list-style-type: none"> • include the development of a safe and sustainable landform with provision of ecological habitat and connectivity; • do not discount other future land uses that may be viable; and • identify that closure planning will continue over the life of the development. <p><u>Consultation:</u></p> <p>During the development of the Project, Mount Owen consulted with Singleton Council and DRE in relation to final landform, land use and mine closure. Community consultation, social impact and cultural heritage assessments for the Project considered stakeholder interests in mine closure and final land use.</p> <p><u>Other Land Management Measures:</u></p> <p>A range of other land management measures are in place, and are proposed for the Project, such as feral animal and noxious weed management and bushfire management.</p>
Blasting	<p><u>Blast Design:</u></p> <p>Mount Owen has well established blast design and blast practices that will be continued as part of the Project.</p> <p><u>Blast Monitoring and Management:</u></p> <p>As discussed further in Section 5.4 of the EIS, a range of blasting controls and monitoring exist and are proposed for the Project. This includes a range of blast monitors, review of local meteorological conditions prior to blasting, appropriate design of each blast including the size of blasts and vibration assessment and the use of blast techniques such as electric detonation.</p>

8.1.1.2 Stakeholder Comments from EIS Process

Subsequent to lodgement and acceptance, the EIS for the Project was placed on public exhibition from 20 January 2015 to 6 March 2015. During the public exhibition period 233 submissions were made on the Project. This included 12 government agency submissions and 221 community submissions (including interest group submissions).

Of the 221 community submissions received, 85 per cent stated support of the Project with 13 per cent objecting to the Project. A further four submissions received provided comments only, neither objecting nor supporting the Project.

Those in support of the Project cited current and future economic benefits directly related to the Project's operations, as the primary reason for their support. Positive views were also attributed to perceptions of good environmental management and monitoring by Mount Owen and general support for the Project. Submissions supporting the Project highlighted the importance of the mining industry in the Hunter Valley, particularly in terms of sustainability of local business. In its report, the PAC acknowledged that there were also numerous submissions that supported the proposal and emphasised the potential benefits of the project, particularly in relation to employment opportunities and economic benefits to the region.

As can be seen in **Chart 8.2** below, opposition responses could be categorised into 17 issue themes, those raised most frequently being impacts on local ecology, noise and air quality.

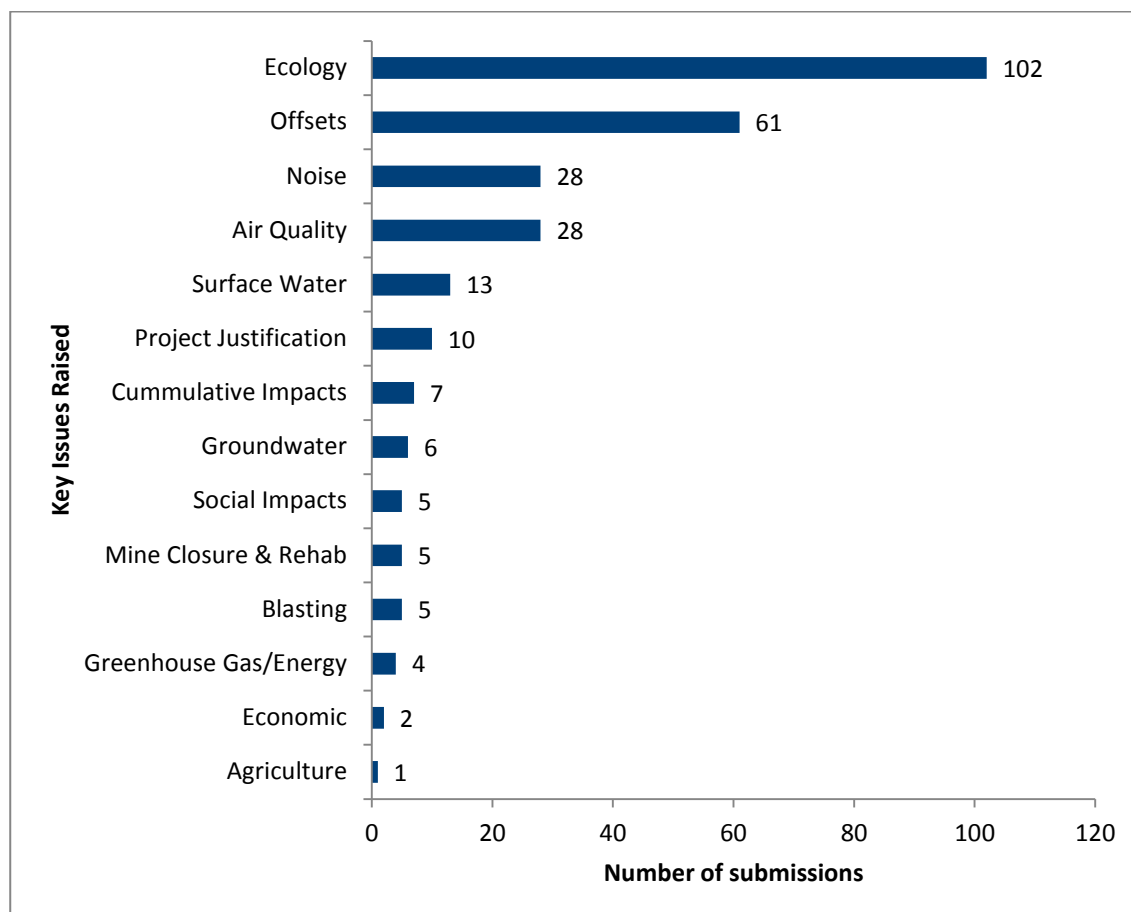


Chart 8.2 **Objecting Submissions Response Themes**

Generally submissions on the EIS, were aligned closely with the community issues discussed in the SIOA and reported as part of the EIS. The ecology issues raised in submissions on the EIS were primarily from local and non-local NGOs (who made up bulk of objections) and not individuals; this is in contrast to the data from the stakeholder engagement process undertaken prior to submission of the EIS.

The issues raised in the public submissions for the Project were addressed through the Response to Submissions Report A (June 2015) and the additional Response to Agency Queries Report (November 2015). These responses are provided on the DP&E and Mount Owen websites.

8.1.1.3 Stakeholder Comments from PAC Public Hearing Process

During the PAC Public Hearing on the Project, held at Singleton on 15 December 2015, a number of issues were raised in verbal submissions. The PAC also requested further information on several matters during the site visit held on 16 December 2015. Furthermore, written Submissions, which raised some additional issues, were received by the PAC and provided to Mount Owen in early January 2016. Three of the written submissions received by the PAC were from residents in the Middle Falbrook area; two of which did not present at the PAC hearing. In addition to the parties that raised issues during the PAC hearing, there were a number of presentations to the PAC in support of the Project, notably the Hunter and local business chambers, citing the economic value of continued mining in the region.

Issues raised by stakeholders during the PAC Public Hearing process were similar to those provided in written submissions on the EIS. A number of issues were also raised regarding the assessment process more generally. Mount Owen provided a comprehensive response to the issues and matters raised at the PAC hearing and written submissions in the Response to Submissions to PAC Report (Umwelt 2016a).

8.1.1.4 SIOA Outcomes

The SIOA completed a comprehensive assessment of the social impacts and opportunities associated with the Project. The SIOA assesses and evaluates social impacts associated with the Project in a risk assessment framework based on extensive and comprehensive analysis and engagement with stakeholders. This assessment, presented in Appendix 5 of the EIS, examined impacts related to population change, housing and accommodation, community services and facilities, social amenity and community sustainability. As acknowledged in the SIOA, a number of social impacts, including the perceived impacts from air quality and noise from the Project were seen as high risk in the community, which is consistent to the feedback received from the community throughout extensive community engagement over the past 4 years.

To the extent practicable, Mount Owen has sought to reduce impacts on the community and have also committed to a range of further mitigation strategies where significant impacts are unavoidable. In relation to the predicted air and noise impacts Mount Owen has committed to specific private property mitigation measures and the acquisition of private residences should this be requested by relevant landholders. It is important to note that of the 11 properties predicted to experience impacts above relevant acquisition criteria (R015c, R021, R023, R022, R105, R111, R114, R115, R116, R133 and R174), two (R105 and R111) already have acquisition rights from surrounding mining operations and 4 properties (R015c, R115, R133 and R174) are vacant land. Mount Owen has engaged with the owners of properties identified as having acquisition rights under the Project and have maintained ongoing dialogue with these people during the Assessment Process.

Importantly, the SIOA found from a technical impact perspective that the Project would not present more than a medium risk of impact for the above impact types, which includes the impacts on social amenity. This includes consideration of the application of technical impact mitigation strategies, which indicates that the Project, with the committed controls in place would not have a significant social impact on the community. This is a critical consideration and the PAC's review report statement that there will be significant social impacts from the Project, is not commensurate with the reported outcomes from the comprehensive SIOA completed for the Project.

8.2 Further Public Input

Recommendation 24 of the PAC Review Report requests that:

the Department should ensure that the community has a further opportunity to provide submissions on the Department's final findings prior to determination.

Mount Owen will continue to engage with all stakeholders in relation to the Project, including an additional community information session and community newsletter on the Refined Project and updated assessment outcomes, planned for 4 June, 2016.

Mount Owen is committed to continued meaningful engagement with the community through its operations and as part of the Project. As detailed in earlier in this section, Mount Owen has implemented a comprehensive stakeholder consultation process for a number of years to provide a range of opportunities for stakeholder input into the Project and the assessment process.

9.0 Economic

9.1 Economic Recommendations

- 20. *That, prior to determination, the Department ensures that the cost-benefit analysis for the project has been prepared in accordance with the relevant guidelines, including the NSW Government Guidelines for Economic Appraisal (NSW Treasury, 2007) and the Guidelines for the Use of Cost Benefit Analysis in Mining and Coal Seam Gas Proposals (NSW Government, 2012).***

The original CBA for the Project as presented in the EIS was prepared in accordance with the relevant guidelines as outlined in the Director-General's Environmental Assessment Requirements (DGRs). The revised CBA for the Project (refer to **Appendix 7**) has been completed in accordance with the guidelines noted in the PAC recommendation as well as the 2015 *Guidelines for the Economic Assessment of mining and coal seam gas proposals* (NSW Government 2015).

- 21. *That, prior to determination, final advice on the EIS, including on air quality, biodiversity and final landforms should be reflected in the CBA.***

A CBA for the Refined Project is included in the Cost Benefit Analysis and Economic Impact Analysis of the Mount Owen Continued Operations Project prepared by Deloitte Access Economics (DAE) (refer to **Appendix 7**). The CBA for the Revised Project updates the revenue to reflect the removal of the RERR mining area from the Project and incorporates the changes to the CBA associated with:

- the refinements to the final landform (refer to **Section 2.0**) and rehabilitation strategy (refer to **Section 5.0**)
- additional offset area (refer to **Section 4.0**)
- the revised impact assessment outcomes (including the revised approach to the assessment of costs associated with air quality impacts (refer to **Section 9.2**) and
- updated commitments included in **Section 10** and **11**.

The results of the CBA for the Refined Project are set out in **Section 10.6**.

- 22. *That, prior to determination, the peer reviewer be given an opportunity to indicate whether the Applicant's response adequately addresses the issues raised in the peer review.***

The CBA for the Refined Project addresses the previous responses provided by the peer reviewer along with the assessment updates noted above.

- 23. *That, prior to determination, the Applicant provide additional information on the methodology employed to produce estimates of the value of the project under alternative scenarios, including the sensitivity of individual variations against the base-line assumptions, how the various scenarios for coal prices, carbon prices and extraction volumes relate to one another and under what conditions the project would generate a zero net present value.***

Section 7.1 of the CBA for the Refined Project (refer to **Appendix 7**) includes a test of the sensitivity of the estimate of net economic benefit by varying the coal price, operating cost and carbon price. The variations undertaken as part of the sensitivity analysis include:

- increasing coal price forecasts by 10 per cent
- decreasing coal price forecasts by 35 per cent
- increasing Project capital investment by 25 per cent
- decreasing Project capital investment by 25 per cent
- increasing the estimate of operating costs per tonne by 10 per cent
- decreasing the estimate of operating costs per tonne by 10 per cent
- pricing the cost of carbon according to alternative prices used in the Australian Treasury Clean Energy Future Policy Scenario (around 300 per cent higher than the prices used in the central case scenario, on average) and
- pricing the cost of carbon according to alternative US EPA Social Cost of Carbon estimates (5 per cent discount rate scenario) (around 80 per cent higher than the prices used in the central case scenario, on average)

The analysis of the sensitivity to coal prices is against the coal prices used in both the CBA for the Refined Project and the 2014 CBA for the Project (DAE 2014) and not current market prices or forecasts.

The CBA includes discussion of the different carbon pricing scenarios which may apply to the Project. The alternative pricing scenarios used for the cost of carbon are those identified in the Review of the NSW Energy Savings Scheme (NSW Government, 2015) as these have been deemed appropriate for use by the NSW Government in modelling industries heavily exposed to carbon price scenarios.

A comparison of the total net benefits of the Project obtained in each of these scenarios, using a 4 per cent, 7 per cent and 10 per cent discount rate is presented in **Table 9.1** The market assumptions used for the Central CBA is the same as that used in the 2014 DAE Report (refer to Appendix 17 of the EIS).

Table 9.1 Sensitivity Analysis – comparison of net benefits

Parameter	Variation in Parameter	Total Net Benefits (\$m)		
		4%	7%	10%
Central CBA	N/A	1,078	857	689
Coal price forecasts	+ 10%	1,477	1,183	959
	- 35%	-320	-283	-254
Project capital investment	+ 25%	1,041	822	656
	- 25%	1,114	892	723
Operating costs per	+ 10%	842	665	531

Parameter	Variation in Parameter	Total Net Benefits (\$m)		
		4%	7%	10%
tonne	- 10%	1,314	1,049	848
Cost per tonne of carbon emissions	Australian Treasury Clean Energy Future Policy Scenario prices (approx. + 300%)	962	766	616
	US EPA Social Cost of Carbon prices 5% discount rate scenario (approx. + 80%)	1,040	827	665

Source: DAE calculations, discounting back to start of 2016

Section 7.1 of the CBA for the Refined Project (refer to **Appendix 7**) includes a test of the sensitivity of the estimate of net economic benefit to the State of NSW using the same variation for coal price, operating cost and carbon price as applied to the Project CBA. A comparison of the total net economic benefit to the State of NSW obtained in each of these scenarios using a 4%, 7% and 10% discount rate is presented in **Table 9.2**.

Table 9.2 Sensitivity analysis – comparison of net benefits for State of NSW

Parameter	Variation in Parameter	Net Benefits (\$m)		
		4%	7%	10%
Central CBA	N/A	383	312	257
Export coal price forecasts	+ 10%	451	367	303
	- 35%	177	142	116
Incremental royalties	+ 25%	463	376	311
	- 25%	304	247	204
Project case company income tax	+ 50%	426	347	287
	- 50%	340	276	228
Social cost per tonne of carbon emissions	Australian Treasury Clean Energy Future Policy Scenario prices (approx. + 300%)	346	282	234
	US EPA Social Cost of Carbon prices 5% discount rate scenario (approx. + 80%)	371	302	250

Source: DAE calculations, discounting back to start of 2016

As noted above, under all scenarios examined, the Refined Project is predicted to deliver significant net benefits to the NSW over the life of the Project.

The CBA for the Refined Project also includes an NPV estimate for the Project using March 2016 Consensus Economics (Consensus Economic 2016) coal price forecasts. Despite the depressed coal prices currently being experienced, the CBA found that the NPV for the Refined Project using the March 2016 Consensus Economics forecasts was approximately \$108 million using a 7 per cent discount rate. Using these assumptions, the Project would deliver benefits to the State of NSW over the life of the Project of approximately \$186 million in NPV terms.

Section 7.1 and 7.2 of the CBA for the Refined Project (refer to **Appendix 7**) also includes discussion around how each of the variables addressed in the sensitivity analysis relate to each other. As can be seen from **Table 9.1**, the key determinate of whether the CBA for the Project generates a positive NPV is coal price. It is considered to be unduly speculative to identify different scenarios which may give rise to a zero NPV given the complex interactions between different variables and the dominance of the coal price in the determination of NPV.

It should also be stressed that a project NPV of zero does not indicate that the Project is not financially viable for the operator, nor does it mean the project will not deliver net benefits to the State of NSW or the local community as the payment of royalties, rates, wages, and taxes, and payment for services and capital costs will still flow through to the broader economy. As can be seen in **Table 9.2**, the Project will deliver significant benefits to the State of NSW even under the low coal price scenario. As noted above, even in the currently depressed market conditions, the Project is still identified as having a positive NPV and will deliver significant economic benefits to the community over the life of the Project.

9.2 Issues raised by DP&E

In correspondence dated 8 March 2016, DP&E clarified the following matters to be addressed as part of this PAC response report.

The Department understands that Glencore is not disputing the request for a sensitivity analysis of the valuation of air pollution impacts, but disagrees with The CIE's recommendation to use the PAE Holmes (2013) study for this purpose. To date, the advice we have received is that the PAE Holmes study should still be considered as a valid alternate method for valuing air quality impacts. The Department therefore requests that Glencore present and justify an appropriate alternate method for providing a sensitivity analysis of the [DEC 2005b] study, or provide a sensitivity analysis using the PAE Holmes report, as recommended in The CIE's review.

Review and update (as necessary) the economic impact assessment for the project. In particular, Glencore should consider whether the cost-benefit analysis should be revised and updated to reflect any changes to predicted air quality impacts following the completion of the air quality peer review, as well as any material changes to the project made in response to the Commission's review recommendations (for instance changes to biodiversity offsets or final landforms). As part of this review and/or update of the economic impact assessment, Glencore should also provide:

- a. justification for the use and representativeness of Singleton Heights to derive a value for air pollution impacts (noting that residents in closer proximity to the mine, such as Middle Falbrook, may experience greater air quality impacts); and***
- b. a sensitivity analysis of air pollution costs (as requested in The CIE's review report – see comment below);***

An analysis of the economic costs of air quality impacts associated with the Project has been prepared by Pacific Environment (Pacific Environment AQ Economic Impacts Report) and is included as **Appendix 8** to this report. The Pacific Environment AQ Economic Impacts Report includes discussion around the

appropriateness of using the PAE Holmes 2013 methodology for assessing mining projects such as the Mount Owen Continued Operations Project, and provides an alternate approach which has been adopted in the revised CBA.

As identified in the Pacific Environment letter of 27 October 2015, the PAE Holmes 2013 'damage cost' approach to valuing air quality impacts has limitations when applied to large but localised industrial emission sources located in areas with small pockets of population such as the Project. As identified in that letter *'In relation to the Mount Owen Continued Operations Project, there are sufficient technical reasons for not using the damage cost method and applying an alternative assessment methodology'*. This conclusion is reaffirmed in the Pacific Environment AQ Economic Impacts Report which includes additional discussion regarding the technical limitations of applying the PAE Holmes 2013 'damage cost' approach to the Project.

The Pacific Environment AQ Economic Impacts Report includes an assessment of the economic costs associated with the air quality impacts from the Project using an approximated impact pathway methodology. This approach is considered to be more robust than either the DEC 2005b or the PAE Holmes 2013 approaches as it utilises the modelled increases in PM_{2.5} concentrations on impacted populations to determine the likely economic impacts associated with the air quality impacts from the Project. Applying the approximated impact pathway methodology, the Project economic cost is estimated to be \$4.9 million in Present Value (PV) terms (2015 dollars using a 7 per cent real discount rate). The results from the Pacific Environment AQ Economic Impacts Report have been used in the CBA for the Refined Project

Notwithstanding the limitations of the 'damage cost' approach to valuing air quality impacts from the Project, the Pacific Environment AQ Economic Impacts Report includes a quantification of potential economic costs from the Refined Project using the 2013 Pacific Environment damage cost approach for comparative purposes.

2. Provide further information in relation to carbon prices

The Department has considered the net benefit sensitivity analysis provided in DAE's response to the economics peer review (26 Oct 2015). This sensitivity analysis clearly demonstrates that potential changes to carbon prices under future stages of the EU Emissions Trading Scheme (ETS) could affect the price of carbon pollution over the life of the project.

While the carbon price of AUD\$8.91/t adopted in the EIS aligns with the current phase of the EU ETS, this phase concludes in 2020. The Department understands there is speculation about potential increases to the carbon prices under Phase 4 of the EU ETS (which commences in 2021 and includes the later years of the project) and notes that The CIE identifies that when the maximum EU ETS prices for carbon pollution are applied to the project, the costs over the life of the project could increase to up to \$85 M (refer to page 3 of The CIE review report). This would appear to approach the anticipated royalties (approx. \$85 M) that NSW would be expected to receive under a low coal price scenario.

The Department therefore requests that you consider and provide advice on the potential implications for the project under a scenario involving increased carbon prices and low coal prices. The Department is particularly interested in understanding how this scenario would affect the net public benefits of the project (including royalties to NSW and any environmental, social and economic costs that would accrue to the public).

The sensitivity analysis undertaken in the 26 October 2015 DAE response to the economics peer review assessed the NPV of the Project against a lower sensitivity carbon price scenario of \$6.86 and a higher carbon sensitivity price scenario of \$51.98/ t CO₂. These scenarios assumed the price of carbon remained static for the life of the Project. Under both scenarios, the CBA for the original Project was positive. As identified by DP&E, the higher prices of carbon would occur at the later stages of the Project when discounts have a greater impact; accordingly, the higher price scenario used in this sensitivity analysis is conservative as it assumed the higher price would apply for the duration of the Project.

The CBA for the Refined Project (refer to **Appendix 7**) includes a discussion of different carbon pricing options appropriate for use in the CBA. As discussed in **Section 9.1** above, the CBA for the Refined Project includes a sensitivity analysis of the CBA for the Project having regard to the different carbon price scenarios used by the NSW Government in the Review of the NSW Energy Savings Scheme (NSW Government, 2015). As shown in **Table 9.1**, under all carbon price scenarios examined, the Project is still identified as having a positive NPV. As shown in **Table 9.2**, the Project is predicted to deliver significant benefits for the State of NSW under all sensitivity scenarios examined.

2. Provide further information in relation to carbon prices

The Department has considered the net benefit sensitivity analysis provided in DAE's response to the economics peer review (26 Oct 2015). This sensitivity analysis clearly demonstrates that potential changes to carbon prices under future stages of the EU Emissions Trading Scheme (ETS) could affect the price of carbon pollution over the life of the project.

While the carbon price of AUD\$8.91/t adopted in the EIS aligns with the current phase of the EU ETS, this phase concludes in 2020. The Department understands there is speculation about potential increases to the carbon prices under Phase 4 of the EU ETS (which commences in 2021 and includes the later years of the project) and notes that The CIE identifies that when the maximum EU ETS prices for carbon pollution are applied to the project, the costs over the life of the project could increase to up to \$85 M (refer to page 3 of The CIE review report). This would appear to approach the anticipated royalties (approx. \$85 M) that NSW would be expected to receive under a low coal price scenario.

The Department therefore requests that you consider and provide advice on the potential implications for the project under a scenario involving increased carbon prices and low coal prices. The Department is particularly interested in understanding how this scenario would affect the net public benefits of the project (including royalties to NSW and any environmental, social and economic costs that would accrue to the public).

The sensitivity analysis undertaken in the 26 October 2015 DAE response to the economics peer review assessed the NPV of the Project against a lower sensitivity carbon price scenario of \$6.86 and a higher carbon sensitivity price scenario of \$51.98/ t CO₂. These scenarios assumed the price of carbon remained static for the life of the Project. Under both scenarios, the CBA for the original Project was positive. As identified by DP&E, the higher prices of carbon would occur at the later stages of the Project when discounts have a greater impact; accordingly, the higher price scenario used in this sensitivity analysis is conservative as it assumed the higher price would apply for the duration of the Project.

The CBA for the Refined Project (refer to **Appendix 7**) includes a discussion of different carbon pricing options appropriate for use in the CBA. As discussed in **Section 6.1** above, the CBA for the Refined Project includes a sensitivity analysis of the CBA for the Project having regard to the different carbon price scenarios used by the NSW Government in the Review of the NSW Energy Savings Scheme (NSW Government, 2015). As shown in **Table 9.1**, under all carbon price scenarios examined, the Project is still identified as having a positive NPV. As shown in **Table 9.2**, the Project is predicted to deliver significant benefits for the State of NSW under all sensitivity scenarios examined.

10.0 Updated Assessment for Refined Project

10.1 Preliminary Environmental Assessment

A preliminary environmental assessment was undertaken of the Refined Project to identify the environmental, economic and social aspects where the impacts may have changed from those outlined in the EIS. It is noted that for all relevant issues, the impacts of the Refined Project are similar to or less than those of the proposed Project as outlined in the EIS.

The findings of the preliminary environmental assessment are provided in **Table 10.1**, identifying which aspects will result in changed environmental and social outcomes and require further assessment. In these cases further assessment has been completed and presented in this section to provide detailed analysis of the relevant issues. It is noted that this section only reports on the relevant assessment outcomes that have changed as a result of the Refined Project, with the remainder of issues remaining as previously assessed.

The impacts associated with the transfer of tailings to Ravensworth East mine from Ravensworth Operations and Liddell Coal (refer to **Section 2.0**) have been assessed as part of Ravensworth East DA52-03-99 MOD 6 approved in February 2016. As outlined in **Section 2.0**, these approved works will be continued as part of the Project should it be approved.

Table 10.1 Preliminary Environmental Assessment for the Refined Project

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required
Land Resources and Land Use	The areas of disturbance remain unchanged to that assessed in the EIS.	No
Agricultural	The areas of disturbance remain unchanged to that assessed in the EIS.	No
Noise	Noise impacts associated with the Refined Project have been remodelled to consider changes in landform and mining areas.	Yes. Refer to Section 10.2
Blasting	The Refined Project will result in the removal of the RERR mining area and the blasting impacts are expected to be the same as or slightly less than that outlined in the EIS as the majority of blast sensitive structures and locations are located in closer proximity to other unchanged aspects of the Project.	No
Air Quality	Air quality impacts associated with the Refined Project have been remodelled to consider changes in landform and mining areas. Additional analysis associated with updated air quality monitoring and additional cumulative assessment sensitivity analyses are presented.	Yes. Refer to Section 10.3
Ecology	The areas of disturbance remain unchanged to that assessed in the EIS. Further information in relation to the ecological outcomes of the proposed rehabilitation and final land use is presented in Section 5.0 .	No

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required
Surface Water	The Refined Project will result in an altered landform due to the removal of the RERR final void and landform changes to the BNP void. As such further consideration of the design of the surface water management system is required.	Yes. Refer to Section 10.4
Groundwater	The Refined Project is unlikely to significantly affect the inflow and regional drawdown impacts outlined in the EIS. However, there will be a reduced number of final voids in the final landform which may result in some reductions to impacts and therefore a Refined Project assessment has been completed.	Yes. Refer to Section 10.4
Visual	The Refined Project will result in an altered landform due to the incorporation of extensive areas of micro relief and removal of a void in the final landform. These changes are not expected to change the key findings of the assessment as outlined in the EIS. Further detail on the final landform, including cross sections, is provided in Section 5.0 .	No
Aboriginal Cultural Heritage	The areas of disturbance remain unchanged to that assessed in the EIS.	No
Historic Heritage	The areas of disturbance remain unchanged to that assessed in the EIS. In addition the results of the blasting assessment outlined in the EIS will not be affected by the Refined Project, and are similar or less than that assessed in the EIS.	No
Greenhouse Gas and Energy	Due to the removal of the RERR mining area the Refined Project will have a lower energy use and emissions profile. A revised assessment has been undertaken to identify and calculate the emissions associated with Refined Project.	Yes. Refer to Section 10.5 .
Traffic and Transport	There is no change to the traffic generated from the Refined Project relative to that assessed in the EIS.	No
Rehabilitation and Closure	The Refined Project will result in changes to the out of pit overburden emplacement areas and a reduction in the number of voids in the final landform.	Yes. Refer to Section 5.0
Waste	There is no change to the waste generated from the Refined Project relative to that assessed as part of the EIS.	No
Bushfire	There is no change to bushfire impacts from the Refined Project relative to that assessed as part of the EIS.	No
Hazard	There is no change to hazards from the Refined Project relative to that assessed as part of the EIS.	No
Social	There are no changes to the SIOA as presented in the EIS.	No
Economic	A revised economic assessment for the Refined Project has been completed.	Yes. Refer to Section 10.6 .

10.2 Noise

A comprehensive assessment of potential noise impacts was completed for the Project and included in the EIS as Appendix 7. Potential noise impacts associated with the Refined Project have been assessed as outlined in the following sections. The assessment methodology outlined in Section 5.4 and Appendix 7 of the EIS has been used for the Refined Project noise assessment. It is noted that through the assessment process, DP&E refined the applicable Project Specific Noise Levels (PSNLs) for Area 4 and Area 8 surrounding the Project area. For the purposes of the updated assessment the refined PSNL have been used, along with the assessment criteria outlined in the EIS.

10.2.1 Noise Assessment Findings

As the refinements of the Project relate to removal of the RERR mining area this only affects the Year 10 noise impact assessment as presented in the EIS. As outlined in **Section 2.0**, the capping and rehabilitation of the TP2 area (previously proposed as part of the RERR mining area) is proposed, but has been assessed to have no material change to the predicted noise levels outside of Year 10 as presented in the EIS.

As discussed in Section 5.3.1 of the EIS, the Project was designed to incorporate the management of the operation of the RERR Mining Area during periods when the weather conditions enhance the noise impacts, such as inversion conditions, during some winter night times. Consequently, the results for Year 10 in Section 5.3.3 of the EIS did not include operations in the RERR Mining Area under adverse weather conditions during winter night times, (estimated to be approximately 20 to 30 nights during the June-August winter period). Accordingly the updated assessment in **Section 10.2.1.1** presents the updated noise predictions during non-winter nights, non-winter evenings and all season day time predicted noise levels.

The updated noise assessment, that incorporates the refined PSNL for the Project as provided by DP&E, results in a reduction in the total noise predicted during Year 10 of the Project during all periods with the removal the RERR mining area from the Project as outlined in **Section 10.2.1.1**. In addition the DP&E revised PSNLs, which are applied to all modelled years (1, 5 and 10), also result in a number of changes to the outcomes of the NIA as detailed further in **Section 10.2.1.1**.

The key findings of the updated noise impact assessment include:

- the number of noise affected properties will decrease by one residence during Year 10 of the Refined Project with a total 24 properties predicted to exceed the relevant PSNL
- the number of non-mined owned properties (residences and land) predicted to exceed the relevant PSNL by greater than 5 dB, and therefore located in the noise affectation area, is reduced by one relative to that assessed in the EIS (it is noted that R018 has been purchased by Glencore)
- the number of properties predicted to exceed the relevant PSNL by between 3dB and 5dB, and are therefore located within the noise management area has reduced to 4 during Year 10 relative to 8 as predicted in the EIS
- Mount Owen will continue to implement the comprehensive mitigation and management measures as described in Section 5.3.10 of the EIS, including the continuation of the real time noise monitoring and management system.

Further detail of the findings of Refined Project noise assessment is outlined in the following sections.

10.2.1.1 Intrusive Noise

The results for non-mine owned residences with predicted exceedances of the relevant noise impact criteria during the life of the Refined Project, compared to the Year 10 noise modelling results presented in the EIS are shown in **Table 10.2**. **Table 10.2** also provides a summary of the relevant changes in noise affectation and management areas for areas surrounding the Project. The shading in the table highlights the changes in predicted noise levels between the EIS and for the Refined Project.

Table 10.2 Comparison of Year 10 noise model results for properties above relevant PSNL

Receiver Location	Period	PSNL ¹	Year 10 (EIS Project)				Year 10 (Refined Project)				Changes to Management and Affection
			Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night ²	Non-winter Nights	Non-winter Evening	All Seasons Day	
Area 1 - R041	Day	35	-	-	-	-	-	-	-	-	Exceedance of 1 to 2dB due to Year 1 operations (refer to Table 5.3.4 of EIS) – no change to Year 10 impacts
Area 1 - R048	Day	35	-	-	-	-	-	-	-	-	Exceedance of 1 to 2dB due to Year 1 operations (refer to Table 5.3.4 of EIS) – no change to Year 10 impacts
Area 3 – R174 (vacant land)	Day	35		-	-	43		-	-	43	Greater than 25% of land affected – remains unchanged from EIS
	Evening	35		-	36	-		-	36	-	
	Night	35	43	39	-	-	43	39	-	-	
Area 4 - R015c (vacant land)	Day	35		-	-	43		-	-	42	Greater than 25% of land affected – remains unchanged from EIS
	Evening	37		-	-	-		-	-	-	
	Night	35	41	38	-	-	41	38	-	-	
Area 4 - R010	Night	36	-	37	-	-	-	37	-	-	Exceedance of 1 to 2dB in Year 10 operations – no change to impacts
Area 4 - R011	Night	36	37	37	-	-	37	37	-	-	Exceedance of 1 to 2dB in Year 10 operations – no change to impacts
Area 4 - R012	Night	36	-	38	-	-	-	38	-	-	Moves out of management area due to refined PSNL (DP&E) - exceedance of 1 to 2dB in Year 10 operations
Area 4 - R013	Day	35		-	-	38		-	-	38	Remains in management area – no change in impacts
	Night	35	38	37	-	-	38	37	-	-	
Area 4 - R014	Day	35		-	-	37		-	-	37	Exceedance of 1 to 2dB – no change to impacts
	Night	35	37	-	-	-	37	-	-	-	
Area 4 - R019	Day	35		-	-	38		-	-	37	Remains in management area – no change in impacts
	Night	35	39	38	-	-	39	38	-	-	
Area 4 - R021	Day	35		-	-	39		-	-	38	Remains in affectionation area – no change in impacts
	Evening	37		-	37	-		-	37	-	
	Night	35	41	39	-	-	41	39	-	-	
Area 4 - R022	Day	35		-	-	40		-	-	39	Remains in affectionation area – no change in impacts
	Evening	37		-	37	-		-	37	-	
	Night	35	41	39	-	-	41	39	-	-	
Area 4 - R023	Day	35		-	-	38		-	-	38	Remains in affectionation area – no change in impacts
	Evening	37		-	38	-		-	37	-	
	Night	35	41	39	-	-	41	39	-	-	
Area 4 - R093	Day	37		-	-	38		-	-	38	Remains in management area – no change in impacts
	Night	36	40	36	-	-	40	36	-	-	
Area 4 - R094	Night	36	38	36	-	-	38	35	-	-	Moves out of management area due to lower predicted noise level and refined PSNL (DP&E) - exceedance of 1 to 2dB in Year 10 operations
Area 4 - R095	Night	36	37	-	-	-	37	-	-	-	Moves out of management area due to refined PSNL (DP&E) - exceedance of 1 to 2dB in Year 10 operations
Area 4 - R112	Night	36	-	38	-	-	-	38	-	-	Moves out of management area due to refined PSNL (DP&E) - exceedance of 1 to 2dB in Year 10 operations

Receiver Location	Period	PSNL ¹	Year 10 (EIS Project)				Year 10 (Refined Project)				Changes to Management and Affection
			Winter Night	Non-winter Nights	Non-winter Evening	All Seasons Day	Winter Night ²	Non-winter Nights	Non-winter Evening	All Seasons Day	
Area 4 - R114	Day	37		-	-	37		-	-	36	Not predicted to exceed refined PSNL (DP&E) and predicted lower noise levels
	Night	36	36	-	-	-	36	-	-	-	
Area 4 - R115 (vacant land)	Night	36	37	36	-	-	37	35	-	-	Exceedance of 1 to 2dB – no change to impacts
Area 5 - R091	Day	35		-	-	36		-	-	36	Exceedance of 1 to 2dB – no change to impacts
	Night	35	36	-	-	-	36	-	-	-	
Area 5 - R092	Day	35		-	-	37		-	-	36	Exceedance of 1 to 2dB – no change to impacts
	Night	35	37	36	-	-	37	36	-	-	
Area 6 - R122 ³	Day	39		-	-	42		-	-	41	Remains in management area – no change in impacts
	Evening	39		-	42	-		-	42	-	
	Night	39/37 ⁴	42	42	-	-	42	42	-	-	
Area 7 - R004	Day	37		-	-	38		-	-	38	Exceedance of 1 to 2dB – no change to impacts
Area 8 – R111	Day	41	-	-	-	36	-	-	-	35	Not predicted to exceed refined PSNL (DP&E)
	Evening	44	-	-	36	-	-	-	35	-	
	Night	42	35	36	-	-	35	35	-	-	

Note: 1) PSNL based on intrusiveness LAeq,15minute Criteria unless otherwise noted and as previously reassessed
2) No change to predicted noise levels due to the Refined Project.
3) Predicted noise levels are at the residence.
4) Criteria 39 dB(A) LAeq,15minute and 37 dB(A) LAeq,night.

It is noted that an exceedance of up to 2dB of the refined PSNL at R154 and R155 is predicted in Year 1 of the Project. These properties are located within existing noise affectation and management areas for surrounding approved mining operations.

Figures 10.1 to 10.3 present the 10th percentile noise level contours predicted under the representative worse case meteorological conditions.

The potential exceedances of the relevant PSNL for the Project are provided in **Table 10.3**. **Table 10.3** provides a consolidated list of residences and vacant land assessment presented in the EIS, Response to Submissions Report and the updated assessment.

Table 10.3 Summary of Predicted Noise Impacts

Noise Prediction Outcome	No. of Properties	Properties
Residences where noise levels are predicted to exceed PSNL's by up to and including 2 dB	13	R004, R041, R048, R010, R011, R012, R014, R091, R092, R094, R095, R112, R115
Residences where noise levels are predicted to exceed PSNL's by 3 dB, up to and including 5 dB and located in management area	4	R013, R019, R093, R122 ¹
Residences within Noise Affectation Zone (exceedance of greater-than 5 dB above relevant PSNL)	5 ²	R021, R022, R023, R015c, R174

Note: 1) R122 is subject to acquisition under Glencore's Glendell Mine.

2) R015c, and R174 are vacant land predicted with greater than 25% affected by noise from the Project

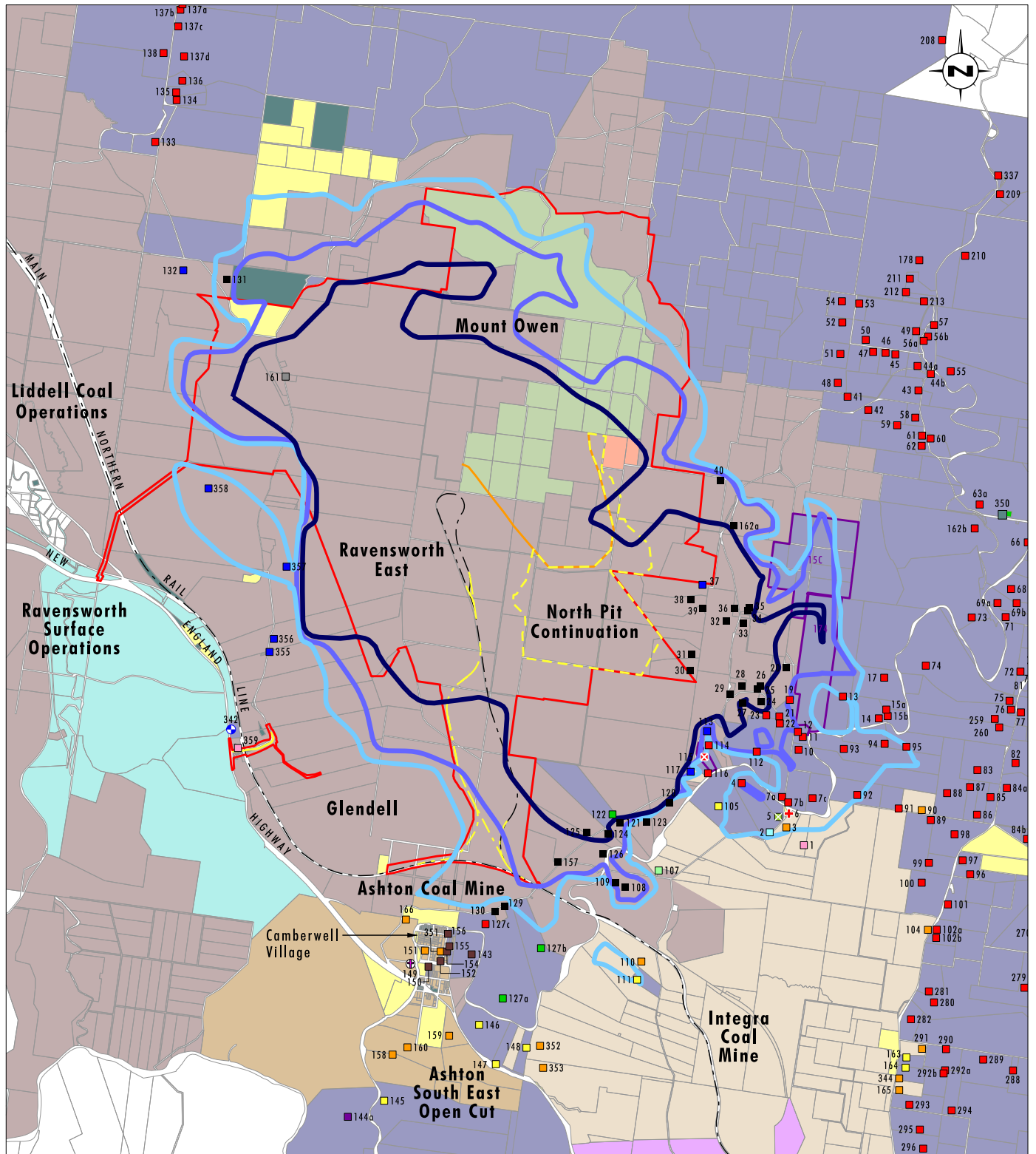
10.2.1.2 Sleep Disturbance

There are no additional predicted exceedances of the $L_{A1, 1 \text{ minute}}$ criterion of 45 dB(A) at any residences for the Refined Project. As outlined in Section 5.3.5 of the EIS, the property where the predicted LA1, 1 minute noise levels associated with the Project could result in sleep disturbance impacts is R018 which is vacant land and has been purchased by Mount Owen.

10.2.1.3 Low Frequency Noise

An analysis of the predicted noise level results for the inclusion of 'modifying factors' was completed as part of the NIA in accordance with Section 4 of the INP (EPA 2000), the INP application notes and the low frequency noise criteria suggested by DP&I (2013) and Broner (2011) (refer to Appendix 7 of the EIS). Tonal noise, impulsive noise, intermittent noise during the night time and single event duration noise were found to not require the application of modifying factors to the predicted noise levels.

The NIA found that the predicted low frequency noise levels for the Project were below the DP&E 60 dB(C) night time criteria. In addition, the predicted low frequency noise levels were found to be generally close to the threshold of hearing and therefore unlikely to be intrusive or cause annoyance. The findings of the NIA remain unchanged for the Refined Project.



Data Source: Mount Owen (2014), Department of Lands (2009)

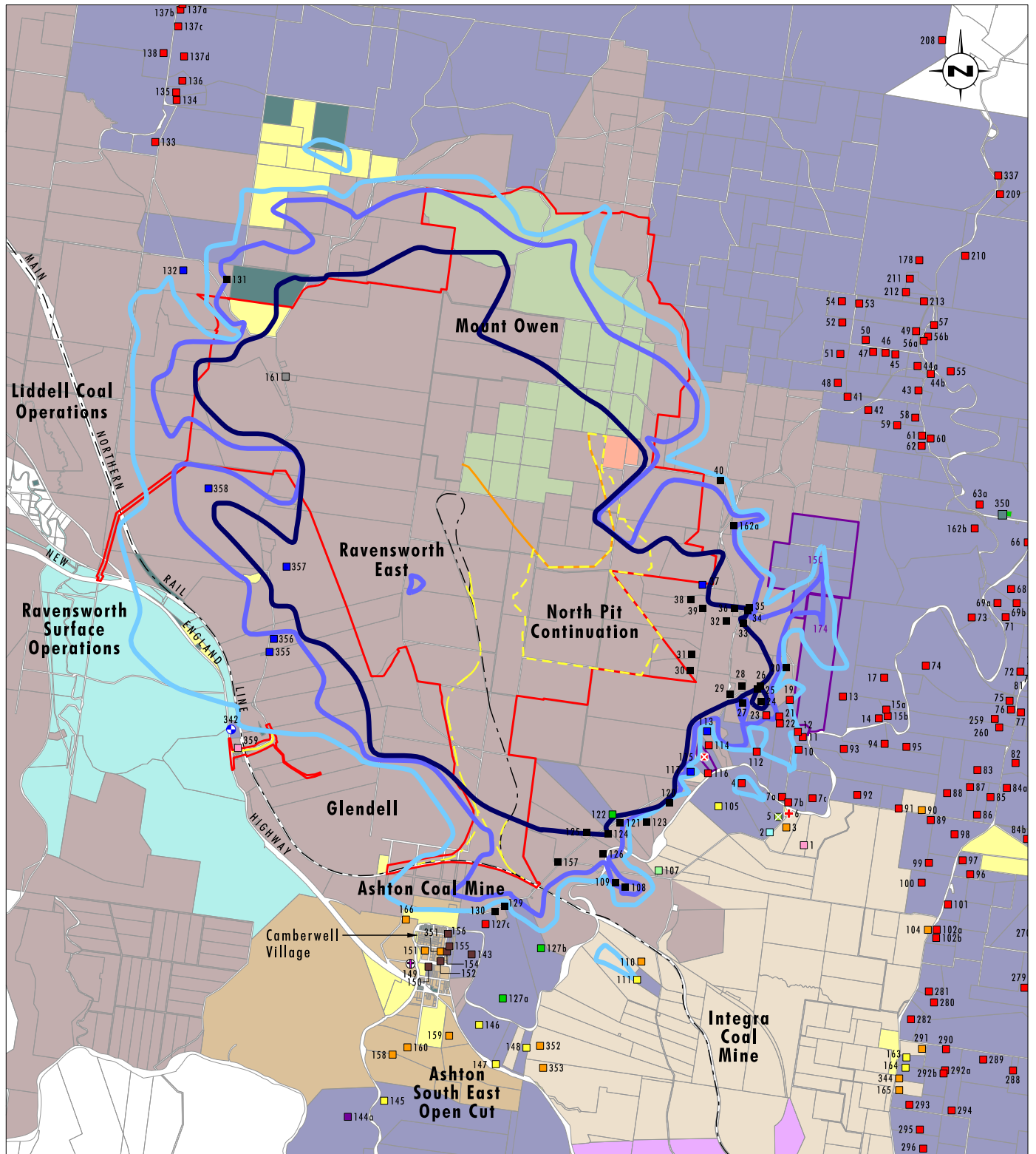
Legend

- | | | |
|--|---|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Other Mine |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Derelict |
| Proposed North Pit Continuation | Minister for Education | Mine Owned Residence - Vacant |
| Proposed Rail Upgrade Works | 35 dB(A) 10th Percentile Exceedence | Community Hall |
| Proposed Hebdon Road Upgrade Works | 37 dB(A) 10th Percentile Exceedence | Private No Dwelling |
| Vacant Land | 40 dB(A) 10th Percentile Exceedence | Church |
| Ashton Coal | Mt Pleasant Primary School | Daracon Site Office |
| Crown Land | Currently Subject to Acquisition Rights - Dairy | Glennies Creek Fire Brigade |
| Crown Land TSR | SEOC Acquisition | Former Hebdon Public School |
| Government Authority | Private Residence | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Macquarie Generation | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Glencore | Subject to Acquisition Rights - Glencore No Dwelling | |
| Private | Mine Owned Residence - Glencore | |

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FIGURE 10.1

Year 10 Non-winter Nights
Noise Contours
Refined Project



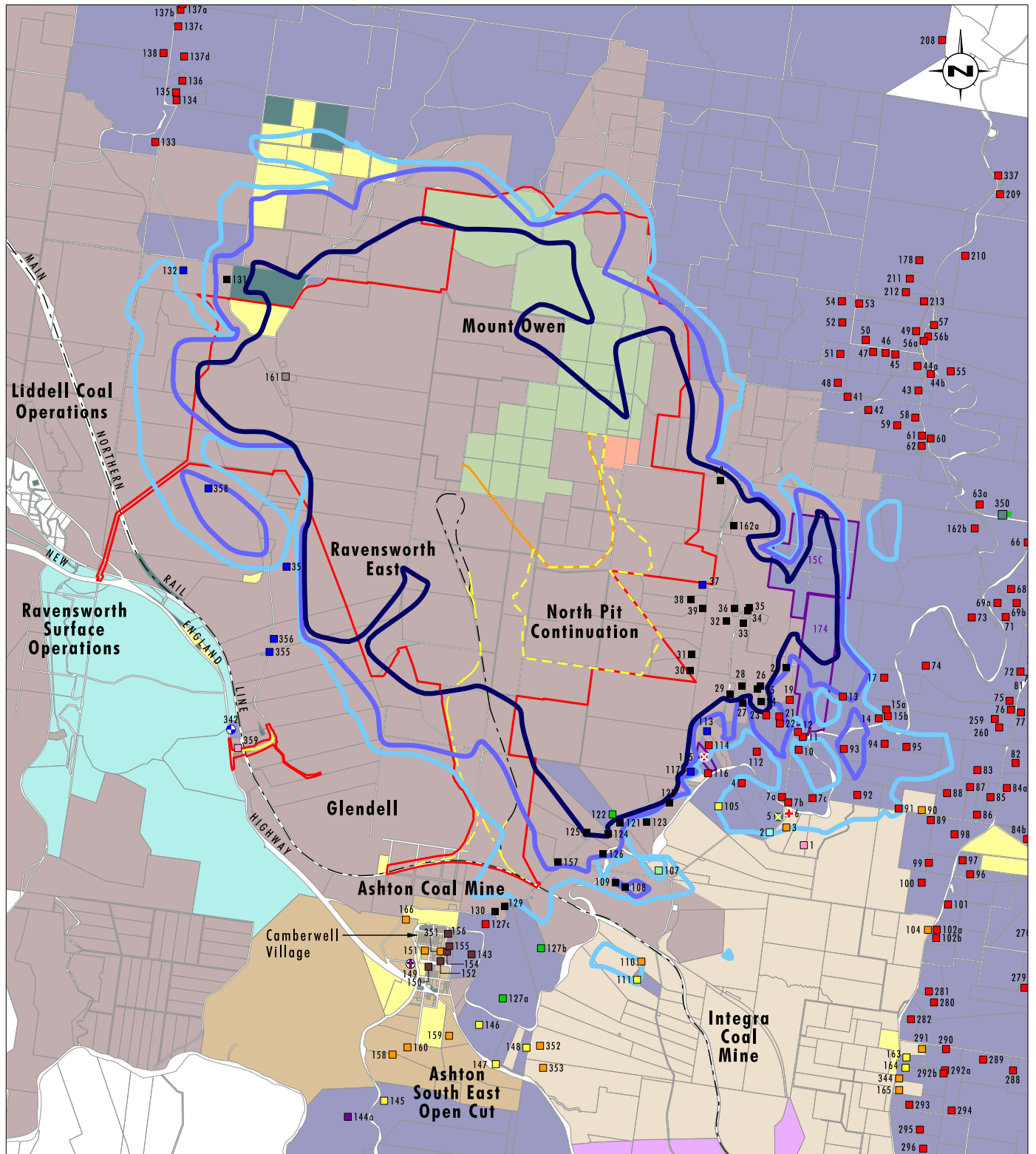
Data Source: Mount Owen (2014), Department of Lands (2009)

Legend

- | | | |
|--|---|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Other Mine |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Derelict |
| Proposed North Pit Continuation | Minister for Education | Mine Owned Residence - Vacant |
| Proposed Rail Upgrade Works | 35 dB(A) 10th Percentile Exceedence | Community Hall |
| Proposed Hebdon Road Upgrade Works | 37 dB(A) 10th Percentile Exceedence | Private No Dwelling |
| Vacant Land | 40 dB(A) 10th Percentile Exceedence | Church |
| Ashton Coal | Mt Pleasant Primary School | Daracon Site Office |
| Crown Land | Currently Subject to Acquisition Rights - Dairy | Glennies Creek Fire Brigade |
| Crown Land TSR | SEOC Acquisition | Former Hebdon Public School |
| Government Authority | Private Residence | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Macquarie Generation | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Glencore | Subject to Acquisition Rights - Glencore No Dwelling | |
| Private | Mine Owned Residence - Glencore | |

FIGURE 10.2

Year 10 Non-winter Evenings
Noise Contours
Refined Project



Data Source: Mount Owen (2014), Department of Lands (2009)

Legend

- | | | |
|--|---|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Other Mine |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Derelict |
| Proposed North Pit Continuation | Minister for Education | Mine Owned Residence - Vacant |
| Proposed Rail Upgrade Works | 35 dB(A) 10th Percentile Exceedence | Community Hall |
| Proposed Hebdon Road Upgrade Works | 37 dB(A) 10th Percentile Exceedence | Private No Dwelling |
| Vacant Land | 40 dB(A) 10th Percentile Exceedence | Church |
| Ashton Coal | Mt Pleasant Primary School | Daracon Site Office |
| Crown Land | Currently Subject to Acquisition Rights - Dairy | Glennies Creek Fire Brigade |
| Crown Land TSR | SEOC Acquisition | Former Hebdon Public School |
| Government Authority | Private Residence | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Macquarie Generation | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Glencore | Subject to Acquisition Rights - Glencore No Dwelling | |
| Private | Mine Owned Residence - Glencore | |

FIGURE 10.3

Year 10 All Seasons Day
Noise Contours
Refined Project

10.2.1.4 Cumulative Noise

As outlined in the NIA for the Project (refer to Appendix 7 of the EIS) for the areas surrounding the Project Area outside of Camberwell village, the cumulative noise assessment indicates that the cumulative noise impact assessment criteria will not be exceeded based on the Project and the relevant surrounding mining operations. Based on the remodelled results for Year 10 of the Refined Project (refer to **Section 9.2.1.1**) the findings of the NIA for the Project remain unchanged for cumulative noise for the Refined Project.

Mount Owen proposes to maintain a continuous noise monitoring unit between the Project and potentially affected privately owned residential receivers to discern the contribution the Project makes to the cumulative noise level. Noise levels that are recorded above the cumulative noise impact assessment criteria by the continuous noise monitoring system will be investigated on a case-by-case basis. When required, attended noise monitoring will be undertaken to confirm the noise source(s) contributing to the cumulative noise levels. This approach to noise performance management of the cumulative noise impacts has been successfully implemented at Mount Owen since 2004. The use of the continuous noise monitoring system to assess the noise impact of the Project was outlined further in Section 5.3.10 of the EIS.

10.2.1.5 Road, Rail and Construction Noise

As outlined in **Section 2.0**, the Refined Project will not alter the proposed road, rail and construction activities as proposed in the EIS and as such the outcomes of the noise assessment for these activities remain unchanged from that presented in the EIS.

10.3 Air Quality

A comprehensive assessment of potential air quality impacts was completed for the Project and included in the EIS as Appendix 6. A description of the existing meteorological environment and relevant assessment criteria is contained in Section 5.2 and Appendix 6 of the EIS.

An assessment of the changes to the predicted air quality assessment findings outlined in the EIS has been completed for Year 10 of the Project (refer to **Appendix 2**). This assessment was completed to identify and assess any changes in the predicted air quality impacts associated with the Refined Project for both the project alone and cumulative assessment (refer to **Section 10.3.2**). In addition, the air quality assessment (refer to **Appendix 2**) presents the following updated information in relation to the Project:

- Updated existing air quality based on additional air quality monitoring data available since the completion of the AQIA for the EIS in 2014 (refer to **Section 10.3.1**)
- Additional sensitivity scenarios for the cumulative air quality impact assessment on the basis of the changing mining activities within proximity to the Project (refer to **Section 10.3.2**).

10.3.1 Updated Existing Air Quality

As part of the updated air quality impact assessment for the refined Project (refer to **Appendix 2**) analysis of additional background monitoring data from the Mount Owen and Upper Hunter Air Quality Monitoring Network (UHAQMN) sites through to the end of 2015 has been completed.

When the AQIA was completed in 2014, monitoring data was available until the end of 2013, which were used to describe the existing air quality in the Project area using the Mount Owen monitoring data, and also further afield using the UHAQMN data. The results of the analysis were presented in Section 5.3 of the AQIA (Appendix 6 of the EIS).

Chart 10.1 presents the fixed point PM₁₀ concentrations annual averages (to 31 December each year) for the Mount Owen monitoring stations through to 2015. **Chart 10.1** also includes additional data for some sites that have become available since March 2014 (SX9, SX10 and PM10-2).

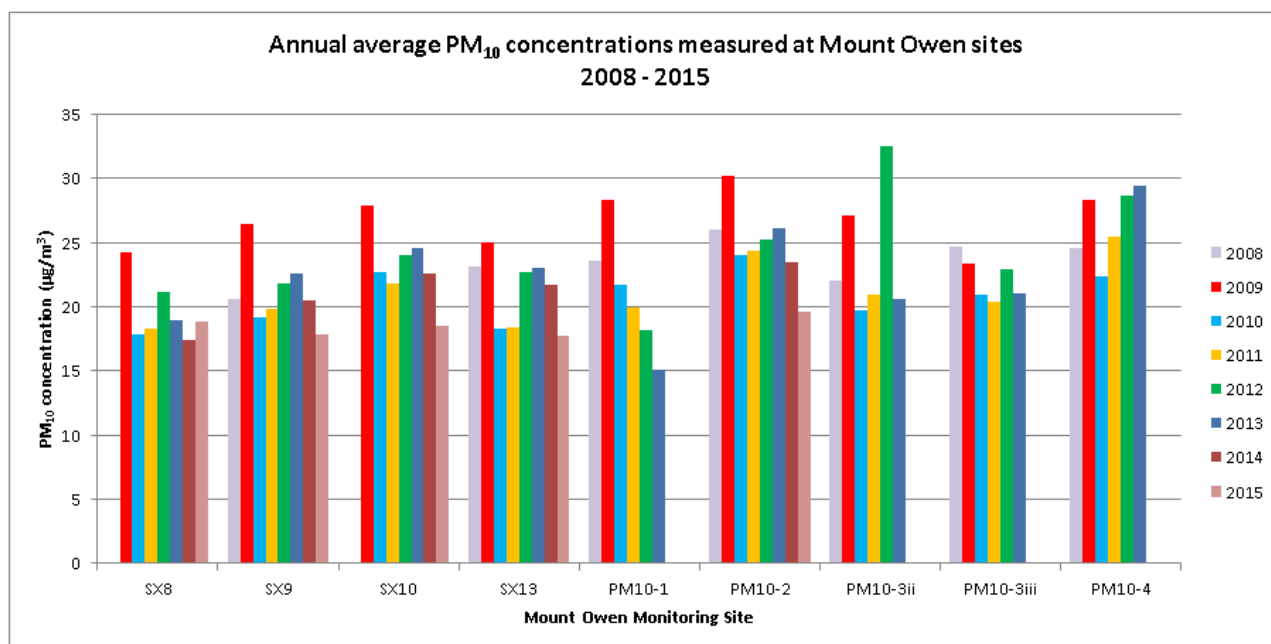


Chart 10.1 Annual average PM₁₀ concentrations measured at Mount Owen sites from 2008 – 2015

From the monitoring results presented in **Chart 10.1**, it is clear that 2009 was an anomalous year, with a significant dust storm and a number of bushfires occurring in that year. It is also noted that at PM10-1 there has been a steady decrease in annual average PM₁₀ since 2008 (with the exception of 2009). It is important to note that in general (excluding 2009), levels at SX9, SX10, PM10-2 and PM10-3iii have remained reasonably consistent, varying by about 6 µg/m³ or less over seven years. In fact, these four sites have been the most consistent of all the Mount Owen sites. As noted in the 2014 AQIA, this temporal and spatial variability in emissions poses significant difficulties in using these data to determine appropriate background levels for the assessment of cumulative impacts associated with the Project.

The Upper Hunter Air Quality Monitoring Network (UHAQMN) is the regional air quality monitoring network in the Upper Hunter, established by NSW OEH and managed by the NSW EPA. By the beginning of 2012 there were 14 sites operating in strategic locations across the region. These sites include those in major population areas, Muswellbrook and Singleton, as well as near large mining operations. There are a smaller number of more remote sites that were specifically sited to provide an estimate of levels less influenced by mining. These include the Wybong and Merriwa sites, and also Jerrys Plains as it is outside the predominant NW-SE wind direction axis in the valley. A key objective of the establishment of monitoring at these sites was to represent a ‘non-mining background’ value for the cumulative annual average PM₁₀ assessment. That is, sites that are less influenced by contributions from mining operations within the Hunter Valley.

The use of the UHAQMN to indicate a non-mining background level has been supported by the Project’s peer reviewer, Shane Lakmaker of Jacobs who notes “Background station monitoring PM10 and PM2.5 concentrations in continental air reaching the Hunter Valley from the northwest” (Upper Hunter Valley Monitoring Design Network [HAS 2008]). Therefore the PEL approach was consistent with the monitoring data objectives and the Project assessment objectives, that is, to avoid double counting.

The monitoring results for the period 2012 to 2015 for the UHAQMN in relation to annual average PM₁₀ concentration is shown on **Chart 10.2**. As shown on **Chart 10.2**, concentrations have been decreasing at most sites since monitoring began with the lowest values at the Wybong, Merriwa and Jerrys Plains sites. The annual average PM₁₀ concentration from 2012 – 2015 at these three sites is 15.1 µg/m³.

It is noted that this annual average PM₁₀ concentration value is higher than the value of 14.9 µg/m³ used in the most recent evaluation of cumulative annual average PM₁₀, in the Response to Submissions regarding the AQIA (Umwelt, 2015).

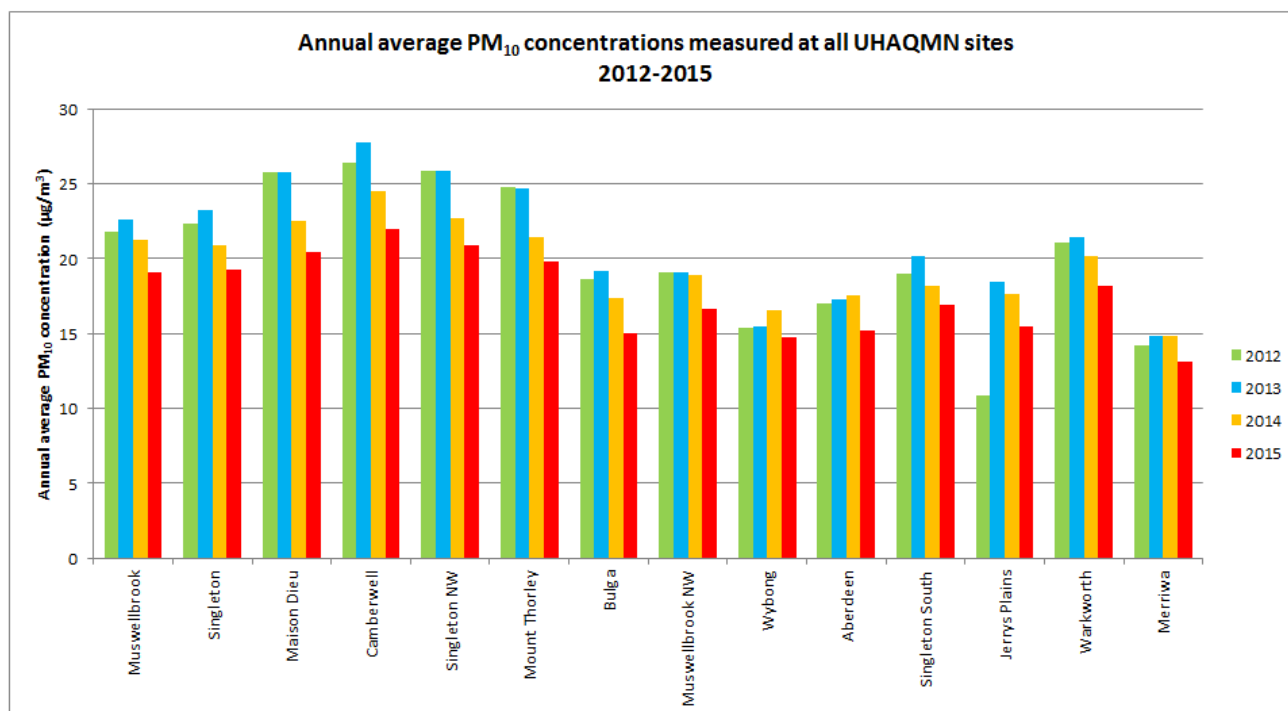


Chart 10.2 Annual average PM₁₀ concentrations measured at UHAQMN sites from 2012 – 2015

The analysis of the data indicates that a level of 14.9-15.1 µg/m³ is therefore a reasonable, if not slightly conservative, assumption of non-mining background levels present in the Hunter Valley. As outlined in **Section 10.3.2**, the revised annual average PM₁₀ concentration of 15.1 µg/m³ has been assumed in the updated cumulative assessment to represent the non-mining background component of the air quality environment in the vicinity of the Project.

10.3.2 Air Quality Assessment Findings

The air quality assessment for the Refined Project (refer to **Appendix 2**) has generally found that air quality impacts of the Refined Project are consistent with the original Project as described in the EIS. A summary of the key assessment findings is presented below.

10.3.2.1 Year 10 Project Alone

In the original 2014 AQIA, the predicted concentrations were presented as contour plots for each operational year assessed. In Years 1 and 5, this included combined operations in the North and Bayswater North Pits, which remain unchanged as part of the Refined Project.

Year 10 operations will no longer include the RERR mining area and will include the North Pit only. From the information presented in **Appendix 2** it is clear that the removal of the RERR mining area reduces air emissions in the immediate area surrounding the RERR mining area, with lower changes in the vicinity of non-mine owned residences located predominately to the south and south east of the North Pit. As outlined in the updated assessment (refer to **Appendix 2**) non-mine owned Residence 23 is no longer predicted to exceed relevant PM₁₀ 24 hr Project specific criteria. In addition, the PM₁₀ 24 hour Project specific criterion is no longer predicted to be exceeded on more than 25% of the landholding of property R114.

Figures 10.4 to 10.7 show the key updated air quality predictions for the original and Refined Project for particulate matter including:

- predicted 24-hour and annual average PM_{2.5} concentrations for Year 10, for both the original and Refined Project and
- predicted 24-hour and annual average PM₁₀ concentrations for Year 10, for both the original and Refined Project.

10.3.2.2 Revised Cumulative Assessment

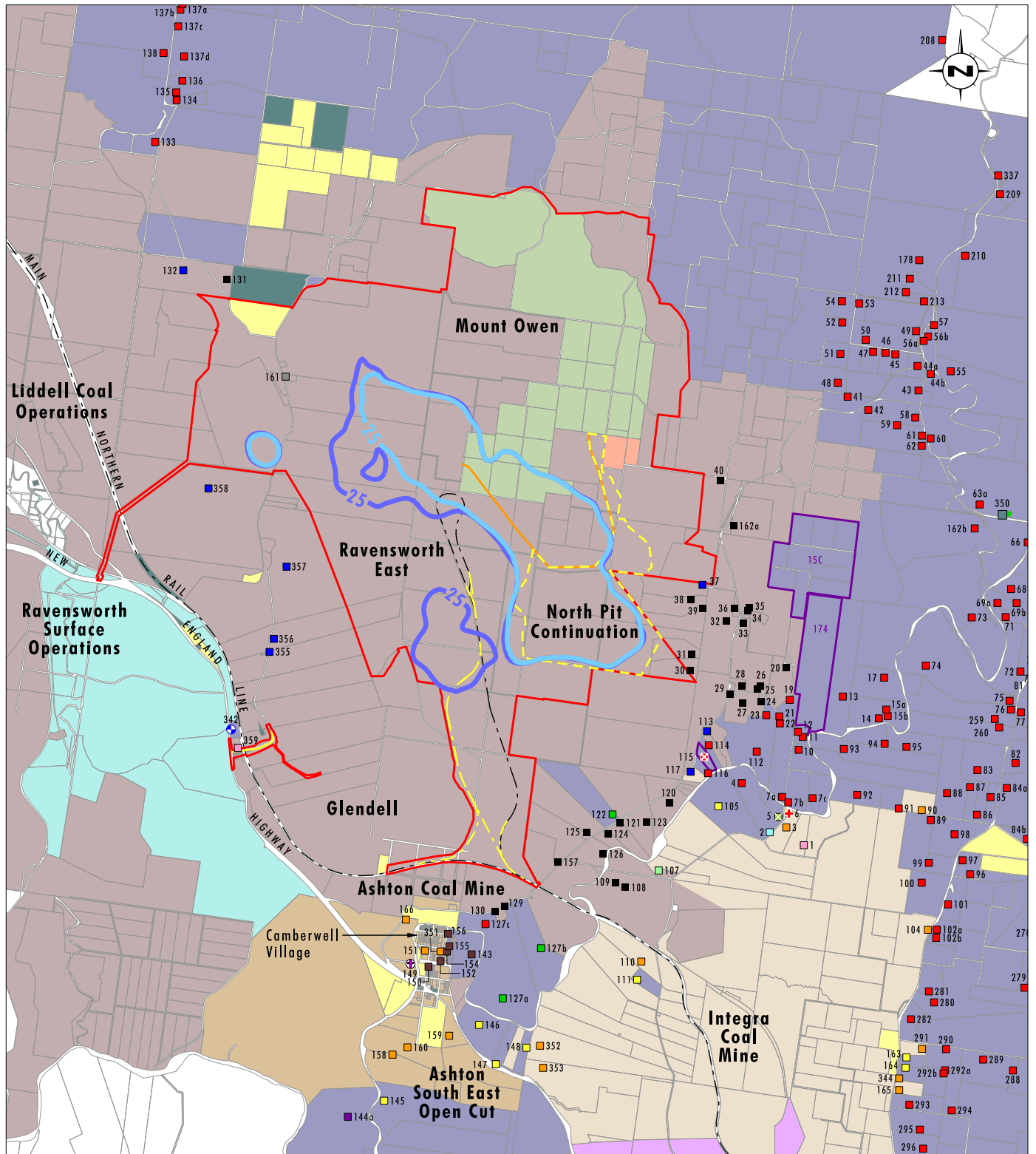
As outlined above, additional data from the UHAQMN data have become available since the 2014 AQIA and Responses to Submissions were completed. As outlined in **Section 10.3.1**, the UHAQMN data were used to determine an annual average PM₁₀ level which is predominantly unaffected by mining and therefore more representative of general background conditions without the influence of large mining operations.

This has been referred to in the AQIA and subsequent documents as the non-mining background, to which modelled mines can then be added. As noted in the Refined Project AQIA (refer to **Appendix 2**), this value slightly increases to 15.1 µg/m³ when using the additional data available to 2015. This 15.1 µg/m³ non-mining background value was used to recalculate the cumulative annual average PM₁₀ for the updated Project in Year 10 and these results are presented in **Figure 10.8**. Comparing this to the results of the revised cumulative PM₁₀ assessment for the Refined Project to that provided in the AQIA (refer to Appendix 6 of EIS), demonstrates that the findings of the EIS remain unchanged with the Refined Project.

10.3.2.3 Cumulative Assessment Sensitivity Analysis

Since the lodgement of the EIS there have been a number of changes for mining activities in proximity to the Project including:

- The Rix's Creek Continuation of Mining Project (Rix's Creek) was lodged and the EIS placed on exhibition in late 2015, and whilst not approved, has been included into the cumulative assessment as an active assessment
- Ashton South East Open Cut Project, was approved in 2015, subject to conditions that may limit the ability to commence this approved Project – accordingly the assessment has included a sensitivity scenario of excluding this Project from the cumulative assessment.



Data Source: Mount Owen (2014), Department of Lands (2009)

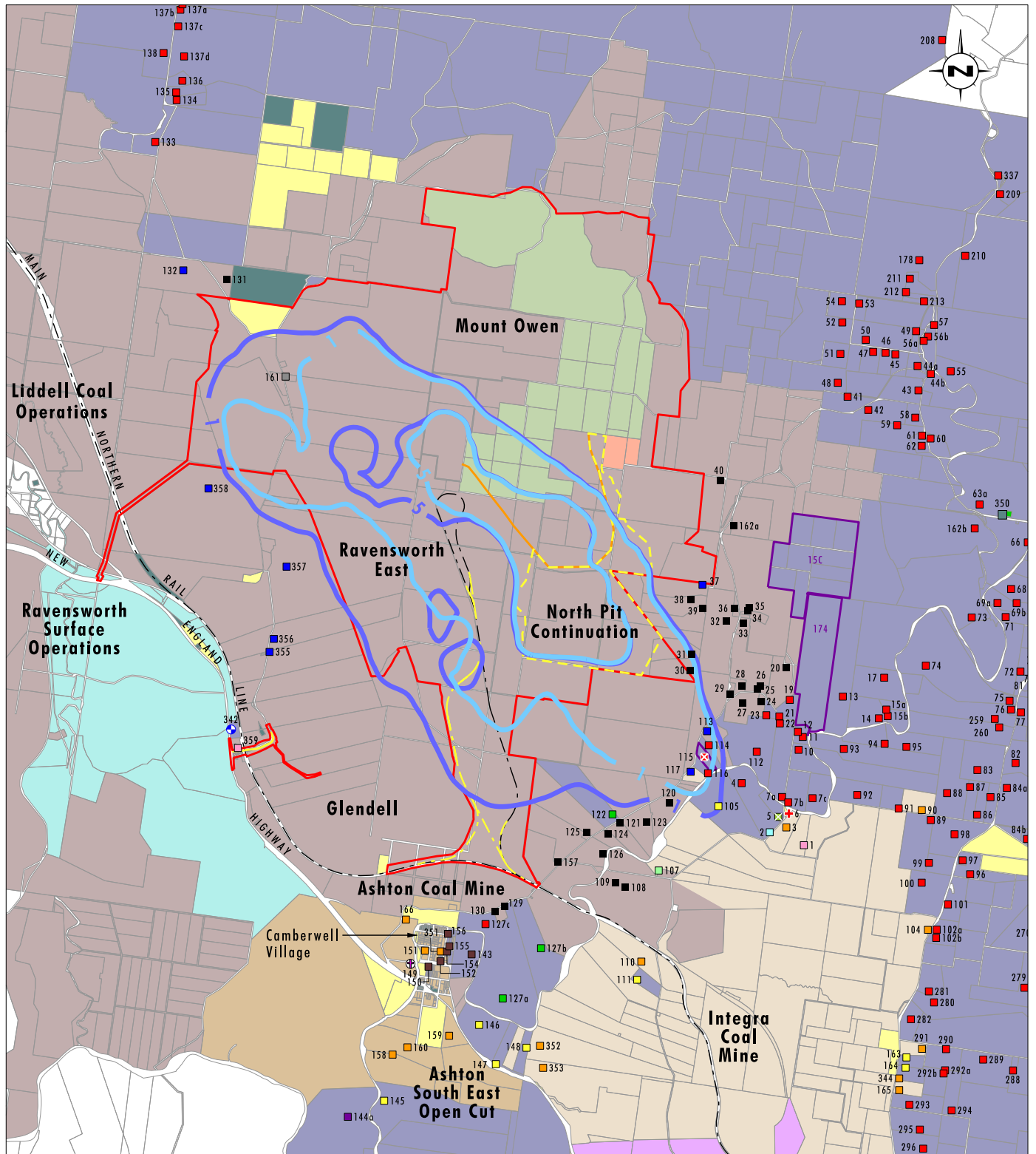
Legend

- | | | |
|--|---|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Derelict |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Vacant |
| Proposed North Pit Continuation | Minister for Education | Community Hall |
| Proposed Rail Upgrade Works | Predicted 24 hour $PM_{2.5}$ Concentration ($\mu g/m^3$) Original Project | Private No Dwelling |
| Proposed Hebdon Road Upgrade Works | Predicted 24 hour $PM_{2.5}$ Concentration ($\mu g/m^3$) Refined Project | Church |
| Vacant Land | Mt Pleasant Primary School | Daracon Site Office |
| Ashton Coal | Currently Subject to Acquisition Rights - Dairy | Glennies Creek Fire Brigade |
| Crown Land | SEOC Acquisition | Former Hebdon Public School |
| Crown Land TSR | Private Residence | |
| Government Authority | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Macquarie Generation | Subject to Acquisition Rights - Glencore No Dwelling | |
| Glencore | Mine Owned Residence - Glencore | |
| Private | Mine Owned Residence - Other Mine | |

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20160527 10.17

FIGURE 10.4

Predicted Year 10
24 hour $PM_{2.5}$
Original and Refined Project



Data Source: Mount Owen (2014), Department of Lands (2009)

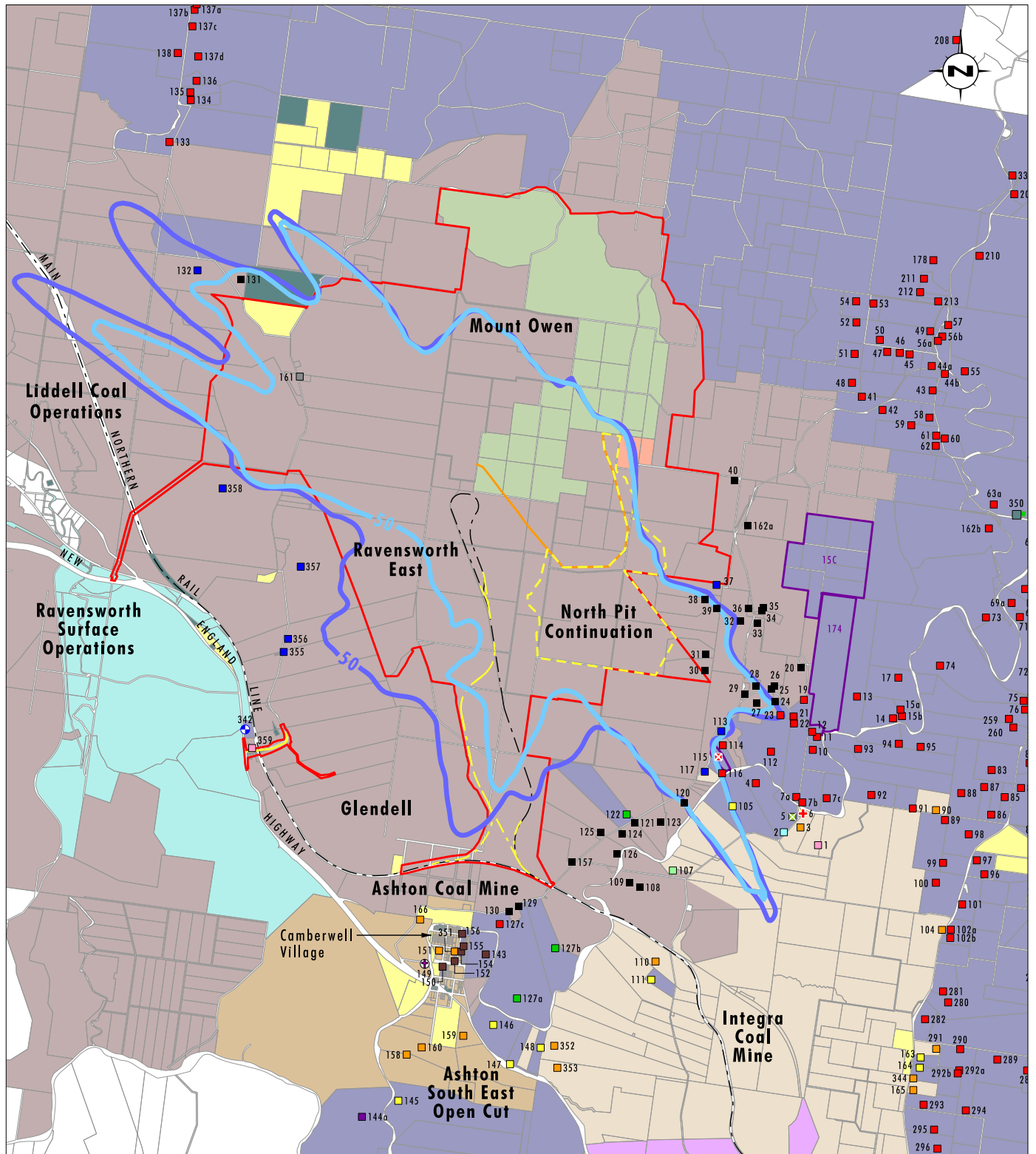
Legend

- | | | |
|--|--|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Derelict |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Vacant |
| Proposed North Pit Continuation | Minister for Education | Community Hall |
| Proposed Rail Upgrade Works | Predicted Annual Average PM _{2.5} Concentration (µg/m ³) Original Project | Private No Dwelling |
| Proposed Hebdon Road Upgrade Works | Predicted Annual Average PM _{2.5} Concentration (µg/m ³) Refined Project | Church |
| Vacant Land | Mt Pleasant Primary School | Daracon Site Office |
| Ashton Coal | Currently Subject to Acquisition Rights - Dairy | Glennies Creek Fire Brigade |
| Crown Land | SEOC Acquisition | Former Hebdon Public School |
| Crown Land TSR | Private Residence | |
| Government Authority | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Macquarie Generation | Subject to Acquisition Rights - Glencore No Dwelling | |
| Glencore | Mine Owned Residence - Glencore | |
| Private | Mine Owned Residence - Other Mine | |

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20160527 10.10

FIGURE 10.5

Predicted Year 10
Annual Average PM_{2.5}
Original and Refined Project



Data Source: Mount Owen (2014), Department of Lands (2009)

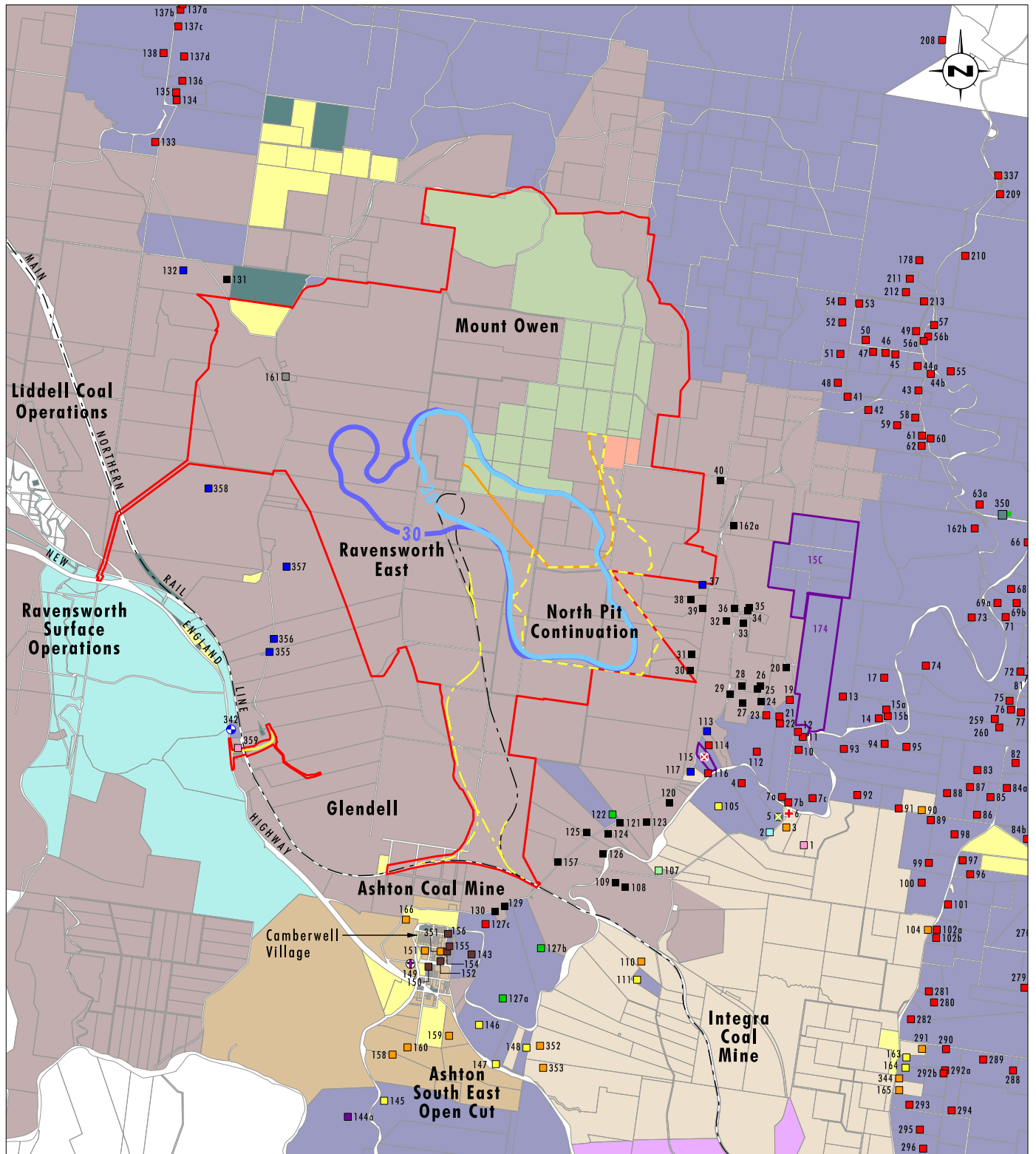
Legend

- | | | |
|--|---|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Derelict |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Vacant |
| Proposed North Pit Continuation | Minister for Education | Community Hall |
| Proposed Rail Upgrade Works | Predicted 24 hour PM ₁₀ Concentration (µg/m ³) Original Project | Private No Dwelling |
| Proposed Hebden Road Upgrade Works | Predicted 24 hour PM ₁₀ Concentration (µg/m ³) Refined Project | Church |
| Vacant Land | Mt Pleasant Primary School | Daracon Site Office |
| Ashton Coal | Currently Subject to Acquisition Rights - Dairy | Glennies Creek Fire Brigade |
| Crown Land | SEOC Acquisition | Former Hebden Public School |
| Crown Land TSR | Private Residence | |
| Government Authority | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Macquarie Generation | Subject to Acquisition Rights - Glencore No Dwelling | |
| Glencore | Mine Owned Residence - Glencore | |
| Private | Mine Owned Residence - Other Mine | |

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20160527 10.05

FIGURE 10.6

Predicted Year 10
24 hour PM₁₀
Original and Refined Project



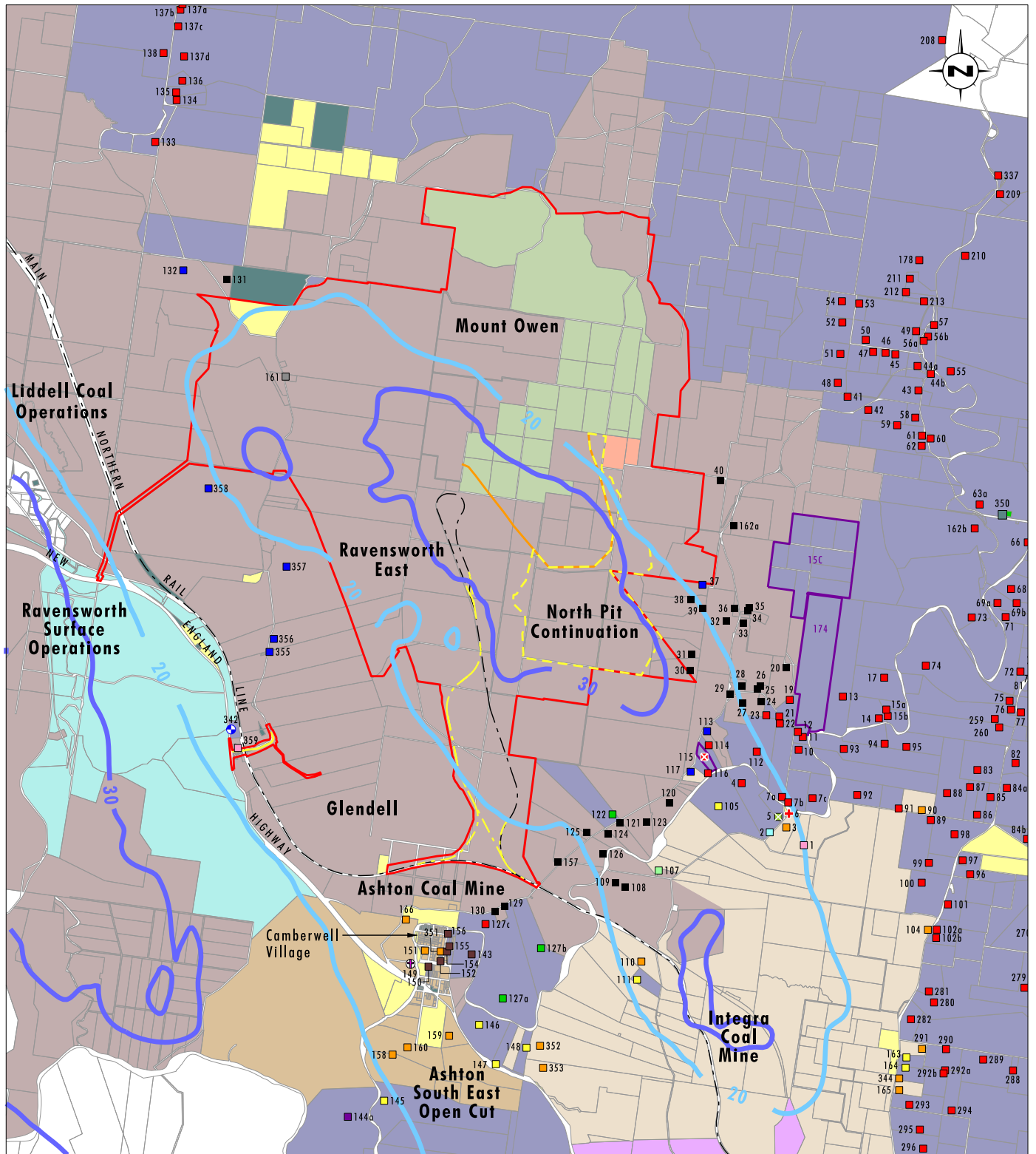
Data Source: Mount Owen (2014), Department of Lands (2009)

Legend

- | | | |
|--|---|---|
| Project Area | Rixs Creek Mine | Mine Owned Residence - Derelict |
| Approved North Pit Mining Extent | State Forest | Mine Owned Residence - Vacant |
| Proposed North Pit Continuation | Minister for Education | Community Hall |
| Proposed Rail Upgrade Works | Predicted Annual Average PM ₁₀ Concentration (µg/m ³) Original Project | Private No Dwelling |
| Proposed Hebdon Road Upgrade Works | Predicted Annual Average PM ₁₀ Concentration (µg/m ³) Refined Project | Church |
| Vacant Land | Mt Pleasant Primary School | Doracon Site Office |
| Ashton Coal | Currently Subject to Acquisition Rights - Dairy | + Glennies Creek Fire Brigade |
| Crown Land | SEOC Acquisition | Former Hebdon Public School |
| Crown Land TSR | Private Residence | |
| Government Authority | Private Residence - Currently Subject to Acquisition Rights - Glencore | |
| Integra Coal | Private Residence - Currently Subject to Acquisition Rights - Other Mines | |
| Macquarie Generation | Subject to Acquisition Rights - Glencore No Dwelling | |
| Glencore | Mine Owned Residence - Glencore | |
| Private | Mine Owned Residence - Other Mine | |

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20160516 10.31

FIGURE 10.7
Predicted Year 10
Annual Average PM₁₀
Original and Refined Project



Data Source: Mount Owen (2014), Department of Lands (2009)

Legend

- | | | | | |
|--|--|---|---|---|
| Project Area | Rixs Creek Mine | State Forest | Minister for Education | Community Hall |
| Approved North Pit Mining Extent | Predicted Cumulative Annual Average PM ₁₀ Concentration (µg/m ³) Original Project | Predicted Cumulative Annual Average PM ₁₀ Concentration (µg/m ³) Refined Project | Private No Dwelling | Church |
| Proposed North Pit Continuation | Mt Pleasant Primary School | Currently Subject to Acquisition Rights - Dairy | SEOC Acquisition | Daracon Site Office |
| Proposed Rail Upgrade Works | Private Residence | Private Residence - Currently Subject to Acquisition Rights - Glencore | Private Residence - Currently Subject to Acquisition Rights - Other Mines | Glennies Creek Fire Brigade |
| Proposed Hebdon Road Upgrade Works | Subject to Acquisition Rights - Glencore No Dwelling | Mine Owned Residence - Glencore | Mine Owned Residence - Other Mine | Former Hebdon Public School |
| Vacant Land | Mine Owned Residence - Derelict | Mine Owned Residence - Vacant | | |
| Ashton Coal | | | | |
| Crown Land | | | | |
| Crown Land TSR | | | | |
| Government Authority | | | | |
| Integra Coal | | | | |
| Macquarie Generation | | | | |
| Glencore | | | | |
| Private | | | | |

FIGURE 10.8

Cumulative Annual
Average PM₁₀
Refined Project

Rix's Creek Continuation Project

As outlined in Section 8.5 of the original AQIA, Rix's Creek operations were not included in the cumulative assessment for Year 5 and Year 10. Since the lodgement and exhibition of the Rix's Creek Continuation Project in late 2015 this has been taken to be an active mining operation over the life of the Project.

The results of the inclusion of the Rix's Creek Continuation Project are detailed in **Appendix 2**, and shown on **Charts 10.3** and **10.4** for Years 5 and 10 of the Refined Project. **Charts 10.3** and **10.4** show the individual surrounding mining operations, Project and non-mining background concentrations for the most affected residences in Middle Falbrook (located between the Project and Rix's Creek).

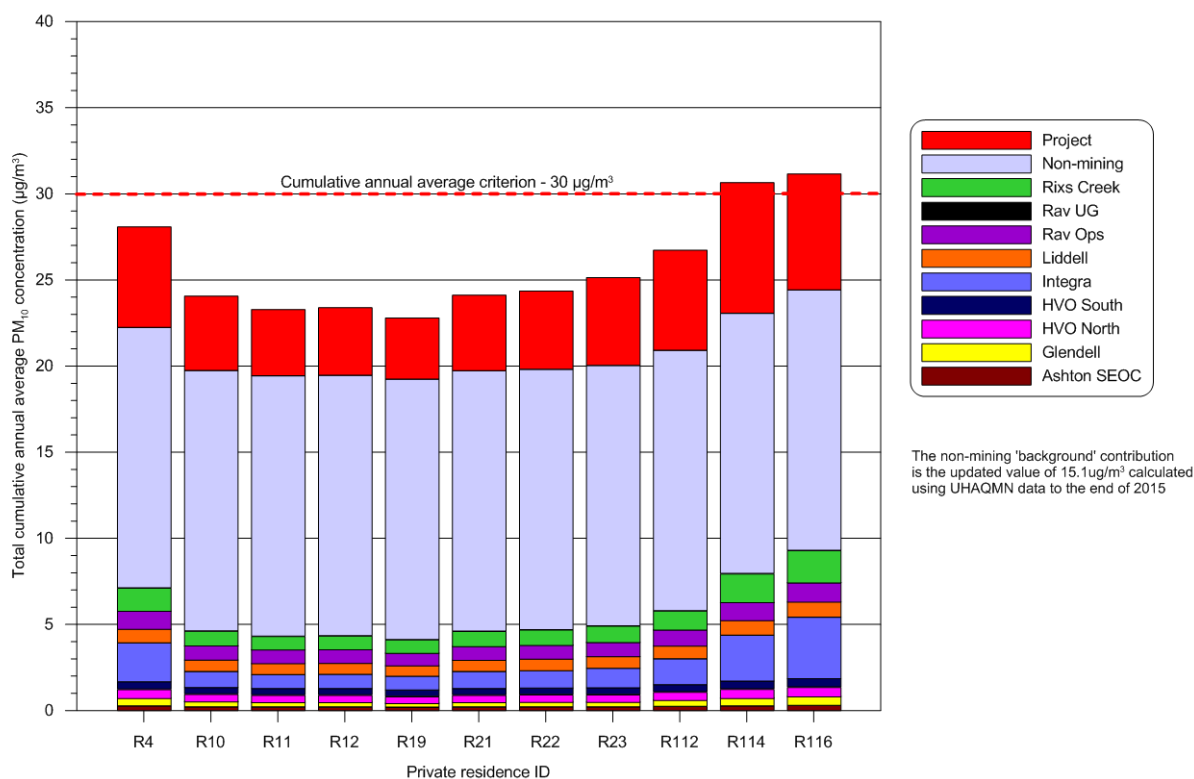


Chart 10.3 Individual contributions of annual average PM_{10} concentrations in Year 5 – Other mines have no calibration factor applied and include the Rix's Creek COM ($\mu g/m^3$)

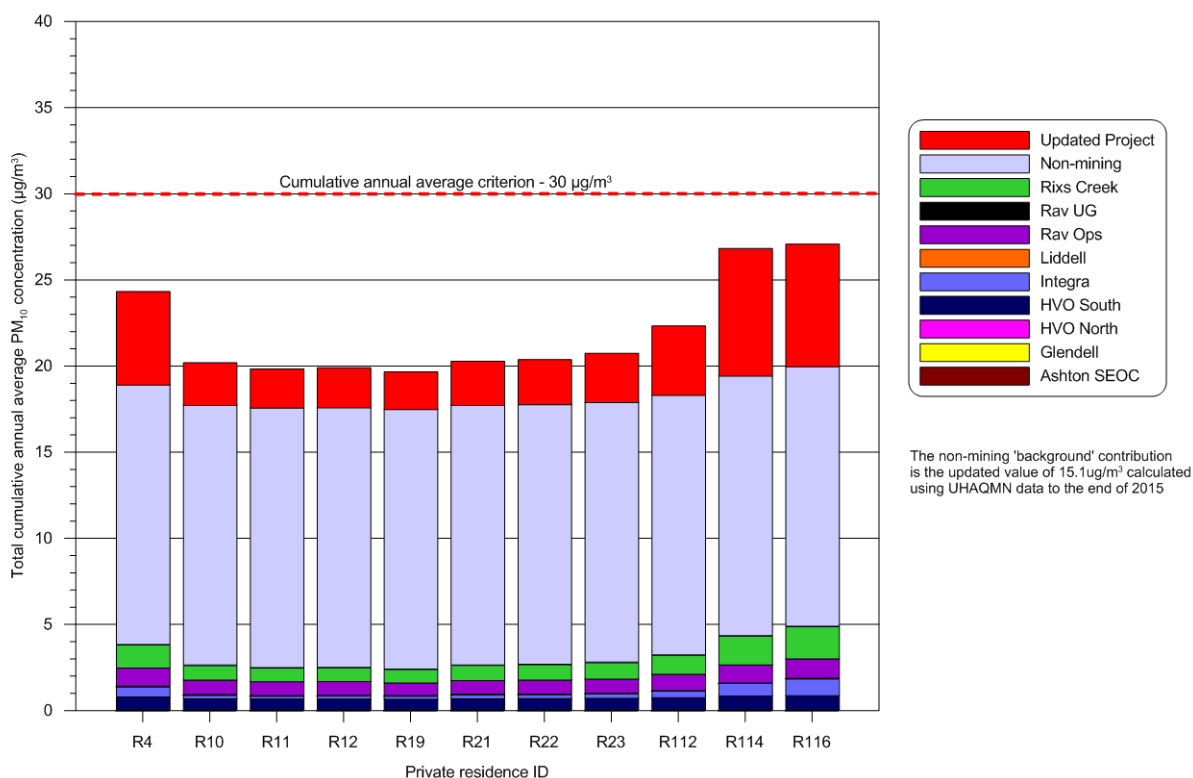


Chart 10.4 Individual contributions of annual average PM₁₀ concentrations in Year 10 – Other mines have no calibration factor applied and include the Rix's Creek COM (µg/m³)

Whilst the calibration factors used in this area as part of the cumulative model have been demonstrated to be reasonable, these updated figures are presented without calibration factors applied to other mines to show that there is no change to the outcomes of the original assessment presented in the EIS. This approach is more conservative than applying calibration factors to the contribution from other mines.

Ashton South East Open Cut Project

The proposed Ashton SEOC operations were included in the 2014 AQIA, to coincide with Years 1 and 5 of the Project. At that time it was approved but is subject to conditions that may limit proceeding with this Project. This section presents the predicted cumulative annual average PM₁₀ concentrations at the nearest Middle Falbrook residences in the absence of the Ashton SEOC Project. **Chart 10.5** and **10.6** show the results of removing Ashton SEOC from the cumulative assessment for Years 1 and 5 of the Project.

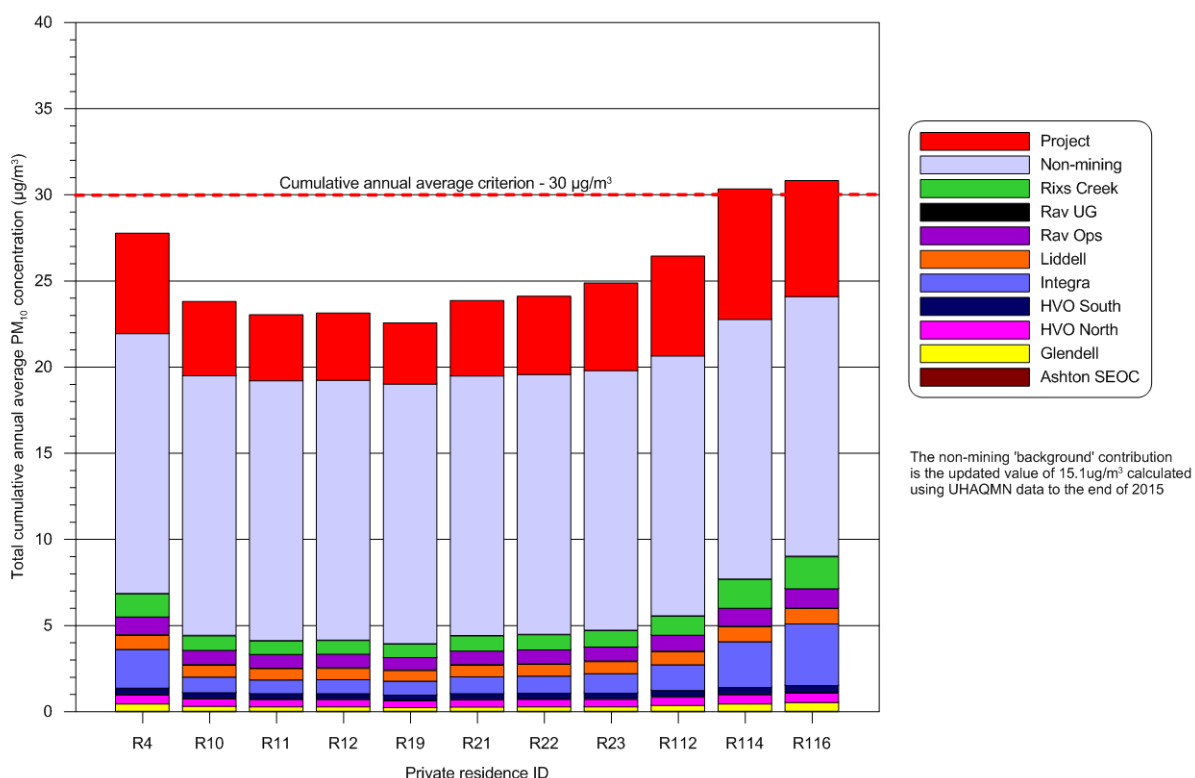


Chart 10.5 Individual contributions of annual average PM₁₀ concentrations in Year 1 – Other mines have no calibration factor applied and do not include the Ashton SEOC (µg/m³)

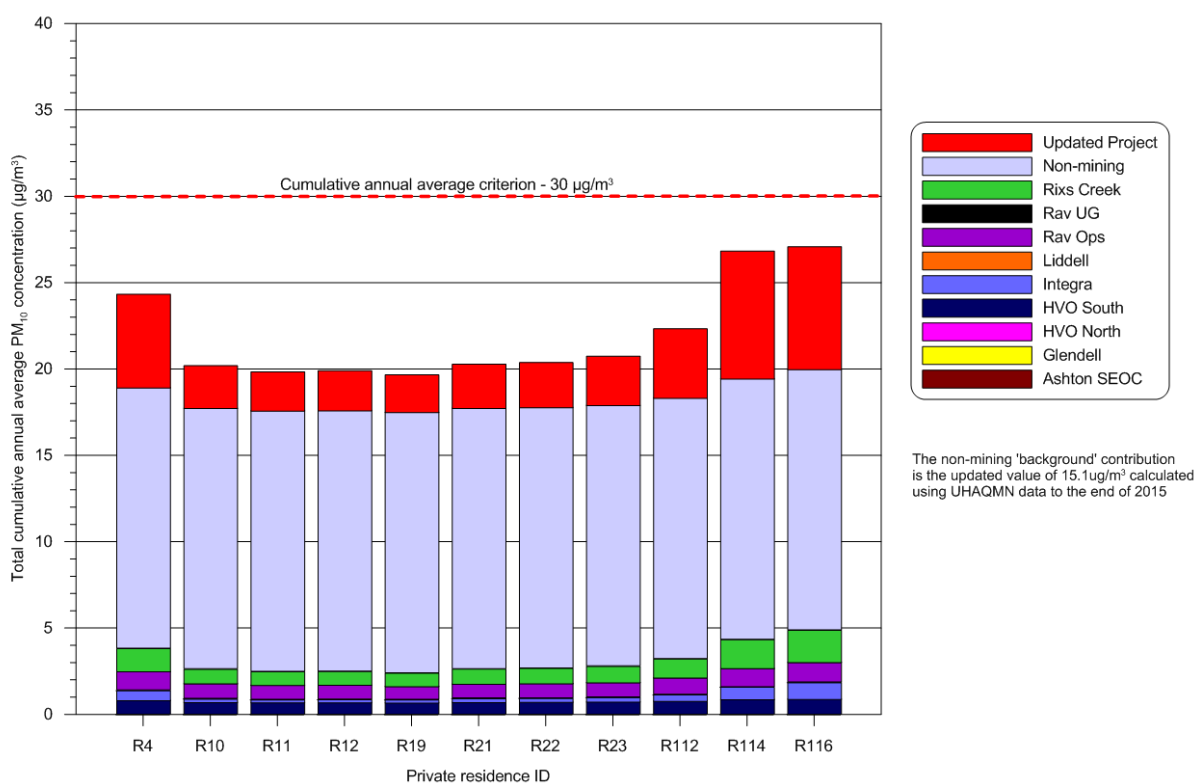


Chart 10.6 Individual contributions of annual average PM₁₀ concentrations in Year 10 – Other mines have no calibration factor applied and do not include the Ashton SEOC (µg/m³)

Only R114 and R116 are predicted to exceed this criterion under the conservative approach when there are no calibration factors applied. Residences R114 and R116 are located on landholdings that are predicted to experience exceedances of the 24 hour, project only PM₁₀ voluntary acquisition criteria over more than 25% of the landholding in Years 1 and 5 and, in the case of R116, in Year 10 are therefore already identified as having voluntary acquisition rights under the Voluntary Land Acquisition and Mitigation Policy (refer to Section 10.3.2).

10.3.3 Application of Voluntary Acquisition and Management Policy

As outlined above and detailed in **Appendix 2**, the updated air quality assessment for the Project is consistent with the outcomes of the AQIA outlined in the EIS. The following provides a summary of predicted exceedances of acquisition and management criteria under the Voluntary Land Acquisition and Mitigation Policy (VLAMP).

The VLAMP includes the following land acquisition rights in relation to air quality impacts associated with major mining projects that are now applicable to the Project:

Air Quality

A consent authority should only apply voluntary acquisition rights where, even with the implementation of best practice management, the development is predicted to contribute to exceedances of the acquisition criteria in Table 3:

- *At any residence on privately owned land; or*
- *At any workplace on privately owned land where the consequences of those exceedances in the opinion of the consent authority are unreasonably deleterious to worker health or the carrying out of business at that workplace, including consideration of the following factors:*
 - *the nature of the workplace;*
 - *the potential for exposure of workers to elevated levels of particulate matter;*
 - *the likely period of exposure; and*
 - *the health and safety measures already employed in that workplace.*
- *On more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.*

Table 3: Particulate matter acquisition criteria¹⁰

POLLUTANT	AVERAGING PERIOD	ACQUISITION CRITERION		IMPACT TYPE
PM ₁₀	Annual	30 µg/m ³ *		Human health
PM ₁₀	24 hour	50 µg/m ³ **		Human health
Total suspended particulates (TSP)	Annual	90 µg/m ³ *		Amenity
Deposited dust	Annual	2 g/m ² /month**	4 g/m ² /month*	Amenity

* Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).

** Incremental impact (i.e. increase in concentrations due to the development alone), with up to 5 allowable exceedances of the criteria over the life of the development.

The VLAMP also affords properties exceeding the criteria in Table 3 of the VLAMP rights to mitigation measures. Properties where the PM₁₀ 24 hour criteria is exceeded, but on less than 5 occasions over the life of the project, are also entitled to mitigation rights.

PM₁₀ 24-hour Criteria

The air quality modelling results presented in the EIS indicate there are no privately owned residences that are predicted to exceed the 24 hour average PM₁₀ criterion (50 µg/m³) in Year 1 or Year 5 as a result of the incremental increase in impact from the Project specifically. Residence R023 was the only residence where there was a predicted exceedance of the 24 hour average PM₁₀ criteria (50 µg/m³) in any year. This predicted exceedance was less than 1 µg/m³ and was predicted to occur in Year 10 of the original Project assessed in the EIS. The effect of removal of mining from the RERR mining in Year 10 means this property is no longer predicted to exceed the 24 hour average PM₁₀ criteria (50 µg/m³). It is noted however that this property will retain acquisition rights under the VLAMP due to predicted noise impacts (refer to **Section 10.2**).

Seven properties (R018, R105, R114, R115, R116, R133, and R181) are predicted to be impacted by PM₁₀ levels greater than 50 µg/m³ over more than 25 per cent of the contiguous property area. Properties R018, R115, R133, and R181 are vacant parcels of land.

Property R018 has recently been acquired by Mt Owen. R181 is owned by an extractive industry and does not qualify for acquisition rights under the VLAMP.

Due to the representative nature of the modelling and the fact that all exceedances of the 24 hour average PM₁₀ criterion relate to impacts on land where this is no residence, it is difficult to determine the number of predicted exceedances of the 24 hour average PM₁₀ criterion over more than 25% of affected properties during the life of the Project. Accordingly, a conservative approach to the application of the VLAMP has been applied and it is assumed that all properties with more than 25% of the landholding that are predicted to exceed the criteria in at least one Year of the Project will experience at least 5 exceedances over the life of the Project.

Table 10.4 provides a consolidated list of residences and vacant land where there are predicted potential exceedances of PM₁₀ 24 hour acquisition and management criteria under the VLAMP.

Table 10.4 Private Properties predicted to have PM₁₀ impacts over 50 µg/m³ (24 hour – Project only) (including >25 per cent Contiguous Property Area)

Land ID	Lot & DP	Acquisition rights under Policy	Area of land holding (ha)	Area impacted (residence or ha)	% of Land Impacted	Years above criteria
R105	79/1161577	Yes - Residence located on land holding. Currently has acquisition rights (noise) with Integra	62.8	19.9	32	Year 10
R114	5/851867	Yes - Privately owned land - Residence located on land holding.	5.7	1.7	30	Year 5

Land ID	Lot & DP	Acquisition rights under Policy	Area of land holding (ha)	Area impacted (residence or ha)	% of Land Impacted	Years above criteria
R115	4/851867	Yes - Vacant land – dwelling could be built under existing planning controls	5.9	3.4	58	Year 5
R116	3/851867	Yes - Privately owned land - Residence located on land holding.	4.1	3.3	80	Years 5 to 10
R133	31/6842	Yes - Vacant land holding – dwelling could be built on land under existing planning controls.	107.5	84.9	79	Years 1 to 5

Property R105 qualifies for voluntary acquisition rights in relation to the Project, however it is noted that this property also has existing acquisition rights under the Integra Development Consent (PA 08_0101 and PA 08_0102) in relation to predicted noise impacts.

PM₁₀ Annual Average

An assessment of the cumulative PM₁₀ annual average air quality impacts associated with the Project and neighbouring mines was undertaken as part of the AQIA. Three private properties (R111, R145 and R354) were identified as having predicted exceedances of the cumulative annual average criteria during years 1 and 5 of the Project. The AQIA did not predict any exceedances of PM₁₀ annual average criteria in year 10 of the Project. The predicted cumulative impact and the contribution from the Project at the three properties where exceedances of PM₁₀ annual average criteria were predicted are identified in **Table 10.5**.

Table 10.5 Predicted Project Contribution to Cumulative Annual Average at Properties with Predicted Exceedance of PM₁₀

Exceeding Residence ID	Predicted Total Cumulative PM ₁₀	Predicted contribution from Project (µg/m ³)
Year 1		
R111 (acquisition rights – Integra – Air and Noise)	36	3
R145 (acquisition rights – South East Open Cut – Air and Noise)	42	1
R354	35	<1

Exceeding Residence ID	Predicted Total Cumulative PM ₁₀	Predicted contribution from Project (µg/m ³)
Year 5		
R111	36	3
R145 (acquisition rights – South East Open Cut – Air and Noise)	31	<1
Year 10		
No predicted exceedances at private residents		

As shown in **Table 10.5**, the contribution of the Project at these residences is very low and, in all cases, the cumulative annual average criteria would be exceeded at these residences without any contribution by the Project.

R111 is located close to the Integra Operations but is located between Integra and the Mount Owen Complex. R111 is currently identified as having acquisition rights under the Integra Open Cut project approval. The Project's predicted impact at this property during Year 1 (worst case scenario) is 3 µg/m³ and the model indicates that this residence would exceed the applicable air quality criteria irrespective of the Project.

R145 is located to the west of the Ashton South East Open Cut. R145 is currently identified as having acquisition rights under the South East Open Cut project approval (PA 08_0182). The Project's predicted impact at this property during Year 1 and 5 (worst case scenarios) respectively are 1 µg/m³ and <1 µg/m³ and the model indicates that the cumulative annual average criteria would be exceeded at this residence irrespective of the Project.

Property R354 is predicted to exceed the annual average cumulative PM₁₀ criteria (30 µg/m³) in Year 1 only. The residence is located in excess of 10 kilometres from the Proposed Disturbance Area and amenity levels at this location are most likely to be heavily influenced by both noise and air quality impacts from the much closer mining operations of Rix's Creek and Integra. The Project's predicted impact at this property during Year 1 (worst case scenario) are less than 1 µg/m³ and the model indicates that this residence would experience annual average PM₁₀ levels in the order of 34 µg/m³ without contributions from the Project. At present, R354 is not specifically identified in either the Rix's Creek development consent or the Integra project approval as having acquisition rights, however, it is noted that the Integra Open Cut project approval does include an acquisition right for properties where monitored PM₁₀ levels exceed the annual average criteria of 30 µg/m³. Accordingly, based on the model's predictions of impacts from other sources (i.e. background plus other mines), it is expected that R354 would qualify for acquisition rights under the Integra Open Cut project approval. This Property has also been identified as having acquisition rights under the Rix's Creek Continuation of Mining Project EIS (TAS 2015).

The predicted exceedances at both R354 and R145 are almost entirely due to impacts from other existing sources of PM₁₀ particulates including approved mining developments much closer to these residences. Conservative modelling indicates that the Project's impact at these locations is 1 µg/m³ or less for the life of the Project. The Project's minor contribution to predicted air quality exceedances at these properties (less than 1 µg/m³) and the overwhelming influence of other PM₁₀ sources, should be taken into consideration

when determining whether any development consent granted for the Project should include acquisition rights for these residences.

As discussed in **Section 3.1**, the Peer Review of the AQIA commissioned by DP&E recommended that Residence R114 and R116 also be afforded acquisition rights due to potential exceedances of Cumulative PM₁₀ Annual Average criteria in Year 10 of the Project. Whilst the assessment outcome in the peer review is very conservative, as noted in **Section 3.1** and in **Table 10.4** above, these residences already qualify for acquisition rights under the VLAMP due to predicted PM₁₀ 24 hour impacts. Accordingly, the inclusion of an additional trigger for voluntary acquisition rights does not affect the overall findings of the air quality assessment undertaken for the original Project (the AQIA) or Year 10 of the Refined Project (Refer to **Appendix 2**).

10.4 Water Resources

10.4.1 Surface Water

A comprehensive assessment of potential surface water impacts was completed for the Project and included in the EIS as Appendix 9. Potential surface water impacts associated with the Refined Project have been assessed with the findings provided in **Appendix 6** and summarised below.

The surface water impacts and management required for the Refined Project is primarily related to the revised final landform development over the life of the Project, and operational water management system as a result of the removal of the RERR mining area from the Project. Accordingly, the surface water assessment provided in **Appendix 6** focuses only on relevant matters that have changed as a result of the Refined Project.

The key findings of the updated surface water assessment for the Refined Project are:

- impacts on water quality in the surrounding environment remain unchanged to those described in the EIS
- the amendments to the Project design have required a number of minor modifications to the Water Management System (WMS) as detailed in **Appendix 6**. The changes to the WMS are minor in nature and as a result alters the catchments within the WMS, however these changes do not significantly alter the impacts as assessed in the EIS
- in terms of flooding:
 - the revised final landform incorporating micro relief over the life of the Project has led to a change in the catchment directed to Main Creek. The revised flood assessment for this catchment demonstrates there is no significant impact associated with this change and the overall findings in relation to downstream users and water quality remain unchanged from the EIS
 - the Refined Project will not increase any of the potential impacts of the Project on base flows, downstream water users, riparian and ecological values of the watercourses or environmental flows relative to the original Project.
- the site water balance has been amended for the Refined Project (refer to **Appendix 6**), including the incorporation of approved tailings emplacement from Ravensworth Operations and Liddell operations associated with the Ravensworth East MOD 6, which confirms that the water balance findings are not materially different to that outlined in the EIS. As outlined in **Section 6.0**, Mount Owen will continue to manage water requirements as part of the GRWSS.

In summary, the predicted impacts of the Refined Project in relation to surface water are not materially different to that detailed in the EIS.

10.4.2 Groundwater

A comprehensive assessment of potential groundwater impacts was completed for the Project and included in the EIS as Appendix 10. The Refined Project will not alter the proposed mining operations in North Pit as described and assessed in the EIS, and accordingly the overall outcomes of the groundwater impact assessment remain unchanged to that presented in the EIS. As outlined in **Section 2.0**, the Refined Project modifies the final landform of the Project through the removal of the RERR mining area void, softening of the BNP final void and incorporation of micro relief across the North Pit and Ravensworth East mining areas. Accordingly the Refined Project, through the removal of the final void associated with the RERR mining area, will have an overall positive effect on the final void water as assessed in the EIS. The potential changes in Final Void water, including water quality, have been assessed in **Appendix 6** and summarised below.

At the end of mining open voids in the North Pit and BNP will remain. The final voids will receive inflows through infiltration through spoils, direct rainfall and runoff and groundwater ingress from coal seams and highwalls. The voids will also lose water to the atmosphere through evaporation. It is proposed that, on completion of mining within the BNP, the void will be investigated to be potentially used for ongoing operational water storage (should it not be required for tailings emplacement as part of the Project) and allow for integration within the GRWSS, as required. The assessment assumes that the BNP void remains open from completion of mining in this area and subsequent to closure and decommissioning of the Project area.

The groundwater model predicts that the North Pit Continuation will act as groundwater sink, with the long term equilibrium water level identified in **Appendix 6**. As detailed in **Appendix 6**, the long term void level will be reached approximately 200 years after completion of mining. Consistent with the findings of the groundwater assessment in the EIS, the equilibrium level of approximately 20 mAHD is significantly below the spill level of the final void and accordingly is predicted not to spill to the surrounding environment.

In the EIS, the BNP was predicted to act as a groundwater sink until the water level in that pit exceeds 37 metres AHD, above which point water movement would be back into the hard rock aquifers via the coal seam. The groundwater assessment identified that water movement out of the BNP ultimately flows to the RERR Mining Area. As part of the Refined Project the base of the amended BNP void will remain at the final mining depth of -30 mAHD, primarily as a result of not receiving overburden from other mining areas, including the previously proposed RERR mining area. As a result, the recalculated final void level outlined **Appendix 6**, predicts that the BNP void will remain as a groundwater sink with the final equilibrium water level establishing at approximately 10 mAHD approximately 100 years after cessation of the Project. At this level it is not predicted that the final void water in the BNP will spill to the environment.

Salinity in the final North Pit and BNP will remain below observed levels in the receiving aquifers for at least 150 years and less than 100 years post-mining, respectively.

The results of the final void water characteristics are consistent with the findings of the groundwater assessment in the EIS. **Appendix 6** also includes an updated assessment of the Project against the relevant Aquifer Interference Policy and Minimal Harm Criteria of the Refined Project, which identifies that the Project would have similar or lower levels of impacts relative to that assessed in the EIS.

10.5 Greenhouse Gas and Energy

A detailed Greenhouse Gas and Energy Assessment was undertaken as part of the EIS to consider emissions from the Project. Scope 1 emissions from the Project are primarily from the combustion of diesel and release of fugitive emissions as part of the construction and operation phase and Scope 2 emissions are associated with electricity used by the Project. Scope 3 emissions are indirect emissions that will occur downstream of the Project and be generated by third parties during product transport and consumption activities, and represent approximately 96 per cent of the Project's GHG emissions.

The Refined Project will result in a lower total coal resource mined associated with the removal of the RERR mining area. Accordingly, the Greenhouse Gas and Energy Assessment has been revised to estimate the emissions and energy use associated with the Refined Project. **Table 10.6** provides the revised greenhouse gas and energy emissions associated with the Refined Project.

Table 10.6 Updated Greenhouse Gas Emissions for the Refined Project (emissions for the Project in the EIS provided in brackets)

	Life of Mine Emissions	
	(t CO ₂ -e)	(%)
Scope 1	4,660,000 (5,085,000)	3.7
Scope 2	811,000	0.6
Scope 3	122,366,000 (131,759,000)	95.7
TOTAL	127,836,000 (137,655,000)	100

The Refined Project is forecast to produce approximately 311,000 t CO₂-e Scope 1 emissions per annum, which is comparable to other Hunter Valley open cut coal mining operations of similar size. The majority of Scope 1 emissions are generated by fugitive emissions and diesel combustion. Mount Owen has a direct influence over Scope 1 emissions and these emissions will be subject to management and mitigation plans.

The Project is forecast to consume approximately 225,000 GJ of electricity per annum, which will generate approximately 55,000 t CO₂-e of Scope 2 emissions. Mount Owen can influence reductions in Scope 2 emissions by driving electricity reduction and efficiency initiatives.

Approximately 8,158,000 t CO₂-e of Scope 3 emissions per annum are estimated to be associated with the Project. The majority of Scope 3 emissions associated with the Project will be generated by third parties who transport and consume coal products. Mount Owen has no operational control over Scope 3 emissions, as these emissions are generated by the activities of other organisations.

The Project's greenhouse gas inventory is dominated by Scope 3 emissions. Approximately 96 per cent of the Project's greenhouse gas emissions will occur either upstream or downstream of the Project and outside the direct operational control of Mount Owen. Approximately 4 per cent of the greenhouse gases associated with the Project are related to on-site energy use and fugitive emissions (Scope 1 and 2 emissions) (refer to **Chart 10.7**).

Breakdown of Emissions by Scope

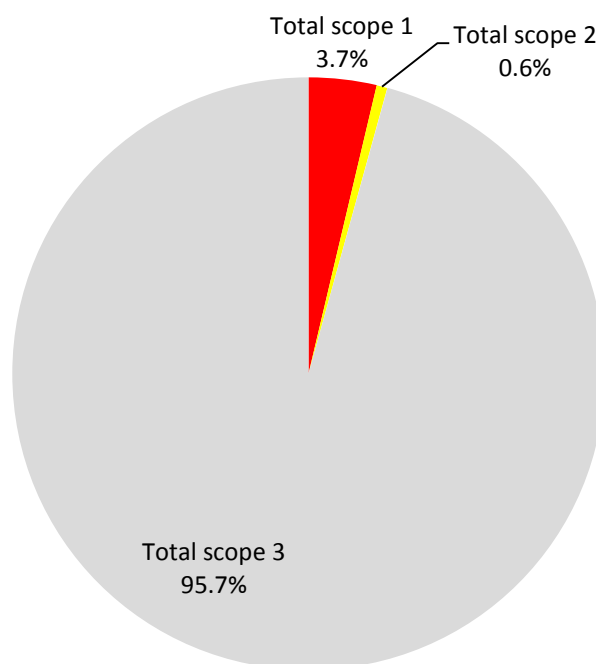


Chart 10.7 Breakdown of Emissions by Scope

The Refined Project is unlikely to impact national greenhouse gas policy objectives due to the relatively small contribution the Project will make to national emissions on an annual basis. The Project will mitigate greenhouse gas emissions through ongoing energy efficiency initiatives, utilising alternative fuel sources and optimising productivity. This includes limiting the length of haulage routes (where feasible) to minimise transport distances and associated fuel consumption, select equipment and vehicles that have high energy efficiency and scheduling activities so that equipment and vehicle operation is optimised.

The Project will contribute to global emissions, however, the extent to which global emissions and atmospheric concentrations of greenhouse gases have a demonstrable impact on climate change will be largely driven by the global response to reducing total global emissions which includes all major emission sources and sinks.

10.6 Economic Assessment

As outlined in **Section 9.0**, a Cost Benefit Analysis (CBA) has been undertaken by Deloitte Access Economics for the Refined Project. The CBA for the Refined Project is provided in **Appendix 7**.

The CBA for the Refined Project has had regard to the following guidelines:

- NSW Treasury (2007), “NSW Government Guidelines for Economic Appraisal”
- NSW Department of Urban Affairs and Planning (2002), “Guideline for economic effects and evaluation in EIA”
- NSW Government (2012) “Guidelines for the Use of Cost Benefit Analysis in mining and Coal Seam Gas Proposals”
- NSW Government (2015), “Guidelines for the economic assessment of mining and coal seam gas proposals”
- These four documents move from high level issues around CBA through to how CBA should be applied to an EIA and then also cover the application of CBA to coal mines in particular.

It is important to note that NSW Government (2015) is the final version of the draft set of guidelines proposed by NSW Government (2012). The main difference between the 2012 and the 2015 guidelines is that the 2015 Guidelines provide specific guidance for the use of CBA in assessing benefits to the State. As a result of this change, the CBA for the Refined Project (refer to **Appendix 7**) now includes a CBA of State benefits; the CGE analysis for the original Project has not been updated as a result of the changes in guideline requirements.

The other change in the assessment relates to the change in base year. The CBA for the original Project assessed the Project in 2014 dollars. The assessment of the Refined Project has assumed the Project would commence in late 2016 and has therefore assessed the Project in 2016 dollars terms.

The key findings of the economic assessment are discussed in the following sections.

10.6.1 Refined Project Cost Benefit Analysis

A Project CBA is a method of obtaining a consolidated estimate of the net economic value of the Project by identifying the incremental costs and benefits of the Project relative to the base case (i.e. no Project), and placing a quantitative value on these items wherever possible. To carry out this economic assessment, a base case representing business as usual has been compared to a Project case. The base case in the CBA involves ongoing production of approximately 14.3Mt saleable coal from North Pit between 2016 and 2018 with rehabilitation activities undertaken upon cessation of mining. The Project case for the CBA essentially involves undertaking additional capital investment and operating expenditure to expand the area for mining operations in the North Pit Continuation area to 2030 and continued mining activity at the BNP to 2022. In the Refined Project case, 47.9Mt of saleable coal is produced as a result of not mining the previously proposed RERR area.

The Project case also incorporates a total of \$152.9 million in capital investment which has been assumed to be incurred, during the construction phase in 2016 and 2017.

To enable comparison with the CBA undertaken for the original Project against that prepared for the Refined Project, the CBA has been completed using the same pricing assumptions as used in the previous

assessment. For sensitivity purposes, the CBA has also been undertaken based on the March 2016 Consensus Economics consensus pricing forecasts (Consensus 2016).

As part of the CBA, the potential economic costs and benefits of the Refined Project have been separated into two categories:

- the costs and benefits that affect the financial outcomes of the proponent (Mount Owen) that can be classified as internal effects of production and
- externalities, which incorporates the broader implications of the Refined Project for third party stakeholders, such as residents and businesses from the local Singleton community, the broader Hunter and Central Coast region, and beyond, along with the various levels of government, which do not directly affect the financial outcomes of the proponent.

The items included in the CBA as potential costs and benefits are shown in **Table 10.7**. It should be noted, some benefits of the Project to the community such as salaries paid to staff (included in operating costs), are considered a cost in the CBA analysis, as they are a cost to the Project.

Table 10.7 Potential Costs and Benefits Considered in CBA for the Refined Project

	Costs	Benefits
Production	Other onsite revenue forgone Exploration costs Capital investment costs Operating costs excluding taxes Rehabilitation costs Decommissioning costs Residual value of land forgone	Gross mining revenue Residual value of capital
Externalities	Offsite agricultural revenue* Related public expenditure* Groundwater quality* Surface water quality* Air pollution – carbon emissions Air pollution – particulate matter Air pollution – other pollutants* Noise impacts Visual amenity* Biodiversity – flora and fauna Quality of open space* Rural amenity and culture Aboriginal heritage* European heritage* Health*	Net traffic impacts Conservation*

* Item has been considered qualitatively

Note: As the Refined Project involves open-cut mining activity, there are no subsidence impacts which need to be valued in this analysis. Nevertheless, this item is discussed qualitatively in Section 5 of the Cost Benefit Analysis and Economic Impact Analysis of the Mount Owen Continued Operations Project (DAE 2014) in accordance with NSW Government (2012).

The overall finding of the CBA is that the Refined Project, when all potential costs and benefits are considered, is predicted to deliver net economic benefits (\$857 million) over its life. After accounting for the difference in timing, this is slightly lower than the benefits estimated in the previous economic assessment.

As discussed in **Section 9.1**, adjustments to take into account current market forecasts indicate that the Refined Project has a NPV of \$108 million over the life of the Project. It should also be noted that the CBA results do not explicitly identify benefits to particular groups (such as tax payments to the NSW government) as these are a transfer payment and do not sit within the scope of a CBA.

10.6.2 Benefits to NSW

The Economic Analysis for the Refined Project therefore includes an analysis of the share of each cost and benefit that is attributable to NSW. This analysis has been undertaken in response to the PAC recommendations and is in line with approaches set out in the Guidelines for the Use of Cost Benefit Analysis in mining and Coal Seam Gas Proposals (NSW Government 2012) and the Guidelines for the economic assessment of mining and coal seam gas proposals (NSW Government 2015).

The benefits to NSW have been identified as:

- Net producer surplus
- Royalties
- Company income tax
- Economic benefit to existing landholders
- Economic benefit to workers
- Economic benefit to suppliers
- Net environmental, social and transport-related costs
- Net public infrastructure costs

Adjusting the original CBA analysis for changes relating to the Refined Project indicates that Royalties generated by the Refined Project, relative to the baseline, are estimated to be worth around \$259 million in NPV terms to the NSW Government (equivalent to a total of \$461 million in additional revenue over the life of the Project). The benefits for the NSW community are estimated at \$312 million in NPV terms. The additional royalties to the NSW Government is the main incremental benefit to NSW of the Project in relation to the base case. The key incremental costs of the Project (within the NSW community) are the additional external costs, such as the cost of greenhouse gas emissions.

As discussed in **Section 9.1**, adjustments to take into account current market forecasts indicate that the Refined Project delivers net benefits to the NSW Community of around \$186 million.

As noted above, the analysis of flow on economic impacts of the Project using CGE analysis has not been updated as part of this report as they are not used as part of the decision making process of the NSW Government.

In regard to the benefits for the local community, the potential net benefits to the Singleton community (based on the location of mine employees and mine suppliers) is estimated to be a net benefit to the community of around \$306 million over the life of the Project in NPV terms.

The CBA therefore shows that when all potential costs and benefits are considered, the Refined Project will deliver a substantial net benefit whether using the pricing assumptions used in the original EIS or the current market prices reflected in the March 2016 Consensus Economics consensus pricing forecasts (Consensus 2016).

11.0 Mitigation and Management Commitments

This Section outlines the consolidated updated management and mitigation measures for the Project, which captures all relevant commitments since the lodgement of the EIS.

Hours of Operation

- Mining and associated activities for the Project will be undertaken 24 hours a day, 7 days a week.
- Construction of the Hebden Road upgrade works and the proposed rail line works will generally occur during standard construction hours of 7.00 am to 6.00 pm, Monday to Friday and 8.00 am to 1.00 pm on Saturday. Construction works relating to the Main Northern Rail Line, may be required outside of the standard construction hours, and works will be managed to ensure that total noise emissions will be in compliance with the operational noise criteria for the Project, unless otherwise agreed with affected landowners.
- All other on site construction activities will be undertaken 24 hours per day, 7 days a week.

Air Quality

Mount Owen will continue to implement air quality controls in accordance with the Mount Owen Air Quality and Greenhouse Gas Management Plan which will be updated to include the additional controls proposed for the Project, within 12 months of Project Approval. The controls include the following key measures:

- A weather station that complies with the appropriate Australian Standard (including 10m high mast) will be installed in the general vicinity of the cluster of private receptors to the southeast of the Project. This would be a location approximately between or at either of dust monitoring stations SX9 and SX10
- Properties R114 and R116 be afforded acquisition rights on the basis of potential cumulative annual average PM₁₀ impacts
- Continued use of the Mount Owen Complex proactive air quality control system to inform operational dust management with focus on the properties to the southeast of the Project
- Continued use of visual triggers and associated procedures and training for wheel generated dust from unpaved haul roads, bulldozer operations, overburden emplacement, loading trucks and windblown erosion
- Continued monitoring to demonstrate haul road dust control efficiency achieves the target of 85 per cent
- Continued implementation of current PRP commitments to monitor and manage dust generation. Control practices may include treatment of permanent unpaved roads, by for example increased watering, application of dust suppressants, or use of select materials for haul road topping
- Temporarily treat disturbed areas if prompt rehabilitation is not feasible, for example on some topsoil stockpiles

- Update the relevant Blast Fume Management Plans to restrict blasting to periods when meteorological conditions are not conducive to fume dispersal towards residential receivers. These conditions will vary for different mining areas
- In the unlikely event that a Rating 2 or 3 Fume Category event occurs, and where unpredicted weather conditions such as a sudden wind shift are experienced which could result in residual risk to residents, Mount Owen will notify any potentially impacted residents and advise them of any measures that should be taken to avoid harm
- Managing the risk of spontaneous combustion in accordance with the Mount Owen Spontaneous Combustion Procedure
- Mount Owen will contact all residences within 4 kilometres of the approved Project area within 6 months of project approval and discuss the inspection and cleaning of tanks. Rainwater tanks at privately-owned properties within a 4 kilometre radius from the approved mining limit will be inspected at least every two years with cleaning carried out should the inspection identify that this is required. Residents will also be advised that additional management options are available if cleaning alone is not adequate in managing the impacts and further management measures are required.

The additional mitigation and management controls specified in Section 5.2.5 of the EIS also apply to the extent they remain relevant to the Refined Project and are consistent with the commitments set out in this section.

Noise

Within 12 months of project approval, Mount Owen will develop and implement a Noise Management Plan (NMP) (to update the current Noise Monitoring Program) in accordance with the Project Approval and EPL. The NMP will detail the continued management and monitoring controls to be utilised to manage potential noise impacts associated with operations, as outlined in Section 5.3.10 of the EIS.

Key management commitments include:

- Mount Owen will manage relevant activities during adverse weather conditions, such as when wind or inversion conditions enhance the noise propagation towards sensitive receiver locations, as described in Section 5.3.10 of the EIS, in order to meet noise performance requirements
- Bunds will be included in strategic locations along some haul roads, and where practicable be located along the exposed side of the ramps, shielding noise from trucks and equipment on exposed sections of the ramps
- In the later years of the Project, the primary coal haul road to the Mount Owen CHPP will be located on the western side of the North Pit Continuation
- Location and orientation of haul roads will consider prevailing source to receiver winds, where practicable and some key haul roads within the North Pit Continuation will be located below ground surface to maximise topographical shielding to surrounding receiver areas
- Incorporation of reasonable and feasible noise attenuation on key plant and equipment as detailed in Appendix 7 of the EIS.

Mount Owen intends to achieve the predicted noise levels associated with the Project presented in the NIA through the continued implementation of an adaptive management approach, focused on implementing appropriate operational controls and management strategies to minimise noise impacts. The approach will vary during different mine stages, weather conditions and consider technological improvements and associated equipment noise levels. A range of controls and strategies may be adopted as required to meet noise performance requirements for the Project as outlined in Section 5.3.10 of the EIS.

Mount Owen will continue to implement the extensive continuous monitoring network to enable proactive and real time management of operations during noise propagating conditions. The noise monitoring system will comprise:

- continued use of predictive forecasting of adverse weather conditions to identify when and where management measures are likely to be required as a result of an adverse weather event
- maintenance of the existing continuous noise monitoring network, with refinements as mining progresses, as described in Section 5.3.10 of the EIS. This continuous monitoring network consists of fixed and mobile continuous noise monitoring units and two weather stations. In these circumstances where the noise impacts are predicted based on stability class rather than lapse rate, a 10 metre tower is suitable for measuring stability class based on sigma theta. As a result, the current weather stations used by Mount Owen are suitable for assessing the presence of inversion conditions that could lead to the enhancement of noise impacts
- continued attended noise monitoring, as described in Section 5.3.10 of the EIS. The location and frequency of monitoring will be determined on an ongoing risk assessment basis and
- use of continuous noise monitoring system to identify when noise levels are approaching relevant noise limits in the surrounding area to actively manage operations to minimise potential noise impacts as far as practicable.

Blasting

Blasting activities will continue to be undertaken in accordance with the Blast Management Plan which includes controls to manage safety to people, property and livestock and vibration and air blast emissions.. Commitments associated with the management of potential air quality impacts associated with blasting are addressed above and will also be included in the Blast Management Plan. The cumulative effects of blasting will be managed through:

- blasting will be undertaken in accordance with current approved operations, namely between 9am and 5pm (EST) and 9am and 6pm (DST) Monday to Saturday inclusive with 12 blasts per year between 7am and 9am Monday to Saturday inclusive. No blasting will be undertaken on Sundays, public holidays or any other time without the agreement of the Secretary of DP&E
- limiting to no more than 2 blasts per day at Mount Owen and 2 blasts per day at Ravensworth East Mine
- endeavour to contact the landowner / occupier of all residences within a 3 kilometres radius of proposed mining limit to advise them of the various notification options available to them
- notification of the landowner / occupier of all residences (who register to be notified) within a 3 kilometres radius of proposed mining limit, of the blasting schedule

- continuation of the blasting hotline and provision of up to date information relating to the blasting schedule for the Mount Owen Complex on the Mount Owen website (www.mtowencomplex.com.au) (to be updated at least weekly)
- notification of all landowners within 3 kilometres of the proposed mining limit that they are entitled to a structural property inspection (to be carried out by a suitably qualified, experienced and independent person)
- modification of the existing Mount Owen blast monitoring system to include a monitor to the east and south east of the North Pit Continuation
- should mining operations within the North Pit Continuation and the Integra Underground Mine overlap, a Blast Management Protocol will be developed prior to any blasting within 500 metres of the currently approved and developed underground workings. The Protocol will be developed in consultation with the operators of the Integra Underground Mine and include details of:
 - systems for the prior and timely notification of scheduled blasting and subsidence activities
 - personnel evacuation and safety protocols for specific blast events and
 - procedures and protocols for managing the interaction of the two mines.

The Protocol will be incorporated into the Blast Management Plan:

- Mount Owen will coordinate blasting with Liddell operations to ensure there is no simultaneous blasting likely to impact beyond relevant criteria at the historic Chain of Ponds Inn
- blasting activities within the North Pit Continuation and BNP will not occur simultaneously
- a communication protocol will be developed with surrounding mines to minimise the risks of firing blasts simultaneously and
- Mount Owen will continue to consult with the owner of Residence ID17 regarding blasting impacts upon hand feed cattle in feedlot environment.

Within 12 months of Project approval, the Blast Management Plan will be updated to reflect the changes associated with the Project.

Surface Water

Mount Owen will continue to manage operations in accordance with the WMP, the EPL and the HRSTS.

- Within 12 months of Project approval, Mount Owen will revise the WMP to reflect the changes to the surface water catchments and the additional monitoring and management measures required including:
 - additional off-line detention capacity to the Ravensworth East MIA, and flow conveyance at Hebden Road, will be provided by modifying the existing Industrial Dam to provide off line detention storage for flood events above the 10 per cent AEP event.
 - installation of flood warning signs along Hebden Road near the Yorks Creek crossing. These signs will be NSW Roads and Maritime Service (RMS) standard warning signs to advise drivers that the road ahead may be covered in floodwaters and flood depth signs to show the depth of floodwaters

across the road. The signs would be placed, in accordance with RMS standards to the north and south of the Yorks Creek crossing on Hebden Road (outside of the 1 per cent AEP storm event flood extent).

- implementation of Construction Management Plans detailing the specific inspection, maintenance and revegetation requirement prior to construction activities within each work area.
- Erosion and sediment controls will be monitored during construction and operation in accordance with the Blue Book (Landcom 2004 and DECC 2008).
- As part of the water balance monitoring for the Mount Owen water management system, water imported to site, water used on site and water discharged from site will be monitored in accordance with Water Reporting Requirements for Mines (NOW undated).
- Within 12 months of approval, the Surface Water Monitoring Plan will be revised to include a trigger for analysis of metal / metalloid concentration in sediment dam water should a significant change in pH be noted as part of the routine monitoring program.
- Monitoring and remediation of erosion within watercourses outside of the active mining and emplacement areas will continue to be managed as set out in the Mount Owen Complex Landscape Management Plan.
- Mount Owen will install a new monitoring point on Main Creek (MC3). Monitoring at MC3 will commence upon Project Approval. In addition, Mount Owen will continue to monitor water quality during HRSTS discharge events as set out in the EPL.
- Within 12 months of Project approval, Trigger Action Response Plans (TARPs) will be developed (or where already present, revised) to deal with the unlikely eventuality that the Project impacts on water quality in all downstream creek systems (which have existing monitoring points located on it).
- Should a discharge point be required at the Mount Owen Complex, a variation to the EPL will be sought, subject to gaining relevant approvals at that time.
- Mount Owen will operate the Project in accordance with the *Hunter Regulated River Water Sharing Plan 2004* for extractions from Glennies Creek.
- Mount Owen will continue to provide a summary of the surface water monitoring results as part of the Annual Review.
- Mount Owen proposes to, within 3 years of Project Approval, review the Mount Owen Complex water balance and interactions with the GRWSS.

Groundwater

- Mount Owen will continue to undertake groundwater monitoring in accordance with the Mount Owen Complex Groundwater Monitoring Program. The Mount Owen Complex Groundwater Monitoring Program and Surface Water and Groundwater Response Plan will be updated within 12 months of Project approval to include the additional management and monitoring requirements identified in the EIS and Section 2.5 of the Response to Submissions Report B including: monitoring requirements for both alluvial groundwater levels and ecological condition of vegetation communities potentially impacted by changes in alluvial groundwater levels (ie. Bettys and Main Creeks). Monitoring will include both hard rock and alluvial aquifers and include the installation of additional piezometers in area of

maximum predicted drawdown in Main Creek and Bettys Creek and the identification of triggers that may indicate greater than predicted impacts.

- TARPs will be developed for any unexpected impacts on groundwater systems as well as impacts on riparian vegetation.

Mount Owen will continue to extract groundwater from hard rock aquifers that flow into the Mount Owen and Ravensworth East Mines under the existing Part 5 licenses under the *Water Act 1912*.

The results of groundwater monitoring will be subject to an annual review and reported in the Mount Owen Complex Annual Review. The groundwater model will be periodically updated and refined as additional data and monitoring results become available.

Ecology

Mount Owen will incorporate the relevant strategies from the existing Mount Owen Complex Flora and Fauna Management Plan in the revised and consolidated Landscape Management Plan within 12 months of Project approval. These strategies will include:

- feral animal and weed control
- rehabilitation of disturbed areas with species characteristic of extant vegetation communities
- use of native species in revegetation, and the linkage and integration of rehabilitation areas with existing vegetated areas to improve ecological function and provide appropriate fauna habitat, except in areas identified for improved pasture
- management of erosion and sedimentation to minimise impacts on adjoining vegetation communities and aquatic systems
- adaptive management, as required, if a previously unrecorded or assessed threatened species is identified in the Proposed Disturbance Area during operations
- ongoing monitoring and maintenance of revegetation works and habitat enhancement activities and
- an adaptive approach to ongoing monitoring of native flora and fauna.

The following fauna re-instatement strategies will be implemented:

- the re-establishment of ground fauna habitat through the relocation of cleared vegetation and rocks in targeted rehabilitation areas, where practicable
- installation of supplementary arboreal habitat, such as nest boxes, once rehabilitated vegetation communities are of sufficient maturity and
- the retention or augmentation of dams in the post-mining landform to facilitate the re-colonisation of woodland fauna communities, subject to licencing requirements.

Mount Owen will incorporate the existing Tree Felling Procedure into the consolidated Landscape Management Plan, within 12 months of Project approval, to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees.

In the event that any threatened flora species or populations are identified within the proposed disturbance footprint, the suitability of salvage, translocation, or propagation to minimise the impacts on these species would be implemented, where feasible.

The Landscape Management Plan will be updated to include the management plan revisions identified in Table 3.6 of the Response to Submissions Report B.

The Biodiversity Management Plan will be updated to include the management plan revisions identified in Table 3.6 of the Response to Submissions Report B.

Biodiversity Offset Strategy

Mount Owen will implement a comprehensive Biodiversity Offset Strategy for the Project which includes the long-term conservation of the following land-based offset areas:

- Cross Creek Biodiversity Offset Area approximately 367 hectares (located adjacent to the existing Mount Owen Biodiversity Offset Areas)
- Stringybark Creek Habitat Corridor ((approximately 97.5 hectares)
- Mitchell Hills Offset Area (approximately 144 hectares) and
- Esparanga Biodiversity Offset Area approximately 303 hectares (located in a priority conservation area within the Great Eastern Ranges in the Manobalai Region).

To assist with the persistence of the Spotted-tailed quoll, Mount Owen will implement the following habitat enhancement measures within the proposed Stringybark Creek Habitat Corridor:

- salvage of trees felled during construction works and emplacement within the Stringybark Creek Habitat Corridor as log piles for potential denning habitat; and
- salvage and placement of large rocks and boulders into piles as further potential denning habitat.

The management actions to be undertaken at each Biodiversity Offset Site (including Stringybark Creek Habitat Corridor) include:

- targeted weed removal using techniques including both spraying and/or manual removal – initiated in year 1, then continued on an as needs basis
- targeted pest control program on an annual basis
- a mix of passive and active regeneration and assisted revegetation works, including preparation of soil and re-planting areas of DNG with locally sourced tube stock where regeneration activities show poor results or are considered unlikely to deliver effective results without intervention
- erection and upkeep of fencing and appropriate signage and maintaining fire trails around the perimeter of the property.

Habitat Connectivity

Mount Owen will implement mine rehabilitation which will provide native vegetation communities and fauna habitat augmentation.

Mount Owen will establish the East-West Corridor Management Area (refer to **Figure 4.3** of the Response to PAC Review Report) to maintain habitat connectivity.

Mount Owen will undertake additional revegetation works in the Additional Active Revegetation Area located in the South East Corridor Offset (refer to **Figure 4.3** of the Response to PAC Review Report) commencing within 12 months of Project.

Monitoring

As part of the preparation of the consolidated Landscape Management Plan, Mount Owen will review the existing monitoring program to include the proposed Biodiversity Offset Areas. The review of the monitoring program and the preparation of the Landscape Management Plan will be completed within 12 months of Project approval.

Results of the ecological monitoring program will be reported in the Annual Review and be made available on the Mount Owen website.

Water Dependant Ecosystems

The Landscape Management Plan will also be updated to include monitoring requirements for both alluvial groundwater levels and ecological condition of vegetation communities potentially impacted by changes in alluvial groundwater levels (i.e. Bettys and Main Creeks). Monitoring will include both hard rock and alluvial aquifers and the identification of triggers that may indicate greater than impacts predicted in the EIS. TARPs will be developed for any unexpected impacts on groundwater systems as well as impacts on riparian vegetation.

Land Use and Agricultural Impacts

Mount Owen, through Colinta Holdings Pty Ltd (or other lease arrangements), will maintain the agricultural production on non-operational land it currently owns and manages, where consistent with environmental, safety and operational matters on that land.

The proposed closure plan, final landform and final land use will include rehabilitation of land to ensure sustainable post mining land use options including some areas suitable for sustaining potential future agricultural activities such as grazing, as outlined in Section 5.8.5 of the EIS.

Aboriginal Cultural Heritage

Mount Owen will prepare and implement an Aboriginal Cultural Heritage Management Plan (ACHMP) for the Project within 12 months of Project Approval. Mount Owen will also seek to establish an Aboriginal Cultural Heritage Working Group within six months of project approval to include representatives of the Knowledge Holder groups, the RAPs and the Wanaruah LALC. The updated Plan will be prepared in consultation with the Working Group and will include the Aboriginal cultural heritage management measures to be implemented as part of the Project. These management measures will be based on the proposed measures outlined in Section 5.9.7 and Appendices 13a and 13b of the EIS. Key commitments include:

- The revised ACHMP will include a staged approach to research and salvage works to ensure that areas required for construction are completed as a priority.
- Mount Owen will consult with the Working Group on matters raised in the ACHA, in order to better understand where there may be changes or improvements to existing cultural heritage management mechanisms and protocols for consideration in the revised Mount Owen ACHMP.
- Mount Owen will revise its onsite induction program to include material to raise awareness of Aboriginal cultural values of the Project Area and local area more generally. The induction material will positively message the Aboriginal Cultural Heritage Values of the area. The induction materials and content will be developed in consultation with the Working Group.
- Mount Owen will undertake salvage (excavation, analysis and collection) as per the recommendations of the Archaeological Values Assessment Report for the salvage of the 34 sites to be harmed within the Proposed Disturbance Area (refer to Appendix 13b of the EIS).
- Mount Owen will revise the ACHMP to include the new sites identified in the Aboriginal Archaeological Values Assessment Report completed for the Project. Sites identified in the Mount Owen ACHA have been recorded on site cards and submitted to OEHL.
- Mount Owen will develop care and control management measures and include in the ACHMP for Aboriginal objects recovered through the Archaeological research and salvage program implemented for the Project and for long term storage of artefacts recovered from previous research and salvage programs.
- Mount Owen will construct a suitable fit for purpose artefact storage facility to store cultural heritage artefacts recovered during previous research and salvage programs, and for items recovered for the Project, within 2 years of approval for the Project.
- During construction there will be protective fencing of the sites outside the Project Disturbance Area that were identified by the Aboriginal Archaeological Values Assessment.
- Mount Owen will support funding of a memorial story board or other suitable marker, located in an appropriate location, to provide information on Aboriginal occupation of the area, and the conflicts that occurred in region in the early European settlement period. The wording of any plaque shall be developed through the Working Group.
- Mount Owen will consult with the RAPs and other stakeholders including Singleton Council in the naming of infrastructure works on Hebden Road and Bowmans Creek.
- Mount Owen will provide funding toward the development of an educational DVD or reference material to record the cultural knowledge as identified in the ACHA including the cultural context and relationship to significant Creation story sites, song lines, and other significant sites in the local area.
- During the life of the Project, Mount Owen will offer assistance towards three trainee scholarships (up to three years in duration) to be undertaken in culture related training areas. The training and education opportunity will include opportunities which may arise from vocational based learning including graduate and postgraduate studies.

Historic Heritage

Mount Owen will manage potential impacts to the Historic Heritage as described in Sections 5.10.4 and 5.10.5 of the EIS. The key management measures are outlined below.

Former Ravensworth Public School

- Prior to the commencement of works for the construction of the Hebden Road upgrade works and if any physical or sub-surface impacts are proposed in the area to the north of Hebden Road, the area will be surface surveyed to identify, or confirm the absence of, the potential for items or remains that may be associated with the listed former Ravensworth Public School.
- If any potential items or remains are identified, management measures will be developed by Mount Owen in consultation with the Heritage Division, OEH to ensure the items or remains are protected or, if appropriate, mitigated.

Ravensworth Village

- Prior to the commencement of works for the construction for the proposed Hebden Road upgrade works, on-site archaeological investigation of the associated portion of the Proposed Disturbance Area will be undertaken, in the manner described in Section 5.10.4 of the EIS.

Greenhouse Gas and Energy

Mount Owen will continue to implement the existing energy management controls. This will include the incorporation of the reasonable and feasible management controls identified in Section 5.11.6 and Appendix 15 of the EIS.

At an operational level, Mount Owen will continue to develop and implement mitigation and management measures to improve energy efficiency and reduce greenhouse gas emissions including:

- limiting the length of material haulage routes (where feasible), minimising transport distances and associated fuel consumption
- consideration of energy efficiency in the selection of equipment and vehicles and
- scheduling activities so that equipment and vehicle operation is optimised.

Traffic and Transport

Mount Owen will prepare and implement Construction Traffic Management Plans (CTMPs) in consultation with Singleton Council to proactively manage construction traffic movements on the local road network including Glennies Creek Road, Forest Road and Hebden Road during the construction phase of the Project, refer to Section 5.12.4 of the EIS. The CTMPs will involve the development of specific management measures in relation to Forest Road to ensure the road is upgraded where necessary and sufficiently maintained during use in the construction phase. Consideration of school bus timetables will be included in the development of the CTMPs applying to roads that have bus runs.

Works associated with the construction of the dual land bridge on Hebden Road across Bowman's Creek will commence within one year of mining beyond the currently approved mining limit.

Visual Amenity

Mount Owen will undertake the following measures to reduce the potential impact on visual amenity (refer to Section 5.13.5 of the EIS):

- progressive rehabilitation will be undertaken to reduce the duration of visible soil exposure
- ongoing management of mobile lighting to reduce the impacts of lighting at night, where practical, positioning lights so they are shielded by walls, overburden emplacement areas and vegetation and the ongoing implementation of procedures for the appropriate placement of mobile lighting plant and
- all lighting associated with the Project will be installed and maintained in accordance with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*.

Waste Management

No waste will be disposed of onsite except for inert wastes permissible under applicable legislation and waste tyres buried deep in pit. Waste will continue to be separated on site to allow different waste streams to be appropriately managed. Waste that cannot be reused or recycled will be transported off-site by licensed waste management contractors.

Hazards and Bushfire

Hazards

The handling and storage of hazardous substances will continue to be managed in accordance with the existing hazard management system.

Should any new hazardous substances or dangerous goods be introduced, they will be identified and managed in accordance with the existing hazard management system.

Bushfire

The Asset Protection Zone distances specified in the existing Bushfire Management Plan will continue to be applied to all relevant existing infrastructure and proposed infrastructure as part of the Project.

Bushfire threat will continue to be managed in accordance with the bushfire management controls included in the Bushfire Management Plan, and the Bushfire Management Plan will be reviewed and updated within 12 months of Project approval and as required, in consultation with the RFS.

Social

The existing Mount Owen Social Involvement Plan will be revised within 12 months of Project approval to incorporate the Project mitigation strategies identified in Section 5.17.5 of the EIS (as amended by the commitments in this section and the agreed VPA with Singleton Council). This will include a framework to monitor the effectiveness of the proposed mitigation strategies in mitigating negative social impacts and / or enhancing positive social impacts over time.

Closure and Rehabilitation

- The existing Landscape Management Plan for Mount Owen will be revised to reflect the Project and be submitted to the DP&E within 12 months of approval being granted.
- The revised Landscape Management Plan will include a Rehabilitation and Offset Management Plan for the Project developed in consultation with DRE, DP&E, OEH and Singleton Council which will include:
 - development of a rehabilitation and revegetation strategy for the Project to re-establish native vegetation communities consistent with the concept strategy described in this EIS
 - a Conceptual Closure Plan
 - completion criteria, determined in consultation with relevant agencies, that will be utilised to demonstrate achievement of rehabilitation objectives. The achievement of the completion criteria will be monitored and reported within the Annual Review and
 - monitoring of rehabilitated areas on at least an annual basis over the life of the Project. The monitoring findings and resulting actions will be reported in the Annual Review.

Mount Owen will commence development of a detailed Mine Closure Plan at least five years prior to the anticipated mine closure date (i.e. cessation of mining) and be submitted to the relevant regulatory authorities at a minimum of 2 years prior to the planned cessation of mining operations. The detailed Mine Closure Plan is to include consideration of water licensing requirements, social impacts associated with closure and potential future land uses and be developed with relevant stakeholders, including DRE, DP&E DPI Water and Singleton Council.

Rehabilitation will be undertaken progressively in accordance with an updated Mining Operations Plan (MOP) to be approved by DRE. Details of the micro-relief features to be incorporated into the rehabilitated landform will be identified in the MOP.

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