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Shenhua Watermark Coal

Additional Environmental Information to Support Extension of Stage 3 Exploration Drilling

June 2010

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1. Background

Exploration Licence (EL) 7223 was granted on the 22nd October 2008 and expires on 28 February 2011. During 2009 and 2010, approximately 400 coal exploration sites were drilled by Shenhua Watermark Coal Pty Ltd (Shenhua), over three stages, as part of the drilling program within EL 7223. The environmental impact for the exploration program was considered in the approved Review of Environmental Factors (REF) document supplied to the State government for determination in April 2009 (GHD, 2009b). The REF document incorporated all geographic areas within EL 7223 potentially affected by the drilling program. The REF was supported by an Environmental Management Plan (GHD, 2009c) that documented the environmental controls and mitigation measures for the exploration program.

Completion of the initial exploration program has identified a resource that requires subsequent infill drilling to improve the confidence around the potential resource. A further 200 (approximately) drill sites are now proposed as an extension to the previous stage 3 works. In accordance with Condition 2 of EL 7223, approval of the Department of Primary Industries (now Industry & Investment NSW) is required for the type of works proposed.

1.1 Purpose of this Document

It is therefore the purpose of this additional information to seek approval from Industry and Investment NSW (I&I) for the additional exploration program by providing additional environmental assessment to ensure environmental impacts are minimised across EL 7223.

This document must be considered in conjunction with the REF Stages 1, 2 and 3 Exploration Drilling April 2009 (GHD, 2009b). The purpose of this additional information is to:

- ▶ identify the need to undertake further drilling
- ▶ provide a summary of the proposed drilling program
- ▶ identify the four key environmental issues affected by the proposed drilling program
- ▶ comment on environmental management and mitigation measures

A map showing the approximate location of the additional sites is attached (Figure 1).

The planned drilling program is designed to:

- ▶ Provide additional coal quality and coal washability data
- ▶ Verify the resource boundary and conceptual mine planning purpose
- ▶ Confirm site geotechnical characteristics
- ▶ Provide additional data for hydrogeological modelling
- ▶ Define the alluvial boundary within the black soil plains surrounding the Watermark site

1.2 Summary of the Proposed Drilling Program

The following indicative drilling program is to be undertaken during the period June to December 2010:



Type	Projected Number of Site	Maximum Number of holes
▶ Coal Measures GW Monitoring	10	18
▶ Water Resource Investigation	5	5
▶ Alluvial Aquifer Monitoring (Black Soil)	12	14
▶ Alluvial Aquifer Investigation	4	12
▶ Water Production Testing	4	4
▶ Geotechnical	10	10
▶ Maules Creek	29	29
▶ Resource Category Improvement	29	32
▶ LOX Boundary	77	77
▶ Cindered Coal Definition	17	17
Total	200	218

Note - one drill site may consist of multiple drill holes.



2. Environmental Issues, Management and Mitigation

All additional sites occur within the area previously assessed in the REF and approved by I&I within Watermark EL 7223. Under the I&I exploration classification scheme, the proposed additional exploration drilling program is considered to be Category 2 activities. Category 2 activities have potential for moderate disturbance to the land surface, native vegetation or other environmental value. Due to the potential for minor site clearing as required on a site specific basis the works are considered Category 2. It is, however, important to note that all future works are planned to be completed using the same drilling teams, machinery and practices that have been applied on site to date, and are described in the original REF (GHD, 2009b).

In accordance with Condition 2 of EL 7223, approval from I&I is required for this type of work. While an REF is not expressly required for Category 2 prospecting operations, a REF was prepared, which incorporated all exploration works within EL 7223 in order to address community sensitivities, landholder access requirements, the environmental values of the area, and the exempt areas (Crown Lands Act 1998) within EL 7223. However, it is understood that additional boreholes completed during the exploration program represent an extension to the existing approval, and are therefore covered by the approved REF.

It is important to note that more than one borehole may be sunk from each drill pad or site, thereby reducing the potential for environmental harm. This approach has been detailed in the approved REF (GHD 2009b). Given a similar scope of work featuring repeated logistics, GHD believes that any potential environmental impacts remain consistent with those previously described in the approved REF (GHD 2009b).

The above consideration notwithstanding, GHD provides the following additional details on four key environmental issues within EL 7223.

2.1 Aboriginal archaeology

No Aboriginal archaeological sites have been encountered during the drilling activities to date in EL 7223. The additional sites are to be located well away from the Mooki River which was identified as an area where sites are most likely to be found. The local Aboriginal community has been assisting in the evaluation of sites prior to drilling and this practise is proposed to continue.

The mitigation and control procedures outlined in the original REF (GHD, April 2009b) and in the EMP (GHD, April 2009c) associated with the operation will continue to be applied to all drilling. During the operational phase, works will be designed to avoid disturbance of Aboriginal Cultural heritage sites where possible, otherwise the appropriate permits will be obtained as required. There remains no evidence to date of any cumulative impacts on Aboriginal archaeology as a result of the drilling activities in EL 7223. This is expected to continue.

2.2 Noise impacts

Construction noise impacts associated with the drilling were conservatively estimated using the commonly recognised distance attenuation relationship described in Equation 1.

$$SPL = SWL - 20\text{Log}(d) + 10\text{Log}(Q) - 11 \quad \text{Equation (1)}$$



Where d = distance (m) between source and receiver;
 Q = Directivity index (2 for a flat surface);
 SPL = sound pressure level at the distance d from the source; and
 SWL = sound power level of the source.

Drill rig noise generation data has been sourced from The United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) and GHD's internal database, is generally in the order of 105 SWL dB(A) to 115 SWL dB(A). This is shown in the table below for a variety of distances to a typical receiver, with no noise barriers or acoustic shielding in place and with each plant item operating at full power.

Predicted Plant Item Noise Levels, dB(A)

Plant	Estimated SWL [dB(A)]	Estimated SPL [(dB(A)] at Distance (m)						
		50	75	100	200	400	600	1200
Drill	105	63	60	57	51	45	41	35
Drill	110	68	65	62	56	50	46	40
Drill	115	73	70	67	61	55	51	45

The magnitude of off-site noise impact associated with drilling will be dependent upon a number of factors, potentially including, though not limited to::

- ▶ The intensity of drilling activities.
- ▶ The location of drilling activities.
- ▶ The type of equipment used.
- ▶ Existing local noise sources.
- ▶ Intervening terrain.
- ▶ The prevailing weather conditions.

During any given period, the drills to be used across EL 7223 would operate at maximum sound power levels for only brief periods. Therefore, at other times, the machinery may produce lower sound levels while carrying out activities not requiring full power.

On balance the sound power levels at a distance of 200 m or more from sensitive receivers (such as dwellings) in the range of 51 to 61 dB (A) are likely to have minimal impact. This is due to the short term nature of each drill operation and the fact that drilling will only take place during daylight hours when background noise is likely to be at its highest.

Noise related to the extended drilling program will continue to be mitigated by implementing the controls identified in the exploration EMP.

2.3 Ecology

This supplementary desktop assessment is an addendum to the information previously provided in *Shenhua Watermark Exploratory Drilling REF Ecological Impact Assessment* (GHD 2009a). It should also be read in conjunction with the information provided in the REF (GHD 2009b) and EMP (GHD 2009c).



No additional site surveys have been performed for this supplementary ecology assessment, whose scope includes assessing the additional bore sites in addition to the surrounding natural environment. The following is a qualitative assessment of potential ecological impacts arising from the proposed additional drilling program based on the following considerations:

- ▶ The presence of ecological constraints as identified in previous assessments (GHD 2009a, 2009b)
- ▶ The drilling procedure that would be employed at each site including a pre-drilling checklist employed to assess native biota risks such that location refinements may be undertaken in real time
- ▶ Measures to mitigate impacts on the environment such as that described above for example

Native vegetation within EL 7223 is shown in Figure 1. The ecological value of the additional bore sites was assessed with reference to air photos and vegetation mapping, and conservation significance and ecological constraints as described in GHD (2009a). Ecological constraints were identified across EL 7223 during the desktop assessment and field surveys reported in GHD (2009a). They include areas of Endangered Ecological Communities (EECs), and threatened species and their habitats. These identified EECs were subsequently grouped into four classes and mapped across EL 7223 (Figure 2).

Indicative borehole locations are depicted on Figures 1 and 2; with final locations only being approved following a pre-drilling ecological risk management procedure. This environmental management procedure is provided in GHD (2009c). It includes procedures for identifying sensitive ecology, heritage items and other environmental constraints. The procedure allows for modification of borehole locations as far as is practicable, including relocation of up to 300 metres.

It is important to note that EL 7223 includes extensive areas of modified agricultural land; therefore, it should remain possible to locate the majority of borehole locations in previously disturbed environments. Therefore, the additional boreholes should :

- ▶ Not require removal of hollow-bearing trees;
- ▶ Not require removal of threatened plants;
- ▶ Have no impacts within the vicinity of threatened fauna, or removal of any important habitat resources (nests, roosts etc); and
- ▶ Only use existing access tracks, so that the disturbance footprint is limited to the area of the drill site.

It is recognised that in some instances it may not be possible to place final drill sites entirely outside areas of woodland consistent with a threatened ecological community (TEC) or threatened species habitat. Unavoidable impacts may occur where potential drill sites are greater than 300 metres from the edge of a patch of vegetation. In these instances it is assumed that the lowest conservation value site available would be selected to ensure:

- ▶ As little disturbance of threatened species habitat as is practicable;
- ▶ Removal of as few mature trees as is practicable;
- ▶ As little disturbance to native ground cover and understorey as is practicable;
- ▶ Remediation of the site following the proposed works, returning the site as close as is practicable to original condition; and



- ▶ Supplementary planting with species representative of the surrounding vegetation community.

The pre-drilling checklist procedure has been applied to approximately 400 bore sites within the Shenhua Watermark drilling program across the EL. The site environmental management team has reported that the drilling program to date has progressed with minimal impacts on native vegetation and habitats. Site staff report that the majority of proposed drilling sites have fallen within disturbed agricultural land with little ecological value. On the majority of occasions where proposed drilling sites have coincided with native vegetation it has been possible to re-site the final drilling site in disturbed environments within 300m. Based on the indicative locations presented in Figure 1 and Figure 2 it is likely that the majority of the additional drilling sites could also be positioned so as to avoid sensitive environments.

The proposed additional drilling program has the potential for environmental impacts common to drilling activities. The drill pad preparation area results in a direct impact. Commensurate with the initial site condition, there remains potential for understorey vegetation to be destroyed. Further, the drill rig will be parked at one location for up to eight days, with support vehicle movements also potentially damaging vegetation. Potential impacts may therefore include modification of vegetation and habitat through clearing and traffic movements.

It is likely that any potential impacts can be successfully mitigated with the application of the pre-drilling checklist procedure and other management measures described in GHD (2009b). It is noted that a small proportion of the proposed boreholes are located within larger patches of known or potential woodland TECs. In such cases, it may be possible to locate the final borehole on dirt tracks or on existing clearings not visible on aerial photographs. In instances where such clearings are not available, the proposed works would require removal of understorey vegetation and sub-mature trees within a surface disturbance area of approximately 15m by 25m at each additional drill site.

Such an activity is unlikely to directly harm any fauna as it would disturb only a small area of habitat, and there would remain opportunities for fauna to vacate the drilling site into adjacent habitat. The proposed activity may disturb animals sheltering within disturbance footprints, in addition to removing or modifying shelter and foraging resources associated with native vegetation. There are large quantities of equivalent TECs, fauna habitat and resources in the locality, and therefore, it is likely that the impact on local populations of native biota will be minor.

A few additional borehole sites are located outside the area that was assessed and mapped in GHD (2009a). These sites appear to be in disturbed agricultural land, and would thereby be unlikely to be a significant ecological risk.

Drill sites would be remediated following core extraction, and therefore any impacts would comprise modification of native vegetation rather than removal of any gross areas of vegetation communities. Native forbs and shrubs are likely to successfully recolonise disturbed areas in the short to medium term and restore the value of drilling sites as habitat for native biota over the medium term.

On the basis of the above considerations, provided that the pre-drilling checklist procedure and other management measure presented in GHD (2009c) are adopted the proposed activity is unlikely to result in significant impacts on threatened biota and their habitats or any species of native flora and fauna.



2.4 Hydrogeology

The additional drill sites proposed will increase the density of bore holes in the potential mining areas where the Permian Gunnedah Basin strata outcrops and to a lesser degree increase the density of bore holes on the alluvial plains where the Quaternary alluvial sediments overlie the Permian strata. The potential for the cumulative impact of the additional boreholes proposed to impact on the existing groundwater systems is assessed for each of the hydrogeological settings and assumes the mitigation measures as outlined in Section 6.3.3 of the REF (GHD, 2009b) and EMP continue to be implemented.

Alluvial Plains Area

On the alluvial plains there is potential (due to poor drilling practices) for connection and cross contamination between the Quaternary alluvial aquifer and the underlying Permian strata. This could impact on the groundwater quality in the alluvial aquifer which is used extensively for agriculture and domestic purposes in the plains area. The currently adopted mitigation measures of casing off and sealing the alluvial aquifer when drilling into the underlying Permian Coal sequence and constructing all monitoring bores to comply with the LWBC Minimum Construction Requirements for Water Bores in Australia will minimise any risk for inter aquifer connection. The implementation of the mitigation measures and procedures in the EMP (GHD, 2009c) and REF will also continue to minimise potential for groundwater systems to be impacted by drilling fluids and other chemicals and fuels.

The Stage 1 and 2 drilling program included drilling of 6 nested groundwater monitoring sites on the alluvial plains and due to access constraints only one of these sites has been completed. The plans for the Stage 3 drilling include completion of nested groundwater monitoring at the remaining 5 sites that have not been completed and installation of 4 additional monitoring nested sites to the south (2), east (1) and north east (1) to extend the groundwater monitoring network in these areas. It is noted that density of groundwater monitoring bores to be installed on the southern alluvial plains area has not increased significantly from the original REF program with the inclusion of the 2 additional monitoring sites. The bore density in the eastern and north eastern alluvial areas will be low with only one site at each location planned.

Permian Outcrop Area

Aquifer testing to date indicates that the Permian strata is low yielding typically forming a low permeability fractured rock aquifer with variable groundwater quality. Given the additional bore holes to be drilled will either be grouted on completion or installed as groundwater monitoring bores which are grouted above the gravel pack to surface, the potential for contamination to enter the groundwater via surface water ingress or connection between different fracture zones within the bore hole is considered minimal. The implementation of the measures and procedures in the EMP and REF (GHD, 2009b) will continue to minimise potential for groundwater to be impacted by drilling fluids and other chemicals and fuels and no impacts to the groundwater levels or groundwater quality would be expected due to the greater density of bore holes.



3. Conclusion

The exploration conducted to date has confirmed the need to undertake further drilling in a more concentrated area within EL7223 to improve the level of information on the potential resource. The measures put in place to protect the environment in the exploration so far have proved to be effective and are recommended to continue. The impact of the additional drilling is likely to be minimal and cumulative impacts on the environment are not predicted to be significant if the measures and procedures in the EMP (GHD, 2009c) and REF (GHD, 2009b) are followed.



4. References

GHD Pty Ltd (2009a) *Shenhua Watermark Exploratory Drilling REF Ecological Impact Assessment*. Report prepared on behalf of Shenhua Watermark Pty Ltd.

GHD Pty Ltd (2009b) *Review of Environmental Factors for the proposed Exploration Drilling – Watermark EL 7223*. Report prepared on behalf of Shenhua Watermark Pty Ltd

GHD Pty Ltd (2009c) *Environmental Management Plan for the proposed Exploration Drilling – Watermark EL 7223*. Report prepared on behalf of Shenhua Watermark Pty Ltd.

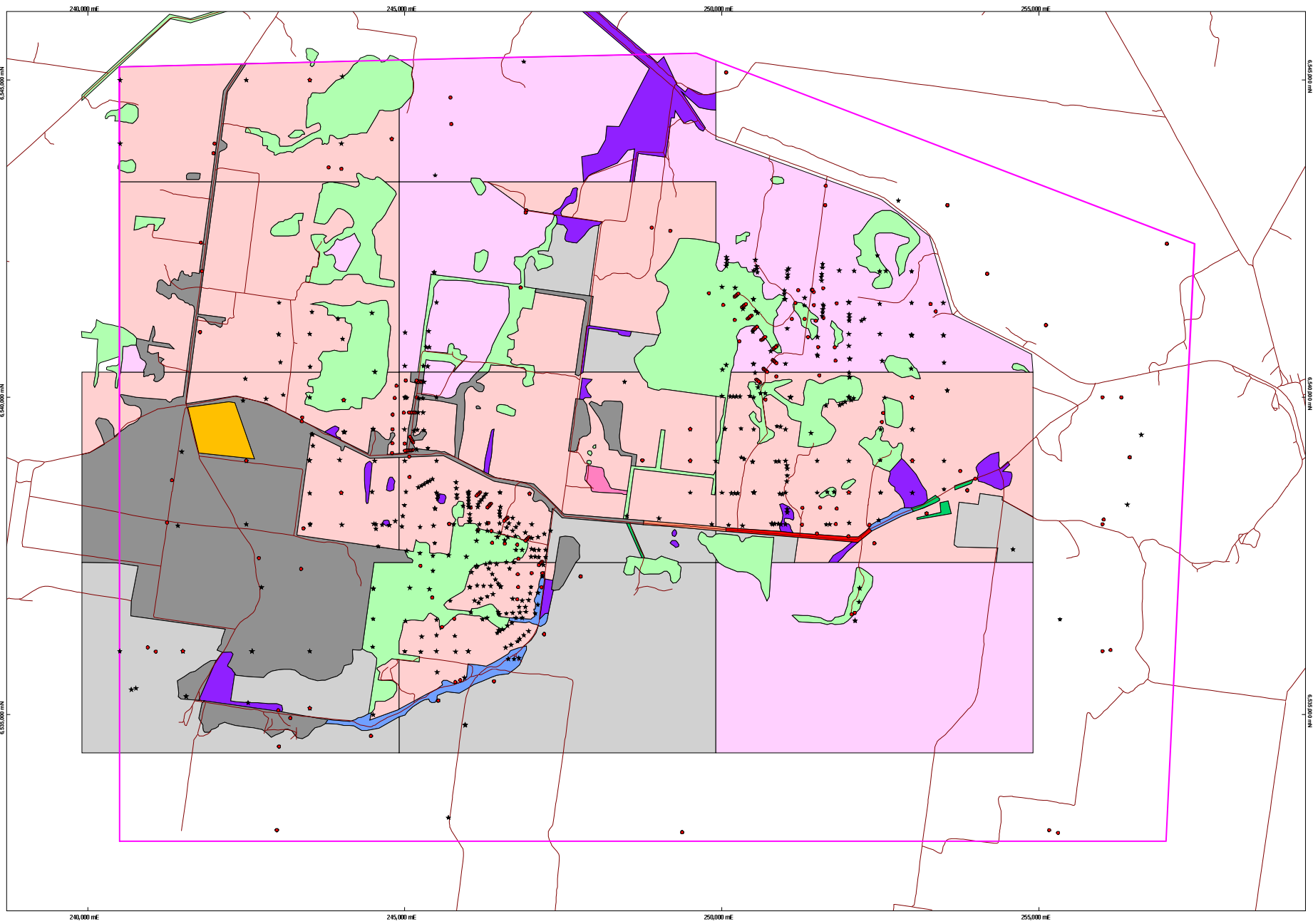


Appendix A

Figures

Vegetation

Ecological Constraints



- Vegetation Communities**
- Birnie Box / White Cypress Pine / Wilga Woodland
 - Birnie Box / Yellow Box Woodland
 - Fuzzy Box / Buloke Woodland
 - Intact Native Vegetation (unverified)
 - Modified Agricultural Land
 - Native Pasture
 - Native Pasture With Native Remnant Paddock Trees
 - Regenerating White Cypress Pine
 - Shelter Belt / Planted Trees
 - Undefined
 - Weeping Myall Woodland
 - White Box / White Cypress Pine / Wilga Woodland

- Shenhua EL Boundary
- Properties Boundaries
- Roads

★ Completed Sites (411)
 ● Proposed Sites (200)

Note:
 Holes within Black Soil Plain
 require land access agreements

Scale - 1:30000 @ A1



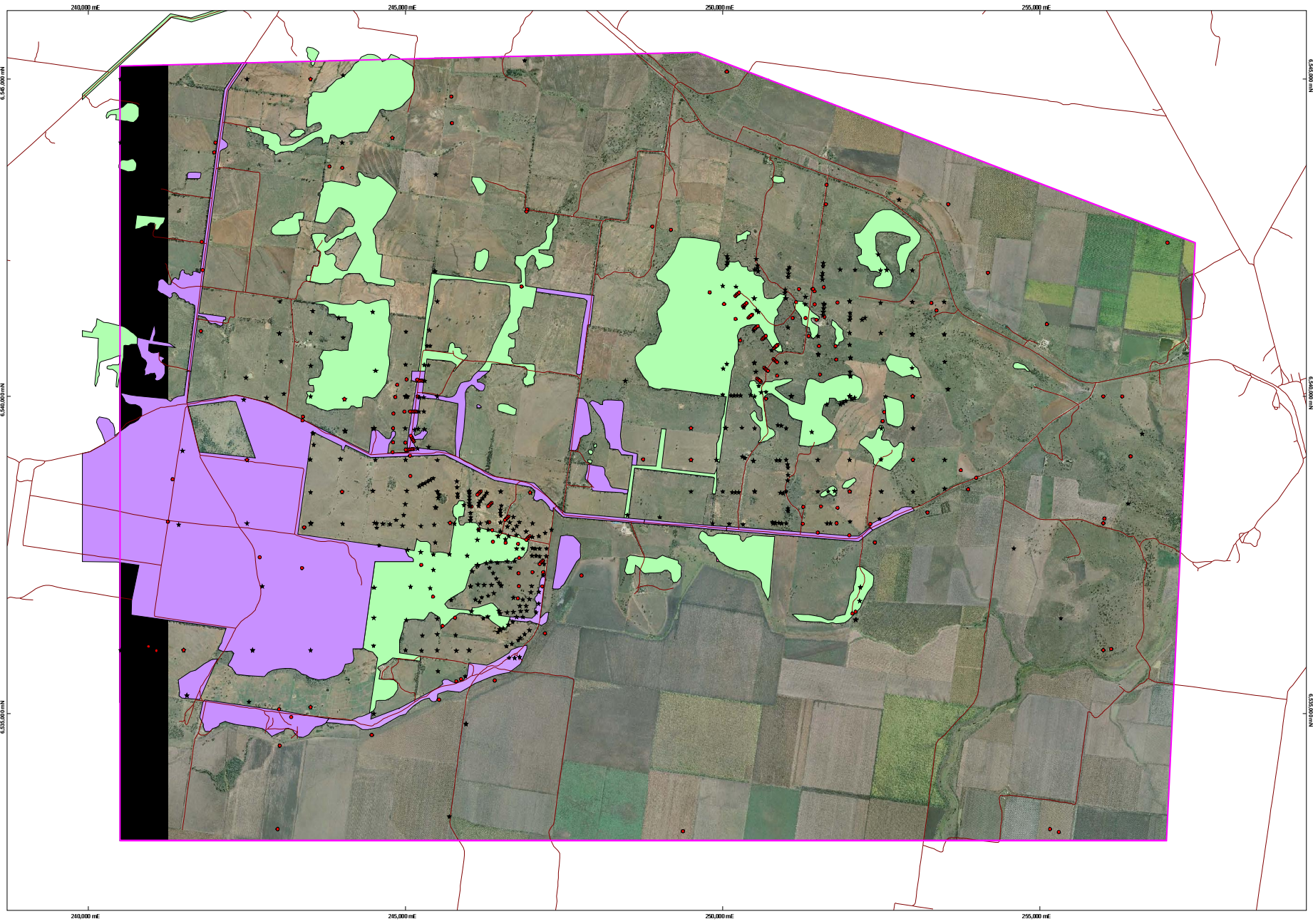
Map Projection: Universal Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia 1994
 Grid: Map Grid of Australia, Zone 56

SHENHUA WATERMARK COAL PTY LIMITED
 神华沃特马克煤矿有限公司

Vegetation

Job Number | 22-14551
 Revision | A
 Date | 17-Jun-2010

Figure 1



- Legend**
- Endangered Ecological Community (ECC)
 - Unverified, likely ECC
 - Properties Boundaries
 - Roads
 - ★ Completed Sites (411)
 - Proposed Sites (200)
- Note:
Holes within Black Soil Plain
require land access agreements

Scale - 1:30000 @ A1



Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 58



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Ecological Constraints

Job Number	22-14551
Revision	A
Date	17-Jun-2010

Figure 2

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M Svikis	B Snedden		Stephen Burns	<i>S Burns</i>	24/06/2010
1	M Svikis	B Snedden		Stephen Burns	<i>S Burns</i>	29/06/2010
2	M Svikis	B Snedden		Stephen Burns		30/06/2010