Drayton South Coal Project (SSD 6875): Evaluation of soil impacts and Review of Department of Planning & Environment Final Assessment Report, September 2016

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November 2016

Contents

A. Executive Summary

Drs Peter Bacon and Pam Hazelton were commissioned by Godolphin Australia and Coolmore Australia to review and provide advice on the Department of Planning and Environment's (DP&E) Final Assessment Report (September 2016) Drayton South Coal Project and Anglo American's Response to the Planning Assessment Commission Review Report (November 2015).

Our expertise is in soil and land management including rural and mining environments. Our evaluation and comments concentrate on these areas. As outlined to the PAC at its meeting on 16 November 2016, our assessment of the above reports in relation to the Drayton South Proposal leads us to conclude:

1. *Biophysical Strategic Agricultural Land (BSAL) will be lost if the mine proceeds. There were deficiencies in the BSAL assessment processes undertaken which make it difficult to identify how much BSAL will be lost. However there were 218 ha of' 'verified' BSAL identified in the gateway application.*
2. *The disturbance will result in the loss of 253 ha of 'croppable' land. Additionally there will be loss of 122 ha of grazing land. Conversely, Class 5 land, which is 'unsuitable for agriculture or at best only light grazing' increased by 379 ha. <u>'These are major impacts'</u> - quote from NSW Dept P&I (2012).*
3. *Mining activities such as blasting and dust production will degrade the quality and productivity of agricultural land. It also creates a significant environmental health issue for surrounding areas.*
4. *The soil mapping, sampling and subsequent testing was inadequate especially given the known complexity of the soils/geology in the region.*
5. *However, the soil information provided by the proponent demonstrates that sodic and saline sub-soils underlying many in areas at the site will be exposed. This will create significant potential for soil erosion due to the high dispersibility of sodic substrates.*
6. *Additionally there is a high risk of salinity impacts on water quality (including the Hunter River) from disturbance and exposure of saline subsoils.*
7. *Due to the soil characteristics, the rehabilitation/revegetation proposed is unlikely to succeed unless extensive rehabilitation measures are undertaken. The cost of rehabilitation is expensive with often a very poor response and success rate.*
8. *These aforementioned issues are ignored in the DP&E Final Assessment Report.*

B. Introduction

We (Dr Peter Bacon and Dr Pam Hazelton) have been commissioned by Godolphin and Coolmore Australia to examine the Department's Final Assessment report (NSW Planning and Environment, 2016) and the Proponent's response to the PAC review Report.

This is the third report we have made into this issue (including to the Review PAC in 2015 refer Bacon and Hazelton, 2015).

All of the issues we raised with the Review PAC remain unaddressed by the Department and the Proponent – contrary to the Department's SEARs.

1. The Report does not appear to address the key reasons why the local area has important agricultural industries such as horse breeding, wine grape growing, lucerne growing and dairying.

2. These reasons include favourable soils and landforms (including BSAL[1]), a warm humid climate in which the decile 1 rainfall exceeds 350 mm/year (a key BSAL criterion), a supply of water suitable for irrigation (the Hunter River), relative nearness to markets and well established infrastructure.

3. The industries on these soils and landscapes are economically important and also synergistic. For example, lucerne grown on the local high quality soils are a significant food source for local livestock.

    Irrigated lucerne is particularly susceptible to saline irrigation water (DNR, 1997). Some of the soils in the proposed mine void have saline subsoils (e.g. TP 115). Mining in this area (TP115) will release the salt from the soil resulting in hard setting subsoils and an increase in runoff potential, subsequent erosion and poor vegetation response. The salt will be released into the drainage lines and these lines drain to the Hunter River. This has major consequences for downstream irrigation water quality, especially when the water is used on salt sensitive species including legumes and horticultural plants.

4. The DP&E Report ignores this critical impact. This approach is not consistent with the report's comments on the Upper Hunter Strategic Regional Land Use Plan (SRLUP) (NSW Department of Planning and Infrastructure (2012).

    The Upper Hunter SRLUP identifies agricultural land that has strategic significance because of its land capability, productivity or other economic or social value to the region. Areas of significance are identified by mapping as either Biophysical Strategic Agricultural Land (BSAL) or Critical Industry Cluster (CIC) as is the case with the Upper Hunter Equine CIC.

5. In this report we identify the important soil based considerations which have been ignored in the Department's Final Assessment Report.

[1] BSAL: Biophysical Strategic Agricultural Land. BSAL covers some 3% of NSW. It is land with high quality soil and water resources capable of sustaining high levels of productivity.

C. Is BSAL land likely to be impacted by the development?

Definition of BSAL

The Upper Hunter Strategic Regional Land Use Plan (SRLUP) (NSW Department of Planning and Infrastructure (2012), contains the following text

> *'Biophysical Strategic Agricultural Land is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality. As these lands are rare, the NSW Government is putting mechanisms in place to protect these strategic land assets'.*

Figure 8, from Drayton South Coal Project Gateway Certification Application prepared by Hansen Bailey for Anglo American Coal, shows that BSAL lands extend well towards the centre of the mining void (see, Figure 1 below).That is, the proposed mining involves disturbance and removal of BSAL.

According to the criteria on page 78 of the Upper Hunter Strategic Regional Land Use Plan, an issue is '*whether the proposal of the land based on* :

(a) Impacts on the land through surface area disturbance and subsidence;

(b) Impacts on:

- (i) soil fertility
- (ii) rooting depth, or
- (iii) soil profile materials and thicknesses;

(c) Increases in land surface microrelief or soil salinity, or significant changes to soil pH

would significantly reduce the agricultural productivity of the land'.

The maps within the EIS show that mining results in a decrease in land capability.

For example a comparison of figure 7 from page T43 with figure 8 from page T44, (both presented on the following pages), shows a clear loss of class 3 agricultural land suitability within the BSAL lands. Much of the lands that met the BSAL criteria are shown as being reduced to class 5 land following mining.

This is a highly significant loss of BSAL land in an area north of the Golden Highway and east of Edgerton Road where BSAL land appears to be relatively scarce.

We note that in its assessment of this Project, the Gateway Panel in 2015 (p 19) raised similar concerns (which remain unaddressed) in providing a “conditional” Gateway certificate:

17 H (4) (a) BSAL	Determined Impact
(i) any impacts on the land through surface area disturbance and subsidence	Significant impact
(ii) any impacts on soil fertility, effective rooting depth or soil drainage	Significant Impact
(iii) increases in land surface micro-relief soil, soil salinity, rock outcrop, slope and surface rockiness or significant changes to soil pH	Potentially Significant Impact
(v) any fragmentation of agricultural land uses	Significant Impact
(vi) any reduction in the are of biophysical strategic agricultural land	Potentially Significant Impact

We also refer the Commission’s attention to the Gateway Panel’s findings:

“The Gateway Panel found that this project failed five of the six biophysical strategic agricultural land criteria”

“The Gateway Panel finds that the verification of BSAL within the PDA is incomplete and this has implications for assessing the full extent of the Project’s impact on BSAL. However, it is determined that the open cut mining operation will have significant direct impact on the agricultural productivity of any BSAL verified within the PDA through surface disturbance, reduction in soil fertility and structure, alteration to effective rooting depth, increased drainage and fragmentation of land use following the proposed landform rehabilitation. More definitive information on the rehabilitation program is required to determine the direct impact on the final land surface slope and rockiness, soil salinity and soil pH”.

‘The change in verified BSAL in the revision document (SLR 2015b) results from a modification to the original boundaries of Soil Units 1 and 2 (originally identified as BSAL) which reduce their extent, and the subsequent removal of Soil Unit 2 from identified BSAL. While the Gateway Panel acknowledges that increased site sampling and analysis has been used to inform these decisions, there remain some inconsistencies regarding the removal of Soil Unit 2 from verified BSAL, its dominant soil type and the drawing of its boundaries.

See also our comments in 6.14.2 BSAL Verification in Soil Report at Annexe 1 to this report.

D. How much BSAL Land will be lost?

The EIS shows the BSAL land as a light yellow outline, overlying the mine void. See map of initially verified BSAL shown below as figure 1. The report states that there were 218 ha of ‘verified BSAL’ (SLR 2015).

By May 2015 the BSAL was ‘shrunk’ to 78 ha (see page 4-4 and section 7.13.3 of the EIS SLR 2015). In a later report, the BSAL was moved westward and away from the mine void footprint. See figure 4 in appendix A 3.1 of the SLR (2015) report.

The remaining 78 ha were deemed to be not BSAL following an inspection by unidentified consultants and staff from Office of Agricultural Sustainability &Food Security (OAS&FS).

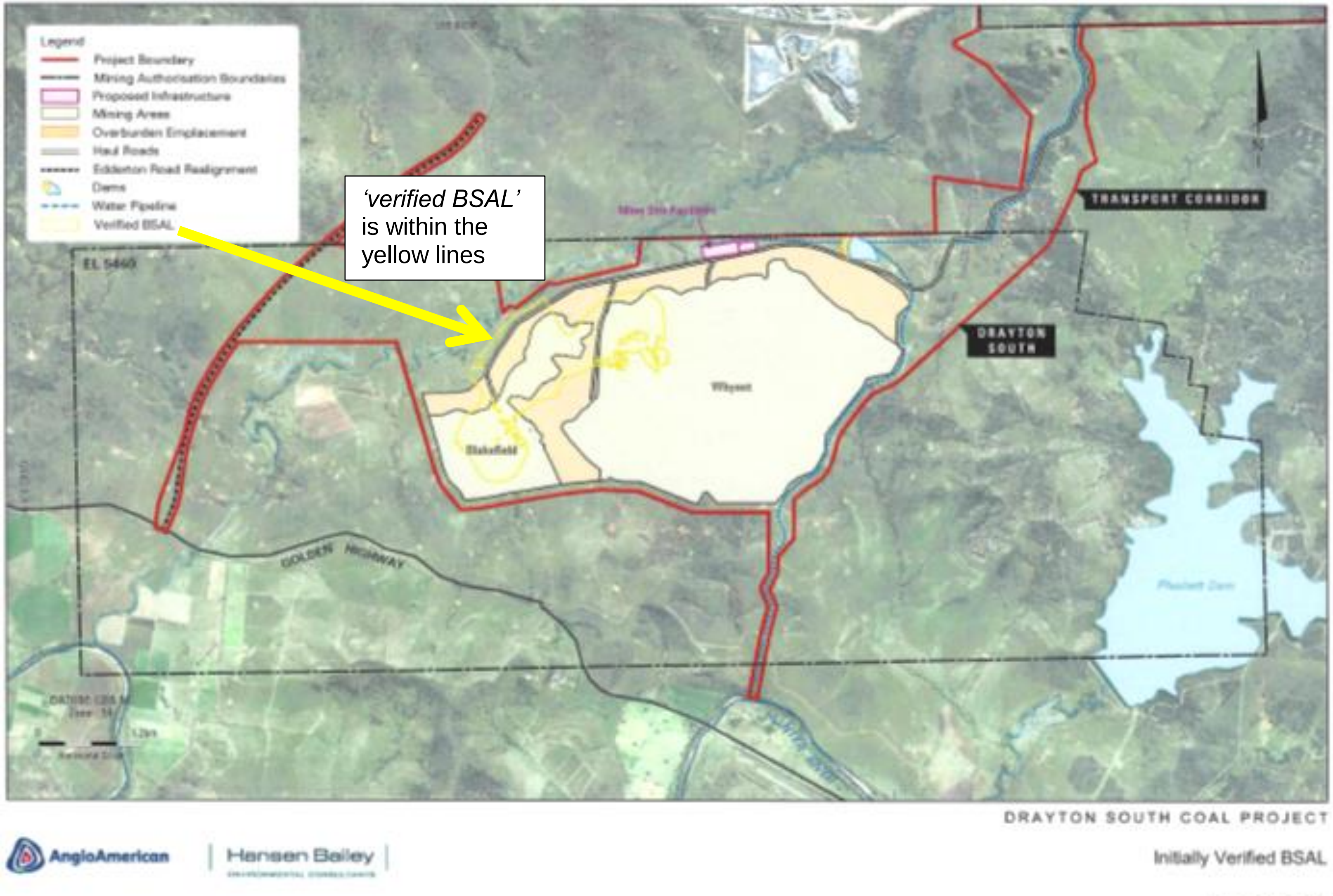

Figure 1. The area referred to as **Verified BSAL** in the legend above is within the light yellow lines (Sourced from Hansen Bailey).

E. Based on the EIS what extent of land will be degraded by the development?

The assessment in the EIS of the impact of the mine on agricultural land suitability was not undertaken in accordance with the guidelines applicable in 2012.

Table 15, Comparison of pre and post-mining agricultural land suitability classes (page T-41 of the EIS), is based on a 2002 publication. It should be based on the more current publications:

- NSW Office of Heritage and Environment (2012). The Land and soil capability assessment scheme. Second approximation. Sydney, NSW.
- NSW Office of Heritage and Environment and Office of Agricultural sustainability and Food Security. (2013). Interim Protocol for site verification and mapping of biophysical strategic agricultural land.

Based on data presented in Table 15, there a loss of 253 ha of land that *'is moderately productive and well suited for grazing or to crop cultivation with a pasture rotation'* (quoted from page T-41).

This can be considered a major impact; see page 78 of NSW Department of Planning and Infrastructure (2012). Figure 2 and 3 shows the changes in the agricultural suitability classes.

Additionally there is a net loss of 122 ha of class 4 land. This land is *'suitable for grazing but not cultivation'* (quoted from page T-40).

Conversely, Class 5 land, which is *'unsuitable for agriculture or at best only light grazing'* (quoted from page T-40), increased by 379 ha.

These results demonstrate a major net loss of productive land from the region (see NSW Department of Planning and Infrastructure (2012)).

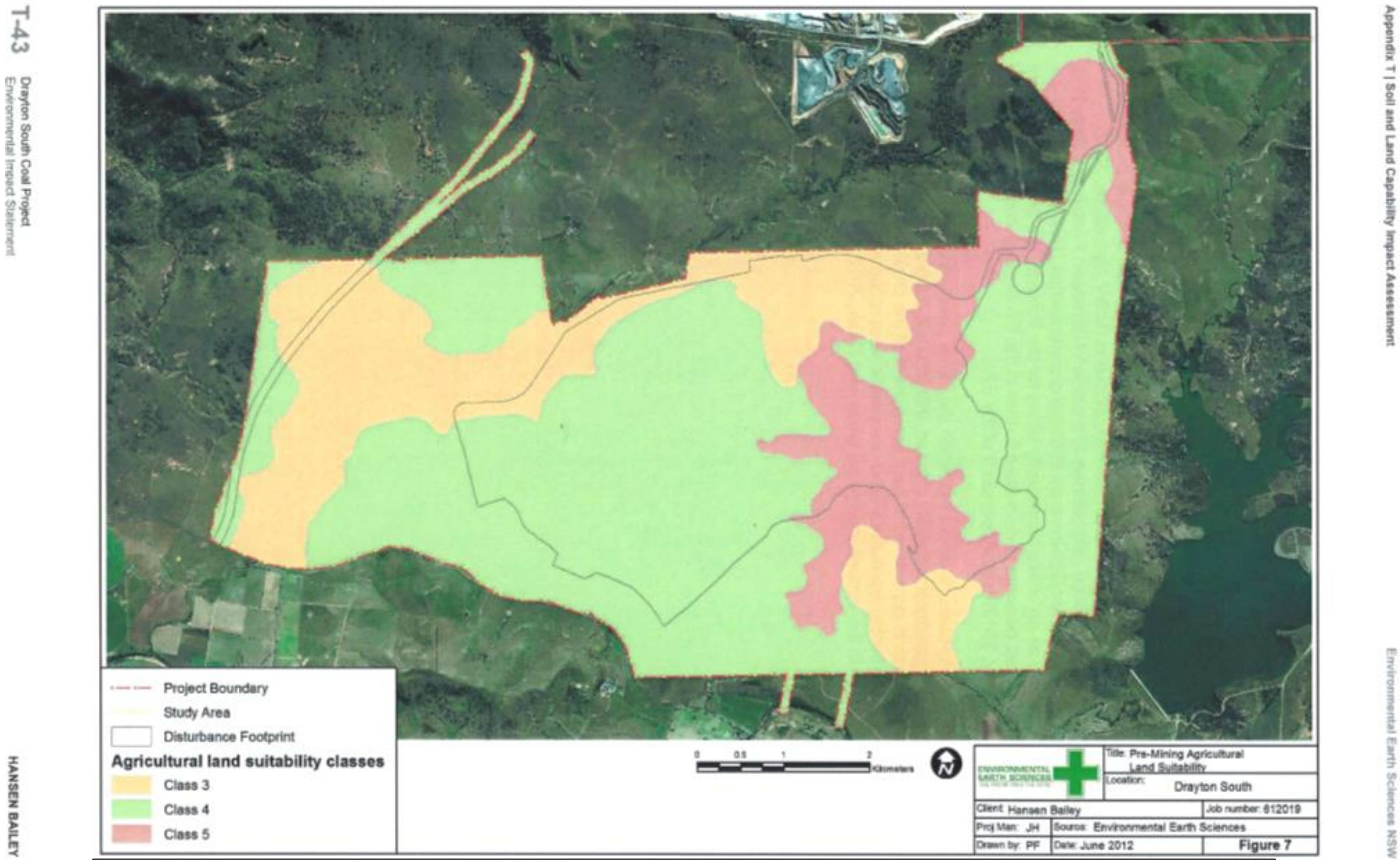

Figure 2. The distribution of agricultural suitability classes in and around the proposed mine void prior to mining. Sourced from the T-43 Drayton South Coal Project. EIS Hanson Bailey.

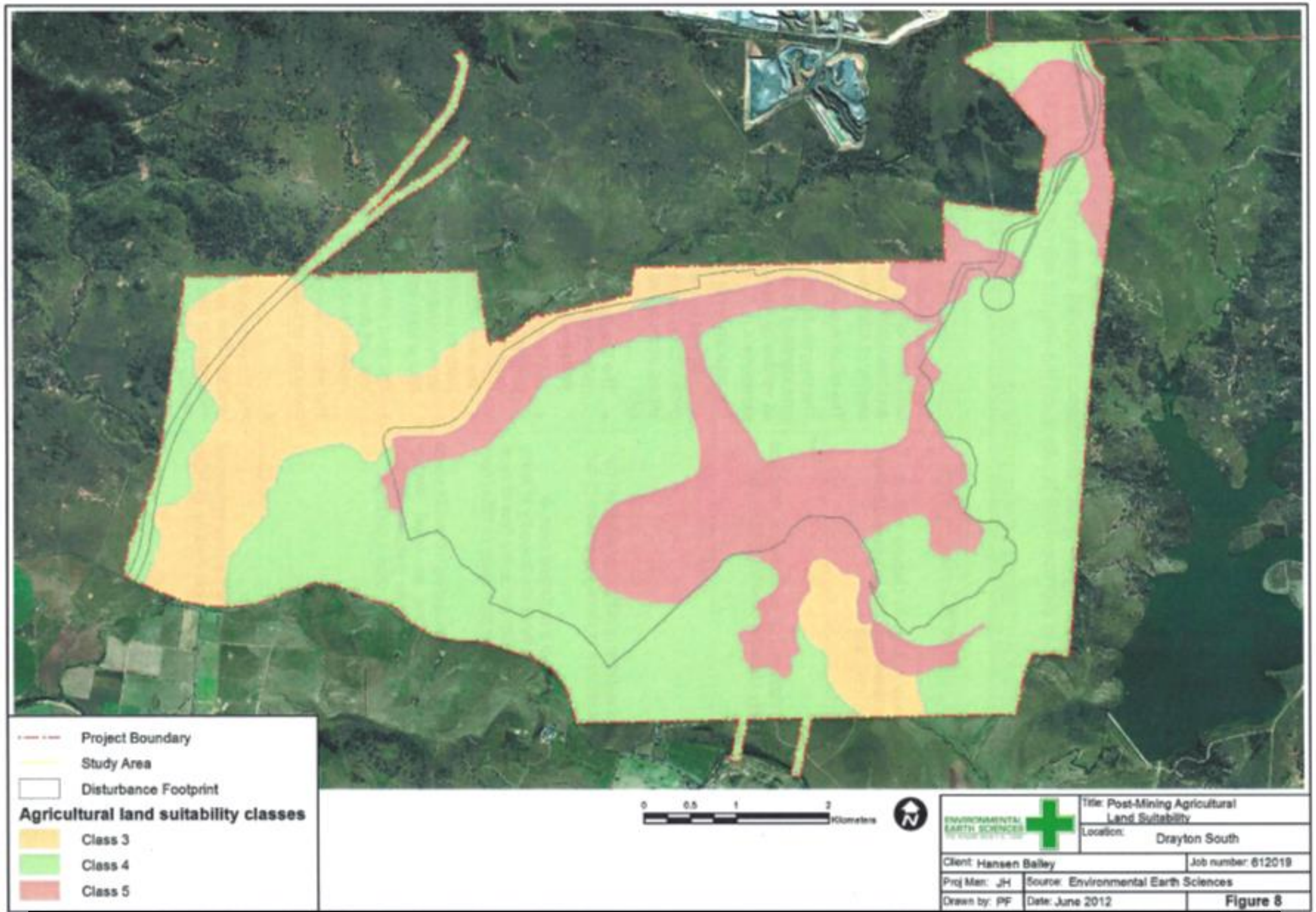

Figure 3. The distribution of agricultural suitability classes in and around the proposed mine void after mining.
Sourced from the T-44 Drayton South Coal Project. EIS Hanson Bailey.

F. What are the consequences of soil disturbance?

There are no contour maps provided for the site. If the land is to be disturbed, the topographic location of the test pits in the landscape is important. For example TP115 is sodic and has a saline subsoil. It appears to be in the lower area of the landscape.

It would be impossible to precisely remove a 0.1 m layer without disturbing and inadvertently including potentially sodic subsoil. Desirable soil physical and chemical properties such as structure and organic matter are destroyed by removal and stockpiling. This degradation seems to occur even when topsoil and subsoil are separated (Tongway and Ludwig, 2011)

Moreover the depth of the topsoil is often very shallow at these sites. For example in the EIS for the Drayton South project Tables 7 to 10, pages T 21 to T 29, 14 of the 30 profiles have a topsoil depth of 0.1 m, (Refer Table 1).

Soil salinity also occurs in the topsoil and some shallow subsoils within the mine void footprint (from EIS).Thus mining in this area (e.g. TP115) will release the salt from the soil resulting in hard setting subsoils and an increase in runoff potential, subsequent erosion and poor vegetation response. The saline solution will be discharged and /or seep into the drainage lines and these drainage lines, with their salt loading, will flow into the Hunter River. This has major consequences for downstream horticultural crops.

These consequences are discussed in more detail in section 4 of our previous report dated 9 October 2015 provided to the Review PAC.

G. Is the number of soil samples sufficient to justify the soil mapping and assessment?

There is a standard for the number of samples required for a soil map depending on the scale (Hazelton and Murphy 2007). This standard has not been followed.

The number of soil samples taken in the test pits is too low. Also the number of pits recorded/ha is extremely low compared with those recommended in the CSIRO publication ‘Guidelines for Surveying Soil and Land Resources’ (Gallant et al 2008).

This inadequate sampling leads to major unexplained changes in soil properties between test pits. For example, TP115 is a very ‘poor’ soil. Yet TP118 which is the nearest soil to TP115 that is in the mine void footprint, has ‘low’ sodicity and salinity. The distance between them is approximately 1.7 km. The mine void footprint covers some 600 ha. It has five test pits in the central void footprint of Whynot (figure 3, page T-15). This is approximately one test pit per 100 ha.

The BSAL guidelines (NSW Gov., 2013) states

'sampling density should be:

1. *1 site per 5 to 25 ha (Gallant et al 2008) for more intensive developments, e.g., open-cut coal mines'.*

The actual sampling density in the EIS is 4 to 20 times less intensive than that recommended by the NSW government (NSW Gov., 2013).

The reason, and hence the design for the sampling locations of the soil test pits, have been stated as consistent with McKenzie et al (2008) for a 1:50 000 scale survey.

Gallant et al (2008), who were the authors referred to as being *McKenzie et al 2008* in the EIS, make the point that basing survey intensity on map scale is

'not reliable for assessing accuracy and precision of a survey. Others factors are important such as complexity of soil variation…'

Moreover, the geology in the Hunter Region is very complex. Correlating any site specific information from the 1;250 000 Soil Landscapes of the Singleton Sheet (Kovac and Lawrie 1991) with the survey scale of 1:50 000 therefore would be tenuous and provide a general overview only. Thus substantial field work at the appropriate intensity is still required.

The geology at a site determines the chemical and physical properties of soil. From the information provided by the Proponent there is insufficient sampling to accurately determine soil boundaries. For example In Fig 4 page T-30 (shown on page 10, below as figure 4.), the soil boundaries have been drawn using the description of soil test pits, the location of others undocumented surface observations. Based on the number and locations of the test pits, there appears to be insufficient sampling to justify the boundaries drawn in this figure.

There are obvious deficiencies in the sampling techniques used when they are compared with those advocated in the acknowledged industry handbook (McKenzie et al, 2008) and (Hazelton and Murphy 2007).

Laboratory Soil Assessment and Analytical Results

Selection of samples for analysis was based on establishing the physical and geochemical suitability of surface and near surface soil horizons for use as top dressing in rehabilitation works.

The EIS also sought to identify soils that may require particular management. However the insufficient sampling intensity makes it impossible to achieve this objective in an area such as the mine void footprint as the soils in this area are extremely variable

Co**mment on analytical results**

A very general reason for soil sample selection for analysis was reported. It is also not obvious as to whether the soils were bulked for testing. This lack of clear methodology makes it difficult to fully evaluate the proponent's findings and conclusions.

H. What are the implications of the soil results?

Based on the results tabulated in table 7 on T-21 of the EIS, soils in the southern portion of the mining void are sodic and saline (see data for soils from TP115). Again it is noted that there are insufficient soil samples to draw any justifiable conclusions regarding the extent of different soils types.

- These deficiencies in soil survey make rehabilitation at the scale required extremely difficult. Creation of windrows of stockpiled coal-mined soil is a practice used to retain suitable soil for the restoration and rehabilitation of the site after mining operations cease.
- The topsoil at the site is apparently largely non-saline and non-sodic in nature and contains aggregates that exhibit a degree of soil stability. In contrast, the subsoil is generally saline, sodic, disperses and has a tendency to slake when exposed to moisture. Such characteristics are evident through the presence of surface erosion, including gullying and rill formations and slumping'. Stockpiling these soils will create a significant risk of sediment mobilisation and contamination of local drainage lines with dispersible clay that could also have absorbed contaminants and salt. Disturbing these soils creates a significant risk to downslope drainage systems including the Hunter River. For example, clay dominant sediment which has exited the disturbed mine site can settle out on the floor of the Hunter River smothering benthic biota. Additionally, the nutrients in this sediment can increase the potential for algal blooms.
- Exposed sodic, saline soils are notoriously difficult to revegetate. No evidence is provided to justify the assertion that they can be rehabilitated.
- Salinity creates an increased osmotic potential in the soil, reducing the 'availability' of the water. In turn this inhibits seed germination and growth. Use of this mix of topsoil and saline sodic subsoil to recreate Endangered Ecological Communities (EEC) is highly problematic as the non-salt tolerant plants simply will not establish. EECs grow in a specific soil types. The Scientific Final Determination for EECs, used by both the State and Federal Government provides the classification of the soils required in which the EECs grow. If salinity is increased the resulting vegetation communities will be skewed towards only salt tolerant species. Consequently the pasture will be slow to re-establish (Tongway and Hindley 2004). Also the EEC could fail to regenerate. Loss of EECs requires biobanking preferably in close proximity to the EEC lost. The potential loss of the EEC is very poorly addressed by both the Proponent and the Department in its Final Assessment Report.

I. Is the rehabilitation proposed feasible?

It is highly unlikely that the excavated soils that have unstable sodic and saline properties can be used to rehabilitate and revegetate the area to pre mining conditions as suggested by the proponent (Tongway and Ludwig, 2011)

Tongway and Ludwig (2011) point out that significant time, commitment to biodiversity and land management strategies would be needed to reduce the effects of the adverse and variable soil properties described. Such measures are costly and are often not successful.

As already stated in this Report it would be impossible to precisely remove a 0.1 m layer without disturbing and inadvertently including potentially sodic subsoil.

The exposure will occur in three phases:

1. Attempting to strip off a 0.1m topsoil layer will result in some mixing of the topsoil and the saline sodic subsoil. It is noted Anglo American Coal proposed to strip and retain the surface 0.3m. Therefore the topsoil stockpiles will contain a mix of subsoil and topsoil. Based on the information of 30 test pits in the EIS it is likely that almost half the volume of soil in the stockpiles will contain approximately 1/3 topsoil to 2/3 subsoil mix. The sodic subsoil will dominate the 'topsoil' stockpiles.

2. The subsoil stockpiles will largely comprise sodic soils. Only 12 out of the 30 profiles reported upon in tables 7 to 10, pages T21 to T29 of the EIS were 'non;' sodic and or 'non-saline '. It is also noted that only one or two subsoil layers were reported upon in the EIS. There is no information on the other horizons.

3. Using the stockpiles as topdressing will result in the sodic soils being the main material on the surface. This will occur because there is too little surface soil to achieve adequate coverage of the domed mass returned to the mine void. As indicated previously the topsoil is only 0.1m thick on 14 out of the 30 profiles reported upon. Consequently the cover will have to contain a mix of topsoil and sodic/saline subsoil.

Yet this separation of topsoil and subsoil is essential for remediation and rehabilitation, because the topsoil is the biological powerhouse of soil and essential for vegetation growth.

Soil salinity is also evident in the topsoil. Some shallow subsoils within the mine void footprint are very saline (e.g TP 114). Some of this material will also occur as topsoil on the rehabilitated slopes,(refer to 30 soil test results in EIS). Thus subsoil mixed in with the 10 cm of topsoil would mean that saline soils would be used as topdressing. That is, after mining there will be large areas of the site contaminated with exposed sodic and saline soils.

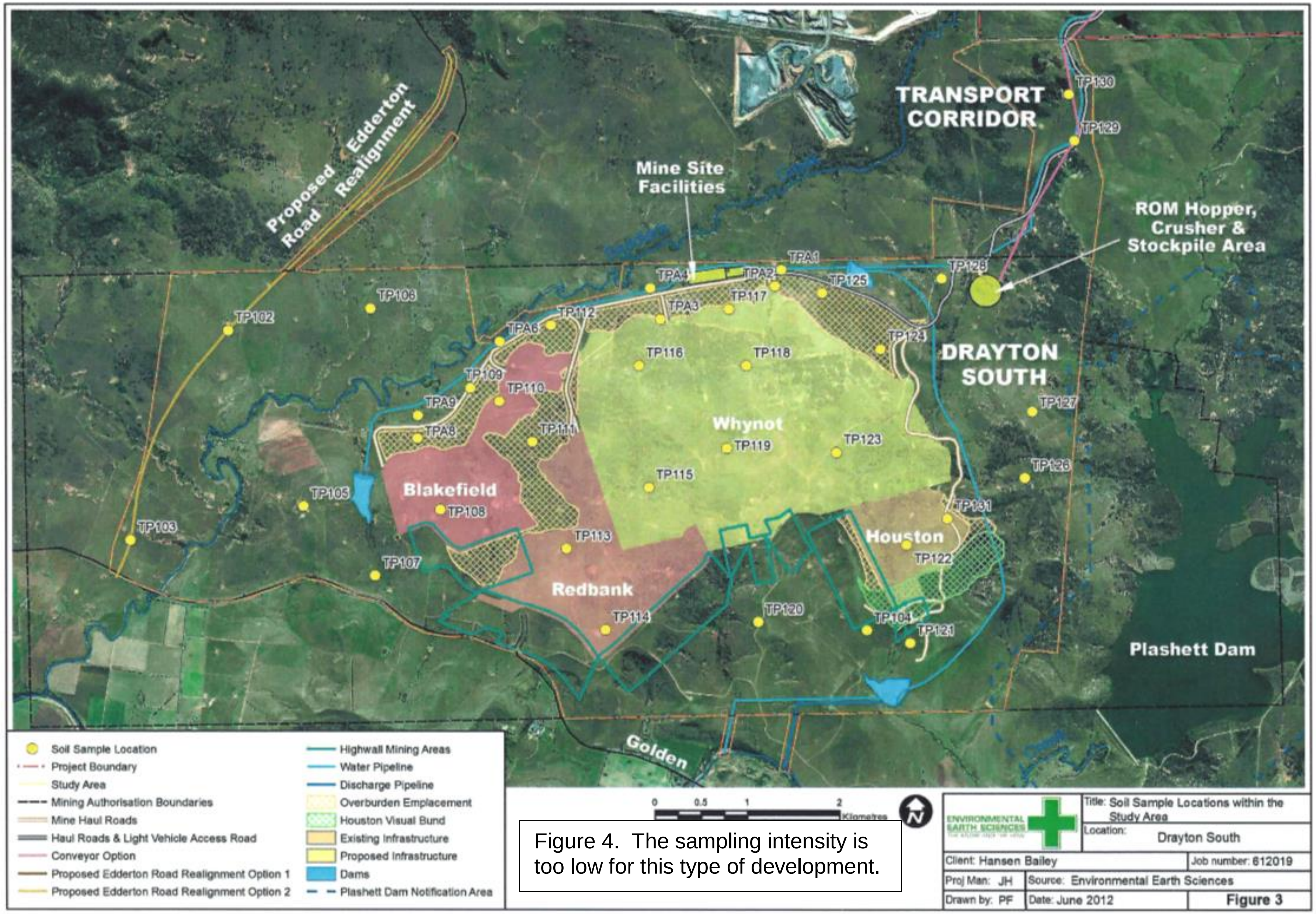

Figure 4. The sampling intensity is too low for this type of development.

J. Will the agricultural production be impacted?

This issue is examined in the report prepared by Scott Barnett & Associates. It is found in appendix U of the EIS.

Page U-ii contains the phrase; *'The project will not reduce the availability of land for agricultural purposes'* [2] This is patently not true. The EIS appendix T, table 15 clearly shows degradation of land from that suitable for agriculture (class 3), to class 5 land that can only be used for limited grazing.

Figure 1, page U-3 shows that the Drayton extension extends into the Equine Cluster along the western side of the Golden Hwy.

For some reason Figure 1 (cited above) does not show Coolmore Stud on it. Yet, it is directly opposite the proposed mine entrance and within the equine cluster. It is also a famous thoroughbred stud. This lack of local information suggests a tentative understanding of a key agricultural resource in the Hunter Valley.

Figure 4 on page U-14 is extremely confusing and the labels appear to be wrong. However it does demonstrate that vertosols[3] are a key soil within the mine void area. These meet the BSAL criteria, but will be destroyed by the mining activity. The vertosols cover some 431 ha within the project boundary (page U-13, para 4).

A key point is that '*The topsoil is largely non-saline and non-sodic in nature and contains aggregates that exhibit a degree of soil stability …….. In comparison, the subsoil is generally saline, sodic, disperses and has a tendency to slake when exposed to moisture. Such characteristics are evident through the presence of surface erosion, including gullying and rill formations and slumping'.* (Page U-15 para 5).

If the subsoil is so unstable that mining disturbance will produce major issues with erosion then why expose it? As mentioned above it will be a major challenge to use this material to revegetate the site.

Table 6 on page U-23 and figure 5 on U-22 demonstrate that the bulk of the proposed mine void consist of agricultural domains B (19% of area) and C (56% of area). Domain B soils are suited for grazing and some cropping while domain C soils are suited for improved pastures. It is noted that the report does not discuss Type C, even though it covers the majority of land in the project area.

This is a significant deficiency in the EIS which was not considered in the NSW Planning and Environment (2016) Final Assessment Report.

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[2]This sentence is confusing and could be interpreted to say there are no offsite impacts on agricultural production. In either case there is a documented loss of agricultural land quality within the project area

[3] Vertosol: *'Clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates'* Isbell RF, and National Committee on Soil and Terrain 2016. The Australian soil classification. CSIRO Publ. Melbourne.

K. Relative agricultural values of the proposed offset areas

The proposed offset area is much poorer country than that found in the project area. For example in Table 7, on page U-24 has no domain A or B soils as defined in Table 6 and found in the project area. Additionally the project area has 1,219 ha of domain C soil compared with 333 ha of domain Y soil in the offset area. That is, the offset area has poorer soils and the domain of soil approximately equivalent to that in the project area covers only 27% of the coverage in the proposed offset area. The proposed offset area cannot be considered equivalent. This was not considered in the NSW Planning and Environment (2016) Final Assessment Report.

L. Key conclusions

The NSW Planning and Environment (2016) Final Assessment Report ignores the impact of the proposal on BSAL in the Mine Authorisation Area. Further, it ignores the potential impact of disturbing and exposing sodic and/ or saline subsoils with can lead to increased salinity in the Hunter River.

According to the impact assessment the majority of lands in the project area are covered with productive soil.

However other soils within the mine void area have unstable and or saline subsoils.

The number of sampling pits/ assessment sites and the extent of individual sample analysis are insufficient to justify the detailed mapping or conclusions regarding the distribution of soil types in the current mine disturbance area.

Most of the soils within the proposed mining void area are vulnerable to disturbance that exposes the unstable subsoil. This will result in increased erosion rates, sediment mobilisation and the likely contamination of local waterways with clay dominant sediment that can smother stream floors and increase the potential for algal blooms.

It is highly unlikely that such soils can be rehabilitated to pre mining conditions. Consequently there is significant loss of pasture and Endangered Ecological Communities (EEC). To recreate an EEC is highly problematic as the non-salt tolerant plants simply will not establish because EECs grow in a specific soil type.

Any re-establishment of EEC will be very slow and success is unlikely.

Increased salinity and decline in water quality will also occur in the Hunter River as a result of landscape disturbance. The increased salinity will put at risk salt sensitive plants such as lucerne which rely on Hunter River water for irrigation.

M. References

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ANNEX 1

SOIL REPORT

THE DRAYTON SOUTH COAL PROJECT

Dr Peter Bacon and Dr Pam Hazelton

SOIL REPORT
THE DRAYTON SOUTH COAL PROJECT

Dr Peter Bacon and Dr Pam Hazelton

The two issues which have been addressed in this report by Dr Bacon and Dr Hazelton are the use of large piles of stockpiled coal-mine soil for the restoration and rehabilitation of the site after mining operations cease and the loss of BSAL land. We have set out below our responses to both submissions and to Anglo American Coal's responses.

Open Cut Coal Mining
In open-cut coal mining drag-lines are used to strip away soil and overburden and expose the coal layer.

Desirable soil physical and chemical properties such as structure and organic matter are destroyed by the dragline method used to remove topsoil. This degradation seems to occur even when topsoil and subsoil are separated (Tongway and Ludwig, 2011).

Moreover the depth of the topsoil is often very shallow at these sites. For example in the EIS for the Drayton South project Tables 7 to 10, pages T21 to T29, 14 of the 30 profiles have a topsoil depth of 0.1 m, (Refer Table 1)

Table 1. Soil type, topsoil depth and sodicity/ salinity issues associated with the 30 test pits reported in the EIS.

Test pit number	Soil type	Topsoil depth	Subsoil saline or sodic?	Depth tested (m)
103	Brown sodosol	0.3m	Strongly sodic	
107	Brown sodosol	0.1m	Saline AND sodic	
108	Brown sodosol	0.2m	Saline AND sodic	
110	Brown sodosol	0.1m	Sodic	
114	Brown sodosol	0.1m	Saline AND sodic	
115	Brown sodosol	0.4m	Saline AND sodic	
117	Brown sodosol	0.2m	OK	0.4-0.5m OK
118	Brown sodosol	0.3m	OK	
120	Brown sodosol	0.1m	OK	
121	Brown sodosol	0.3m	Saline AND sodic	0.4-0.5
122	Brown sodosol	0.1m	OK	
123	Brown sodosol	0.1m	OK	
125	Brown sodosol	0.1m	Saline AND sodic	0.6-0.8

Test pit number	Soil type	Topsoil depth	Subsoil saline or sodic?	Depth tested (m)
126	Brown sodosol	0.1m	OK	0.4-0.5
127	Brown sodosol	0.1m	Saline	0.1-0.2
130	Brown sodosol	0.1m	OK	
102	Brown dermosol	0.3m	OK	
105	Brown dermosol	0.1m	OK	
113	Brown dermosol	0.1m	Sodic	
128	Brown dermosol	0.3m	OK	
129	Brown dermosol	0.2m	Sodic AND saline	>0.9m
106	Brown vertosol	0.1m	OK	
109	Brown vertosol	0.2m	Sodic AND saline	0.7-0.8
112	Brown vertosol	0.1m	Subsoil not tested	
119	Brown vertosol	0.2m	Subsoil not tested	
111	Orthic tenosol	0.4m	Saline AND sodic	0.4-0.5
116	Orthic tenosol	0.2m	Saline	topsoil
124	Orthic tenosol	0.2m	OK	0.2-0.4
131	Orthic tenosol	0.2m	Not tested	

Stockpiled Soil

- *The topsoil is largely non-saline and non-sodic in nature and contains aggregates that exhibit a degree of soil stability …….. In comparison, the subsoil is generally saline, sodic, disperses and has a tendency to slake when exposed to moisture. Such characteristics are evident through the presence of surface erosion, including gullying and rill formations and slumping'.* (Page U-15 para 5).

    - It would be impossible for a dragline to precisely remove a 0.1 m layer without disturbing and inadvertently including potentially sodic subsoil.

    - The exposure will occur in three phases:

1. Attempting to strip off a 0.1m topsoil layer will result in some mixing of the topsoil and the saline sodic subsoil. It is noted Anglo American Coal proposed to strip and retain the surface 0.3m. Therefore the topsoil stockpiles will contain a mix of subsoil and topsoil. Based on Table 1 it is likely that almost half the volume of soil in the stockpiles will contain approximately1/3 topsoil to 2/3 subsoil mix. The sodic subsoil will dominate the 'topsoil' stockpiles.

2. The subsoil stockpiles will largely comprise sodic soils. Only 12 out of the 30 profiles reported upon in tables 7 to 10, pages T21 to T29 of the EIS were 'non;' sodic and or 'non-saline '. It is also noted that only one or two subsoil layers were reported upon in the EIS. There is no information on the other horizons.

3. Using the stockpiles as topdressing will result in the sodic soils being the main material on the surface. This will occur because there is too little surface soil to achieve adequate coverage of the domed mass returned to the mine void. As indicated previously the topsoil is only 0.1m thick on 14 out of the 30 profiles reported upon. Consequently the cover will have to contain a mix of topsoil and sodic/saline subsoil.

Yet this separation of topsoil and subsoil is essential for remediation and rehabilitation, because the topsoil is the biological powerhouse of soil and essential for vegetation growth. Soil salinity is also evident in the topsoil. Some shallow subsoils within the mine void footprint are very saline (e.g TP 114). Some of this material will also occur as topsoil on the rehabilitated slopes,

This data is documented in Table 1, which in contains information directly copied from the EIS. Thus subsoil mixed in with the 10 cm of topsoil would mean that sodic soils would be used as topdressing. That is, after mining there will be large areas of the site contaminated with exposed sodic and saline soils.

The environmental consequences of exposing sodic and saline soils

Sodic soils form surface crusting, and are hard setting when dry (see the SOILpak series produced by NSW Agriculture in 1998, Surapaneni ,et al, 2002). The crusting inhibits seedling emergence so plant establishment is difficult especially for the small seeds of many pasture species. The crusting reduces water infiltration rate 4 to 6 fold (Shainberg, 1985). In turn the surface sealing increases runoff rate and therefore is erosion risk (Hazelton and Murphy 2007, Miller et al 1998)

The rainfall impact causes the exposed sodic soil to disperse, The dispersed clay forms a stable floc that does not settle out. Cadmium and lead are two of the heavy metals found in the chemical analysis of soil at the site. These contaminants will adhere to the soil clay particles and will be transported by overland runoff towards the Hunter River and other waterways.

The presence of sodic soil on the land surface will also make plant establishment extremely difficult due to crusting, reduced water percolation increasing the risk of erosion (Lawrie, et al, 2007, Hazelton and Murphy 2007,Shainberg, 1985).

Some of the subsoils are also saline. See tables 7 to 10, to T29 of the EIS. The salinity creates an increased osmotic potential in the soil, reducing the 'availability' of the water. In turn this inhibits seed germination and growth. Use of this mix of topsoil and saline sodic subsoil to recreate Endangered Ecological Communities (EEC) is highly problematic as the non-salt tolerant plants simply will not establish. Therefore the resulting vegetation communities will be skewed towards only salt tolerant species. Consequently the EECs and pasture will be slow to re-establish (Tongway and Hindley 2004). Any resulting bare areas will be subject to gully erosion (Hazelton and Murphy 2007), exposing yet more sodic soils.

A recognised management strategy for sodic soil is to minimise disturbance (Hamilton, et al, 2005b). Yet Anglo American Coal proposes to excavate this unstable material, stockpile it for an indefinite time and then spread it out onto the new landscape surface. This approach will result in significantly increased dispersion of exposed sodic soil, increased erosion and increased clay sediment addition to the Hunter River (NSW Agriculture, 1998).

Volume and height of stockpile

The text states that there are 'at least 2,864,000 cubic m of (topsoil)[4] material available for use in rehabilitation. Applying this volume in a 1m layer would cover 286.4 ha. Applying it in a 0.2 m layer would cover 1,432 ha or a 3.8 *3.8 km square. The project area is larger than this.
So the issue becomes:
How do you maintain such large stockpiles without the soil becoming sterile? (having stockpiles >2m high for long periods is likely to result in sterilisation of the deeper soil)?

The responses page 165, section 6.14.3 refers to stockpiles being a maximum of 3m. This is 50% higher than that specified in Landcom (2004), which is the industry reference for erosion and sediment control. The text on page 4.5 reads:
'Where there is sufficient area topsoil stockpiles shall be less than 2 metres in height'.
Landcom (2004) refers to topsoil being 100 to 150 mm thick. Anglo American Coal is suggesting up to 0.3m could be stripped as topsoil. However tables T7 to T10 indicate sodic and saline conditions, even in the surface 0.1m of some profiles. These soils with sodic material at or near the land surface should be treated as subsoils and not used for land surface covering.

Furthermore, The DECC publication on erosion and sediment control (DECC, 2008) refers readers specifically to the stockpile management measures given in Landcom, 2004). The proponents seem to have ignored the specifications in this and the other industry standard guidelines**.**

- Volume of soil material excavated is greater than the open cut. The material is not homogeneous

[4] It is difficult to reconcile this volume with the fact that the topsoil on almost half the test pit sites in the EIS have 0.1 m of topsoil.

Suggested height of stock piles by Anglo American is 2-3m (no cover is suggested) *Topsoil management is an important factor in determining the long-term success of rehabilitation and sustainable post-mining land-use. However, topsoil in the Hunter Valley is often scarce and of poor quality, in terms of its physical, chemical and biological properties. Current Department of Infrastructure, Planning and Natural Resources (DIPNR) guidelines recommend that if storage of topsoil is needed stockpiles should be constructed to a height of less than 3 m. Keipert et al 2004*

OFFICE OF AGRICULTURAL SUSTAINABILITY AND FOOD SECURITY (OAS&FS) Section 4.4

The inspection identified the fact that the current landuse management is insufficient to reach site potential. This lack of management is very obvious from the photos presented in the SLR Agricultural Landuse Strategy report attached as Appendix E to the Anglo American Coal's response.

The OAS&FS officers state that Anglo American Coal's would only commit to maintaining historical landuses in the area outside the mine void.
'*there is no commitment to mitigate the impacts of the loss of agricultural resources as discussed with the proponent* (page 13, para 3).

Comments on Anglo American Coal's response
If, as agreed by the proponent, the site is poorly managed at present when Anglo American Coal has every incentive to improve it in order to demonstrate 'good faith', then what is the likelihood of the site being well managed during mine operation and following closure?

Para 6, page 13, has the text: 'Post mining, the objective of the progressive rehabilitation is to return impacted areas to their pre-mining land capability'

However, the maps within the EIS show that these lands have a fall in their land capability. For example a comparison of figure 7 from page T43 with figure 8 from page T44, (both presented on the following pages), shows a clear loss of class 3 agricultural land suitability. For example, much of the lands that met the BSAL criteria according to the EIS (see figure 3 below) are shown as class 5 land following mining. This is a highly significant loss of BSAL land in an area north of the Golden Hwy and east of Edgerton Road where BSAL land appears to be relatively scarce.

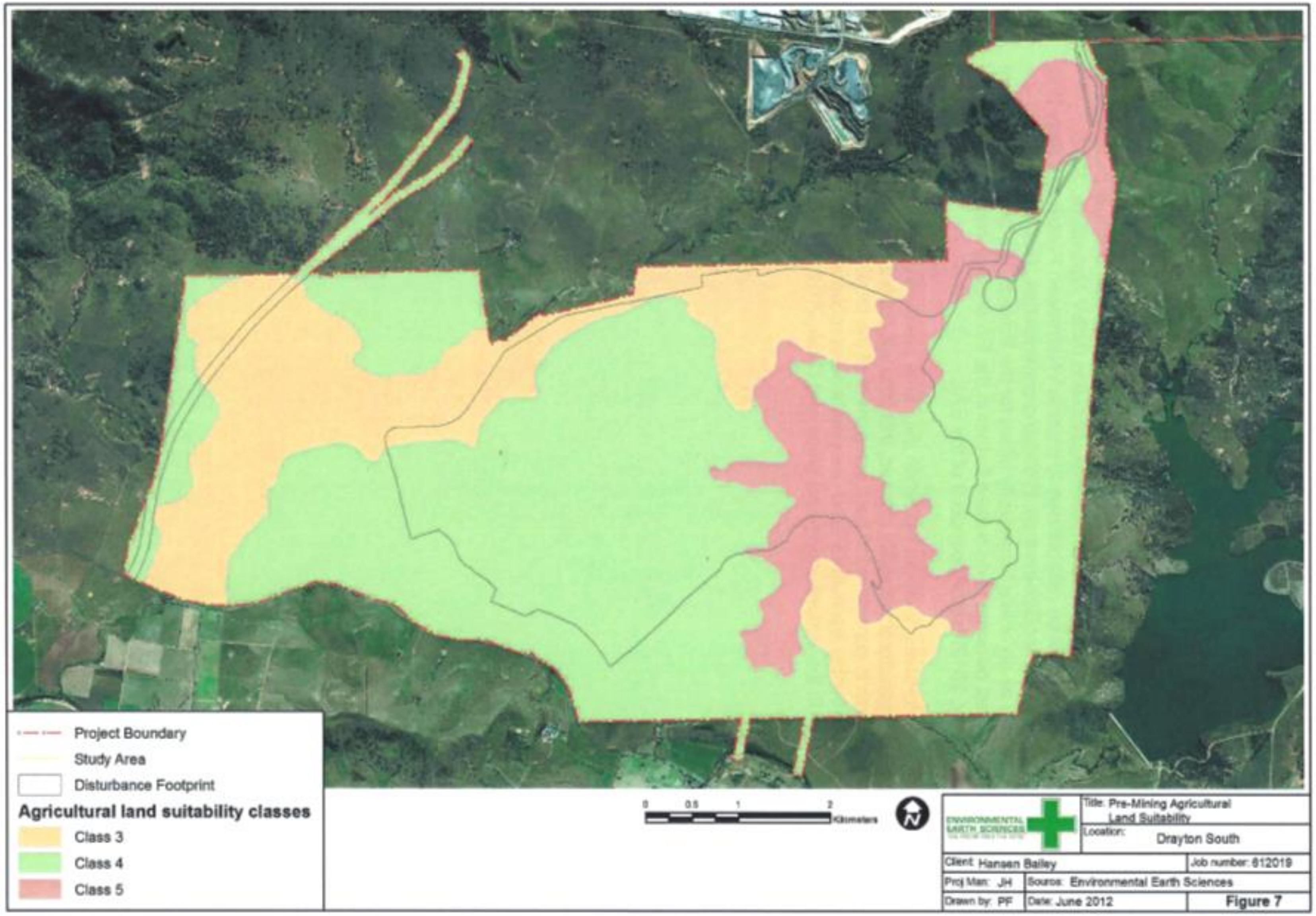


Figure 1 in current document

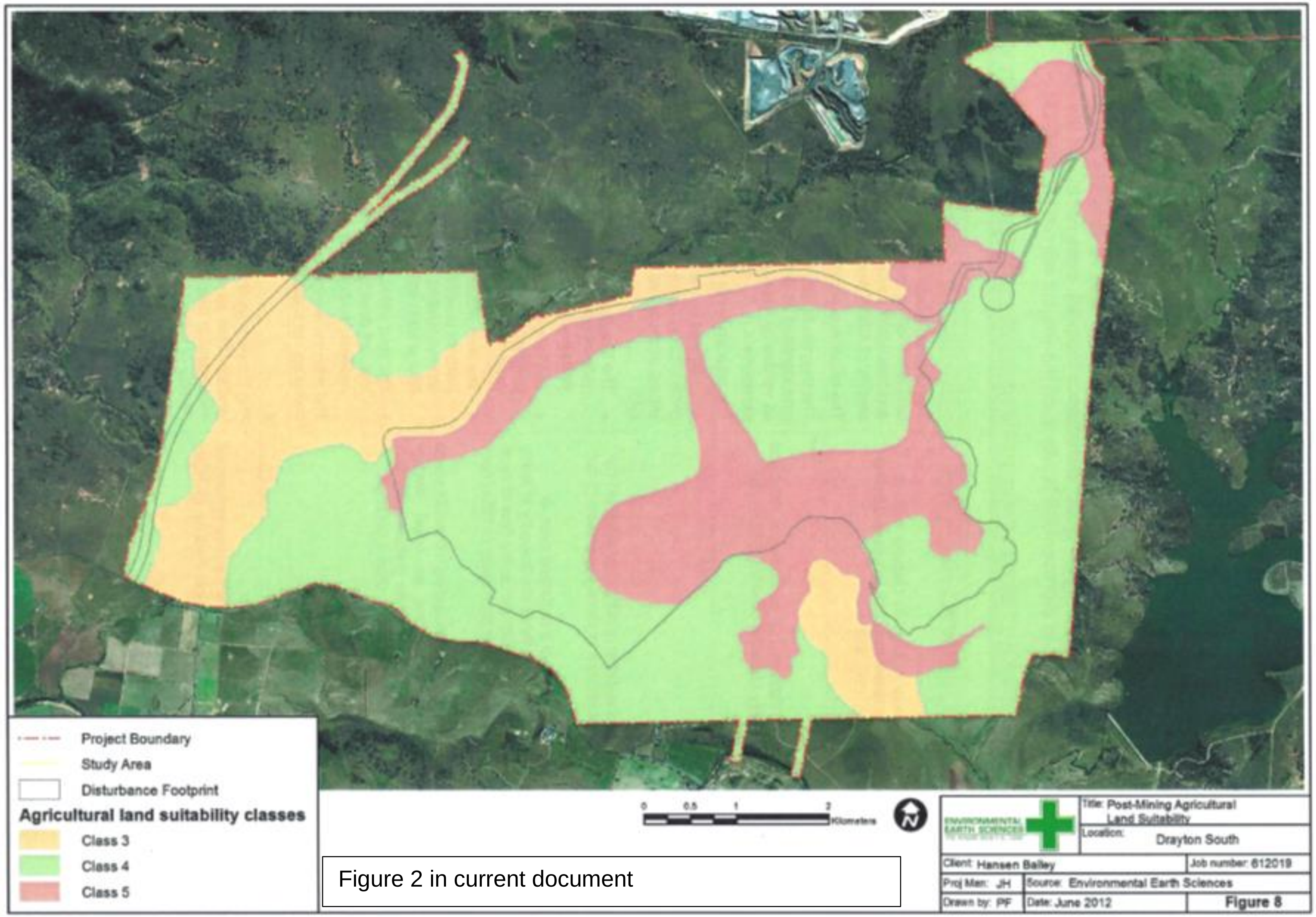
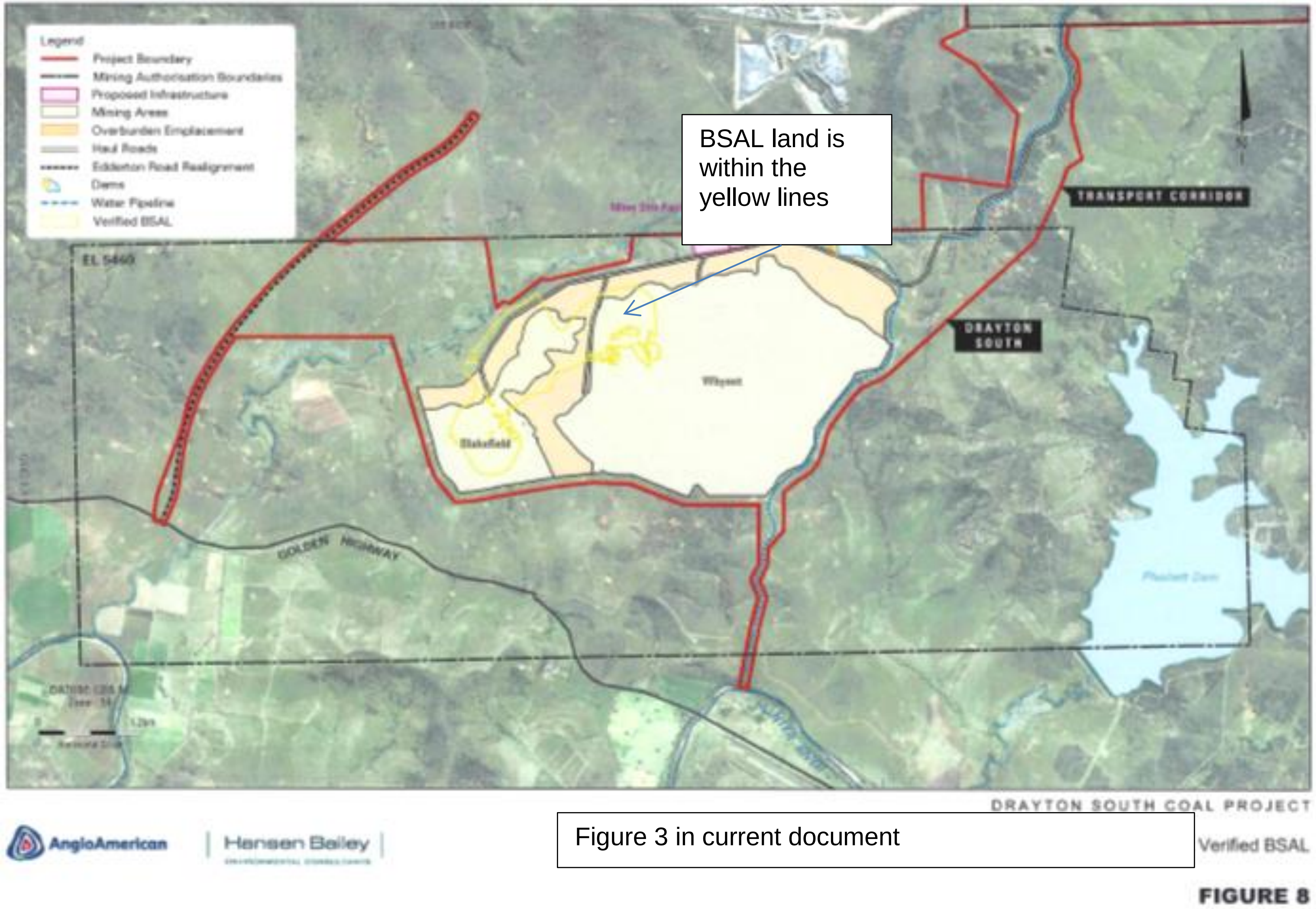


Figure 2 in current document



Will the agricultural production be impacted?

This is examined within the report prepared by Scott Barnett & Associates. It is found in appendix U of the EIS.

Page U-ii contains the phrase; *'The project will not reduce the availability of land for agricultural purposes'* [5] This is patently not true. The EIS appendix T, table 15 clearly shows degradation of land from that suitable for agriculture (class 3), to class 5 land that can only be used for limited grazing.

Figure 1, page U-3 shows that the Drayton extension extends into the Equine Cluster along the western side of the Golden Hwy.

A key point is that '*The topsoil is largely non-saline and non-sodic in nature and contains aggregates that exhibit a degree of soil stability ……. In comparison, the subsoil is generally saline, sodic, disperses and has a tendency to slake when exposed to moisture. Such characteristics are evident through the presence of surface erosion, including gullying and rill formations and slumping'.* (Page U-15 para 5).

If the subsoil is so unstable that mining disturbance will produce major issues with erosion then why expose it? As mentioned above it will be a major challenge to use this material to revegetate the site.

Table 6 on page U-23 and figure 5 on U-22 demonstrate that the bulk of the proposed mine void consist of agricultural domains B (19% of area) and C (56% of area). Domain B soils are suited for grazing and some cropping while domain C soils are suited for improved pastures. It is noted that the report does not discuss Type C, even though it covers the majority of land in the project area. This is a major deficiency.

The proposed offset area is much poorer country than that found in the project area. For example in table 7, on page U-24 are no domain A or B soils as defined in table 6 and found in the project area. Additionally the project area has 1,219 ha of domain C soil compared with 333 ha of domain Y soil in the offset area. That is, the offset area has poorer soils and the domain of soil approximately equivalent to that in the project area covers only 27% of the coverage in the offset area.

It can only be concluded that the proposed offset area cannot be considered equivalent.

Based on the EIS what extent of land will be degraded by the development?

Table 15, Comparison of pre and post-mining agricultural land suitability classes (page T-41 of the EIS), is based on a 2002 publication. It should be based on the more current publications:

- NSW Office of Heritage and Environment (2012). The Land and soil capability assessment scheme. Second approximation. Sydney, NSW.
- NSW Office of Heritage and Environment and Office of Agricultural Sustainability and Food Security. (2013). Interim Protocol for site verification and mapping of biophysical strategic agricultural land.

There is a real need to address the questions below:

[5] This sentence is confusing and could be interpreted to say there are no offsite impacts on agricultural production. In either case there is a documented loss of agricultural land quality within the project area

1. Is BSAL land likely to be impacted by the development?
2. Based on the EIS what extent of land will be degraded by the development?
3. Does the assessment ‘cover’ the same area and extent as the proposed mining activities?
4. Is the survey as reported sufficient to characterise the subject area?
5. Based on the EIS what extent of land will be degraded by the development?
6. Is the Agricultural Impact Assessment consistent with the DPI technical notes on AISs (DPI, 2013)?

Most importantly, can these issues be resolved by further investigation or are they essentially ‘show-stoppers’?

Results of the proponent’s own assessment suggest that the proposal would significantly and permanently reduce the agricultural productivity of the project area. It would also greatly increase the risk of environmental damage to local streams via increased sedimentation
Page 13 of the RESPONSE has the text “P*ost mining, the objective of progressive rehabilitation is to return impacted areas to their pre-mining capability…*

However, based on data presented in Table T 15, there a loss of 253 ha of land that *‘is moderately productive and well suited for grazing or to crop cultivation with a pasture rotation’* (quoted from page T-41). This can be considered a major impact; see page 78 of NSW Department of Planning and Infrastructure (2012).

Additionally there is a net loss of 122 ha of class 4 land. This land is *‘suitable for grazing but not cultivation’* (quoted from page T-40).

Conversely, Class 5 land, which is *‘unsuitable for agriculture or at best only light grazing’* (quoted from page T-40), increased by 379 ha.

These EIS statements show a major net loss of productive land from the region (see NSW Department of Planning and Infrastructure (2012)).

The text in DOCUMENT: DRAYTON SOUTH COAL PROJECT, Response to Submissions is in direct contradiction to the statements regarding agricultural land loss in EIS. This raises serious issues regarding the credibility of the process.

Again, it is noted that lands that are under Anglo American Coal are degraded (see photos in Appendix E, Agricultural landuse strategy DRAYTON SOUTH COAL PROJECT, Response to Submissions), especially due to weed infestation. It is reasonable to expect the proponents to change this once the economic incentive from coal mining is no longer present?

Page 14, para 4 of DRAYTON SOUTH COAL PROJECT, Response to Submissions only refers to the loss of BSAL land and states that creating 2700 ha of agricultural reserve somehow compensates for this. There are at least 3 issues with the statement:

1. It trivialises the loss of BSAL land, which as the proponents themselves point out, is relatively rare in the area.
2. It ignores the large scale increase in degraded lands from one class to another as a result of Anglo American Coal’s activities. See Table 15 of section T in the EIS.

Class 5 lands increase by 379 ha (EIS page T-40). This major impact is ignored in the proponent's response.

3. We are not sure what an 'agricultural land reserve' is;. a museum? The issue is loss of agricultural land. The land 'dedicated to 'agricultural land reserve' is already present: See figure 2 in Appendix E. What is being proposed is simply sound rural land management that would be undertaken by any landholder interested in long term sustainability. This cannot be seen as an 'offset'. More importantly it does not compensate for the loss of relatively high quality land within the mine disturbance area.

Section 4.4.3 Final Landform (page 17)

Submissions requested detail that would demonstrate '*stability and sustainability of the final landform.'*

The Anglo American response is to say '*Noted*'. *'Noted'* is not a satisfactory response. Referring readers back to the original document, which the original readers found inadequate is not a satisfactory response. The EIS section referred to, 7.14.4, provides virtually no detail on the final landform. This is a major deficiency in the EIS and it still has not been rectified. How will the final landform incorporate the up to 10 million cubic metres of unstable sodic subsoil without creating a major risk of landform failure?

Additionally the proponents seem to have ignored the industry guidelines for stockpile construction and management (Landcom, 2004, DECC, 2006).

Section 4.6.1 Surface Water (p 20).

The NSW EPA itself makes the important point that there is a risk from turbid runoff. This is a major issue because of the presence of up to a million cubic m of sodic, and therefore unstable soil. The sodicity will make revegetation difficult and extremely turbid runoff can result from heavy rainfall onto sloping sites without revegetation

Again this issue is ignored by the proponent.

The EPA comments on the '*absence of sufficient justification for the inclusion of wet weather discharge limits, particularly in relation to TSS and turbidity.'* (page 21, para 5)

It is assumed, therefore, that the proponent has assessed the risk of requiring wet weather discharge and taken the 'brave' decision to not seek permission. This effectively seals off the site.

Table 1 on page 33 refers specifically to topsoil. How will the other 70 to 90% of soil volume be managed?

According to table 1, part 2 on page 35, the lands in the disturbance footprint area will be created as capable for biodiversity conservation. As much of the substrate is likely to be disturbed sodic and in some cases saline B horizon, it will be a major challenge to establish any vegetation, let alone native flora.

6.14.2 BSAL Verification

' *The Gateway Panel found that this project failed five of the six biophysical strategic agricultural land criteria'* (quote from the Gateway Panel findings).

The Report by the Mining & Petroleum Gateway Panel to Accompany a Conditional Gateway Certificate contains the following text:
The Gateway Panel finds that the verification of BSAL within the PDA is incomplete and this has implications for assessing the full extent of the Project's impact on BSAL. However, it is determined that the open cut mining operation will have significant direct impact on the agricultural productivity of any BSAL verified within the PDA through surface disturbance, reduction in soil fertility and structure, alteration to effective rooting depth, increased drainage and fragmentation of land use following the proposed landform rehabilitation. More definitive information on the rehabilitation program is required to determine the direct impact on the final land surface slope and rockiness, soil salinity and soil pH.

'The change in verified BSAL in the revision document (SLR 2015b) results from a modification to the original boundaries of Soil Units 1 and 2 (originally identified as BSAL) which reduce their extent, and the subsequent removal of Soil Unit 2 from identified BSAL. While the Gateway Panel acknowledges that increased site sampling and analysis has been used to inform these decisions, there remain some inconsistencies regarding the removal of Soil Unit 2 from verified BSAL, its dominant soil type and the drawing of its boundaries.

Firstly, the justification for the re-classification of sites 11, 15 and 18 as non-BSAL (refer Figures 5, 6 and 7) based on failure to meet the salinity criteria (criteria 11) is difficult to corroborate based on data supplied. The soil salinity values as documented for Sites 11 and 15 do not exceed the criteria, and if the reported interpretation (SLR 2015b; Table 36) is applying a factor to convert values to saturated extract equivalence, this is certainly not explained or the texture assumptions elucidated. For Site 15, given the documented soil physical attributes, it is unclear how the site would fail the criteria using conversion factors suggested in the BSAL Protocol (OEH & OAS&FS, 2013). Site 18 is a check site and the salinity values are not reported. The BSAL Protocol requires a laboratory analysis to be provided in order to accurately assess a site against the salinity criteria.

Secondly, the dominant soil type for Soil Unit 2, as documented in Section 3.2, Table 10 (SLR, 2015b), is described as a 'Self-mulching brown Vertosol, deep, non-sodic with slightly saline subsoil and high CEC'. As the dominant soil type for Soil Unit 2, the properties recorded for this soil would qualify the Unit as BSAL.

Thirdly, in light of the above issues, the soil description provided for Site 10 (BSAL verified) and its location adjacent to the northern boundary of the revised Soil Unit 2, suggests that the site may be more accurately included within Soil Unit 2.

The Gateway Panel recommends that further investigation/clarification is required to correctly verify the extent of BSAL within the PDA, especially with regard to Soil Unit 2.'

The proponent still has not produced any laboratory or further bore log data to meet the very justified criticisms made by the Gateway Panel.

OAS&FS submission
As discussed by the proponent the site was inspected in the company of OAS&FS staff. Their report noted the erosion and water logging in lower areas.

Note that erosion and waterlogging are not specifically named in the BSAL decision criteria (NSW Gov, 2013, page 6)).

Critically the OAS&FS response noted that Anglo American Coal made NO commitment to mitigate the loss of agriculture resources. Indeed their own EIS documented the fall in agricultural production expected from the proponent's development.

This is despite the Hunter being considered an agriculturally important area.

Change in BSAL land over time
The EIS shows the BSAL land as a light yellow outline, overlying the mine void. (See map of initially verified BSAL shown as figure 3 in the current document).
Subsequently, following detailed investigation and sampling by John Lawrie, a Certified Professional Soil Scientist (grade 111, senior), the BSAL and was 'shrunk' to 78 ha.(see page 4-4 and section 7.13.3 of the EIS). The BSAL lands has also been moved westward and away from the mine void footprint. See figure 4 in appendix A 3.1 of the SLR (2015) report (copy below as figure 4 in current document).

Following this detailed report an inspection by unidentified consultants and staff from OAS&FS decided, apparently without further laboratory investigations or additional soil pits, that the remaining 78 ha were not BSAL after all. This decision was apparently based on erosion and waterlogging. Erosion is not mentioned in the BSAL criteria in figure 2 of NSW Gov, (2013). Waterlogging is normally an obvious landform feature, yet it was not reported by Mr Lawrie during the detailed first survey.

This is a most fortunate result for Anglo American coal as it means that the statement on page 10.3 of the EIS is meaningless:***' Any BSAL disturbed during construction of this infrastructure will be selectively stripped and set aside for restoration. Following restoration, a verification program involving comparative pre and post topsoil sampling will be undertaken to confirm restoration to a BSAL standard'.***

Additionally REF 35 of the Commitment list contains the sentence:
'BSAL soils will be stripped and selectively stockpiled for use in final rehabilitation EIS section 3.8 and 1.13.4'
Does not apply because the BSAL soils have somehow 'disappeared'.
We note:

- BSAL classification protocol is very detailed (NSW Gov, 2013), requiring both field observation and laboratory confirmation.
- It is therefore incongruent that the established BSAL classification for the 78.8 ha within the mine void can be dismissed on the basis of a site inspection and limited laboratory analysis. It indicates major error on at least one of the consultant groups.
- An examination of the TP logs (TP 110, TP 111, and TP 116) which appear to be within the BSAL area[6], do NOT show evidence of waterlogging. In fact, according to the geological soil sample logs, the profiles are largely dry.
- Citing waterlogging as a reason for removing BSAL protection from the area is untenable without evidence. Further, flooding *per se*, is not listed as part of the soil assessment (See figure 2: flow chart for site assessment of BSAL in NSW Gov, 2013).

[6] The exact location of the bores with respect to the BSAL area is difficult to assess because of the scale of the maps provided. For example Figure 3 from Appendix 3 compared with figure 8 from the Gateway Certification Application.

- The BSAL land within the mine void foot print will be lost forever. This is a significant impact under the SRLUP, as the proponent well knows. To argue that the current poor management, which is responsible for issues such as erosion and weed infestation, means that the area can now be destroyed forever is false. As pointed out in the SLR report (appendix E), if the erosion and weeds were addressed the area would regain productivity.

Intended sustainable agricultural practices

The paucity of laboratory data makes it difficult to be definitive, however the photos within the Agricultural Land Use Strategy document suggest the weeds are a major current problem. The weed species present also suggest poor soil physical and chemical conditions.

There is very obvious scope to improve productivity of lands surrounding the mine disturbance area. Yet commitment to do this as a way of partly compensating for loss of agricultural lands has not been agreed to by Angle American Coal.

6.14.5 Cattle and Sheep Enterprises

The statement that *'the project will not affect availability of land for agricultural purposes'* is patently untrue. Creation of a mine void represents loss of over 1000 ha of agriculture land . Land which the proponents state will not return to their current level of productivity.

The surrounding Anglo American Coal owned land could be made more productive, but this has not been agreed to.

The Agricultural Landuse Strategy (SLR, 2015)

SLR undertook a visual assessment of 18 sites surrounding the proposed mine disturbance area. SLR commented that the soils surrounding the proposed mine disturbance area *'are well suited to the current activity of cattle grazing on perennial grass based pastures'* (SLR page 10, [para 2).

The soil map produced in the EIA (figure 4, page T-30) shows that these soils referred to above extend throughout the proposed mine disturbance area. That is the proposal will destroy soils that *'are well suited to the current activity of cattle grazing on perennial grass based pastures'*

This is a very obvious loss of agricultural productivity. It occurs in addition to the loss of BSAL soil.

The report offers helpful advice on increasing productivity of the inspected sites, however it is noted the Anglo American Coal has specifically avoided commitment to this action.

The report also details the soil analytical regime considered necessary to identify chemical constraints to production in lands surrounding the mine disturbance area. Again Anglo American Coal have not committed to this.

Conclusions

According to the impact assessment the majority of lands in the project area are covered with productive soil.

However, it is our opinion that most of these soils within the proposed mining void area have soil properties that are vulnerable to disturbance. After the cessation of the mining operation the resulting stock piled material is to be used for the restoration and rehabilitation of the site after mining operations cease. The unstable properties of the soil can result in gully erosion sediment, mobilization poor vegetation and likely contamination of the Hunter River and its tributaries with clay polluted sediment that can smother stream floors. As a result of soil and landscape disturbance an increase in salinity is likely in the Hunter River and local waterways

It is highly unlikely that such soils can be rehabilitated to pre mining conditions. Any restoration would require significant cost, time and commitment to biodiversity and land management strategies to reduce the effects of the adverse and variable unstable soil properties.

A further direct impact is the “disappearance” of highly productive agricultural productive BSAL land and also the loss of very productive (Class 2 and Class 3) land. Class 5 land which is unsuitable for agriculture or at best for light grazing will increase by 379 ha.

For the entire region there would be loss of landscape attributes necessary for critical industry clusters leading to a decline in tourism in the Hunter Valley region.

Dr Peter Bacon and Dr Pam Hazelton

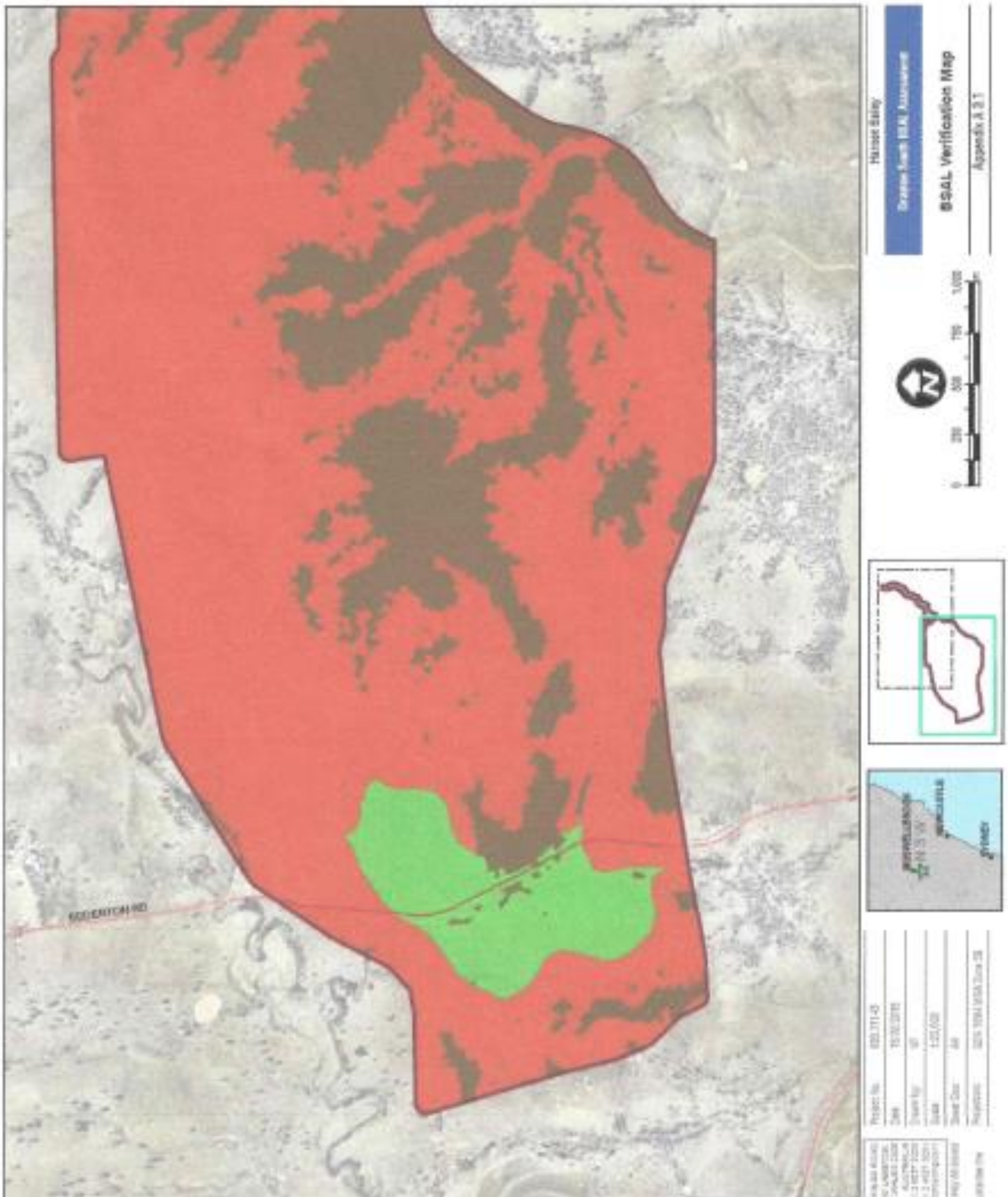


Figure 4. Map of verified BSAL within the proposed Project Disturbance Area (PDA) submitted by the Proponent in a revised BSAL Site Verification Assessment (SLR, 2015b).

Figure 4 in current document. Note this figure is also shown as figure 8 BSAL verification map. Produced by SLR and dated 06/02/2015.

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