GLENCORE

15 July 2016

Ms Kerry Riethmuller
Executive Director
Regional and Precinct Planning
Department of Infrastructure, Local Government and Planning
PO Box 15008
City East Qld 4002

ATTENTION: RPI Act Development Assessment Team

Dear Kerry

**Rolleston Coal Expansion Project (RCEP) – Regional Interests Development Approval Assessment Application (RPI16/001/Glencore)**

I refer to your correspondence of 2 June 2016, being a Request for Further Information issued in respect of the application made by the participants in the Rolleston Coal Joint Venture (RJV) for a Regional Interest Development Approval (RIDA) under the *Regional Planning Interests Act 2014* (RPI Act), for the Rolleston Coal Expansion Project (RCEP), submitted on 31 March 2016 (the "Application").

I also make reference to correspondence from the Director-General, Department of Infrastructure, Local Government and Planning (DILGP), dated 17 June 2016, in which he provided RJV with an extension to 15 July 2016 in which to respond to matters raised in your correspondence of 2 June 2016.

As per your 2 June 2016 correspondence, DILGP has sought from RJV the following information "to demonstrate that the prescribed solutions 5(1)(a) and 5(1)(e) in Part 2, Schedule 2 of the RPI Regulation have been met":

- Details of land and land uses that will be restricted (e.g. for safety purposes or other reasons) from ongoing agricultural use during the mining operations;
- A proposal that provides equivalent land that will be used as a PALU for the life of the resource activity; and/or
- An alternative proposal to counterbalance the loss of productive capacity of the PALU and ensures the continual and ongoing agricultural production in areas affected by the resource activities.

The RJV's responses to the request for information are provided below.

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**Point 1: Details of land and land uses that will be restricted (e.g. for safety purposes or other reasons) from ongoing agricultural use during the mining operations**

Clarification is sought by DILGP in relation to the RJV's response to Priority Agricultural Area Prescribed Solution 5(1)(e), on page 34 of the RIDA Supporting Information Report (the Report), which stated that:

> *To date, where Glencore and its Joint Venture Partners hold the land to which the RCEP relates, care has been given to effect arrangements which allow agricultural uses to be ongoing until mining activities are ready to commence. During operation, areas of land will, for safety purposes, be restricted from ongoing agricultural use while being mined.*

In reviewing the RJV's response to the criterion, DILGP has queried whether this means any additional Priority Agricultural Land Use (PALU) is to be constrained, restricted or prevented by the RCEP's activities over and above the areas identified within the Report (74.68ha).

For the avoidance of doubt, the above comment on page 34 of the Report was not intended to relate to PALU. It was the RJV's intent to advise that it would look to continue grazing on land owned by the RJV in the Project area as an agricultural land use, but that use may be restricted for a time as a consequence of mining activities.

It was not the intent to imply PALU over and above the areas identified in Areas 6 and 8 (74.68ha) as per Figure 5 of the Report would be impacted by RCEP activities. That is, no further impact on PALU in the Application area and/or outside it is expected above what has been provided in Figure 5 of the Report.

RJV understands from its reading of the Request for Further Information that this clarification addresses any outstanding concern DILGP has in respect of meeting the requirements of prescribed solution 5(1)(e).

**Point 2 and Point 3: A proposal that "provides equivalent land that will be used as a PALU for the life of the resource activity" and/or "an alternative proposal to counterbalance the loss of productive capacity of the PALU and ensures the continual and ongoing agricultural production in areas affected by the resource activities".**

The RJV's RIDA application noted that the RCEP will impact 74.68ha of PALU. The area of PALU has been used solely for opportunistic fodder cropping, harvested by stock (RJV has no record of the area being mechanically harvested over the last 10 years).

This area of PALU is entirely overlapped by an area of 115.29 hectares of SCA, for which the Department of Natural Resources and Mines (DNRM) has recommended a SCL mitigation condition, which as currently proposed, would require RJV to pay the prescribed mitigation value for the entire area of SCA impacted (being $4,750 per hectare).

The details on the proposed mitigation for SCA and PALU RJV are as outlined below.

**RJV's proposed SCA Mitigation**

RJV proposes that it will make a payment of **$192,900** (i.e. SCA of 40.61 ha x $4,750/ha), on the basis that the SCL mitigation condition is limited to only the area where there is no overlap between SCA and PALU. As outlined below, a separate PALU mitigation is proposed over 74.68 ha.

RJV submits that such an approach is reasonable and consistent with the RPI Act.

**RJV's proposed PALU mitigation**

RJV will mitigate the impacted 74.68ha of PALU (the "Impact Area") in accordance with the following principles:

- RJV will pay no SCA mitigation for the 74.68ha of PALU in the Impact Area;

- The identified "Mitigation Area" (see below) has the same productive capacity as the Impact Area, as assessed by a qualified agronomist; and
- Forage cropping within the proposed Mitigation Area would be on a like for like basis to mitigate the PALU impacted by RCEP in the Impact Area.

RJV has identified areas on Meteor Downs, adjacent to the Rolleston Mine, and owned by Glencore, which according to a report by agronomists Landline Consulting (refer attached report) (the "Landline Report"), have the same productive capacity of the PALU in the Impact Area.

Consistent with the Landline Report, Glencore is prepared to set aside 74.68 ha of the identified areas (the "Mitigation Area") to counterbalance the loss of the productive capacity of the 74.68 ha of PALU permanently impacted by the RCEP in the Impact Area.

Relevantly, the Landline Report notes (concerning the Meteor Downs areas):

- There is 156 ha of stone-free, contoured land and an additional 113 ha of contoured land with a minor rocky limitation (around 2% surface stone) of which 74.68 ha from either area would have the same productive capacity as derived from the Impact Area.
- The productive capacity of the two assessed Meteor Downs (mitigation) areas are similar in terms of forage cropping for cattle. The Impact Area is suitable for grazing of forage crops at a capacity of 5ha/adult animal equivalent, with the Meteor Downs areas assessed as having a similar capacity.
- The Meteor Downs areas have been cropped in the past, there is no evidence to suggest any cropping for the last 10 years.
- Contour banks have been constructed in both areas to reduce erosion hazard particularly for annual crops and forage crops. Sorghum, oats and barley – the crops commonly grown in the Impact Area - can also be grown within either area. The Landline Report also recommends that Butterfly pea be added to the list of forage species (sorghum, oats and barley) that can and should relevantly be grown. It is noted that Butterfly pea does not require annual sowing and land disturbance, and it is well regarded as grazing forage.
- Based on the assessment of soils in the Impact Area and the areas on Meteor Downs, it is clear that land suitability is similar and that 74.68 ha of the stone-free area (156 ha available) is sufficient to replace the productivity of the Impact Area using forage sorghum, oats or barley.

**Mitigation Area Management Plan**

RJV's proposal is that the RIDA would be subject to a condition that within six (6) months from the RIDA decision date, and before works may commence in the Impact Area, RJV must submit a PALU Mitigation Area Management Plan that will contain:

- The location of the land (Mitigation Area) (with the Meteor Downs identified area) to be used to mitigate the loss of the productive capacity of the 74.68ha of PALU impacted by the RCEP (the Impact Area);
- The timing to commence the necessary PALU works on the Mitigation Area (no later than within twelve (12) months from the commencement of resource activities in the Impact Area);
- The crops to be sown in the Mitigation Area (i.e. fodder crops on a like for like basis with the PALU to be impacted by the RCEP, i.e. sorghum, oats and barley, but also butterfly pea);
- How the Mitigation Area is to be developed and managed for PALU over the life of the RCEP; and

- Maintenance of appropriate records, to be provided to the Chief Executive on request, detailing crops sown, rainfall and any fertiliser used within the Mitigation Area, and any events, whether natural or not, which have influenced the productive capacity of the Mitigation Area.

**Consistency with RPI Act**

RJV believes the proposed mitigation measures are consistent with the RPI Act for the following reasons:

1. An SCL mitigation condition is optional. Section 50 does not impose an SCL mitigation condition where SCA will be impacted by a resource activity but rather indicates that such a condition may be imposed. If it was mandatory, it would be expected that the Act would have indicated that where there is an impact on SCA the chief executive must impose an SCL mitigation condition irrespective of whether there is an overlap of SCA with PALU.
2. It follows that an SCL mitigation condition need not be imposed in respect of all SCA impacted by a resource activity. The condition might be limited to only certain SCA that is impacted. Also, section 50 refers to a condition applying to an "area of" SCA, which is not necessarily "all" SCA.
3. Where the application is also assessed against PALU criteria for an area, there is a section (14(4)) in the Regional Planning Interests Regulation 2014 which suggests that an SCL mitigation condition should not apply.

> *if an activity is proposed to be carried out on land used for a priority agricultural land use in a priority agricultural area that is in the strategic cropping area, the assessor only need be satisfied the activity meets the applicable required outcome stated in schedule 2 for the priority agricultural area.*

In short, this means that in areas of PALU and SCA overlap, the application need only be assessed against its impacts to PALU, not SCA.

This means that the assessor does not consider the impacts (if any) to SCA in the area of overlap because the assessor 'only need be satisfied the activity meets the applicable required outcome stated in schedule 2 for the priority agricultural area'.

Given that in the area of overlap with PALU, the impacts need not be assessed against the SCA assessment criteria (as they do not apply), a mitigation measure against an impact to any SCA in the overlap area would not be required.

Such an interpretation promotes a logical outcome with no 'double dipping' of mitigation where SCA and PALU areas overlap. Only the assessed impact to PALU (if reasonable to do so) need be mitigated.

If you have any queries in relation to the above, please do not hesitate to me on 0419 427 561, or brian.j.french@glencore.com.au

Yours sincerely

Brian French
Approvals and Cultural Heritage Manager

Att

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**Attachment: Landline Report**

Lindsay Ford
Project Manager
Rolleston Coal Expansion Project, Coal Assets Australia
Glencore

8 July 2016

Dear Lindsay

**Mitigation of Impacted PALU land**

## Background

The Rolleston Coal Expansion Project (RCEP) will permanently impact 74.68 ha of Priority Agricultural Land Use (PALU) area, which had been previously used for opportunistic dryland fodder cropping and grazing for at least the past 10 years. The mapping study conducted as part of the RCEP Environmental Impact Study (EIS) identified PALU areas associated with road diversions and a proposed dam site.

Rolleston Coal engaged Landline Consulting to provide a technical report outlining the key characteristics and productive capacity of the Impacted PALU area and to find a Mitigation area with similar characteristics and capacity. A management strategy for the proposed Mitigation area is required to provide guidance on development and management of the Mitigation area for cropping as a replacement for the affected PALU. The purpose of the assessment is to find a Mitigation area that will replace the productivity of the area to be Impacted.

An assessment was undertaken in June 2016 of the Impact and potential Mitigation areas, following a desktop assessment of available information on land suitability. The qualifications of Neil Bryde and Dr Mike Gilbert are given in Appendix A. Soil profile descriptions were made in the PALU area to be Impacted by the proposed dam site (Map 1) and in potential Mitigation areas (Map 2). The Soil Conservation Services Branch of the Queensland Department of Primary Industries had previously conducted land use suitability mapping on some potential Mitigation areas on an adjacent property, Meteor Downs, in 1989 (Map 3). The area had been prepared with contour banks to reduce erosion hazard. There is no evidence that the potential Mitigation area has been cultivated in the previous 10 years.

Soil profiles were hand-augured to one metre depth where possible. Generally speaking the profiles could only be dug to 0.6 metres due to the dry condition of the subsoil. Two profiles were dug, and described, at the Impacted area and an additional fourteen surface soil

assessments made. A photograph was taken at each site and location recorded on GPS (Appendix B).

For the Mitigation area there were ten soil profiles dug with samples taken for chemical analysis, and an additional twelve surface soil assessments. Soil samples were sent to SGS laboratory for chemical analysis.

Maps 1 and 2 show sample site locations.

In the EIS for the RCEP, the Impact land was regarded as a Vertosol soil on alluvial plains, which is subject to water-logging and inundation during heavy rainfall. The previous landholder provided a basic history of forage cropping (forage sorghum in summer and oats or barley in winter) on the Impacted land in the eleven years 2004-2014 (Table 1), but there are no data available on crop biomass, fertilizer usage, grazing period, stock numbers and live weight gain in those years. No forage cropping occurred in 2011 due to flooding.

Table 1. Forage cropping history in the Impacted area.

| Year | Area 6 (63.1 ha) | Area 8 (11.6 ha) |
|---|---|---|
| 2004 | - | *Sugargraze* sorghum |
| 2005 | *Sugargraze* sorghum | Barley |
| 2006 | Oats - Barley | Forage sorghum |
| 2007 | Oats | Barley |
| 2008 | Barley | Sorghum - Barley |
| 2009 | Oats | Sorghum - Oats |
| 2010 | Forage sorghum | *Sugargraze* sorghum |
| 2011 | - (flooded) | - (flooded) |
| 2012 | Oats | Oats |
| 2013 | Forage sorghum | Oats |
| 2014 | Forage sorghum | Oats |

## Findings

Soil profiles are described in Appendix C.

The soil in the Impact area is Chromosol (texture-contrast soil profile, overlying buried sand lenses) and Vertosol (Map 1). The Chromosol soil areas have a characteristic coarser texture at

the surface compared with the Vertosol, and are therefore readily identified in field reconnaissance. To the north of the proposed dam site in the Impact area there is a black Vertosol.
Soil fertility data is presented in Appendix D. There is no salinity at depth in all of the profiles. Exchangeable sodium percentages in all of the profiles samples are less than 2.9 and conductivity is also low.
The Vertosols (Orion soils, described by Bourne and Tuck 1993) in the Mitigation area have very similar chemical characteristics to the soils in the Impact area.

The Mitigation area has contour banks indicating that they have been cropped at some time in the past, but not in the past ten years. These areas have black Vertosol soil of variable depth from 0.45m to >0.6m depending on position in the landscape. Slope varies between 0 and 3%.

The regional suitability framework for Inland Fitzroy and Southern Burdekin (Queensland Department of Natural Resources and Mines 2013) indicates the key factors for land suitability in this area are water erosion, subsoil erosion hazard, soil water availability, narrow moisture range, surface condition, rockiness, microrelief and wetness.

The dryland crops presented in the Framework are Sorghum, Oats and Barley. The overall suitability classes for these crops are given in Table 2. For rock-free land and rocky land, the overall class is 2 and 3 respectively. However, if we adopt the crop choice of Butterfly pea, a perennial crop which does not require annual sowing and land cultivation, then certain factors such as water erosion, water availability, narrow moisture range, surface condition, rockiness, microrelief and wetness become less limiting.

In terms of suitable crops, Butterfly pea (*Clitoria ternatea*) is a proven performer on Vertosols in central Queensland not only as a grazing leguminous crop, but also as a crop that can be harvested for seed and the residue baled for hay (Clem 2008). It is a perennial crop that produces high quality hay or can be directly grazed on the fertile Vertosol soils and does not require nitrogen fertilizer. Meteor Downs management views Butterfly pea as a useful crop that fits with its overall cattle management strategy.

Table 2. Overall suitability class for four cropping land uses from the Regional Land Suitability Framework for the Inland Fitzroy and Southern Burdekin Region of Queensland, 2013.

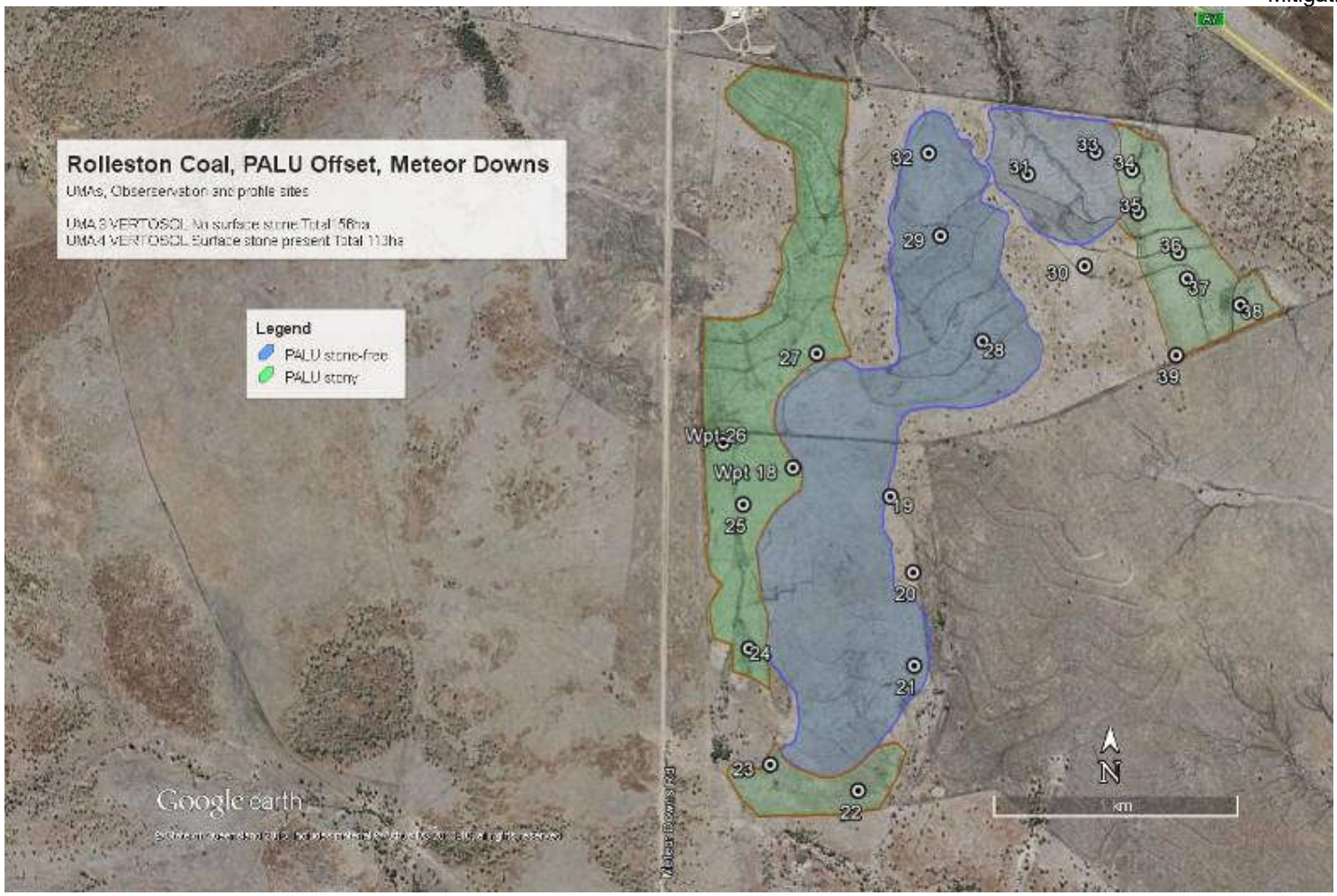
| UMA | Limitation Category | Limitation Value | Suitability sub-class for four land uses | | | |
|---|---|---|---|---|---|---|
| | | | Sorghum Dryland | Oats Dryland | Mungbean Dryland | Chickpea Dryland |
| **1. Mine Lease Impact Area**<br><br>**CHROMOSOL (28ha)** | **E – Water erosion** | **11** | 1 | 1 | 1 | 1 |
| | **Es – Subsoil erosion hazard** | **11** | 1 | 1 | 1 | 1 |
| | **M – Soil water availability *** | **2** | 2 | 3 | 2 | 3 |
| | **Pm - Narrow moisture range** | **2** | 1 | 1 | 1 | 1 |
| | **Ps – Surface condition** | **3** | 2 | 2 | 2 | 2 |
| | **R – Rockiness** | **N/A** | 1 | 1 | 1 | 1 |
| | **Tm – Microrelief** | **1** | 1 | 1 | 1 | 1 |
| | **W - Wetness** | **4M** | 1 | 1 | 1 | 1 |
| | **AMU Overall suitability class** | | **2** | **3** | **2** | **3** |
| **2. Mine Lease Impact Area**<br><br>**VERTOSOL (32ha)** | **E – Water erosion** | **11** | 1 | 1 | 1 | 1 |
| | **Es – Subsoil erosion hazard** | **11** | 1 | 1 | 1 | 1 |
| | **M – Soil water availability *** | **1** | 2 | 2 | 2 | 2 |
| | **Pm - Narrow moisture range** | **2** | 1 | 1 | 1 | 1 |
| | **Ps – Surface condition** | **4** | 2 | 2 | 2 | 2 |
| | **R – Rockiness** | **N/A** | 1 | 1 | 1 | 1 |
| | **Tm – Microrelief** | **6** | 2 | 2 | 2 | 2 |
| | **W - Wetness** | **4S** | 2 | 2 | 2 | 2 |
| | **AMU Overall suitability class** | | **2** | **2** | **2** | **2** |

Table 2 (cont)

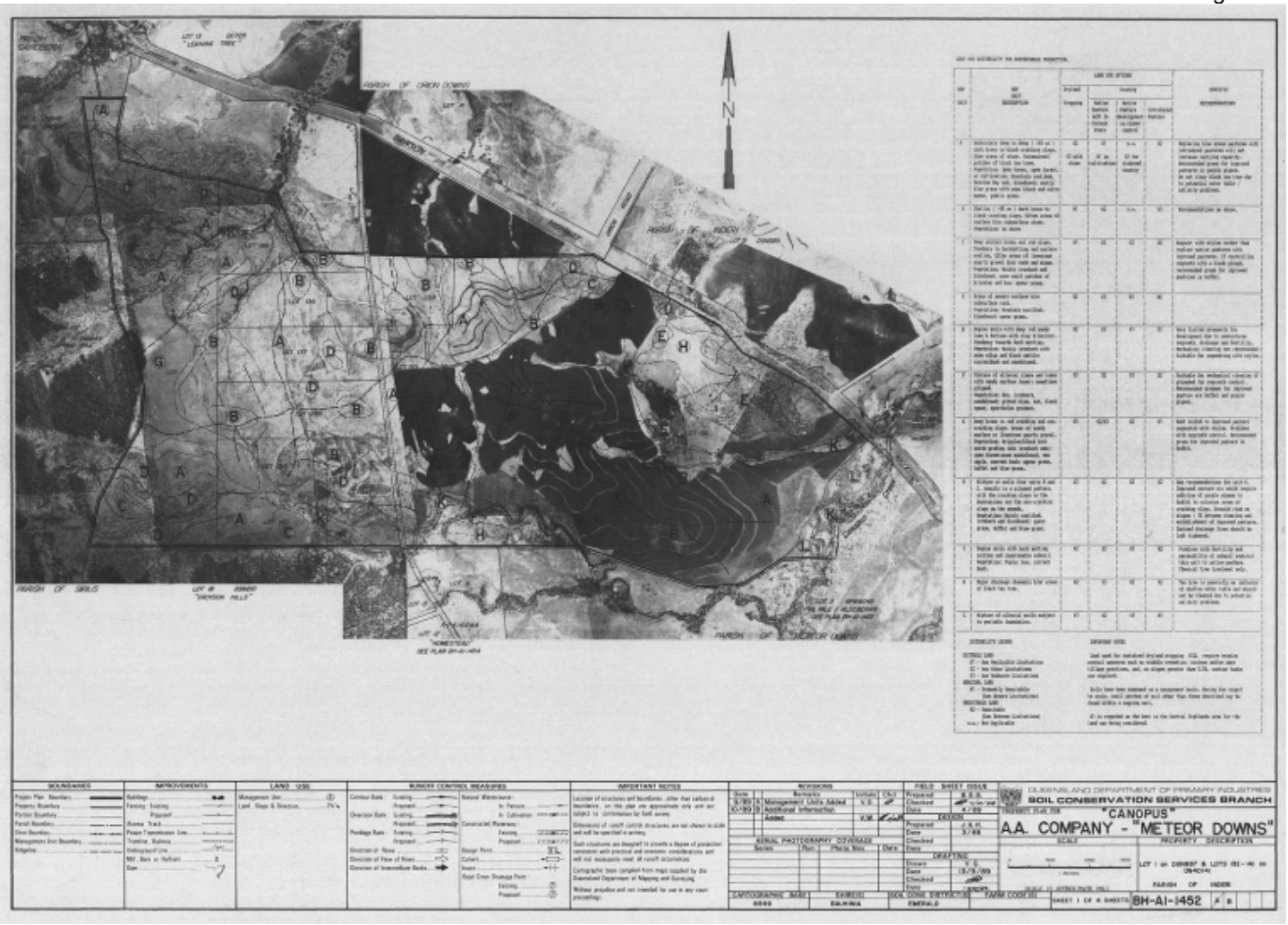
| AMU | Limitation Category | Limitation Value | Suitability sub-class for three land uses | | | |
|---|---|---|---|---|---|---|
| | | | Sorghum - Dryland | Oats - Dryland | Mungbean - Dryland | Chickpea - Dryland |
| **3 Meteor Downs Stone-free VERTOSOL (156ha)** | **E – Water erosion** | **31** | 2 | 2 | 2 | 2 |
| | **Es – Subsoil erosion hazard** | **31** | 1 | 1 | 1 | 1 |
| | **M – Soil water availability *** | **1** | 2 | 2 | 2 | 2 |
| | **Pm - Narrow moisture range** | **2** | 1 | 1 | 1 | 1 |
| | **Ps – Surface condition** | **4** | 2 | 2 | 2 | 2 |
| | **R – Rockiness** | **N/A** | 1 | 1 | 1 | 1 |
| | **Tm – Microrelief** | **1** | 1 | 1 | 1 | 1 |
| | **W - Wetness** | **4M** | 1 | 1 | 1 | 1 |
| | **AMU Overall suitability class** | | **2** | **2** | **2** | **2** |
| **4 Meteor Downs Stony VERTOSOL (113ha)** | **E – Water erosion** | **31** | 2 | 2 | 2 | 2 |
| | **Es – Subsoil erosion hazard** | **31** | 1 | 1 | 1 | 1 |
| | **M – Soil water availability *** | **1** | 2 | 2 | 2 | 2 |
| | **Pm - Narrow moisture range** | **2** | 1 | 1 | 1 | 1 |
| | **Ps – Surface condition** | **4** | 2 | 2 | 2 | 2 |
| | **R – Rockiness** | **S2** | 3 | 3 | 3 | 3 |
| | **Tm – Microrelief** | **1** | 1 | 1 | 1 | 1 |
| | **W - Wetness** | **4M** | 1 | 1 | 1 | 1 |
| | **AMU Overall suitability class** | | **3** | **3** | **3** | **3** |

***** Soil PAWC estimate from Burk & Dalgliesh (2008). *Estimating plant available water capacity – a methodology.* CSIRO. Table 3, Appendix I, pp 25-26.


Map 1. Sampling sites and soils in the main Impact area on the mine site




Map 2. Sampling sites and soil in the proposed Mitigation area on Meteor Downs




Map 3. Land suitability mapping for the potential Mitigation area conducted in 1989.

## Management strategy for proposed Mitigation area

The Impact area of 74.68 ha is flat, uncontoured, with no stones, but subject to inundation. The Mitigation area is sloping, but contoured, with no risk of inundation; there is 156 ha of stone-free, contoured land and an additional 113 ha of contoured land with a minor rocky limitation (around 2% surface stone).

The proposed Mitigation area has been cropped in the past with contour banks constructed to reduce erosion hazard particularly for annual crops and forage crops. Maintenance work is required on the contour banks. The proposed management strategy incorporates the use of the perennial legume crop Butterfly pea, which does not require annual land preparation. Whilst it can be grown for seed, it will more likely be used as a hay crop or grazed forage crop. Therefore any limitation due to stoniness is minimized. Similarly sorghum, oats and barley can be grown as forage crops.

The productive capacity of the two assessed areas is similar in terms of forage cropping for cattle. In the past 10 years, the Impact area has only been used for forage cropping. The Impact area is suitable for grazing of forage crops at a capacity of 5ha/adult animal equivalent and the Mitigation area has a similar capacity.

## Recommendations

Based on the assessment of soils in the Impact area on the mine site and the potential Mitigation areas on Meteor Downs it is clear that land suitability is similar and that 74.68 ha of the stone-free Mitigation area (156 ha available) is sufficient to replace the productivity of the Impact land on the mine site using forage sorghum, oats or barley. Furthermore, the additional 113 ha of contoured, stony land in the Mitigation area could also be used. It is recommended that Butterfly pea be added to the list of forage species (sorghum, oats and barley) that can be grown in the Mitigation area. Butterfly pea does not require annual sowing and land disturbance and it is well regarded as a grazing forage.

## References

Bourne, G.F. and Tuck, G.A. (1993). Field Manual, in R.N. Thwaites and J,M, Maher (eds.) *Understanding and Managing Soils in the Central Highlands*, Department of Primary Industries Training Series QE93002, Brisbane.

Burk, L. and Dalgliesh, N.P. (2008). *Estimating plant available water capacity – a methodology.* CSIRO. Table 3, Appendix I, pp 25-26

Clem, R. (2008) Pastures Australia – Butterfly pea.

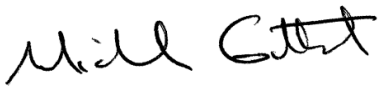
Queensland Department of Natural Resources and Mines (2013).Land Suitability Frameworks for Queensland.

McKenzie N.J. *et al.* (2008). *Guidelines for Surveying Soil and Land Resources*. 2nd edition CSIRO

National Committee on Soil and Terrain (2009). *Australian Soil and Land Survey Handbook* 3rd ed. CSIRO.

Isbell R.F. (2002). *The Australian Soil Classification* revised ed. CSIRO.

Yours sincerely



Dr Michael Gilbert
LANDLINE CONSULTING

Neil Bryde
LANDLINE CONSULTING

**Appendix A**

**Statement of Professional Suitability**

**Neil John Bryde**

***Qualifications:***

Bachelor of Science, James Cook University 2011
Certificate in Sugar Technology, Mackay College of TAFE 1984
Certificate in Agriculture, Queensland Agricultural College 1970

***Experience:***
Twenty-two years experience in land resource mapping and crop production studies across wet and dry tropical north Queensland for the Department of Natural Resources and a further year as an environmental consultant conducting land suitability assessment and vegetation surveys and land condition surveys across Cape York Peninsula.

**Relevant publications include:**
Grundy, M.J. and Bryde, N.J. (1989) Land resources of the Einasleigh – Atherton dry tropics. Queensland Department of Primary Industries, Brisbane.
Grundy, M.J. and Bryde, N.J. (1989) Upper Herbert River – Blunder Creek irrigation feasibility study. Queensland Department of Primary Industries.
Daniells, J.W. and Bryde, N.J. (2001) Banana varieties: The ACIAR years 1987-1996. Queensland Department of Primary Industries, Brisbane.

**Mike Gilbert**

***Qualifications***
Bachelor of Applied Science, Queensland Agricultural College 1972
Master of Agricultural Science, Queensland University 1980
PhD in Soil Science & Plant Nutrition, University of Western Australia 1984

***Experience:***
Forty years field experience in the Agricultural Sciences in tropical and temperate regions of Australia, Papua New Guinea and South East Asia. Studies involved detailed assessments of soils and vegetation in relation to their suitability for agriculture. Mike Gilbert has completed a detailed land suitability assessment in the Weipa area for Rio Tinto Alcan in 2008 and assessments for property developments in south-east Queensland.

**Appendix B**

**Soil profile observation sites and details of the Impact area on the minesite and proposed Mitigation area on Meteor Downs**

| Site # | UTM Zone | Eastings | Northings | Photo # | Notes |
|---|---|---|---|---|---|
| 001 | 55 J | 0640973 | 7288584 | 3617 | Springwood Rd diversion. No evidence of farming – no crop residue, no cultivation. Grazed to bare soil. Since recent rain germination of *Urochloa mosambicensis* 90% and Cooch grass 10%; ground cover 40%, yield 50kg/ha. Small surface cracks but no self mulching and lighter colour. Not the appearance of a true vertosol. |
| 002 | 55 J | 0641311 | 7289613 | 3618 | Meteor Creek diversion. No evidence of farming – no crop residue, no cultivation. Grazed to bare soil. Since recent rain germination of *Urochloa mosambicensis*90% and Cooch grass 10%; ground cover 35%, yield 50kg/ha. Small surface cracks but no self mulching and lighter colour. Not the appearance of a true Vertosol. |
| 004 | 55 J | 0640087 | 7290542 | | Impacted dam site. No evidence of cropping – grazed only. *Urochloa* germinating. Similar surface to site 003 (Chromosol) |
| 006 | 55 J | 0640719 | 7290378 | 3628 | Impacted dam site. No evidence of cropping – grazed only. *Urochloa* germinating. Coarser textured surface – larger soil unit of landscape. (Chromosol) |
| 007 | 55 J | 0640840 | 7290223 | 3629 | Impacted dam site. No evidence of cropping – grazed only. *Urochloa* germinating. Wetter patch of soil but no surface cracking. (Chromosol) |
| 008 | 55 J | 0640892 | 7290442 | 3630 | Impacted dam site. No evidence of cropping – grazed only. *Urochloa* germinating. Coarser textured surface. (Chromosol) |
| 009 | 55 J | 0641258 | 7290343 | 3631 | Impacted dam site closer to existing dam wall (south). Coarser textured surface. (Chromosol) |
| 010 | 55 J | 0641351 | 7290405 | 3632 | Impacted dam site closer to existing dam wall. Coarser textured surface. (Chromosol) |
| 011 | 55 J | 0641316 | 7290486 | 3633 | Impacted dam site closer to existing dam wall (middle). Coarser textured surface. (Chromosol) |
| 012 | 55 J | 0641244 | 7290511 | 3634 | Impacted dam site. No evidence of cropping – grazed only. *Urochloa* germinating. Coarser textured surface – larger soil unit of landscape. (Chromosol) |
| 013 | 55 J | 0641213 | 7290636 | 3635 | Impacted dam site. Finer textured, cracking surface. (Vertosol) |
| 014 | 55 J | 0641175 | 7290676 | 3637 | Impacted dam site. Coarser textured surface. (Chromosol) |
| 015 | 55 J | 0641097 | 7290661 | 3636 | Impacted dam site north side of wet, finer textured, uncleared patch. Coarser textured surface. (Chromosol) |
| 016 | 55 J | 0641015 | 7290578 | 3638 | Impacted dam site north side of wet, finer textured, uncleared patch. Coarser textured surface. (Chromosol) |
| 017 | | | | | |
| 019 | 55 J | 0634951 | 7310390 | 3642, 3643 | Meteor Downs. Top of (east) roadside paddock. Surface pH 7.5 Basalt coarse fragments at 0.5m. Black Vertosol |

| Site # | UTM Zone | Eastings | Northings | Photo # | Notes |
|---|---|---|---|---|---|
| 021 | 55 J | 0635042 | 7309702 | 3647 | Meteor Downs. No surface fragments. Surface pH 7.0 Black Vertosol |
| 023 | 55 J | 0634450 | 7309304 | 3651 | Meteor Downs. Gully. Black Vertosol |
| 025 | 55 J | 0634348 | 7310363 | 3655 | Meteor Downs. Surface pH 7.0 Slope 3%. Numerous, up to 0.5m erosion gullies. |
| 026 | 55 J | 0634270 | 7310615 | 3656 | Meteor Downs. Surface pH 7.0 Slope 1.5 2.5%. Numerous, up to 0.5m erosion gullies. No surface coarse fragments. Black Vertosol |
| 032 | 55 J | 0635123 | 7311784 | 3667 | Meteor Downs. Surface pH 6.8 Slope 0.5 No surface coarse fragments. Lower slope. Good pasture cover. Black Vertosol |
| 033 | 55 J | 0635806 | 7311781 | 3668 | Meteor Downs. Flat, pH 6.8, <1% basalt surface stone (6-22cm). Black Vertosol |
| 034 | 55 J | 0635955 | 7311706 | | Meteor Downs. Erosion gully pH7.2 Decomposing basalt parent material at 0.8m Black Vertosol |
| 035 | 55 J | 0635978 | 7311531 | 3669 | Meteor Downs. Top of erosion gully. 2% surface stone. Decomposing parent material at 0.6m. Black Vertosol |
| 036 | 55 J | 0635139 | 7311367 | 3670 | Meteor Downs. Slope 2%. <1% surface stone. Black Vertosol |
| 038 | 55 J | 0636389 | 7311153 | 3672 | Meteor Downs. Slope 1%. <1% surface stone. Black Vertosol |
| 039 | 55 J | 0636124 | 7310952 | 3673 | Meteor Downs. Slope 0.5% No surface stone. Top of rise. Mountain Coolibah in uncleared areas |
| | | | | 3674 | Landscape photo from Meteor Downs Rd towards top paddock over ridge |
| | | | | 3675, 3676 | Landscape photos from Meteor Downs Rd of lower paddock adjacent to road. |

**Appendix C**

**Soil profile descriptions from the Impact area on the minesite and proposed Mitigation area on Meteor Downs**

| **Site #** | **003** | Slope % | 0 – 0.5 | Permeability | 3 -mod | Erosion | 0 | |
|---|---|---|---|---|---|---|---|---|
| Desc. By | BRYN & GILM | Element | BKP - backplain | | | | | |
| Date | 23/6/16 | | | Drainage | 4/5 – mod/well | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | FLO – flood plain | | | | | |
| Zone | 55J | | | Microrelief | Z -none | Rock Outcrop | 0 | |
| Easting | 0641127 | Northing | 7290284 | | | | | |
| Notes: | Photo 3623<br>New dam site. Grazed with no cultivation evidence.<br>Texture contrast soil with a fine sandy transitional zone to a buried sand lens. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-10 | LC+ | M | 7.5YR 2.5/1 | 0 | 0 | 0 | W | 5 | 7.0 | | 0-10 |
| B2 | 10-18 | HC | M | 10YR 2/1 | 0 | 0 | 0 | M | 30 | 7.5 | | 30-60 |
| B3 | 18-50 | LC F | D | 10YR 2/1 | 0 | 0 | 0 | V | 60 | 7.3 | | 90-120 |
| B3b | 50-120 | LS | D | 10YR 3/3 | 0 | 0 | 0 | S | 90 | 7.5 | | |
| | | | | | | | | | | | | |
| Soil Classification | Black, clayey CHROMOSOL | | | | | | | | | | | |

**PALU Impact area adjacent to Dam (site 3)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **005** | Slope % | 0 - 0.5 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | BKP | | | | | |
| Date | 23/6/16 | | | Drainage | 4 | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | FLO (covered?) | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0640778 | Northing | 7290610 | | | | | |
| Notes: | Photos 3625, 3626, 3627<br>New dam site, small depression<br>Grazed with no cultivation evidence. Soil difficult to auger after 40cm due to dryness | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-15 | MHC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 5 | 7.0 | | 0-10 |
| B2 1 | 15-30 | HC | M/D | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 25 | 7.2 | | 40-50 |
| B2 2? | 30-50 | HC | D | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 40 | 7.3 | | |
| | | | | | | | | | | | | |
| Soil Classification | Moderate to deep black VERTOSOL | | | | | | | | | | | |

**PALU Impact area to north of proposed dam site (site 5)**

| **Site #** | **018** | Slope % | 1.0 | Permeability | 2 | Erosion | 0 | |
|---|---|---|---|---|---|---|---|---|
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | 4 | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0634553 | Northing | 7310510 | | | | | |
| Notes: | Photos: 3639, 3640, 3641<br>Grazed with no cultivation evidence. *Dichanthium sericeum* Qld bluegrass &*Clitoria ternatea* Butterfly pea<br>Meteor Downs. Coarse fragments at depth are decomposing basalt | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1<br>B2 | 0-20<br>20-40 | MHC<br>HC | M<br>M | 7.5YR 2.5/1<br>10YR 2/1 | 0<br>0 | 0<br>1/1 (<2%/ pebbles) | 0<br>0 | M<br>M | 5<br>30 | 7.0<br>6.8 | | No Soil Sample |
| | | | | | | | | | | | | |
| Soil Classification | Shallow to moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 18)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **020** | Slope % | 2.0 | Permeability | 2 | Erosion | G 2 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 2 (few)<br>5 (stones) | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0635043 | Northing | 7310080 | | | | | |
| Notes: | Photos: 3644, 3644, 3646<br>Grazed with no cultivation evidence. Surface stones are basalt.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-12 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 10 | 7.2 | | 0-10 |
| B2 | 12-80 | MHC+ | M | 10TR 2/1 | 0 | 0 | 0 | M | 60 | 7.5 | | 60-80 |
| B3 | 80-100 | MHC+ | M | 10YR 2/1 | 0 | 1/2 | 0 | M | 90 | 7.7 | | 80-100 |
| | | | | | | | | | | | | |
| Soil Classification | Moderate to deep black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 20)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **022** | Slope % | 1.5 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 2/5 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0634808 | Northing | 7309194 | | | | | |
| Notes: | Photos: 3648, 3649, 3650<br>Grazed with no cultivation evidence. Surface stones are basalt.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-13 | MHC+ | M | 10YR 2/1 | 0 | 0 | 0 | M | 10 | 7.0 | | 0-10 |
| B2 | 13-45 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 30 | 6.7 | | 20-40 |
| B3 | 45-60 | MHC+ | D | 7.5YR 2.5/1 | 0 | 2/2 | 0 | M | 60 | 7.3 | | 50-60 |
| | | | | | | | | | | | | |
| Soil Classification | Moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 22)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **024** | Slope % | 2.0 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 2/5 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0634366 | Northing | 7309777 | | | | | |
| Notes: | Photos: 3652, 3653, 3654<br>Grazed with no cultivation evidence. Surface stones are basalt.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-11 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 10 | 7.2 | | 0-10 |
| B2 | 11-80 | HC | M | 7.5YR 2.5/1 | 0 | 1/1 | 0 | M | 40 | 7.5 | | 60-80 |
| | | | | | | | | | 80 | 7.8 | | |
| | | | | | | | | | | | | |
| Soil Classification | Moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 24)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **027** | Slope % | 0.5 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0634656 | Northing | 7310974 | | | | | |
| Notes: | Photos: 3657, 3658<br>Grazed with no cultivation evidence.<br>Meteor Downs. Coarse fragments in the B are decomposing basalt as is the C horizon | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0-10 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 10 | 6.5 | | No |
| B2 | 10-30 | HC | M | 10YR 2/1 | 0 | 1/1 | 0 | M | 30 | 6.4 | | Soil |
| C | 40 | | | 2.5Y 5/2 | | | | | 40 | 7.0 | | Sample |
| | | | | | | | | | | | | |
| Soil Classification | Shallow black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 27)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **028** | Slope % | 1.5 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0635333 | Northing | 7311017 | | | | | |
| Notes: | Photos: 3659, 3660<br>Grazed with no cultivation evidence.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-11 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 7 | 6.7 | | 0-10 |
| B2 | 11-40 | HC | M | 10YR 2/1 | 0 | 0 | 0 | M | 40 | 6.7 | | 30-40 |
| B3 | 40-50 | MHC | M | 10YR 2/1 | 0 | 2/1 | 0 | M | 50 | 7.0 | | |
| | | | | | | | | | | | | |
| Soil Classification | Shallow to moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 28)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **029** | Slope % | 1.0 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0635168 | Northing | 7311447 | | | | | |
| Notes: | Photos: 3661, 3662<br>Grazed with no cultivation evidence.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-9 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 10 | 6.7 | | 0-10 |
| B2 | 9-65 | HC | M | 10YR 2/1 | 0 | 0 | 0 | S | 35 | 7.0 | | 30-60 |
| B3 | 65-80 | HC | M | 7.5YR 2.5/1 | 0 | 1/1 | 0 | S | 75 | 7.5 | | |
| | | | | | | | | | | | | |
| Soil Classification | Moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 29)**

| **Site #** | **030** | Slope % | 1.5 | Permeability | 2 | Erosion | 0 | |
|---|---|---|---|---|---|---|---|---|
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0635755 | Northing | 7311317 | | | | | |
| Notes: | Photos: 3663, 3664<br>Grazed with no cultivation evidence.<br>Meteor Downs. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-10 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 5 | 6.4 | | 0-10 |
| B2 | 10-60 | HC | M | 10YR 2/1 | 0 | 0 | 0 | S | 30 | 6.5 | | 30-40 |
| | | | | | | | | | 60 | 7.5 | | 50-60 |
| | | | | | | | | | | | | |
| Soil Classification | Moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 30)**

| **Site #** | **031** | Slope % | 1.0 | Permeability | 2 | Erosion | 0 | |
|---|---|---|---|---|---|---|---|---|
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 0 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0635527 | Northing | 7311693 | | | | | |
| Notes: | Photos: 3665, 3666<br>Grazed with no cultivation evidence.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-6 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 5 | 7.0 | | 0-10 |
| B2 | 6-45 | HC | M | 10YR 2/1 | 0 | 0 | 0 | S | 30 | 7.0 | | 30-40 |
| B3 | 45-60 | HC | M | 10YR 2/1 | 0 | 3/1 | 0 | S | 60 | 7.0 | | 50-60 |
| | | | | | | | | | | | | |
| Soil Classification | Moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 31)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site #** | **037** | Slope % | 0.5 | Permeability | 2 | Erosion | 0 | |
| Desc. By | BRYN & GILM | Element | PLA | | | | | |
| Date | 23/6/16 | | | Drainage | M | Surface Coarse Fragments | 1/5 | |
| Datum | UTM | Pattern | LAV | | | | | |
| Zone | 55J | | | Microrelief | Z | Rock Outcrop | 0 | |
| Easting | 0636174 | Northing | 7311261 | | | | | |
| Notes: | Photos: 3671<br>Grazed with no cultivation evident. Surface stones are basalt and <1%.<br>Meteor Downs. Coarse fragments at depth are decomposing basalt. Combination of dryness and fragments stopped auguring. Indications are soil depth would go to 60cm but with increasing coarse fragments. | | | | | | | |

| Horizon | Depth | Texture | Moisture | Colour | Mottles | Coarse Frags. | Segregations | Structure | Test depth | pH | EC | Sample Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0-9 | HC | M | 7.5YR 2.5/1 | 0 | 0 | 0 | M | 5 | 7.1 | | No |
| B2 | 9-35 | HC | D | 7.5YR 2.5/1 | 0 | 1/1 | 0 | M | 25 | 7.0 | | Soil |
| | | | | | | | | | 35 | 7.1 | | Sample |
| | | | | | | | | | | | | |
| Soil Classification | Moderate black VERTOSOL | | | | | | | | | | | |

**Potential Mitigation area, Meteor Downs (site 37)**

**Appendix D**

**Soil chemical analyses from sampling sites on the Impact area on the minesite and proposed Mitigation area on Meteor Downs**

| Impact Area | | | Site 3 | | | Site 5 | |
|---|---|---|---|---|---|---|---|
| Analyte Name | Units | Reporting Limit | 0-10 | 30-60 | 90-120 | 0-10 | 40-50 |
| % Moisture | % | 0.5 | 7.7 | 6.1 | 2.2 | 24.4 | 20.3 |
| pH | pH Units | 0 | 7.1 | 7.9 | 8.2 | 7.5 | 7.8 |
| Conductivity of Extract (1:5 dry sample basis) | µS/cm | 1 | 70 | 50 | 10 | 60 | 70 |
| Chloride (water extractable 1:5) | mg/kg | 5 | 8 | 5 | <5 | 8 | 20 |
| Total Nitrogen | %w/w | 0.01 | 0.08 | 0.05 | <0.01 | 0.09 | 0.06 |
| Carbon:Nitrogen Ratio | No unit | 0.1 | 15 | 8.9 | 1.6 | 14 | 18 |
| Nitrate/Nitrite Nitrogen, NOx as N | mg/kg | 0.1 | 17 | 3.9 | 0.5 | 6.6 | 6.9 |
| Total Phosphorus (Kjeldahl Digestion) | mg/kg | 2 | 920 | 860 | 2300 | 780 | 700 |
| Total Organic Carbon | %w/w | 0.05 | 1.2 | 0.46 | <0.05 | 1.2 | 1.0 |
| Organic Matter | %w/w | 0.1 | 2.1 | 0.79 | <0.1 | 2.1 | 1.8 |
| Exchangeable Sodium, Na | meq/100g | 0.01 | 0.08 | 0.33 | 0.13 | 1.1 | 1.8 |
| Exchangeable Sodium Percentage | % | 0.1 | 0.5 | 1.0 | 1.7 | 1.9 | 2.9 |
| Exchangeable Potassium, K | meq/100g | 0.01 | 0.95 | 0.36 | 0.10 | 1.2 | 0.84 |
| Exchangeable Calcium, Ca | meq/100g | 0.01 | 11 | 22 | 5.0 | 26 | 31 |
| Exchangeable Magnesium, Mg | meq/100g | 0.02 | 4.9 | 11 | 2.4 | 27 | 27 |
| Cation Exchange Capacity | meq/100g | 0.02 | 16 | 34 | 7.6 | 55 | 61 |
| Calcium/Magnesium Ratio | No unit | 0.1 | 2.2 | 2.0 | 2.1 | 1.0 | 1.1 |
| KCl-40-extractable Sulphur, S | mg/kg | 1 | <1 | 1 | <1 | 1 | 2 |

| Mitigation Area | | | Site 20 | | | Site 22 | | | Site 24 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Analyte Name | Units | Reporting Limit | 0-10 | 60-80 | 80-100 | 0-10 | 20-40 | 50-60 | 0-10 | 60-80 |
| % Moisture | % | 0.5 | 26.4 | 29.9 | 24.4 | 19.9 | 22.7 | 12.4 | 26.1 | 19.4 |
| pH | pH Units | 0 | 7.8 | 8.0 | 8.6 | 7.8 | 7.8 | 8.0 | 7.8 | 8.2 |
| Conductivity of Extract (1:5 dry sample) | µS/cm | 1 | 320 | 110 | 230 | 50 | 50 | 30 | 100 | 400 |
| Chloride (water extractable 1:5) | mg/kg | 5 | <5 | <5 | 20 | <5 | 10 | 7 | 5 | <5 |
| Total Nitrogen | %w/w | 0.01 | 0.08 | 0.06 | 0.04 | 0.06 | 0.06 | 0.06 | 0.10 | 0.06 |
| Carbon:Nitrogen Ratio | No unit | 0.1 | 16 | 17 | 19 | 14 | 14 | 13 | 15 | 16 |
| Nitrate/Nitrite Nitrogen, NOx as N | mg/kg | 0.1 | 1.9 | 4.0 | 28 | 1.4 | 1.1 | 0.4 | 3.0 | 0.7 |
| Total Phosphorus (Kjeldahl Digestion) | mg/kg | 2 | 190 | 180 | 230 | 1300 | 1200 | 1200 | 710 | 690 |
| Total Organic Carbon | %w/w | 0.05 | 1.2 | 1.1 | 0.78 | 0.87 | 0.78 | 0.77 | 1.4 | 0.96 |
| Organic Matter | %w/w | 0.1 | 2.1 | 1.9 | 1.3 | 1.5 | 1.3 | 1.3 | 2.4 | 1.7 |
| Exchangeable Sodium, Na | meq/100g | 0.01 | 0.94 | 1.7 | 2.5 | 0.30 | 0.38 | 0.44 | 0.21 | 0.40 |
| Exchangeable Sodium Percentage | % | 0.1 | 1.1 | 1.9 | 2.8 | 0.5 | 0.7 | 0.8 | 0.3 | 0.5 |
| Exchangeable Potassium, K | meq/100g | 0.01 | 0.37 | 0.31 | 0.17 | 0.87 | 0.43 | 0.33 | 1.2 | 0.45 |
| Exchangeable Calcium, Ca | meq/100g | 0.01 | 62 | 61 | 60 | 38 | 39 | 40 | 67 | 68 |
| Exchangeable Magnesium, Mg | meq/100g | 0.02 | 26 | 28 | 24 | 17 | 16 | 15 | 16 | 19 |
| Cation Exchange Capacity | meq/100g | 0.02 | 89 | 91 | 88 | 55 | 56 | 56 | 84 | 88 |
| Calcium/Magnesium Ratio | No unit | 0.1 | 2.4 | 2.2 | 2.5 | 2.3 | 2.4 | 2.6 | 4.2 | 3.6 |
| KCl-40-extractable Sulphur, S | mg/kg | 1 | <1 | <1 | 9 | <1 | <1 | <1 | <1 | <1 |

| Mitigation Area | | | Site 28 | | Site 29 | | Site 30 | | | Site 31 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte Name | Units | Reporting Limit | 0-10 | 30-40 | 0-10 | 30-60 | 0-10 | 30-40 | 50-60 | 0-10 | 30-40 | 50-60 |
| % Moisture | % | 0.5 | 18.9 | 24.2 | 26.6 | 19.2 | 27.1 | 22.1 | 18.2 | 22.8 | 21.5 | 18.2 |
| pH | pH Units | 0 | 7.6 | 7.8 | 7.3 | 8.0 | 7.1 | 7.7 | 8.1 | 7.7 | 7.9 | 8.1 |
| Conductivity of Extract (1:5 dry sample basis) | µS/cm | 1 | 180 | 170 | 160 | 170 | 210 | 40 | 50 | 30 | 60 | 30 |
| Chloride (water extractable 1:5) | mg/kg | 5 | <5 | 15 | <5 | 5 | <5 | 12 | <5 | <5 | 8 | 9 |
| Total Nitrogen | %w/w | 0.01 | 0.11 | 0.07 | 0.07 | 0.05 | 0.09 | 0.06 | 0.05 | 0.08 | 0.07 | 0.07 |
| Carbon:Nitrogen Ratio | No unit | 0.1 | 14 | 16 | 15 | 18 | 14 | 18 | 18 | 15 | 16 | 14 |
| Nitrate/Nitrite Nitrogen, NOx as N | mg/kg | 0.1 | 1.8 | 1.7 | 1.5 | 0.6 | 1.2 | 1.1 | 0.3 | 1.6 | 0.7 | 0.7 |
| Total Phosphorus (Kjeldahl Digestion) | mg/kg | 2 | 400 | 310 | 270 | 200 | 360 | 270 | 340 | 350 | 300 | 310 |
| Total Organic Carbon | %w/w | 0.05 | 1.4 | 1.1 | 1.1 | 0.95 | 1.2 | 1.0 | 0.92 | 1.2 | 1.1 | 0.98 |
| Organic Matter | %w/w | 0.1 | 2.5 | 1.9 | 1.8 | 1.6 | 2.1 | 1.8 | 1.6 | 2.0 | 1.9 | 1.7 |
| Exchangeable Sodium, Na | meq/100g | 0.01 | 0.21 | 0.45 | 0.42 | 0.66 | 0.38 | 0.69 | 1.7 | 0.29 | 0.43 | 0.46 |
| Exchangeable Sodium Percentage | % | 0.1 | 0.3 | 0.6 | 0.5 | 0.8 | 0.4 | 0.8 | 1.0 | 0.4 | 0.6 | 0.5 |
| Exchangeable Potassium, K | meq/100g | 0.01 | 0.92 | 0.19 | 0.27 | 0.08 | 1.1 | 0.32 | 0.62 | 0.65 | 0.20 | 0.21 |
| Exchangeable Calcium, Ca | meq/100g | 0.01 | 51 | 53 | 53 | 58 | 63 | 65 | 130 | 56 | 53 | 57 |
| Exchangeable Magnesium, Mg | meq/100g | 0.02 | 22 | 20 | 24 | 26 | 21 | 21 | 41 | 26 | 24 | 26 |
| Cation Exchange Capacity | meq/100g | 0.02 | 74 | 74 | 77 | 85 | 85 | 87 | 170 | 82 | 78 | 84 |
| Calcium/Magnesium Ratio | No unit | 0.1 | 2.3 | 2.7 | 2.2 | 2.2 | 3.0 | 3.2 | 3.1 | 2.2 | 2.2 | 2.2 |
| KCl-40-extractable Sulphur, S | mg/kg | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |