

ATTACHMENT 1
COWAL GOLD MINE
STATEMENT OF ENVIRONMENTAL EFFECTS
OF PROPOSED MODIFICATION



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Project No. HAL-33
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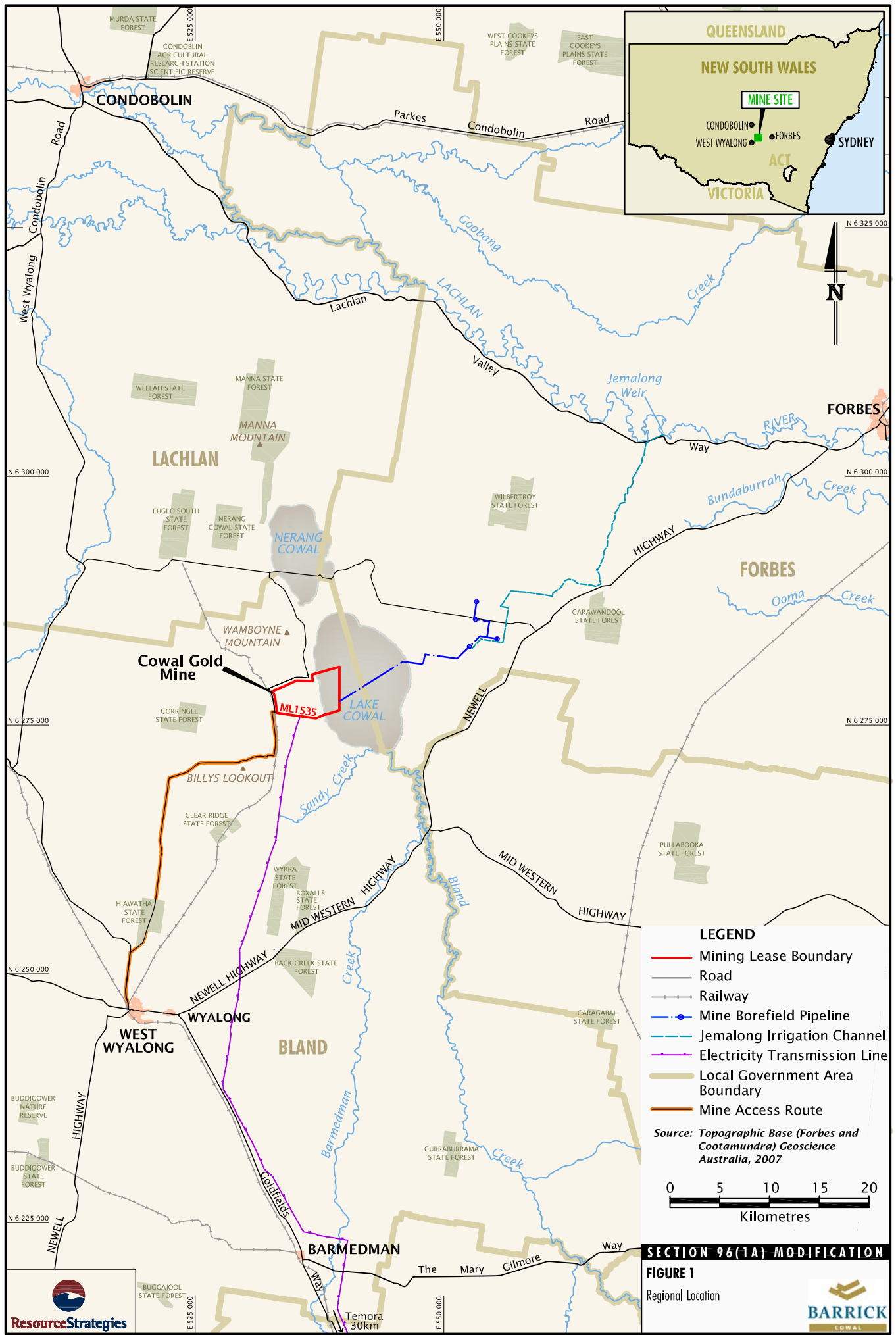
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- Attachment A Letter from Heggies Pty Ltd June 2009
- Attachment B Assessment of Significance for Threatened Species, Populations and Ecological Communities, and Their Habitats

1 BACKGROUND

The Cowal Gold Mine (CGM) was granted Development Consent by the New South Wales (NSW) Minister for Urban Affairs and Planning on 26 February 1999. The Development Consent has been modified on six occasions under Section 96 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) on 11 August 2003, 22 December 2003, 4 August 2004, 23 August 2006, 12 March 2008 and 11 February 2009. The CGM is located approximately 38 kilometres (km) north-east of West Wyalong in NSW (Figure 1).

Barrick (Cowal) Limited (Barrick) has made an application to the Minister for Planning under Section 96(1A) of the EP&A Act to modify Condition 1.1 of the Development Consent (Modification Application). This document has been prepared in support of the Modification Application and sets out the details of the proposed modification which is sought, an assessment of the minimal environmental impacts of the proposed modification and evidence that the development would remain substantially the same as that for which consent was originally granted.



2 PROPOSED AMENDMENTS TO THE DEVELOPMENT CONSENT

Condition 1.1 of the Development Consent provides:

1.1 Adherence to terms of DA, EIS, SIS, etc.

- (a) *The Development is to be carried out generally in accordance with the:*
- (i) *EIS dated 13 March 1998, including the Statement of Intent by North Gold (WA) Ltd, and prepared by Resource Strategies, as amended by the plans in Appendix 2 of this consent;*
 - (ii) *other relevant documentation, including the Applicant's primary submission, and submission in reply to the Commission of Inquiry;*
 - (iii) *modification application submitted by Barrick Australia Limited, dated 20 June 2003;*
 - (iv) *modification application and supporting information submitted by Barrick Australia Limited, dated 13 November 2003;*
 - (v) *modification application and supporting information submitted by Barrick Australia Limited, dated 22 June 2004;*
 - (vi) *modification application and supporting documentation submitted by Barrick Australia Limited, dated 15 August 2006;*
 - (vii) *modification application and supporting documentation submitted by Barrick Australia Limited, dated 24 December 2007; and*
 - (viii) *modification application and supporting documentation submitted by Barrick Australia Limited, dated 30 January 2009; and*
 - (ix) *conditions of this consent.*

Barrick seeks the following modification of Condition 1.1 of the Development Consent (as underlined):

1.1 Adherence to terms of DA, EIS, SIS, etc.

- (a) *The Development is to be carried out generally in accordance with the:*
- (i) *EIS dated 13 March 1998, including the Statement of Intent by North Gold (WA) Ltd, and prepared by Resource Strategies, as amended by the plans in Appendix 2 of this consent;*
 - (ii) *other relevant documentation, including the Applicant's primary submission, and submission in reply to the Commission of Inquiry; (iii) modification application submitted by Barrick Australia Limited, dated 20 June 2003;*
 - (iv) *modification application and supporting information submitted by Barrick Australia Limited, dated 13 November 2003;*
 - (v) *modification application and supporting information submitted by Barrick Australia Limited, dated 22 June 2004;*
 - (vi) *modification application and supporting documentation submitted by Barrick Australia Limited, dated 15 August 2006;*
 - (vii) *modification application and supporting documentation submitted by Barrick Australia Limited, dated 24 December 2007;*
 - (viii) *modification application and supporting documentation submitted by Barrick Australia Limited, dated 30 January 2009;*
 - (ix) *modification application and supporting documentation submitted by Barrick (Cowal) Limited, dated 23 June 2009; and*
 - (x) *conditions of this consent.*

3 REASONS FOR THE MODIFICATION APPLICATION

Background

Barrick has lodged this modification application as a result of the on-going legal proceedings in the Land and Environment Court of NSW which challenges the authority of the Minister for Planning to grant an approval under Section 75W of the EP&A Act to Barrick's E42 Modification to the CGM.

The application for the E42 Modification was lodged with the Minister for Planning in March 2008, pursuant to Section 75W of Part 3A of the EP&A Act and Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). An Environmental Assessment (EA) to accompany the application was lodged in August 2008. The EA was placed on public exhibition from 22 August to 22 September 2008.

The application for the E42 Modification was the subject of proceedings commenced by Neville "Chappie" Williams in the Land and Environment Court on 7 November 2008 against the Director-General of the Department of Planning (DoP), the Minister for Planning and Barrick. Justice Biscoe of the Land and Environment Court delivered the written reasons for his decision on 6 February 2009 and made final orders on 13 February 2009. The orders, amongst other things, restrained the Minister for Planning from determining the application for the E42 Modification under Section 75W of the EP&A Act.

The judgment of Justice Biscoe is currently the subject of an appeal commenced by Barrick in the NSW Court of Appeal on 6 March 2009. The hearing of the appeal is set down for 1 July 2009.

One of the practical effects of the on-going legal proceedings is that the approval process for the E42 Modification will be delayed. The E42 Modification involves, amongst other things, widening and deepening the open pit and an increase in the ore processing rate at the CGM. The E42 Modification is required to establish more efficient ore recovery and hence a more efficient mining project. The requirement for the E42 Modification was identified in response to significant changes in market conditions and an increase in working knowledge of the resource and mining conditions since the original development consent was issued in 1999. Without the E42 Modification, the efficiency of the CGM will be adversely affected.

In January 2009, Barrick submitted a modification application pursuant to Section 96(1A) of the EP&A Act, which allowed Barrick to better manage the adverse consequences of the material delay to the approval process for the E42 Modification. The modification included changes to the open pit to optimise the efficiency of the Project during the delayed approval process. The application to modify the Project was approved by the Minister for Planning on 11 February 2009.

The proposed modification proposes changes to the waste emplacements, cyanide destruction method and water supply to optimise the efficiency of the CGM whilst there is a material delay to the E42 Modification approval process.

Waste Emplacement Changes

Waste emplacement changes are proposed to maximise waste emplacement efficiency whilst preserving soil resources which have been stockpiled in the northern waste emplacement area. The stockpiled soil is proposed to be utilised in the progressive rehabilitation of the mine site. Following the delay to the E42 Modification approval process, rehabilitation areas for re-application of this soil will not become available until after the waste is mined. The proposed height changes of the northern and southern waste emplacements would allow this stockpiled soil to remain in its current location until areas become available for its use in progressive rehabilitation. To account for this, a small extension of the northern waste emplacement area and construction of remaining areas of the northern and southern waste emplacements to currently approved maximum heights are proposed.

The extension to the northern waste emplacement area would improve the efficiency of haulage operations by maximising out-of-pit waste rock haul distances, whilst waste rock is mined from near-surface, shallow areas of the open pit. This increases haulage efficiencies by removing the requirement for either waste rock double-handling or haulage of waste rock over longer distances when operating in deeper zones of the open pit.

The proposed construction of the remaining areas of the northern and southern waste emplacements to approved maximum heights would avoid double-handling costs for soil resources which are currently stockpiled in the northern waste emplacement area.

Caro's Acid Alternative

The proposed modification would also include addition of a cyanide destruction method (i.e. the INCO process) as an alternative to Caro's Acid, whilst maintaining the same, originally approved residual cyanide concentrations. Significant cost savings would result from this change.

Saline Groundwater Supply Borefield

The proposed modification would also involve the introduction of a saline groundwater supply borefield in order to diversify the water supply sources for the CGM. At various times during the life of the CGM the saline groundwater supply borefield would reduce demand on the originally approved external fresh water supply sources.

Summary

The proposed modification has been lodged in order that Barrick can better manage the adverse consequences of further material delay to a successful approval process for the E42 Modification by minor modifications to the CGM waste emplacements, current cyanide destruction method and external water supply sources.

4 LEGISLATIVE FRAMEWORK

The EP&A Act and EP&A Regulation set the framework for planning and environmental assessment in NSW. Modification of the Development Consent is sought under Section 96(1A) of the EP&A Act. Section 96(1A) states:

Section 96 Modification of Consents—Generally

1A) Modifications involving minimal environmental impact

A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:

- (a) it is satisfied that the proposed modification is of minimal environmental impact, and*
- (b) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all), and*
- (c) it has notified the application in accordance with:*
 - (i) the regulations, if the regulations so require, or*
 - (ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
- (d) it has considered any submissions made concerning the proposed modification within any period prescribed by the regulations or provided by the development control plan, as the case may be.*

Subsections (1), (2) and (5) do not apply to such a modification.

Section 96(3) will also apply to the Minister's determination of this Modification Application under Section 96(1A). It states:

96(3) In determining an application for modification of a consent under this section, the consent authority must take into consideration such of the matters referred to in section 79C(1) as are of relevance to the development the subject of the application.

Table 1 identifies the heads of consideration contained in Section 79C(1) and, where the heads relevant to this application, are addressed in this document.

Table 1
Relevant Section 79C(1) Heads of Consideration Addressed in the SEE

EP&A Act Section 79C(1) Matter	SEE Section
Provisions of any environmental planning instrument.	Sections 4 and 6
Provisions of any draft environmental planning instrument that is or has been placed on public exhibition and details of which have been notified to the consent authority.	N/A
Provisions of any development control plan.	N/A
Provisions of any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F.	N/A
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.	Section 6
The suitability of the site for the development.	Section 1
The public interest.	Section 6.12

Further relevant considerations are discussed below.

Bland Local Environmental Plan, 1993

The *Bland Local Environmental Plan 1993* (Bland LEP) applies to all land within the area of Bland and therefore applies to the modified CGM area.

The modified CGM area is located within land zoned 1(a) (General Rural Zone).

Mining on land zoned 1(a) (General Rural Zone) is permissible with development consent from Bland Shire Council.

The provisions of the Mining State Environmental Planning Policy (SEPP), and relevantly its aims (Clause 2) and the determination of permissibility for mining under local environmental plans (Clause 8), will prevail over provisions of the Bland LEP to the extent of any inconsistency, including the objectives of 1(a) (General Rural Zone).

Part 3 of the Bland LEP provides miscellaneous provisions, some of which are of relevance to the modified CGM. The environmental review in the Section 6 includes a description of the relevant existing environment and an assessment of potential impacts. Accordingly, the necessary information is before the Minister to enable the Minister to take into consideration those matters listed in Clause 10 that are relevant to the modified CGM and be satisfied as to these matters.

The modified CGM does not include any proposal to change the potential impacts on heritage items as described in the Cowal Gold Project Environmental Impact Statement (EIS) (North Limited, 1998). Accordingly, it is not necessary to consider the modified CGM against provisions of Clauses 22 (Development in the vicinity of heritage items).

Clause 27 of the Bland LEP is concerned with Aboriginal objects which have been notified under Section 91 of the *National Parks and Wildlife Act, 1974* and places which have been declared as Aboriginal places under Section 84 of that Act. The entirety of the proposed modification will take place within ML 1535. No part of ML 1535 has been declared an Aboriginal place under Section 84. Aboriginal objects within ML 1535 were surveyed for the purpose of obtaining cultural heritage approvals under Part 6 of the *National Parks and Wildlife Act, 1974* for the CGM. Impacts of the proposed modification on Aboriginal cultural heritage are further discussed at Section 6.9 of this document.

Forbes LEP

The *Forbes Local Environmental Plan, 1986* (Forbes LEP) applies to all land within the Shire of Forbes.

The approved CGM water supply borefield and pipeline (greater majority thereof) is located approximately 20 km north-northeast of ML 1535 in the Forbes Shire local government area (LGA). However, given the modified CGM would not modify any components of the approved CGM water supply borefield and pipeline within the Forbes Shire LGA, it is not necessary to consider the modified CGM against provisions in the Forbes LEP.

State Environmental Planning Policy (Major Projects) 2005 (Major Projects SEPP)

The approved CGM in respect of which the Development Consent was granted, is considered to be a project that meets the description in Schedule 1, Group 2, Clause 5(1)(c) of the Major Projects SEPP and therefore, pursuant to Clause 6(1) of the Major Projects SEPP, would be declared to be a project to which Part 3A of the EP&A Act applies but for the operation of Clause 6(2)(a) of the Major Projects SEPP.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP)

General

The Mining SEPP, which commenced on 16 February 2007, regularises the various environmental planning instruments that previously controlled mining activities.

Clause 5(3) of the Mining SEPP gives it primacy where there is an inconsistency between the provisions of the Mining SEPP and the provisions of any other environmental planning instrument (except the Major Projects SEPP, *State Environmental Planning Policy No. 14 [Coastal Wetlands]* [SEPP No. 14] and *State Environmental Planning Policy No. 26 [Littoral Rainforest]* [SEPP No. 26]).

- **Clause 7**

Clause 7 (1) of the Mining SEPP states that development for any of the following purposes may be carried out only with development consent:

- (b) *mining carried out at surface level:*

- ...

- (ii) *on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999.*

The modified CGM comprises surface level mining within ML 1535.

- **Clause 8**

Clause 8 of the Mining SEPP provides:

- 8 *Determination of permissibility under local environmental plans*

- (1) *If a local environmental plan provides that development for the purposes of mining, petroleum production or extractive industry may be carried out on land with development consent if provisions of the plan are satisfied:*

- (a) *development for that purpose may be carried out on that land with development consent without those provisions having to be satisfied, and*

- (b) *those provisions have no effect in determining whether or not development for that purpose may be carried out on that land or on the determination of a development application for consent to carry out development for that purpose on that land.*

- (2) *Without limiting subclause (1), if a local environmental plan provides that development for the purposes of mining, petroleum production or extractive industry may be carried out on land with development consent if the consent authority is satisfied as to certain matters specified in the plan, development for that purpose may be carried out on that land with development consent without the consent authority having to be satisfied as to those specified matters.*

The provisions of the Mining SEPP and the determination of permissibility for mining under local environmental plans will prevail over provisions of the Bland LEP to the extent of any inconsistency, including the objectives of 1(a) (General Rural Zone).

- **Clause 12**

Clause 12 of the Mining SEPP requires that, before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

- (a) *consider:*
 - (i) *the existing uses and approved uses of land in the vicinity of the development, and*
 - (ii) *whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and*
 - (iii) *any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and*
- (b) *evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and*
- (c) *evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).*

The modified CGM is surrounded by land zoned 1(A) (General Rural Zone) and the modified CGM would be generally consistent with this use.

Noise, blasting, visual character, air quality, road transport, socio-economic, hazard and risk assessments are included in Sections 6.1, 6.2, 6.5, 6.11, 6.12 and 6.13 and these assessments indicate that the modified CGM would result in minimal impacts on landuses adjoining the approved CGM.

As described in Section 6.3, the evidence suggests that the modified CGM would reduce the scale of the potential impacts to groundwater resources and not have a significant impact on regional water users. Additionally, Sections 6.7 and 6.8 describe that the modified CGM would not significantly change the potential impacts to flora and fauna, or nature conservation, and is not incompatible with the existing landuses within the vicinity of the approved CGM. As described in Section 6.12, the modified CGM would continue the significant socio-economic benefits to the Lachlan economy, the State of NSW and Australia currently affected by the approved CGM.

As described in Section 6.6, Barrick would, where practicable, continue to implement a range of measures to avoid or minimise incompatibility with existing and future landuses in the vicinity of the modified CGM.

- **Clause 14**

Clause 14, subclause (1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

- (a) *that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,*
- (b) *that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,*
- (c) *that greenhouse gas emissions are minimised to the greatest extent practicable.*

In addition, clause 14, subclause (2) requires that, without limiting clause 14, subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programmes or guidelines concerning greenhouse gas emissions.

The potential impacts of the modified CGM on groundwater resources and surface water (including measures to minimise potential impacts). The potential impacts of the modified CGM on threatened species and biodiversity (measures to minimise potential impacts) are described in Sections 6.7 and 6.8.

The modified CGM would not change the major sources of greenhouse gases for the project greenhouse gas emissions assessment for the modified CGM is provided in Section 6.5.1. Greenhouse gas abatement measures are described in Section 6.5.1.

- **Clause 15**

Clause 15 of the Mining SEPP requires that:

- (1) *Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.*
- (2) *Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.*
- (3) *The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.*

One of the practical effects of the on-going legal proceedings is that the approval process for the E42 Modification will be delayed. The E42 Modification involves, amongst other things, widening and deepening the open pit and an increase in the ore processing rate at CGM. The E42 Modification is required to establish more efficient ore recovery and hence a more efficient mining project. The requirement for the E42 Modification was identified in response to significant changes in market conditions and an increase in working knowledge of the resource and mining conditions since the original development consent was issued in 1999. Without the E42 Modification, the efficiency of the CGM will be adversely affected.

In January 2009, Barrick submitted a modification application pursuant to Section 96(1A) of the EP&A Act, which allowed Barrick to better manage the adverse consequences of the material delay to the approval process for the E42 Modification. The modification included changes to the open pit to optimise the efficiency of the project during the delayed approval process. The application to modify the Project was approved by the Minister for Planning on 11 February 2009.

The proposed modification proposes changes to the waste emplacements, cyanide destruction method and water supply to optimise the efficiency of the CGM whilst there is a material delay to the E42 Modification approval process.

- **Clause 16**

Clause 16 (1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

- (a) *require that some or all of the transport of materials in connection with the development is not to be by public road,*
- (b) *limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,*
- (c) *require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.*

Existing arrangements covering the transport of hazardous materials, including details of routes used for the movement of vehicles carrying hazardous materials to or from the approved CGM, are set out in the Transport of Hazardous Materials Study (THMS) (Barrick, 2005a).

In addition, Clause 16 (3) of the Mining SEPP requires that the consent authority:

- (a) *must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application,...*

- **Clause 17**

Clause 17 of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development. In particular, the consent authority must consider whether conditions of the consent should:

- (a) *require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or*
- (b) *require waste generated by the development or the rehabilitation to be dealt with appropriately, or*
- (c) *require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 145C of the Act and the Contaminated Land Management Act 1997), or*
- (d) *require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.*

The modified CGM would not change the rehabilitation principles and objectives of the Original CGM. Progressive rehabilitation would continue for the modified CGM as outlined in the Flora and Fauna Management Plan (FFMP), Land Management Plan (LMP) and Mining Operations Plan (MOP). The Original CGM rehabilitation proposal provides for landform stability and, consequently public safety. In addition, public safety is provided for under the CGM Mining Lease (ML) conditions.

The proposed management of modified CGM waste rock is discussed in Section 6. The management of tailings and other wastes would continue unchanged from the Original CGM.

As described in Section 6.11, access to the modified CGM for heavy vehicles would continue to be provided via the original approved access route to the CGM from West Wyalong, which follows Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane. The approved access road is a public road.

Clause 16 (2) of the Mining SEPP requires that, if the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within seven days after receiving the development application, provide a copy of the application to each roads authority for the road, and the Roads and Traffic Authority (RTA) (if the RTA is not a roads authority for the road).

5 DESCRIPTION OF THE PROPOSED MODIFICATION

This section describes the “development to which the consent as modified relates” (the modified CGM) and provides a comparison with the:

- “development for which the consent was originally granted” (i.e. as described and shown in: the EIS [North Limited, 1998], including the Statement of Intent by North Gold [WA] Ltd, as amended by the plans in Appendix 2 of the consent; other relevant documentation, including the North Gold [WA] Ltd’s primary submission, and submission in reply to the Commission of Inquiry; and the conditions of the consent) (the original CGM); and
- original CGM as previously modified (the approved CGM).

Table 2 provides a comparison of the original CGM, the approved CGM and the modified CGM. The modified CGM includes the modifications described in Section 3 and shown on Figure 2. Figure 2 shows the layout of the original CGM compared to the approved CGM and modified CGM.

Table 2 demonstrates that the modified CGM would be substantially the same as the development for which the Development Consent was originally granted and before that consent as originally granted was modified.

As identified in Table 2, the key aspects of the proposed modification would include:

- no change to the maximum approved heights of the northern and southern waste emplacements, although an increase in the heights of the remaining areas of the northern and southern waste emplacements that were not subject to a height increase in the February 2009 modification (Figure 2);
- increase to the total area of the waste emplacements (and additional two small stockpiles for associated soil);
- re-alignment of a small portion of the UCDS and minor changes to the internal catchment divide around the modified northern waste emplacement area;
- addition of a cyanide destruction method (i.e. the INCO process) as an alternative to Caro’s Acid;
- introduction of a saline groundwater supply borefield within ML 1535;
- a change to the total disturbance area within ML 1535 from approximately 950 ha to approximately 990 ha (to facilitate the modified northern waste emplacement, two soil stockpiles, re-alignment of a small portion of the UCDS and the saline groundwater supply borefield); and
- other associated minor changes to infrastructure, plant, equipment and activities.

These changes are described further below.

The proposed modification **does not** involve any changes to the following approved CGM development components: total ore production; ore processing rate; life of mine; total water requirement; open pit area or final pit dimensions; lake isolation system; waste rock production rate; tailings production; number or location of tailings storage facilities; tailings storage facilities area; tailings storage facilities water management processes; cyanide destruction levels; power supply; or employment.

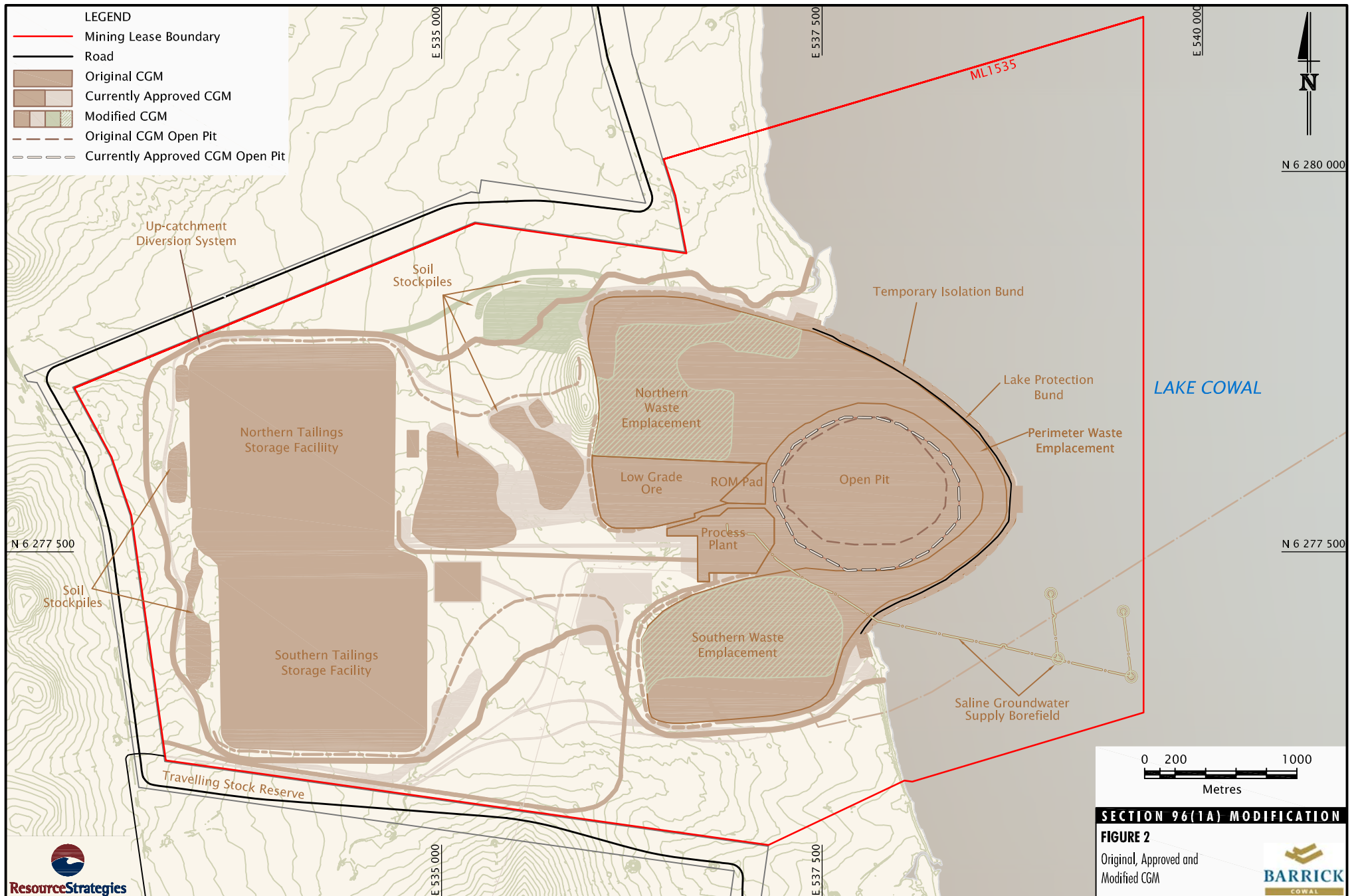


Table 2
Comparison of Original, Approved and Modified CGM

Development Component	Original CGM¹	Approved CGM²	Modified CGM³
Tenement	Mining operations to be conducted within a proposed ML encompassing an area of approximately 2,650 hectares (ha).	No change (ML 1535 granted in June 2003).	No change.
Mining	Open pit mine producing a total of approximately 2.7 million ounces (Moz) of gold which is economically recoverable from some 76 million tonnes (Mt) of ore.	No change.	No change.
Life of Mine	13 year operational life.	No change.	No change.
Ore Processing	Gold extracted from the ore using a conventional carbon-in-leach cyanide leaching circuit. Ore processing rate of up to 6.9 million tonnes per annum (Mtpa).	No change.	No change.
Water Supply	Water requirements over the life of the mine supplied from the following sources: • decant water from tailings storage facilities; • internal runoff collection; • open pit dewatering; and • Bland Creek Palaeochannel borefield. Total external water supply of approximately 47,450 megalitres (ML) (i.e. 10 ML/day x 13 years).	As per the Original CGM, with additional Lachlan River water entitlements supplied via the Jemalong irrigation channel. No change to the total external water supply requirement.	As per the approved CGM with the introduction of a saline groundwater supply borefield within ML 1535. No change to the total external water supply requirement.
Open Pit	Open pit area of approximately 70 ha.	Open pit area of approximately 95 ha.	No change to approved CGM.
	Final open pit dimensions approximately 1,000 metres (m) long, 850 m wide and 325 m deep.	Final open pit dimensions approximately 1,100 m long, 1,050 m wide and 325 m deep.	No change to approved CGM.
	Lake isolation system constructed to hydrologically isolate the open pit and Lake Cowal during mining and post-mining. Lake isolation system comprises the temporary isolation bund, lake protection bund and perimeter waste emplacement.	No change to the lake protection bund or temporary isolation bund. Changes to the perimeter waste emplacement are described below.	No change to approved CGM.

Table 2 (Continued)
Comparison of Original, Approved and Modified CGM

Development Component	Original CGM¹	Approved CGM²	Modified CGM³
Lake Isolation System	The lake isolation system has been constructed to hydrologically isolate the open pit and Lake Cowal during mining and post-mining. The lake isolation system is comprised of a series of isolation embankments designed to prevent the inflow of water from Lake Cowal into the open pit development area during periods of high water levels. The lake isolation system includes the temporary isolation bund, lake protection bund and perimeter waste emplacement.	No change.	No change.
Waste Rock	Approximately 128 Mt of mined waste rock. Waste rock placed within the northern, southern and perimeter waste emplacements.	Approximately 136 Mt of mined waste rock. Increase in the height of some areas of the northern and southern waste emplacements. Reduction in the height in some areas of the perimeter waste emplacement. No change to total waste emplacement area.	No change to approved CGM. No change to the approved maximum heights of the northern and southern waste emplacements. Increase to the height of the areas of the northern and southern waste emplacements that were not subject to a height increase in the February 2009 modification. No change to the perimeter waste emplacement. An increase to the total area of waste emplacements. Re-alignment of a small portion of the Up-catchment Diversion System (UCDS) and minor changes to the internal catchment divide around the modified northern waste emplacement area.
Tailings Storage Facilities	Approximately 76 Mt of tailings produced over the life of the mine.	No change.	No change.
	Tailings stored in two tailings storage facilities located approximately 3.5 km west of the Lake Cowal shoreline.	No change.	No change.
	The tailings storages cover an area of approximately 350 ha.	No change.	No change.

Table 2 (Continued)
Comparison of Original, Approved and Modified CGM

Development Component	Original CGM¹	Approved CGM²	Modified CGM³
Tailings Storage Facility Water Management	Tailings storage facility water management and processes including maximising water re-use through the under-drainage pipe network, decant towers and water return pipeline to the process water storage pond. Seepage control measures have been incorporated into the tailings storage facilities.	No change.	No change.
Cyanide Levels	Cyanide concentrations in the aqueous component of the tailings slurry stream not to exceed the following at the discharge point to the tailings storage facilities: • 20 milligrams per litre (mg/L) weak acid dissociable cyanide (CN_{WAD}) (90 percentile over six months); and • 30 mg/L CN_{WAD} (maximum permissible limit at any time).	No change.	No change.
Cyanide Destruction	Cyanide destruction would be achieved using Caro's Acid.	No change.	Addition of a cyanide destruction method (i.e. the INCO process) as an alternative to Caro's Acid.
Power Supply	Electricity to the site via a 132 kilovolt (kV) transmission line from Temora, approximately 90 km south of the CGM.	No change.	No change.
Employment	Approximately 200 personnel during the mining and processing phase.	Approximately 320 to 370 personnel during the mining and processing phase.	No change to approved CGM.

¹ Original CGM approved 26 February 1999.

² Original CGM as previously modified on 11 August 2003, 22 December 2003, 4 August 2004, 23 August 2006, 12 March 2008 and 11 February 2009.

³ Proposed modification to original CGM as previously modified.

Open Pit Design

As stated above, no changes are proposed to the open pit area, method of open pit development or final pit dimensions. The open pit design would continue to adopt the results of on-going reviews of pit wall stability.

For example, modifications have been made to the pit geotechnical design criteria as a result of a review following a slip that occurred on 20 December 2007 on a transitional pit wall inside the final design outline (note: slip material has been removed and slip remediation has been completed). Following the slip, Barrick commissioned Mining One Pty Ltd to undertake a geotechnical review of the pit wall stability, which included:

- updating the geotechnical model for the E42 deposit incorporating recent geotechnical mapping, photogrammetry, geology modelling, groundwater modelling (based on open pit dewatering and groundwater level monitoring records) and slope stability assessments for wall angles; and
- preliminary long term stability analysis accounting for the factors of safety, locations of the final pit crest, perimeter waste emplacement and lake protection bund.

The open pit geotechnical design criteria resulting from the review are detailed in the 2009 – 2010 MOP. The berm widths and slope angles will continue to be reviewed and monitored through on-going geotechnical studies and data collection during mine development in accordance with current practice.

Based on preliminary results, the current lake protection bund position achieves a Factor of Safety (FoS) of more than 1.5 along all sectors of the east wall of the open pit (i.e. the open pit as per the February 2009 modification) (Mining One Pty Ltd, in prep.).

Further information will be compiled over the term of the 2009 – 2010 MOP to develop geotechnical knowledge. This will include mapping, hydrogeological monitoring and modelling and pit wall monitoring.

Waste Rock and Waste Emplacement

As stated above, the proposed modification would not increase the approved total quantity of waste rock to be removed from the open pit.

The waste rock mining method used at the CGM is typical of open pit mining operations throughout Australia and the world. The waste rock (i.e. rock containing no commercial gold) is broken through a routine sequence of in-pit drilling and blasting. Broken rock is loaded into large rear dump trucks using hydraulic excavators and is then hauled from the pit to be placed within the dedicated waste emplacements. The currently operating mining fleet would remain unchanged for the modified CGM.

No changes to the CGM waste rock mining methods are proposed as part of this modification.

Waste emplacement changes are proposed to maximise waste emplacement efficiency whilst preserving soil resources which have been stockpiled in the northern waste emplacement area. The stockpiled soil is proposed to be utilised in the progressive rehabilitation of the mine site. Following the delay to the E42 Modification approval process, rehabilitation areas for re-application of this soil will not become available until after the waste is mined. The proposed height changes of the northern and southern waste emplacements would allow this stockpiled soil to remain in its current location until areas become available for its use in progressive rehabilitation. To account for this, a small extension of the northern waste emplacement area and construction of remaining areas of the northern and southern waste emplacements to currently approved maximum heights are proposed.

The extension to the northern waste emplacement area would improve the efficiency of haulage operations by maximising out-of-pit waste rock haul distances, whilst waste rock is mined from near-surface, shallow areas of the open pit. This increases haulage efficiencies by removing the requirement for either waste rock double-handling or haulage of waste rock over longer distances when operating in deeper zones of the open pit.

To avoid double-handling costs for the soil resources currently stockpiled in the northern waste emplacement area would require an increase to the height of the remaining areas of the northern waste emplacement to currently approved maximum heights (Figure 2) (i.e. to an approximate final height of relative level (RL) 253 m Australian Height Datum [AHD] [increased from RL 243 m AHD]).

Similarly, the proposed modification would include an increase in the height of the remaining areas of the southern waste emplacement to currently approved maximum heights (Figure 2) (i.e. to an approximate final height of RL 238 m AHD [increased from RL 223 m AHD]).

The proposed modification would include an increase to the total waste emplacement area and an additional two small stockpiles for associated soil (Figure 2). The additional waste emplacement area and soil stockpiles would be located immediately west of the existing northern waste emplacement (Figure 2). The disturbance would occur primarily within land that has been described by Western Research Institute (2008) as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice.

The northern waste emplacement has been designed to meet the long-term goal of directing potential seepage generated from waste emplacement areas during operation and post-closure toward the open pit (i.e. base drainage control zone). In accordance with the Environment Protection Licence (EPL) for the approved CGM, the modified northern waste emplacement would be located on a base drainage control zone with a minimum slope towards the open pit of 1(vertical [v]):200(horizontal [h]). This would mirror the design principles of the originally approved CGM northern waste emplacement.

The additional soil stockpiles would be managed in accordance with the soil stockpile management measures described in the Erosion and Sediment Control Management Plan (ESCMP) (Barrick, 2003a).

No change to the perimeter waste emplacement is proposed as a result of the modification.

Tailings

Given that the proposed modification does not propose an increase in the quantity of ore to be removed from the open pit or the ore processing rate, there would be no change to tailings production. Consequently, there would be no change to the number or location of tailings storage facilities, tailings storage facilities area or tailings storage facilities water management processes.

Lake Isolation System

The CGM lake isolation system has been constructed to hydrologically isolate the open pit and Lake Cowal during mining and post-mining. The lake isolation system is comprised of a series of isolation embankments designed to prevent the inflow of water from Lake Cowal into the open pit development area during periods of high water levels. The lake isolation system includes the temporary isolation bund, lake protection bund and perimeter waste emplacement, which are shown on Figure 2. No change to the lake isolation system is proposed as a result of the modification.

Up-catchment Diversion System

The approved UCDS allows upper catchment surface runoff to flow around the western, northern and southern edges of the site and into the existing drainage lines.

The minor modification to the northern waste emplacement would require the re-alignment of a small component of the UCDS. This would include the re-alignment of a small section of the existing low-flow channel and bund (Figure 2). The disturbance would occur primarily within land that has been described by Western Research Institute (2008) as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice.

Internal Catchment Drainage System

The management of erosion and sedimentation is described in the existing ESCMP (Barrick, 2003a). The approved CGM surface water monitoring programme is described in the existing Site Water Management Plan (SWMP) (Barrick, 2003b) and Cowal Gold Project Surface Water, Groundwater, Meteorological and Biological Monitoring Plan – Mine Operations (SWGMBMP) (Barrick, 2005b).

The approved CGM water management system has been designed such that the ecological integrity of the Cowal wetland system is not compromised (North Limited, 1998). Mine infrastructure and landforms have been constructed within the Internal Catchment Drainage System (ICDS). The ICDS consists of contained water storages for CGM runoff (i.e. D1, D2, D3, D4, D5, D8A and D8B) and the internal catchment divide (i.e. a bund constructed on the outer bounds of the CGM catchment to direct runoff toward the contained water storages). The ICDS combines with the lake isolation system (described above) to isolate Lake Cowal from mine development activities. Runoff from areas upslope of the ICDS is diverted via an UCDS, around the mine area to the Lake Cowal.

The ICDS has remained isolated from Lake Cowal for approved CGM operations to date (Barrick, 2009).

The proposed modification would include minor changes to the alignment of the internal catchment divide around the northern waste emplacement area.

Caro's Acid Alternative

The approved CGM cyanide concentrations in the aqueous component of the tailings slurry stream at the point of discharge to the tailings storage facilities are:

- 20 mg/L CN_{WAD} (90 percentile over six months); and
- 30 mg/L CN_{WAD} (maximum permissible limit at any time).

Following ore processing at the approved CGM, the tailings slurry is passed through a cyanide destruction process before being discharged to the tailings storage facilities.

The proposed modification would include addition of a cyanide destruction method (i.e. the INCO process) as an alternative to Caro's Acid, whilst maintaining the same, originally approved residual cyanide concentrations.

Caro's Acid is currently used at the approved CGM to destroy cyanide. Caro's Acid is a mixture of sulphuric acid (H₂SO₄) and hydrogen peroxide (H₂O₂), both of which are separately transported and stored on site. The two cyanide destruction points are served by a Caro's Acid mixing chamber at each point. The main by-product from the Caro's Acid destruction process is cyanate which itself decays through natural processes.

The modified CGM would involve the use of the INCO process as an alternative method for cyanide destruction. Detailed testwork commissioned by Barrick to date indicates that this process is capable of cyanide destruction to the same current approved levels. The INCO process would be introduced when detailed design works have been completed. The INCO process involves the introduction of sulphur dioxide (SO₂) as sodium metabisulphite (SMBS).

The reaction is catalysed by the presence of copper, which may have to be added (as copper sulphate). Air is also required, as is lime to maintain the pH at optimal levels (i.e. pH between 8 and 10) as the reaction proceeds. The two cyanide destruction points would be served by an INCO mixing chamber at each point. Similar to Caro's Acid, the main by-product from the INCO destruction process is cyanate which decays through natural processes. The geochemistry of the tailings resulting from the use of the INCO process is discussed in Section 6.4.

The quantity of reagents added to the tailings (for either the Caro's Acid or INCO processes) would continue to be regulated by an on-line free cyanide measurement to monitor the effectiveness of cyanide destruction in the tailings.

As stated above, the proposed modification would not change the originally approved CN_{WAD} levels of the aqueous component of the tailings slurry stream.

The Cyanide Management Plan (CMP) (Barrick, 2006a) would be revised to include a description of the INCO process. The mitigation and management measures described in the CMP (including the cyanide monitoring process) would continue for the modified CGM.

Water Supply

The proposed modification would not change the total external water requirement for the CGM, given that there would be no change to the total ore production or ore processing rates and therefore no change to water demand.

No change to the water supply sources for the CGM is proposed, except for the introduction of a saline groundwater supply borefield within ML 1535. The saline groundwater supply borefield is proposed in order to diversify the water supply sources for the CGM. At various times during the life of the CGM the saline groundwater supply borefield would reduce demand on the originally approved external fresh water supply sources.

A review of mineral drilling records identified a prospective local saline alluvial aquifer located within ML 1535 to the east and south of the approved CGM open pit. Pump tests on this aquifer (Coffey Geotechnics, 2008) indicated that a borefield of approximately four bores could supply 1 ML/day of saline water (i.e. electrical conductivity of approximately 40,000 micro Siemens per centimetre [$\mu S/cm$]) to the process plant. Barrick has since conducted further testwork. The results of tests conducted on two licensed test bores indicate that sustainable yields from these bores are in the order of 0.7 ML/day for a period of approximately 5 years.

It is expected that there is a high likelihood that this borefield could be developed using additional bores in ML 1535 to supply 1 ML/day for the currently approved life of the CGM. This expectation is based on:

- the yield results from the two tested bores in the saline alluvial aquifer;
- the number of other existing licensed test bores (i.e. nine) available for conversion to production bores;
- the results of bore yields from open pit dewatering bores; and
- historic hydrogeological investigations in ML 1535 which have confirmed the presence of saline groundwater in three other local aquifers as described in Coffey Geotechnics (2008).

The potential environmental impact associated with this extraction for the modified CGM is assessed in Section 6.3. Figure 2 shows the proposed location of the borefield and associated pipeline. A small area of the lakebed of Lake Cowal would be disturbed for the saline groundwater supply borefield and associated pipeline. This disturbance would not involve the removal of native trees, given that trees are absent from this area (FloraSearch, 2008). Further, this area has been previously cleared for livestock grazing and, in some areas, cropping (*ibid.*).

The borefield would be operated during times when the borefield is not inundated by Lake Cowal. It is anticipated, therefore, that this borefield would operate in drier times and be rested in wetter times when the contained water storages would make up the supply from this source.

The design and installation of the pipeline to the saline groundwater supply borefield within Lake Cowal would be consistent with the policy detailed in the *Guidelines for controlled activities: Laying pipes and cables in watercourses* (Department of Water and Energy, 2008). In particular, in undertaking the works associated with the installation of the pipeline Barrick would:

- minimise disturbance to soil and vegetation communities (i.e. no native trees would be removed for the saline groundwater supply borefield given that trees are absent from this area; further, this area has been previously cleared for livestock grazing and, in some areas, cropping);
- maintain existing/natural hydraulic, hydrologic, geomorphic and ecological functions of Lake Cowal; and
- rehabilitate disturbed areas post installation as appropriate.

In addition, operation of this borefield would include the following control and/or preventative measures:

- shut-down and removal of pumps during periods when the borefield is inundated by Lake Cowal;
- well-heads raised above the full storage level of Lake Cowal by construction of stand pipes;
- steel stand pipes to minimise potential damage to the bore in the unlikely event of an accidental collision;
- prominent signage at the well-heads to minimise the potential for accidental collision and damage;
- an anchored pipeline laid on the ground surface (i.e. above ground level) in a V-drain for potential spill containment;
- an underground powerline to power the pumps; and
- leak detection mechanisms including automatic shut-down capability (i.e. a pressure-based shut-down system).

In the unlikely event of pipeline failure and leakage of saline water, the spill would be controlled, contained and cleaned-up in accordance with the spill response procedures described in the Hazardous Waste and Chemical Management Plan (HWCMP) (Barrick, 2003c).

6 ENVIRONMENTAL REVIEW

6.1 NOISE AND BLASTING

A noise assessment for the modified CGM was conducted by Heggies Pty Ltd (Heggies) and is presented in Attachment A. The results of Heggies' assessment are summarised below.

Environmental Review

Operating Noise

The original CGM (Development Consent and EPL) intrusive noise criteria were generally based on the noise compliance requirements of the NSW Department of Environment and Climate Change (DECC) Environmental Noise Control Manual (ENCM) (Environment Protection Authority [EPA], 1994). More recently the DoP and DECC have amended the Development Consent and EPL, respectively, for consistency with the NSW Industrial Noise Policy (INP).

The Noise Management Plan (NMP) (Barrick, 2004) requires six-monthly noise monitoring and reporting to be conducted in January and July of each year. Operating noise criteria in accordance with the INP are nominated in the NMP and are reproduced in Table 3.

Table 3
NMP (INP) Based Intrusive $L_{Aeq(15minute)}$ and Sleep Disturbance $L_{A1(1minute)}$ Noise Criteria

NMP (INP) Based Intrusive $L_{Aeq(15minute)}$ PSNLs			Sleep Disturbance Screening Criteria $L_{A1(1minute)}$
Daytime (dBA)	Evening (dBA)	Night-time (dBA)	Night-time (dBA)
35	35	35	45

Source: Attachment A.

¹ Daytime defined 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm and Night-time 10.00 pm to 7.00 am.

dBA = A-weighted decibel.

The noise criteria presented in Table 3 apply under site-specific meteorological conditions as determined in accordance with the INP. The environmental noise performance of the CGM has generally been assessed against the NMP (INP) based noise criteria (and meteorological conditions) which are relevant for the purposes of reviewing any potential noise impacts arising from the modified CGM.

The EIS assessment predicted compliance with the ENCM criteria at all the assessed locations. For comparison, a contemporary assessment of the CGM would be required to be undertaken in accordance with the current DECC noise assessment requirements of the INP. In this case, an assessment of the modified CGM has been undertaken generally in accordance with the INP (Attachment A).

The noise sources identified for the modified CGM include the same type of sources as those identified for the original CGM, including fixed processing plant and mobile equipment fleet (e.g. hydraulic excavators, haul trucks, front end loaders, dozers [wheeled and tracked], graders and drill rigs). The proposed modification does not involve any additional mobile equipment by comparison with the typical mobile equipment fleet currently in-use. Similarly, fixed plant remains unaltered by the modified CGM.

The proposed modification is not expected to change the maximum potential noise emissions from the CGM, given there would be no new significant noise sources and no change to the maximum quantity of waste rock or ore to be mined in any one year (Attachment A).

While the modified CGM involves an increase of 10 to 15 m of the final height of some areas of the northern and southern waste emplacements, there would be no increase in mine noise arising from the increasing elevation of waste emplacement areas at the CGM as the noise propagation path (and existing line-of-sight between noise sources and receivers) would remain relatively unaltered by the modified CGM at the nearest residential dwellings (Attachment A). Further, the additional footprint of the northern waste emplacement would not change mine noise emissions, given works in this area would be serviced by the existing mobile equipment fleet. Therefore, the change in noise levels at nearby receptors are unlikely to significantly change.

The original CGM noise modelling predicted that noise emissions would be below relevant noise criteria. With the exception of two minor exceedances, all recent noise measurements show mine levels remain below 35 dBA and CGM emissions are deemed to be in compliance with Consent, EPL and INP requirements (Attachment A). The modified CGM is not anticipated to change CGM noise emission levels (Attachment A). Accordingly, it is reasonable to conclude that existing mine noise emissions are unlikely to significantly change and the proposed changes for the modified CGM would have minimal noise impact potential (Attachment A).

Traffic Noise

The proposed modification would not change traffic movements to and from the CGM (i.e. no new traffic sources).

Blasting

The proposed modification would not change blasting emissions from the CGM (i.e. no change to average blast frequency or blast design parameters).

Mitigation Measures and Management

Noise monitoring would continue to be undertaken in accordance with the existing programme to assess compliance with noise criteria in accordance with the INP. Investigations into noise related complaints and exceedances of criteria would continue to be undertaken in accordance with the NMP.

The Traffic Noise Management Plan (TNMP) (Barrick, 2003d) has been implemented at the CGM. The TNMP includes monitoring requirements, noise management and ameliorative measures, complaint response and property acquisition processes.

Blast mitigation and management measures for the CGM are described in the Blast Management Plan (BLMP) (Barrick, 2003e). The mitigation and management measures (including monitoring) described in the BLMP would not change as a result of the proposed modification and would continue for the modified CGM.

6.2 VISUAL CHARACTER

Environmental Review

As outlined in the EIS, the location and final shape of the mine landforms were designed to integrate with local topographic features (North Limited, 1998). Further, all landforms were restricted in height to lie below that of local topographic highpoints, particularly the prominent ridgeline located immediately to the west of the CGM (North Limited, 1998).

The visual impact assessment undertaken by EDAW Australia (1997) as part of the EIS identified the following sensitive areas which would potentially have views of the CGM. These were:

- Billy's Lookout (RL 368 m AHD);
- Wamboyne Mountain (RL 412 m AHD);
- Lake Cowal – from the surface and eastern edge of the lake;
- residences; and
- sections of the public road and travelling stock reserve to the northern, western and southern boundaries of the mine.

Other areas (i.e. areas not assessed as sensitive areas) assessed to have the potential views of the CGM included:

- areas of rural landscape within the visual catchment; and
- West Wyalong-Burcher Railway.

Views would also potentially be available from the Game Reserve which was relocated, after the original Development Consent was issued, to a location 3 km to the south-east of the mine site. However, as this location's primary purpose is the preservation of game species, the visual sensitivity of this area is considered low. Potential views of the ML from the Game Reserve are restricted by intervening screening vegetation (particularly along the south-western fringe of Lake Cowal) and flat topography.

With the exception of the abovementioned Game Reserve, in the local and sub-regional setting the number of sensitive viewpoints has not changed since the EIS was prepared.

A summary of the potential visual impacts of the original CGM compared to the modified CGM is presented in Table 4.

Table 4
Potential Visual Impact Summary

Viewpoint	Potential Visual Impacts	
	Original CGM*	Modified CGM
Public road within the travelling stock reserve		
– North of mine site	Moderate to high in short term, reducing in time due to screening by trees and landforms.	No change.
– West of mine site	Generally moderate to high on section within 200 m of new landform reducing to low to moderate on road side planting provides screening.	No change.
– South of mine site	Moderate in short term reducing to low as screening is provided by road side tree planting.	No change.
Railway	Freight trains only and infrequent use.	No change.
– West of mine site	Low due to screening by trees planted along eastern edge of realigned road.	No change.
Residences		
– North, west and south of mine site	Views generally screened by landforms and vegetation.	No change.
– East of mine site	Views some 8 km across Lake Cowal. Tops of new landforms below the tree covered prominent ridgeline located west of the CGM.	No change.

Table 4 (Continued)
Potential Visual Impact Summary

Viewpoint	Potential Visual Impacts	
	Original CGM*	Modified CGM
General landscape		
– North, south and west of mine site	Low to moderate due to screening by vegetation and landforms and affect of distance, reducing to low as slopes are rehabilitated.	No change.
– East of mine site	Moderate to low for 8-10 years while rehabilitation vegetation is established and then very low.	No change.
Surface of Lake Cowal	Moderate for 8-10 years while rehabilitation vegetation is established and then low.	No change.
Major Landforms		
– Billys Lookout	Very low due to distance and lookout not routinely accessed by or available to the public.	No change.
– Wamboyne Mountain	Low due to distance and not routinely accessed by or available to the public.	No change.

* Source: EDAW (1997)

The modified CGM would not change the level of visual modification described in the EIS for each of the viewpoints listed in Table 4. In addition to the viewpoints in Table 4, views of the original CGM from the Game Reserve¹ would potentially be available, although those views would be restricted by intervening screening vegetation (particularly along the south-western fringe of Lake Cowal) and flat topography. This would not change as a result of the modified CGM. Further, the proposed modification would not change the number of public viewpoints assessed in the EIS.

For the modified CGM, the heights of the northern and southern waste emplacements (RL 253 m AHD and RL 238 m AHD, respectively) would remain below the elevation of Wamboyne Mountain (RL 412 m AHD) to the north of the CGM and below the elevation of the highest section of the prominent ridgeline immediately to the west of the CGM, which peaks at Billy's Lookout (RL 368 m AHD) to the south-west of the site.

Progressive restoration of the waste emplacements, as outlined in the EIS, would assist in the amelioration of visual impacts. That is, the level of visual impact would progressively reduce once vegetation cover begins to establish on the rehabilitated waste emplacements.

The proposed modification would vary the effects of existing night-lighting (i.e. visible from additional locations due to increased elevations of some light sources) over the life of the modified CGM. The nature of the night-lighting for the modified CGM would be of a similar intensity when compared to the existing night-lighting at the CGM. However, there is potential for the fixed lights to be visible from a wider area surrounding the ML due to the increased elevations of portions of the waste emplacements. Given the lighting strategies/control measures to minimise night-lighting impacts (refer below), the potential impact resulting from the increased elevations of portions of the waste emplacements would be minimal.

The potential change in visual impact resulting from the proposed modification would result in a minimal environmental impact.

¹ The Game Reserve was relocated as a requirement of the original CGM Development Consent. Its current location and views of the project were not assessed in the EIS.

Mitigation Measures and Management

The mitigation and management measures that have been implemented for the maintenance of visual amenity for the CGM are presented in the Landscape Management Plan (LSMP) (Barrick, 2003f). The LSMP includes lighting strategies/control measures to minimise night-lighting impacts (e.g. plan lighting layout to avoid potential for direct views of lights from the public road - i.e. direct lights inward towards the centre of the ML where practicable). The LSMP would be continued for the modified CGM.

Earth mounds have been constructed on sections of the western and northern boundaries of ML 1535 to break up continuous views from Lake Cowal Road. These earth mounds as well as vegetation screen areas surrounding the ML (including along Lake Cowal Road) have been planted with endemic plants that are compatible with the existing surrounding vegetation. Maintenance of the vegetation screens (e.g. addition and replacement of plants where required) would continue to be undertaken in these areas. An increase in screening effect over time as plants grow would continue as a result.

6.3 GROUNDWATER

Environmental Review

Hydrogeological assessments (i.e. EIS and subsequent assessments) have characterised that groundwater resources within the region are generally associated with two geological formations (Coffey Geotechnics Pty Ltd, 2008):

- the Lachlan Formation (Bland Creek Palaeochannel), which comprises an aquifer of quartz gravel with groundwater of generally low salinity; and
- the Cowra Formation, which comprises aquifers of isolated sand and gravel lenses in predominantly silt and clay alluvial deposits, with perched groundwater of generally high salinity.

Bland Creek Palaeochannel Borefield

The modified CGM would not change the original CGM limits on the extraction of water from the CGM Bland Creek Palaeochannel Borefield, or the approved CGM system for managing groundwater levels around the CGM Bland Creek Palaeochannel Borefield. Therefore, potential impacts from CGM Bland Creek Palaeochannel Borefield groundwater extraction are not considered in this section.

Groundwater Inflows to the Open Pit and Open Pit Dewatering

EIS modelling by Coffey Partners International indicated yields from open pit dewatering of 10 ML/day for the first three months with progressive decline over the subsequent 12 to 18 months to about 5 ML/day (North Limited, 1998).

Actual dewatering rates are significantly less than the EIS predictions. The average daily rate of water recovered from the open pit (via in-pit sumps) is approximated at 0.4 ML/day (Coffey Geotechnics Pty Ltd, 2008).

Current operations utilise 19 dewatering bores located on the periphery and within the approved CGM open pit (Coffey Geotechnics Pty Ltd, 2008). Each bore is screened in the local saline alluvial and fractured rock aquifers. In addition, in-pit horizontal drains have been installed on benches to drain areas where groundwater level monitoring had indicated that enhancement of dewatering was required to promote pit slope stability.

Barrick records of dewatering volumes for August 2005 to February 2008 indicate fairly consistent results from approximately August 2005. The average daily extraction rate for the open pit dewatering bores is approximately 0.6 ML/day (Coffey Geotechnics Pty Ltd, 2008).

Given that there would be no change to the currently approved open pit area or final pit dimensions as a result of the proposed modification, the location and number of bores within the open pit dewatering borefield (i.e. bores located on the periphery and within the approved CGM open pit) would not change (note: even for the increased open pit area resulting from the February 2009 Modification, the dewatering volumes from the open pit were expected to be similar in range to the dewatering volumes recorded between August 2005 and February 2008). Further, the proposed modification would not change the currently approved open pit dewatering methods. As stated above, currently predicted dewatering rates are significantly less than those predicted in the EIS.

The water source of the proposed saline groundwater supply borefield comprises the upper sands and gravels in a probable localised palaeochannel to the south-east of the approved CGM open pit. Given the prevailing ground slope and the sources of inflow at the open pit, drawdown from the pumping bores is not likely to significantly influence currently predicted inflow rates to the open pit (Coffey Geotechnics Pty Ltd, 2008).

Measured Groundwater Level Drawdown

The EIS included an assessment of potential regional effects of drawdown from open pit dewatering on groundwater users outside ML 1535. This assessment was based on the EIS rates of dewatering that are significantly higher than both the current and expected rates. Coffey Partners International (1995) conducted modelling to determine the dewatering requirements and calculated the drawdown created in the shallow and deeper alluvium and fractured bedrock aquifers. The modelling results indicated that after several years of continuous pumping predicted drawdowns at potentially sensitive locations 10 km to the east would be less than 1 m in the shallow saline alluvium aquifers and 3 m in the fractured rock saline aquifer (North Limited, 1998).

The groundwater monitoring programme for the approved CGM is described in the SWGMBMP. Bores located further than 700 m from the open pit have generally displayed only minor standing water level changes (i.e. less than 20 centimetres [cm]) over the period July 2004 to December 2007. These variations are typical of natural effects and a muted response to rainfall trends (Coffey Geotechnics Pty Ltd, 2008). Based on the above and similar records from other bores further from the open pit, it would appear that there has not been any regional impact to date from open pit dewatering (*ibid.*).

The Lachlan Formation (Bland Creek Palaeochannel) is a substantial regional aquifer containing water of good quality which is widely used for irrigation (Coffey Geotechnics Pty Ltd, 2008). This aquifer occurs some 10 km east of the approved CGM and is hydraulically well separated from the open pit dewatering borefield and proposed saline groundwater supply borefield (*ibid.*). Further, Groundwater Consulting Services (GCS) reported that no groundwater users have been identified that may be affected by the use of the saline groundwater supply borefield for modified CGM (GCS, 2008).

Hydrogeology Beneath the Tailings Storage Facilities

There would be no change to the volume of tailings or height or location of the tailings storage facilities as a result of the modified CGM and therefore no change to the potential impacts on hydrogeology beneath the tailings storage facilities described in the EIS for the original CGM.

Groundwater Quality

An assessment undertaken for the EIS by Coffey Partners International (1997) reported the following pre-mining groundwater salinity levels:

- Alluvial aquifers had very high salinity in the range of 19,000 to 72,000 $\mu\text{S}/\text{cm}$ measured beneath the open pit and 6,000 $\mu\text{S}/\text{cm}$ to 44,400 $\mu\text{S}/\text{cm}$ beneath the tailings storage facilities area.
- In the fractured rock aquifer, the salinity ranged from 50,900 $\mu\text{S}/\text{cm}$ to 63,700 $\mu\text{S}/\text{cm}$.

Groundwater quality monitoring results reported in 2006 are consistent with the above and indicate that (Coffey Geotechnics Pty Ltd, 2008):

- Groundwater facies within ML 1535 are characterised by saline conditions (total dissolved solids [TDS] vary from 18,000 to 47,000 mg/L attributed to heterogeneous aquifer material, geochemistry and depth in the profile).
- Electrical conductivities are within a similar range to those observed pre-mining.
- Groundwater generally has a slightly alkaline to weakly acid pH range (6.0 to 7.5).

Whilst open pit dewatering is causing a localised reduction in groundwater levels, no changes in groundwater chemistry appear to be associated with this drawdown (Coffey Geotechnics Pty Ltd, 2008). The chemical groundwater data collected shows little variation for each bore and analysis has demonstrated good chemical correlation between data from the pre-mining and operational phases of the approved CGM (*ibid.*).

On the basis of information available, there is no evidence to suggest that the natural groundwater chemistry would alter significantly as a result of the proposed modification compared with the prediction described in the EIS for the original CGM.

Hydraulic Relationship between Lake Cowl and Groundwater

The proposed modification would not increase the area or dimensions of the final void and would not change the depth of the relatively impermeable clay that separates the Lake Cowl bed from the saline aquifer system.

Piezometric response in the saline alluvial aquifers has been small and localised, consistent with low vertical and horizontal permeability, and inflows to the open pit have been small compared with the inflows predicted in the EIS.

On this basis, the open pit and Lake Cowl would remain disconnected as described in the EIS for the original CGM.

Potential Effects of Mine Closure on Lake Cowl

The EIS assessed the potential for seepage from Lake Cowl to the final void as a result of open pit dewatering and the resultant potential for Lake Cowl water balance changes and final void balance characteristics. Modelling conducted by Kalf and Associates (1997) for the EIS indicated that seepage from Lake Cowl to the final void would be an insignificant component of overall seepage because of the very low permeability of the clay pan deposits that form the lake bed and isolate Lake Cowl from the underlying aquifers. Lake Cowl has not filled during the period that the approved CGM has been operational.

Kalf and Associates (1997) determined that once dewatering and open pit excavation commenced, the open pit would become a groundwater sink. Based on the results of Coffey Partners International (1995), Kalf and Associates (1997) presented groundwater flow directions towards the open pit. These flow directions were described to be fundamentally maintained during and post-mining, although the gradients and flow rates would decrease over time (*ibid.*).

At the completion of mining (and hence dewatering), the final void was described to be a permanent sink to local groundwater (Kalf and Associates, 1997) and would gradually fill with water from incident rainfall, runoff from adjacent mine areas and seepage from the intercepted aquifers. These flow directions would be fundamentally maintained during and post-mining, as the water level in the open pit recovered and reached an equilibrium level lower than the current potentiometric surface level at the open pit (Coffey Partners International, 1997). Mining has and would continue to create a sink for surrounding groundwater which flows toward the final void created by the mine.

The proposed modification would not increase the area or dimensions of the final void and would not change the above predictions.

Mitigation Measures and Management

Existing management measures for CGM groundwater quality and quantity are documented in the SWMP (Barrick, 2003b). The SWMP would be updated to include water extraction from saline groundwater supply bores (and associated management and monitoring).

The groundwater monitoring programme is described in the SWGMBMP. The groundwater monitoring component of the SWGMBMP would continue for the modified CGM.

6.4 SURFACE WATER

Environmental Review

Potential impacts associated with the modified CGM on surface water features are:

- localised surface water contamination in the unlikely event of a saline groundwater supply borefield pipeline leak; and
- surface water contamination due to exposure of saline materials during placement of waste materials.

Saline Groundwater Supply Borefield

Section 5 describes the proposed saline groundwater supply borefield.

The potential surface water impacts associated with this borefield would be limited to impacts associated with pipeline failure and leakage of saline water (Gilbert and Associates, 2008).

As described in Section 5, the saline groundwater supply borefield would be operated when it is not inundated by Lake Cowal. There would be no potential for saline water leakage to Lake Cowal and, therefore, no potential for surface water quality impacts to lake water quality (Gilbert and Associates, 2008).

Risks to the public, environment and public property associated with the borefield are discussed in Section 6.13.

The potential groundwater impacts associated with extraction from the saline groundwater supply borefield are assessed in Section 6.3.

Up-catchment Diversion System

Section 5 describes the UCDS.

A small component of the UCDS would be re-aligned around the modified northern waste emplacement. This would include the re-alignment of a small section of the existing low-flow channel and bund (Figure 2).

Internal Catchment Drainage System

The proposed modification would include minor changes to the internal catchment divide around the modified northern waste emplacement area.

Lake Interaction

As part of the original CGM, a model of Lake Cowal and its catchment was used to investigate the potential effects that the mine would have on the water balance dynamics of Lake Cowal, including changes to average water levels in the Lake and changes to the frequency and volume of spills from Lake Cowal to Nerang Cowal downstream.

The mine area is physically isolated from Lake Cowal by the lake isolation system. The outer face of the isolation system extends approximately 1 km into Lake Cowal and will form a new lake foreshore.

The modified CGM would not change the lake isolation system (which was constructed during the approved CGM construction phase). Therefore, the predictions made regarding changes to lake volume and the potential effects on runoff water quality for the original CGM remain the same.

Implications of Geochemical Characteristics of Waste Rock on Surface Water Quality

As described in Section 5, the proposed modification would increase the area of the currently approved northern waste emplacement (Figure 2).

However, the currently approved amount of waste rock to be mined would not increase. Accordingly, no modifications to the operational or long-term mine waste management or water management practices specifically relevant to waste rock geochemistry (e.g. construction of the waste emplacement base drainage controls described in Section 5) would be required as a result of the modified CGM.

Implications of the INCO Process on Tailings Geochemistry

As described in Section 5, the proposed modification would include addition of a cyanide destruction method (i.e. the INCO process) as an alternative to Caro's Acid, whilst maintaining the same, originally approved cyanide concentrations.

The geochemistry of the tailings resulting from the use of the INCO process was assessed by Geo-Environmental Management Pty Ltd (2008) for the E42 Modification EA. Given the INCO process for the proposed modification is the same as that proposed for the E42 Modification, the assessment undertaken by Geo-Environmental Management Pty Ltd (2008) is applicable to the proposed modification. With respect to the use of the INCO process at the CGM, Geo-Environmental Management Pty Ltd (2008) concluded that the process:

...is expected to result in comparable concentrations of sodium and sulphate in the tailings supernatant. These comparable concentrations are attributed to the relatively small quantity of SMBS required to reduce total CN in the tailings to the approved concentrations or below, and the dilution of the treated tailings with tailings from the primary ore flotation circuit.

Post-Closure Water Management

The post-closure water management strategy described for the original CGM (North Limited, 1998) included concepts for runoff minimisation from waste rock emplacements and tailings storage facilities, and the provision of stable drainage channels to drain site surface water to the final void. These concepts would remain for the modified CGM.

Mitigation Measures and Management

Existing surface water management and mitigation measures for the CGM are described in the SWMP. As described in Section 6.3, the SWMP would be updated to include water extraction from saline groundwater supply bores (and associated management and monitoring).

The surface water monitoring programme is described in the SWGMBMP. The surface water monitoring component of the SWGMBMP would be continued for the modified CGM.

6.5 AIR QUALITY

Environmental Review

Dust Deposition and Suspended Particulates

The EIS predicted dust deposition and total suspended particulates (TSP) generated by mining activities at sensitive receptors in the vicinity of the mine.

The EIS air quality assessment was prepared and guided by the relevant criteria at the time, which included:

- The DECC assessment criterion for maximum increase in deposited dust level of 2 grams per square metre per month ($\text{g/m}^2/\text{month}$) and maximum total deposited dust level of 4 $\text{g/m}^2/\text{month}$.
- National Health and Medical Research Council of Australia [NHMRC] guideline maximum permissible TSP criterion of 90 micrograms per cubic metre ($\mu\text{g/m}^3$).
- DECC mean annual particulate matter less than 10 microns in size (PM_{10}) concentration objective of 30 $\mu\text{g/m}^3$ in residential environments.

The EIS assessment predicted compliance with the dust deposition criterion at all non-company owned residences, although noted that some areas of land may receive minor and temporary exceedences. With regard to the TSP criterion and objective, the EIS assessment predicted compliance at all non-company owned residences, although noted that some areas of land may on occasions exceed the NHMRC criterion.

A contemporary assessment of the CGM would be required to be undertaken in accordance with the current DECC air quality criteria. Assessment of the modified CGM has therefore been undertaken in accordance with the contemporary criteria, standards and goals:

- DECC assessment criterion for maximum increase in deposited dust level of 2 $\text{g/m}^2/\text{month}$ and maximum total deposited dust level of 4 $\text{g/m}^2/\text{month}$.
- The National Environment Protection Measure (NEPM) 24-hour reporting standard for PM_{10} of 50 $\mu\text{g/m}^3$ adopted by the DECC as assessment criterion (interpreted as the PM_{10} concentrations due to the project only).

- The DECC annual assessment criterion for PM₁₀ of 30 µg/m³ has been interpreted as a concentration that should be met within the region (interpreted as the PM₁₀ concentrations due to the project and background).
- The NHMRC annual goal for TSP of 90 µg/m³, adopted by the DECC as assessment criterion (interpreted as the TSP concentrations due to the project and background air quality).

Air quality monitoring has been carried out at nearby locations on a regular basis since the commencement of CGM construction, in accordance with the Dust Management Plan (DMP) (Barrick, 2003g) and is reported in the CGM Annual Environmental Management Reports (AEMR) (Barrick, 2005c, 2006b, 2007a, 2008a, 2009).

The monitoring results show that the area generally experiences, on average, dust deposition levels below the DECC total dust deposition (i.e. including background air quality) amenity criterion of 4 g/m²/month (temporal and spatial variation in monthly dust deposition has been large, as is generally the case in dust monitoring results [University of Sydney, 2008]).

Measured annual average TSP concentrations have been below the DECC assessment criterion of 90 µg/m³ for all four years (i.e. between 24 and 43 µg/m³), which is consistent with the EIS which predicted that annual average concentrations of TSP would remain well below 90 µg/m³ at all non-company owned residences (North Limited, 1998).

The monitoring shows that the 24-hour average PM₁₀ concentrations (inferred from the TSP concentrations) have been above the DECC's assessment criterion of 50 µg/m³ on approximately seven days in the past four years. The highest PM₁₀ concentration to date was approximately 151 µg/m³, on 12 January 2008. Based on the mine location relative to the monitor, the mine is unlikely to have contributed to the exceedance on this day (Holmes Air Sciences, 2008).

The modified CGM does not involve any additional mobile equipment by comparison with the typical mobile equipment fleet currently in use. Similarly, fixed plant would remain unaltered by the modified CGM. While the modified CGM involves an increase of 10 to 15 m of the final height of some areas of the northern and southern waste emplacements, there would be no increase to the original CGM maximum quantity of waste rock or ore to be mined in any one year. Therefore, existing mine emissions are unlikely to significantly change and would remain relatively unaltered by the modified CGM at the nearest sensitive receptors.

Existing dust and TSP emissions would be unlikely to significantly change and the proposed changes for the modified CGM would therefore have minimal air quality impact potential.

Mitigation Measures and Management

The mitigation and management measures for wind blown and mine generated dust at the CGM are presented in the DMP. The mitigation and management measures (including the air quality monitoring programme) described in the DMP would continue to be implemented for the modified CGM.

6.5.1 Greenhouse Gas Emissions

Environmental Review

The major sources of greenhouse gas emissions at the CGM include (Barrick, pers. comm., 16 June 2009):

- combustion of diesel during mining operations (Scope 1);
- use of explosives (Scope 1);
- combustion of LPG (Scope 1); and
- off-site generation of electricity consumed at the CGM (Scope 2).

The total CGM Scopes 1, 2 and 3 emissions for 2008 were 58,770 t carbon dioxide equivalent (CO₂-e), 212,575 t CO₂-e and 47,560 t CO₂-e, respectively (Barrick, pers. comm., 16 June 2009). The proposed modification would not significantly change current annual greenhouse gas emissions.

Mitigation Measures

Barrick is currently implementing a number of measures to minimise to the greatest extent practicable greenhouse gas emissions from the CGM. Relevant measures are described below.

- Maximising energy efficiency as a key consideration in the development of the mine plan. For example, significant savings of greenhouse gas emissions (through increased energy efficiency) are achieved by mine planning decisions which minimise haul distances for ore and waste rock transport and therefore fuel use.
- Formation of an Energy Management Committee to manage the identification and implementation of energy efficiency improvements and to increase awareness of energy efficiency at the CGM.
- Preparation of a site-wide energy balance/audit to identify potential energy efficiency opportunities.
- Pre-oxidation in the leach circuit of the processing plant to reduce the amount of oxygen (and therefore heavy vehicle deliveries) required.
- Automation of pumps (i.e. auto shut-off) to minimise pump operation time and therefore reduce energy consumption.
- Installation of solar sensors on external lights to minimise light operation time and therefore reduce energy consumption.

In addition to the above, Barrick prepares internal monthly energy consumption reports.

6.6 LAND RESOURCES

Environmental Review

The proposed modification has the potential to alter:

- topography and landscape features;
- soils and erosion potential;
- soil properties due to contamination through the leakage from water pipelines carrying saline water and other potential contamination sources; and
- the level of bushfire hazard.

These potential impacts are described below.

Topography and Landscape Features

The main modifications to the existing topography that would result from the proposed modification would comprise:

- increasing the height of some areas of the northern and southern waste emplacements;
- increasing the area of the northern waste emplacement; and
- other minor landform alterations associated with construction of erosion and sediment control measures.

Potential visual impacts associated with changes in topography are identified in Section 6.2.

Soils and Erosion Potential

The potential soil and erosion-related impacts identified in the EIS that would be relevant to the modified CGM include:

- loss of *in-situ* soil resources from beneath mine landforms (i.e. material not stripped);
- alteration of physical and chemical soil properties during stripping and stockpiling operations;
- reduced soil quality (structure, fertility and microbial activity) of long-term stockpiles;
- contamination of soil with saline water, process reagents and chemicals;
- erosion of soil from the outer batters of waste emplacements and areas in which vegetation has been cleared or where water is concentrated;
- instability of earthen containment structures due to inherent dispersive characteristics of CGM area soils;
- erosion of stockpiled soil;
- soil erosion and sediment movement during construction of the saline groundwater supply borefield pipeline to the process water dam; and
- increased erosion rates due to the exposure of dispersive soils.

Land Contamination

Section 6.13 summarises the results of the hazard and risk assessments conducted for the modified CGM, and identifies sources of potential risk to the environment. The primary potential land contamination risk has been identified as rupture or leakages from the saline groundwater supply borefield pipeline.

Leakage of saline water (prior to automatic shut-down) into a dry Lake Cowal would increase the salinity of the soil in the local area surrounding the pipeline rupture in the unlikely event this occurs. This localised increase in soil salinity would be minimal (given the leak detection and automatic shut-down mechanisms inherent in the design of the system) and would be cleaned up quickly by the removal of affected material for disposal within the waste emplacement(s).

When Lake Cowal contains sufficient water to inundate the borefield, its operation would cease, thereby removing the potential for saline water leakage.

Bushfire Hazard

Bushfire hazard within ML 1535 is generally considered to be low due to the extensive areas of cleared grazing land and low fuel loads that occur (Barrick, 2003h). The degree of potential impact would vary with climatic conditions (e.g. temperature and wind) and the quantity of available fuel (e.g. grasses and native vegetation).

Mitigation Measures and Management

Potential impacts to land resources are currently managed via implementation of measures included in the following:

- ESCMP;
- BMP;
- LMP;
- Emergency Response Plan (ERP); and
- HWCMP.

These measures would continue to be implemented where relevant for the modified CGM.

Land Contamination – Saline Groundwater Supply Borefield

The SWMP would be revised to include changes to water management required for the modified CGM, including mitigation measures for the saline groundwater supply borefield, viz.:

- installation of a containment drain for the saline groundwater supply borefield pipeline; and
- leak detection mechanisms including automatic shutdown capability.

In the unlikely event of pipeline failure and leakage of saline water, the spill would be controlled, contained and cleaned-up in accordance with the spill response procedures described in the HWCMP.

6.7 FLORA

Background

The landscape surrounding the ML area is predominantly used for agriculture (*viz.* broad-acre cropping and grazing over relatively large landholdings). The modification area is semi-cleared former farmland that was used for grazing of predominantly native pastures by livestock and/or opportunistic cropping on the floor of Lake Cowal.

As shown on Figure 1, the east of the ML includes some Lake Cowal lakebed. Historically throughout its drying cycle, Lake Cowal has been subject to livestock grazing and, in some areas, broad-acre cropping.

Numerous vegetation studies have been undertaken in the ML area and surrounds (Anne Clements and Associates, 1995; Charles Sturt University, 1997; Bower, 1997, 1998a, 1998b, 2003; Barrick, 2003i).

The most recent and relevant flora survey was conducted for the E42 Modification EA by FloraSearch (2008). The survey focused on the proposed disturbance area for the E42 Modification (*i.e.* a much larger area, which includes the proposed additional disturbance area associated with the proposed modification).

Environmental Review

The EIS (North Limited, 1998) and Cowal Gold Project Species Impact Statement (SIS) (Resource Strategies, *et. al.*, 1997) assessed the short-term and long-term potential impacts of the original CGM on flora. The approved CGM has been subject to additional flora assessments for relevant modifications to the original CGM.

The types of potential impacts on flora resulting from the proposed modification would be a subset of the same types of potential impacts identified in the EIS (North Limited, 1998) and SIS (Resource Strategies, *et. al.*, 1997).

The modification would result in a small increase in land clearance to facilitate the modified northern waste emplacement, two soil stockpiles, re-alignment of a small portion of the UCDS and the saline groundwater supply borefield (Figure 2).

The assessment presented below utilises information from the numerous vegetation surveys and targeted searches undertaken in the ML area and surrounds between 1995 and 2008, as well as the recent flora survey and assessment conducted by FloraSearch (2008). The FloraSearch (2008) survey included targeted searches for threatened flora species and ecological communities considered possible occurrences in the ML area and listed under the schedules of the *Threatened Species Conservation Act, 1995* (TSC Act) or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

The proposed modification area is characterised by Secondary Native Grassland with scattered Wilga (*Geijera parviflora*), Rosewood (*Alectryon oleifolius*) and Belah (*Casuarina cristata*) and Swamp Canegrass Grassland (FloraSearch, 2008).

Western Research Institute (2008) described the Secondary Native Grassland with scattered Wilga, Rosewood and Belah as a human-made landscape created through extensive clearing and a range of agricultural practices (with grazing being the dominant practice). Hence, this area is now dominated by native grasses with scattered remnant trees (FloraSearch, 2008). Past management and grazing have eliminated the former midstorey which would have featured a high diversity of native shrubs in the undisturbed condition (*ibid.*). The health of the remnant trees is generally good despite some limb dieback due to past stress (*ibid.*). However, the trees are becoming overmature and regeneration is absent (*ibid.*). Overall, the floristic condition of the Secondary Native Grassland with scattered Wilga, Rosewood and Belah within ML 1535 is considered to be poor (*ibid.*).

The Swamp Canegrass Grassland occurs within the lakebed, the condition of which would vary with the flooding cycle of the Lake (FloraSearch, 2008). Trees are absent from this area (*ibid.*). Further, this area has been previously cleared for livestock grazing and, in some areas, cropping (*ibid.*).

Vegetation Clearance

Clearing native vegetation is a key threatening process listed under the TSC Act and the EPBC Act.

The modification would result in clearance of approximately 40 ha of pre-cleared agricultural land which supports grazing pastures. This equates to an increase of less than 5% to the total disturbance area described in the EIS for the original CGM (Figure 2). This 40 ha disturbance is considered to be minor in the context of the Lachlan River Valley catchment, which has an area of some 84,700 square kilometres (km²) and where the main landuse is agricultural production.

The additional land clearance is comprised of (Figure 3):

- approximately 30 ha of Secondary Native Grassland with Scattered Wilga, Rosewood and Belah, associated with the increase to the northern waste emplacement, two small soil stockpiles and re-alignment of a small portion of the UCDS; and
- approximately 10 ha of Swamp Canegrass Grassland, associated with the saline groundwater supply borefield.

As described above, the Secondary Native Grassland with Scattered Wilga, Rosewood and Belah within the modification area has been subject to nearly complete land clearing as a result of previous pastoral landuse, resulting in a secondary grassland with scattered trees (Figure 3). This area has also been described by Western Research Institute (2008) as a human-made landscape created through extensive clearing and a range of agricultural practices (with grazing being the dominant practice).

Also as described above, the Swamp Canegrass Grassland vegetation within the lakebed has been subject to livestock grazing and, in some areas, cropping (FloraSearch, 2008). Trees are absent from this vegetation community (*ibid.*).

Given the above, in particular the previous clearing for livestock grazing and, in some areas, cropping, the additional land clearance associated with modification would result in minimal environmental impact to flora.

Notwithstanding that the modification would result in minimal environmental impact to flora, in undertaking the works associated with the installation of the pipeline Barrick would:

- minimise disturbance to soil and vegetation (i.e. no native trees would be removed for the saline groundwater supply borefield given that trees are absent from this area; further, this area has been previously cleared for livestock grazing and, in some areas, cropping);
- maintain existing/natural hydraulic, hydrologic, geomorphic and ecological functions of Lake Cowal; and
- rehabilitate disturbed areas post installation as appropriate.

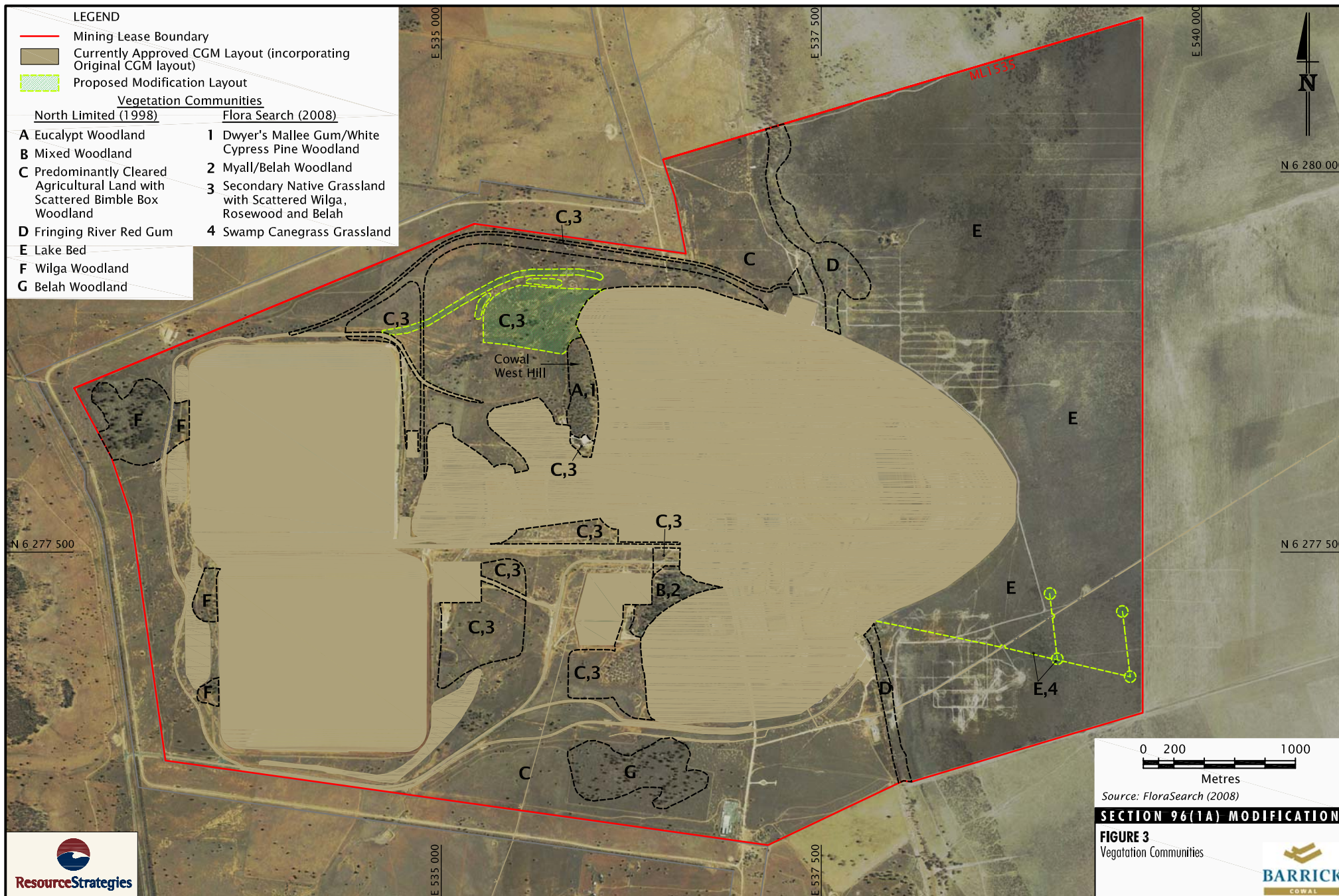
Threatened Flora Species and Ecological Communities

No threatened flora species or listed populations have been recorded in the proposed modification area, despite targeted surveys (FloraSearch, 2008).

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River Endangered Ecological Community (Lachlan River Catchment EEC) is listed under the FM Act and includes Lake Cowal in the listing (DPI Threatened Species Unit, 2006).

Attachment B assesses the proposed modification on relevant threatened flora species, populations and ecological communities, and their habitats in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (NSW Department of Environment and Climate Change, 2007) and *Threatened Species Assessment Guidelines: The Assessment of Significance* (NSW Department of Primary Industries, 2008).

Attachment B concludes that the proposed modification would not be likely to cause a significant effect on any threatened flora species, populations or ecological communities, or their habitats.



Introduced Flora Species

Native vegetation disturbance can act as a catalyst for weed incursion and, if management initiatives are not implemented, proliferation of weeds can occur. The potential weed incursion as a result of the proposed modification would be minimal, given the existing weed control measures outlined in the LMP which would continue to be implemented and the size of the area to be disturbed (i.e. less than 5% of the total disturbance area described for the original CGM).

Introduced Fauna Species

Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*) is a key threatening process listed under the TSC Act (NSW Scientific Committee, 2002). Rabbits and other introduced animal species (e.g. the Red Fox, Feral Cat, Brown Hare, House Mouse and Sheep) have been recorded within ML 1535 (Western Research Institute, 2008). The Rabbit and other introduced animals can result in erosion problems as well as reduce recruitment and survival of native plants (FloraSearch, 2008).

The potential pest incursion as a result of the proposed modification would be minimal, given the existing pest control measures outlined in the LMP which would continue to be implemented and the size of the area to be disturbed (i.e. less than 5% of the total disturbance area described for the original CGM).

Vegetation and Dust

Given that the proposed modification would not change potential dust and suspended particulate emissions from the CGM (Section 6.5), the proposed modification would not change the potential dust impacts on vegetation.

Matters of National Environmental Significance

No threatened flora species or ecological communities listed under the EPBC Act have been recorded in the proposed modification area, despite targeted surveys (FloraSearch, 2008).

FloraSearch undertook an assessment of the potential impact of the CGM as modified by the E42 Modification on matters of national environmental significance relevant to flora (FloraSearch, 2008). Based on this assessment and a review of the matters of national environmental significance since listed under the EPBC Act, no matters of national environmental significance relevant to flora are likely to be significantly impacted as a result of the proposed modification.

Summary of Potential Impacts on Flora

Given the above and the measures included in relevant management plans (refer below) which would continue to be implemented for the modified CGM, the proposed modification would result in minimal environmental impact on flora.

Mitigation Measures and Management

Potential impacts to flora are currently managed via implementation of measures included in the following:

- FFMP (Barrick, 2003i) which includes the Vegetation Clearance Protocol (VCP);
- Implementation of the Threatened Species Management Protocol (TSMP) (Barrick, 2003j);
- Compensatory Wetland Management Plan (CWMP) (Barrick, 2003k);
- LMP;
- LSMP;

- Bushfire Management Plan (BMP);
- DMP; and
- MOP (2007 – 2009) (Barrick, 2007b).

These measures would continue to be implemented where relevant for the modified CGM.

Proposed Modification Offset

Despite the minimal impact to flora resources as a result of the proposed modification, Barrick would implement an offset, which would lead to a gain in the biodiversity values of the region in the medium to long term and complement the mitigation measures described above and the rehabilitation of the proposed modification area.

The offset area would be located on land owned by Barrick to the south of ML 1535 (Figure 4). It is proposed that the offset area would comprise approximately 40 ha of cleared agricultural land. The proposal to revegetate this cleared area with woodland vegetation provides the opportunity to increase existing remnant patch sizes.

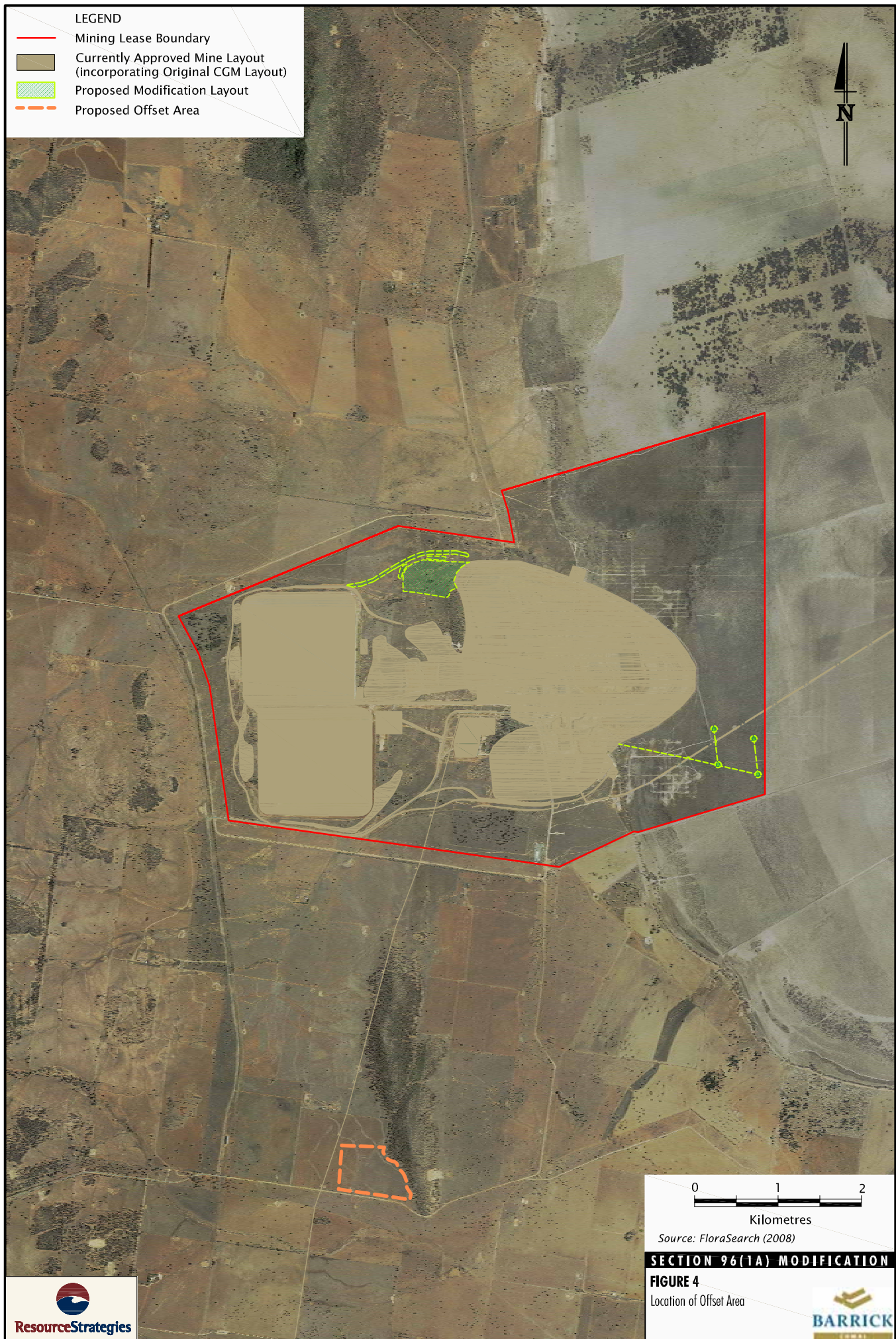
Offset Management

The conservation of the offset area would be secured through rezoning and/or re-conditioning of the relevant landholding to reflect conservation purposes. The rezoning and/or re-conditioning would be undertaken in consultation with the Bland Shire Council. The rezoning and/or re-conditioning of relevant landholdings would be undertaken within three years of the Development Consent being modified or a time period to the satisfaction of the Director-General of the DoP.

In addition, the offset would be managed to enhance existing native vegetation within the offset. The following management measures relevant to flora would be implemented:

- revegetation planting;
- exclusion of grazing to facilitate the regeneration of native vegetation;
- weed and pest management;
- soil erosion remediation;
- selective use of native plant fertilizer;
- signage of the vegetation offset areas; and
- monitoring the performance of the offset by suitably qualified person(s).

The proposed offset area is considered suitable for offsetting the potential residual impacts associated with the proposed modification (after the mitigation measures described above and rehabilitation), given the anticipated improvement in the flora values of the land within the offset area in the medium to long-term.



6.8 FAUNA

Background

The local setting of the approved CGM is described in Section 6.7.

A significant number of vertebrate fauna surveys and studies have been conducted between 1977 and 2008 which are applicable to the CGM area and surrounds, including:

- historic surveys (Vestjens, 1977; Braithwaite *et al.* 1985a, 1985b, 1986a, 1986b; Kingsford *et al.* 1989, 1990, 1991; Lawler, 1989 and Goldney and Bowie, 1990);
- fauna surveys and assessments conducted for the EIS and the SIS (Lane, 1989, 1990, 1991a, 1991b, 1991c; Gunninah Consultants, 1995; Fisheries Research Institute, 1997; Greg Richards and Associates, 1997a, 1997b; Mount King Ecological Surveys, 1997);
- bird breeding monitoring (Lane, 1989, 1990, 1991a, 1991b, 1991c; Crome, 1995; Environmental and Educational Services, 1992-2000; Gell and Peake, 2001; Gell, 2002-2005, 2007, 2008; Peake, 2006);
- fauna surveys and assessments conducted for the TSMP (Barrick, 2003i, 2003j; Country Energy, 2004);
- fauna species recorded within ML 1535 from January 2005 to February 2008 (Donato and Rowntree, 2006; Donato, 2007; Donato and Smith, 2008; Barrick, 2005d-zi, 2005zii, 2005ziii, 2005ziv, 2005zv; 2006c-e; 2007c-f; 2008b, 2008c); and
- a recent vertebrate fauna assessment of the Lachlan Catchment (Goldney *et al.*, 2008).

The most recent and relevant fauna survey was conducted for the E42 Modification EA by Western Research Institute (2008). The survey focused on the proposed disturbance area for the E42 Modification (i.e. a much larger area, which includes the proposed additional disturbance area associated with the proposed modification).

Environmental Review

The EIS (North Limited, 1998) and Cowal Gold Project SIS (Resource Strategies, *et. al.*, 1997) assessed the short-term and long-term potential impacts of the original CGM on fauna. The approved CGM has been subject to additional fauna assessments for relevant modifications to the original CGM.

The types of potential impacts on fauna resulting from the proposed modification would be a subset of the same types potential impacts identified in the EIS (North Limited, 1998) and SIS (Resource Strategies, *et. al.*, 1997).

The modification would result in a small increase in land clearance to facilitate the modified northern waste emplacement, two soil stockpiles, re-alignment of a small portion of the UCDS and the saline groundwater supply borefield (Figure 2).

The assessment presented below utilises information from the numerous fauna surveys and targeted searches undertaken in the ML area and surrounds between 1977 and 2008, as well as the recent fauna survey and assessment conducted by Western Research Institute (2008). The survey by Western Research Institute (2008) included targeted searches for threatened fauna species considered possible occurrences in the ML area and listed under the schedules of the TSC Act or the EPBC Act.

Habitat Removal/Modification

The following key threatening processes listed under the TSC Act are assessed below in relation to the proposed modification:

- Clearing of Native Vegetation;
- Removal of Dead Wood and Dead Trees;
- Loss of Hollow-bearing Trees; and
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

Clearing of Native Vegetation

The modification would result in clearance of approximately 40 ha of pre-cleared agricultural land which supports grazing pastures. This equates to an increase of less than 5% to the total disturbance area described in the EIS for the original CGM (Figure 2). This 40 ha disturbance is considered to be minor in the context of the Lachlan River Valley catchment, which has an area of some 84,700 km² and where the main landuse is agricultural production.

The additional land clearance is comprised of (Figure 3):

- approximately 30 ha of Cleared Land with Scattered Woodland habitat type (North Limited, 1998; Western Research Institute, 2008) associated with the increase to the northern waste emplacement, two small soil stockpiles and re-alignment of a small portion of the UCDS; and
- approximately 10 ha of Lakebed associated with the saline groundwater supply borefield.

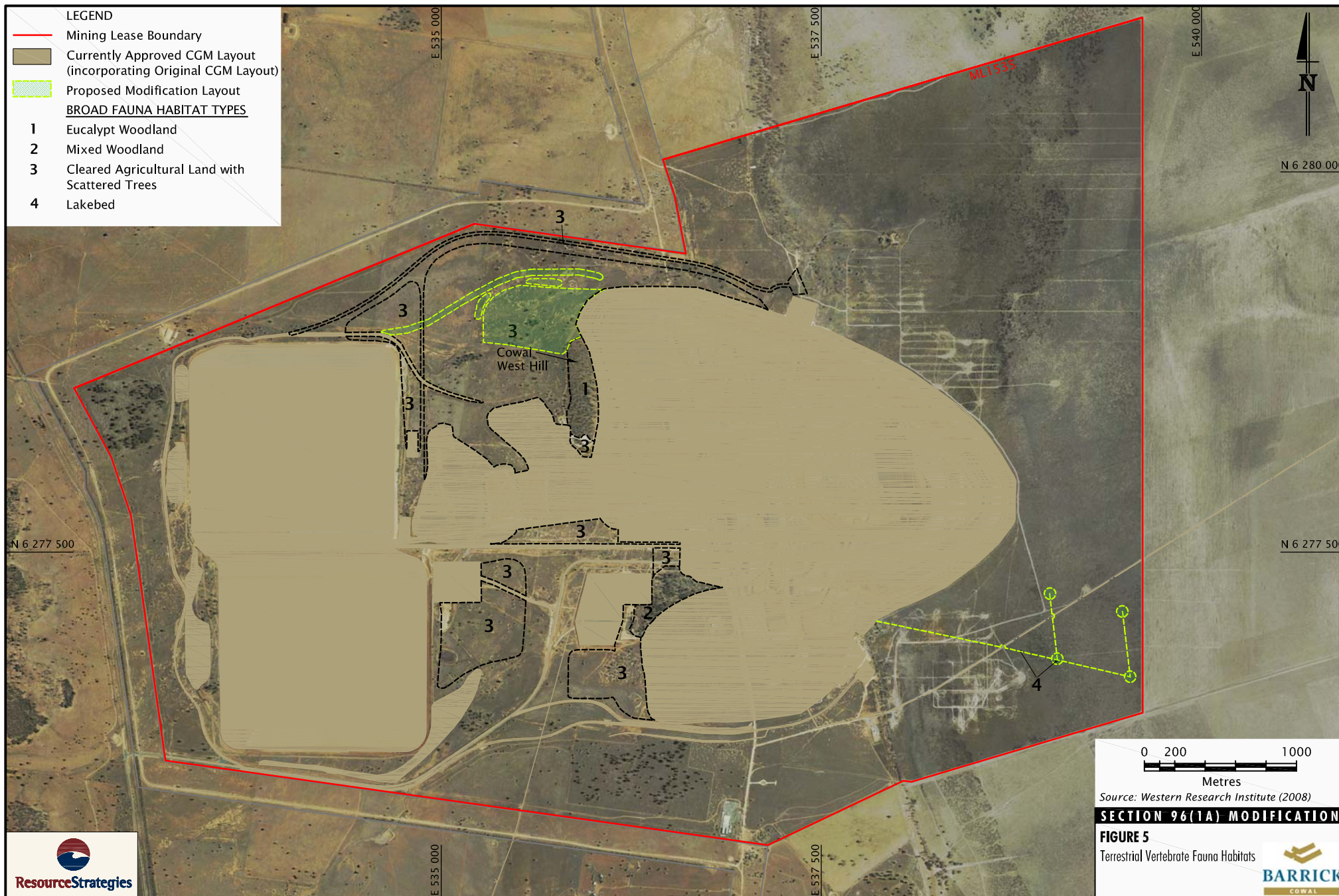
Western Research Institute (2008) described the Cleared Land with Scattered Woodland as a human-made landscape created through extensive clearing and a range of agricultural practices (with grazing being the dominant practice). The overall value of this habitat was assessed as moderate as it has been cleared for grazing, native pasture is in relatively good condition, minimum weed invasion, low to absent mid storey, scattered and clumped mature trees, with little to no regeneration, very limited amounts of fallen logs, and tree hollows in sufficient numbers to support hollow dependent fauna (Western Research Institute, 2008). However, vertebrate species diversity is likely to be relatively low in this habitat type (*ibid.*).

As previously stated, the Lakebed habitat type has been subject to livestock grazing and, in some areas, broad-acre cropping. Trees are absent from this habitat (FloraSearch, 2008)

Given the above, in particular the previous clearing for livestock grazing and, in some areas, cropping, the additional land clearance associated with modification would result in minimal environmental impact to fauna.

Notwithstanding that the modification would result in minimal environmental impact to fauna, in undertaking the works associated with the installation of the pipeline Barrick would:

- minimise disturbance to soil and vegetation (i.e. no native trees would be removed for the saline groundwater supply borefield given that trees are absent from this area; further, this area has been previously cleared for livestock grazing and, in some areas, cropping);
- maintain existing/natural hydraulic, hydrologic, geomorphic and ecological functions of Lake Cowal; and
- rehabilitate disturbed areas post installation as appropriate.



Removal of Dead Wood and Dead Trees

Dead wood and dead trees (i.e. stag trees) within the Cleared Land with Scattered Woodland habitat type would be removed as a result of the modification.

The dead wood in the modification area includes timber from previously cleared areas which has been placed in piles to create artificial reptile habitat within ML 1535. The dead wood would be placed either onto the bed of the lake within the compensatory wetland in ML 1535, consistent with the CWMP, or within the proposed offset area. The placement of the dead wood in these areas would aim to improve habitats for wildlife.

Although stag trees present in the modification area may be utilised by fauna (primarily birds and bats) the removal of these trees is likely to result in minimal environmental impact to any fauna species, given the scattered nature of the stag trees and the strategies to minimise the impact of clearing activities on resident fauna, as outlined in the FFMP.

Loss of Hollow-bearing Trees

Hollow-bearing trees with small to large hollows were recorded by Western Research Institute (2008) in the Cleared Agricultural Land with Scattered Trees habitat. Although hollow bearing trees present in the modification area may be utilised by fauna (primarily birds and bats) the removal of these trees is likely to result in minimal environmental impact to any fauna species, given the scattered nature of the stag trees and the strategies to minimise the impact of clearing activities on resident fauna, as outlined in the FFMP.

Alteration to the Natural Flow Regimes of Rivers and Streams and their Floodplains and Wetlands

As described in Section 5, the modification would involve the construction and operation of a saline groundwater supply borefield within ML 1535 to supply saline water.

The borefield pipeline would extend only partially into the Lake and would therefore not significantly alter the natural flow regime of Lake Cowal.

As stated in Section 5, in the unlikely event of pipeline failure and leakage of saline water, the spill would be controlled, contained and cleaned-up in accordance with the spill response procedures described in the HWCMP.

An ephemeral drainage line in the north of the proposed modification area would be diverted as part of a modified UCDS which comprises the re-alignment of a drainage channel conveying up-catchment water around the proposed modified northern waste emplacement, as described in Section 5. The diversion of this ephemeral drainage line is unlikely to significantly impact any fauna species given it is located within cleared agricultural land and more permanent habitat exists in the surrounding area (e.g. Bland Creek and within Lake Cowal when inundated).

Threatened Fauna Species

No populations or ecological communities listed under the TSC Act or EPBC Act have been recorded in the proposed modification area, despite targeted surveys (Western Research Institute, 2008).

The modification area provides known habitat for the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), which is a threatened bird listed as vulnerable under the TSC Act. Other threatened fauna which have the potential to utilise the habitat within the modification area are described in Attachment B.

Attachment B assesses the potential impact of the proposed modification on relevant threatened fauna species, populations and ecological communities, and their habitats in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC, 2007) and *Threatened Species Assessment Guidelines: The Assessment of Significance* (DPI–Fisheries, 2008).

Attachment B concludes that the proposed modification would not be likely to cause a significant effect on any threatened fauna species, populations or ecological communities, or their habitats.

Further, a number of measures are implemented at the approved CGM and/or have been developed in accordance with the TSMP which would avoid and/or mitigate potential impacts on threatened fauna species, viz.:

- Noise and blast management measures which aim to not create demonstrable disturbance to waterbird breeding at the northern end of the lake.
- Control of weeds to minimise the potential for weeds to degrade the species habitat.
- Pest control to minimise the potential for pests to impact this species and its habitat.
- Control of dust emissions to minimise the potential for dust to impact this species.
- Site water management to prevent the degradation of the quality of water in Lake Cowal.

These measures would be continued at the modified CGM.

Fauna and Vehicular Traffic Movements

As stated in Section 6.11, the proposed modification would not change traffic movements to and from the CGM (i.e. no new traffic sources). Therefore, the modified CGM would not increase the incidence of fauna mortality via vehicle strike.

Fauna and Noise

Given the proposed modification would not change noise emissions from the CGM (Section 6.1), the proposed modification would not change the potential noise effects on fauna.

Fauna and Blasting

Given the proposed modification would not change blasting emissions from the CGM (Section 6.1), the proposed modification would not change the potential blasting effects on fauna.

Fauna and Artificial Lighting

As discussed in Section 6.2, the nature of night-lighting for the modified CGM would be of a similar intensity when compared to the night-lighting for the original CGM. It is considered that this change to artificial lighting required for the modified CGM would result in minimal environmental impact on fauna.

Interaction of Fauna with the Tailings Storage Facilities

Given that there would be no increase in volume of ore (and therefore no change in the volume of tailings as a result of the modified CGM), there would be no change to the potential impacts associated with fauna interacting with the tailings storage facilities.

Movement of Dust to Lake Cowal

The approved CGM operates with a dust monitoring programme and a Lake Cowal monitoring programme. These programmes would continue for the modified CGM. No evidence of adverse impacts to fauna from dust has been identified to date (Barrick, 2005c, 2006b, 2007a, 2009).

Given that the proposed modification would not change potential dust and suspended particulate emissions from the CGM (Section 6.5), the proposed modification would not change the potential dust impacts on Lake Cowal.

Introduced Fauna Species

Rabbits and other introduced animal species (e.g. the Red Fox, Feral Cat, Brown Hare, House Mouse and Sheep) have been recorded within ML 1535 (Western Research Institute, 2008).

The potential pest incursion as a result of the proposed modification would be minimal, given the existing pest control measures outlined in the LMP which would continue to be implemented and the size of the area to be disturbed (i.e. less than 5% of the total disturbance area described for the original CGM).

Fauna and the Final Void

There would be no change to the final void as a result of the proposed modification. As such, the proposed modification would not change the potential impacts of the final void on fauna as described in the EIS for the original CGM.

Matters of National Environmental Significance

The following threatened fauna species listed under the EPBC Act have been recorded in the proposed modification area or close surrounds: Superb Parrot (*Polytelis swainsonii*), Australian Painted Snipe (*Rostratula benghalensis australis*) and Eastern Long-eared Bat (South-east form) (*Nyctophilus timoriensis*) (Western Research Institute, 2008). A number of migratory species listed under the EPBC Act have been recorded in the proposed modification area or close surrounds (Western Research Institute, 2008).

Western Research Institute undertook an assessment of the potential impact of the CGM as modified by the E42 Modification on matters of national environmental significance relevant to fauna, viz. threatened fauna species and migratory species listed under the EPBC Act (Western Research Institute, 2008). Based on the assessment by Western Research Institute (2008) and the matters of national environmental significance since listed under the EPBC Act, no matters of national environmental significance protected by the EPBC Act relevant to fauna are likely to be significantly impacted as a result of the proposed modification.

Other Matters Protected by the EPBC Act

Lake Cowal is listed on the Register of National Estate (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2008), due to its importance as a waterbird concentration area.

Western Research Institute undertook an assessment of the potential impact of the CGM as modified by the E42 Modification on matters protected by the EPBC Act relevant to fauna (Western Research Institute, 2008). Based on the assessment by Western Research Institute (2008) and the other matters protected by the EPBC Act since listed, no other matters protected by the EPBC Act are likely to be significantly impacted as a result of the proposed modification.

Summary of Potential Impacts on Fauna

Given the above and the measures included in relevant management plans (refer below) which would continue to be implemented for the modified CGM, the proposed modification would result in minimal environmental impact on fauna.

Mitigation Measures and Management

Potential impacts to fauna are currently managed via implementation of measures included in the following:

- FFMP, which includes the VCP;
- TSMP;
- CWMP;
- LMP;
- LSMP;
- BMP;
- DMP;
- BLMP;
- NMP;
- SWGMBMP;
- CMP (Barrick, 2006a); and
- MOP (2007 to 2009).

These measures would continue to be implemented where relevant for the modified CGM.

Proposed Modification Offset

Despite the minimal impact to fauna resources as a result of the proposed modification, Barrick would implement an offset, which would lead to a gain in the biodiversity values of the region in the medium to long term and complement the mitigation measures described above and the rehabilitation of the proposed modification area.

The proposed modification offset is discussed in Section 6.7.

In addition, the following management measures relevant to fauna would be implemented:

- revegetation planting;
- regeneration of existing native vegetation communities;
- exclusion of grazing to facilitate the regeneration of native vegetation;
- weed and pest management;
- soil erosion remediation;
- selective use of native plant fertilizer;
- fire management measures to include irregular mosaic burnings to maintain and/or increase habitat heterogeneity;
- signage of the vegetation offset areas; and
- monitoring the performance of the offset by suitably qualified person(s).

The proposed offset area is considered suitable for offsetting the potential residual impacts associated with the proposed modification (after the mitigation measures described above and rehabilitation), given the anticipated improvement in the fauna habitat value of the land within the offset area in the medium to long-term.

6.9 ABORIGINAL CULTURAL HERITAGE

Environmental Review

Aboriginal heritage sites which occur within ML 1535 and have been registered with the DECC include sites P1, P2, LC1-LC4 and exposures A-N. These sites range from open scatters (e.g. site P1) to base camps (e.g. site LC2) to a scarred tree. The recorded artefacts associated with these sites include quartz flakes, backed blades and axes. The majority of registered sites within ML 1535 are open scatters with concentrations of quartz flakes. Summaries of the survey results and the registered Aboriginal sites identified in each management zone are outlined in the Indigenous Archaeology and Cultural Heritage Management Plan (IACHMP) (Barrick, 2003l).

The proposed modification would avoid registered Aboriginal heritage sites. As such, the proposed modification would not change the potential impacts on Aboriginal heritage described in the EIS for the original CGM.

Mitigation Measures and Management

Notwithstanding, Barrick and its consultant archaeologists have obtained permits and consents under Section 87 and Section 90, respectively, pursuant to the *National Parks and Wildlife Act, 1974* for the management of Aboriginal heritage artefacts at the CGM. Activities for the CGM have been conducted in accordance with relevant permit and consent conditions and the IACHMP. All construction earthworks have been monitored and no non-compliances have been reported (Barrick, 2005c, 2006b, 2007a, 2008a, 2009). Future works would continue to be undertaken in accordance with the permits and consents for the CGM. The IACHMP would be continued for the modified CGM.

6.10 NON-ABORIGINAL HERITAGE

Environmental Review

Subsequent to Development Consent being granted for the approved CGM, the Cowal West Homestead and Shearing (Wool) Shed were listed as heritage items under the Bland LEP. The items were listed as an amendment to the Bland LEP which was gazetted in November 1999. The listed items are located at the Cowal West Homestead Complex (CWHC), which is situated immediately west of the approved CGM southern waste emplacement. The CWHC currently comprises the following buildings: Homestead; Shearing (Wool) Shed; and Hayshed. The listing recognises the local heritage significance of these buildings to the Bland Shire area. There are no other items listed on the Bland LEP located within ML 1535.

The proposed modification would avoid the CWHC. As such, the proposed modification would not change the potential impacts on non-Aboriginal heritage described in the EIS for the original CGM.

Mitigation Measures and Management

The Heritage Management Plan (HMP) (Barrick, 2003m) includes management measures for existing non-Aboriginal heritage items. The HMP would be continued for the modified CGM.

6.11 ROAD TRANSPORT

Environmental Review

The proposed modification would not change traffic movements to and from the CGM (i.e. no new traffic movements). Therefore, no impacts on the local road network would be expected as a result of the proposed modification.

Mitigation Measures and Management

Notwithstanding, Barrick would continue to encourage use of the existing employee shuttle bus service and car pooling, where practicable, to minimise traffic. The arrangements covering the transport of hazardous materials set out in the THMS would be continued.

6.12 SOCIO-ECONOMICS

As stated in Section 3, the proposed modification proposes changes to maximise waste emplacement efficiency whilst there is a material delay to the E42 Modification approval process. Further, significant cost savings would result from the addition of a cyanide destruction method (i.e. the INCO process) and introduction of the saline groundwater supply borefield.

The modified CGM would continue the significant economic and employment benefits provided by the approved CGM. The CGM currently employs some 320 to 370 people and this level of employment would continue for the proposed modification. The majority of these workers (approximately 90%) come from the region, with approximately 60% from Bland Shire. Based on employment ratio multipliers adopted by Gillespie Economics (2008), the CGM is estimated to continue to result in approximately 470 indirect jobs in the region.

The operation of the CGM would also continue to result in the collection of royalties and taxes by the State of NSW and the Commonwealth Government.

Barrick continues to make numerous donations to a variety of local schools, sporting groups, annual events, charity groups and businesses (Barrick, 2009). For example, the Cowl Partnering Program allocated \$57,168 to approved funding request causes during 2008 and the Ronald McDonald House Wagga Wagga received support of \$10,000 (*ibid.*).

Barrick also continues to provide both financial and in-kind support to the Lake Cowl Foundation Limited (LCF), which was established as a non-profit Environmental Trust in June 2000 (LCF, 2008). The Lake Cowl Conservation Centre (LCCC) was established in 2006 through a licence agreement between Barrick, the LCF, the NSW Department of Education and Training and the Lachlan Catchment Management Authority. The LCCC is located on a Barrick-owned property immediately south of the approved CGM and was established to provide a community learning centre for school students, landholders and community members to learn about and experience issues associated with landscape management (*ibid.*).

Barrick also continues to work with the Wiradjuri Condobolin Corporation regarding cultural heritage matters at the CGM, and also through a number of formal committees (Barrick, 2008a) including:

- the Cowl Project Coordinating Committee; and
- the Employment, Training and Business Committee.

Community liaison during the development of the proposed modification would continue to be provided by the quarterly Community Environmental Monitoring and Consultative Committee (CEMCC) meetings. The 24-hour community complaints line would continue to operate to provide the local community with a method to register issues or complaints with respect to CGM mining activities. In addition to the consultation with the CEMCC, Barrick's community consultation has involved (Barrick, 2009):

- participation in the LCF;
- regular consultation with the Wiradjuri Condobolin Corporation and Wiradjuri Council of Elders;
- community visits to the CGM;
- community information newsletters; and
- on-going involvement with numerous committees, organisations and groups.

6.13 HAZARD AND RISK

Existing Measures

A Preliminary Hazard Analysis (PHA), THMS, HAZOP Study Report (HAZOP) (Pinnacle Risk Management, 2004a), Fire Safety Study (FSS) (Pinnacle Risk Management, 2005), HWCMP, Final Hazard Analysis (FHA) (Pinnacle Risk Management, 2004b), BMP, CMP, Safety Management System (SMS) and ERP have been completed and relevant measures implemented for the approved CGM.

Preliminary Hazard Analysis

The PHA conducted as part of the EIS analysed the off-site risks to the environment, public safety and public property of potential hazardous events. The study ranked the risks and reviewed the adequacy of the safeguards and recommended improvements where necessary. No hazardous events or incidents have occurred at the CGM since the commencement of operations that have changed the assumed consequence and likelihood ratings described in the PHA.

Final Hazard Analysis

The FHA was also conducted for the approved CGM and was designed to extend and update the analysis in the PHA. Overall, the FHA concluded that the approved CGM complied with the Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 and HIPAP No. 6 Guidelines for tolerable fatality, injury, irritation and societal risk (Pinnacle Risk Management, 2004b). The FHA also concluded that the risks to the biophysical environment, the risk of propagation and the potential impact on cumulative risks in the area from releases were considered to be generally negligible (*ibid.*). Overall, the assessment concluded that the CGM would not pose any unacceptable levels of risk (*ibid.*). No hazardous events or incidents have occurred at the approved CGM since the commencement of operations that have changed the assumed consequence and likelihood ratings described in the FHA.

Hazard Identification and Risk Assessment

The proposed modification would not introduce new hazardous materials or change the transport routes for the hazardous materials previously assessed in the THMS or increase the frequency of deliveries or quantities per delivery to the extent that it would change the risk levels previously assessed. Revision of the THMS for the modified CGM would therefore not be required.

Overall, apart from hazards and risks associated with the proposed modification saline groundwater supply borefield, the proposed modification would not change the potential impact mechanisms to the environment, public and public property, and their associated consequences or likelihoods, to the extent that risk levels would change from those previously assessed in the PHA or FHA. Subsequently, no change to the overall PHA or FHA risk assessment findings would result from the proposed modification.

Potential hazards and risk associated with the saline groundwater supply borefield, however, were not assessed as part of the PHA or FHA. A hazard analysis was therefore conducted for this component of the proposed modification.

The assessment of risks for the saline groundwater supply borefield involved the application of the following basic steps undertaken for the PHA and FHA, including:

- assessment of the hazard potential of the materials involved;
- identification of the potential hazardous events (including incidents involving the materials and site/transport specific occurrences);
- evaluation of the consequences of the potential hazardous events;
- evaluation of the likelihood of the potential hazardous events; and
- assessment of the risk of the potential hazardous events.

Hazards identified as relevant to the saline groundwater supply borefield were limited to the following incident types:

- potential leaks or spills from failure of the saline groundwater supply pipeline delivering water from the borefield to the CGM process water dam (D6); and
- potential public safety risks due to possible accidental damage to borefield infrastructure during a lake full scenario.

These incident types were assessed to potentially result in the release of saline water into Lake Cowal (only when dry) or areas outside the Lake and potentially result in public safety issues.

The maximum reasonable consequence of the hazards was assessed as minor (i.e. hazards that could cause minimal localised environmental harm associated with elevated levels of TDS² or result in a medical treatment injury [Pinnacle Risk Management, 2004a]). A probability assessment concluded these would be rare events (i.e. unusual and conceivable, but only in extreme circumstances).

An assessment of the combination of the consequence and probability rankings concluded that the overall risk rankings for the above hazards would be low, and therefore tolerable.

Proposed preventative and control measures to address potential hazards are discussed below.

Hazard Prevention and Mitigation Measures

The hazard prevention and mitigation measures described in the PHA, THMS, HAZOP, FSS, HWCMP, FHA, BMP, CMP, SMS and ERP would continue to be implemented for the modified CGM.

² This assessment assumes the implementation of preventative and control measures.

Additional Measures

The modified CGM saline groundwater supply borefield control and/or preventative measures proposed for implementation would include:

- shut-down and removal of pumps during periods when the borefield is inundated by Lake Cowal;
- well-heads raised above the full storage level of Lake Cowal by construction of stand pipes;
- steel stand pipes to minimise potential damage to the bore in the unlikely event of an accidental collision;
- prominent signage at the well-heads to minimise the potential for accidental collision and damage;
- an anchored pipeline laid on the ground surface (i.e. above ground level) in a V-drain for potential spill containment;
- an underground powerline to power the pumps; and
- leak detection mechanisms including automatic shut-down capability (i.e. a pressure-based shut-down system).

In the unlikely event of pipeline failure and leakage of saline water, the spill would be controlled, contained and cleaned-up in accordance with the spill response procedures described in the HWCMP.

7 CONCLUSION

Based on Sections 2 to 6 of this document, it is considered that:

- the proposed modification is of minimal environmental impact; and
- the modified CGM is substantially the same development as the original CGM.

Minimal Environmental Impact

For the reasons set out below, it is concluded that the proposed modification is of minimal environmental impact.

- As described in Section 6, the proposed modification would not result in operational or material changes to the CGM that would alter the potential environmental impacts predicted in the EIS in regard to blasting, groundwater, surface water, air quality, Aboriginal heritage, non-Aboriginal heritage, road transport or socio-economics.
- As described in Section 6.1, the proposed modification would not result in operational or material changes to the CGM that would alter the potential environmental impacts predicted in the EIS in regard to noise. The original CGM noise modelling predicted that noise emissions would be below relevant noise criteria. With the exception of two minor exceedances, all recently measured intrusive mine noise levels are below relevant noise criteria. The modified CGM is not anticipated to change CGM noise emission levels. Heggies (Attachment A) advise that, accordingly, it is reasonable to conclude that existing mine noise emissions are unlikely to significantly change, the ability to comply with relevant noise criteria would continue and the proposed changes for the modified CGM would have minimal noise impact potential.
- The modification proposes an increase in the height of a proportion of the northern and southern waste emplacements. As described in Section 6.2, the change in the level of visual modification resulting from the modified CGM would be minimal because: the modified CGM would not change the level of visual modification described in the EIS for each of the relevant viewpoints; the modification would not change the number of public viewpoints which were identified in the EIS; the proposed waste emplacement elevations would remain well below surrounding existing prominent topographic high points; and the level of potential impact would be limited because the area subject to an increase in height is confined to a relatively small proportion of the overall footprint of the waste emplacements.
- With regard to potential impacts to land resources, leakage of saline water (prior to automatic shut-down) into a dry Lake Cowal would increase the salinity of the soil in the local area surrounding the pipeline rupture in the unlikely event this occurs. As described in Section 6.6, this localised increase in soil salinity would be minimal (given the leak detection and automatic shut-down mechanisms inherent in the design of the system) and would be cleaned up quickly by the removal of affected material for disposal within the waste emplacement(s).
- As described in Sections 6.7 and 6.8, no threatened flora or fauna species, populations, ecological communities, or their habitats, or matters of national environmental significance or other matters protected by the EPBC Act are likely to be significantly affected by the proposed modification, considering aspects such as the extent of potential habitat for the species, the small scale of the proposed modification and the already fragmented nature of the habitat which would be removed. Given the small area of vegetation disturbance, the already disturbed nature of that area and the application of mitigation measures and the proposed offset, the additional land clearance associated with the proposed modification would result in minimal environmental impact to flora and fauna.

- As described in Section 6.13, the proposed modification would not introduce new hazardous materials or change the transport routes for the hazardous materials previously assessed in the THMS or increase the frequency of deliveries or quantities per delivery to the extent that it would change the risk levels previously assessed. An assessment of the combination of the consequence and probability rankings concluded that the overall risk rankings for the hazards identified as relevant to the saline groundwater supply borefield would be low, and therefore tolerable.

In summation, the assessment of impacts contained in this document justifies a conclusion that the proposed modification will be of minimal environmental impact.

Substantially the Same Development

For the reasons set out below, it is concluded that the development to which the consent as modified relates is considered to be substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified.

- As described in Table 2, the modified CGM **does not** involve any changes to the following original CGM development components: total ore production; ore processing rate; life of mine; total water requirement; lake isolation system; maximum annual waste production rate; tailings production; number or location of tailings storage facilities; tailings storage facilities area; tailings storage facilities water management processes; cyanide destruction levels; or power supply.
- When the differences are compared between the whole or totality of the modified CGM and the whole or totality of the original CGM, it must be concluded that the modified CGM is substantially the same as the original CGM.

8 REFERENCES

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- Barrick Australia Limited (2003d) *Cowal Gold Project Traffic Noise Management Plan*.
- Barrick Australia Limited (2003e) *Cowal Gold Project Blast Management Plan*.
- Barrick Australia Limited (2003f) *Cowal Gold Project Landscape Management Plan*.
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ATTACHMENT A

LETTER FROM HEGGIES PTY LTD JUNE 2009



16 June 2009

10-3405 30-400 Modification 20090619

Barrick (Cowal) Limited
PO Box 210
WEST WYALONG NSW 2671

Attention: Mr Andrew Bywater, Technical Services Manager

Dear Andrew

Cowal Gold Mine Proposed Modification Review of Noise Impacts

1 Introduction

In January 1999 Development Consent was granted to develop the Cowal Gold Mine (CGM) as an open-cut gold mine utilising drill and blast, truck and shovel extractive methods with on-site processing to produce gold. The Mining Lease (ML) 1535 is located approximately 38 kilometres (km) northeast of West Wyalong, New South Wales (NSW).

This report presents an assessment of the potential noise impacts associated with a proposed modification to the CGM (the modified CGM) and provides a comparison with the:

- "Development for which the consent was originally granted" (as described and shown in the Cowal Gold Project Environmental Impact Statement [CGM EIS] [North Limited, 1998]) - the original CGM.
- The original CGM as previously modified - the approved CGM.

Heggies Pty Ltd (Heggies) has carried out a review of potential noise impacts arising from changes associated with the modified CGM. The key aspects of the proposed modification would include:

- No change to the maximum approved heights of the northern and southern waste emplacements, although an increase in the heights of the remaining areas of the northern and southern waste emplacements that were not subject to a height increase in the February 2009 modification (**Attachment A**).
- Increase to the total area of the waste emplacements (and additional two small stockpiles for associated soil).
- Re-alignment of a small portion of the Up-catchment Diversion System (UCDS) and minor changes to the internal catchment divide around the modified northern waste emplacement area.
- Addition of a cyanide destruction method (ie the INCO process) as an alternative to Caro's Acid.
- Introduction of a saline groundwater supply borefield within ML 1535.

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- A change to the total disturbance area within ML 1535 from approximately 950 hectares (ha) to approximately 990 ha (to facilitate the modified northern waste emplacement, two soil stockpiles, re-alignment of a small portion of the UCDS and the saline groundwater supply borefield); and
- Other associated minor changes to infrastructure, plant, equipment and activities.

The proposed modification **does not** involve any changes to the following approved CGM development components: total ore production; ore processing rate; life of mine; total water requirement; open pit area or final pit dimensions; lake isolation system; waste production rate; tailings production; number or location of tailings storage facilities; tailings storage facilities area; tailings storage facilities water management processes; cyanide destruction levels; power supply; or employment.

The review of noise impacts considered the information contained in the following documents:

- CGM EIS (North Limited, 1998).
- Cowal Gold Project Noise Transportation and Blasting Impact Assessment (Appendix H of the EIS).
- Reports 10-4111-R1 to 10-4111-R9 Mine Operating Noise Monitoring - August 2005 to January 2009, prepared by Heggies.
- The description of the modified CGM provided to Heggies on 21 May 2009.

2 Noise Criteria

2.1 Original and Approved CGM

Barrick has consent to operate the CGM (with respect to noise and vibration emissions) in accordance with the CGM Development Consent (DA 14/98) and Environment Protection Licence (EPL) (No 11912), as shown on **Attachment B**. The original CGM (Development Consent and EPL) intrusive noise criteria were generally based on the noise compliance requirements of the NSW Department of Environment and Climate Change's (DECC's) Environmental Noise Control Manual (ENCM) 1994.

Subsequent amendments to the EPL and more recently the Consent has resulted in the approved CGM noise limits being generally consistent with the requirements of the NSW Industrial Noise Policy (INP) (2000).

2.2 Proposed Modified CGM

The DECC previously requested that Barrick amend the CGM Noise Management Plan (NMP) (November 2004) in accordance with the NSW INP, including intrusive LAeq(15minute) project-specific noise levels that apply under a limited range of site-specific wind and temperature inversion conditions determined in accordance with the NSW INP.

The NMP requires six-monthly noise monitoring and reporting to be conducted in January and July of each year. Operating noise criteria in accordance with the NSW INP are nominated in Section 3.2 Table 2 of the NMP (2004) and are reproduced in **Table 1**.

Table 1 NMP (INP) Based Intrusive LAeq(15minute) and Sleep Disturbance LA1(1minute) Noise Criteria

NMP (INP) Based Intrusive LAeq(15minute) PSNLs			Sleep Disturbance Screening Criteria LA1(1minute)
Daytime	Evening	Night-time	Night-time
35 dBA	35 dBA	35 dBA	45 dBA

Note 1: Daytime defined 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.



The noise criteria presented in **Table 1** apply under site-specific meteorological conditions as determined in accordance with the NSW INP. As a result, the environmental noise performance of the CGM has generally been assessed against the NMP (INP) based noise criteria (and meteorological conditions) which also remain useful for the purposes of reviewing any potential noise impacts arising from the modified CGM.

3 Modified CGM Overview

The key changes arising from the proposed modification are described in Section 1 and shown on the Mine Layout Plan shown as **Attachment A**.

The noise sources identified for the modified CGM include the same type of sources as those identified for the original CGM, including fixed processing plant and mobile equipment fleet (eg hydraulic excavators, haul trucks, front end loaders, dozers [wheeled and tracked], graders and drill rigs). The proposed modification does not involve any additional mobile equipment by comparison with the typical mobile equipment fleet currently in-use. Similarly, fixed plant remains unaltered by the modified CGM.

The proposed modification is not expected to change the maximum potential noise emissions from the CGM, given there would be no new significant noise sources and no change to the maximum quantity of waste rock or ore to be mined in any one year.

4 EIS Predicted, Operating CGM and Modified CGM Noise Impacts

4.1 CGM EIS Predicted Noise Emissions

The EIS predicted LA10(15minute) intrusive mine operating noise at the nearest potentially affected receivers are presented in **Table 2**.

Table 2 CGM EIS Predicted LA10(15minute) Intrusive Noise (dBA re 20 µPa)

ID	Location	Neutral (calm)		ENCM Light Wind		ENCM Moderate Inversion	
		Year 3	Year 8	Year 3	Year 8	Year 3	Year 8
No 2	"Coniston"	11	21	26	31	22	27
No 5	"Gumbelah"	9	11	17	17	16	15
No 6	"Lake Cowal"	14	13	22	22	20	19
-	"Lakeside"	10	19	23	28	20	24

MPa = micro Pascals.

As discussed in **Section 2.1**, the CGM EIS noise assessment was prepared and guided by the relevant noise impact procedures at the time (ie DECC's ENCM). The EIS assessment predicted compliance with the ENCM criteria at all the assessed locations. For comparison, a contemporary assessment of the CGM would be required to be undertaken in accordance with the current DECC noise assessment requirements of the NSW INP. In this case, an assessment of the modified CGM has been undertaken generally in accordance with the NSW INP (Section 4.3).

4.2 Noise Monitoring Locations and Operating CGM Noise Emissions

The CGM currently monitors noise emissions at:

- Non-Barrick-owned residential receivers.
- Barrick-owned residential receivers.
- Bird breeding areas.



- An on-site control point (ie site located within the ML 1535 boundary).

The above Noise Monitoring Locations are shown on **Attachment C**. The nearest non-Barrick-owned residential receivers and birding breeding area monitoring locations are presented in **Table 3**.

Table 3 Noise Assessment Locations

ID	Location	Receiver Type
NO2	"Coniston"	Private property
NO5	"Gumbelah"	Private property
NO7	"Westlea"	Private property
NO3	Bird Breeding Area (South)	Wildlife area
NO4	Bird Breeding Area (North)	Wildlife area

The measured LAeq(15minute) intrusive mine noise levels are presented in **Table 4**, **Table 5**, and **Table 6** based on the August 2005, February 2006, July 2006, January 2007, July 2007, September 2007 (Westlea), January 2008, July 2008 and January 2009 monitoring results.

Table 4 Daytime Measured LAeq(15minute) Intrusive Mine Level (dBA re 20 µPa)¹

ID	Location	Aug 05	Feb 06	Jul 06	Jan 07	Jul 07	Sept 07	Jan 08	Jul 08	Jan 09
NO2	"Coniston"	n/a, <30	n/a	<30, <30	<30, <30	<30, <30	-	n/a, n/a	<30, <30	n/a, n/a
NO5	"Gumbelah"	n/a	n/a	<30	n/a	<30, <30	-	n/a, n/a	<30, <30	n/a, n/a
NO7	"Westlea"	-	-	-	-	-	38, <30, 38, 39	<30, <30	<30, <30	n/a, n/a
NO3	Bird Area (S)	n/a	n/a	<30, <30	<30, <30	<30, <30	-	n/a	-	n/a
NO4	Bird Area (N)	-	-	n/a, n/a	n/a, n/a	n/a, n/a	-	n/a	<30, <30	n/a

Note 1: n/a - mine noise not discernible.

Measured daytime intrusive mine levels at all three residential locations (Nos 2, 5 and 7) are below 35 dBA, except at Westlea (No 7) in September 2007 where mine levels were up to 39 dBA. Early morning temporary tailings embankment lift works were subsequently modified and recent noise measurements show mine levels below 35 dBA.

Table 5 Evening Measured LAeq(15minute) Intrusive Mine Level (dBA re 20 µPa)¹

ID	Location	Aug 05	Feb 06	Jul 06	Jan 07	Jul 07	Sept 07	Jan 08	Jul 08	Jan 09
NO2	"Coniston"	-	<30	37	<30, <30	-	-	<30	<30, <30	n/a, n/a
NO5	"Gumbelah"	-	-	<30, <30	n/a, n/a	-	-	<30	-	n/a
NO7	"Westlea"	-	-	-	-	-	<30, <30	<30, <30	<30, <30	<30, <30
NO3	Bird Area (S)	-	n/a	-	<30, <30	-	-	-	-	-
NO4	Bird Area (N)	-	n/a	-	-	-	-	-	-	-

Note 1: n/a - mine noise not discernible.

Measured evening intrusive mine levels at all three residential locations (Nos 2, 5 and 7) are below 35 dBA, except at Coniston (No 2) in July 2006 where mine levels were marginally up to 2 dBA above the noise limit. More recent noise measurements show mine levels remain below 35 dBA.



Table 6 Night-time Measured LAeq(15minute) Intrusive Mine Level (dBA re 20 µPa)¹

ID	Location	Aug 05	Feb 06	Jul 06	Jan 07	Jul 07	Sept 07	Jan 08	Jul 08	Jan 09
NO2	"Coniston"	35	n/a	37, <30	<30, <30	35, 35	-	<30, 30	33, 30	n/a, n/a
NO5	"Gumbelah"	<30	n/a	-	<30, <30	<30, <30	-	<30, <30	30, 31	n/a, n/a
NO7	"Westlea"	-	-	-	-	-	<30, <30, 32	34, 31, n/a	<30, <30	32, 36
NO3	Bird Area (S)	33	-	-	-	-	-	-	-	-
NO4	Bird Area (N)	<30	-	-	-	-	-	-	-	-

Note 1: n/a - mine noise not discernible.

Measured night-time intrusive mine levels at all three residential locations (Nos 2, 5 & 7) are below 35 dBA, except at Consiston (No 2) in July 2006 and Westlea (No 7) in January 2009 where mine levels were marginally above the noise limit (ie by 2dBA and 1 dBA, respectively). With the exception of these two minor exceedances, all recent noise measurements show mine levels remain below 35 dBA and CGM emissions are deemed to be in compliance with Consent, EPL and INP requirements.

4.3 Modified CGM Potential Noise Emissions

The modified CGM does not involve any additional mobile equipment by comparison with the typical mobile equipment fleet currently in-use. Similarly, fixed plant remains unaltered by the modified CGM. While the modified CGM involves an increase of 10 m to 15 m of the final height of some areas of the northern and southern waste emplacements, there would be no increase in mine noise arising from the increasing elevation of waste emplacement areas at the CGM as the noise propagation path (and existing line-of-sight between noise sources and receivers) would remain relatively unaltered by the modified CGM at the nearest residential dwellings. Furthermore, works carried-out in the extended footprint of the northern waste emplacement areas are no closer nearest receptors and would be serviced by the existing mobile equipment fleet. Hence, the existing mine noise emissions are unlikely to significantly change.

4.4 CGM Noise Mitigation and Management Measures

CGM Noise mitigation and management measures are described in the NMP. The NMP describes:

- Relevant noise standards.
- Potential noise sources and impacts.
- Noise management and mitigation measures.
- A noise monitoring programme.
- Provisions for the establishment of proactive and responsive noise management protocols.
- Provisions for the establishment of community consultation protocols.

It is understood that the NMP would be continued for the modified CGM.

5 Summary of Findings

The CGM EIS noise predictions were undertaken in accordance with the now superseded ENCM. An assessment of noise emission levels at relevant receiver locations based on the superseded ENCM would not provide relevant conclusions regarding the modified CGM's conformance with the DECC's current noise guidelines.



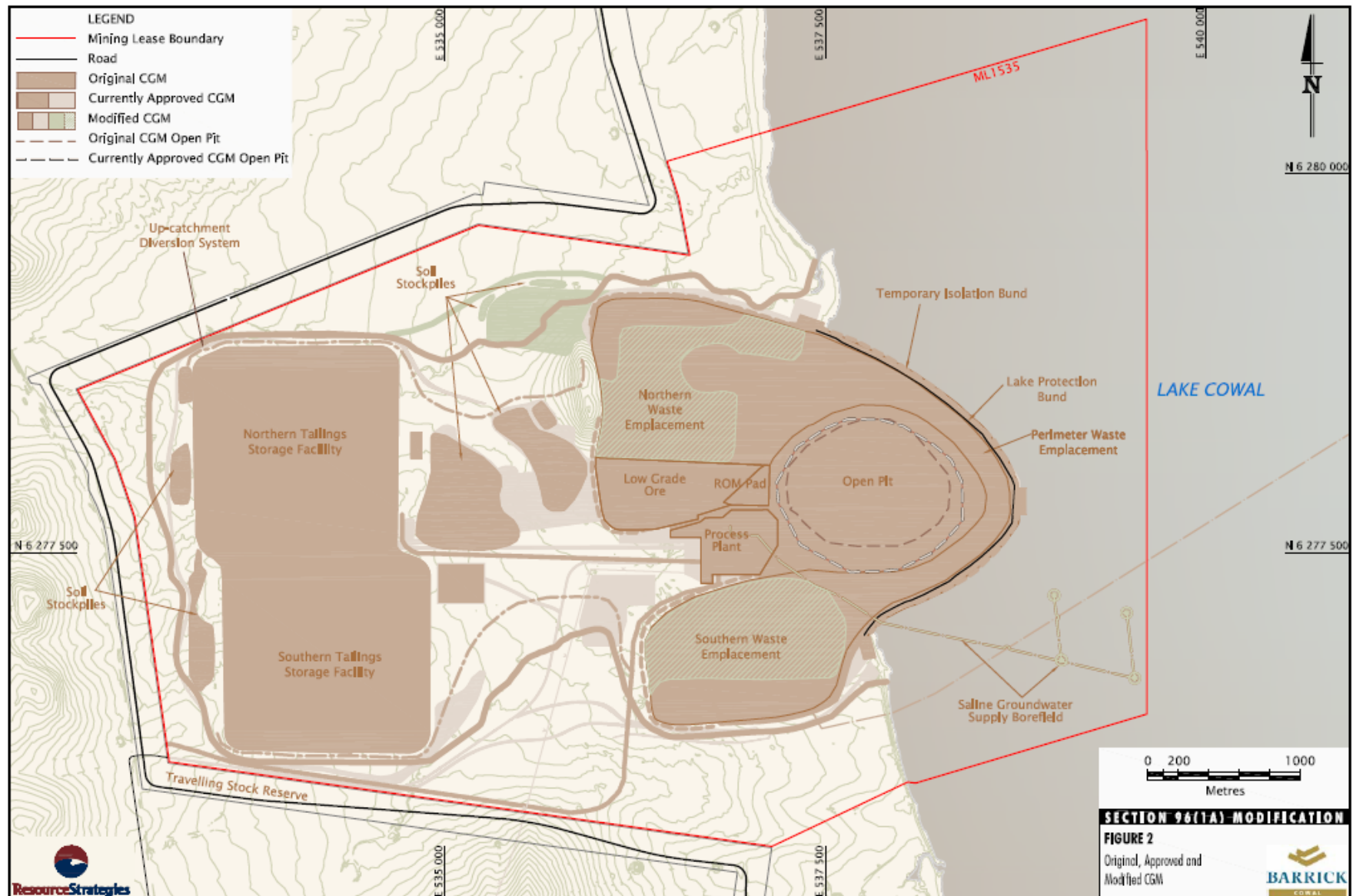
The current DECC methodology for establishing appropriate noise criteria for a project (i-e project-specific noise criteria) is described in the NSW INP. A contemporary NSW INP assessment would necessarily produce different project specific noise criteria in comparison to the CGM EIS as the INP contains different noise descriptors, meteorological conditions and assessment procedures. As a result, this review of the modified CGM assesses the potential noise impacts against existing CGM noise performance as well as INP based noise criteria.

The original CGM noise modelling predicted that noise emissions would be below relevant noise criteria. With the exception of two minor exceedances, all recent noise measurements show mine levels remain below 35 dBA and CGM emissions are deemed to be in compliance with Consent, EPL and INP requirements. The modified CGM is not anticipated to change CGM noise emission levels. Accordingly, it is reasonable to conclude that existing mine noise emissions are unlikely to significantly change and the proposed changes for the modified CGM would have minimal noise impact potential.

Should you require any additional information or wish to discuss this matter further please contact undersigned.

Yours sincerely

GLENN THOMAS



Development Consent Conditions

The Development Consent nominates operating noise criteria in Condition 6.4 part (a) as follows:

6.4 Noise Control

(a) Noise levels - mine operations

The Applicant shall ensure that the LAeq (15 minute) noise emissions from the mine, when measured or computed at any dwelling in the vicinity of the mine (other than one owned by a mining company), do not exceed:-

- *during day time (7am-10pm), an LAeq (15 minute) noise level of 35dB(A)*
- *during evening (6pm to 10pm), Monday to Friday, an LAeq (15 minute) noise level of 35dB(A).*
- *at all other times, an LAeq (15 minute) noise level of 35dB(A), except as expressly provided by other approvals/licences granted by other agencies.*

These goals apply under meteorological conditions of:

- *wind speeds up to 3m/s at 10 m about ground level, or*
- *temperature inversion conditions of up to 3°C/100 m and wind speed up to 2 m per second at 10 m above ground level.*

Environment Protection Licence (EPL)

The DEC's EPL No 11912 with review date 23 December 2011 nominates operating noise criteria under section L6 "Noise Limits" which are as follows:

L6 Noise Limits

L6.1 Noise from the premises must not exceed:

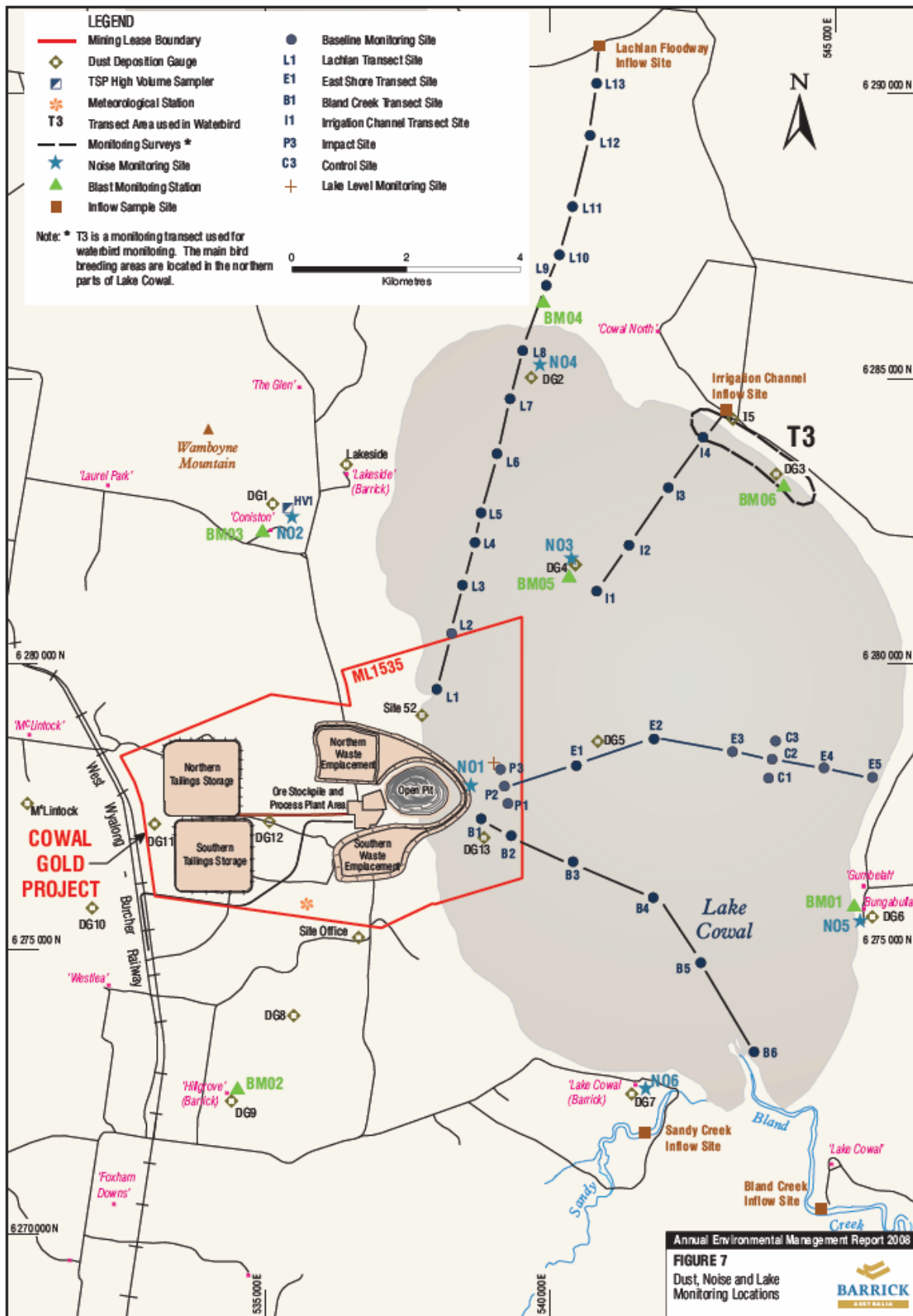
- (a) *35 dB(A) LAeq(15 minute) during the day (7am to 6pm) Monday to Friday; and*
- (b) *35 dB(A) LAeq(15 minute) during the evening (6pm to 10pm) Monday to Friday; and*
- (c) *at all other times 35 dB(A) LAeq(15 minute), except as expressly provided by this licence.*

Where LAeq means the equivalent continuous noise level - the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L6.2 *The noise emission limits identified in condition L6.1 apply when measured at, or computed for, any residence not owned by the licensee. A modifying factor correction must be applied for tonal, impulsive or intermittent noise in accordance with the "Environmental Noise Management - NSW Industrial Noise Policy (January 2000)".*

L6.3 *The noise emission limits identified in condition L6.1 apply under meteorological conditions of:*

- *Wind speed up to 3 metres per second at 10 metres about ground level; or*
- *Temperature inversion conditions of up to 3°C/100 metres and wind speed up to 2 metres per second at 10 metres above ground level.*



ATTACHMENT B

ASSESSMENT OF SIGNIFICANCE FOR THREATENED SPECIES, POPULATIONS,
AND ECOLOGICAL COMMUNITIES AND THEIR HABITATS

ATTACHMENT B

COWAL GOLD MINE
PROPOSED MODIFICATION

ASSESSMENT OF SIGNIFICANCE
FOR THREATENED SPECIES, POPULATIONS
AND ECOLOGICAL COMMUNITIES, AND THEIR HABITATS



JUNE 2009
Project No. HAL-33
Document No. Attachment B (Assessment of Significance) – C
(00285979.DOC)

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EXECUTIVE SUMMARY

The Cowal Gold Mine (CGM) is owned and operated by Barrick (Cowal) Limited (Barrick). The CGM is located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure B-1). Barrick is proposing a minor modification to the CGM.

The purpose of this document is to assess whether the proposed modification is likely to significantly affect threatened species, populations or ecological communities or their habitats listed under the NSW *Threatened Species Conservation Act, 1995* and *Fisheries Management Act, 1994* in accordance with Section 5A of the *Environmental Planning and Assessment Act, 1979*.

This document assesses the potential impacts of the proposed modification on four flora species, eleven fauna species and one ecological community.

Having regard to the content of Section B2 of this document in respect of each threatened species and ecological community (and their habitats) assessed in this document, when all the factors that must be taken into account under Section 5A of the *Environmental Planning and Assessment Act, 1979* are considered in combination, the proposed modification is unlikely to have a significant effect on any threatened species, populations, ecological communities or their habitats, considering aspects such as the extent of potential habitat for the species, the small scale of the proposed modification and the already fragmented nature of the habitat which would be removed.

B1 INTRODUCTION

The Cowal Gold Mine (CGM) is owned and operated by Barrick (Cowal) Limited (Barrick). The CGM is located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure B-1).

Barrick is proposing a minor modification to the CGM. The key aspects of the proposed modification would include:

- no change to the maximum approved heights of the northern and southern waste emplacements, although an increase in the heights of the remaining areas of the northern and southern waste emplacements that were not subject to a height increase in the February 2009 modification;
- increase to the total area of the waste emplacements (and additional two small stockpiles for associated soil);
- re-alignment of a small portion of the Up-catchment Diversion System (UCDS) and minor changes to the internal catchment divide around the modified northern waste emplacement area;
- addition of a cyanide destruction method (i.e. the INCO process) as an alternative to Caro's Acid;
- introduction of a saline groundwater supply borefield within Mining Lease (ML) 1535;
- a change to the total disturbance area within ML 1535 from approximately 950 hectares (ha) to approximately 990 ha (associated with the increase to the waste emplacements, additional two small soil stockpiles and saline groundwater supply borefield); and
- other associated minor changes to infrastructure, plant, equipment and activities.

It is estimated that the proposed modification would marginally increase the disturbance area by approximately 40 ha (comprising approximately 30 ha of Secondary Native Grassland with Scattered Wilga, Rosewood and Belah vegetation community/Cleared Agricultural Land with Scattered Trees habitat and approximately 10 ha of Swamp Canegrass Grassland vegetation community/ Lakebed habitat), an increase of less than 5% to the total disturbance area described in the *Cowal Gold Project Environmental Impact Statement* (EIS) (North Limited, 1998). The vegetation and habitat types within the proposed modification are shown on Figures B-2 and B-3.

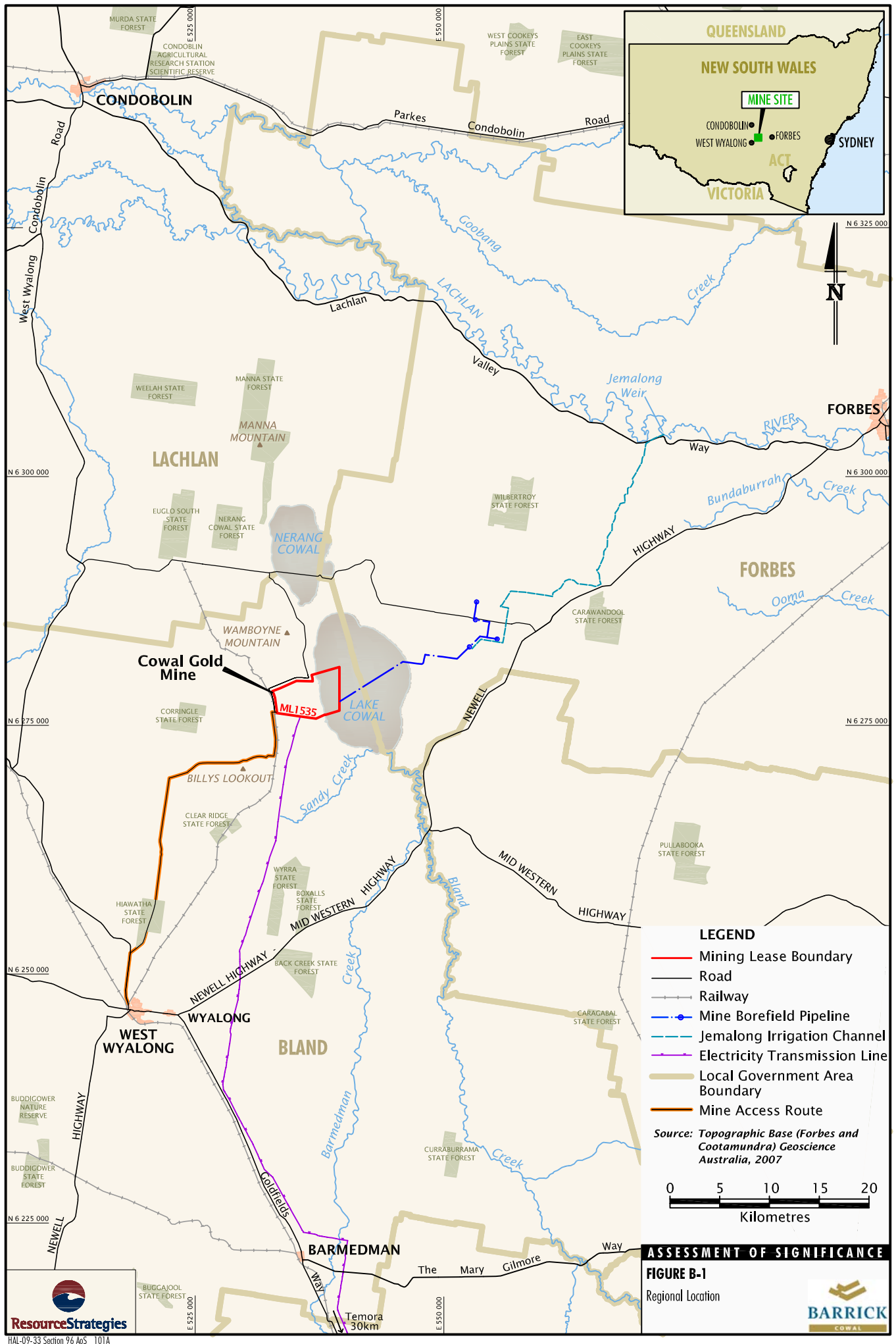
Changes implemented to the approved CGM by the proposed modification would result in the modified CGM.

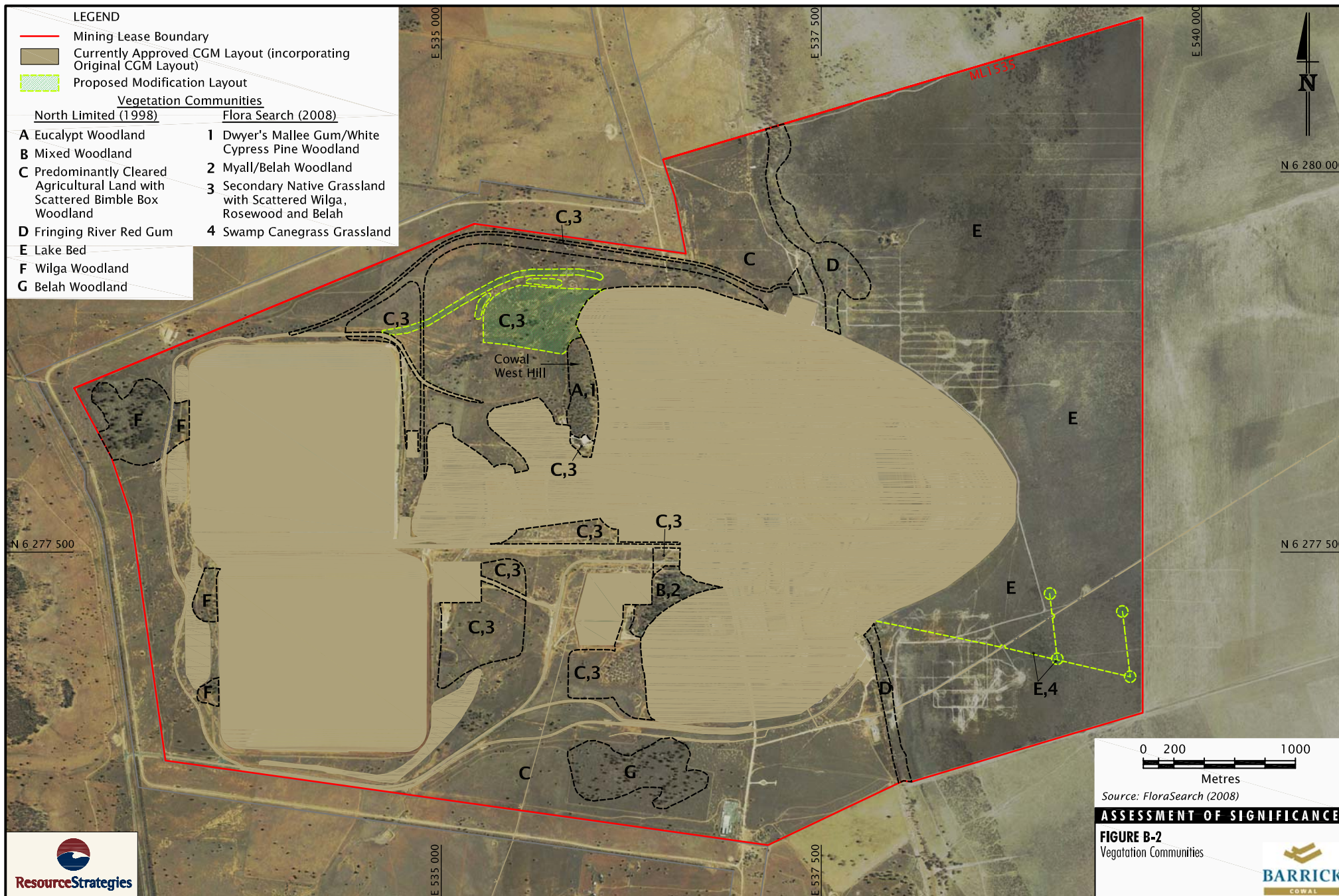
A more detailed description of the proposed modification is provided in Sections 3 and 5 of the *Cowal Gold Mine – Statement of Environmental Effects of Proposed Modification* (SEE) (Barrick, 2009).

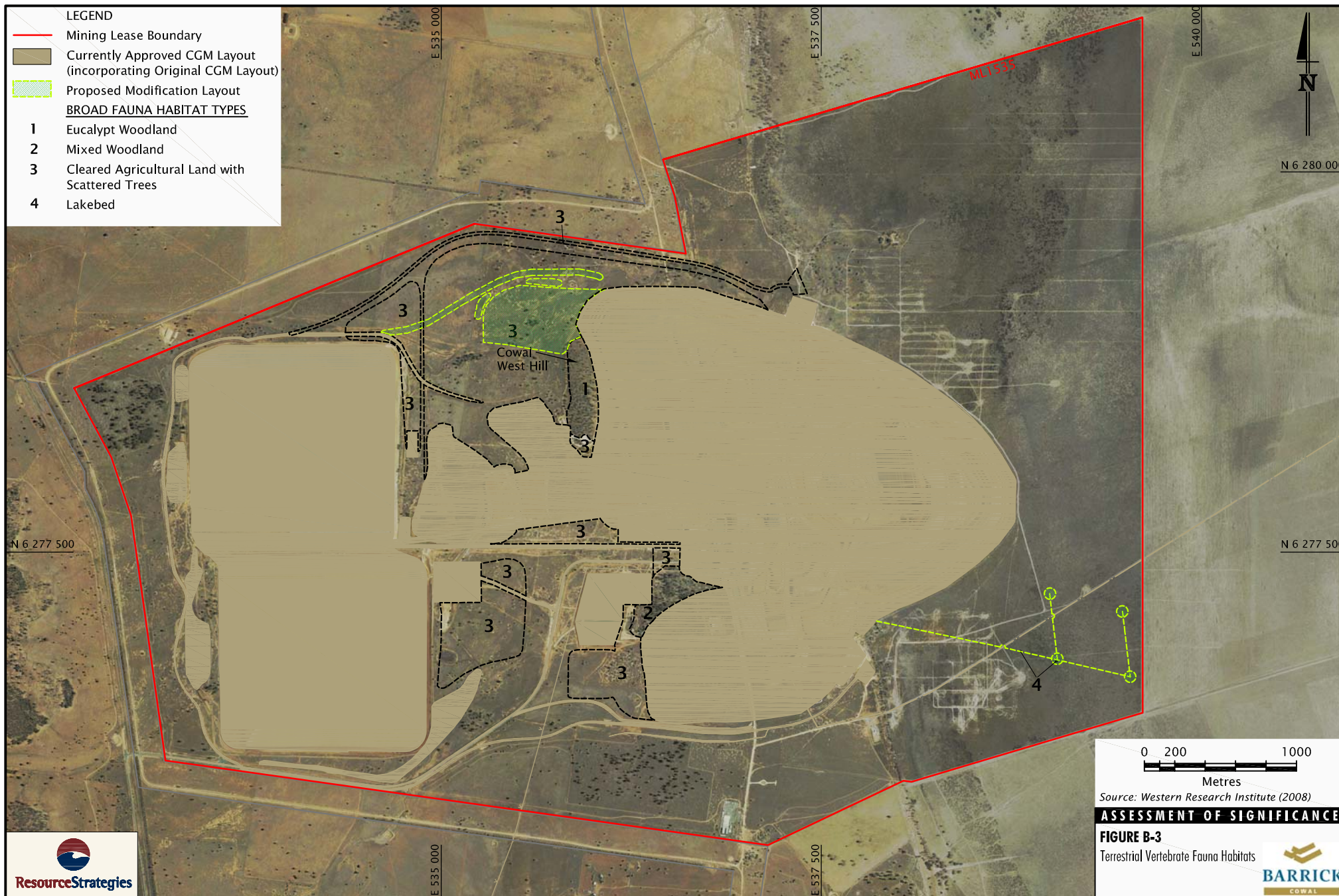
B1.1 PURPOSE OF THE DOCUMENT

The purpose of this document is to assess whether the proposed modification is likely to significantly affect threatened species, populations or ecological communities or their habitats listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and *Fisheries Management Act, 1994* (FM Act) in accordance with Section 5A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). The following factors are considered to determine the likelihood of a significant impact:

- (a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*







Source: Western Research Institute (2008)

ASSESSMENT OF SIGNIFICANCE

FIGURE B-3

Terrestrial Vertebrate Fauna Habitats



- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*
- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
 - (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*
- (d) *In relation to the habitat of a threatened species, population or ecological community:*
 - (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
 - (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*
- (e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*
- (f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*
- (g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

B1.2 DOCUMENT TERMS

<i>Study Area</i>	The proposed modification area and any additional areas which are likely to be affected by the proposal, either directly or indirectly.
<i>Direct Impacts</i>	Are those that directly affect habitat and individuals and include but are not limited to death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat.
<i>Indirect Impacts</i>	Occur when proposed modification-related activities affect species, populations or ecological communities in a manner other than a direct loss.
<i>Lifecycle</i>	The series or stages of reproduction, growth, development, aging and death of an organism.
<i>Viable</i>	The capacity to successfully complete each stage of the lifecycle under normal conditions.
<i>Local Population</i>	The population that occurs in the study area. In cases where multiple populations occur in the study area, each population should be assessed separately.
<i>Risk of Extinction</i>	Is the likelihood that the local population or the local occurrence of the ecological community will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population or on the ecological community.
<i>Local Occurrence</i>	Occurrence within the study area.
<i>Composition</i>	Refers to both the assemblage of flora and fauna species, and the physical structure of the ecological community.

Habitat Is the area occupied, or periodically or occasionally occupied, by any threatened species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species during the different stages of their lifecycles.

For clarity the following terms have also been defined:

Known Habitat Is considered to be habitat in the study area in which the species has been recorded.

Potential Habitat Is considered to be habitat in the study area in which the species has not been recorded but may potentially utilise.

B1.3 DOCUMENT SCOPE

Table B-1 provides a list of threatened species and ecological communities assessed in this document.

Table B-1
Conservation Status of Threatened Species and Ecological Communities
Assessed Against Factors of Significance

Species	Conservation Status ¹
Flora	
Austral Pillwort (<i>P. novae-hollandiae</i>)	E
A Speargrass (<i>Austrostipa wakoolica</i>)	E
Winged Peppercress (<i>Lepidium monoplacoides</i>)	E
Spiny Pepper-cress (<i>Lepidium aschersonii</i>)	V
Amphibians	
Sloane's Froglet (<i>Crinia sloanei</i>)	V
Birds	
Magpie Goose (<i>Anseranas semipalmata</i>)	V
Blue-billed Duck (<i>Oxyura australis</i>)	V
Freckled Duck (<i>Stictonetta naevosa</i>)	V
Australasian Bittern (<i>Botaurus poiciloptilus</i>)	V
Brolga (<i>Grus rubicunda</i>)	V
Black-tailed Godwit (<i>Limosa limosa</i>)	V
Australian Painted Snipe (<i>Rostratula australis</i>)	E
Superb Parrot (<i>Polytelis swainsonii</i>)	V
Grey-crowned Babbler (<i>Pomatostomus temporalis temporalis</i>)	V
Mammals	
Yellow-bellied Sheath-tail-bat (<i>Saccolaimus flaviventris</i>)	V
Ecological Communities	
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River	E

¹ NSW TSC Act/FM Act.
V (Vulnerable), E (Endangered).

No endangered populations are known or considered to possibly occur in the study area. The list of threatened species and ecological communities was compiled in consideration of a number of references and factors including:

- The schedules of the TSC Act and FM Act.
- Australian Museum database records within a search area of approximately 400 square kilometres (km²) surrounding the study area (Australian Museum, 2009).
- Atlas of Australia Birds database records produced by Birds Australia (2009) within a search area of approximately 400 km² surrounding the study area.
- Sydney Royal Botanical Gardens (SRBG) database records within a search area of approximately 400 km² surrounding the study area (SRBG, 2009a).
- Cowal Gold Project Implementation of the Threatened Species Management Protocol (TSMP) (Barrick, 2003).
- Distribution and habitat descriptions on the Department of Environment and Climate Change (DECC) Threatened Species Internet Site (DECC, 2009a), botanical databases such as Plant NET (SRBG, 2009b) and in seminal texts such as Strahan (2004).
- Preliminary and Final Determinations of the NSW Scientific Committee (DECC, 2009b).
- DECC Atlas of NSW Wildlife database records within a search area of approximately 400 km² surrounding the study area (DECC, 2009c).
- The essential lifecycle components of candidate species (including germination, breeding, foraging, roosting/nesting and movement/migration).
- The nature and extent of the disturbance associated with the proposed modification.

B1.4 APPLYING FACTORS OF THE ASSESSMENT

The following sections (a) to (g) provide an overview of the factors considered for the threatened species addressed in Section B2.

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

As defined in Section B1.2, a lifecycle is the series or stages of reproduction, growth, development, aging and death of an organism (DECC, 2007a). The removal or modification of habitat resources or the disruption of important periodic events (e.g. plant germination) may disrupt a species lifecycle and be detrimental to the survival of a species (DECC, 2007a). Important lifecycle components for plants include seed banks, recruitment (germination and establishment of plants) and reproduction (including pollination and fecundity). For animals, important lifecycle components include breeding, mortality, dormancy, roosting, feeding, migration and dispersal. The risk of such an activity to cause a local population to become extinct will increase if any factor operates to reduce the local population size or reproduction success (DECC, 2007a).

In accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC, 2007a), any known or potential local population described in this document is assumed to be viable, i.e. the population has the capacity to successfully complete each stage of the lifecycle under normal conditions.

Factor (a) is applicable to the threatened species addressed in Section B2 of this document.

- (b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

This factor is essentially identical to Factor (a) except that it refers only to endangered populations, whereas Factor (a) refers to species. Table B-2 provides a list of endangered populations currently (28 May 2009) listed in the TSC Act (DECC, 2009c).

Table B-2
Endangered Populations under the *Threatened Species Conservation Act, 1995*

Species	Endangered Populations
Flora	
Weeping Myall (<i>Acacia pendula</i>)	Weeping Myall population in the Hunter catchment.
Gosford Wattle (<i>Acacia prominens</i>)	Gosford Wattle population in the Hurstville and Kogarah Local Government Areas (LGAs).
Black Cypress Pine (<i>Callitris endlicheri</i>)	Black Cypress Pine, Woronora Plateau population.
<i>Chorizema parviflorum</i> Benth. (a shrub)	<i>Chorizema parviflorum</i> Benth. population in the Wollongong and Shellharbour LGAs.
<i>Cymbidium canaliculatum</i>	<i>Cymbidium canaliculatum</i> population in the Hunter Catchment.
<i>Darwinia fascicularis</i> subsp. <i>oligantha</i>	<i>Darwinia fascicularis</i> subsp. <i>oligantha</i> populations in the Baulkham Hills and Hornsby LGAs.
<i>Dillwynia tenuifolia</i>	<i>Dillwynia tenuifolia</i> population at Kemps Creek. <i>Dillwynia tenuifolia</i> in the Baulkham Hills LGA.
Pine Donkey Orchid (<i>Diuris tricolor</i>)	Pine Donkey Orchid population in the Muswellbrook LGA.
River Red Gum (<i>Eucalyptus camaldulensis</i>)	<i>Eucalyptus camaldulensis</i> population in the Hunter catchment.
Narrow-leaved Stringybark (<i>Eucalyptus oblonga</i>)	<i>Eucalyptus oblonga</i> population at Bateau Bay and Wyong LGA.
<i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i>	<i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> population in the Wyong and Lake Macquarie LGAs.
Narrow-leaved Red Gum (<i>Eucalyptus seeana</i>)	<i>Eucalyptus seeana</i> population in the Greater Taree LGA.
Nambucca Glycine (<i>Glycine clandestine</i>)	<i>Glycine clandestina</i> population in the Nambucca LGA.
<i>Keraudrenia corrolata</i> var. <i>denticulate</i>	<i>Keraudrenia corrolata</i> var. <i>denticulata</i> population in the Hawkesbury LGA.
<i>Leionema lamprophyllum</i> subsp. <i>obovatum</i>	<i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> population in the Hunter Catchment.
<i>Lespedeza juncea</i> subsp. <i>sericea</i>	<i>Lespedeza juncea</i> subsp. <i>sericea</i> population in the Wollongong LGA.
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs.
<i>Pomaderris prunifolia</i> (a shrub)	<i>Pomaderris prunifolia</i> population in the Parramatta, Auburn, Strathfield and Bankstown LGAs.
<i>Pultenaea villifera</i>	<i>Pultenaea villifera</i> population in the Blue Mountains LGA.
<i>Rhizanthella slateri</i>	<i>Rhizanthella slateri</i> in the Great Lakes LGA.
Tadgell's Bluebell (<i>Wahlenbergia multicaulis</i>)	Tadgell's Bluebell population in the Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs.
<i>Zieria smithii</i>	Low growing form of <i>Zieria smithii</i> population at Diggers Head.
Fauna	
Tusked Frog (<i>Adelotus brevis</i>)	Tusked Frog population in the Nandewar and New England Tablelands Bioregions.
White's Skink (<i>Egernia whitii</i>)	White's Skink in the Broken Hill Complex Bioregion.
Australian Brush-turkey (<i>Alectua lathami</i>)	Australian Brush-turkey population in the Nandewar and Brigalow Belt South Bioregions.
Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs.

Table B-2 (Continued)
Endangered Populations under the *Threatened Species Conservation Act, 1995*

Species	Endangered Populations
Fauna (Continued)	
Glossy Black-cockatoo (<i>Calyptrorhynchus lathamii</i>)	Glossy Black-cockatoo, Riverina population.
White-browed Treecreeper (<i>Climacteris affinis</i>)	White-browed Treecreeper population in the Carrathool LGA south of the Lachlan River and Griffith LGA.
Emu (<i>Dromaius novaehollandiae</i>)	Emu population in the NSW North Coast Bioregion and Port Stephens LGA.
Little Penguin (<i>Eudyptula minor</i>)	Little Penguin population in the Manly Point Area.
Broad-toothed Rat (<i>Mastacomys fuscus</i>)	Broad-toothed Rat population at Barrington Tops in the Gloucester, Scone and Dungog LGAs.
Long-nosed Bandicoot (<i>Perameles nasuta</i>)	Long-nosed Bandicoot population at North Head.
	Long-nosed Bandicoot in inner west Sydney.
Long-nosed Potoroo (<i>Potorous tridactylus</i>)	Long-nosed Potoroo population at Cobki Lakes and Tweed Heads West.
Squirrel Glider (<i>Petaurus norfolcensis</i>)	Squirrel Glider population on the Barrenjoey Peninsula, north of Bushrangers Hill.
	Squirrel Glider population in the Wagga Wagga LGA.
Greater Glider (<i>Petauroides volans</i>)	Greater Glider population in the Eurobodalla LGA.
Yellow-bellied Glider (<i>Petaurus australis</i>)	Yellow-bellied Glider population on the Bago Plateau.
Koala (<i>Phascolarctos cinereus</i>)	Koala population in the Hawks Nest and Tea Gardens area.
	Koala population in the Pittwater LGA.
<i>Menippus fugitives</i> (a beetle)	<i>Menippus fugitivus</i> population in the Sutherland Shire.

None of the endangered populations in Table B-2 occur within the study area. Therefore, Factor (b) is not applicable to the proposed modification and is indicated as such in the following Assessments of Significance.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

This factor provides for consideration of the local occurrence of an ecological community and any modification to the composition of the community (DECC, 2007a).

In accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC, 2007a), this factor also provides for an assessment of the impact to species components of an ecological community and consideration of their function.

- (d) In relation to the habitat of a threatened species, population or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
 - (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

This factor has three parts. Part (i) of this factor requires an assessment of the extent of habitat removal or modification as a result of the proposed modification, Part (ii) of this factor requires an assessment of the likelihood of an area to become fragmented or isolated and Part (iii) of this factor requires an assessment of the importance of the habitat to the long-term survival of the species, population or ecological community. When applying this factor, consideration is given to impacts (e.g. short-term, long-term, direct and indirect) on known and potential habitat.

In accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC, 2007a), applying this factor has involved the following steps:

- *An assessment of the area and quality of habitat of the threatened species, population or ecological community that occurs within the locality...*
- *An estimate of the area and quality that the habitat of the study area represents in relation to the area and quality of that habitat within the locality.*
- *An assessment of the role of the habitat to be affected in sustaining habitat connectivity in the locality.*
- *An assessment of the ecological integrity of the habitat to be affected in the study area, in relation to the ecological integrity, tenure and security of the habitat which will remain both in the study area and in the locality.*

Factors such as habitat clearance, fire, damming, road/freeway construction, fences, mining/quarrying, etc. can create a barrier to the dispersal of some species. The type of barrier and the species involved will determine the level of impact on dispersal capability or the degree of isolation.

Factor (d) is applicable to the threatened species and ecological communities presented in Section B2.

- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Factor (e) considers whether the proposed modification is likely to affect land that is, or is part of, critical habitat. Table B-3 provides a list of critical habitat currently (28 May 2009) listed in the Register of Critical Habitat kept by the Director-General of the DECC and the Register of Critical Habitat kept by the Director-General of the Department of Primary Industries (DPI) (DECC, 2009d; DPI, 2009a).

Table B-3
Critical Habitat in the Registers of Critical Habitat

Critical Habitat	Declaration Status
DECC	
<i>Bomaderry zieria</i> within the Bomaderry bushland	Pending finalisation
Eastern Suburbs Banksia Scrub Endangered Ecological Community (EEC)	Preparation of final version of declaration
Gould's Petrel (<i>Pterodroma leucoptera leucoptera</i>)	Final declaration made November 2006
<i>Wollemia nobilis</i> (the Wollemi Pine)	Final declaration made December 2006
Little penguin population in Sydney's North Harbour	Final declaration made September 2002
Mitchell's Rainforest Snail in Stotts Island Nature Reserve	Final declaration made October 2001
DPI	
Grey Nurse Shark Critical Habitat	Final declaration made 2002

No declared critical habitat is identified within the Local Environmental Plan applicable to the proposed modification. There are no Regional Environmental Plans that are applicable to the proposed modification. Further no critical habitat listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) occurs within the vicinity of the study area.

Considering the above, there is no critical habitat within the vicinity of the study area as designated by the Register of Critical Habitat held by the Director-General of the DECC or the Director-General of the DPI.

Factor (e) is not applicable to the proposed modification, as no critical habitat occurs within the study area, and is indicated as such in the following Assessments of Significance.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The DECC and Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) internet sites (DECC, 2009e; DEWHA, 2009) were searched for approved or draft recovery plans and threat abatement plans relevant to the species listed in Table B-1. There were no applicable recovery plans. Threat abatement plans applicable to species assessed in this document are listed in Table B-4.

Table B-4
Threat Abatement Plans Applicable to Threatened Species Assessed Against Factors of Significance

Threat Abatement Plans
DEWHA
<i>Threat Abatement Plan for Competition and Land Degradation by Rabbits</i> (DEWHA, 2008a)
<i>Threat Abatement Plan for Predation by the European Red Fox</i> (DEWHA, 2008b)
<i>Threat Abatement Plan for Beak and Feather Disease Affecting Endangered Psittacine Species</i> (DEH, 2005)
<i>Threat Abatement Plan for Infection of Amphibians with Chytrid Fungus Resulting in Chytridiomycosis</i> (DEH, 2006)
DECC
<i>NSW Threat Abatement Plan. Predation by the Red Fox (Vulpes vulpes)</i> (NPWS, 2001a)
<i>NSW Threat Abatement Plan. Predation by Gambusia holbrooki - The Plague Minnow</i> (NPWS, 2003)

In 2004, amendments were made to the TSC Act and FM Act which remove the mandatory requirement for the government departments to prepare recovery plans and threat abatement plans, and instead require the government department to prepare a *Threatened Species Priorities Action Statement* (PAS). The PAS (DECC, 2007b) sets out the measures required to promote the recovery of each threatened species, population and ecological community to a position of viability in nature and for managing each key threatening process. Despite the new approach to recovery and threat abatement planning, existing recovery plans and threat abatement plans remain in place.

In applying this Factor (f), consideration was given to measures outlined in the PAS (DECC, 2007b) as well as existing threat abatement plans. Factor (f) is applicable to the threatened fauna species presented in Section B2.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There is currently (28 May 2009) 33 key threatening processes listed under the TSC Act (DECC, 2009f) and seven listed under the FM Act (DPI, 2009b) (Table B-5).

Table B-5
Key Threatening Processes under the *Threatened Species Conservation Act, 1995* and *Fisheries Management Act, 1994*

Key Threatening Process	Type of Threat
TSC Act	
Invasion, establishment and spread of Lantana (<i>Lantana camara</i>)	Weed
Invasion and establishment of exotic vines and scramblers	Weed
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i>	Weed
Invasion of native plant communities by exotic perennial grasses	Weed
Invasion and establishment of Scotch Broom (<i>Cytisus scoparius</i>)	Weed
Invasion and establishment of the Cane Toad (<i>Bufo marinus</i>)	Pest animal
Competition and grazing by the feral European Rabbit (<i>Oryctolagus cuniculus</i>)	Pest animal
Competition and habitat degradation by Feral Goats (<i>Capra hircus</i>)	Pest animal
Competition from feral honeybees (<i>Apis mellifera</i>)	Pest animal
Herbivory and environmental degradation caused by feral deer	Pest animal
Importation of Red Imported Fire Ants (<i>Solenopsis invicta</i>)	Pest animal
Introduction of the Large Earth Bumblebee (<i>Bombus terrestris</i>)	Pest animal
Invasion of the Yellow Crazy Ant (<i>Anoplolepis gracilipes</i>)	Pest animal
Predation by the Feral Cat (<i>Felis catus</i>)	Pest animal
Predation by the European Red Fox (<i>Vulpes vulpes</i>)	Pest animal
Predation by the Plague Minnow (<i>Gambusia holbrooki</i>)	Pest animal
Predation by the Ship Rat (<i>Rattus rattus</i>) on Lord Howe Island	Pest animal
Predation, habitat degradation, competition and disease transmission by feral pigs (<i>Sus scrofa</i>)	Pest animal
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	Habitat loss/change
Bushrock removal	Habitat loss/change
Loss of hollow-bearing trees	Habitat loss/change
Clearing of native vegetation	Habitat loss/change
Alteration of habitat following subsidence due to longwall mining	Habitat loss/change
High frequency fire resulting in the disruption of lifecycle processes in plants and animals and loss of vegetation structure and composition	Habitat loss/change

Table B-5 (Continued)
Key Threatening Processes under the *Threatened Species Conservation Act, 1995* and
Fisheries Management Act, 1994

Key Threatening Process	Type of Threat
TSC Act (Continued)	
Anthropogenic climate change	Habitat loss/change
Loss and/or degradation of sites used for hill-topping by butterflies	Habitat loss/change
Removal of dead wood and dead trees	Habitat loss/change
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	Habitat loss/change
Infection by Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species and populations	Disease
Infection of frogs by amphibian chytrid causing the disease Chytridiomycosis	Disease
Infection of native plants by <i>Phytophthora cinnamomi</i>	Disease
Death or injury to marine species following capture in shark control programs on ocean beaches	Other
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	Other
FM Act	
Degradation of native riparian vegetation along NSW water courses	Habitat loss/change
Hook and line fishing in areas important for the survival of threatened fish species	Other
Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams	Habitat loss/change
Introduction of fish to waters within a river catchment outside their natural range	Pest animal
Introduction of non-indigenous fish and marine vegetation to the coastal waters of NSW	Pest animal
Removal of large woody debris from NSW rivers and streams	Habitat loss/change
The current shark meshing programme in NSW waters	Other

The applicable threatening processes listed in Table B-5 have been considered in the following assessment for threatened species and ecological communities (Section B2).

B2 ASSESSMENTS OF SIGNIFICANCE

B2.1 FLORA SPECIES

B2.1.1 Austral Pillwort (*Pilularia novae-hollandiae*)

- (a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Austral Pillwort is a widespread, small semi-aquatic perennial fern that grows in seasonally dry depressions, margins of marshes and gilgai country when wet (Bower, 1997). The growth cycle begins when gilgai depressions fill with water in wet winters and is completed before the mud dries out in summer (Bower, 1998). Austral Pillwort consist of long, slender creeping rhizomes just below the mud surface from which arise the filiform bright green fronds in groups of two or three at intervals of about 1 centimetre (cm) (Harden, 1990-2002; Bower, 1998).

A number of targeted searches have been conducted for the Austral Pillwort across ML 1535 and surrounding areas (FloraSearch, 2008).

The surveys indicated that the Austral Pillwort is a relatively common inhabitant of saturated gilgai depressions not only in ML 1535 but also in much of the gilgai habitat that is found along the western margin of Lake Cowal both to the north and south of ML 1535 (Bower, 1998). Table B-6 provides the distribution and abundance of the Austral Pillwort recorded during a survey of the proposed modification area.

Table B-6
Distribution and Abundance of the Austral Pillwort in the Lake Cowal Area

Number	Location (easting, northing)	Approximate Distance from ML 1535	Number of Gilgai Depressions with Austral Pillwort	Abundance within Gilgai
1	536402, 6281265	0.9 km north	3	Rare
			4	Common
			1	Moderately Common
			2	Abundant
2	536660, 6282289	1.9 km north	1	Moderately Common
			2	Common
			2	Abundant
3	536126, 6283986	3.7 km north	3	Rare
			1	Common
			1	Abundant
4	535969, 6285173	6.6 km north	2	Moderately Common
			5	Abundant
5	539237, 6272458	5.3 km south-southeast	4	Rare
			1	Moderately Common
			13	Abundant

Source: Adapted from Bower (1998).

Bower (1998) noted that the Austral Pillwort grew most commonly in gilgai depressions with a sticky grey mud base and was absent from depressions with friable or stony soils. The gilgai depressions in the proposed modification area occur on gravelly red cracking clay soils that are not favoured by *P. novae-hollandiae* (FloraSearch, 2008). In addition, the depressions did not have the sealed grey clay bases usually associated with Austral Pillwort (Bower 1998), all had basal holes to the substrate below (FloraSearch, 2008). It was concluded the depressions on the proposed modification area are unlikely to support populations of the Austral Pillwort (FloraSearch, 2008).

Therefore, it is unlikely that the proposed modification would have an adverse effect on the lifecycle of the Austral Pillwort such that a viable local population of the species is likely to be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) *In relation to the habitat of a threatened species, population or ecological community:***

- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

As described above, although gilgai depressions occur in the proposed modification area, they are considered to be unsuitable as habitat for the Austral Pillwort (FloraSearch, 2008). Therefore, the proposed modification would not remove or modify habitat for the Austral Pillwort.

The Austral Pillwort is known to occur to the north and south of the proposed modification area. These populations are already bisected by ML1535. The proposed modification may further reduce physical connectivity. However, this is unlikely to be biologically significant given the probable dispersal of the species sporocarps by water birds. Austral Pillwort is known to be eaten by herbivorous water fowl (Mark Clayton, CSIRO Division of Sustainable Ecosystems, pers. comm.) and its sporocarps are likely to be dispersed in their droppings. Hence, physical habitat connectivity is unlikely to be necessary for the exchange of genetic material between the northern and southern populations of Austral Pillwort on the western side of Lake Cowal.

- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Not applicable. Refer to Section B1.4(e).

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

No NSW or Commonwealth recovery plan is available for the Austral Pillwort and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

- (g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Clearing native vegetation is a key threatening process listed under the TSC Act and the EPBC Act. However, the vegetation clearance required for the proposed modification would not impact on this species, given that proposed modification would not remove or modify habitat for the Austral Pillwort.

B2.1.2 A Speargrass (*Austrostipa wakoolica*)

- (a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Austrostipa wakoolica is a densely tufted grass which grows to 1 metre (m) in height. *Austrostipa wakoolica* occurs on grey clay floodplain soils of the Murray River and tributaries (Vickery *et al.*, 1986, Jacobs and Hastings 1993). There is one record validated by a herbarium specimen in the nearby region, located some 22 km north-northwest of ML 1535.

Austrostipa wakoolica flowers from October to December, usually in response to rain (DECC, 2009a; SRBG, 2009b). Seed is dispersed via wind, rain and flood events, with the floret appearing to have adapted to burying the seed into the soil. This species is unlikely to have a long-lived seed bank, with seeds only considered viable for a period of three to five years (*ibid.*).

Threats relevant to the *Austrostipa wakoolica* include (DECC, 2009a):

- *Habitat reduction and modification from pastoral development, irrigation and altered flooding regimes.*
- *Grazing; total grazing pressure has increased with higher numbers of rabbits, domestic stock and kangaroos. The species is probably palatable to sheep and rabbits.*
- *Drought, as the species is rainfall-dependant, the flowering season is affected by drought or prolonged dry periods.*
- *Weed invasion and competition, particularly from exotic grasses.*

The SRBG (2009a) and DECC (2009c) databases contains records of this species within a wide search area surrounding the proposed modification area.

Limited potential floodplain habitat resources for *Austrostipa wakoolica* (i.e. within the lake shore and shallower inundation areas of the lake) occur within the proposed modification area, however, it is considered unlikely that *Austrostipa wakoolica* occurs within the proposed modification area given it has not been previously recorded at Lake Cowal (FloraSearch, 2008). *Austrostipa wakoolica* was targeted in March 2008 and no plants were found (*ibid.*). Since it is a large conspicuous species, it is unlikely to have been overlooked in the targeted survey in 2008, which identified two other *Austrostipa* species (*ibid.*).

It is unlikely that the proposed modification would have an adverse effect on the lifecycle of *Austrostipa wakoolica* such that a viable local population of this species is likely to be placed at risk of extinction.

- (b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable. Refer to Section B1.4(b).

- (c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or**
 - (i) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable. Refer to Section B1.4(c).

- (d) In relation to the habitat of a threatened species, population or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
 - (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Some limited potential floodplain habitat resources for *Austrostipa wakoolica* (e.g. within the lake shore and shallower inundation areas of the lake) occur within the proposed modification area. However, this species has not been previously recorded at Lake Cowal. *Austrostipa wakoolica* was targeted in March 2008 in appropriate habitats and no plants were found (*ibid.*).

Although the proposed modification may result in disturbance to a small portion of limited potential habitat for *Austrostipa wakoolica*, that limited potential habitat is not considered to be important to the long-term survival of the species.

Given that the seed of this species is dispersed via wind, rain and flood events (DECC, 2009a) and since limited habitat for *Austrostipa wakoolica* occurs in the proposed modification area, it is considered unlikely that this species' habitat would be fragmented or isolated from other areas of habitat as a result of the proposed modification (were this species to occur at Lake Cowal).

Further, the design and installation of the pipeline to the saline groundwater supply borefield within Lake Cowal would minimise disturbance to soil and vegetation communities.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Not applicable. Refer to Section B1.4(e).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No NSW or Commonwealth recovery plan is available for *Austrostipa wakoolica* and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing native vegetation is a key threatening process listed under the TSC Act and the EPBC Act. However, the vegetation clearance required for the proposed modification is unlikely to significantly impact on this species, given that it is unlikely that this species occurs within the proposed modification area since it has not been previously recorded at Lake Cowal.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.1.3 Winged Peppercress (*Lepidium monolocoides*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Winged Peppercress (*Lepidium monolocoides*) is an erect, branched, annual herb or perennial forb (DECC, 2009a). Growing to between 15 to 20 cm high, it may be found on seasonally moist to waterlogged sites, on heavy fertile soils (*ibid.*). Its habitat is usually open woodland dominated by Bulloak (*Allocasuarina luehmannii*) and/or eucalypts, including Black Box (*Eucalyptus largiflorens*) and Poplar Box (*Eucalyptus populnea*) (*ibid.*). Records have also been made in a wetland-grassland community (*ibid.*).

The Winged Peppercress produces inflorescences from August to October and sometimes until December (Harden, 1990; Ayers *et al.*, 1996).

The most recent records of the Winged Peppercress are from alluvial soils, although many records from the late 1800s refer to mallee scrub on sandhills (Leigh *et al.*, 1984). Cunningham *et al.* (1981) note its occurrence in Poplar Box, *Eucalyptus populnea*, communities. Early records suggest it was widespread and common in western NSW (Leigh *et al.*, 1984). The nearest historical published record is Lake Cargelligo 100 km from ML1535 (Leigh *et al.*, 1984; Entwistle, 1996; Retter and Harden, 2000). The closest recent published records are from the shore of Lake Urana (NPWS, 2001b) to the south and Narran Lake to the north (NPWS, 2000) of the proposed modification area.

Threats relevant to the Winged Peppercreess include (DECC, 2009a):

- *Agricultural development (most of the former range of the species has been extensively used for agriculture, cropping and improved pasture).*
- *Habitat removal (small depressions that were former principal habitat eliminated by ploughing).*
- *Grazing (the species is highly palatable to rabbits and kangaroos).*
- *Disturbances associated with a Navy-owned communications tower, service roads and fire-breaks.*
- *Pugging and trampling by stock.*

The Winged Peppercreess was collected from widely scattered localities, with large numbers of historical records but few recent collections. Collections were widespread in the semi-arid western plains regions of NSW. There is a single collection from Broken Hill, but only two collections since 1915, the most recent being 1950 (DEC, 2009a). No records of the Winged Peppercreess occur in the Atlas of NSW Wildlife (DECC, 2009c), or SRBG (2009a) database for a search area surrounding the proposed modification area.

Given the records in lakes to the north and south of the proposed modification area, this species may have formerly occurred at Lake Cowal. However, given the limited potential habitat resources within the proposed modification area (FloraSearch, 2008), and this species has not been previously recorded at Lake Cowal, it is unlikely that the proposed modification would have an adverse effect on the lifecycle of the Winged Peppercreess such that a viable local population of this species is likely to be placed at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(b).

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

(d) *In relation to the habitat of a threatened species, population or ecological community:*

- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Some limited potential floodplain habitat resources for the Winged Peppercreess occur within the proposed modification area (e.g. within the lake shore and shallower inundation areas of the lake). However, this species has not been previously recorded at Lake Cowal.

Although the proposed modification may result in disturbance to a small portion of limited potential habitat for the Winged Peppercress, that limited potential habitat is not considered to be important to the long-term survival of the species.

Further, the design and installation of the pipeline to the saline groundwater supply borefield within Lake Cowal would minimise disturbance to soil and vegetation communities.

The proposed works are unlikely to result in the fragmentation or isolation of potential habitat for this species (were this species to occur at Lake Cowal).

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

Not applicable. Refer to Section B1.4(e).

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No NSW or Commonwealth recovery plan is available for the Winged Peppercress and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Winged Peppercress (NSW Scientific Committee, 2001a; DECC, 2009g). However, the vegetation clearance required for the proposed modification is unlikely to significantly impact on this species, given that it is unlikely that this species occurs within the proposed modification area since it has not been previously recorded at Lake Cowal.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.1.4 Spiny Peppercress (*Lepidium aschersonii*)

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Spiny Peppercress (*Lepidium aschersonii*) is a perennial herb which grows to approximately 30 cm in height (DECC, 2009a). It inhabits ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), with *Austrodanthonia* and/or *Austrostipa* species in the understorey (*ibid.*). Vegetation structure varies from open to dense Brigalow, with sparse grassy understorey and occasional heavy litter.

Flowering from spring to autumn, this species tends to grow well under dry conditions and is reportedly salt tolerant (DECC, 2009a). Plant numbers appear to increase during drought, and may reappear several seasons later following flooding inundation (*ibid.*).

Threats relevant to the Spiny Peppercreess include (DECC, 2009a):

- *Weed invasion (intense competition from trees and introduced grasses reduces plant densities).*
- *Grazing (grazed by stock and rabbits at basal rosette stage).*
- *Land development (tree clearing, levelling and crop establishment).*
- *Trampling and soil compaction (reduces seedling regeneration).*
- *Roadworks and rubbish dumping.*
- *Grazing by introduced snails and slugs.*

Prior to 2004, little was known about the occurrence of the Spiny Peppercreess in Central Western NSW. The main extant populations were thought to occur in Victoria (Leigh *et al.*, 1984; Entwistle, 1996; Harris and Smith, 2000; Retter and Harden, 2000) on heavy clay soils near salt lakes and swamps, usually with seasonal inundation or waterlogging. Three historic records from 1915, 1931 and 1943 exist for the wider Lake Cowal region (DECC, 2009c; SRBG, 2009a). It was recorded in 1993 at Narrabri, but not at former locations at Temora, West Wyalong or Barmedman (Harris and Smith, 2000).

In 1999 it was located approximately 6 km west of the approved CGM access road (DECC, 2009c; SRBG, 2009a).

Targeted searches conducted for the Spiny Peppercreess in January 2004 found it at nine locations in the West Wyalong – Barmedman area in a diverse range of habitats (Bower, 2004). Most populations occurred in Belah (*Casuarina cristata*) woodland on gilgai soils, however the species was also recorded in mallee dominated by Bull Mallee (*Eucalyptus behriana*) as well as Grey Box (*E. microcarpa*)/Bull Oak (*Allocasuarina luehmannii*) woodland. The number of individuals estimated at each site ranged from approximately 20 to over several thousand and totalled well in excess of 10,000 plants (Bower, 2004).

Limited potential habitat resources for the Spiny Peppercreess occur within the proposed modification area and this species has not been recorded within ML 1535, despite several flora surveys (FloraSearch, 2008). The Spiny Peppercreess was targeted in March 2008 in appropriate habitats and no plants were found (*ibid.*). As such it is unlikely that the proposed modification would have an adverse effect on the lifecycle of the Spiny Peppercreess such that a viable local population of this species is likely to be placed at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(b).

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) In relation to the habitat of a threatened species, population or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
 - (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Some limited potential habitat resources for the Spiny Peppercreess occur within the proposed modification area. However, this species has not been recorded within ML 1535, despite several flora surveys (FloraSearch, 2008). The Spiny Peppercreess was targeted in March 2008 in appropriate habitats and no plants were found (*ibid.*).

Although the proposed modification may result in disturbance to a small portion of limited potential habitat for the Spiny Peppercreess, that limited potential habitat is not considered to be important to the long-term survival of the species.

Further, the design and installation of the pipeline to the saline groundwater supply borefield within Lake Cowal would minimise disturbance to soil and vegetation communities.

The proposed works are unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Not applicable. Refer to Section B1.4(e).

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

No NSW or Commonwealth recovery plan is available for the Spiny Peppercreess and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

- (g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of *Lepidium aschersonii* (NSW Scientific Committee, 2001a; DECC, 2009g). However, the vegetation clearance required for the proposed modification is unlikely to significantly impact on this species, given that it is unlikely that this species occurs within the proposed modification area since it has not been previously recorded within ML 1535.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.2 FAUNA SPECIES

B2.2.1 Sloane's Froglet (*Crinia sloanei*)

- (a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.***

The Sloane's Froglet is most common in woodlands, floodplains, grasslands, and open and disturbed areas. Within these habitats they shelter under logs and other debris, usually in moist depressions or near water. The Sloane's Froglet breeds from late winter to spring and small eggs are laid singly (DECC, 2009a).

Individual froglets may group together either seasonally, such as at breeding sites, or they may occupy discrete habitat patches within the broader landscape, such as discrete water bodies or drainage units (Frogs Australia Network, 2008).

Threats relevant to the Sloane's Froglet include (DECC, 2009a):

- *Degradation of habitat and water quality through clearing and grazing.*
- *Drought and longer term climate change impacts on the presence, persistence and seasonality of water at breeding sites. This in turn impacts on recruitment and persistence of populations.*
- *Changes in water availability, flow and flooding regimes in creeks, rivers, floodplains and wetlands.*
- *The susceptibility of C. sloanei to the amphibian chytrid fungus is not known.*

The Sloane's Froglet was recorded within Lake Cowal by Gunninah Consultants (1995) and records are contained within the DECC Wildlife Atlas from 1995 and 1997. Despite many surveys, this froglet has not been recorded within ML 1535.

It is possible that the proposed modification would remove or modify a portion of habitat resources which may be occasionally utilised by this species, given the occurrence of potential habitat for this species in low lying areas within Cleared Agricultural Land with Scattered Trees as well as within the ephemeral drainage line.

However, the proposed modification is unlikely to significantly disrupt the breeding cycle, foraging behaviour or dispersal ability of a local population (if one existed) given the availability of ephemeral habitat within Lake Cowal and in similar agricultural lands in the immediate surrounds. That is, it is unlikely that the proposed modification would have an adverse effect on the lifecycle of the Sloane's Froglet such that a viable local population of the species is likely to be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or**
- (i) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable. Refer to Section B1.4(c).

(d) In relation to the habitat of a threatened species, population or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
- (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

It is possible that the proposed modification would remove or modify a portion of habitat resources which may be occasionally utilised by this species, given the occurrence of potential habitat for this species in low lying or gilgai areas within Cleared Agricultural Land with Scattered Trees as well as within the ephemeral drainage line. However, it is noted that despite many surveys, the Sloane's Froglet has not been recorded within ML 1535.

The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species, given the availability of ephemeral habitat within Lake Cowal and in similar agricultural lands in the immediate surrounds.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Not applicable. Refer to Section B1.4(e).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The threat abatement plans which are relevant to the threats of the Sloane's Froglet are:

- *Threat Abatement Plan for Infection of Amphibians with Chytrid Fungus Resulting in Chytridiomycosis* (DEH, 2006); and
- *NSW Threat Abatement Plan. Predation by Gambusia holbrooki - The Plague Minnow* (NPWS, 2003).

These threat abatement plans are not relevant to the threats which may result from the proposed modification.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Sloane's Froglet (NSW Scientific Committee, 2001a; DECC, 2009g). However, the vegetation clearance required for the proposed modification is unlikely to significantly impact on this species, given the relatively small areas of native vegetation to be cleared and the availability of ephemeral habitat within Lake Cowal and in similar agricultural lands in the immediate surrounds. Further, this species has not been previously recorded within ML 1535.

Other key threatening processes listed under Schedule 3 of the TSC Act which are relevant to the Sloane's Froglet are anthropogenic climate change (NSW Scientific Committee, 2000), predation by the Plague Minnow (NPWS, 2003), alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (NSW Scientific Committee, 2002a) and infection by amphibian chytrid causing the disease Chytridiomycosis (DECC, 2009g; DEH, 2006). The proposed modification would not increase the impact of these key threatening processes.

B2.2.2 Magpie Goose (*Anseranas semipalmata*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Magpie Goose (*Anseranas semipalmata*) lives in shallow wetlands (less than 1 m deep), dry ephemeral swamps, wet grasslands and floodplains with dense growth of rushes or sedges (DECC, 2009a). During the dry season this species has also been known to utilise dry floodplains (Pizzey, 1980 in Ayers *et al.*, 1996).

Breeding of the Magpie Goose is strongly influenced by water levels, occurring in both summer and winter dominated rainfall areas (DECC, 2009a). The majority of breeding occurs in monsoonal areas, and is unlikely to occur in south-eastern Australia (*ibid.*).

The Magpie Goose nests in extensive colonies (Garnett and Crowley, 2000), with nests consisting of woven platforms constructed from the dominant aquatic vegetation at each site (Ayers *et al.*, 1996). Closely built nests are often found in tall erect vegetation (up to 1-2 m high) approximately 25-50 cm above the water line, in water between 60 and 100 cm deep (Pizzey, 1980 and Marchant and Higgins, 1990 in Ayers *et al.*, 1996).

The Magpie Goose exhibits a marked preference for feeding in open places, including the shallow water at lagoon edges (Slater *et al.*, 1995), and perch and loaf freely in trees as well as roosting communally (Lindsey, 1992). Feeding mainly on bulbs, roots and seeds of various aquatic plants, especially sedges, rushes and rice (*ibid.*), the Magpie Goose is also known to feed on terrestrial plants (Frith, 1982; Schodde and Tidemann, 1997) and aquatic invertebrates (Barker and Vestjens, undated).

This species is often seen in trios or flocks (DECC, 2009a). The Magpie Goose is nomadic with movements controlled by seasonal changes in the availability of food (Frith, 1977 in Ayers *et al.*, 1996). During the dry season the Magpie Goose shifts from one drying swamp to another until concentrating around the most permanent water source (Schodde and Tidemann, 1997).

Threats relevant to the Magpie Goose include (DECC, 2009a):

- *Inappropriate hydrological regimes of wetland habitats through drainage of swamps, ponds, dams and other wetlands for agricultural and other human purposes.*
- *Degradation of habitat through water pollution (e.g. salinity, chemicals, eutrophication).*
- *Modification of habitat and nest loss from trampling and overgrazing.*
- *Predation on eggs and goslings.*
- *Too-frequent burning of wetlands.*

The Atlas of NSW Wildlife (DECC, 2009c) indicates the Magpie Goose has been recorded at several locations in the region. The Magpie Goose was observed on two occasions during the pre-clearance surveys within ML 1535 in 2005 under very wet conditions. The first observation was a pair of Magpie Geese observed flying overhead (Barrick, 2005) and the second observation was a Magpie Goose in a temporary inundated area created by ponded water from rainfall.

Other records of this species occur in the Birds Australia (2009) database for a search area surrounding the proposed modification area.

Lake Cowal and immediate surrounds provide habitat resources for this species during periods when the lake contains water.

Limited habitat for the Magpie Goose would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants (e.g. within the lake shore and shallower inundation areas of the lake). The Magpie Goose is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(b).

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) In relation to the habitat of a threatened species, population or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
 - (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Magpie Goose, that potential habitat is not considered to be important to the long-term survival of the species in the locality.

This species is nomadic with movements controlled by seasonal changes in the availability of food (Frith, 1977 in Ayers *et al.*, 1996). During the dry season the Magpie Goose shifts from one drying swamp to another until concentrating around the most permanent water source (Schodde and Tidemann, 1997). Due to the nomadic nature of the Magpie Goose, fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Magpie Goose are considered to be any suitable waterbodies which occur within this species' distribution. Given the above, the proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Not applicable. Refer to Section B1.4(e).

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

No NSW or Commonwealth recovery plan is available for the Magpie Goose and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

- (g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act which is applicable to this species (NSW Scientific Committee, 2001a). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that a significant impact on this species is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.2.3 Blue-billed Duck (*Oxyura australis*)

- (a) ***In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.***

The Blue-billed Duck (*Oxyura australis*) is an almost wholly aquatic species favouring deep water in large permanent wetlands and swamps with dense aquatic vegetation (DECC, 2009a). Non-breeding flocks congregate on large, deep, open freshwater dams and lakes during autumn and winter (Pizzey, 1980 in Ayers *et al.*, 1996). Sewage ponds, large rivers and saline water bodies are also inhabited by this species during non-breeding periods (Marchant and Higgins, 1990 in Ayers *et al.*, 1996).

Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes, and some long-distance dispersal to breed during spring and early summer (DECC, 2009a). A bowl-shaped nest is constructed in trampled vegetation in Lignum, sedges or Spike-rushes, with a common clutch size of five or six (*ibid.*).

Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies. Feeding occurs in open water within or beside tall dense vegetation (Frith, 1982).

This species is regionally and seasonally nomadic readily colonising new areas of suitable habitat as they form following floods (Ayers *et al.*, 1996). Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (DECC, 2009a). These areas may be up to 300 km away (*ibid.*).

Threats relevant to the Blue-Billed Duck include (DECC, 2009a):

- *Frequent burning which reduces the diversity of woody plant species.*
- *Destruction or degradation of breeding habitat through drainage, flood mitigation works and ground water extraction.*
- *Regulation of river flows and water harvesting schemes can poses a major threat to flooding regimes of inland wetland breeding areas.*
- *Clearing and overgrazing of Cumbungi and Lignum.*
- *Increased salinity can result in degradation and loss of tall dense wetland vegetation used for nesting.*
- *Illegal hunting.*
- *Pesticides and herbicide pollution of wetlands.*
- *Rubbish dumping.*

The Blue-billed Duck is endemic to south-eastern and south-western Australia, but is most common in the southern Murray-Darling Basin area (DECC, 2009a). Generally they are only seen in coastal areas during summer or in drier years (*ibid.*). The Atlas of NSW Wildlife (DECC, 2009c) indicates the Blue-billed Duck has been recorded at several locations in the region.

Other records of this species occur in the Birds Australia (2009) and Australian Museum (2009) databases for a search area surrounding the proposed modification area.

Lake Cowal and immediate surrounds provide habitat resources for this species during periods when the lake contains water.

Limited habitat for the Blue-billed Duck would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants (e.g. within the lake shore and shallower inundation areas of the lake). The Blue-billed Duck is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) *In relation to the habitat of a threatened species, population or ecological community:***
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
 - (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Blue-Billed Duck, the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

This species is regionally and seasonally nomadic readily colonising new areas of suitable habitat as they form following floods (Ayers *et al.*, 1996). Due to the nomadic nature of the Blue-billed Duck, fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Blue-billed Duck are considered to be any suitable waterbodies which occur within this species distribution. Given the above, the proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

Not applicable. Refer to Section B1.4(e).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No NSW or Commonwealth recovery plan is available for the Blue-billed Duck and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Blue-billed Duck (NSW Scientific Committee, 2001a; DECC, 2009g). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that a significant impact on this species is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

Another key threatening process listed under Schedule 3 of the TSC Act which is relevant to the Blue-billed Duck is the alteration of natural flow regimes of rivers and streams and their floodplains and wetlands (NSW Scientific Committee, 2002a). However, the scale of disturbance associated with the proposed modification is such that an impact on the Blue-billed Duck is not likely.

B2.2.4 Freckled Duck (*Stictonetta naevosa*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Freckled Duck (*Stictonetta naevosa*) inhabits permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree (DECC, 2009a). In inland eastern Australia, the largest numbers of Freckled Ducks occur in brackish to hypersaline wetlands that are densely vegetated with Lignum (Garnett and Crowley, 2000). During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds (DECC, 2009a).

The Freckled Duck nests between October and December, although this may occur at other times given favourable conditions (DECC, 2009a). Nests are usually located in dense vegetation at or near water level (*ibid.*). They are usually well constructed bowls of finely woven stems and sticks supported by a base of horizontal stems or accumulated litter (Pizzey, 1980 and Marchant and Higgins, 1990 in Ayers *et al.*, 1996).

The Freckled Duck feeds at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates (DECC, 2009a).

In most years, this species is nomadic between ephemeral inland wetlands (Garnett and Crowley, 2000). This species is typically gregarious regularly forming groups of 10 to 100 birds, but seldom seen in larger numbers (Ayers *et al.*, 1996).

Threats relevant to the Freckled Duck include (DECC, 2009a):

- *Draining and clearing of wetland and swamp habitat.*
- *Changes to natural river flows and flood patterns as a result of dams, weirs and irrigation.*
- *Grazing and trampling of wetland habitat by grazing stock.*
- *Illegal shooting.*

Seasonal changes control the distribution and abundance of the Freckled Duck (DECC, 2009a). It is found primarily in south-eastern and south-western Australia, breeding in large temporary swamps in the Bulloo and Lake Eyre basins and the Murray-Darling system (*ibid.*). During extensive inland droughts, the duck is forced to disperse to wetlands in the Murray River basin and may be found as far as coastal NSW and Victoria during such times (*ibid.*). The Atlas of NSW Wildlife (DECC, 2009c) indicates the Freckled Duck has been recorded at numerous locations in the region.

Other records of this species occur in the Birds Australia (2009) database. The closest record to the proposed modification area is located within Lake Cowal (Birds Australia, 2009).

Lake Cowal and immediate surrounds provide habitat resources for this species during periods when the lake contains water.

Limited habitat for the Freckled Duck would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants. The Freckled Duck is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) In relation to the habitat of a threatened species, population or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
 - (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Freckled Duck, the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

This species is regionally and seasonally nomadic readily colonising new areas of suitable habitat as they form following floods (Ayers *et al.*, 1996). Due to the nomadic nature of the Freckled Duck, fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Freckled Duck are considered to be any suitable waterbodies which occur within this species distribution. The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Not applicable. Refer to Section B1.4(e).

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

No NSW or Commonwealth recovery plan is available for the Freckled Duck and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

- (g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Freckled Duck (NSW Scientific Committee, 2001a; DECC, 2009g). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that an impact on the Freckled Duck is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.2.5 Australasian Bittern (*Botaurus poiciloptilus*)

- (a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Australasian Bittern (*Botaurus poiciloptilus*) inhabits terrestrial and estuarine wetlands, generally where there is permanent water (Marchant and Higgins, 1990 and Garnett, 1992 in NPWS, 1999a). The Australasian Bittern favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).

The Australasian Bittern typically breeds from October to January (DECC, 2009a). Nests are built in secluded places in densely-vegetated wetlands on a platform of reeds, with around six olive-brown eggs to a clutch (*ibid.*).

The diet of the Australasian Bittern consists of medium sized aquatic animals including frogs, fish, crustaceans, insects and snails, other small vertebrates including snakes and other reptiles, mammals and birds as well as leaves and fruit (Pizzey, 1980, Kingsford, 1991 and Barker and Vestjens, undated in Ayers et al., 1996; Schodde and Tidemann, 1997). Feeding platforms may be constructed over deeper water from reeds trampled by the bird and are often littered with prey remains (DECC, 2009a).

Although generally sedentary in areas of permanent habitat, the Australasian Bittern may be nomadic or migratory elsewhere and often moves in response to flooding and drought (Pizzey, 1980 and Serventy, 1985 in Ayers et al., 1996; NPWS, 1999a).

Threats relevant to the Australasian Bittern include (DECC, 2009a):

- *Drainage of wetlands and ponds.*
- *Reduced water quality due to siltation, pollution and salinity.*
- *Predation by foxes and cats.*
- *Use of herbicides, pesticides and other chemicals near wetland areas.*
- *Grazing and associated frequent burning of wetland areas.*

Australasian Bitterns are widespread but uncommon over south-eastern Australia (DECC, 2009a). In NSW they may be found over most of the state except for the far north-west (*ibid.*). The Birds Australia database (2009) indicates that an Australasian Bittern has been recorded within the region. Other records of this species occur in the Atlas of NSW Wildlife (DECC, 2009c).

The northern portions of Lake Cowal when the lake is full may provide habitat resources for this species.

Limited habitat for the Australasian Bittern would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants. The Australasian Bittern is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) *In relation to the habitat of a threatened species, population or ecological community:***
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
 - (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Australasian Bittern, the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

Without areas of permanent habitat, the Australasian Bittern is nomadic or migratory and often moves in response to flooding and drought (Pizzey, 1980 and Serventy, 1985 in Ayers *et al.*, 1996; NPWS 1999a). Due to the nomadic nature of the Australasian Bittern fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Australasian Bittern are considered to be any suitable waterbodies which occur within this species' distribution. The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

Not applicable. Refer to Section B1.4(e).

- (f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

No NSW or Commonwealth recovery plan is available for this species. Threat abatement plans which are relevant to the threats of the Australasian Bittern include:

- *Threat Abatement Plan for Predation by European Red Fox* (Environment Australia, 1999); and
- *Threat Abatement Plan for Predation by the Red Fox (Vulpes vulpes)* NPWS, 2001a).

These threat abatement plans are not relevant to the threats which may result from the proposed modification.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Australasian Bittern (NSW Scientific Committee, 2001a). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that an impact on the Australasian Bittern is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

Another key threatening process listed under Schedule 3 of the TSC Act which is relevant to the Australasian Bittern is predation by the European Red Fox (NPWS, 2001a; DECC, 2008b). The proposed modification would not increase the impact of this key threatening process.

B2.2.6 Brolga (*Grus rubicunda*)

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Brolga (*Grus rubicunda*) favours open wetlands, including shallow swamps, their margins and floodplains; grasslands, paddocks, ploughed fields, irrigated pastures, stubble crops and salt flats (Pizzey, 1980; Serventy, 1985 in Ayers *et al.*, 1996).

The Brolga nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Two eggs are laid from autumn to winter (DECC, 2009a). The Brolga vigorously defends a substantial breeding territory of up to 2.5 km² (Arnol *et al.*, 1984 in Ayers *et al.*, 1996).

Though Brolgas often feed in dry grassland, ploughed paddocks or desert claypans, they are also dependent on wetlands, particularly shallow swamps (DECC, 2009a). The Brolga diet consists of sedge roots and tubers, large insects, crustaceans, molluscs and frogs (*ibid.*).

The Brolga can be sedentary, but many are nomadic (Ayers *et al.*, 1996; Simpson and Day, 1999).

Threats relevant to the Brolga include (DECC, 2009a):

- *At least in former times, Brolgas were poisoned and shot because of their feeding incursions into crops, following drainage of swamps.*
- *Loss of wetland habitat through clearing and draining for flood mitigation and agriculture.*

Predation by the European Red Fox is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Brolga (NPWS, 2001a).

The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country (DECC, 2009a). It is still abundant in the northern tropics, but very sparse across the southern part of its range (*ibid.*). The Atlas of NSW Wildlife (DECC, 2009c) indicates the Brolga has been recorded at several locations within the region surrounding the proposed modification area.

Limited habitat for the Brolga would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants. The Brolga is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) *In relation to the habitat of a threatened species, population or ecological community:***
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
 - (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Brolga, the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

The Brolga can be sedentary, but many are nomadic (Ayers *et al.*, 1996; Simpson and Day, 1999). Fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Brolga are considered to be any suitable waterbodies which occur within this species' distribution. The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Not applicable. Refer to Section B1.4(e).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No NSW or Commonwealth recovery plan is available for this species.

Threat abatement plans which are relevant to the threats of the Brolga include:

- *Threat Abatement Plan for Predation by European Red Fox* (Environment Australia, 1999); and
- *Threat Abatement Plan for Predation by the Red Fox (Vulpes vulpes)* (NPWS, 2001a).

These threat abatement plans are not relevant to the threats which may result from the proposed modification.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Predation by the European Red Fox is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Brolga (NPWS, 2001a). The proposed modification would not increase the impact of this key threatening process.

B2.2.7 Black-tailed Godwit (*Limosa limosa*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Black-tailed Godwit (*Limosa limosa*) primarily inhabits coastal sand spits, lagoons and mudflats, however may also be found in inland mudflats and portions of large muddy lakes and swamps where the water is less than 10 cm deep during suitable conditions (DECC, 2009a). Individuals have also been recorded in wet fields and sewerage treatment works (*ibid.*).

The Black-tailed Godwit breeds from April to August in the Palaearctic (Mongolia and Siberia) and visits Australia during the summer (Kingsford, 1991 and Higgins and Davies, 1996 in NPWS, 1999b). Nests are a small shallow depression in the ground lined with grass and usually positioned amid sparse grass and other low lying plants in open marshy areas (Schodde and Tidemann, 1997). Four eggs are incubated for 22 to 24 days by both parents (*ibid.*).

The Black-tailed Godwit forages for insects, crustaceans, molluscs, worms, larvae, spiders, fish eggs, frog eggs and tadpoles in soft mud or shallow water (DECC, 2009a).

The Black-tailed Godwit migrates in dispersed pairs or sometimes loose colonies (Lindsey, 1992).

Threats relevant to the Black-tailed Godwit include (DECC, 2009a):

- *Hydrological changes to inland lakes and estuaries may modify or remove important areas of suitable habitat for individuals remaining in Australia over winter.*
- *Tourism, residential or agricultural developments reducing coastal and inland habitat areas.*

Breeding in Mongolia and Eastern Siberia (Palearctic), the Black-tailed Godwit is a migratory wading bird that flies to Australia for the southern summer (August to March) (DECC, 2009a). In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland (*ibid.*). Records indicate this species uses a regular inland passage, occurring around any of the large lakes in the western areas during summer when muddy shores are exposed (*ibid.*). The species has been recorded within the Murray-Darling Basin, on the western slopes of the Northern Tablelands and in the far north-western corner of the state (*ibid.*). The Atlas of NSW Wildlife (DECC, 2009c) indicates that the Black-tailed Godwit has been recorded within a search area surrounding the proposed modification area.

Lake Cowal and immediate surrounds provide potential habitat resources for this species during periods when the lake contains water.

Limited habitat for the Black-tailed Godwit would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants. The Black-tailed Godwit is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(b).

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

(d) *In relation to the habitat of a threatened species, population or ecological community:*

- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Black-tailed Godwit, the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

The Black-tailed Godwit migrates in dispersed pairs or sometimes loose colonies (Lindsey, 1992). Due to the migratory nature of this species, fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Black-tailed Godwit are considered to be any suitable waterbodies which occur within this species' distribution. The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Not applicable. Refer to Section B1.4(e).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No NSW or Commonwealth recovery plan is available for the Black-tailed Godwit and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act which is applicable to this species (NSW Scientific Committee, 2001a). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that a significant impact on this species is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.2.8 Australian Painted Snipe (*Rostratula benghalensis australis*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Australian Painted Snipe (*Rostratula benghalensis australis*) inhabits the fringes of swamps and other marshy areas, generally where there is a cover of samphire grasses, Lignum, low scrub, open timber (Ayers *et al.*, 1996; NSW Scientific Committee, 2004) and occasionally River Red Gum (*Eucalyptus camaldulensis*) and Poplar Box (*E. populnea*) (Garnett and Crowley, 2000). This species is most often recorded in freshly flooded areas or shallow fresh water swamps with rushes (Slater *et al.*, 1986 in Ayers *et al.*, 1996). Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland (Marchant and Higgins, 1993 in NPWS 1999c).

The Australian Painted Snipe breeds from October through to December in southern Australia and March through to May in the north (Schodde and Tidemann, 1997). The species roosts during the day in dense vegetation (NSW Scientific Committee, 2004). Nests consist of a scrape in the ground, lined with grass and leaves (Pringle, 1987 in NPWS, 1999c) and are constructed amongst tall vegetation, such as grass, tussocks or reeds (NPWS, 1999c).

The Australian Painted Snipe forages at dusk (NPWS, 1999c) in the shallow water along swamp edges (Ayers *et al.*, 1996). The diet of the Australian Painted Snipe consists of plant material such as the seeds of *Bromus* sp., *Heliotropium supinum* and *Atriplex* sp. and invertebrates such as worms, snails and water beetles (Barker and Vestjens, 1989 and Marchant and Higgins, 1993 in NPWS 1999c).

This species may be migratory in Australia (NSW Scientific Committee, 2004) and is likely to be nomadic in response to suitable conditions, such as floods (NPWS, 1999c).

Threats relevant to the Australian Painted Snipe include (DECC, 2009a):

- *Use of herbicides, insecticides and other chemicals near wetlands.*
- *Drainage of breeding sites in wetlands.*
- *Reduced water quality from siltation and pollution.*
- *Predation by foxes and feral cats.*
- *Grazing and associated frequent burning of wetlands.*

In the NSW South Western Slopes bioregion, potential habitat for this species predominantly occurs within parts of the Murrumbidgee, Lachlan and Macquarie Rivers and the associated tributaries and wetlands (DECC, 2009a). The Atlas of NSW Wildlife (DECC, 2009c) and Birds Australia database (2009) indicates the Australian Painted Snipe has been recorded at a few locations within the region.

The closest record of the Australian Painted Snipe is located within Lake Cowal (Birds Australia, 2009). Lake Cowal provides habitat resources for this species during periods when the lake contains water.

Limited habitat for the Australian Painted Snipe would be removed or changed by the proposed modification. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow-adapted wetland plants. The Australian Painted Snipe is unlikely to nest within the limited available habitat in the proposed modification area unless on-going wet conditions are present. Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) In relation to the habitat of a threatened species, population or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
 - (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Australian Painted Snipe, the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

The Australian Painted Snipe may be migratory in Australia and is likely to be nomadic in response to suitable conditions, such as floods (NSW Scientific Committee, 2004). Due to the migratory nature of this species, fragmentation of habitat appears to be a lesser threat to this species. Proximate habitat areas for the Australian Painted Snipe are considered to be any suitable waterbodies which occur within this species' distribution. The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

Not applicable. Refer to Section B1.4(e).

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

No NSW or Commonwealth recovery plan is available for the Australian Painted Snipe and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

- (g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act which is applicable to this species (NSW Scientific Committee, 2001a). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that a significant impact on this species is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.2.9 Superb Parrot (*Polytelis swainsonii*)

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Superb Parrot (*Polytelis swainsonii*) is associated with eucalypt forest, open woodland and watercourses particularly where River Red Gum, Box-Gum, Box-Cypress-pine and Boree Woodlands occur (DECC, 2009a).

The Superb Parrot breeds from September to January, nesting in hollows or holes in tall trees (DECC, 2009a). In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland (*ibid.*). On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees (*ibid.*). Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box (*ibid.*).

The Superb Parrot may forage up to 10 km from nesting sites, primarily in grassy box woodland (DECC, 2009a). Its diet ranges from grass seed to nectar (Webster, 1988 in Garnett and Crowley, 1993; Lindsey, 1992) and the flowers, fruits and young buds of Box species such as White Box (*E. albens*) and Bimble Box (*E. populnea*) (Webster, 1988 in Garnett, 1993; Ayers *et al.*, 1996). Middle and understorey species such as Wallaby Grass (*Danthonia* sp.), wattles (*Acacia acinacea* and *A. dealbata*), mistletoes (*Amyema* sp.) and ballarts (*Exocarpus* sp.) are also important (Weber and Ahern, 1992).

It exhibits high nest site fidelity while non-breeding flocks are nomadic and partly migratory (Ayers *et al.*, 1996).

Threats relevant to the Superb Parrot include (DECC, 2009a):

- *Removal of hollow bearing trees.*
- *Clearing of woodland remnants.*
- *Poor regeneration of nesting trees and food resources.*
- *Feeding on grain spills and subsequently being struck by vehicles.*
- *Loss of hollows to feral bees and native and exotic hollow-nesting birds.*
- *Illegal trapping which can also result in the destruction of hollows.*

The Superb Parrot occurs in the western watershed of the Great Dividing Range, west to the eastern edge of Hay Plains, south to the Murray-Murrumbidgee Rivers, and north to the Barwon catchment (DECC, 2009a). Estimates indicate less than 5,000 breeding pairs remain in the wild (*ibid.*). A group of Superb Parrots were observed flying overhead during the pre-clearance surveys within ML 1535 in 2005 (Barrick, 2005) and again in 2008 foraging on mistletoe within ML1535.

The Atlas of NSW Wildlife (DECC, 2009c) indicates the Superb Parrot has been located at numerous locations in the region.

Other records of this species occur in the Birds Australia (2009) database for a search area surrounding the proposed modification area area.

No ideal breeding habitat for the Superb Parrot occurs within the proposed modification area (e.g. River Red Gums and Eucalypt forest), however it is recognised that the Superb Parrot has been known to nest in hollows within open woodland or isolated paddock trees (after DECC, 2009a) which do occur within the study area. It is likely that the Superb Parrots previously recorded in ML 1535 were part of a non-breeding flock, as non-breeding flocks are nomadic and partly migratory (Ayers *et al.*, 1996), whereas breeding parrots exhibits high nest site fidelity (DECC, 2009a).

The proposed modification would remove limited breeding and potential foraging habitat resources for the Superb Parrot within the proposed modification area. However, the proposed modification is unlikely to significantly disrupt the breeding cycle or foraging and dispersal behaviour of a local population (were it to exist) given the availability of more suitable habitat in the surrounds (e.g. River Red Gums around Lake Cowal). Therefore, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of this species (were one to exist) would be placed at risk of extinction.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) *In relation to the habitat of a threatened species, population or ecological community:***
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
 - (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The proposed modification would remove limited breeding and potential foraging habitat resources for the Superb Parrot within the proposed modification area. However, more suitable habitat for the Superb Parrot exists in the surrounds (e.g. River Red Gums around Lake Cowal).

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Superb Parrot the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

Fragmentation of habitat is thought to be a significant threat to the Superb Parrot since it breaks the links between breeding and adjacent feeding sites, although this has not yet been properly demonstrated (Ayers *et al.*, 1996). The Superb Parrot exhibits high nest site fidelity while non-breeding flocks are nomadic and partly migratory (Ayers *et al.*, 1996). The proposed modification area does not represent a main breeding centre for this species (Garnett and Crowley, 2000; Weber and Ahern, 1992). The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

Not applicable. Refer to Section B1.4(e).

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No NSW or Commonwealth recovery plan is available for this species.

The *Threat Abatement Plan for Beak and Feather Disease Affecting Endangered Psittacine Species* (DEH, 2005) is the only threat abatement plan which is relevant to the threats of the Superb Parrot (NSW Scientific Committee, 2002b). However, this threat abatement plan is not relevant to the threats which may result from the proposed modification.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Superb Parrot (NSW Scientific Committee, 2001a; DECC, 2009g). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that an impact on the Superb Parrot is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

Other key threatening processes listed under Schedule 3 of the TSC Act which are relevant to the Superb Parrot are Psittacine Circoviral (beak and feather) Disease (DEH, 2005) and competition from feral honeybees (*Apis mellifera*) (NSW Scientific Committee, 2002c). The proposed modification would not increase the impact of these key threatening processes.

B2.2.10 Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)

- (a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Grey-crowned Babbler (eastern sub-species) (*Pomatostomus temporalis temporalis*) inhabits open forests, Acacia shrubland, open woodlands (dominated by mature eucalypts with regenerating trees, tall shrubs and an intact ground cover of grass and forbs) and adjoining farmland (Garnett and Crowley, 2000; DECC, 2009a).

The Grey-crowned Babbler (eastern sub-species) typically breeds between July and February (DECC, 2009a). A domed nest is made of sticks (NSW Scientific Committee, 2001b). The nest is built in the fork of small branches usually about 4 m above the ground (*ibid.*). Approximately 2 to 3 eggs are laid, and incubated by the female (DECC, 2009a). Nests are maintained year round and old nests are often used to build new nests (*ibid.*).

The Grey-crowned Babbler (eastern sub-species) feeds on invertebrates (spiders and insects) and lizards, foraging on the ground, in leaf litter, on the bark of trees, shrubs and foliage (Garnett and Crowley, 2000; NSW Scientific Committee, 2001b; DECC, 2009a).

The Grey-crowned Babbler (eastern sub-species) lives in family groups which may include up to 15 individuals (DECC, 2009a). These extended family parties are essential for both the co-operative feeding of young and predator avoidance (King, 1980 in Garnett and Crowley, 2000). This species defends territories of between 1 ha and 50 ha all year round (DECC, 2009a). The birds are generally unable to cross large open areas (*ibid.*).

Threats relevant to the Grey-crowned Babbler (eastern sub-species), include (DECC, 2009a):

- *Clearing of woodland remnants.*
- *Heavy grazing and removal of coarse, woody debris within woodland remnants.*
- *Nest predation by species such as ravens and butcherbirds may be an issue in some regions where populations are small and fragmented.*

The Grey-crowned Babbler (eastern sub-species) formally ranged throughout eastern Australia, from South Australia through NSW and central Queensland, and north to southern New Guinea (NSW Scientific Committee, 2001b). The species is now considered to be extinct in South Australia, coastal Victoria and the ACT. In NSW, *P. temporalis* occurs on the western slopes and plains but is less common at higher altitudes of the tablelands (*ibid.*). Isolated populations exist in coastal woodlands on the North Coast, in the Hunter Valley, and from the South Coast near Nowra (Blakers *et al.*, 1984; Schodde and Mason, 1999 in NSW Scientific Committee, 2001b).

The Atlas of NSW Wildlife (DECC, 2009c) indicates that the Grey-crowned Babbler has been recorded at numerous locations in the region.

The Grey-crowned Babbler (eastern sub-species) has been recorded within ML 1535 on many occasions between January 2005 and February 2008. The resident population appears to have diminished progressively within ML 1535 as habitat and multiple nest sites have been removed. During the survey in 2008 which included the proposed modification area, the Grey-crowned Babbler was recorded utilising all broad habitat types (Western Research Institute, 2008). Furthermore, nest sites from previous years and spring 2008 were located within the study area suggesting that recent breeding events are likely to have occurred (*ibid.*).

Habitat resources for the Grey-crowned Babbler exist in the proposed modification area and immediate surrounds. However, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of the species would be placed at risk of extinction given the modification area has been subject to nearly complete land clearing as a result of previous pastoral land use (resulting in a secondary grassland with scattered trees), the availability of suitable habitat in the surrounds and the small scale of the disturbance associated with the proposed modification.

- (b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(b).

- (c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

- (d) *In relation to the habitat of a threatened species, population or ecological community:***
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
 - (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Habitat resources for the Grey-crowned Babbler exist in the proposed modification area and immediate surrounds. However, suitable habitat is available in the surrounds and the disturbance associated with the proposed modification is of a small scale.

Although the proposed modification may result in disturbance to a small portion of potential habitat for the Grey-crowned Babbler (eastern sub-species), the potential habitat to be disturbed is not considered to be important to the long-term survival of the species, given the availability of suitable habitat in the surrounds and the small scale of the disturbance.

Populations of the Grey-crowned Babbler (eastern sub-species) are nomadic ground foragers (Flegg, 2002). However, these birds are reluctant to traverse tracts of cleared land (NSW Scientific Committee, 2001b). The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

- (e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

Not applicable. Refer to Section B1.4(e).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No NSW or Commonwealth recovery plan is available for the Grey-crowned Babbler (eastern sub-species) and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act which is applicable to this species (NSW Scientific Committee, 2001a). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that a significant impact on this species is not likely.

B2.2.11 Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Yellow-bellied Sheathtail-bat (*S. flaviventris*) can be found in a wide range of habitats, including wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert (Churchill, 1998).

The Yellow-bellied Sheathtail-bat roosts in tree hollows that are predicted to be large and situated such that there is enough clear space at the exit to allow an unencumbered drop until the bat attains normal flight speed (Greg Richards and Associates, 2000). The species has been found to utilise multiple roost sites (*ibid.*), and may roost singly or in groups of up to six (DECC, 2009a). It breeds from December to mid-March, with a single offspring born (DECC, 2009a).

The Yellow-bellied Sheathtail-bat is insectivorous and forages above the tree canopy. A variety of prey items are eaten including long-horned grasshoppers, shield bugs and flying ants, while beetles comprise up to 90% of this species' diet (Churchill, 1998).

The seasonal movements of the Yellow-bellied Sheathtail-bat are unknown, although there is speculation about their migration to southern Australia in late summer and autumn (DECC, 2009a).

The threats relevant to the Yellow-bellied Sheathtail-bat include (DECC, 2009a):

- *Disturbance to roosting and summer breeding sites.*
- *Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.*
- *Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.*
- *Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.*

The Yellow-bellied Sheathtail-bat has a widespread distribution across eastern and northern Australia (Churchill, 1998; Richards, 1998 in Strahan, 1998). The Atlas of NSW Wildlife (DECC, 2009c) indicates the Yellow-bellied Sheathtail-bat has been recorded at a few locations in the region.

The Yellow-bellied Sheathtail-bat was recorded from within ML 1535 during fauna surveys for the original CGM (North Limited, 1998). This species was recorded in River Red Gum Woodland fringing Lake Cowal (Greg Richards and Associates, 1997). The River Red Gum Woodland would not be removed or modified as part of the proposed modification. However, no threatened bat species have been recorded within ML 1535 from January 2005 to February 2008, despite many bat surveys undertaken (Western Research Institute, 2008).

Considering the above, the Yellow-bellied Sheathtail Bat is considered unlikely to occur within the proposed modification area.

Foraging habitat resources for the Yellow-bellied Sheathtail-bat may exist in the proposed modification area and in the immediate surrounds. However, the proposed modification is unlikely to disrupt the lifecycle of this species such that a local viable population of the species (were one to exist) would be placed at risk of extinction given the small scale of the disturbance associated with the proposed modification.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(b).

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- (i) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable. Refer to Section B1.4(c).

(d) *In relation to the habitat of a threatened species, population or ecological community:*

- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- (i) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The Yellow-bellied Sheathtail-bat was recorded from within ML 1535 during fauna surveys for the original CGM (North Limited, 1998). This species was recorded in River Red Gum Woodland fringing Lake Cowal (Greg Richards and Associates, 1997). The River Red Gum Woodland would not be removed or modified as part of the proposed modification. However, no threatened bat species have been recorded within ML 1535 from January 2005 to February 2008, despite many bat surveys undertaken (Western Research Institute, 2008).

Considering the above, the Yellow-bellied Sheathtail Bat is considered unlikely to occur within the proposed modification area.

Foraging habitat resources for the Yellow-bellied Sheathtail-bat may exist in the proposed modification area and in the immediate surrounds. Although the proposed modification may result in disturbance to a small portion of potential habitat for the Yellow-bellied Sheathtail-bat the potential habitat to be disturbed is not considered to be important to the long-term survival of the species.

Due to the species' mobility, all occurrences of potential habitat for this species in the locality are considered proximate habitat areas for this species. The proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for this species.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

Not applicable. Refer to Section B1.4(e).

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No NSW or Commonwealth recovery plan is available for the Yellow-bellied Sheathtail-bat and no NSW or Commonwealth threat abatement plan is applicable to the recognised threats of this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Yellow-bellied Sheathtail-bat (NSW Scientific Committee, 2001a; DECC, 2009g). Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that an impact on the Yellow-bellied Sheathtail-bat is not likely.

Further, the disturbance would occur primarily within land that has been described as a human-made landscape created through extensive clearing and a range of agricultural practices, with grazing being the dominant practice (Western Research Institute, 2008). The proposed disturbance to the lakebed would not involve the removal of native trees. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

B2.3 ECOLOGICAL COMMUNITIES

B2.3.1 Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(a).

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable. Refer to Section B1.4(b).

- (c) ***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***
- (i) ***is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
 - (i) ***is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River (Lachlan River EEC) includes *all native fish and aquatic invertebrates within all natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands and paleo-channels, flood runners, floodplains and effluent streams of the Lachlan River* (DPI Threatened Species Unit, 2006). The listing of the Lachlan River EEC has given all native fish and other aquatic animal life within its boundaries the protected status of endangered species (*ibid.*).

Lake Cowal is included in the listing of the Lachlan River EEC (DPI Threatened Species Unit, 2006). The Lake Cowal wetland is located on the Jemalong Plain which is formed in the lower reaches of Bland Creek in the Lachlan Valley. The plain extends to the Lachlan River in the north and is bounded by ridgelines to the east and west (North Limited, 1998).

Lake Cowal receives inflow from Bland Creek, which drains into the lake at its southern end. Inflows to the lake also occur from the Lachlan River via breakout flows during major flood events in the Lachlan, causing back flooding to Lake Cowal. Historically, the lake is substantially inundated approximately seven years out of ten, with relatively small increases in lake water depth leading to significant increases in the area of inundation due to the flat, shallow nature of the lake.

The vegetation on the lakebed of Lake Cowal is adapted to the irregular wetting and drying cycle. When inundated, propagules of ephemeral aquatic plants germinate and grow rapidly providing a food source for similarly ephemeral invertebrates and nomadic waterbirds. When the Lake is inundated with water, the wetland supports ephemeral aquatic plants which provide habitat for fauna such as aquatic invertebrates, fish and wetland birds (Western Research Institute, 2008). When dry, the bare lakebed is colonised by the seeds of native and naturalised pasture grasses creating temporary grassland.

Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (*ibid.*). The overall habitat condition of the temporary grassland habitat which occurs within the proposed modification area has been assessed as being low to moderate (*ibid.*). This assessment was based on: past disturbance from cropping and long-term grazing as well as the occurrence of widespread pasture grasses (*ibid.*). It is recognised that when the Lake is inundated the condition of the habitat would change (*ibid.*). It is considered, however, that the dominant influence on the condition of the Lake habitat (in both its wetland and dry grassland states) is agricultural practices (e.g. cropping and grazing) (*ibid.*).

The shallower parts of the lakebed also feature permanent swamp vegetation (*viz.* Lignum and Canegrass) which can tolerate the extremes of wet and dry (North Limited, 1998).

The dynamics of the Lake Cowal system have been modified significantly by a number of factors including agricultural landuse within the catchment, clearing, levee construction and modifications to flood entry and exit points and the construction of the Jemalong-Wyldes Plains irrigation system, including the Jemalong Weir (Goldney *et al.*, 1997 in North Limited, 1998). European Carp (*Cyprinus carpio*), a recognised threat to the Lachlan River Catchment EEC, has also been historically recorded in Lake Cowal.

Recognised threats to the Lachlan River EEC include (DEC, 2009a):

- *Clearing of riparian vegetation and continued access of stock to the riparian zone.*
- *The reduction of river flow by water extraction for irrigation, and pollution through insecticide and fertiliser runoff.*
- *Overfishing has reduced populations of native fish species including Murray cod (*Maccullochella peelii peelii*) and golden perch (*Macquaria ambigua*).*
- *In-stream structures, such as dams and weirs, regulate natural flows thereby affecting the normal reproductive and other biological cues of species in the community.*
- *Deterioration of water quality thermal pollution, increased salinity in some tributaries, increased nutrients, increased incidence of blue-green algal blooms and increased turbidity.*
- *Loss of aquatic plants from the Lachlan River, creeks and wetlands contributing to degradation and destabilisation of the ecosystem and to an overall reduction in biodiversity.*
- *The presence of at least seven introduced species: carp (*Cyprinus carpio*), redfin perch (*Perca fluviatilis*), goldfish (*Carassius auratus*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), mosquitofish (*Gambusia holbrooki*) and the snail (*Physa acuta*). Introduced species can act as predators, competitors, habitat modifiers and disease carriers.'*

An ephemeral drainage line was recorded within the Cleared Agricultural Land with Scattered Trees habitat in the north of the proposed modification area. This ephemeral drainage line would be redirected as part of the Up-Catchment Diversion System as part of the proposed modification. This drainage line once connected with Lake Cowal as part of a widespread minor drainage network (Western Research Institute, 2008). It is predominantly treeless (*ibid.*). It appears to have incised over the years, and is connected with a series of farm dams (*ibid.*).

The location of the saline groundwater supply borefield within Lake Cowal is unlikely to alter the natural flow regime of Lake Cowal as it would extend only partially into the lake. Further, it should be noted that no native trees would be removed for the saline groundwater supply borefield.

The saline groundwater supply borefield is unlikely to have an adverse effect on the extent or composition of the Lachlan River EEC such that its local occurrence would be placed at risk of extinction, given the small area of disturbance and the borefield would extend only partially into the lake.

(d) In relation to the habitat of a threatened species, population or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;**
- (i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Figures B-2 and B-3 show the proposed location of the borefield and associated pipeline. The disturbance area for the saline groundwater supply borefield (including the associated pipeline) has been conservatively estimated at approximately 10 ha and has been identified as Lakebed habitat (North Limited, 1998; Western Research Institute, 2008) (Figure B-3).

The vegetation on the lakebed of Lake Cowal is adapted to the irregular wetting and drying cycle. When inundated, propagules of ephemeral aquatic plants germinate and grow rapidly providing a food source for similarly ephemeral invertebrates and nomadic waterbirds. When the Lake is inundated with water, the wetland supports ephemeral aquatic plants which provide habitat for fauna such as aquatic invertebrates, fish and wetland birds (Western Research Institute, 2008). When dry, the bare lakebed is colonised by the seeds of native and naturalised pasture grasses creating temporary grassland. Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (*ibid.*). The overall habitat condition of the temporary grassland habitat which occurs within the proposed modification area has been assessed as being low to moderate (*ibid.*). This assessment was based on: past disturbance from cropping and long-term grazing as well as the occurrence of widespread pasture grasses (*ibid.*). It is recognised that when the Lake is inundated the condition of the habitat would change (*ibid.*). It is considered, however, that the dominant influence on the condition of the Lake habitat (in both its wetland and dry grassland states) is agricultural practices (e.g. cropping and grazing) (*ibid.*).

The borefield would be operated during times when the borefield is not inundated by Lake Cowal. It is anticipated, therefore, that this borefield would operate in drier times and be rested in wetter times when the contained water storages would make up the supply from this source.

The design and installation of the pipeline to the saline groundwater supply borefield within Lake Cowal would be consistent with the policy detailed in the *Guidelines for controlled activities: Laying pipes and cables in watercourses* (Department of Water and Energy, 2008). In particular, in undertaking the works associated with the installation of the pipeline Barrick would:

- minimise disturbance to soil and vegetation communities;
- maintain existing/natural hydraulic, hydrologic, geomorphic and ecological functions of Lake Cowal; and
- rehabilitate disturbed areas post installation as appropriate.

In addition, operation of this borefield would include the following control and/or preventative measures:

- shut-down and removal of pumps during periods when the borefield is inundated by Lake Cowal;
- well-heads raised above the full storage level of Lake Cowal by construction of stand pipes;
- steel stand pipes to minimise potential damage to the bore in the unlikely event of an accidental collision;
- prominent signage at the well-heads to minimise the potential for accidental collision and damage;
- an anchored pipeline laid on the ground surface (i.e. above ground level) in a V-drain for potential spill containment;
- an underground powerline to power the pumps; and
- leak detection mechanisms including automatic shut-down capability (i.e. a pressure-based shut-down system).

In the unlikely event of pipeline failure and leakage of saline water, the spill would be controlled, contained and cleaned-up in accordance with the spill response procedures described in the HWCMP.

An ephemeral drainage line was recorded within the Cleared Agricultural Land with Scattered Trees habitat in the north of the proposed modification area. This ephemeral drainage line would be redirected as part of the Up-Catchment Diversion System as part of the proposed modification. This drainage line once connected with Lake Cowal as part of a widespread minor drainage network (Western Research Institute, 2008). It is predominantly treeless (*ibid.*). It appears to have incised over the years, and is connected with a series of farm dams (*ibid.*).

Although the proposed modification would result in disturbance to part of the Lachlan River EEC (i.e. where the saline groundwater supply borefield would extend partially into the lake and where the ephemeral drainage line would be directed in the north of the proposed modification area), the proposed modification is unlikely to result in the fragmentation or isolation of potential habitat for the Lachlan River EEC given the small scale of the temporary disturbance associated with the proposed modification.

The proposed modification is unlikely to have an adverse effect on the long-term survival of the Lachlan River EEC given the small scale of the disturbance associated with the proposed modification.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

Not applicable. Refer to Section B1.4(e).

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No NSW or Commonwealth recovery plan or threat abatement plan is available for this ecological community.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The clearing of native vegetation is a key threatening process listed under Schedule 3 of the TSC Act and is a recognised threat of the Lachlan River EEC (DPI Threatened Species Unit, 2006).

Although the proposed modification would involve disturbance to native vegetation, the scale of native vegetation disturbance associated with the proposed modification is such that a significant impact on the Lachlan River EEC is not likely. No native trees would be removed for the saline groundwater supply borefield. Further, historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, broad-acre cropping (Western Research Institute, 2008).

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is also a key threatening process listed under Schedule 3 of the TSC Act.

The modification would involve the construction and operation of a saline groundwater supply borefield within ML 1535 to supply saline water. The borefield pipeline would extend only partially into the Lake and would therefore not significantly alter the natural flow regime of Lake Cowal. In the unlikely event of pipeline failure and leakage of saline water, the spill would be controlled, contained and cleaned-up in accordance with the spill response procedures described in the HWCMP.

An ephemeral drainage line in the north of the proposed modification area would be diverted as part of a modified UCDS which comprises the re-alignment of a drainage channel conveying up-catchment water around the proposed modified northern waste emplacement. The diversion of this ephemeral drainage line is unlikely to significantly impact any fauna species given it is located within cleared agricultural land and more permanent habitat exists in the surrounding area (e.g. Bland Creek and within Lake Cowal when inundated).

B3 CONCLUSION

Having regard to the content of Section B2 of this document in respect of each threatened species and ecological community (and their habitats) assessed in this document, when all the factors must be taken into account under Section 5A of the *Environmental Planning and Assessment Act, 1979* are considered in combination, the proposed modification is unlikely to have a significant effect on any threatened species, populations, ecological communities or their habitats, considering aspects such as the extent of potential habitat for the species, the small scale of the proposed modification and the already fragmented nature of the habitat which would be removed.

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