REPORT

Baralaba North:–PAA and SCL Mitigation

Prepared for	Cockatoo Coal Ltd.
Attention of	Brendan Dillon *(Senior Environmental Planner)*
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Author	Dr Evan Thomas
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EXECUTIVE SUMMARY

Cockatoo Coal Ltd (CCL) is seeking to continue the development and operation of the Baralaba North Continued Operations Project (BNCOP). Key to this objective is the need to construct spoil dumps over areas identified through Regional Planning as affecting areas of regional interest, specifically areas of Priority Agriculture (PAA) and Strategic Cropping (SCA) on Lot 7 KM44. Approval is contingent on finding suitable land to mitigate the loss identified PALU and SCL within the areas of PAA and SCA.

Through a desktop study and short field reconnaissance, CCL identified an area of approximately 200 ha which appears to have soil suitable for dry land (90ha) and irrigated cropping (110ha)

The predominant soil is a moderately self-mulching cracking clay (affinities with Soil 4b) on a back plain that is not flooded more frequently that between 1:20 and 1:50.

Increase the productivity of cropping in the State

The lost PALU, due to BNCOP is some 110ha. The identified land within this study indicates up to 200 ha that will be brought under cropping that is not currently listed as PALU. Bringing this land into production will result in an increase to the productivity of cropping in the state by at least double that of the lost PALU. The net economic benefit of this to the local community will be of the order of $1.7M per annum, not counting the value of site development.

Provide a public, rather than a private benefit

It is proposed that to mitigate the loss of SCL, CCL is prepared to establish a mitigation deed to the value of at least that identified ($275,000), and as part of this undertake a trail to restore the lost SCL on another part of the mine. This would be done through selective and careful stripping of the soil profile from the area of SCL and its placement as part of the rehabilitation of the Central Pit with the view to restore cropping land as part of the post-mining landscape. It is intended that this trail would be established with the input and management of a recognised research provider and would be of at least the same area of SCL as that affected by the BNCOP. If successful this trial will be the first of its type in Queensland that has been designed from conception to address key concerns of the community and industry.

A trial such as this would be of benefit to the public, is consistent with established industry research priorities, and supports coexistence of mining and agriculture.

Aim to provide an enduring effect

It is the intention of CCL that the 200 ha become recognised as PALU to help provide on-going protection of the land, beyond the life of the mine. During the operation of the mine it is the intention of CCL that these lands be under productive sustainable cropping.

It is hoped that through the SCL restoration trial an enduring effect is established that sets the standard for mine rehabilitation where cropping land is affected, supporting the. Co-existence of mining and agriculture.

Be quantifiable and able to be independently valued

The benefits and impacts of the proposed dry land and irrigated farming system proposed, are able to be readily identified, evaluated and quantified on an annual basis using established scientific monitoring and accounting and methods. It is intended that a process of independent peer review be used as part of the reporting process for the PALU and the SCL restoration trial.

Benefit the largest possible number of cropping agribusinesses

It is anticipated that direct benefits to cropping agribusinesses will be derived from establishing a share-farming relationship with a competent local farmer. This new area of land being farmed will have an additional flow-on benefit to local agribusinesses that supply local farmers.

The potential enduring value of the proposal to the local community and cropping production in the state is of the order of $1.7M

Provide a benefit similar to that type of activity or system affected

The land affected by the proposed BNCOP development included 110 ha of PAA and 58 ha of SCL. This proposal provides over 200 ha of land as PALU with 110 ha under irrigated cropping.

Phased development of site

To bring this land into production the following phased approach is proposed for the mitigation deed.

SCL research trial

- 2014 Establish a research relationship with a research provider to work on the project.
- 20142015 Establish base-line data that is required for the trial
- 2015 strip SCL land to temporary stockpiles and replace onto rehabilitated pit.
- 2015-2020 undertake study of restoration of cropping
- Annual reporting of trial to DAFF, DNRM and DSDIP.

PALU mitigation

- Establish soil data to assist with the sustainable management of irrigation on the area to become PALU
- Seek expressions of interest from experienced farmers to enter into a share-farming arrangement that will provide for the preparation of the land for irrigated and dry land farming
- Select the share farmer and establish the relationship with the possibility of the first two years of access free to the farmer for preparation for cropping.
- During this time invest in the establishment of the irrigation infrastructure (approx., $350,000 investment over two years.
- Develop a monitoring and reporting plan to ensure that the land resource is sustainably managed and that all required quantitative data are recorded for annual reporting to DSDIP.

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1. Introduction

Cockatoo Coal Ltd (CCL) is seeking to continue the development and operation of the Baralaba North Continued Operations Project (BNCOP). Key to this objective is the need to construct spoil dumps over areas identified through Regional Planning as affecting areas of regional interest, specifically areas of Priority Agriculture (PAA) and Strategic Cropping (SCA) on Lot 7 KM44. These broader areas contain specific areas mapped as Priority Agricultural Land Use (PALU) and also as Strategic Cropping Land (SCL). Recent land resource surveys (Burgess 2014) identified that while the area of PALU was 110 ha, the area of SCL was limited to some 69.1 ha, of which 57.6ha was going to be permanently impacted by BNCOP. CCL submitted Regional Interests Development Application (RIDA) to The Department of State Development and Infrastructure Planning (DSDIP). This application was respectively assessed for PALU and SCL by the Department of Agriculture Forests and Fisheries (DAFF) and Natural Resources and Mines (DNRM) - the Assessing Agencies (AA). Both assessments concluded that PALU and SCL would be impacted by the development and that mitigation would be required for both PALU and SCL

2. Summary of assessments

The DAFF considered the application and identified the following points with respect to the *Regional Planning Interests Act 2014 (RPI)*, PAA and PALU (Dr Beth Woods CTS 21668/14:

- The application did not comply with the prescribed solutions provided for PAA Required Outcome 1concluding that if approval were to be given for the activity, it be conditional on:
  - The provision of evidence to the Chief Executive of DSDIP that the activity will not be located on land used for a PALU which is not owned by the applicant
- The application did not comply with the prescribed solutions provided for PAA Required Outcome 2 concluding that if approval were to be given for the activity, it be conditional on:
  - Equivalent land to that which is used for a PALU, and which will be impacted, is developed elsewhere in the PAA prior to the commencement of the activity
  - That the equivalent land is maintained as land used for a PALU for the full term of the proposed activity
  - That an annual report on the production from the equivalent land detailing yield quantity, quality, inputs and events be prepared and submitted to the Chief Executive of DSDIP.

This area of residual SCL was confirmed by the Department of Natural Resources and Mines (DNRM) in their response (RPI14/001/Cockatoo) to the original by CCL. However, DNRM also identified the following points with respect to strategic cropping land as provided in the *Regional Planning Interests Regulation 2014*:

- The application did not comply with the prescribed solutions provided for SCA Required Outcome 1, concluding that the activity will not result in a material impact on the strategic cropping land on a property in the strategic cropping area.
- That while CCL was effectively the sole owner of the affected land, the application did not comply with all of the prescribed solutions provided for SCA Required Outcome 2: concluding that that insufficient evidence was provided to demonstrate that the activity could not be done

elsewhere on the property; that the impact on SCL was not being minimised; and that more than 2% of the SCL is affected.

- That a mitigation value of $275,000 was identified to address Required Outcome 3.

To address these concerns suitable forms of mitigation must be identified for both the areas of affected PALU and SCL.

- DAFF identified that if approval were to be given the identification of equivalent land to the affected PALU would provide sufficient mitigation provided that the mitigation criteria expressed in the *RPI Act 2014* (s65 (1)) are addressed. This land should be owned by CCL and not already be PALU, and preferably within the PAA.
- DNRM recommended that if approval were to be given, the *RPI Act 2014* provides for a CCL and DSDIP to enter into a Mitigation Deed of equivalent value to the mitigation value determined (i.e. $275,000).

3. Methods

Identification of potential areas of land as an offset for affected PALU and options for the Mitigation Deed for addressing the loss of SCL:

- Desktop assessment of climate, soils/land use information to find properties to focus on for potential 'agricultural offset' – for both 110ha impact on PALU and 58ha impact on SCL
- Review if recent relevant land resource studies such as Soil Mapping and Monitoring Pty Ltd (2014).
- Site visit to ground truth explore/investigate possible 'agricultural offset' options which are a product of the desktop analysis.
- Review of the Australian Coal Association Research Program (ACARP) 2014 Research Priorities.

The methods used will be drawn from the following standards, Acts regulations and guidelines as listed in the Reference section of this report:

- Guidelines for Surveying Soil and Land Resources (McKenzie et al. 2008)
- Australian Soil and Land Survey handbook (The National Committee on Soil and Terrain 2009)
- The Australian Soil Classification (Isbell 1996)
- Regional Planning Interests Act 2014 and supporting regulations, guidelines and supporting documents including Guidelines for the assessment of land suitability and capability relevant to the region.

4. Desktop and Field Assessment

4.1. Climate

A summary of relevant climate data for Baralaba is presented in Table 1 below. Average maximum temperatures are highest in January (summer), with a maximum average temperature of 34.3 °C. July is the coldest month, with a mean minimum daily temperature of 7.4 °C.

The dominant winds in the vicinity of the study area are from the north-east and southerly quadrants. Winds from the north and north-east are dominant in spring and summer months, while winds from the south are dominant in autumn and winter. Frosts are common during the winter months of June, July and August, and may be severe.

Median annual rainfall for the region was 697.1 mm with a summer dominant distribution. Annual rainfall is highly variable with totals ranging from 349.9 to 1,348.6 mm per year. The 10th percentile and 90th percentile average annual rainfall for Baralaba PO is 449.8 mm and 952.5mm respectively.

Table 1*: Summary Climate Statistics for Baralaba (BOM station 039004)*

Month	Mean Daily Temp.(°C)		Median Rainfall (mm)	Mean Rain days (>10 mm)	Mean Relative Humidity (%)		Mean Wind Speed (km/hr)	
	Min	Max			9 am	3 am	9 am	3 am
Jan	21.3	34.3	78.2	2.8	65	43	7	7.7
Feb	21.2	33.4	87.5	3.1	69	46	6.9	7.8
Mar	19.4	32.6	56.6	2.2	67	41	7.1	7.6
Apr	16.0	30.3	25.4	1.2	67	42	7.5	7.6
May	12.3	26.6	24.3	1.2	69	42	7.2	7.4
Jun	8.9	23.6	15.0	1.2	74	46	7.1	8.2
Jul	7.4	23.1	11.6	0.8	70	40	7.2	8.5
Aug	8.7	25.2	12.2	0.7	66	38	6.9	8.0
Sep	11.9	28.4	48.0	0.9	62	34	8.2	8.6
Oct	15.6	31.2	78.6	1.9	60	35	8.5	8.5
Nov	18.4	32.8	81.6	2.5	60	38	7.9	7.8
Dec	20.3	34.0	11.6	3.2	62	40	7.9	8.1
Annual	15.1	29.6	697.1	21.7	66	40	7.5	8.0

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4.2.Available Land Resources.

Field investigations considered land owned by CCL that were within or adjacent to areas mapped as PAA or SCA and that were not already shown as PALU or SCL. Figure 1 shows the areas within the Blocks considered (11KM46, 2SP235019, 3SP235019) as possible offsite locations determined from the desktop assessment.

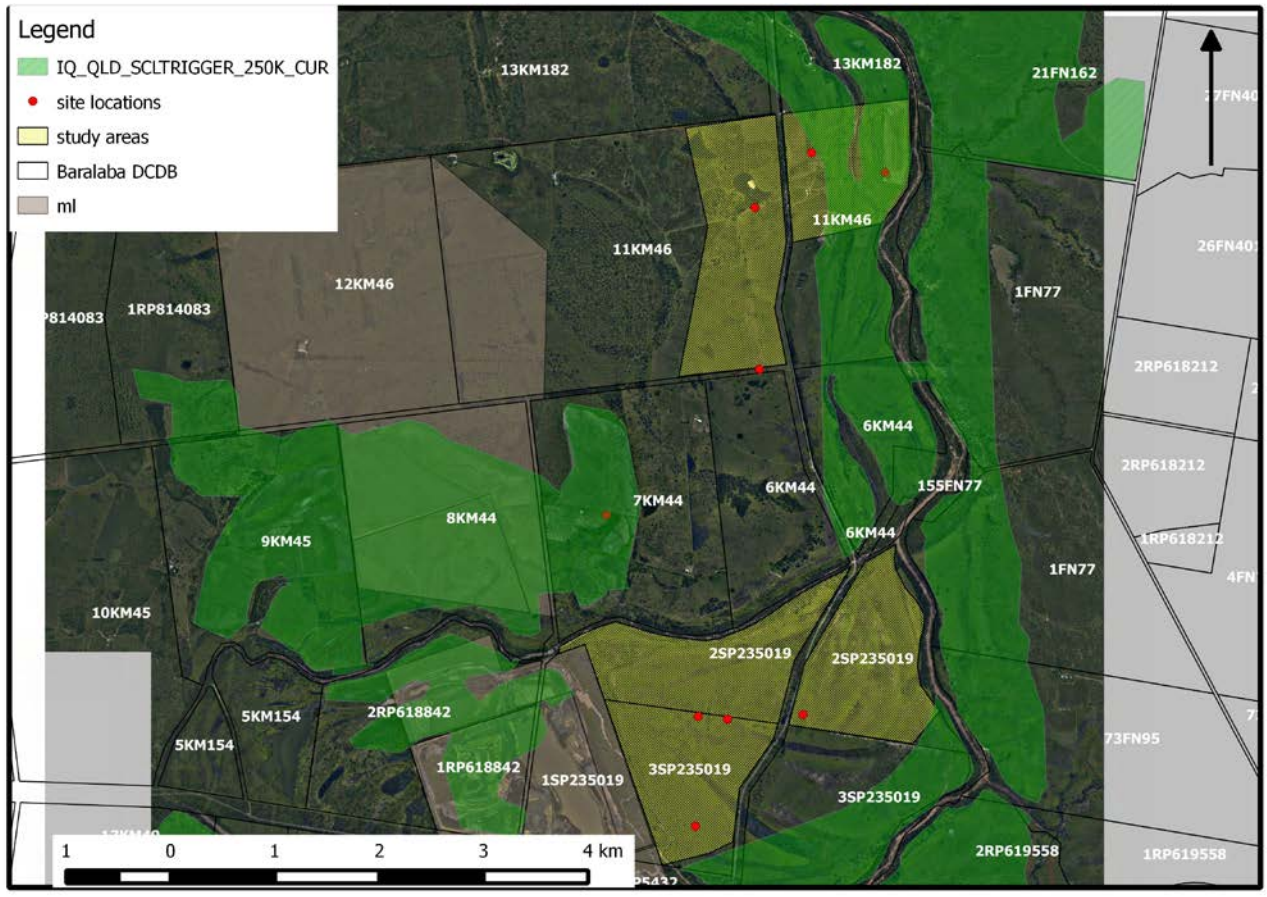

Figure 1: Location of study areas and sites

Field inspection of these lots was conducted to a depth of 1000mm, where required, to assess the land resource against the SCL criteria –summary data for some key sites are provided in Appendix A. No areas inspected had slopes greater than 3% and none were affected by surface rock or significant micro-relief (Gilgai).

Soils on lot 11 of KM46 were on a ridge of older unconsolidated sediments and shown to be generally sandy texture contrast soils which have been described as sodic in adjacent areas – soils types 7b and 7c (Soil Mapping and Monitoring Pty Ltd 2014), although field testing at site 4 did not reflect this. There is evidence of these soils being regularly used for cropping. However, as soil water storage (SWS) appears limited to around 75mm over a 1 m depth, independent of any restricting to the effective rooting depth due to sodicity, it appears unlikely that these soils would be considered as SCL.

The soil on the eastern block of 2SP235019 were of a lighter texture and a distinct bleached sub-surface layer (A2e) indicating that this soil has a greater affinity with soil 6b Brown Chromosol. Soil Water Storage on this soil was estimated at around 84mm and would be marginal with respect to the SCL criteria.

In contrast the soils on lots 2 and 3 of SP235019 owned by CCL, to the west of the Duaringa–Baralaba Road, lie on an elevated back plain that appears to have drainage lines in aerial photos but these were very indistinct when inspected and not clearly incised. There was little variation in elevation over the extent of the site – elevation approx. 85m (Figure 2)

The vegetation present was Coolibah (E. microtheca) and other Eucalypt species, occasional Bauhinia (B. carronii) and Brigalow (A. harpophyla). Grass species present were a mixture of Black Speargrass (H. contortus) and Buffel grass (C. ciliaris). The area appears to have been under cultivation at some stage in the past, although not within the past 20 years and is not mapped as either PAA or SCA.

The landscape and the predominant soil, a moderately cracking clay, is most closely related to that described for Soil Type 4b in earlier studies (Regional soil type: Lindsay -Ld). Soil 4b is found on back plains that flood infrequently. This is consistent with the flooding assessment for the area discussed in section 4.5, showing that the both areas have a similar elevation and are inundated at the same frequency. This soil is commonly found on extensive level, and more elevated, back plains (. Expected

This soil, and soil type 4b, has soft nodules of Calcium Carbonate present below about 300mm and a gradual colour change to a brown with depth (from 500-700mm). Below 1.2 m a buried profile may be encountered but this was not found using the hand auger to 1m. For the soil observed on lots 2 and 3, the depth to the gradual change to a brown soil occurs a little shallower (approx. 500mm). However, roots were evident throughout the profile to 1000mm. This soil is estimated to have a soil water storage capacity of approximately 120mm with no major limitations identified from these visual inspections – samples for analysis were collected from the site but have yet to be analysed.

From this assessment it was determined that the soils on lots 2 and 3 of SP235019 owned by CCL, to the west of the Duaringa–Baralaba Road provided the greatest opportunity for development as PALU to offset the losses projected from the approval of BNCOP. The total area of available land for dry land cropping is some 200ha, with opportunity for development of a centre-pivot irrigation system of approximately 110ha. Figure 2 presents the profile and landscape observed at Site 1 – the use of hand auger has disrupted the structure to some extent. Figure 3 shows the preliminary assessment of the extent of the soils on the site. The detailed descriptions of the soils found on the site are provided in Appendix A

Figure 2: Soil profile for Site 1: Moderately self-mulching cracking Clay

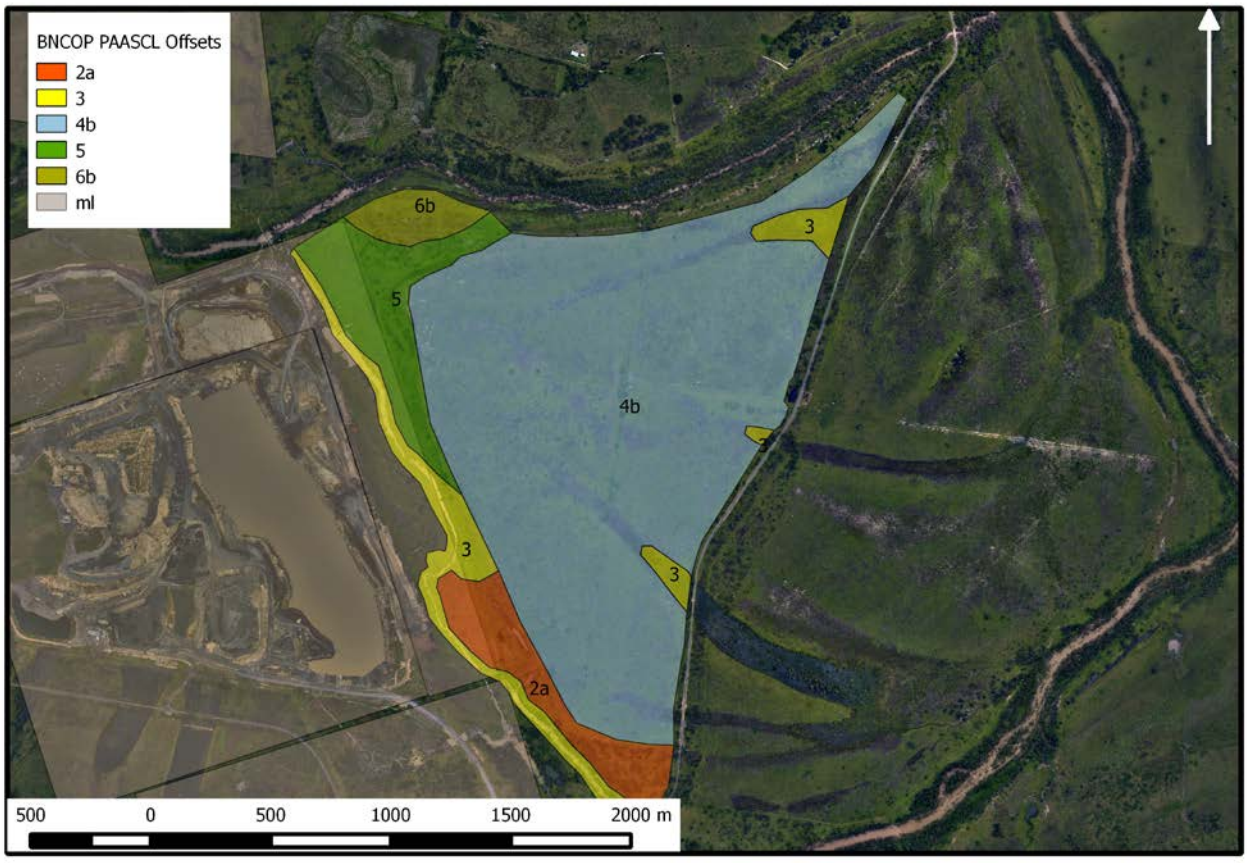

Figure 3 Preliminary mapping of land resource areas proposed as mitigation for loss of areas of PAA and SCA

4.3.Available Water Resources and existing infrastructure.

In addition to rainfall, CCL has access to, and control over, a number of water sources of varying quality ranging from a licenses to access water from the Dawson River to aquifers, reservoirs and storages on their properties of significant capacity. One of these storages has the capacity to act as a storage for an irrigation system.

Table 2 summaries the available water resources and Figure 2 shows the location of potential storages and known observation bores. CCL is also intending to secure additional water licenses and to develop irrigation infrastructure and appropriate management techniques to utilise all available water where possible. This will require appropriate dilution of lower quality water and to ensure that irrigation is managed to ensure that sufficient leaching fraction to maintain a healthy balance of salts in the soil.

Discussion with local farmers and review of available irrigation crop gross margin and management data indicate that for an irrigated Wheat –Sorghum management system annual total water demand (including rainfall) is of the order of 10 ML per hectare or 1100ML for the 110 ha irrigation system. CCL has access to at least 500ML of quality water with other sources potentially available. The 10th percentile annual rainfall of 449mm, translates to 4.49 ML per hectare or 494 ML across the 110 ha irrigation area. This suggests that in most years (90% of years) there should be adequate water available for the irrigation system, without having to rely on lower quality water resources.

Table 2: CCL Water resources

Water resource	Quality (dS/m)	Annual Volume (ML)	Storage Volume (ML)_
Water license allocation - Wonbindi Coal Ltd.	<1	400	NA
Water license allocation- Cacatua Pastoral Pty	<1	50	NA
Water license allocation - Cockatoo Coal Pty	<1	50	NA
Observation bore PZ14D	0.9	Not known	NA
Observation bore PZB1	1.9	Not known	NA
Observation bore PZ11	1.2	Not known	NA
Observation bore PM03	1.9	Not known	NA
Residual Void	9.0	2.0 (@ 2.0 dS/m)	400
Proposed Irrigation Storage	NA	NA	200

NA - Not applicable

4.4. Productive potential of proposed new PAA and SCL

The crops commonly grown in the Baralaba area are predominantly wheat and sorghum with the use of legumes, such as chickpeas and mungbeans as break crops within a cropping system. Other crops recorded in the district are cotton and lucerne. Table 3 summarises the production and gross margin analyses for the range of crops identified.

The potential for dry land wheat-sorghum cropping will provide a gross margin of approximately $450/ha per year, with over $1100/ha per year for irrigated. The water use efficiency for irrigated cropping, measured as $/ML, was the greatest for mungbeans ($228/ML) and the least for sorghum (43/ML), with $77/ML, $199/ML, $210/ML, 225/ML for Lucerne, wheat, chickpea and cotton respectively.

This translates to a projected potential annual gross income to the Share Farming operation of approximately $155,000. This income was derived from production costs of approximately $280,000. This is a direct total value of the crop to the local community is therefore of the order of $435,000 and considering a conservative four-fold economic multiplier, a total additional economic value to the community of approximately $1,700,000.

Table 3: Dry land and irrigated cropping projections

Crop	Salt tolerance	Yield potential		Water demand*	Crop Value	Gross margins (Variable Cost)	
	dS/m	Dry land (t/ha)	Irrigated (t/ha)	(ML/ha)	($/t)	Dry land ($/ha)	Irrigated ($/ha)
Winter Crops							
Wheat	6.0	2.5	6.0	5.0	265***	233 (429)	598 (992)
Chickpeas	1.6	1.5	2.8	2.6	440	213 (446)	548 (683)
Summer Crops							
Sorghum	6.8	3.5	8.0	4.5	210	267 (468)	195 (938)
Lucerne	2.0	NA	15.4	7.0	240	NA	540 (3,156)
Cotton	7.7	2.7**	9.0**	7.0	380**	50 (1,109)	1,581 (3,056)
Mungbeans	1.6	1.2	1.8	2.8-3.9	700	414 (426)	686 (574)

*based on no rainfall during cropping
**bales/ha +seed, $/bale
***Australian Prime Hard wheat (AH)
NA-not applicable
Note: the data in this table are developed from published available gross margin analyses for each crop from the QLD DAFF and the NSW DPI for the nearest production area.

4.5. Flood risk of proposed new PAA and SCL

The site is elevated being approximately 85m AHD. Modelling within *Appendix F Flood Modelling and Assessment in the BNCOP EIS* (Water Solutions 2014) shows that the sites flooding risk is equivalent to that of the affected PAA and SCL.

The new PAA and SCL is only be partially inundated with still water during a 1:20 flood. The site is completely inundated during a 1:50 flood with relatively still water. This is similar for 1:100 and 1:1000 floods. During the Probable Maximum Flood a flow path is projected to flow across the north of the area adjacent to the current anabranch.

4.6. Review of ACARP Research priorities

ACARP's 2014 research priorities list the following within the Environment and Community section:

> *Sustainability of mine rehabilitation and mine closure including landform design, subsidence, final voids, soil profile development, revegetation including species selection, knowledge management, performance assessment, geomorphology, strategic cropping land re-establishment, land scape function and alternate post mining land uses.*

The restoration of strategic cropping land, such as the lost SCL involved with BNCOP application, is consistent with the established ACARP priorities and builds on the need for maintaining agricultural production and developing co-existence.

5. Discussion

5.1. Appropriateness of identified land for mitigation

The assessment of the RIDA application submitted by CCL, identified that any lands involved with mitigation of loss of PAA or to be included in a Mitigation Deed for the loss of SCA should have the following characteristics:

- Be owned by CCL
- Not be currently mapped as PAA or SCL
- Be able to meet the criteria that identifies SCL (*RPI Act 2014*)
- Meet the mitigation criteria (*RPI Act 2014*)

The soils on lots 2 and 3 of SP235019, to the west of the Duaringa–Baralaba Road, are owned by CCL and, with the exception of a small area to the south, are not currently mapped as either PAA or SCA.

While further investigation may be warranted the soils identified on the site are consistent with soils mapped and identified in adjacent land. The predominant soil on the site appears to be a moderately self-mulching cracking clay (type 4b) which meets all of the criteria for SCL.

5.2. Proposed site development to meet mitigation criteria

The mitigation criteria, as listed in the *RPI ACT 2014* are provided below:

a) Aim to increase the productivity of cropping in the State: and
b) Provide a public, rather than a private benefit; and
c) Aim to provide an enduring effect; and
d) Be quantifiable and able to be independently valued; and
e) Benefit the largest possible number of cropping agribusinesses; and
f) If a cropping activity or cropping system existed for mitigate SCL land to which the measures relate – provide a benefit to that type of activity or system in the relevant local area.

5.2.1. Increase the productivity of cropping in the State

The lost PALU, due to BNCOP is some 110ha. The identified land within this study indicates up to 200 ha that will be brought under cropping that is not currently listed as PALU. However, it is not within the PAA although discussions with DSDIP indicate that this may not be a barrier to its inclusion as PALU once it is under cropping. It is the intention of CCL to develop 110ha of this area as irrigated cropping utilising its existing water licences and other available water resources as appropriate.

This will result in an increase to the productivity of cropping in the state by at least double that of the lost PALU. The net economic benefit of this to the local community will be of the order of $1.7M per annum, not counting the value of site development.

5.2.2. Provide a public, rather than a private benefit

It is proposed that to mitigate the loss of SCL, CCL is prepared to establish a mitigation deed to the value of at least that identified ($275,000), and as part of this undertake a trail to restore the lost SCL on another part of the mine. This would be done through selective and careful stripping of the soil profile from the area of SCL and its placement as part of the rehabilitation of the Central Pit with the view to restore cropping land as part of the post-mining landscape. It is intended that this trail would be established with the input and management of a recognised research provider and would be of at least the same area of SCL as that affected by the BNCOP. If successful this trial will be the first of its type in Queensland that has been designed from conception to address key concerns of the community and industry.

A trial such as this would be of benefit to the public, is consistent with established industry research priorities, and supports coexistence of mining and agriculture.

Table 4 below provides indicative contributions and timeframes for the trial

Table 4: Indicative contributions and timeframes for a SCL restoration trail

Activity	Year	Mitigation Deed CCL contribution	Research provider	Additional CCL involvement
Establish trial design and program with research provider and link to ACARP	2014	$5,000	Researcher team from research provider Internal costs	Internal costs with key staff from corporate and site
Establishing baseline soil physical properties of original SCL	2014	$20,000	Field Measurements of soil physical and hydraulic properties not already captured through existing studies	Internal costs with key staff from corporate and site
Stripping and placement of SCL material to create post-mining cropping land scape	2015	$10,000	Supervise and record trail development against established best practice.	Internal costs with key staff from corporate and site Additional cost to CCL is approx. **$1.74M** *
Establish restoration trials aimed at bringing the land back into production	2015	Included in costs above	Researcher team from research provider	Internal costs with key staff from corporate and site
Annual program of cropping and monitoring of soil (edaphic) and crop production factors. Annual reporting of trial to DNRM, DAFF and DSDIP	2015-2020	$240,000 ($40,000 p.a. including a post graduate stipend)	Researcher team from research provider	Internal costs with key staff from corporate and site
Total		**$275,000**		**>$1,700,000**

*$30,000/ha additional cost to mining.

5.2.3. Aim to provide an enduring effect

It is the intention of CCL that the 200 ha become recognised as PALU to help provide on-going protection of the land, beyond the life of the mine. During the operation of the mine it is the intention of CCL that these lands be under productive sustainable cropping.

It is hoped that through the SCL restoration trial an enduring effect is established that sets the standard for mine rehabilitation where cropping land is affected, supporting the coexistence of mining and agriculture.

5.2.4. Be quantifiable and able to be independently valued

The benefits and impacts of the proposed dry land and irrigated farming system proposed, are able to be readily identified, evaluated and quantified on an annual basis using established scientific monitoring and accounting and methods. It is intended that a process of independent peer review be used as part of the reporting process for the PALU and the SCL restoration trial.

5.2.5. Benefit the largest possible number of cropping agribusinesses

It is anticipated that direct benefits to cropping agribusinesses will be derived from establishing a share-farming relationship with a competent local farmer. This new area of land being farmed will have an additional flow-on benefit to local agribusinesses that supply local farmers.

The potential enduring value of the proposal to the local community and cropping production in the state is of the order of $1.7M

5.2.6. Provide a benefit similar to that type of activity or system affected

The land affected by the proposed BNCOP development included 110 ha of PAA and 58 ha of SCL. This proposal provides over 200 ha of land as PALU with 110 ha under irrigated cropping.

5.3. Phased development of site

To bring this land into production the following phased approach is proposed for the mitigation deed.

SCL trial

- 2014 Establish a research relationship with a research provider to work on the project.
- 2014-2015 Establish base-line data that is required for the trial
- 2015 strip SCL land to temporary stockpiles and replace onto rehabilitated pit.
- 2015-2020 undertake study of restoration of cropping
- Annual reporting of trial to DAFF, DNRM and DSDIP.

PALU mitigation

- Establish soil data to assist with the sustainable management of irrigation on the area to become PALU
- Seek expressions of interest from experienced farmers to enter into a share-farming arrangement that will provide for the preparation of the land for irrigated and dry land farming
- Select the share farmer and establish the relationship with the possibility of the first two years of access free to the farmer to for preparation for cropping.
- During this time invest in the establishment of the irrigation infrastructure (approx., $350,000 investment over two years.
- Develop a monitoring and reporting plan to ensure that the land resource is sustainably managed and that all required quantitative data are recorded for annual reporting to DSDIP.

6. Conclusions

CCL has developed this report to address the valid concerns raised by DSDIP in the loss of PALU and SCL that will occur through the approval of the BNCOP.

CCL has identified an area of some 200ha of land that is not currently recorded a PALU that can be brought into production, with 110 ha of this PALU to be irrigated cropping

In addition CCL propose to develop a trial program to preserve the affected soil from the current areas of SCL and to seek to re-establish productive land as part of the post-mining landscape. It is intended that this form the basis of a mitigation deed to a value of $275,000.

7. References

Water Solutions (2014) Baralaba North Continues Operations Project Flood Study, Appendix F - Flood Modelling and Assessment in the BNCOP EIS

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APPENDIX A

Soil Descriptions

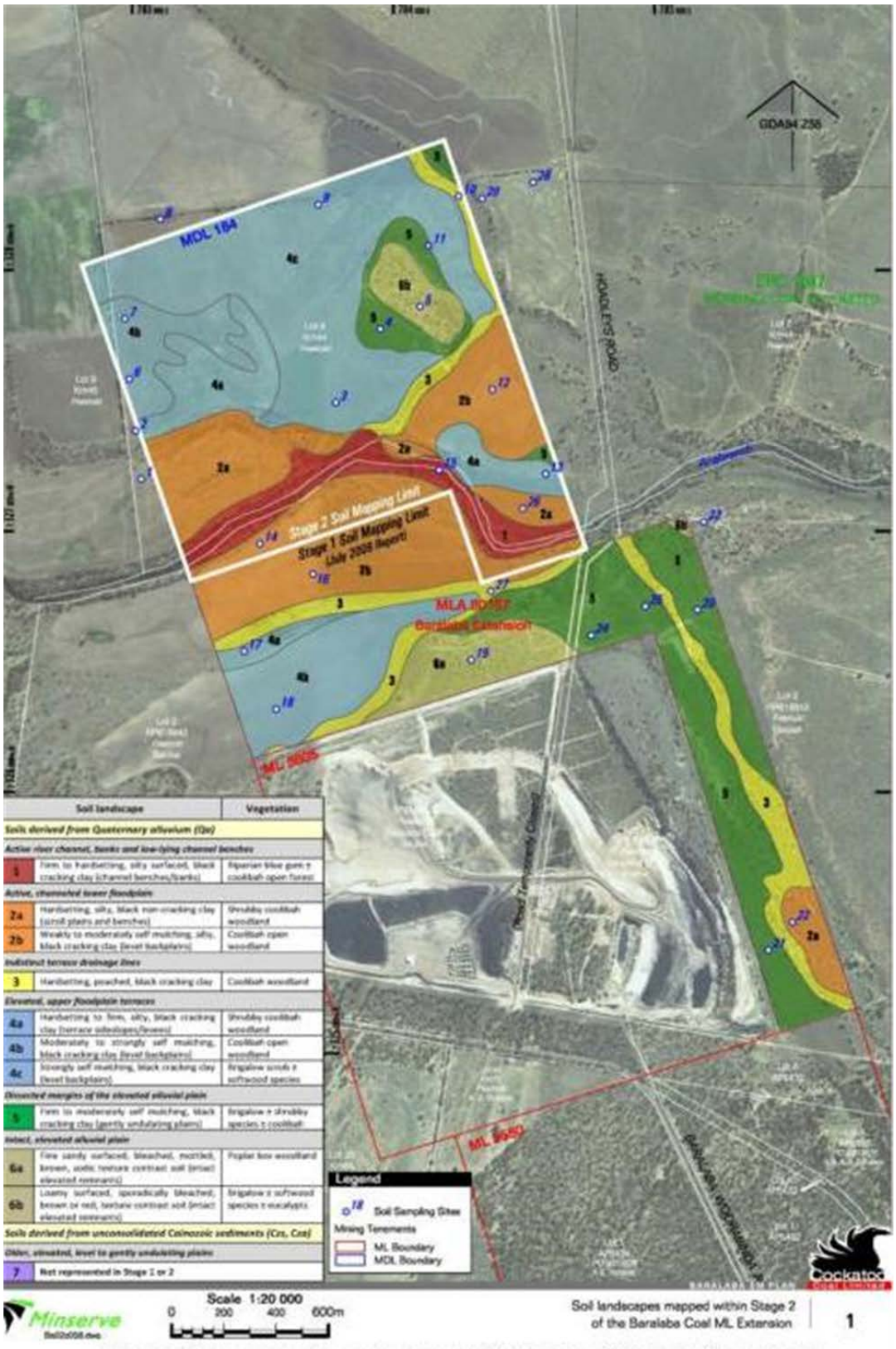

Figure 4: Soil mapping Baralaba Coal Mine Stage 2

Table 5: Soil Descriptions - Baralaba Coal Mine Stage 2

Soil	Landscape framework and soil concept	Dominant vegetation
Quaternary alluvium (Qa)		
Active river channels and banks		
1	Firm to hardsetting, silty surfaced black cracking clay	Coolibah
Active, channelled lower floodplain		
2b	Moderately self-mulching (often silty) black cracking clay	Coolibah ± brigalow
Active levees and alluvial plains of tributary drainage lines		
3a	Hardsetting to coarsely self mulching (poached) black cracking clay	Coolibah ± shrubs ± brigalow
3b	Hardsetting, clay loamy surfaced, brown sodic texture contrast soil	Shrubby poplar box ± brigalow
3c	Brown sand to soft, sandy surfaced, brown non-sodic texture contrast soil	Moreton Bay ash – forest red gum
Elevated, upper floodplain, terraces and backplains		
4a	Hardsetting to firm, silty black cracking clay	Coolibah ± other eucalypts
4b	Moderately to strongly self-mulching (coarse) black cracking clay	Coolibah
4c	Moderately to strongly self-mulching black cracking clay	Brigalow ± minor softwood species
4d	Weakly to moderately self-mulching grey cracking clay	Brigalow ± coolibah (emergent)
4e	Hardsetting, sandy to clay loamy surfaced, grey/brown texture contrast soil	Shrubby brigalow – Dawson gum
Gently undulating Qa –TQr transitional sideslopes		
5	Firm pedal or weakly to moderately self-mulching black cracking clay	Brigalow ± shrubby species
High level alluvial plain, levees and relict scroll plains		
6b	Hardsetting, loamy to clay loamy surfaced, brown/red texture contrast soil	Very shrubby eucalypt ± coolibah
6c	Soft, sandy surfaced, mottled, brown/grey texture contrast soil	Moreton Bay ash – forest red gum
Older unconsolidated Tertiary–Quaternary sediments (Cz/TQr)		
Level to gently undulating plains and low rises		
7a	Hardsetting to weakly self-mulching, grey cracking clay with strong melonhole	Brigalow
7b	Hardsetting, clay loamy surfaced, grey/brown sodic texture contrast soil grading to a grey or brown non-cracking/cracking clay ± occ. weak gilgai	Very shrubby poplar box
7c	Hardsetting, sandy surfaced, bleached, mottled, brown non-sodic to weakly sodic texture contrast soil	Shrubby eucalypt grading to eucalypt – softwood scrub
7d	Hardsetting, clay loamy surfaced, bleached, black sodic texture contrast soil	Brigalow ± Dawson gum
Internally drained closed depressions		
swp 7a	Hardsetting, silty, mottled, grey non-cracking/cracking clay ± weak gilgai	Forest red gum
Older insitu consolidated Tertiary sandstone (Ta/Tm)		
Level to gently undulating plains/remnant plateau surface		
8a	Hardsetting, massive, gradational loamy red earth	Eucalypt
Undulating to rolling dissected rises		
8b	Soft/loose, sandy surfaced, bleached, mottled, grey non-sodic texture contrast soil on sandstone	Eucalypt
Colluvial footslopes and pediments		
8c	Loose, massive, bleached, grey coarse sand	Eucalypt
8d	Loose, red/brown sand to sandy surfaced, red/brown texture contrast soil	Eucalypt
Older insitu calcareous sediments (Pwy)		
Gently undulating plains and low rises		
9a	Hardsetting, loamy to clay loamy surfaced, brown non-sodic texture contrast soil grading to a brown non-cracking clay	Eucalypt
9b	Hardsetting to moderately self-mulching black cracking clay ± weak gilgai	Open grassland

Table 6: Soil Descriptions – Baralaba Mitigation Offsets Study 2014

Soil Concept: Moderately self-mulching black cracking clays on level backplains within the lower floodplain supporting Coolibah ±Brigalow. Most closely relates to Soil 4b (Qa_uf2, Lindsay -Ld)

Australian soil classification: Brown Vertosol
Substrate material: Quaternary Alluvium
Slope: <1%
Landform element: Level backplains
Micro-relief: N/A
Surface coarse fragments: N/A
Site disturbance: Cleared for cultivation or grazing
Vegetation: Coolibah with Brigalow and occasional Bauhinia/ Buffle and Spear Grass
Geological landscape: Cainozoic alluvial plains

Similar sites described at:

- Site 6 (786449/7326360)
- Site 7 (786163/7325320)
- Site 8 (786239/7326359)

Profile (Site 1):

Horizon Depth (mm)	*Description*
A_{21} 0-100	Black (10YR 2/1) Light to Medium Clay with slightly silty course granular structure ; field pH=6.5;
A_{22} 100-500	Black (10YR 3/1) Medium Clay; field pH=7.0; CaCO3
B_{21} 500-1000	Brown (10YR4/1 Medium Clay; field pH=8.0; CaCO3

Site 1 (*GDA94; Zone 55; 786464E/7326359N)*

Soil Concept: Hard setting thick surfaced brown non-sodic texture contrast soil on elevated relict alluvial deposits, supporting Shrubby Eucalypt softwood scrub. Most closely related to soil 7c, Collawmar –Cm

Australian soil classification: Brown Sodosol; Brown Chromosol
Substrate material: Cainozoic Sand deposits
Slope: <1%
Landform element: Level to gently undulating elevated plain
Micro-relief: N/A
Surface coarse fragments: N/A
Site disturbance: Cleared for cultivation or grazing
Vegetation: Shrubby Eucalypt softwood scrub
Geological Landscapes: Unconsolidated tertiary-Quaternary Sediments

Site 3
(55; 786709E/7331199N)

Site 4
(55, 786709/7331199)

Profile (Site 4: 786709/7331199**):**

Horizon Depth (m)	***Description***
A_{21} 0-100	Brown (10YR5/3) Sandy Loam; field pH=6.0;
A_{22} 100-600	Brown (10YR5/4) Sandy Loam; field pH=6.0;
B_{22} 600-1000	Brown (10YR4/4) Light-Medium Clay sub-angular blocky structure; field pH=6.5

Soil Concept: Loamy surfaced (0.25m) sporadically bleached Brown or Red texture contrast soil on intact remnants of the elevated alluvial plain, supporting Shrubby Eucalypt softwood scrub. Most closely related to soil 7c, Collawmar –Cm

Australian soil classification: Brown or Red Chromosol Sodosol; Brown Chromosol
Substrate material: Cainozoic Alluvial Plains
Slope: <1-3%
Landform element: Intact elevated alluvial plain and dissected remnants; occurs mostly as relict scroll plains characterised by intermittent levees and indistinct drainage lines/relict floodways; rarely flooded Level to gently undulating elevated plain
Micro-relief: N/A
Surface coarse fragments: N/A
Site disturbance: Cleared for cultivation or grazing
Vegetation: Brigalow Scrub ± softwood scrub species ± Eucalypts
Geological Landscapes: Quaternary Alluvium

Profile (Site 9: 787170/7326399**):**

Horizon Depth (m)	***Description***
A_{21} 0-100	Brown (10YR4/1) Silty/sandy Clay Loam; field pH=5.5;
A_{22} 100-200	Bleached layer - Sandy Clay Loam; field pH=6.0;
B_{22} 200-300	Brown (10YR3/1) Light-Medium Clay sub-angular blocky structure; field pH=7.0
B23300-1000	Brown (10YR4/2) Light-Medium Clay sub-angular blocky structure; field pH=7.0

Site 9

(55, 787170/7326399)