

# Peculiar Knob Iron Ore Mine MARCR

# 2011-12

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**Document Status**

| Rev No. | Authors                       | Responsible Managers                                       |                                                                                              | Approved for Issue                                 |                                                                                                |
|---------|-------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------|
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# ENVIRONMENT POLICY

Arrium's primary operations include mining, metal recycling, steelmaking, the manufacture of intermediate and finished steel products, and the distribution and sale of metal and mineral products.

Arrium seeks to improve business sustainability by valuing environmental, social and economic considerations in its decision-making.

Arrium is committed to pursuing a high standard of environmental management throughout its global operations. Arrium strives for continual improvement of environmental performance, the efficient use of resources, and the minimisation or prevention of pollution.

## Specifically, it is Arrium's policy to:

Establish, review, document and monitor measurable environmental objectives and targets to continually improve environmental performance whilst taking into account evolving community expectations, management practices, scientific knowledge, technology and business structure.

Use energy, fresh water and other resources more efficiently where economically viable. This includes scrap metal recovery and recycling, and the promotion of and improvement to the environmental credentials of Arrium, its operations, its products and their application.

Comply with applicable environmental laws, regulations and mandatory standards. Where these do not exist, apply appropriate internal standards that reflect Arrium's commitment to prevent or minimise adverse environmental impacts resulting from its operations, products and services.

Communicate on environmental issues with relevant governments and communities directly affected by Arrium's operations, and contribute to the development of policies, legislations and regulations that may affect Arrium and its operations.

Control and manage environmental risks arising from Arrium's operations by implementing systems to identify, assess, control, and monitor those environmental risks.

Educate and appropriately train employees, contractors and labour hire employees to assist with Arrium's environmental standards understanding and assignment of appropriate accountabilities and responsibilities to those individuals.

Inform relevant employees, contractors and suppliers of goods and services to Arrium managed sites of their obligations regarding this policy, to manage policy implementation, facilitate stakeholder understanding and be committed to continual policy maintenance and improvement.

## Geoff Plummer

Managing Director and Chief Executive Officer  
September 2010

| Issue Date                                                                              | Reason for Key Changes                   | Approved by                      |
|-----------------------------------------------------------------------------------------|------------------------------------------|----------------------------------|
| July 2012<br>September 2010<br>Previous revisions: 08/2000, 01/2003,<br>11/2005, 7/2008 | Rebranded as 'Arrium'<br>Biennial review | P. Thomas<br>Arrium OHSE Council |

## Table of Contents

|       |                                                                                           |    |
|-------|-------------------------------------------------------------------------------------------|----|
| 1     | Introduction .....                                                                        | 7  |
| 1.1   | General Overview .....                                                                    | 7  |
| 2     | Peculiar Knob Mining and Construction Activities 2011/12.....                             | 9  |
| 2.1   | Construction Activities. ....                                                             | 9  |
| 2.2   | Mining Activities 2011-12. ....                                                           | 11 |
| 2.3   | Exploration and Resource Definition. ....                                                 | 14 |
| 3     | Rehabilitation and Environmental Management Activities. ....                              | 15 |
| 3.1   | Native Vegetation Management.....                                                         | 15 |
| 3.1.1 | Baseline Annual Flora Survey .....                                                        | 15 |
| 3.1.2 | Vegetation Clearance Permitting Management .....                                          | 17 |
| 3.2   | Fauna Management .....                                                                    | 17 |
| 3.3   | Dust Management .....                                                                     | 18 |
| 3.3.1 | Dust Deposition Monitoring.....                                                           | 18 |
| 3.3.2 | Soil Salinity and pH Monitoring.....                                                      | 20 |
| 3.4   | Land Management .....                                                                     | 21 |
| 3.4.1 | Erosion and Sediment Control Photo Monitoring.....                                        | 22 |
| 3.5   | Water Management.....                                                                     | 23 |
| 3.5.1 | Groundwater Water Monitoring and Compliance .....                                         | 23 |
| 3.5.2 | Surface Water Monitoring and Compliance.....                                              | 24 |
| 3.6   | Dangerous Substances Management.....                                                      | 26 |
| 3.7   | Waste Management.....                                                                     | 26 |
| 3.8   | Culture Heritage Management .....                                                         | 27 |
| 3.9   | Stakeholder Communications .....                                                          | 27 |
| 3.10  | Mine Closure and Rehabilitation Management .....                                          | 27 |
| 4     | Proposed Activities for 2012/13 .....                                                     | 29 |
| 5     | Statement of Compliance with Outcomes Criteria .....                                      | 30 |
| 6     | Rectification of Non-compliances .....                                                    | 53 |
| 7     | Management System Review.....                                                             | 54 |
| 8     | Fitness-for-purpose reviews of plant, equipment, infrastructure and other facilities..... | 55 |
| 9     | New Environmental hazards .....                                                           | 56 |
| 10    | Environment Protection and Biodiversity Conservation Act Reporting .....                  | 57 |
| 11    | References .....                                                                          | 58 |



## LIST of TABLES

|           |                                                                                    |    |
|-----------|------------------------------------------------------------------------------------|----|
| Table 1.  | Peculiar Knob Mining and Infrastructure Tenements (July, 2012).                    | 8  |
| Table 2.  | Ancillary, Transport & Mining Infrastructure Commencement and Completion Schedule. | 10 |
| Table 3.  | General Descriptive Mining Details                                                 | 12 |
| Table 4.  | Ore and Waste Volumes 2011-12                                                      | 12 |
| Table 5.  | Resource Definition and Exploration                                                | 14 |
| Table 6.  | Peculiar Knob JORC Compliant Resource.                                             | 14 |
| Table 7.  | Total Clearing Area by Tenement (2011/12) and planned clearing (2012/13)           | 17 |
| Table 8.  | Soil Salinity and Dust Deposition Site Location and Frequency.                     | 21 |
| Table 9.  | Photo Monitoring Locations.                                                        | 23 |
| Table 10. | Summary of Production Bores, Allocations and Water Usage for 2011-12.              | 24 |
| Table 11. | Drawdown of SWL and Drawdown Levels for Regional Monitoring Program                | 24 |
| Table 12. | Surface water, soil sampling and photo monitoring sites                            | 25 |
| Table 13. | Total Waste Removed from Peculiar Knob Site                                        | 26 |

## LIST of FIGURES

|           |                                                                                    |    |
|-----------|------------------------------------------------------------------------------------|----|
| Figure 1. | Mine Pit stage two profile July 2012 (long section)                                | 13 |
| Figure 2. | Mean Ash Content in g/m2 per Month for all monitoring site.                        | 19 |
| Figure 3. | Mean Total Solids in g/m2 per Month for all monitoring site.                       | 20 |
| Figure 4. | Daily Inspections in 2011-12 for each work zone, broken down into item inspected.  | 22 |
| Figure 5. | Endemic Acacia Species being grown to complement EML rehabilitation.               | 28 |
| Figure 6. | Thick-billed Grasswren (Eastern subspecies) ( <i>Amytornis textilis modestus</i> ) | 57 |

## Acronyms List

SI = Southern Iron

WPG = Western Plains Group

ML = Mining Lease

EML = Extractive Mineral Lease

MPL = Miscellaneous Purpose Lease

MPLA = Miscellaneous Purpose Lease Application

PEPR = Program for Environment and Rehabilitation

PK = Peculiar Knob

SEWPaC = Department for Sustainability, Environment, Water, Population and Communities

ROM = Run of Mine

MBCM = Million Bulk Cubic Metres

JORC = Joint Ore Reserves Committee

NVMP = Native Vegetation Management Plan

um = micrometres

SEB = Significant Environmental Benefit

EPBC = Environment Protection and Biodiversity Conservation

CRAW = Construction Risk Assessment Workshop

DMITRE = Department for Manufacturing, Innovation, Trade, Resources and Energy

DTEI = Department for Transport, Energy and Infrastructure

SEA = Site Environmental Advisor

WRD = Waste Rock Dump

# 1 Introduction

## 1.1 General Overview

Southern Iron Pty Ltd (SI) is the owner and operator of the Peculiar Knob Iron Ore Project which is located approximately 475 km north west of Port Augusta and 65km South of Coober Pedy, South Australia.

On the 7<sup>th</sup> of July 2011 Western Plains Resources (WPG) and their wholly owned subsidiary SI received approval for the Peculiar Knob Program for Environmental Protection and Rehabilitation (PEPR). In the same month SI and WPG started construction on the Peculiar Knob Iron Ore Mine and associated infrastructure.

Effective as of 6th of October 2011 WPG sold all iron ore assets to Onesteel (OST), this includes all items in Table 1 below. OST then on the 1<sup>st</sup> of July 2012 changed the company name to Arrium and Southern Iron became a subsidiary of Arrium Mining.

This report has been designed to meet all of Arrium and SI requirements to The Department for Manufacturing, Innovation, Trade, Resources and Energy in South Australia (DMITRE) with regards to the submissions of an annual mining and rehabilitation compliance report (MARCR). This report has been compiled in accordance with the principles of DMITRE's MG3 Guidelines for Miners: *preparation of a mining and rehabilitation compliance report MARCR in South Australia*, Version 1.4 (dated March 2009).

This report represents the inaugural MARCR and is designed to represent baseline monitoring, mining and construction activities between 7 July 2011 and 7 July 2012.

Table 1. Peculiar Knob Mining and Infrastructure Tenements (July, 2012).

| Tenement                                             | Tenement                                                                                                                                                                  | Tenement Type                              | Approval Date |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------|
| Peculiar Knob Mineral Lease                          | ML6314                                                                                                                                                                    | Mineral Lease                              | 25/06/2008    |
| Extractive Mineral Lease over the Mineral Lease Area | EML6366                                                                                                                                                                   | Extractive Mineral Lease                   | 25/06/2008    |
| Accommodation Village and Access Road                | MPL127                                                                                                                                                                    | Miscellaneous Purposes Licence             | 28/10/2012    |
| Haul Road and Water Circuit Infrastructure           | MPL125, MPL126 MPL127, MPL128, MPL129 and MPL130                                                                                                                          | Miscellaneous Purposes Licence             | 28/10/2010    |
| Rail Loop and Crusher Facility                       | MPL131                                                                                                                                                                    | Miscellaneous Purposes Licence             | 28/10/2010    |
| Penrhyn Borefield and Water Circuit Infrastructure   | MPL134                                                                                                                                                                    | Miscellaneous Purposes Licence             | 29/06/2010    |
| Stafford Borefield and Water Circuit Infrastructure  | MPL133                                                                                                                                                                    | Miscellaneous Purposes Licence             | 29/06/2010    |
| Camp Borefield and Water Circuit                     | (MPLA)                                                                                                                                                                    | Miscellaneous Purposes License Application | 30/4/2012     |
| Borrow Pits Adjacent to Haul Road                    | EML6363, EML6364, EML6365, EML6367, EML6368, EML6369, EML6370, EML6371, EML6372, EML6373, EML6374, EML6375, EML6376, EML6377, EML6378, EML6379, EML6380, EML6381, EML6382 | Extractive Mineral Lease                   | 28/10/2010    |

## **2 Peculiar Knob Mining and Construction Activities 2011/12.**

### **2.1 Construction Activities.**

Construction activities started shortly after the approval of the Peculiar Knob PEPR in July 2011, the construction engineering group Como Engineering supervised the infrastructure implementation, although SI ultimate control across all areas.

The first of the construction activities undertaken at PK was to build the 248 person remote accommodation village, complete with power generation, waste water treatment facilities, reverse osmosis plant, dining facilities, laundry complexes and amenities. The name Maluku Kuru was given to the Peculiar Knob village by local elders from the traditional owners Antakarinja Matu-Yankunyjtjajara. The literal translation meaning “kangaroo eyes” as this is the traditional name for the Stuart Desert Pea that is found abundantly around the village in spring time. As stated in the PK PEPR the accommodation village is expected to expand by as much as 60 rooms in 2012-13.

The water infrastructure was also started early in July 2011 and the majority of the major items such as 140km of interconnected pipe, four production water wells with completed infrastructure, five turkey’s nests with five complementing header tanks and circuit pumps were completed by January 2012. Two new water licenses were awarded in December 2011 for the Camp Borefield, primarily to feed the reverse osmosis plant at the accommodation village and to top up water for dust suppression during construction. Several water infrastructure areas are yet to be commissioned due largely to fixed plant such as crushing facilities being incomplete.

Transport infrastructure remains largely incomplete at the end of the reporting period, with the rail siding and 96km long haul road incomplete. The access tracks associated with water infrastructure that runs parallel with the Peculiar Knob haul road is complete and provides an alternate route for light vehicles (LV), it also decreases the frequency of heavy vehicle (HV) and LV interaction.

Construction of the crushing fixed plant located on MPL131 was started in February 2012. This start date was governed by the completion of clearing and initial pavement on the western section of the haul road from the Stuart Highway to the Wirrida siding. It is expected that the crushing facilities will be complete and commissioned before the start of the second quarter of 2012-13 financial year.

Table 2 provides a summary of major construction items with commencement, completion and where necessary scheduled completion dates for the 2012/13 reporting period. For project disturbance footprint description, refer to section 3.1.2 Vegetation Clearance Permitting Management for the full ancillary, transport and mining infrastructure footprints for each tenement.



Table 2. Ancillary, Transport &amp; Mining Infrastructure Commencement and Completion Schedule.

| Ancillary Infrastructure              | Commencement Date                       | Completion Date  | Percent Complete in 2011/12 Period |
|---------------------------------------|-----------------------------------------|------------------|------------------------------------|
| Accommodation Village                 | 15-Jul-11                               | 01-Dec-11        | 100%                               |
| Water Supply and Treatment Facilities | 15-Jul-11                               | 01-Jan-12        | 85%                                |
| Onsite Waste Management Facility      | <i>*Landfill deferred until 2012/13</i> |                  | 0%                                 |
| Camp Fuel Storage Facilities          | 15-Jul-11                               | 01-Dec-11        | 100%                               |
| Vehicle Wash Down Facilities          | <i>*Deferred until 2012/13</i>          |                  | 0%                                 |
| Offices and Amenities Buildings       | 15-Jul-11                               | <i>01-Dec-11</i> | 100%                               |
| Onsite Communications                 | 15-Jul-11                               |                  | 50%                                |

| Transport Infrastructure | Commencement Date | Completion Date   | Percent Complete in 2011/12 Period |
|--------------------------|-------------------|-------------------|------------------------------------|
| Haul and Access Roads    | 27-Jul-11         | <i>*30-Aug-12</i> | 80%                                |
| Rail loop/ siding        | 09-Jun-12         | <i>*30-Aug-12</i> | 90%                                |

| Mining Infrastructure                                 | Commencement Date | Completion Date   | Percent Complete in 2011/12 Period |
|-------------------------------------------------------|-------------------|-------------------|------------------------------------|
| Mine Pit                                              | 01-Dec-11         | <i>**</i>         |                                    |
| <i>stage 1</i>                                        | <i>01-Dec-11</i>  | <i>**</i>         |                                    |
| <i>Stage 2</i>                                        | <i>22-Apr-12</i>  | <i>**</i>         |                                    |
| <i>Stage 3</i>                                        |                   | <i>**</i>         |                                    |
| Waste Rock Dump                                       | 01-Dec-11         | <i>**</i>         | 7.75%                              |
| <i>Topsoil Stockpile</i>                              | <i>01-Dec-12</i>  | <i>**</i>         |                                    |
| Crusher Plant and Facilities                          | 01-Feb-12         | <i>*30-Aug-12</i> | 75%                                |
| ROM Pad                                               | 22-Feb-12         | 01-May-12         | 100%                               |
| HV wash down facilities, HV Workshop and Fuel Storage | 01-Apr-12         | <i>01-Oct-12</i>  | 100%                               |

*\* 1-Jan-12 indicates the expected completion date in 2012/13 reporting period*

*\*\* Indicates the construction and operation is ongoing for life of mine*

## 2.2 Mining Activities 2011-12.

Mining at Peculiar Knob commenced on the 1<sup>st</sup> of December 2011 with the initial pre-strip of topsoil in stage one of the open pit (Table 2). At the same time topsoil was pushed up in the waste rock dump (WRD) footprint and hauled to the topsoil stockpile PK\_ML6314\_001. Minimal topsoil was available in stage 1 and stage 2 of the open pit as was expected with unsuitable bulldog shale cropping naturally throughout the landscape. Stage 3 of the open pit is expected to have topsoil and a zone of suitable sub-soil (300mm) that could be harvest to offset deficient areas.

Shortly after the Arrium purchase of SI, programs were developed to review the geotechnical aspects of the WRD and Open Pit. The review incorporated new and old data from diamond drill programs, primarily to evaluate the 'safety and stability' of both designs. As a consequence recommendations are expected regarding potential modifications of both the open pit and the WRD. Any potential optimised WRD and pit designs may require a review of the Peculiar Knob PEPR and Condition 1 of EPBC2010\_5634, with DMITRE and SEWPaC. Details of the potential review have been documented in meetings with DMITRE.

During the reporting period the total material mined from the open pit was 5.36 million BCM (MBCM) at an average rate of 25536 BCM per day as is shown in Table 3. Considerable waste (overburden) was moved in the initial stages of mining in stage 1 and 2, with 5.34MBCM farout weighing ore resources mined during the period (Table 4). Figure 1 gives a visual representation of the predominantly waste area mined in the reporting period, against final mine closure shape and in situ iron grade. As can be seen in Figure 1 iron ore to be mined in 2012/13 reporting year will dramatically reduce waste to ore ratios. Of the ore that was mined in the reporting period 75,517t of ore was mined and used for construction of the ROM, with the remaining ore stored on the ROM ready for transport.

Since PEPR approval the following mining related activities have commenced onsite:

- Topsoil harvesting,
- Mining waste and ore products,
- Construction of ROM pad,
- Early stages of construction of permanent office and workshop areas,
- Permanent fuel and hydrocarbon storage hard stand areas, and
- Drill and Blast commencement 1/06/2012.

Mine sequencing and expected timelines of mine stages are listed on Table 2, specific design criteria for the WRD and open pit stages as constructed in the reporting period are listed below:

- Pit batter height – 15m
- Pit berm width – 10m
- Ramp gradient 1:10
- North ramp width 25-30m
- WRD batter height – 10m
- WRD berm width – 25m
- WRD total height – 195mRL (July 2012)

- A safety bund has been constructed around the entire circumference of the open pit.

Table 3. General Descriptive Mining Details

| Item                            | Description of Mining Activities   |
|---------------------------------|------------------------------------|
| Mineral lease                   | ML6314                             |
| Mineral Lease Area              | 249.48ha                           |
| Mining disturbance area         | 161.8 Ha                           |
| Mining Method                   | Open Pit                           |
| Mineralisation                  | Iron (haematite)                   |
| Average Mining Rate             | 9.6M BCM p.a (forecast)            |
| Mine Life                       | 5-6 years                          |
| Resource                        | 13.6Mt @64% Fe                     |
| Pit Dimensions                  | 1.3km long x 400m wide x 180m deep |
| Mine Closure WRD Relevant level | 242mRL                             |
| July 2012 WRD Relevant level    | 195mRL                             |
| Mining Contractor               | Mining and Civil Australia         |

Table 4. Ore and Waste Volumes 2011-12

| Mining Volumes (BCM)   | Total December 2011 - July 2012 |
|------------------------|---------------------------------|
| Waste (free dig)       | 5,347,223                       |
| PAF                    | 2,504,580                       |
| Ore* (BCM)             | 15,318                          |
| Total (tonnes)         | 5,362,541                       |
| Tonnes Ore             | 75,517                          |
| Fe%*                   | 63.77                           |
| **Topsoil ML6314 (BCM) | 80,237                          |

\*Un-calibrated

\*\*Topsoil stockpiled in ML6314

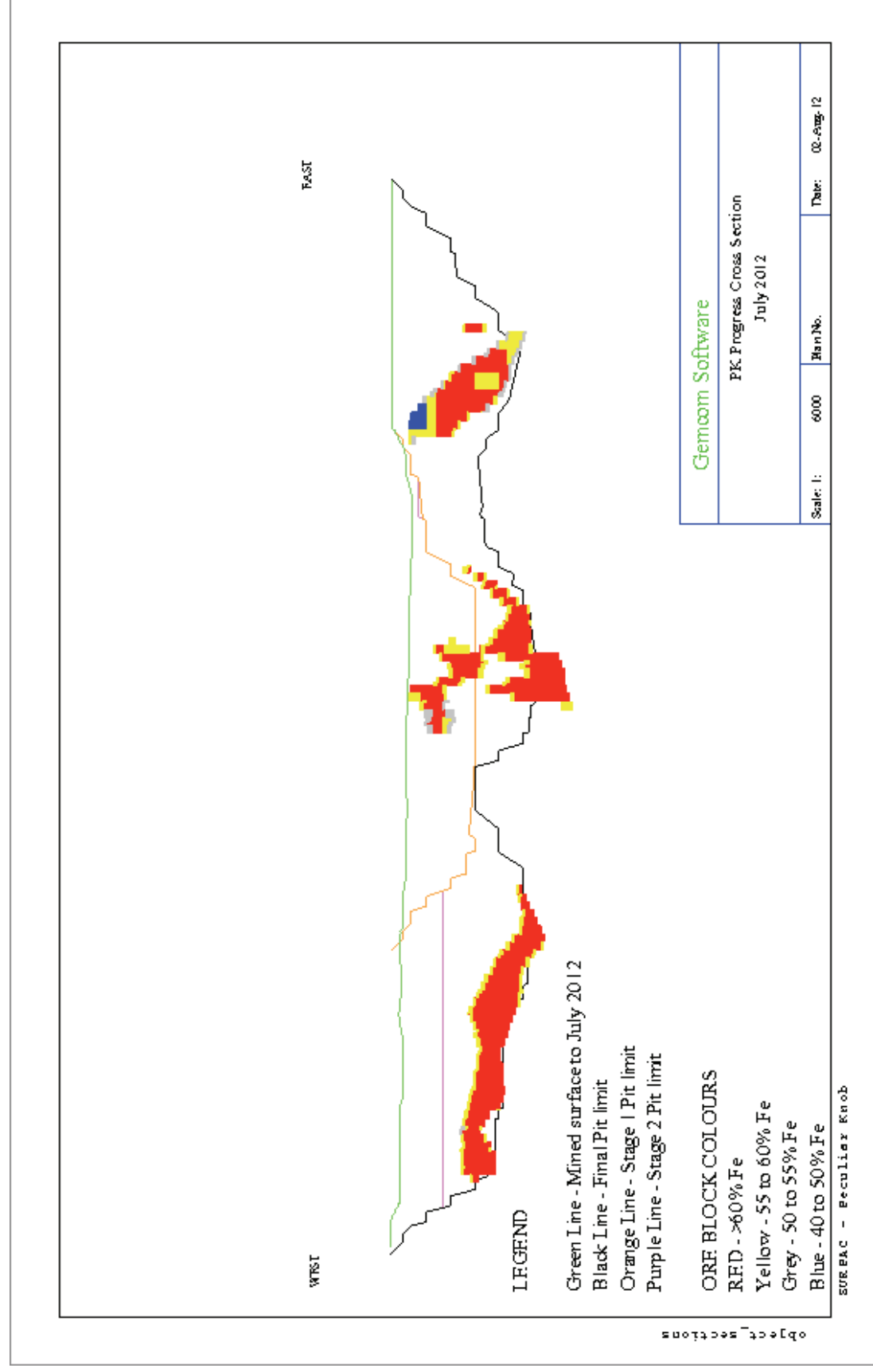


Figure 1. Mine Pit stage two profile July 2012 (long section)

## 2.3 Exploration and Resource Definition.

Drilling at the Peculiar Knob mine has been split into infill RC drilling, extensional RC drilling and geotechnical diamond drilling to test wall stability.

The infill drilling is focussed on lifting existing resources to indicated status from inferred status to ensure they are reportable as reserves (refer to Table 6 for JORC compliant resource); this has chiefly focussed on the stage 1 pit with limited additional drilling at the eastern end of the ore body. Total drilling to date is 4950m with approximately 3,550m of additional drilling expected (Table 5). Total tonnes and grade estimate is forecast to remain similar to existing resources as local increases in ore width and strike are offset by complexity within the ore body.

To date diamond drilling comprises 1100m over 5 holes positioned back from the pit crest and drilled sub-parallel to the pit wall. One hole has encountered haematite mineralisation that is interpreted as down-dip extension of an ore lense.

The extensional drilling is aimed at adding tonnes to resource within reasonably minable depth from surface continuous with or immediately adjacent to existing ore reserves and resources. This has not been commenced yet. The expected total drilling is approximately 8,500m by end of September 2012.

Table 5. Resource Definition and Exploration

| Drilling Category      | Metres Drilled<br>2011/12 |
|------------------------|---------------------------|
| Resource Definition    | 4950                      |
| *ML6314<br>Exploration | 6050                      |
| **Exploration          | 0                         |
| Geotechnical           | 1100                      |
| Drill and Blast        | 5600                      |

\* Exploration Drilling inside ML6314 to extend mine life

\*\* Exploration outside ML6314, but to extend Peculiar Knob mine life.

Table 6. Peculiar Knob JORC Compliant Resource.

| Category              | Million tonnes | Fe (%)      | P (%)       | SiO <sub>2</sub> (%) | Al <sub>2</sub> O <sub>3</sub> (%) | LOI (%)     |
|-----------------------|----------------|-------------|-------------|----------------------|------------------------------------|-------------|
| Measured resource     | 13.60          | 64.0        | 0.01        | 7.11                 | 0.27                               | 0.42        |
| Indicated resource    | 4.10           | 63.8        | 0.02        | 7.69                 | 0.20                               | 0.38        |
| Inferred resource     | 1.50           | 64.6        | 0.03        | 6.15                 | 0.20                               | 0.24        |
| <b>Total resource</b> | <b>19.2</b>    | <b>64.0</b> | <b>0.01</b> | <b>7.16</b>          | <b>0.25</b>                        | <b>0.40</b> |

### 3 Rehabilitation and Environmental Management Activities.

#### 3.1 Native Vegetation Management

##### 3.1.1 Baseline Annual Flora Survey

Southern Iron in November 2011 conducted and established the baseline monitoring program in line with the native vegetation management plan (NVMP) as stated in the Peculiar Knob PEPR, 2011. Monitoring was conducted in Spring from 31/10/2011 to 5/11/2011. These monitoring sites will be resurveyed annually for the life of mine to track compliance with the NVMP (PK PEPR, 2011). To review the full report please refer to Appendix A.

The monitoring program required the establishment of 7 monitoring sites, (Fig. 10.6 Sect. 10.7.2 PEPR) one at the rail siding, four sites along the haul route and two sites near the Mineral Lease (ML) infrastructure. Locations for monitoring sites were based on vegetation and habitat types and it was noted in the PEPR that final monitoring site locations could change for a number of reasons including changes in site access and infrastructure final locations.

During the establishment of flora monitoring sites in November 2011 Southern Iron Environment personnel and the flora and fauna consultants determined that it would be beneficial to pair the flora and fauna monitoring sites as potential impacts are intrinsically linked between both communities. Each control site was therefore paired to an impact site to allow comparisons to be made on potential impacts of the mining operation as opposed to regional influences. Some monitoring sites were moved from the NVMP recommendations to better reflect vegetation communities and landforms, which influence community composition, with the goal of limiting natural variables between impact and control sites.

Due to the dynamic nature of the environs found in the Stony Plains Bioregion significant fluctuations in plant community composition, species densities and health will influence vegetation monitoring results. At the time of the establishment of the monitoring sites the regions flora and fauna were flourishing due to higher than average rainfall over the past two years (BOM Coober Pedy). Consequently normally sparse perennial Chenopod Shrublands that contain few annual or short lived perennials were returning high annual species counts and densities with most species either flowering or in advanced seed set. For example *Atriplex holocarpa* which is an annual or rarely a short lived perennial was recorded in densities >350 per 30m quadrat at the mine area at Site 6. In average rainfall years these quadrats may contain extensive bare areas only supporting perennial chenopods such as *Atriplex vesicaria* and very sparse hardy perennial grasses.

During the November 2011 flora surveys the overall average condition class of >90% of vegetation was Excellent (at full potential – budding, flowering and seeding) with a maximum potential for annual and perennial species for each land type. Annual and winter active perennial grasses had dried off and set seed prior to survey in the majority of the sites, however some sites near the ML still contained actively growing C4 grass species. Annual or short lived perennial shrubs such as *Maireana eriantha* and *Atriplex spongiosa* were drying off within Sites 1, 2 and 3 but had produced large amounts of seed. Minor drainage lines intersecting Site 6 control (6C) contained large amounts of *Atriplex spongiosa* seed which was being harvested by the House Mouse, native mice and native rodents.

All perennial species recorded within quadrats in November 2011-12 were either producing new growth or had produced new growth in the past few weeks (. The only recorded impact to new growth on perennial vegetation was from station cattle. Grazing of new growth on annual herbs and grasses by native mice and rats and grasshoppers was commonplace but overall of a minor nature. Leaf litter produced by actively growing perennials or mature annuals averaged 25% but was as high as 80% in sites containing healthy annual and perennial shrubs and grasses. The high litter loadings will be maintained over the summer months of 2011 – 12 which will maintain productivity and protect soils from wind and water erosion on most of the sites.

Impacts on vegetation communities at the time of survey were restricted to cattle grazing and trampling which was considered Moderate across most of the eastern sites. Monitoring sites 3 to 7 sustained higher levels of grazing and trampling due to the proximity of water points or ephemeral pools in drainage lines.

Dust monitoring of vegetation within transects returned minimal background dust deposition from bare soil areas and cattle pads or camps which will not persist as it will be flushed from leaf hairs during rainfall events. Sites PK 4.3 Control and PK 5.1 Impact returned results for light staining on adaxial leaf hairs of *Atriplex vesicaria* and *Maireana aphylla*. Light dust loads on adaxial leaf hairs will not negatively impact on plants as arid land plants have evolved with significant natural background dust loads generated from bare soil areas by wind.

Moderate to Heavy dust loadings (full depth of adaxial / abaxial hairs, visible on canopy) will be deposited on vegetation within impact sites PK 2 I, 3 I and 4 I during high traffic movements along the existing pipeline track prior to the construction of the rubble haul road. Clay based soils on the pipeline track have poor structure and rapidly turn into “bull-dust” under heavy traffic situations. Watering this type of surface will only suppress dust for short periods as deep bull-dust is virtually non-wetting at depth, consequently deposition of dust particles <10um (Bebbington, 2011) within 200m of these temporary natural surfaced roads can be significant. High traffic movements along the pipeline track will be of a short duration as the rubble haul road from the highway to the mine site is a high priority. Therefore the heavy dust loadings generated from pipeline traffic will be of a short duration and will be flushed from vegetation in summer rainfall events. Moderate to Heavy dust loads with a particulate size of ~10-30um will not impact negatively on chenopod plants as the fine dust particles are trapped in cuticle hairs and rarely reach the leaf cuticle. Staining of cuticle hairs and bark from clay particulates in solution during rainfall events may occur on plants within the dust drop out zone, however this process also occurs naturally from background dust and has no impact on plant health.

There are no conclusive studies that prove that anthropogenic derived dust deposition on plants has a long term impact on plant health. Studies world wide (Bebbington, 2011) indicate that whilst shoot growth can be slightly impaired in the short term due to dust loadings, net photosynthetic increases resulted due to higher plant temperatures.

The use of water trucks and polymers for dust suppression on the pipeline track, the new haul road and the pit surrounds will greatly reduce fugitive dust emissions generated during operations. The use of saline groundwater for dust suppression is unavoidable and is likely to have a localised negative impact on annuals and salt sensitive species. Given the short life span of the mine and the localised impact of saline water usage it is considered unlikely that impacts



will be long term or a major impact. Localised impacts that may occur on annual or salt sensitive species should over time be nullified by the natural recruitment of salt tolerant chenopod plants. As part of the Dust deposition monitoring program deposit gauges have been paired with vegetation monitoring sites to identify areas of concern and quantify the relative amount of dust produced in these environments (refer to Appendix A for more baseline statistics).

The Baseline statistics collected at Impact and Control sites in 2011/12 reporting year will be assessed further in spring 2012, by which time construction will have finished and Peculiar Knob will be an operating iron ore mine.

### 3.1.2 Vegetation Clearance Permitting Management

Vegetation clearing is controlled by the Southern Iron clearing procedure.

Southern Iron has not exceed 643.2ha of native vegetation clearance at Peculiar Knob. A comprehensive review of clearance is undertaken on a three monthly basis and current clearance areas are shown in Table 7. For full aerial representation of clearance areas during 2011-12 refer to Appendix B.

Table 7. Total Clearing Area by Tenement (2011/12) and planned clearing (2012/13)

|                     | Current Reporting Period |                      | Proposed Next 2012 13 |                       |
|---------------------|--------------------------|----------------------|-----------------------|-----------------------|
|                     | Disturbed                | Actual Rehabilitated | Planned Disturbed     | Planned Rehabilitated |
| Tenements           | (ha)                     | (ha)                 | (ha)                  | (ha)                  |
| ML6314              | 162.96                   | 0                    | 31.7                  | 0                     |
| MPL 125             | 56.72                    | 0                    | 5                     | 0.7                   |
| MPL 126             | 55.55                    | 0                    | 6                     | 1                     |
| MPL 127             | 50.16                    | 0                    | 7                     | 1.9                   |
| MPL 128             | 50.00                    | 0                    | 8                     | 2                     |
| MPL 129             | 59.19                    | 0                    | 4                     | 2                     |
| MPL 130             | 13.00                    | 0                    | 1                     | 0                     |
| MPL 131             | 56.44                    | 0                    | 7                     | 0                     |
| MPL 133             | 5.04                     | 0                    | 0                     | 4.2                   |
| MPL 134             | 0.00                     | 0                    | 0                     | 0                     |
| All EML's           | 106.73                   | 0                    | 0                     | 72                    |
| Total               | 615.8                    | 0                    | 69.7                  | 83.8                  |
| Total SEB Clearance |                          |                      | 685.5                 |                       |

## 3.2 Fauna Management

The Peculiar Knob mine site and infrastructure traverses three main vegetation communities which provide important habitat for endemic fauna. Ecological Horizons Pty Ltd was

commissioned by Southern Iron in November 2011 to undertake the inaugural baseline fauna survey of the area. The baseline monitoring program consisted of five sites, at each site surveys were undertaken at proximal impact sites and distal control sites that represent a regional scale influence. Nominally one monitoring site was located at both the Wirrida crushing site and the mine site, with the remaining three sites being located along the haul road in differing vegetation types. These monitoring sites were paired with dust, soil and flora monitoring sites.

From these initial surveys seven native terrestrial species of mammals were trapped with another four opportunistically spotted during the survey. The Plains Rat (*Pseudomys australis*) which are listed as vulnerable under the EPBC Act were surprisingly abundant in all sites as well as large numbers of the House Mouse (*Mus musculus*), both of which were attributed to the elevated levels of rainfall and vegetation condition in the season preceding the baseline survey.

Many reptiles were also identified during the trapping period, with 26 species being captured in total across all monitoring sites and areas.

A total of 61 bird species were recorded in the survey, Zebra Finches and Orange Chats were the most plentiful, although this can be attributed to the wet season conditions preceding the survey. The EPBC listed Thick Billed Grasswren was also recorded at three chenopod associated monitoring sites. The South Australian endemic Chestnut Breasted Whiteface was also recorded in the monitoring area as well as the State listed-Rare Flock Pigeon which may also be attributed to recent rainfall.

Monitoring will be conducted annually with the next fauna monitoring to take place in November 2012. To review the full baseline annual fauna report please refer to Appendix C.

### **3.3 Dust Management**

#### **3.3.1 Dust Deposition Monitoring**

The main objective of the Depositional Dust Environmental Monitoring Program (DD-EMP) is to provide SI and DMITRE with a more detailed description of environmental dust and construction dust. The baseline monitoring program has already been initiated as part of the data gathering exercise by SI to build up an environmental baseline data set and to test the practical aspects of monitoring regional dust via deposition gauges (in accordance with AS 3580). The baseline and monitoring data will be used to demonstrate that the control measures to prevent unacceptable dust deposition are working as planned during the daily operations at Peculiar Knob.

Dust monitoring sites have been established at five sites. Within each site there are three measurement zones: an impact site (~15m from direct impact), a control site (between 250m to 500m from impact site) and a transition site located approximately half way between the impact and control sites (location and frequency in Table 8). The impact and control sites have been paired with flora and fauna site to quantify the relative dustiness on an annual basis and will provide further data for the annual flora reporting related to plant health. Soil salinity and pH samples are also taken at the same locations on a 3 monthly basis.

A full baseline monitoring program for depositional dust has not yet been completed, however two monitoring periods and results have been received and are presented in Figure 2 and Figure 3 below. The last baseline sampling period ends on the 26/11/12.

Results have shown that summer months are extremely dusty as a result of dry and windy conditions. This data will be evaluated in full at the end of the baseline period in November 2012 and will be presented as a baseline report in the 2012-13 MARCR to DMITRE.

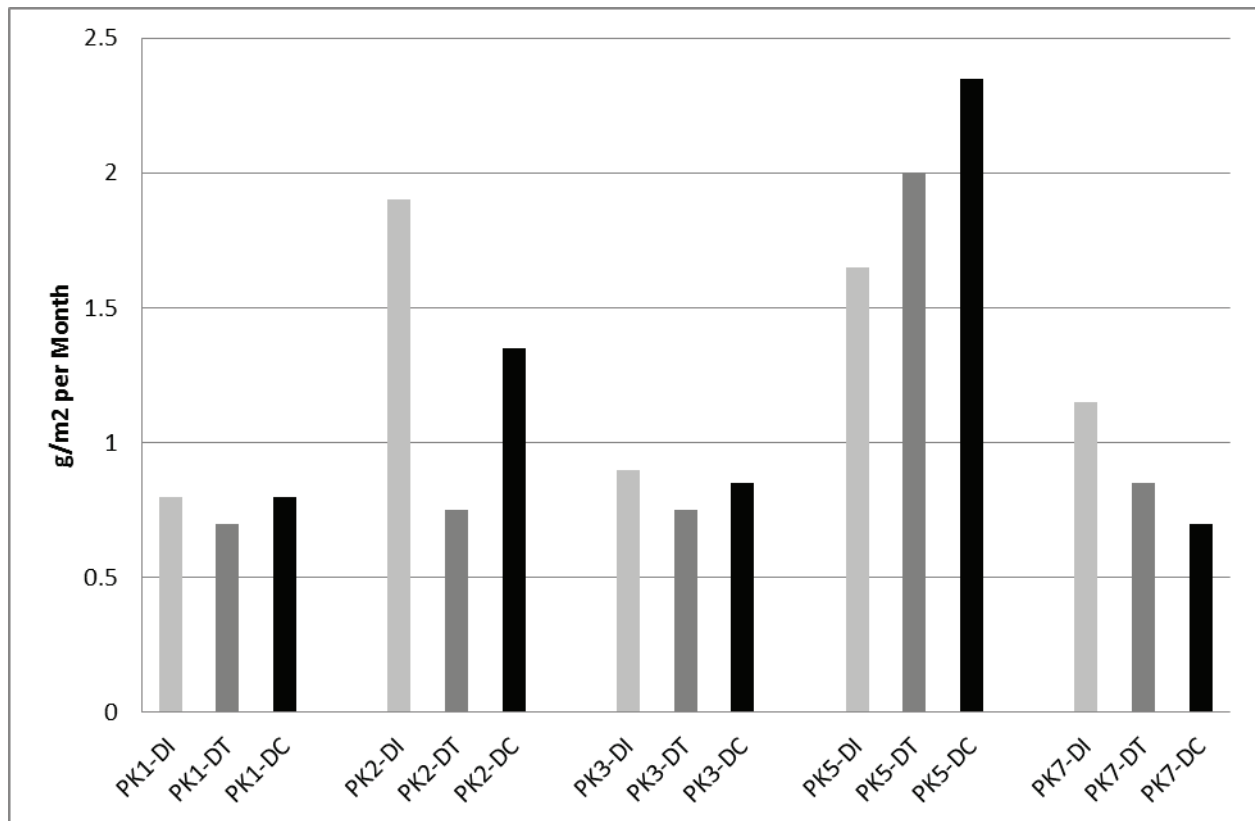


Figure 2. Mean Ash Content in g/m<sup>2</sup> per Month for all monitoring site.

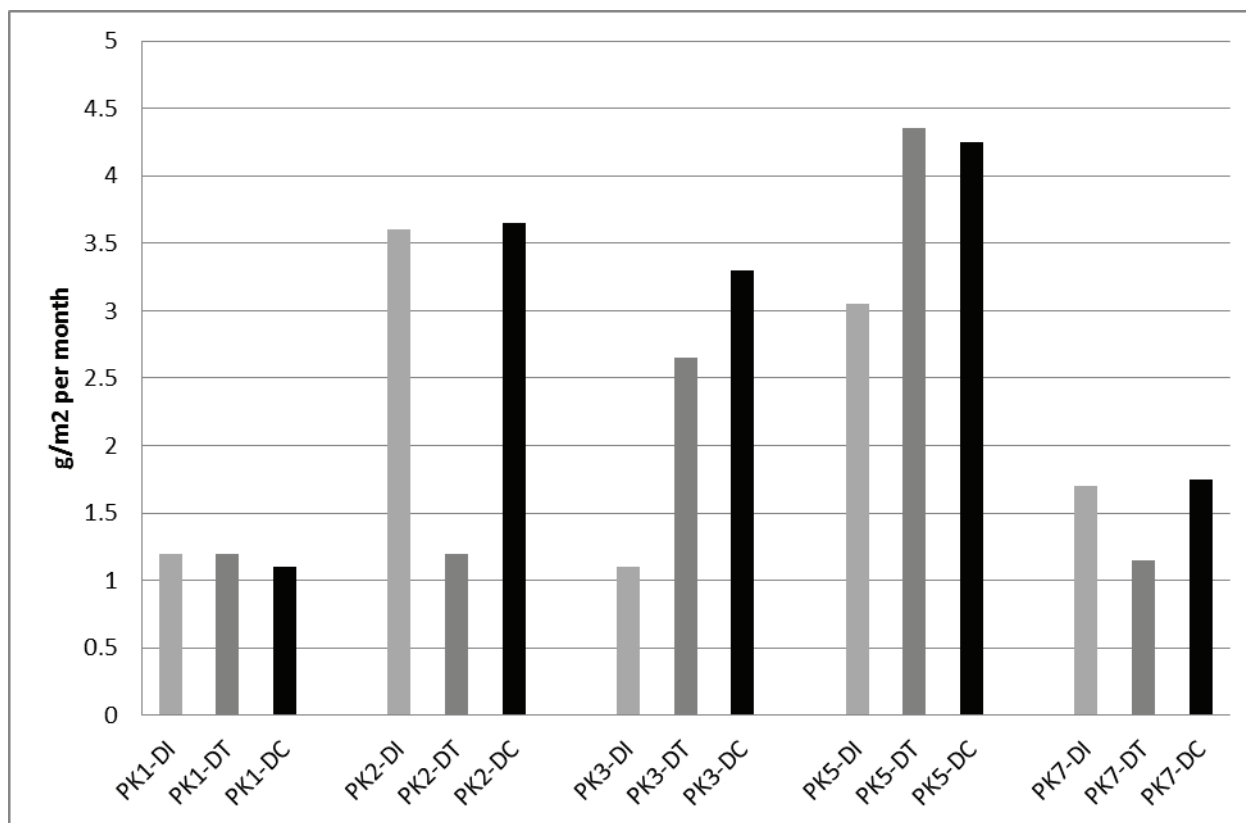


Figure 3. Mean Total Solids in g/m<sup>2</sup> per Month for all monitoring site.

### 3.3.2 Soil Salinity and pH Monitoring

Soil salinity and pH monitoring is required to be undertaken as a requirement of the PK PEPR 2011 on a bi-annual basis. The program is design to monitor changes in salinity at impacts sites as a result of using saline water for dust suppression activities. Soil salinity and pH are monitored at the same sites as dust deposition (Table 8) and are designed to provide further data for the annual flora surveys, regarding the effect of the saline groundwater use as dust suppression.

The monitoring frequency required is bi-annually, however, during construction SI have undertaken monitoring on a three monthly basis as this represents the period of greatest risk. The extra results will also help to define the regional salinity levels with greater confidence as salinity in soils varies greatly between and within sites.

The soil salinity monitoring was undertaken at each location in Table 8, six replicate samples are taken at each site. The baseline data set is not yet complete with one round of sampling still to be completed in August 2012. A full baseline inclusive of methodology will be included in the next annual MARCR (2012-13), refer to Appendix D for interim results.

Table 8. Soil Salinity and Dust Deposition Site Location and Frequency.

| Site ID | Type       | eMGA 94 | nMGA 94 | Salinity Frequency | Soil Replicates | Dust Frequency | Number Samples |
|---------|------------|---------|---------|--------------------|-----------------|----------------|----------------|
| SS1     | Impact     | 457765  | 6736520 | Quarterly          | 6               | Quarterly      | 1              |
|         | Transition | 457996  | 6736677 | Quarterly          | 6               | Quarterly      | 1              |
|         | Control    | 458204  | 6736866 | Quarterly          | 6               | Quarterly      | 1              |
| SS2     | Impact     | 503910  | 6735775 | Quarterly          | 6               | Quarterly      | 1              |
|         | Transition | 503862  | 6735866 | Quarterly          | 6               | Quarterly      | 1              |
|         | Control    | 503805  | 6735957 | Quarterly          | 6               | Quarterly      | 1              |
| SS3     | Impact     | 515532  | 6727464 | Quarterly          | 6               | Quarterly      | 1              |
|         | Transition | 515737  | 6727465 | Quarterly          | 6               | Quarterly      | 1              |
|         | Control    | 515906  | 6727464 | Quarterly          | 6               | Quarterly      | 1              |
| SS5     | Impact     | 534934  | 6718289 | Quarterly          | 6               | Quarterly      | 1              |
|         | Transition | 534823  | 6718247 | Quarterly          | 6               | Quarterly      | 1              |
|         | Control    | 534716  | 6718191 | Quarterly          | 6               | Quarterly      | 1              |
| SS7     | Impact     | 537323  | 6727927 | Quarterly          | 6               | Quarterly      | 1              |
|         | Transition | 537241  | 6728162 | Quarterly          | 6               | Quarterly      | 1              |
|         | Control    | 537129  | 6728382 | Quarterly          | 6               | Quarterly      | 1              |

### 3.4 Land Management

Land Management at Peculiar Knob is managed and monitored via the monthly site environmental audits for each contractor, daily site inspections and the Erosion and Sediment control photo monitoring program. Other monitoring programs such as the Soil ARD (section 3.5.2), Dust Monitoring, Soil Salinity/pH and Flora and Fauna monitoring also complement the land management section, however these are covered in representative section in the PK PEPR.

Each contractor is audited against specific compliance obligations such as those contained in the Southern Iron Construction Environmental Management Plan, PK PEPR and also any extra compliance aspects identified in individual Construction Risk Assessment Workshops (CRAW). Also, ad hoc site inspections were carried out in situations when an issue needed attention between monthly contractor audits, and are an important way to record non-compliant items. Both the daily inspections and monthly audit non-compliances are tracked through a corrective action register, which is designed to set completion dates for improvement opportunities and areas of concern. During the reporting period SI performed 16 monthly CEMP and PEPR compliance audits on contractors and 17 daily inspections for various issues of concern. As can be seen from Figure 4 the majority of daily inspection were carried out at Wirrida, Borrow Pits (EML's) and on the Haul road and the most common inspections were either topsoil or design related.

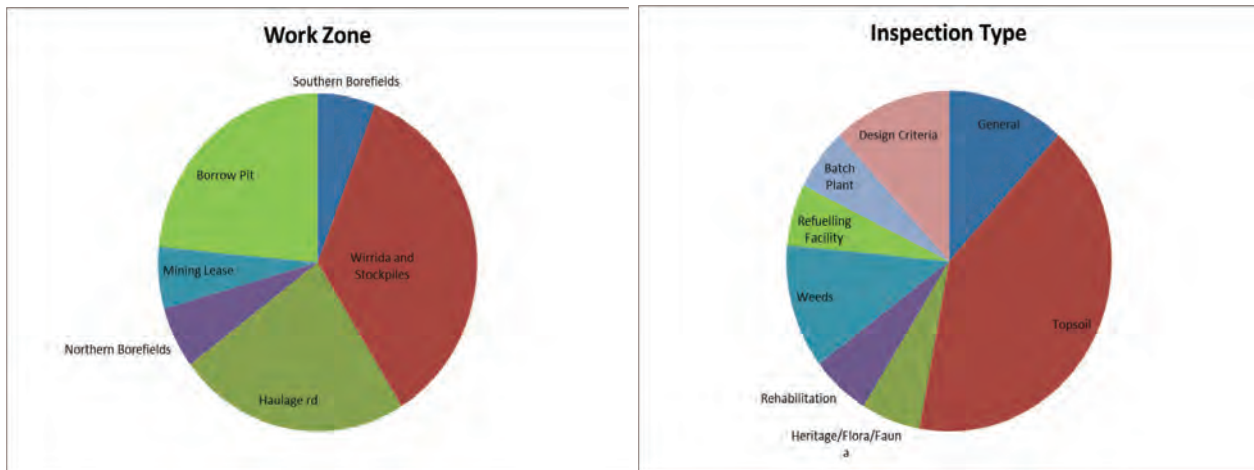


Figure 4. Daily Inspections in 2011-12 for each work zone, broken down into item inspected.

Since the start of construction twenty nine corrective actions have been issued to various contractors, with eight still in progress as at July 7<sup>th</sup> 2012.

#### 3.4.1 Erosion and Sediment Control Photo Monitoring

The photo monitoring programs is designed to incrementally track the design performance of sediment and erosion control around site. This is done by actively inspecting all infrastructure areas and capturing hot spot areas via photo monitoring for future comparison.

For ease of monitoring, WRD photo monitoring sites from the surface water monitoring program (PKPM-01, PKPM-02 and PKPM-03) were included in the Erosion and Sediment Control Photo Monitoring program and are completed on a 3 monthly basis (Table 9). The program has been designed in line with the intent of monitoring hot spot areas for erosion and sediment mobilisation; therefore the majority of sites are located near culverts or where erosion is likely. The entire photo monitoring program was also undertaken because of a rain event on the 10/3/12 of >10mm in 24 hours. The inaugural photo monitoring report (30/12/11) and subsequent monitoring events are presented in Appendix E.

During construction erosion has not been an issue, largely because the site has been rapidly changing, however sedimentation has been closely monitored throughout 2011-12. During general operations the corrective action register will be used to correct areas that are subject to excessive erosion.

Table 9. Photo Monitoring Locations

| Site ID | EMGA 94 | NMGA 94 | Area                | Sensitive | Frequency |
|---------|---------|---------|---------------------|-----------|-----------|
| PKPM1   | 0537543 | 6728002 | WRD                 | o         | 3 monthly |
| PKPM2   | 0536370 | 6727378 | WRD                 | o         | 3 monthly |
| PKPM3   | 0535767 | 6727030 | WRD                 | o         | 3 monthly |
| PKPM4   | 0536194 | 6722057 | Breakaway           | o         | 3 monthly |
| PKPM5   | 0536160 | 6721877 | Breakaway           | o         | 3 monthly |
| PKPM6   | 0536019 | 6721722 | Breakaway           | o         | 3 monthly |
| PKPM7   | 0536127 | 6721615 | Breakaway           | o         | 3 monthly |
| PKPM8   | 0492541 | 6733976 | Haul Rd             |           | 3 monthly |
| PKPM9   | 0530334 | 6716922 | Haul Rd             |           | 3 monthly |
| PKPM10  | 0469530 | 6731872 | Haul Rd             |           | 3 monthly |
| PKPM11  | 0469517 | 6731919 | Haul Rd             |           | 3 Monthly |
| PKPM12  | 0457703 | 6736299 | Wirrida<br>Crushing |           | 3 monthly |
| PKPM13  | 0457198 | 6735947 | Wirrida<br>Crushing |           | 3 monthly |
| PKPM14  | 0457699 | 6735491 | Rail siding         |           | 3 monthly |
| PKPM15  | 0457618 | 6735491 | Rail siding         |           | 3 monthly |
| PKPM16  | 0464599 | 6752386 | Penrhyn             |           | 3 monthly |

### 3.5 Water Management

#### 3.5.1 Groundwater Water Monitoring and Compliance

The Southern Iron groundwater monitoring program focuses on regional groundwater levels, water quality and water allocation compliance. As well as the major compliance aspects SI also track and report on borefield performance in line with the necessary principles stated in DfW licensing, these are associated with the Water Allocation Plan for the Far North Prescribed Wells Area (SAALNRMB,2009), to review compliance statements please refer to Appendix F.

During 2011-12 four production water wells were brought online from the seven extraction licensed water wells that are associated with Peculiar Knob Iron Ore Project (Table 10). As can be seen in Table 10 individual production bores commissioning was staggered throughout 2011 and 2012. The Penrhyn borefield was first brought into production in September 2011 and the Accommodation Camp Borefield followed in February 2012. The Stafford borefield was not commissioned in the 2011-12 reporting year, but the monitoring program has been conducted in full and represents an extended baseline period. Southern Iron is compliance with water extraction levels for 2011-12 and will continue to track extraction levels throughout 2012-13 water reporting year.

No water level compliance criteria were triggered at either Penrhyn or the Accommodation Camp Borefield in the 2011-12 period. As can be seen in Table 11 draw down triggers in production monitoring were compliant and 70% of regional bores actually had an increase in surface water level compared to pre-extraction and are well above the regional thresholds. Stafford has not been included in the report as a result of zero production during the period; however the monitoring program at Stafford has been conducted in full and is discussed in Appendix F. Regional bores are monitored monthly, production bores are monitored on a weekly basis.

The remaining aspect of the groundwater monitoring program is the three monthly (regional bores) and monthly (production bores) EC and pH monitoring and the annual major chemical analysis for both regional and production bores. During the period SI had some fluctuating results for EC and pH with some results treated as potentially inaccurate. However, laboratory NATA results showed that during the period small to negligible increases in salinity were observed between 0.8% and 4% across both operational borefields.

Table 10. Summary of Production Bores, Allocations and Water Usage for 2011-12.

| License No. | Borefield          | S.I. Bore No. | Pump Commissioning Date | Water Allocation | Water Usage   |
|-------------|--------------------|---------------|-------------------------|------------------|---------------|
|             |                    |               |                         | kL/a             | kL in 2011-12 |
| 193858      | Penrhyn            | PCWP-02A      | 16-Sep-11               | 378,000          | 238,938       |
| 193860      | Penrhyn            | TNB-01        | 03-Nov-11               | 158,000          | 62,673        |
| 205010      | Accommodation Camp | PKWB-01A      | 23-Mar-12               | 347,000          | 67,701        |
| 205011      | Accommodation Camp | PKWB-03A      | 03-Feb-12               | 158,000          | 5,258         |
| 165398      | Stafford           | HN48          | n/a                     | 507,350          | 0             |
|             |                    | HN73          | n/a                     |                  |               |
|             |                    | HN77          | n/a                     |                  |               |
|             |                    |               | Annual Totals           | 1,548,350        | 374,570       |

Table 11. Drawdown of SWL and Drawdown Levels for Regional Monitoring Program

| Borefield          | Bore     | Drawdown Threshold (m) | Water Level Changes (m) over the monitoring period |
|--------------------|----------|------------------------|----------------------------------------------------|
| Penrhyn            | PMB-01   | 0.6                    | -0.17                                              |
|                    | PMB-02   | 0.6                    | +0.12                                              |
|                    | PMB-03   | 0.6                    | +0.09                                              |
|                    | PMB-04   | 0.6                    | +0.1                                               |
|                    | PMB-05   | 0.6                    | -0.01                                              |
| Accommodation Camp | PKWB-02  | 1.5                    | +0.02                                              |
|                    | PKWB-04A | 1.0                    | +0.04                                              |
|                    | PKWB-05  | 1.5                    | +0.04                                              |
|                    | PKWB-06  | 1.5                    | -0.03                                              |
|                    | Site F   | 1.0                    | +0.03                                              |

### 3.5.2 Surface Water Monitoring and Compliance

Surface water monitoring revolves around three monitoring programs consisting of surface water metals analysis, WRD photo monitoring and soil acid rock drainage monitoring in the vicinity of the WRD. All sampling of surface water, soil and photo monitoring is as per the Surface water and Soil ARD monitoring Procedure.



Sampling locations were selected to enable SI to measure their performance in ARD encapsulation. The sediment dam in the north east corner of the minerals lease next to the WRD will receive the majority of runoff water either directly from the WRD or from drainage channels surrounding the structure. Sampling locations have been strategically selected on the WRD retention channel to determine the water quality upstream and downstream of mining influence, to determine if a significant change in water quality has occurred as a result of mining activities. These sites are described in Table 12

Table 12. Surface water, soil sampling and photo monitoring sites

| Site                       | Site Description                                                                                                                                                                                                                                                                  | GPS Location and Replicates                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| PKPM-01 (soil SS-01)       | Sediment dam on the northern most edge of the WRD, photo monitoring point, surface water and soil sampling location (western boundary)                                                                                                                                            | E 537,363.61<br>N6,727,815.12<br>x 5 soils  |
| PKPM-02 (soil SS-02)       | Soil monitoring and photo point only, located west of the proposed ANFO storage location (it is unlikely that a suitable surface water sample will be taken at this location)                                                                                                     | E 536,389.57<br>N 6,727,346.68<br>x 5 soils |
| PKPM-03 (soil SS-03)       | Photo Point and soil sampling only, located in the north western corner of the ML (it is unlikely that a suitable surface water sample will be taken at this location)                                                                                                            | E 535,857.03<br>N 6,727,002.59<br>x 5 soils |
| REG Control 4 (soil SS-04) | A regional control site has been implemented for regional water quality comparison, it is anticipated that this sample will be taken to compare the regional water quality with that coming directly off of the WRD (this is a quality control measure and goes above compliance) | E 537, 129.00<br>N6,728,382.00<br>X 5 soils |

Surface water monitoring did not take place at the sediment dam during the period as a result of the WRD being constructed and therefore limited runoff was experienced after construction. Soil and photo monitoring was conducted at the locations indicated in Table 12, three monitoring rounds were recorded for soil ARD and an interim results table is attached in Appendix G. Photo monitoring of the WRD was undertaken as part of the Peculiar Knob Site Erosion and Sediment Control Monitoring Program and are shown in Appendix E (as discussed in Section 3.4.1).

### 3.6 Dangerous Substances Management

During construction SI has undergone a full review of contractor facilities prior to the construction of permanent facilities onsite. This has been done to ensure that SI and contractors onsite have designed facilities in line with the SA EPA guidelines 080/07 and Australian Standards AS 1940–1993 and AS 3780–1994 where it is deemed necessary. In the long term SI will continue to audit contractors on a monthly basis to ensure that permanent and temporary facilities are maintained as per the design intent. The audit section for hazardous substances covers maintaining bunding volume, spill preparedness, waste tracking, MSDS, waste disposal, training and dangerous goods standards. Any non-compliances are handled via the corrective actions process and spills are remediated within 72 hours.

Also SI maintain a potentially contaminated site register that captures information such as the nature of the spill, spilt material, GPS location of spill, photo's (where necessary), volume spilt and a link to the initial incident report. This register and procedure is designed to capture information to assist targeted sampling programs during operations and mine closure to ensure that Arrium and Southern Iron are aware of the necessary remedial actions. Please refer to Section 3.4 Land Management for an in depth description regarding auditing in 2011-12.

### 3.7 Waste Management

Waste generation on a daily basis is generally from the mine, accommodation village and the Wirrida Construction area. Currently waste products are transport to the Port Augusta landfill facility by Veolia Environmental Services for recycling or disposal.

Construction work fronts and mine operational areas are equipped with waste bin and skips which are picked up on a weekly basis. Table 13 shows the total waste produced and disposed offsite during the reporting period.

Table 13. Total Waste Removed from Peculiar Knob Site

| Type                              | Unit         | 2011/12 |
|-----------------------------------|--------------|---------|
| General Rubbish                   | Cubic Meters | 1525    |
| Recycling (aluminium & Cardboard) | Cubic Meters | 126     |
| Waste Oil                         | Litres       | 40,600L |
| Contaminated material             | Cubic Meters | 7.5     |

Southern Iron intend to construct a category SB- landfill as per Southern Iron's SA EPA approved LEMP in 2012/13 reporting period (Appendix H).

### **3.8 Culture Heritage Management**

The greatest risk to sites of cultural significance is earthworks during the construction phase of a mining operation. As such Southern Iron has developed a site procedure which has been presented to all contractors that work onsite. The procedure documents communication protocol in the event a new site is found, employee responsibilities, employer responsibility, demarcation standards, site fencing requirements for significant sites and legal consequences for interfering with sites of significance.

At the time of reporting no identified Aboriginal Heritage sites are recorded on the Peculiar Knob infrastructure or mining project. If sites of significance are identified, SI will record, demarcate, sign post and fence the site as per the SI procedure or as agreed with traditional owners during consultation.

During construction Southern Iron and its contractors have approx. 9-10% indigenous employment at Peculiar Knob.

### **3.9 Stakeholder Communications**

Communication agreements were drawn up prior to construction operations starting at Peculiar Knob. It has been an objective to keep stakeholders well informed regarding operations that can impact on pastoral activities or neighbouring mining activities.

Southern Iron has not had a complaint from any stakeholders, although informal meetings are recorded on the stakeholder and complaints register and formal meeting are minuted.

The access agreement between Southern Iron and Department of Defence has been rigorously maintained and monitored to ensure compliance is continued for mining within the WPA.

### **3.10 Mine Closure and Rehabilitation Management**

During the 2011-12 period Southern Iron and Arrium were progressing with an amendment to the PK PEPR, as part of the approvals update the mine closure and rehabilitation management plan was also updated. The amended PK PEPR incorporated an appraisal of additional design items and the necessary extra bond and mine closure actions that resulted as a consequence of extra clearance or different infrastructure than was approved in the initial PEPR document. This update is currently being assessed by DMITRE and comment is expected in the first half of the 2012-13 financial year.

Additional to the PEPR update, management plans and procedures below have been developed to ensure that Southern Iron and its contractors are aware of the criteria and standards required during construction and operations for successful rehabilitation and mine closure. These plans and procedure below will also facilitate accurate forward planning for mine closure.

- Topsoil Management and Handling Plan,
- Annual Topsoil Volumetric Monitoring,
- Borrow Pit Management Plan,

- Rehabilitation and Contractor Communication Plan,
- Erosion and Sediment Monitoring Procedure,
- Terrestrial Weed and Pest Management Plan, and
- Weed and Pest Management Procedure.

In May 2011 a volumetric audit of topsoil harvesting and harvesting techniques was undertaken. The aim was to track performance and inform construction contractors on compliance with topsoil management procedures and to assess interim construction topsoil volumes harvested compared to land clearance area. A secondary audit is plan for the first quarter of 2012 financial year (Topsoil register is attached in Appendix I).

SI plan to start mine closure actions in the 2012-13 financial year as construction operations concluded (as stated in PK PEPR, 2011), the first items to undergo rehabilitation will be 16 extractive minerals leases (EML). Locally endemic species have already been germinated as part of this program and will be planted at the entrance to EML's when closed off after rehabilitation (Figure 5). This program will be updated further in 2012-13.



Figure 5. Endemic Acacia Species being grown to complement EML rehabilitation.

## 4 Proposed Activities for 2012/13

In the 2012-13 reporting period Arrium and SI will at Peculiar Knob move from the construction phase of the PK project to a fully operational mine. This will include a fully operational rail loop facility, haul road, permanent workshop infrastructure and completed water circuit and infrastructure.

Mining will move into Stage 3 of the open pit and the block model will be finalised and updated to complement the extensive drilling program undertaken since Arrium took possession of the Peculiar Knob Iron Ore Project. It is envisaged that Arrium will continue exploration of the existing resource to extend the Peculiar Knob mine life and potentially expand the open pit to exploit any additional defined resource or potential safety aspects. DMITRE are aware that Arrium intend to investigate the possible extension of ML6314 and may seek DMITRE assessment of an extension during the 2012-13 period. It should also be noted that Arrium are updating the PK PEPR to capture variations from the original approved document, delivery of the update will be in first quarter of 2012-13 financial year.

Mining rates are expected to slow as drill and blast takes over from the predominantly free dig scenario experienced during 2011-12. The forecast ore to be mined and shipped via rail to the Arrium port in Whyalla is approximately 3 million tonnes. This will be as a result of first ore being scheduled to be loaded and transported to Whyalla early in the second quarter of 2012-13, representing 9 months of production.

Environmental activities onsite will include the dot points below:

- Continue the Groundwater Monitoring Program as in 2011-12,
- First Annual Flora Monitoring program comparison,
- First Annual Fauna Monitoring program comparison,
- Complete Baseline Dust Monitoring program and continue as operational monitoring program,
- Complete Baseline Soil Salinity and pH Monitoring program and continue as operational monitoring program,
- Complete Baseline Soil ARD Monitoring program and continue as operational monitoring program,
- Continue Site Erosion and Sediment Control Inspection and Photo Monitoring program,
- Continue Quarterly Clearing Permit Reconciliation program,
- Commence rehabilitation works as per PK PEPR (2011 after construction ceases),
- Complete an update to Site Specific Environmental Risk Assessment to document any new environmental hazards identified as a result of becoming a full functioning mine,
- Monthly Contractor Auditing and Compliance,
- Annual Topsoil balance, and
- Continue Weed and Pest control management program onsite.

Environmental staff onsite will also be conducting an assessment of the operational procedures onsite and envisage that a gap analysis will identify further procedure that will be required for Peculiar Knob moving forward.



## 5 Statement of Compliance with Outcomes Criteria

| PK RISK ID                         | IMPACT                                                                | OUTCOME                                                                                                         | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                             | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                    |
|------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Flora and Native Vegetation</b> |                                                                       |                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                          |
| PK_001                             | Reduced flora species diversity and density                           | Clearance of native vegetation is no greater than 643.20 ha.                                                    | <p>Total area cleared is not to exceed the clearing associated with direct infrastructure footprint of 643.20 ha (refer figures and Table 10.2 in Native Vegetation Management Plan (Section 10) in MARP).</p> <p>Annual vegetation survey do not show reduction in abundance and species richness of native vegetation in comparison with control sites.</p> | <p><b>Compliant</b> - Three monthly reconciliation of clearing permits and clearing register. GIS database for permit closeout up to date and accurate. NVMP section 10 implemented. Southern Iron is compliant with clearing budgets.</p>                                                               |
| PK_002                             | Adverse effects on threatened flora.                                  |                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                               | <p><b>Compliant</b> - Spring Vegetation Baseline Complete. Vegetation monitoring as per PEPR section 10 NVMP implemented.</p>                                                                                                                                                                            |
| PK_003                             | Reduced plant regrowth in areas adjacent to infrastructure operations | No identified impacts to native vegetation associated with dust in areas adjacent to infrastructure operations. | <p>Annual vegetation survey shows no demonstrated impacts associated with dust in comparison with control sites. An appropriately qualified and experienced specialist will assess whether there is a demonstrated impact associated with dust.</p>                                                                                                           | <p><b>Compliant</b> - Spring Vegetation Baseline Complete. Vegetation monitoring as per PEPR section 10, NVMP implemented. Depositional dust being measured three monthly and suitably qualified specialist assessment of baseline impacts of dust for future comparison to plant health statistics.</p> |

| PK RISK ID                                     | IMPACT                                           | OUTCOME                                                                                                                                          | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                    | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PK_004                                         | Flora impacts adjacent to dust suppression areas | No identified impacts to native vegetation associated with saline water use for dust suppression in areas adjacent to infrastructure operations. | Annual vegetation survey shows no demonstrated impacts associated with saline water use for dust suppression in comparison with control sites. An appropriately qualified and experienced specialist will assess whether there is a demonstrated impact associated with saline water use for dust suppression.                                                                                       | <b>Compliant</b> - Spring Vegetation Baseline Complete. Baseline soil salinity and pH monitoring at three monthly intervals during construction as precautionous step to ensure any impacts are identified.                                                                                                                                                                                                                                                            |
| PK_005<br>PK_006<br>PK_007<br>PK_008<br>PK_010 | Establishment of weeds in disturbed areas.       | No new introduction of new declared weed species or increases in existing weed species within mining infrastructure areas.                       | <p>No demonstrated increase in weeds or plant pathogens and no new introduction of new declared weeds that can be reasonably attributed to mining operations (Section 10 in MARP as identified during annual vegetation surveys).</p> <p>An appropriately qualified and experienced ecologist (i.e. &gt; 6 year field experience) will assess whether there is a demonstrated increase in weeds.</p> | <p><b>Compliant</b> - Spring Vegetation Baseline Complete. Weed identification and location during baseline monitoring program. Weeds found within project footprint, GWA and Stuart Highway recorded Buffel Grass and Afghan Melons. Register updated as required</p> <p><b>Compliant</b> - For Weed Eradication program and construction risk register identified GWA Rail line and Stuart Highway as hot spot treatment areas prior to construction activities.</p> |

| PK RISK ID | IMPACT                                                                                                                            | OUTCOME                                                      | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                          | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                       |
|------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PK_007     | Introduction and spread of weeds from machinery entering site from infested areas.                                                |                                                              |                                                                                                                                                                                                                                                                                                                                                            | <b>Compliant</b> - PK_005, and vehicle weed and seed forms are part of site mobilisation package and is covered in the Southern Iron induction. Weed and Seed mobilisation register tracks vehicles coming to site and is part of monthly site audit process.                                                                               |
| PK_009     | Loss or reduction in quality of downstream riparian habitats due to altered flow regimes through diversion of local watercourses. | Clearance of native vegetation is no greater than 643.20 ha. | <p>Total area cleared is not to exceed the clearing associated with direct infrastructure footprint of 643.20 ha (refer figures and Table 10.2 in Native Vegetation Management Plan (Section 10) in MARP).</p> <p>Annual vegetation surveys show no reduction in abundance and species richness of native vegetation in comparison with control sites.</p> | <p><b>Compliant</b> -Three monthly reconciliation of clearing permits and clearing register. GIS database for permit closeout up to date and accurate. NVMP section 10 NVMP implemented. Vegetation Monitoring baseline complete and will be compared annually. SEB allowance and NVMP is undergoing review in consultation with DMITRE</p> |



| PK RISK ID                           | IMPACT                                                                                            | OUTCOME                                                                                                                                                      | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                 |
|--------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fauna</b>                         |                                                                                                   |                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                       |
| PK_011<br>PK_012<br>PK_013<br>PK_020 | Reduction in native fauna species diversity and abundance due to reduction in vegetation habitats | There are no permanent loss of native fauna abundance or diversity in ML, MPLs, EMLs and adjacent areas caused by mining operations and vegetation clearing. | <p>Results of monitoring program demonstrate no net adverse impacts on native fauna abundance or diversity when compared with control site results (refer Fauna Management Plan (Section 11) in MARP). An appropriately qualified and experienced specialist will assess whether there have been any net adverse impacts to native fauna.</p> <p>Total area cleared is not to exceed the clearing associated with direct infrastructure footprint of 643.20 ha (refer figures in Native Vegetation Management Plan (Section 10) in MARP).</p> <p>Fauna recovery post closure to be consistent with control site results (refer Fauna Management Plan (Section 11) in MARP).</p> | <p><b>Compliant</b> - Spring Baseline Fauna Monitoring Program Complete. Program completed as per section 11 of PEPR and will be re-visited annually to compare results.</p> <p>NVMP Clearance areas have been updated and submitted to DMITRE for comment (SEB).</p> |

| PK RISK ID | IMPACT                                                                 | OUTCOME                                                                                                                                        | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | COMPLIANCE ASSESSMENT                                                                                                                                         |
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| PK_014     | Reduction in abundance of fauna species with conservation significance | There are no permanent loss of native fauna abundance or diversity in ML, MPLs, EMLs and adjacent areas caused by mining operations            | <p>Results of monitoring program demonstrate no net adverse impacts on fauna with conservation significance abundance or diversity when compared with control site results (refer Fauna Management Plan (Section 11) in MARP).An appropriately qualified and experienced specialist will assess whether there have been any net adverse impacts on species with conservation significance.</p> <p>Total area cleared is not to exceed the clearing associated with direct infrastructure footprint of 643.20 ha (refer figures in Native Vegetation Management Plan (Section 10) in MARP).</p> <p>Fauna recovery post closure to be consistent with baseline and control site results (refer Fauna Management Plan (Section 11) in MARP).</p> | <p><b>Compliant</b> - Thick Billed Grass Wren habitat monitored for land clearance (EPBC requirements) and also assessed during fauna monitoring program.</p> |
| PK_015     | Fauna entrapment in trenches and pits                                  | Predicted outcomes, assessment criteria and leading indicators have only developed for environmental aspects with a PRL of moderate or higher. | Predicted outcomes, assessment criteria and leading indicators have only developed for environmental aspects with a PRL of moderate or higher.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Compliant</b> - Open trenches inspected daily by operators to ensure trapped fauna have egress from deep excavations.</p>                               |

| PK RISK ID       | IMPACT                                                                                                                                                          | OUTCOME                                                                                                 | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                               | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                              |
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| PK_016           | Vehicle collisions with fauna causing death or injury.                                                                                                          | Injured and/or nuisance fauna are managed in accordance with Section 13 of the Animal Welfare Act 1985. | Site induction records indicating compliance with Section 13 of the Animal Welfare Act and Animal Welfare Regulations 2008.                                                                                                                                     | <b>Compliant</b> - Induction covers fauna management for all employees. Fauna rescues undertaken by Environmental Manager or Environmental Advisor. Register of fauna injuries and deaths maintained onsite.                                                                       |
| PK_017<br>PK_015 | Fauna entrapment in water containment structures causing injury or death.<br>Fauna Egress from trenches.                                                        |                                                                                                         |                                                                                                                                                                                                                                                                 | <b>Compliant</b> - Haul out points installed in all Operational Dams, also all dams are fenced in accordance with pastoral agreement. Open trenches are also inspected daily by operators to ensure trapped fauna have egress from deep excavations.                               |
| PK_018           | Increased abundance and diversity of feral fauna species.                                                                                                       | No introduction of new pests (including feral animals) or increase in abundance species.                | No demonstrated increase in pests or new pests species that can be reasonably attributed to mining operations (Section 11 in MARP).<br><br>An appropriately qualified and experienced specialist will assess whether there is a demonstrated increase in pests. | <b>Compliant</b> - Baseline fauna monitoring program included feral animal abundance and identification. Feral animal control will be assessed again in Nov 2012. Feral animal sighting register is maintained by Southern Iron and contractors are encourages to report sightings |
| PK_019           | Reduction in native fauna species density and diversity due to predation and competition for resources from increased abundance and diversity of feral species. |                                                                                                         |                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                    |

| PK RISK ID                                     | IMPACT                                                                                               | OUTCOME                                                                                                                                       | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                             | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <b>Groundwater</b>                             |                                                                                                      |                                                                                                                                               |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| PK_021<br>PK_022<br>PK_023<br>PK_024<br>PK_025 | Reduction in regional groundwater levels impacting the Greater Artesian Basin springs                | The extraction and use of groundwater does not adversely affect groundwater dependent ecosystems that are reliant on that groundwater system. | Groundwater levels/drawdown as measured in monitoring holes are the same or better as than predicted modelled drawdown levels of 5m for both Stafford and Penrhyn Borefields (refer Water Management Plan (Section 14) & Groundwater Reports in Appendix C in MARP).          | <b>Compliant</b> - As per baseline Peculiar Knob Production and Monitoring Compliance Report (Appendix F)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| PK_026<br>PK_027                               | Adverse impacts on groundwater quality, and consequent reduction in available groundwater resources. | Fuel, chemical and storage areas to be bundled in accordance with EPA Bunding and Spill Management Guidelines (EPA 080/07).                   | <p>Demonstrate that facilities are designed in accordance with EPA Guideline (EPA 080/07).</p> <p>Records indicate all spills greater than 20 litres per incident on site are managed in accordance with Dangerous Substances Management Plan (refer Section 15 in MARP).</p> | <b>Compliant</b> - EPA inspection assessed Peculiar Knob temporary workshops compliant with EPA Guideline (EPA 080/07). Permanent facilities have been designed and will be constructed in line with EPA 080/07. Southern Iron also progressively monitor compliance through monthly contractor auditing of temporary and permanent facilities. Incidents and spill areas are recorded with GPS location and spill details in the PK Potentially contaminated site register, allowing assessment during/prior to mine closure. Waste water treatment auditing of each contractor as per Site Construction Environmental Management Plan (frequency monthly for each contractor). |

| PK RISK ID           | IMPACT                                                                                                                                                                                           | OUTCOME                                                      | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <b>Surface Water</b> |                                                                                                                                                                                                  |                                                              |                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| PK_028               | Erosion of soils due to altered flow volumes, frequency and velocities.                                                                                                                          | Post mining landform is stable and a safe reliable landform. | <p>No operational induced gully erosion to exceed &gt;0.5m deep or &gt;1.5m long or &gt;0.8m wide greater than the natural gully erosion that existed prior to mining operations.</p> <p>Inspection records maintained of silt traps and erosion control devices as well as contour banks and formed drains.</p> | <p><b>Compliant</b> - 3 monthly Photo Monitoring of sensitive site as well as site inspections of infrastructure after rainfall events of &gt;10mm (also includes photo monitoring). Photo monitoring points have been setup to assess critical areas of erosion (i.e. Creeks, floodway's and culverts) Construction taking place and therefore will continually be monitored and assessed, daily inspection sheet is designed to capture non-compliances and feed into corrective actions procedure.</p> |
| PK_029               | Construction of culverts or floodway's over creek lines for transport corridors could adversely impact surface water regimes and quality through altered flow volumes, frequency and velocities. |                                                              |                                                                                                                                                                                                                                                                                                                  | <p><b>Compliant</b> - PK_028</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| PK RISK ID | IMPACT                                                                                    | OUTCOME                                                                                                                    | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                      | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                        |
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| PK_030     | Reduction in surface water quality through increased sediment load in local watercourses. |                                                                                                                            |                                                                                                                                                                                                                                                                        | <b>Compliant</b> - PK_028                                                                                                                                                                                                                                                    |
| PK_031     | Erosion of soils along the access road through the Breakaways.                            | Breakaways are not impacted / damaged by mining activities by placement of haul/access road                                |                                                                                                                                                                                                                                                                        | <b>Compliant</b> - PK_028<br>Photo monitoring points 4, 5, 6 and 7 are located in elevated positions to enable assessment of potential impacts to the Breakaway Ranges.                                                                                                      |
| PK_032     | Reduction in surface water quality due to chemical contamination.                         | Fuel, chemical and storage areas to be bunded in accordance with EPA Bunding and Spill Management Guidelines (EPA 080/07). | Demonstrate that facilities are designed in accordance with EPA Guideline (EPA 080/07).<br><br>Records indicate all spills greater than 20 litres per incident on site are managed in accordance with Dangerous Substances Management Plan (refer Section 15 in MARP). | <b>Compliant</b> - Incident monitoring and records show contaminated areas are recorded for sampling during mine closure. Audit template has been designed with EPA Guidelines incorporated for facility design and permanent facilities are audited monthly for compliance. |

| PK RISK ID       | IMPACT                                                                                | OUTCOME                                                                                                                                             | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                       | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| PK_033<br>PK_037 | Reduction in surface water quality due to acidic leakage from the waste rock facility | No compromise of pastoral use of downstream surface water bodies.                                                                                   | Sequencing of encapsulation / treatment of PAF within WRD in compliance with design requirements for ARD management (refer Section 6.4.2 in MARP).<br><br>Operational reports and material testing demonstrate implementation of sequencing and encapsulation (refer Section 6.4.2 in MARP).<br><br>No contamination of sites from ML6314.<br><br>Certification by a suitable independent professional to demonstrate that WRD has been constructed in accordance with approved design. | <b>Compliant</b> - ARD Monitoring Program Compliant for Sequencing of PAF associated with section 6.4.2<br><br><b>Compliant</b> - regarding operational report demonstrating compliance with WRD construction sequencing, audit of sequencing planned at the 12 month mark (December 2012, suitable independent professional). WRD construction started in January and assessment will be made as the WRD primary footprint is filled to the second bench. |
| PK_034           | Reduction in general surface water quality through sewage contamination.              | Predicted outcomes, assessment criteria and leading indicators have only been developed for environmental aspects with a PRL of moderate or higher. | Predicted outcomes, assessment criteria and leading indicators have only been developed for environmental aspects with a PRL of moderate or higher.                                                                                                                                                                                                                                                                                                                                     | <b>Compliant</b> - Site Environmental Management plan and Health SA licensing requirements are included in site audits as part of the monthly audit schedule for all areas, this includes sewage treatment plants.                                                                                                                                                                                                                                         |



| PK RISK ID | IMPACT | OUTCOME | ASSESSMENT CRITERIA (MEASUREMENT) | COMPLIANCE ASSESSMENT |
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| Land Management and Land Use |                                                                                                                                |                                                              |                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| PK_035                       | Erosion of soils in cleared and disturbed areas across the project area.                                                       | Post mining landform is stable and a safe reliable landform. | <p>No operational induced gully erosion to exceed &gt;0.5m deep or &gt;1.5m long or &gt;0.8m wide greater than the natural gully erosion that existed prior to mining operations.</p> <p>Inspection records maintained of silt traps and erosion control devices as well as contour banks and formed drains.</p>      | <p><b>Compliant</b> - Site Photo Monitoring program is design to target erosion hotspots on the project. These areas are monitored quarterly and after &gt;10mm of rainfall across the project. Site inspection template has been developed to trigger corrective actions where monitoring program highlights erosion or sedimentation is an issue during life of mine. Baseline established during construction.</p> |
| PK_036                       | Increased level of salt in soils exposed to saline water used for dust suppression activities within the ML, MPL and EML areas | The existing soil quality is maintained.                     | <p>Annual vegetation survey shows no demonstrated impacts associated with saline water use for dust suppression in comparison with control sites. An appropriately qualified and experienced specialist will assess whether there is a demonstrated impact associated with saline water use for dust suppression.</p> | <p><b>Compliant</b> - Baseline for soil salinity and pH monitoring implemented during construction. Soil salinity monitoring locations are paired with annual flora monitoring site that are assessed by an independent specialist.</p>                                                                                                                                                                               |

| PK RISK ID | IMPACT                                                                                                    | OUTCOME                                                                     | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                              | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                        |
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| PK_037     | Reduction in soil quality resulting in reduced capacity for soils to promote vegetation re-establishment. | All mine waste materials left on site are chemically and physically stable. | <p>Sequencing of encapsulation / treatment of PAF within WRD in compliance with design requirements for ARD management (refer Section 6.4.2 in MARP).</p> <p>Operational reports and material testing demonstrate implementation of sequencing and encapsulation (refer Section 6.4.2 in MARP).</p> <p>No contamination of sites from ML6314.</p> <p>Certification by a suitable independent professional to demonstrate that WRD has been constructed in accordance with approved design.</p> | <p><b>Compliant</b> - PAF material as modelled by Golder Associates in mining block model reports to PAF in WRD, SI geology department are developing an ARD management plan for PAF material arising from exploration works.</p> <p>Baseline ARD Monitoring Program shown in Appendix G</p> |

| PK RISK ID | IMPACT                                                  | OUTCOME                                                                                                                                                                                                                                         | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                             | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| PK_038     | Soil contamination from spills                          | <p>Fuel, chemical and storage areas to be bunded in accordance with EPA Bunding and Spill Management Guidelines (EPA 080/07).</p> <p>No long term impacts to soil quality due to spills of fuel, oil or chemicals during mining operations.</p> | <p>Demonstrate that facilities are designed in accordance with EPA Guideline (EPA 080/07).</p> <p>Records indicate all spills greater than 20 litres per incident on site are managed in accordance with Dangerous Substances Management Plan (refer Section 15 in MARP).</p> | <p><b>Compliant</b> - EPA inspection assessed Peculiar Knob temporary workshops compliant with EPA Guideline (EPA 080/07). Permanent facilities have been designed and will be constructed in line with EPA 080/07. Southern Iron also progressively monitor compliance through month contractor auditing of temporary and permanent facilities. Incidents and spill areas are recorded with GPS location and spill details in the PK Potentially contaminated site register, allowing assessment during/prior to mine closure.</p> |
| PK_039     | Effects on Department of Defence operations             | <p>Predicted outcomes, assessment criteria and leading indicators have only developed for environmental aspects with a PRL of moderate or higher.</p>                                                                                           | <p>Predicted outcomes, assessment criteria and leading indicators have only developed for environmental aspects with a PRL of moderate or higher.</p>                                                                                                                         | <p><b>Not Applicable</b> – No report has been received regarding adverse impacts on Department of Defence operations.</p>                                                                                                                                                                                                                                                                                                                                                                                                           |
| PK_040     | Collisions with pastoral stock causing injury or death. | <p>Injured and/or nuisance fauna are managed in accordance with Section 13 of the Animal Welfare Act 1985.</p>                                                                                                                                  | <p>Site induction records indicating compliance with Section 13 of the Animal Welfare Act and Animal Welfare Regulations 2008.</p>                                                                                                                                            | <p><b>Compliant</b> - Site register maintained as per Pastoral communication protocol. Also Southern Iron fauna interaction procedure.</p>                                                                                                                                                                                                                                                                                                                                                                                          |

| PK RISK ID | IMPACT                                                                                               | OUTCOME                                                                                                                                    | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                  | COMPLIANCE ASSESSMENT                                                                                                                      |
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| PK_041     | Disruption of pastoral activities through reduction of access and presence of mining infrastructure. | Communications and operating protocol developed with pastoral lease holders and implemented in accordance with lease / licence conditions. | <p>Communications and operating protocol approved by Director of Mines prior to commencement of operations.</p> <p>Records of implementation, and compliance with, Stakeholder Communications Plan (refer Section 18 in MARP).</p> | <b>Not Applicable</b> - No complaints received at this time, although personnel maintain stakeholder complaints and communication register |

| Heritage         |                                                                                                |                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                 |
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| PK_042<br>PK_043 | Disturbance or destruction of Aboriginal heritage sites during the construction and operations | No disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained. | <p>Demonstration of consultation with the native title claimants and statutory reporting in the event that a suspected Aboriginal site / relic is discovered.</p> <p>Records of implementation of Indigenous Heritage Management Plan (refer Section 17 in MARP).</p> <p>Documented Aboriginal Heritage Clearance surveys of all operational areas (i.e. Work Area Clearances).</p> <p>Annual audits indicate flagged areas are not disturbed due to mining activities.</p> | <b>Not Applicable</b> – No report of Heritage related material have been received and all project areas have been formally inspected by the traditional owners. Every employee onsite is trained regarding aboriginal heritage awareness during site induction. |

| PK RISK ID | IMPACT | OUTCOME | ASSESSMENT CRITERIA (MEASUREMENT) | COMPLIANCE ASSESSMENT |
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| Dust   |                                                                                                                          |                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                               |
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| PK_044 | Increase in dust levels associated with WPG activities leads to impacts to the public, and third party mining operations | No nuisance impacts to the public , lease holders or third party mining operations due to dust generated by mining operations | <p>Complaints received from public, lease holders or third party mining operations.</p> <p>Records of implementation of Dust Management Plan (refer Section 12 in MARP).</p> <p>Records indicating maintenance and dust suppression of high traffic areas around operations.</p> <p>Compliance with communications protocol with the operator of Prominent Hill Mine.</p> | <b>Compliant</b> - Communication procedure in place with Oz Minerals, no complaints have been received from any stakeholders. |

| Noise and vibration |                                                                                                                                  |                                                                                                                                                     |                                                                                                                                                     |                                                                                          |
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| PK_045              | Disturbance to neighbours due to an increase in ambient noise and vibration levels from construction and operational activities. | Predicted outcomes, assessment criteria and leading indicators have only been developed for environmental aspects with a PRL of moderate or higher. | Predicted outcomes, assessment criteria and leading indicators have only been developed for environmental aspects with a PRL of moderate or higher. | <b>Not Applicable</b> - No report of disturbance as a result of noise, dust or vibration |

| PK RISK ID | IMPACT | OUTCOME | ASSESSMENT CRITERIA (MEASUREMENT) | COMPLIANCE ASSESSMENT |
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| <b>Waste</b> |                                                                                                                                                      |                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                         |
| PK_046       | Increase in litter across the project area resulting in a decrease in surrounding environmental aesthetics and potential increase in vermin numbers. | All domestic or industrial waste is disposed of in accordance with relevant legislation.<br><br>No breaches of EPA waste policies and guidelines.                                                                                    | Audit and inspection records demonstrate waste correctly stored and managed and transported off-site in accordance with Waste Management Plan (refer Section 16 in MARP).                                                                                                                                 | <b>Compliant</b> - Southern Iron maintains a site waste disposal register and receives waste tracking numbers where necessary, waste transfer area is audited monthly for compliance with EMP and CEMP. |
| PK_047       | Groundwater, surface water and soil contamination associated with landfill operations on site.                                                       | Landfill design and construction in accordance with EPA guidelines ("Environmental management of landfill facilities (municipal solid waste and commercial and industrial general waste), January 2007), Works Approval and Licence. | Certification by suitable independent professional to demonstrate that facilities are designed in accordance with EPA Guide lines "Environmental management of landfill facilities (municipal solid waste and commercial and industrial general waste), January 2007) EPA Works Approval and EPA Licence. | <b>Not Applicable</b> - Although Southern Iron has an SA EPA approved design for a category SB- facility, LEMP has also been approved and is attached, see Appendix H.                                  |

|                                            |                                                                  |                                                                                                                                                |                                                                                                                                                |                                                                    |
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| <b>Radiation and Asbestiform materials</b> |                                                                  |                                                                                                                                                |                                                                                                                                                |                                                                    |
| PK_048                                     | Radiation impacts to soil, water, air and biological parameters. | Predicted outcomes, assessment criteria and leading indicators have only developed for environmental aspects with a PRL of moderate or higher. | Predicted outcomes, assessment criteria and leading indicators have only developed for environmental aspects with a PRL of moderate or higher. | <b>Not Applicable</b> – Radioactive material has not been recorded |

| PK RISK ID | IMPACT                                        | OUTCOME                                                                                                                  | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                             | COMPLIANCE ASSESSMENT                                                                                                                                                |
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| PK_049     | Detrimental effects to human or fauna health. | Asbestiform materials to be managed by adopting the guidelines for "Management of Asbestos in Mining Operations" (2001). | <p>Audit of asbestos management procedures and actions demonstrate compliance with guideline requirements.</p> <p>Audit only undertaken if asbestiform materials are encountered on site.</p> | <b>Compliant</b> - Arrium Occupational Hygienist and Site Geological Team are developing any necessary management programs regarding potential asbestiform material. |

| Landscape and Visual Amenity |                                                                                                                 |                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                          |
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| PK_050                       | Reduced visual amenity in project area (local and regional area including Breakaways Environmental Association) | Mining infrastructure removed and post mining landform is stable and a safe reliable landform. | <p>Total area cleared is not to exceed the clearing associated with direct infrastructure footprint of 643.20 ha (refer figures and Table 10.2 in Native Vegetation Management Plan (Section 10) in MARP).</p> <p>Post mining infrastructure audit demonstrates all mining infrastructure is removed (unless agreed with pastoralist, Pastoral Board and PIRSA that infrastructure is to remain).</p> <p>Certification by suitable independent professional that post mining audit demonstrates remaining landforms are physically stable and a safe reliable landform.</p> | <p><b>Complaint</b> - NVMP Clearance areas and SEB credits have been update with DMITRE</p> <p><b>Not Applicable</b> – Post closure audit will be conducted after rehabilitation has been conducted.</p> |

| PK RISK ID          | IMPACT                                                                                                                 | OUTCOME                                                                                                                                                                                         | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                   | COMPLIANCE ASSESSMENT                                                                                                          |
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| <b>Stakeholders</b> |                                                                                                                        |                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                |
| PK_051              | Increased road safety and maintenance issues due to an increase in traffic on local/regional roads by haulage vehicles | Formal agreements with DTEI in place detailing design, construction and maintenance requirements of WPG. Agreements to address mine traffic use of public roads and mine/public road interface. | <p>Internal audit demonstrates design, construction and operational activities undertaken in accordance with DTEI agreement.</p> <p>Complaints register to show remedial action undertaken for complaints within 72 hours of incident occurring.</p>                                                                                                                                                | <p><b>Compliant-</b><br/>External audit carried out by DTEI prior to underpass opening and re-aligning the Stuart Highway.</p> |
| PK_052              | Interference with Prominent Hill operations due to proximity of haul road operations                                   | Communications and operating protocol developed with operators of Prominent Hill Mine and implemented in accordance with lease / licence conditions                                             | <p>Communications and operating protocol approved by Director of Mines prior to commencement of operations.</p> <p>Records of implementation of Stakeholder Communications Plan (refer Section 18 in MARP) and approved Communications Protocol.</p> <p>Complaints register to show all complaints are addressed and closed out in an appropriate timeframe (dependent on nature of complaint).</p> | <p><b>Compliant</b> - Although no complaints recorded to date, register will be continually updated.</p>                       |



| PK RISK ID | IMPACT                                                                                                                           | OUTCOME | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                               | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                    |
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| PK_053     | Decrease in pastoral income due to a decrease in grazing area associated with project infrastructure construction and operations |         | <p>Communications and operating protocol approved by Director of Mines prior to commencement of operations.</p> <p>Records of implementation of Stakeholder Communications Plan (refer Section 18 in MARP).</p> <p>Complaints register to show all complaints are addressed in an appropriate timeframe (dependent on nature of complaint).</p> | <p><b>Compliant</b> - Although no complaints recorded to date, register will be continually updated.</p> <p><b>Compliant</b> - Access Deed Communication Operating Protocols PK Mine (PK June 2011) - No formal communication protocol has been developed for communication between.</p> |

| PK RISK ID                             | IMPACT                                                                               | OUTCOME                                               | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | COMPLIANCE ASSESSMENT                                                                                 |
|----------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>Mine Closure and Rehabilitation</b> |                                                                                      |                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                       |
| PK_054                                 | Final landforms and revegetation are not integrated into the surrounding environment | Post mining landform is rehabilitated and revegetated | <p>Post closure audit / inspection / survey demonstrates post mining landforms are rehabilitated in accordance with Mine Closure and Rehabilitation Plan (refer Section 20 in MARP).</p> <p>Mine operations undertaken to reflect conceptual mine operations, closure and rehabilitation (refer Table 20.6 in Section 20 in MARP)</p> <p>Audit shows all equipment and infrastructure removed from site on completion of project (as agreed by pastoralists, Pastoral Board and PIRSA).</p> <p>All ponds/turkey's nest dams rehabilitated back to compatibility with local landscape.</p> <p>Monitoring of sites on rehabilitation closure domains have achieved/or have potential to achieve rehabilitation outcomes (sites will be selected based on professional expertise).</p> | <b>Not Applicable</b> – Post closure audit will be conducted after rehabilitation has been conducted. |

| PK RISK ID | IMPACT                                                                                                                                          | OUTCOME                                                                                                                                      | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PK_055     | Final landforms are unstable and create previously non-existent (i.e. pre-mining) risks to the health and safety of the public and fauna        | Post mining landforms are physically stable and risks to the health and safety of the public and fauna are as low as reasonable practicable. | <p>Post closure audit / inspection / survey demonstrates pre-mining ecosystem and function are re-established.</p> <p>Post closure audit shows:</p> <ul style="list-style-type: none"> <li>- all ponds/pits (not required by pastoralists) removed/refilled or recontoured to be compatible with the local landscape</li> <li>- all wells either capped or filled to surface to avoid leaving traps for small fauna</li> <li>- all waste facilities closed according to EPA standards and geotechnically assessed</li> </ul> | <b>Not Applicable</b> – Post closure audit will be conducted after rehabilitation has been conducted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| PK_056     | Inadequate topsoil available for rehabilitation activities resulting in failure to re-establish the pre-mining ecosystem and landscape function | Pre activity soil quality and quantities are maintained to assist re-establishment of pre-mining ecosystem and landscape function.           | <p>Records show that all available topsoil is/was stripped and stockpiled in accordance with topsoil stockpile management (refer Land Management Plan (Section 13) in MARP).</p> <p>Post closure audit / inspection / survey demonstrates pre-mining ecosystem and function are rehabilitated in accordance with Mine Closure and Rehabilitation Plan (refer Section 20 in MARP).</p>                                                                                                                                        | <p><b>Compliant</b> at this Stage although full re-survey will be conducted again in 1<sup>st</sup> quarter of 2012 financial year - Clearing Procedure and Topsoil Management Procedure has been developed to advise contractors the amount of topsoil that must be harvest in all areas, the harvesting techniques and the necessary signage to demarcate a topsoil storage area. Also as part of the annual requirement Southern Iron has surveyed all topsoil stockpiles across the project, up to May 2012 and this will be repeated at the end of construction.</p> <p><b>Not Applicable</b> – Post closure audit will be conducted after rehabilitation has been conducted.</p> |

| PK RISK ID | IMPACT                                                                                                                                                  | OUTCOME                                                                     | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                                                                                                                                                                                                       | COMPLIANCE ASSESSMENT                                                                                                                                                                                                                                                                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PK_057     | Industrial and / or domestic waste materials are left onsite post closure                                                                               | No industrial or domestic wastes left on site.                              | Waste disposal in accordance with Waste Management Plan (refer MARP).<br><br>Post closure audit demonstrates no industrial or domestic waste left on site.                                                                                                                                                                                                                                                                                                                              | <b>Not Applicable</b> – Post closure audit will be conducted after rehabilitation has been conducted.                                                                                                                                                                                                                                                                               |
| PK_058     | Reduction in soil quality (due to inappropriate storage of PAF material) resulting in reduced capacity for soils to promote vegetation re-establishment | All mine waste materials left on site are chemically and physically stable. | Sequencing of encapsulation / treatment of PAF within WRD in compliance with design requirements for ARD management (refer Section 6.4.2 in MARP).<br><br>Operational reports and material testing demonstrate implementation of sequencing and encapsulation (refer Section 6.4.2 in MARP).<br><br>No contamination of sites from ML6314.<br><br>Certification by a suitable independent professional to demonstrate that WRD has been constructed in accordance with approved design. | <b>Compliant</b> for ARD Monitoring Program Compliant for Sequencing of PAF associated with section 6.4.2<br><br><b>Compliant</b> regarding demonstrating compliance for WRD construction as approved (suitable independent professional). WRD construction started in January and assessment will be in December 2012, as the WRD primary footprint is filled to the second bench. |

| PK RISK ID | IMPACT                                                                                                                                    | OUTCOME                                                                                                                                       | ASSESSMENT CRITERIA (MEASUREMENT)                                                                                                                                                                                                                                                                | COMPLIANCE ASSESSMENT                                                                            |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| PK_059     | Quality and quantity of groundwater available to 3rd party users and dependent ecosystems compromised as a result of project operations   | The extraction and use of groundwater does not adversely affect groundwater dependent ecosystems that are reliant on that groundwater system. | Groundwater levels/drawdown as measured in monitoring holes are the same or better as than predicted modelled drawdown levels of 5m for both Stafford and Penrhyn Borefields (refer Water Management Plan (Section 14) & Groundwater Reports in Appendix C in MARP).                             | <b>Compliant</b> – Annual Groundwater Compliance Report                                          |
| PK_060     | Quality and quantity of surface water available to 3rd party users and dependent ecosystems compromised as a result of project operations | The post mining landform is physically stable and safe reliable landform                                                                      | No operational induced gully erosion to exceed >0.5m deep or >1.5m long or >0.8m wide greater than the natural gully erosion that existed prior to mining operations.<br><br>Inspection records maintained of silt traps and erosion control devices as well as contour banks and formed drains. | <b>Compliant</b> – Erosion monitoring implemented and carried out, no corrective actions issued. |

## 6 Rectification of Non-compliances

DMITRE were notified regarding one non-compliance resulting from a clearing event in the period. The environmental incident in question occurred on the 15/10/2011 and it was not discovered until a three monthly balance of clearing audit was conducted. The balance was conducted to compare the permitted clearance and the corresponding actual cleared areas.

Mosel Steed was contracted to conduct the survey and Southern Iron Site Environmental Advisers (SEA) compared the survey results to the ML, MPL and EML boundaries and the SEB of 643.2ha. The field survey was conducted on the 22/1/2012 and the results were analysed using Mapinfo in early February 2012. From the survey it was found that a clearing event had triggered a non-compliance regarding clearing beyond the boundary of MPL 128.

As a result there was 660m<sup>2</sup> of native vegetation cleared beyond the southern boundary of MPL 128. The on ground clearing was approximately one bulldozer blade width in a straight line for 75m.

An investigation was carried out onsite that recommended initial corrective actions be put in place. These are listed below:

- Rehabilitate the area and sign post to demarcate as a no go area.
- Review the clearing permit system and provide procedural controls for situations when operators are visually impeded during clearing operations.
- Monitor the rehabilitated area in the following Spring Flora Survey to assess recovery of vegetation.

Secondly, SI has undertaken a review of total clearance areas that are associated with design variations. DMITRE have been informed of SI's intent to update the Peculiar Knob PEPR to include the necessary extra SEB credits that are required to complete the construction project. As a result of the PEPR update and additional disturbance area SI will also be submitting an updated bonding assessment for consideration by DMITRE. The update is due on the 31st of July 2012 and is designed to avoid any issues regarding clearing greater than the previously approved 643.2ha as stated in the PK PEPR, 2011.

## **7 Management System Review**

An internal Environmental Management System (EMS) review was undertaken during the period to deliver a gap analysis for SI moving into operations. This gap analysis covered EMS, PEPR compliance and performance to ISO14001 and was conducted in May 2012. As a result of the audit Southern Iron now have a working list of improvements in procedure and practice moving forward at Peculiar Knob. The list below consists of some of the outstanding items that will be progressively implemented in the future.

- Develop a PEPR training and information presentation and roll out onsite,
- Display EPA works Approvals and Facilities License onsite,
- Develop a set of Key Performance Indicators for Peculiar Knob,
- Develop a management of change procedure for engineering variations,
- Develop a Document Control Procedure that involves review by Environment Manager, and
- Develop a poster showing sensitive vegetation and areas as defined in the PEPR and post prominently at site.

It is envisaged that Southern Iron will as part of it lease conditions conduct an independent audit in 2012-13 to evaluate the site performance against the Outcomes and Assessment Criteria as stated in Section 5. DMITRE will be consulted regarding potential auditor selection.

## **8 Fitness-for-purpose reviews of plant, equipment, infrastructure and other facilities.**

SI were in the construction and commissioning phase of the Peculiar Knob project during the reporting period, therefore this section will be re-visited in the 2012-13 reporting year.



## **9 New Environmental hazards**

No new environmental hazards were identified during the start of construction that were not captured in the Peculiar Knob outcomes and assessment criteria. However, a risk assessment after the baseline flora survey identified that two major sources for weeds existed on the project, the GWA rail line and the Stuart Highway. As a result Glenbarr weed control contractors were engaged to conduct a weed assessment and control program to minimise the potential of weeds spreading throughout the operational areas of Peculiar Knob. It is envisaged that this control program will be repeated in the 2012-13 period to minimise the risk of weeds spreading from the GWA rail line and the Stuart Highway.

## 10 Environment Protection and Biodiversity Conservation Act Reporting.

Arrium and Southern Iron has an approved research program of works with the Department for Sustainability, Environment, Water, Population and Communities (SEWPAC) as part of meeting the requirements of the Environment Protection and Biodiversity Act 1998 (EPBC Act) and South Australian legislative requirements (Native Vegetation Act 1991) to address the conservation of the Thick-billed Grasswren (Eastern subspecies) (*Amytornis textilis modestus*). The research component of the proposal specifically addresses on-ground conservation-based research to improve knowledge of the biology and environment of the Thick-billed Grasswren at the Nature Foundations Witchelina Reserve. Witchelina Reserve is approximately 4,219 km<sup>2</sup> in size and located about 45 km northeast of Lyndhurst between Lake Eyre in the north and Lake Torrens in the south.

The Nature Foundation research project is currently in a development phase with the PhD and honours student's recruitment underway. It is expected that these placements will be filled by September 2012, an addition to the project has been the inclusion of a post-doctorate team lead. This inclusion will add an experienced researcher to value add and mentor junior researchers throughout the Thick-billed Grasswren project.

To read the Nature Foundation interim report in full refer to Appendix J



Figure 6. Thick-billed Grasswren (Eastern subspecies) (*Amytornis textilis modestus*)

## 11 References

Parsons Brinkerhoff (2011) *Peculiar Knob Iron Ore Mining Project – Mining and Rehabilitation Program (MARCR)*, WPG.

Rockwater Proprietary Limited (2012) *Groundwater Monitoring Annual Report for Peculiar Knob Iron Ore Project, July 2012*.

Environment Protection Authority (2007) *South Australian Bunding and Spill Management Guidelines*. EPA.

PIRSA (2009) *MG3 Guidelines for miners: Preparation of a Mining and Rehabilitation Compliance Report (MARCR) in South Australia*, Version 1.4, March 2009.

[http://www.pir.sa.gov.au/minerals/publications\\_and\\_information/guidelines](http://www.pir.sa.gov.au/minerals/publications_and_information/guidelines)

Larry Bebbington (2012) *Baseline Flora Monitoring Peculiar Knob Mining Operations for Southern Iron Pty Ltd Coober Pedy*, November 2011.

Ecological Horizons Pty Ltd (2010) *Peculiar Knob Baseline Fauna Monitoring Program*, November 2011.

# Appendix A

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS



**Flora Monitoring**  
**Peculiar Knob Mining Operations**  
  
**for**  
**Southern Iron Pty Ltd Coober Pedy**

Assessed /Compiled by:

December 2011

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## Document Information

Job/Project Title:

**Baseline Flora Monitoring Southern Iron Pty Ltd Coober Pedy  
Peculiar Knob Mine**

Title:

**Flora Monitoring Southern Iron Pty Ltd Coober Pedy Peculiar Knob  
Mining Operations**

Client Organisation:

**Southern Iron Pty Ltd Coober Pedy**

Document ID:

M234-OSPK-911

Date:

November 2011 (Field Monitoring)

Report Revision Status:

First Draft – January 2011, Revision February 2012,  
Final February 2012

Assessor:

Larry Bebbington

Current Document Approval:

Graeme Noll – Manager Environmental

In preparing this report, Larry Bebbington Habitat & Land Management Consultant has relied upon certain data (or the absence thereof) relative to the site, provided by government Agencies, the Client and others identified herein. Except as otherwise stated in the report, Larry Bebbington has not attempted to verify the accuracy or completeness of any such information.

No warranty or guarantee whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions and information in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client and is subject to and issued in connection with the provisions of the agreement between Larry Bebbington and the Client. Larry Bebbington accepts no liability or responsibility whatsoever for or in respect of any use of, or reliance upon, this report by a third party.

## Index

|                                                          |         |
|----------------------------------------------------------|---------|
| Background.....                                          | 4       |
| Methodology .....                                        | 5-6     |
| Summary of November 2011 Baseline Monitoring.....        | 7-10    |
| 1.0 – PKSD 1.1 – Impact Data Sheets.....                 | 11-17   |
| 1.1 – PKSD 1.3 – Control Data Sheets.....                | 18-24   |
| 2.0 – PKSD 2.1- Impact Data Sheets.....                  | 25-31   |
| 2.1 – PKSD 2.3 - Control Data Sheets.....                | 32-38   |
| 3.0 – PKSD 3.1 – Impact Data Sheets.....                 | 39-45   |
| 3.1 – PKSD 3.3 – Control Data Sheets.....                | 46-52   |
| 4.0 – PKSD 4.1 – Impact Data Sheets.....                 | 53-59   |
| 4.1 – PKSD 4.3 – Control Data Sheets.....                | 60-66   |
| 5.0 – PKSD 5.1 – Impact Data Sheets.....                 | 67-73   |
| 5.1 – PKSD 5.3 – Control Data Sheets.....                | 74-80   |
| 6.0 – PKSD 6.1 – Impact Data Sheets.....                 | 81-87   |
| 6.1 – PKSD 6.3 – Control Data Sheets.....                | 88-94   |
| 7.0 – PKSD 7.1 - Impact Data Sheets.....                 | 95-101  |
| 7.1 – PKSD 7.3 – Control Data Sheets.....                | 102-108 |
| Appendix A – Plant Species Recorded Nov 2011             | 109-112 |
| Appendix B – Species Counts for Monitoring Quadrats..... | 113-116 |
| Appendix C – Status Codes.....                           | 117-119 |
| Appendix D – Leaf Surface Dust Load Indicator Diagram    | 120     |
| Appendix B – References.....                             | 121     |



## Background

Flora monitoring is a scheduled annual activity that will continue to add to the data set to assess the potential impacts of mining on Flora adjacent to the Southern Iron (SI) Peculiar Knob mine and mine related facilities. By comparing data from impact sites to replicate control sites it is expected that with time and accumulated data sets, trends related to mine related impacts, in particular from dust emissions, will be able to be analysed against specific vegetation health indicators.

The extent of the flora monitoring field work was to assess flora species diversity, health and abundance at seven Impact sites and seven control sites.

Baseline field surveys included the following:

- Establishment of permanent 30m x 30m monitoring quadrats at sites identified in the Peculiar Knob 2011 MARP.
- Establish three Control and three Impact 30m x 30m monitoring quadrats at each Site. The control sites are to be as close as possible replicates of the impact sites.
- Provide a full vegetation species list including weeds
- Establish photo point monitoring at all monitoring locations
- Determine key indicator species
- Record the relative abundance densities of individual plants of each selected indicator species within the monitoring quadrats, list adults and juveniles separately.
- Record estimates of healthy canopy cover of the adult key indicator species as a percentage of the total healthy potential.
- General observations about the health and abundance of individual species including, deaths, fasciated growths, dust loads on foliage and soil surface (% cover and depth), species that are flowering and/or seeding, foliage shooting or shedding, variations in seed set abundance compared to control sites, mice, insect attack and galls present, mistletoe, grazing pressure and soil colour and temperature etc.
- Comment on weed species abundance
- Provide GPS coordinates of all corners of each permanent quadrat
- Comment on the significance of habitat types to fauna species
- Record Opportunistic fauna observations
- Comment on fauna present as indicators of flora community health (e.g. ants and spiders)
- Record cryptogram cover at each site
- Comment on litter cover at each site
- Record soil type, soil moisture and pH.
- Describe the landscape at all monitoring locations
- Record vegetation communities present in an extended area (100m x 100m) at each monitoring location and provide comments on vegetation health/vigour.



## Methodology

The following methodology was used to monitor 30m x 30m quadrats:

**Quadrats** – 4 corners and photo point plotted to GPS with Garmin® 60C hand held unit to accuracy +/-3m formatted in WGS84.

Plots measured with 30m Silvan® Forestry tape or Bushnell® Laser Pro range finder accuracy +/- 1m @ 500m.

**Vegetation** – monitoring follows but is not limited to: *Vegetation Structural Formations*- from Heard & Channon (1997) - adapted from Forward and Robinson (1996).

“An update of the Conservation Status of the Major plant Associations of South Australia” Neagle (1995). Canopy Cover follows Specht 1972. Litter cover/abundance follows Braun-Blanquet 1965.

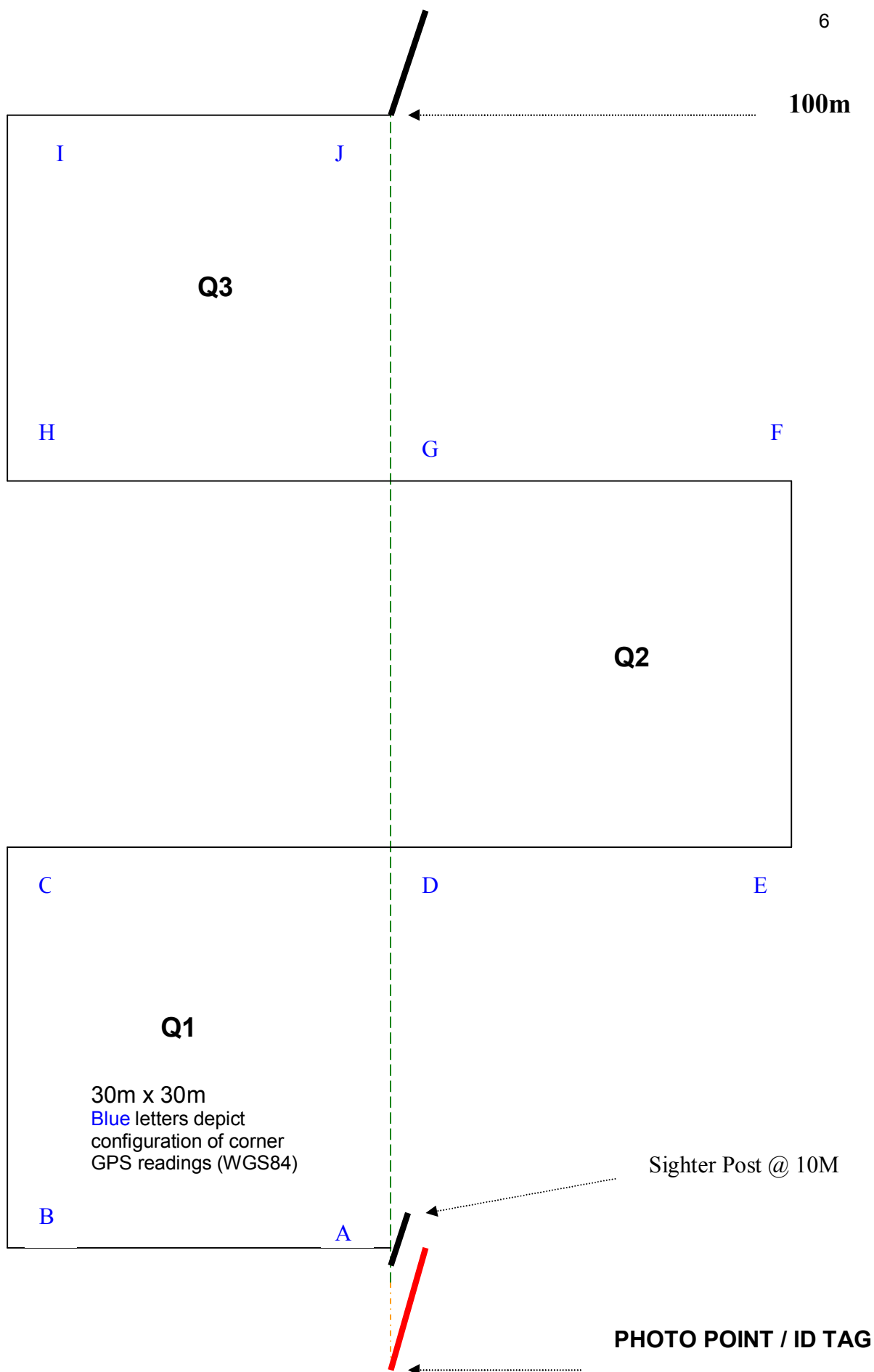
Quadrat vegetation sampling was based on Heard & Channon (DEH -1997) *Biological Survey of South Australia Methodology*.

**Soil** – Temperature measured with Silvan® Infra Red Digital thermometer. Comparisons of soil temperature surface readings were taken from natural surface soils devoid of rock or leaf litter. pH and moisture measured with a Kelway® pH / moisture meter probe, calibrated against Kelway® pH mediums.

**Ambient Air Temperature** – measured with a Scientific Instruments® tube thermometer

**Leaf Surface Analysis** – Depth of dust deposition on adaxial and abaxial leaf surfaces and identification of leaf cuticle types conducted with a Bushnell® 30x field microscope

**Photographs** – digital Canon® S50 on medium resolution. Photographic records include 100m x 100m general, 30 x 30m general with blackboard plot reference and individual indicator species photographs with height gauge.



**Diagram 1** – Layout of all permanent quadrats along 100m transect line

## Summary of November 2011 Baseline Monitoring

The establishment of flora monitoring sites within ML and EML leases at the Southern Iron Peculiar Knob mine are scheduled activities that are directly linked to the MARP approvals. Flora (dust impact) monitoring is a component of the native vegetation management plan (Sect. 10) of the Western Plains Resources 2011 MARP (Parsons Brinckerhoff 2011).

Parsons Brinckerhoff recommended the establishment of 7 monitoring sites, (Fig. 10.6 Sect. 10.7.2 MARP) one at the rail siding, four sites along the haul route and two sites near the Mining Lease (ML) infrastructure. Locations for monitoring sites were based loosely on vegetation types and it was noted in the MARP that final monitoring site locations could change for a number of reasons including changes in site access and infrastructure final locations.

During the establishment of flora monitoring sites in November 2011 Southern Iron Environment personnel and the flora and fauna consultants determined that it would be beneficial to pair the flora and fauna monitoring sites as potential impacts are intrinsically linked between both communities. Some monitoring sites were relocated to better reflect vegetation communities and landforms which influence community composition. Each control site was paired to an impact site to allow comparisons to be made on potential impacts of the mining operation.

Due to the dynamic nature of the environs found in the Stony Plains Bioregion significant fluctuations in plant community composition, species densities and health will influence vegetation monitoring results. At the time of the establishment of the monitoring sites the regions flora and fauna were flourishing due to higher than average rainfall over the past two years (BOM Coober Pedy<sup>1</sup>). Consequently normally sparse perennial Chenopod Shrublands that contain few annual or short lived perennials were returning high annual species counts and densities with most species either flowering or in advanced seed set. For example *Atriplex holocarpa* which is an annual or rarely a short lived perennial was recorded in densities >350 per 30m quadrat at the mine area at Site 6. In average rainfall years these quadrats may contain extensive bare areas only supporting perennial chenopods such as *Atriplex vesicaria* and very sparse hardy perennial grasses.

During the November 2011 flora surveys the overall average condition class of >90% of vegetation was Excellent (at full potential – budding, flowering seeding) with a maximum potential for annual and perennial species for each land type. Annual and winter active perennial grasses had dried off and set seed prior to survey in the majority of the sites, however some sites near the ML still contained actively growing C4 grass species. Annual or short lived perennial shrubs such as *Maireana eriantha* and *Atriplex spongiosa* were drying off within Sites 1, 2 and 3 but had produced large amounts of seed. Minor drainage lines intersecting Site 6 control (6C) contained large amounts of *Atriplex spongiosa* seed which was being harvested by the House Mouse, native mice and native rodents.

All perennial species recorded within quadrats were either producing new growth or had produced new growth in the past few weeks. The only recorded impact to new growth on perennial vegetation was from station cattle. Grazing of new growth on annual herbs and grasses by native mice and rats and grasshoppers was commonplace but overall of a minor nature. Leaf litter produced by actively growing perennials or senescing annuals averaged 25% but was as high as 80% in sites containing healthy annual and perennial shrubs and grasses. The high litter loadings will be maintained over the summer months of 2011 – 12 which will maintain productivity and protect soils from wind and water erosion on most of the sites.

Impacts on vegetation communities at the time of survey were restricted to cattle grazing and trampling which was considered Moderate across most of the eastern sites. Monitoring sites 3 to 7 sustained higher levels of grazing and trampling due to the proximity of water points or ephemeral pools in drainage lines.

Dust monitoring of vegetation within transects returned minimal background dust deposition from bare soil areas and cattle pads or camps which will not persist as it will be flushed from leaf hairs during rainfall events. Sites PK 4.3 Control and PK 5.1 Impact returned results for light staining on adaxial leaf hairs of *Atriplex vesicaria* and *Maireana aphylla*. Light dust loads on adaxial leaf hairs will not negatively impact on plants as arid land plants have evolved with significant natural background dust loads generated from bare soil areas by wind.

Moderate to Heavy dust loadings (full depth of adaxial / abaxial hairs, visible on canopy) will be deposited on vegetation within impact sites PK 2 I, 3 I and 4 I during high traffic movements along the existing pipeline track prior to the construction of the rubble haul road. Clay based soils on the pipeline track have poor structure and rapidly turn into “bull-dust” under heavy traffic situations. Watering this type of surface will only suppress dust for short periods as deep bull-dust is virtually non-wetting at depth, consequently dust deposition of particles  $<10\mu\text{m}$  (Arup Environmental 1995<sup>2</sup>). within 200m of these temporary natural surfaced roads can be significant. High traffic movements along the pipeline track will be of a short duration as the rubble haul road from the highway to the mine site is a high priority. Therefore the heavy dust loadings generated from pipeline traffic will be of a short duration and will be flushed from vegetation in summer rainfall events. Moderate to Heavy dust loads with a particulate size of  $\sim 10\text{--}30\mu\text{m}$  will not impact negatively on chenopod plants as the fine dust particles are trapped in cuticle hairs and rarely reach the leaf cuticle. Staining of cuticle hairs and bark from clay particulates in solution during rainfall events may occur on plants within the dust drop out zone, however this process also occurs naturally from background dust and has no impact on plant health.

There are no conclusive studies that prove that anthropogenic derived dust deposition on plants has a long term impact on plant health. Studies world wide (WERC 2007<sup>3</sup>, Paling E 2001<sup>4</sup>) indicate that whilst shoot growth can be

slightly impaired short term due to dust loadings although net photosynthetic increases resulted due to higher plant temperatures.

The use of water trucks and polymers for dust suppression on the pipeline track, the new haul road and the pit surrounds will greatly reduce fugitive dust emissions generated during operations. The use of saline groundwater is unavoidable and is likely to have a localised negative impact on annuals and salt sensitive species. Given the short life span of the mine and the localised impact of saline water usage it is considered unlikely that impacts will be long term or a major in impact. Localised impacts that may occur on annual or salt sensitive species should over time be nullified by the natural recruitment of salt tolerant chenopod plants.

The following summarised points have been included under the broad Flora Management category due to the significance of the vegetation communities and ecological values of the localised systems involved. The following vegetation community was not flagged in the Vegetation Baseline Surveys for the 2011 MARP although the potential impacts on the community and downstream environs may not have been considered significant enough to include engineering controls at the time.

The community under comment is found on a first order stream in the vicinity of chainage markers CH60000 – CH65000 on the new haul road to the west of the accommodation village. The wide flood plain is potentially linked to the Brumby Creek system in significant rainfall events and supports a vegetation community of *Eucalyptus coolabah ssp arida* / *Melaleuca glomerata* Low Open Woodland+/- *Acacia tetragonophylla*, *Acacia victoriae ssp victoriae*, *Alectryon oleifolius*, *Pittosporum angustifolium*, *Eremophila glabra ssp glabra*, *Rhagodia spinescens*, *Astrebla pectinata*, *Setaria constricta*. The conservation status of this community is under revision but is considered under threat within its range. The habitat value of the Coolabah and Inland Paperbark communities along the watercourse is considered Very Good with a Condition Class of S<sup>2</sup> Neagle 1995 and a HSR Score of A<sup>400</sup> NVC. *Eucalyptus coolabah* trees provide food, roosts, elevated nest sites and nesting hollows for a range of native fauna. *Melaleuca glomerata* trees provide large amounts of nectar when in flower for a range of insectivorous and nectivorous native fauna.

The *E. coolabah ssp arida* Low Open Woodland conservation status is “of concern” regionally and considered Vulnerable at a National level due to its reliance of ground water as well as episodic flood events. There is a potential that negative impacts will occur during and post civil works and recommended engineering controls are dot pointed below:

- Avoid unnecessary clearance of vegetation upstream and downstream of constructed infrastructure.
- Armour entry and discharge aprons with a combination of geotextile and graded rock to minimise scour and head cutting of constructed crossings. Ensure graded rock is suitably sized allowing for 1:50 year flow events.

- Maintain natural bed levels to avoid flow restrictions to downstream environs or drop-point erosion at change of level.
- If elevated structures (bridges) are constructed within flood plain depressions armour disturbed soils with rip rap around footings extending beyond the structure width upstream and downstream to reduce scour during 1:50 to 1:100 flow events.
- Armour constructed batters adjacent to infrastructure with graded rock to reduce rill or scour erosion.

Although potential impacts and generalised remedial actions to riparian environments are flagged in the MARP for the mine site (Sect. 5.5 Surface Water pg. 41 & Sect. 6.1.7.1 Drainage and Sediment Flow at the mine site pg P.B. 2011). It is recommended that the loss of first order drainage lines at the headwaters of Balta Baltana Creek that will be impacted by the mining footprint are diverted where possible as is recommended in the MARP.

Potential impacts to first order main drainage lines include: reduced flows to flora / fauna habitat and potential increased water flow velocity causing increased erosion in the existing creek. It was also noted during survey that high numbers of cattle grazing within the drainage lines exacerbated vegetation loss through bank slumping, pugging and impact on ephemeral pools by increased sediment transport.

The Baseline statistics collected at the Impact and Control sites in 2011/12 reporting year will be assessed further in spring 2012, by which time construction will have finished and Peculiar Knob will be an operating iron ore mine. It is considered that significant impacts could potentially be rainfall/weather related, grazing related or mining related and will be assessed for significance in the following reporting year.

### 1.0 – PK SD1-1 Impact

|                                                    |                                                                         |                                        |                                |                                        |
|----------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------|--------------------------------|----------------------------------------|
| <b>Site Location - ID</b>                          | <b>Surveyed by:</b>                                                     |                                        | <b>Project Controller</b>      | <b>Date</b>                            |
| <b>PK SD1-1 IMPACT</b>                             | L. Bebbington – Land Management Consultant                              | Graeme Noll – Manager Env. Coober Pedy |                                | 31.10.11                               |
|                                                    | <b>Weather</b><br>Mild, Overcast<br>Ambient temperature 16 <sup>o</sup> | <b>Rainfall past 30 days</b><br>Yes    |                                | <b>Landform / Aspect</b><br>Sand Plain |
| <b>Photographs</b>                                 | <b>General:</b>                                                         | <b>PPoint:</b> 1                       | <b>Indicator Plants:</b> 2 - 7 |                                        |
| <b>Photo point Map No. SD 1I</b>                   | <b>Ref Tag No: PK 01 I</b>                                              |                                        |                                |                                        |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                | <b>B</b>                               | <b>C</b>                       | <b>D</b>                               |
| <b>Easting</b>                                     | 0457761                                                                 | 0457732                                | 0457724                        | 0457753                                |
| <b>Northing</b>                                    | 6736529                                                                 | 6736517                                | 6736545                        | 6736558                                |
| <b>SOIL</b>                                        |                                                                         |                                        |                                |                                        |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                               | <b>TYPE</b>                            |                                | <b>SOIL TEMP.</b>                      |
|                                                    | 0mm                                                                     |                                        |                                | Dust Coated                            |
|                                                    |                                                                         | Coarse red sand <5% clay               |                                | Natural                                |
|                                                    |                                                                         |                                        | 20 <sup>o</sup>                | 7                                      |
|                                                    |                                                                         |                                        |                                | 15%                                    |

| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Acacia aneura</i> Low Open Woodland +/- Mid Dense <i>Senna ft petiolaris</i> , <i>Maireana eriantha</i> , <i>Atriplex vesicaria</i> , <i>Scaevola spinescens</i> , <i>Ptilotus obovatus</i> , <i>Solanum quadriloculatum</i> . Mid Dense <i>Aristida contorta</i> , <i>Aristida holathera ssp holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Fire scars on <i>A. aneura</i> stumps indicate wildfire burnt through site c.20 years ago. Annual / perennial grasses in abundance with the majority in late stages of seed shed. Impacts restricted to Galls on acacias and grazing by kangaroos and cattle.<br><b>Leaf Litter:</b> 80% >3mm diam. <b>Cryptograms:</b> 0 |      |       |         |        |           |               |              |                                                       |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|--------|-----------|---------------|--------------|-------------------------------------------------------|--|
| Species 30 x 30m <u>Quadrat 1</u> PK SD1-1 Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       |         |        |           |               |              |                                                       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Juv. | Adult | % Cover | Health | Increaser | Flower / Seed | Impact       | Other                                                 |  |
| <i>Acacia aneura</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2    |       | N       | E      |           |               | Gall, beetle | Background dust from bare areas (20%) within quadrats |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | 4       | E      |           | S             | Grasshopper  |                                                       |  |
| <i>Aristida holathera ssp holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | T       | E      |           | S             |              |                                                       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2    | 10    | T       | E      | I         | S             |              |                                                       |  |
| <i>Austrostipa nitida</i> / <i>scabra</i> x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | N       | VG     |           | S             | grazing      |                                                       |  |
| <i>Maireana eriantha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | 20    | 1       | E      | I         | F             |              |                                                       |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | N       | E      |           | F             |              |                                                       |  |
| <i>Scaevola spinescens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | N       | E      |           | B             |              |                                                       |  |
| <i>Senna ft petiolaris</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 17   | 17    | 2       | VG     |           | S             | gall         |                                                       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | 4       | VG     |           | S             |              |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       |         |        |           |               |              |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       |         |        |           |               |              |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       |         |        |           |               |              |                                                       |  |



| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Acacia aneura</i> Low Open Woodland +/- Mid Dense <i>Senna ft petiolaris</i> , <i>Dodonaea microzyga</i> ssp <i>microzyga</i> , <i>Maireana eriantha</i> , <i>Maireana georgei</i> , <i>Atriplex vesicaria</i> , <i>Scaevola spinescens</i> , <i>Ptilotus obovatus</i> . Mid Dense <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Fire scars on <i>A. aneura</i> stumps indicate wildfire burnt through site c.20 years ago. Annual / perennial grasses in abundance with the majority in late stages of seed shed. Impacts restricted to old fire, borers, Galls on acacias and grazing by kangaroos and cattle.<br><b>Leaf Litter:</b> 70% >3mm diam. <b>Cryptograms:</b> 0 |      |       |         |                     |           |               |               |                                                       |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|---------------------|-----------|---------------|---------------|-------------------------------------------------------|--|
| <b>Species 30 x 30m Quadrat 2 PK SD1-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       |         |                     |           |               |               |                                                       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Juv. | Adult | % Cover | Health              | Increaser | Flower / Seed | Impact        | Other                                                 |  |
| <i>Acacia aneura</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4    | 5     | T       | E <sup>6</sup> Dead |           | Sht           | Fire, borers  | Background dust from bare areas (30%) within quadrats |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | 4       | VG                  |           | S             |               |                                                       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | 3       | VG                  |           | S             |               |                                                       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 6     | N       | E                   | I         | S             |               |                                                       |  |
| <i>Austrostipa nitida</i> / <i>scabra</i> x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | N       | E                   |           | S             | Grazing       |                                                       |  |
| <i>Dodonaea microzyga</i> ssp <i>microzyga</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 2     | N       | E                   |           | sht           |               |                                                       |  |
| <i>Eremophila glabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | 1     | N       | E                   |           | F             |               |                                                       |  |
| <i>Maireana eriantha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2    | 20    | 1       | E                   | I         | F             |               |                                                       |  |
| <i>Maireana georgei</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      | 6     | N       | E                   | I         | F             |               |                                                       |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | T       | E                   |           | F             |               |                                                       |  |
| <i>Senna ft petiolaris</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 10   | 9     | 1       | E <sup>9</sup> dead |           | S             | Galls, insect |                                                       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | N       | E                   |           | S             |               |                                                       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | N       | E                   |           | F             |               |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       |         |                     |           |               |               |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       |         |                     |           |               |               |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       |         |                     |           |               |               |                                                       |  |

| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Acacia aneura</i> Low Open Woodland +/- Mid Dense <i>Senna ft petiolaris</i> , <i>Dodonaea microzyga</i> ssp <i>microzyga</i> , <i>Maireana eriantha</i> , <i>Maireana georgei</i> , <i>Atriplex vesicaria</i> , <i>Scaevola spinescens</i> , <i>Ptilotus obovatus</i> , <i>Solanum quadriloculatum</i> . Dense <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Fire scars on <i>A. aneura</i> stumps indicate wildfire burnt through site c.20 years ago. Annual / perennial grasses in abundance with the majority in late stages of seed shed. Impacts restricted to old fire, borers, Galls on acacias and grazing by kangaroos and cattle.<br><b>Leaf Litter:</b> 70% >3mm diam. <b>Cryptograms:</b> Moss <1% |      |       |         |                                 |           |               |                                |                                                       |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|---------------------------------|-----------|---------------|--------------------------------|-------------------------------------------------------|--|
| <b>Species 30 x 30m Quadrat 3 PK SD1-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       |         |                                 |           |               |                                |                                                       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Juv. | Adult | % Cover | Health                          | Increaser | Flower / Seed | Impact                         | Other                                                 |  |
| <i>Acacia aneura</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 5     | N       | VG                              |           | S             | galls                          | Background dust from bare areas (30%) within quadrats |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | 5       | VG                              |           | S             |                                |                                                       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | 2       | VG                              |           | S             |                                |                                                       |  |
| <i>Austrostipa nitida</i> / <i>scabra</i> x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | N       | Fair                            |           | S             | Grazing                        |                                                       |  |
| <i>Dodonaea microzyga</i> ssp <i>microzyga</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 2     | N       | Poor <sup>80% canopy dead</sup> |           |               | Scale, insect                  |                                                       |  |
| <i>Maireana sedifolia</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 1     | N       | E                               |           |               |                                |                                                       |  |
| <i>Senna ft petiolaris</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 13    | T       | Senescing <sup>6 dead</sup>     |           | F,S           | Case moth, Borers, Beetle      |                                                       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | T       | VG                              |           | S             |                                |                                                       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       |         |                                 |           |               |                                |                                                       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | 1       | Excellent                       |           | S             | Hopping Mice consumed 90% seed |                                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       |         |                                 |           |               |                                |                                                       |  |

| <b>DUST<br/>MONITORING</b> | <b>PK SD1-1 Impact Transect</b> |                                      |                  |                                   |                        |           |                                   |                                   |    |                                                                  |
|----------------------------|---------------------------------|--------------------------------------|------------------|-----------------------------------|------------------------|-----------|-----------------------------------|-----------------------------------|----|------------------------------------------------------------------|
|                            | <b>Indicator Species</b>        | <b>Canopy<br/>Dusting%</b>           | <b>Leaf Type</b> | <b>Dust Load (leaf)<br/>L,M,H</b> | <b>Soil<br/>colour</b> | <b>pH</b> | <b>H<sub>2</sub>O<br/>Content</b> | <b>Soil Temp<br/>Dust Natural</b> |    | <b>Background<br/>Dust Sources</b>                               |
|                            |                                 |                                      |                  |                                   | R                      | 7         | 15%                               |                                   | 20 | Background<br>dust from<br>bare areas<br>and dam<br>construction |
|                            |                                 | Nil - All Spp.<br>Due to recent rain |                  |                                   |                        |           |                                   |                                   |    |                                                                  |
|                            |                                 |                                      |                  |                                   |                        |           |                                   |                                   |    |                                                                  |
|                            |                                 |                                      |                  |                                   |                        |           |                                   |                                   |    |                                                                  |
|                            |                                 |                                      |                  |                                   |                        |           |                                   |                                   |    |                                                                  |
|                            |                                 |                                      |                  |                                   |                        |           |                                   |                                   |    |                                                                  |

| WEED SPECIES                          | ABUNDANCE                                                                                    | FAUNAL HABITAT                                                                                                                                                                                                                                                                                                                                                                                                                                                                | FAUNAL SPECIES RECORDED        | Opportunity             |
|---------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------|
| <i>Cenchrus ciliaris</i> Buffel Grass | Single plant recorded which was physically removed in zip lock bag and disposed of off site. | <p>Due to good seasonal rains and the ensuing cover of herbs and grasses the habitat value is considered to be Good for the 01 impact site.</p> <p>3 species of ants, Ant Lions and 5 genera of ground dwelling spiders were recorded within quadrats.</p> <p><i>Notomys mitchellii</i> and <i>Varanus gouldii</i> tracks were common across all quadrats.</p> <p>Bird species were not well represented which is a reflection on the sparseness of the tall shrub layer.</p> |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Artamus personatus</i>      | Masked Wood-swallow     |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Colluricincla harmonica</i> | Grey shrike thrush      |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Craticus torquatus</i>      | Grey Butcherbird        |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Oreoica gutturalis</i>      | Crested Bellbird        |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Macropus fuliginosus</i>    | Western Grey Kangaroo   |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Notomys mitchellii</i>      | Mitchell's Hopping Mice |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <i>Varanus gouldii</i>         | Gould's Goanna          |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |
|                                       |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                         |

# **PK 01 Impact - Photo Point image**



### 1.1 – PK SD1-3 Control

| Site Location - ID                          | Surveyed by:                                                                |                                        | Project Controller                  | Date        |                   |         |            |         |         |         |
|---------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------|-------------------------------------|-------------|-------------------|---------|------------|---------|---------|---------|
| PK SD1-3 Control                            | L. Bebbington – Land Management Consultant                                  | Graeme Noll – Manager Env. Coober Pedy | 1.11.11                             |             |                   |         |            |         |         |         |
|                                             | Weather<br><br>Mild, scattered cloud<br>Ambient temperature 28 <sup>o</sup> | Rainfall past 30 days<br><br>Yes       | Landform / Aspect<br><br>Sand Plain |             |                   |         |            |         |         |         |
| Photographs                                 | General:                                                                    | PPoint: 8                              | Indicator Plants: 9-12              |             |                   |         |            |         |         |         |
| Photo point Map No. SD 1 C                  | Ref Tag No: PK 01 C                                                         |                                        |                                     |             |                   |         |            |         |         |         |
| Quadrat Co-ordinates<br>Layout as per Pg. 6 | A                                                                           | B                                      | C                                   | D           | E                 | F       | G          | H       | I       | J       |
| Easting                                     | 045 8215                                                                    | 0458203                                | 045 8232                            | 0458244     | 0458255           | 0458284 | 0458271    | 0458257 | 0458285 | 0458297 |
| Northing                                    | 6736858                                                                     | 6736885                                | 6736898                             | 6736867     | 6736842           | 6736853 | 6736888    | 6736903 | 6736923 | 6736893 |
| SOIL                                        |                                                                             |                                        |                                     |             |                   |         |            |         |         |         |
|                                             | DUST DEPOSIT DEPTH                                                          | TYPE                                   |                                     | SOIL TEMP.  |                   | pH      | MOISTURE % |         |         |         |
|                                             | 0mm                                                                         |                                        |                                     | Dust Coated | Natural           |         |            |         |         |         |
|                                             |                                                                             | Coarse red sand <5% clay               |                                     |             | 41.4 <sup>o</sup> | 7       | 2%         |         |         |         |

| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Acacia aneura</i> Low Open Woodland +/- Mid Dense <i>Senna ft petiolaris</i> , <i>Maireana eriantha</i> , <i>Scaevola spinescens</i> , <i>Ptilotus obovatus</i> , <i>Solanum quadriloculatum</i> . Mid Dense <i>Aristida contorta</i> , <i>Aristida holathera ssp holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Fire scars on <i>A. aneura</i> stumps indicate wildfire burnt through site c.20 years ago. Annual / perennial grasses in abundance with the majority in late stages of seed shed. Impacts restricted to Galls and scale on acacias and grazing by kangaroos and cattle.<br><b>Leaf Litter:</b> 30% >3mm diam. <b>Cryptograms:</b> 0 |      |       |         |        |           |               |                     |       |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|--------|-----------|---------------|---------------------|-------|--|
| <b>Species 30 x 30m Quadrat 1 PK SD1-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       |         |        |           |               |                     |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Juv. | Adult | % Cover | Health | Increaser | Flower / Seed | Impact              | Other |  |
| <i>Acacia aneura</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 3     | N       | E      |           | F,S           | Gall, beetle, scale |       |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | 3       | E      |           | S             | Grasshopper         |       |  |
| <i>Aristida holathera ssp holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | T       | E      |           | S             |                     |       |  |
| <i>Austrostipa nitida</i> / <i>scabra</i> x                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | N       | VG     |           | S             | grazing             |       |  |
| <i>Eremophila glabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | N       | E      |           | F             | Scale               |       |  |
| <i>Maireana eriantha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4    | 46    | 3       | E      | I         | F             |                     |       |  |
| <i>Maireana georgei</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 17    | 2       | E      | I         | F             |                     |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | 2       |        |           | S             | Grazing             |       |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | 3       | E      |           | F             |                     |       |  |
| <i>Ptilotus sessilifolius ssp sessilifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | N       | E      |           | F             |                     |       |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | T       | VG     |           | S             |                     |       |  |
| <i>Senna ft petiolaris</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 23   | 20    | 3       | E      |           | F,S           | gall                |       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | 4       | VG     |           | S             |                     |       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | 3       | E      |           | S             |                     |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       |         |        |           |               |                     |       |  |

**Vegetation Community 100 x 100m:** Sparse *Acacia aneura* Low Open Woodland +/- Mid Dense *Senna ft petiolaris*, *Dodonaea microzyga ssp microzyga*, *Maireana eriantha*, *Maireana georgei*, *Atriplex vesicaria*, *Scaevola spinescens*, *Ptilotus obovatus*. Mid Dense *Aristida contorta*, *Aristida holathera ssp holathera*, *Austrostipa nitida* / *scabra*, *Setaria constricta*

**Health:** Excellent due to above average rainfall in past 12 months. Fire scars on *A. aneura* stumps indicate wildfire burnt through site c.20 years ago. Annual / perennial grasses in abundance with the majority in late stages of seed shed. Impacts restricted to old fire, borers, Galls on acacias and grazing by kangaroos and cattle.

**Leaf Litter:** 70% >3mm diam. **Cryptograms:** 0

**Species 30 x 30m Quadrat 2 PK SD1-3 C**

| # = indicator Spp.                          | Juv. | Adult | % Cover | Health                 | Increaser | Flower / Seed | Impact        | Other |
|---------------------------------------------|------|-------|---------|------------------------|-----------|---------------|---------------|-------|
| <i>Abutilon halophilum</i>                  | 2    | 1     | N       | E                      |           | F             | Insect        |       |
| <i>Acacia aneura</i>                        |      |       | T       | 9 dead <sup>fire</sup> |           |               | Fire, borers  |       |
| <i>Aristida contorta</i>                    |      |       | 4       | VG                     |           | S             |               |       |
| <i>Aristida holathera ssp holathera</i>     |      |       | 3       | VG                     |           | S             |               |       |
| <i>Austrostipa nitida</i> / <i>scabra</i> x |      |       | N       | E                      |           | S             | Grazing       |       |
| <i>Eremophila glabra</i>                    |      | 1     | N       | E                      |           | F             |               |       |
| <i>Maireana eriantha</i> <sup>#</sup>       | 6    | 2     | T       | E                      | I         | F             |               |       |
| <i>Maireana georgei</i> <sup>#</sup>        |      | 10    | T       | E                      | I         | F             |               |       |
| <i>Panicum decompositum</i>                 |      |       | 1       | E                      |           |               |               |       |
| <i>Senna ft petiolaris</i> <sup>#</sup>     | 3    | 1     | T       | E                      |           | S             | Galls, insect |       |
| <i>Senna ft gawlerensis</i>                 | 4    | 3     | T       | VG <sup>1 dead</sup>   |           | S             | Gall, insect  |       |
| <i>Setaria constricta</i>                   |      |       | N       | E                      |           | S             |               |       |
| <i>Sida cunninghamii</i>                    |      |       | 4       | E                      |           | S,F           |               |       |
|                                             |      |       |         |                        |           |               |               |       |



| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Acacia aneura</i> Low Open Woodland +/- Mid Dense <i>Senna ft petiolaris</i> , <i>Dodonaea microzyga ssp microzyga</i> , <i>Maireana eriantha</i> , <i>Maireana georgei</i> , <i>Atriplex vesicaria</i> , <i>Scaevola spinescens</i> , <i>Ptilotus obovatus</i> , <i>Solanum quadriloculatum</i> . Dense <i>Aristida contorta</i> , <i>Aristida holathera ssp holathera</i> , <i>Austrostipa nitida / scabra</i> , <i>Setaria constricta</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Fire scars on <i>A. aneura</i> stumps indicate wildfire burnt through site c.20 years ago. Annual / perennial grasses in abundance with the majority in late stages of seed shed. Impacts restricted to old fire, borers, Galls on acacias and grazing by kangaroos and cattle.<br><b>Leaf Litter:</b> 70% >3mm diam. <b>Cryptograms:</b> Moss <1% |      |       |         |           |           |               |                                 |              |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|---------------------------------|--------------|--|
| <b>Species 30 x 30m Quadrat 3 PK SD1-3 C</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       |         |           |           |               |                                 |              |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact                          | Other        |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | 5       | VG        |           | S             | grazing                         |              |  |
| <i>Aristida holathera ssp holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | 2       | VG        |           | S             |                                 |              |  |
| <i>Austrostipa nitida / scabra x</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | N       | Fair      |           | S             | Grazing                         |              |  |
| <i>Duboisia hopwoodii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | N       | E         |           | F             |                                 | Single plant |  |
| <i>Eremophila glabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | N       | E         |           | F             | scale                           | Single plant |  |
| <i>Maireana eriantha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 76    | 1       | VG        | I         | S             |                                 |              |  |
| <i>Maireana georgei</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 42    | T       | VG        | I         | S             |                                 |              |  |
| <i>Maireana sedifolia</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | 1     | N       | E         |           | Bud           |                                 | Single Plant |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | 3       | E         |           | S             | Grazing                         |              |  |
| <i>Senna ft petiolaris</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4    | 19    | N       | VG        |           | F,S           | Case moth, Borers, Beetle       |              |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | T       | VG        |           | S             |                                 |              |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | 1       |           |           |               |                                 |              |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | 1       | Excellent |           | S             | Hopping Mice consumed 100% seed |              |  |



| WEED SPECIES | ABUNDANCE | FAUNAL HABITAT                                                                                                                                                                                                                       | FAUNAL SPECIES RECORDED           | Opportunity             |
|--------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------|
|              |           | Due to good seasonal rains and the ensuing cover of herbs and grasses the habitat value is considered to be Excellent for the 01 control site. 5 bird species recorded nesting in Shrublands adjacent to and within monitoring site. |                                   |                         |
|              |           |                                                                                                                                                                                                                                      | <i>Apeloecephala leucopsis</i>    | Southern White-face     |
|              |           |                                                                                                                                                                                                                                      | <i>Artamus personatus</i>         | Masked Wood-swallow     |
|              |           |                                                                                                                                                                                                                                      | <i>Colluricincla harmonica</i>    | Grey shrike thrush      |
|              |           |                                                                                                                                                                                                                                      | <i>Craticus torquatus</i>         | Grey Butcherbird        |
|              |           |                                                                                                                                                                                                                                      | <i>Ephthianura aurifrons</i>      | Orange Chat             |
|              |           | 3 species of ants, Ant Lions and 7 genera of ground dwelling spiders were recorded within quadrats. Insects well represented including parasitic wasps, Short Horned Grasshoppers and 1 native bee sp.                               | <i>Oreoica gutturalis</i>         | Crested Bellbird        |
|              |           |                                                                                                                                                                                                                                      | <i>Pomatostomus superciliosus</i> | White Browed Babbler    |
|              |           |                                                                                                                                                                                                                                      | <i>Psophodes occidentalis</i>     | Chiming Wedgebill       |
|              |           |                                                                                                                                                                                                                                      | <i>Taeniopygia guttata</i>        | Zebra Finch             |
|              |           |                                                                                                                                                                                                                                      |                                   |                         |
|              |           |                                                                                                                                                                                                                                      | <i>Macropus fuliginosus</i>       | Western Grey Kangaroo   |
|              |           | Notomys mitchellii and Varanus gouldii tracks were common across all quadrats.                                                                                                                                                       | <i>Notomys mitchellii</i>         | Mitchell's Hopping Mice |
|              |           |                                                                                                                                                                                                                                      | <i>Varanus gouldii</i>            | Gould's Goanna          |

**PK01 Control – Photo Point Image**



## 2.0 – PK SD2-1 Impact

| Site Location - ID | Surveyed by:                                                       | Project Controller                     | Date                                                  |
|--------------------|--------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------|
| PK SD2-1 Impact    | L. Bebbington – Land Management Consultant                         | Graeme Noll – Manager Env. Coober Pedy | 4.11.11                                               |
|                    | <b>Weather</b><br>70% cloud<br>Ambient temperature 32 <sup>0</sup> | <b>Rainfall past 30 days</b><br>Yes    | <b>Landform / Aspect</b><br>South facing gibber Plain |
| Photographs        | General: PPoint: 42 Indicator Plants: 43, 44                       |                                        |                                                       |

| Photo point Map No. SD 2 I                  | Ref Tag No: PK 02 I |         |         |         |         |         |         |         |         |         |
|---------------------------------------------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Quadrat Co-ordinates<br>Layout as per Pg. 6 | A                   | B       | C       | D       | E       | F       | G       | H       | I       | J       |
| Easting                                     | 0503924             | 0503915 | 0503944 | 0503952 | 0503957 | 0503986 | 0503980 | 0503973 | 0504004 | 0504009 |
| Northing                                    | 6735781             | 6735807 | 6735815 | 6735786 | 6735756 | 6735765 | 6735796 | 6735825 | 6735835 | 6735805 |

| SOIL |                           |                                |      |                   |            |
|------|---------------------------|--------------------------------|------|-------------------|------------|
|      | DUST DEPOSIT DEPTH<br>0mm |                                | TYPE | SOIL TEMP.        |            |
|      |                           |                                |      | Dust Coated       | pH         |
|      |                           |                                |      | Natural           | MOISTURE % |
|      |                           | Sandy clay with surface gibber |      | 57.4 <sup>0</sup> | 6.8        |
|      |                           |                                |      |                   | 25%        |









| PK SD 2-1 Impact Transect                |                 |           |                           |             |     |                          |                           |                                               |
|------------------------------------------|-----------------|-----------|---------------------------|-------------|-----|--------------------------|---------------------------|-----------------------------------------------|
| DUST MONITORING                          |                 |           |                           |             |     |                          |                           |                                               |
| Indicator Species                        | Canopy Dusting% | Leaf Type | Dust Load (leaf)<br>L,M,H | Soil colour | pH  | H <sub>2</sub> O Content | Soil Temp<br>Dust Natural | Background Dust Sources                       |
| <i>Atriplex vesicaria</i> <sup>#</sup>   | 10%             | mealy     | L                         | R gibber    | 6.8 | 25%                      | 57.4                      | Bulldust from adjacent pipeline track traffic |
| <i>Maireana astrotricha</i> <sup>#</sup> | 80%             | ADX, ABX  | M                         |             |     |                          |                           | Bulldust from adjacent pipeline track traffic |
|                                          |                 |           |                           |             |     |                          |                           |                                               |
|                                          |                 |           |                           |             |     |                          |                           |                                               |
|                                          |                 |           |                           |             |     |                          |                           |                                               |
|                                          |                 |           |                           |             |     |                          |                           |                                               |



## PK02 Impact – Photo Point Image



## 2.2 – PK SD2-3 Control

| Site Location - ID                                 | Surveyed by:                                                                  |                                        | Project Controller                                          | Date                                      |                   |                   |           |                   |          |          |
|----------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------|-------------------------------------------|-------------------|-------------------|-----------|-------------------|----------|----------|
| PK SD2-3 Control                                   | L. Bebbington – Land Management Consultant                                    | Graeme Noll – Manager Env. Coober Pedy | 1.11.11                                                     |                                           |                   |                   |           |                   |          |          |
|                                                    | <b>Weather</b><br>Mild, 2% cloud cover<br>Ambient temperature 30 <sup>o</sup> | <b>Rainfall past 30 days</b><br>Yes    | <b>Landform / Aspect</b><br>Nth facing angular rubble slope |                                           |                   |                   |           |                   |          |          |
| <b>Photographs</b>                                 | <b>General:</b>                                                               | <b>PPoint:</b> 13                      | <b>Indicator Plants:</b> 14, 15                             |                                           |                   |                   |           |                   |          |          |
| <b>Photo point Map No. SD2 C</b>                   | <b>Ref Tag No: PK 02 C</b>                                                    |                                        |                                                             |                                           |                   |                   |           |                   |          |          |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                      | <b>B</b>                               | <b>C</b>                                                    | <b>D</b>                                  | <b>E</b>          | <b>F</b>          | <b>G</b>  | <b>H</b>          | <b>I</b> | <b>J</b> |
| <b>Easting</b>                                     | 0503857                                                                       | 0503882                                | 0503820                                                     | 0503838                                   | 0503857           | 0503882           | 0503861   | 0503845           | 0503865  | 0503883  |
| <b>Northing</b>                                    | 6735960                                                                       | 6735985                                | 6736007                                                     | 6735984                                   | 6735960           | 6735976           | 6736001   | 6736024           | 6736041  | 6736022  |
| <b>SOIL</b>                                        |                                                                               |                                        |                                                             |                                           |                   |                   |           |                   |          |          |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                                     |                                        |                                                             | <b>TYPE</b>                               | <b>SOIL TEMP.</b> |                   | <b>pH</b> | <b>MOISTURE %</b> |          |          |
|                                                    | 0mm                                                                           |                                        |                                                             |                                           | Dust Coated       | Natural           |           |                   |          |          |
|                                                    |                                                                               |                                        |                                                             | red sand <5% clay<br>Angular rubble >25mm |                   | 49.2 <sup>o</sup> | 7         | <1%               |          |          |

| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Maireana eriantha</i> / <i>Maireana astrotricha</i> Low Chenopod Shrubland+/- Very Sparse <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Zygophyllum ammophilum</i> , <i>Enneapogon avenaceus</i><br><b>Health:</b> Excellent for landform type due to above average rainfall in past 12 months. Canopy cover averages 60% for transect.<br><b>Leaf Litter:</b> <5%% >3mm diam. <b>Cryptograms:</b> 0 |      |       |         |           |           |               |                |       |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 1</u> PK SD2-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       |         |           |           |               |                |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <29%    | senescing |           | S             |                |       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <5%     | Senescing |           | S             |                |       |  |
| <i>Atriplex vesicaria</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | 19    | <10%    | Very Good | I         | S             | Rabbit grazing |       |  |
| <i>Maireana eriantha</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 117   | <60%    | Very Good | I         | S             | Rabbits        |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     | Senescing |           | S             |                |       |  |
| <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Good      |           | S             |                |       |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Very Good |           | S             |                |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       |         |           |           |               |                |       |  |

| <b>Vegetation Community 100 x 100m:</b> Sparse – Mid Dense <i>Maireana eriantha</i> / <i>Maireana astrotricha</i> Low Chenopod Shrubland+/- Very Sparse <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Zygophyllum ammophilum</i> , <i>Zygophyllum howittii</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months.<br><b>Leaf Litter:</b> <5% >3mm diam. <b>Cryptograms:</b> 0 |      |       |         |           |           |               |         |       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|---------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD2-3 C</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       |         |           |           |               |         |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact  | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <20%    | senescing |           | S             | Rabbits |       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <10%    | senescing |           | S             |         |       |  |
| <i>Atriplex vesicaria</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 46    | <20%    | Excellent | I         | S             |         |       |  |
| <i>Maireana astrotricha</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 139   | <50%    | Excellent | I         | S,F           |         |       |  |
| <i>Maireana eriantha</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 32    | <10     | Very Good | I         | S             |         |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <2%     | senescing |           | S             | Rabbits |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <1%     | Fair      |           | S             |         |       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | senescing |           | S             |         |       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Good      |           | F             |         |       |  |
| <i>Zygophyllum ammophilum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Very Good |           | F             | Rabbits |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Good      |           | S             |         |       |  |



| DUST MONITORING   |                                                                             | PK SD2-3 Control Transect |                             |                                                           |    |                          |                   |                      |                            |  |  |
|-------------------|-----------------------------------------------------------------------------|---------------------------|-----------------------------|-----------------------------------------------------------|----|--------------------------|-------------------|----------------------|----------------------------|--|--|
| Indicator Species | Canopy Dusting%                                                             | Leaf Type                 | Dust Load (leaf)<br>L, M, H | Soil colour                                               | pH | H <sub>2</sub> O Content | Soil Temp<br>Dust | Soil Temp<br>Natural | Background<br>Dust Sources |  |  |
|                   |                                                                             |                           |                             | R with<br>>25mm<br>angular<br>surface<br>strewn<br>rubble | 7  | 0%                       |                   | 49.2                 | Minimal<br>natural         |  |  |
|                   | Nil - All Spp.<br>Due to recent rain<br>and distance from<br>pipeline track |                           |                             |                                                           |    |                          |                   |                      |                            |  |  |
|                   |                                                                             |                           |                             |                                                           |    |                          |                   |                      |                            |  |  |
|                   |                                                                             |                           |                             |                                                           |    |                          |                   |                      |                            |  |  |
|                   |                                                                             |                           |                             |                                                           |    |                          |                   |                      |                            |  |  |
|                   |                                                                             |                           |                             |                                                           |    |                          |                   |                      |                            |  |  |



| WEED SPECIES | ABUNDANCE | FAUNAL HABITAT                                                                                                                                                                   | FAUNAL SPECIES RECORDED              |                       | Opportunity |
|--------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|-------------|
|              |           | Due to good seasonal rains the Sparse to Mid Dense shrub and grass cover at the time of survey provides a higher habitat value for this landform than in average rainfall years. |                                      |                       |             |
|              |           |                                                                                                                                                                                  | <i>Apeloecephala leucopsis</i>       | Southern White-face   |             |
|              |           |                                                                                                                                                                                  | <i>Ephthianura aurifrons</i>         | Orange Chat           |             |
|              |           |                                                                                                                                                                                  | <i>Peltohyas australis</i>           | Inland Dotterel       |             |
|              |           |                                                                                                                                                                                  | <i>Taeniopygia guttata</i>           | Zebra Finch           |             |
|              |           | 1 species of ant, Ant Lions and 3 genera of ground dwelling spiders were recorded within quadrats.                                                                               |                                      |                       |             |
|              |           |                                                                                                                                                                                  | <i>Ctenophorus Isolepis</i>          | Military Dragon       |             |
|              |           |                                                                                                                                                                                  | <i>Tympanocryptis intima</i>         | Gibber Earless Dragon |             |
|              |           | Earless Dragons present throughout including gravid females.                                                                                                                     | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon |             |
|              |           |                                                                                                                                                                                  |                                      |                       |             |
|              |           |                                                                                                                                                                                  |                                      |                       |             |
|              |           |                                                                                                                                                                                  |                                      |                       |             |
|              |           |                                                                                                                                                                                  |                                      |                       |             |

## PK02 Control – Photo Point Image



### 3.0 – PK SD3-1 Impact

| Site Location - ID                          | Surveyed by:                                                          | Project Controller                     | Date                                                                                             |                   |         |         |            |         |         |         |
|---------------------------------------------|-----------------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------|-------------------|---------|---------|------------|---------|---------|---------|
| PK SD3-1 Impact                             | L. Bebbington – Land Management Consultant                            | Graeme Noll – Manager Env. Coober Pedy | 4.11.11                                                                                          |                   |         |         |            |         |         |         |
|                                             | Weather<br><br>85% cloud cover<br>Ambient temperature 33 <sup>0</sup> | Rainfall past 30 days<br><br>Yes       | Landform / Aspect<br><br>Undulating outwash plain with minor drainage lines falling to the south |                   |         |         |            |         |         |         |
| Photographs                                 | General:                                                              | PPoint: 39                             | Indicator Plants: 40, 41                                                                         |                   |         |         |            |         |         |         |
| Photo point Map No. SD3 I                   | Ref Tag No: PK 03 I                                                   |                                        |                                                                                                  |                   |         |         |            |         |         |         |
| Quadrat Co-ordinates<br>Layout as per Pg. 6 | A                                                                     | B                                      | C                                                                                                | D                 | E       | F       | G          | H       | I       | J       |
| Easting                                     | 0515545                                                               | 0515547                                | 0515580                                                                                          | 0515572           | 0515565 | 0515597 | 0515601    | 0515607 | 0515639 | 0515631 |
| Northing                                    | 6727460                                                               | 6727490                                | 6727485                                                                                          | 6727457           | 6727428 | 6727424 | 6727452    | 6727481 | 6727477 | 6727448 |
| SOIL                                        |                                                                       |                                        |                                                                                                  |                   |         |         |            |         |         |         |
|                                             | DUST DEPOSIT DEPTH                                                    | TYPE                                   |                                                                                                  | SOIL TEMP.        |         | pH      | MOISTURE % |         |         |         |
|                                             | 0mm                                                                   |                                        |                                                                                                  | Dust Coated       | Natural |         |            |         |         |         |
|                                             |                                                                       | red clay prone to mild cracking        |                                                                                                  | 53.2 <sup>0</sup> |         | 6.8     | <1%        |         |         |         |

**Vegetation Community 100 x 100m:** Mid Dense *Atriplex vesicaria* Low Chenopod Shrubland+/- Sparse *Atriplex spongiosa*, *Maireana aphylla*, *Cullen graveolens*, *Sclerolaena cuneata*, *Salsola kali*, *Ptilotus sessilifolius* ssp *sessilifolius*, *Solanum quadriloculatum*, *Aristida contorta*, *Aristida holathera* ssp *holathera*, *Austrostipa nitida* / *scabra*, *Zygophyllum ammophilum*, *Enneapogon avenaceus*

**Health:** Excellent for landform type due to above average rainfall in past 12 months. Canopy cover averages 85% for transect of which 50% consists of dormant grass species. Recently grazed by cattle.

**Leaf Litter:** <30% >3mm diam. **Cryptograms:** 0

**Species 30 x 30m Quadrat 1 PK SD3-1 Impact**

| # = indicator Spp.                             | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact                     | Other |
|------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------------------|-------|
| <i>Aristida contorta</i>                       |      |       | 20%     | senescing |           | S             | Cattle grazing             |       |
| <i>Aristida holathera</i> ssp <i>holathera</i> |      |       | <10%    | senescing |           | S             | Cattle grazing             |       |
| <i>Atriplex spongiosa</i>                      |      | 4     | <2%     | Excellent |           | S             |                            |       |
| <i>Atriplex vesicaria</i> <sup>#</sup>         | 2    | 26    | <10     | Excellent | I         |               |                            |       |
| <i>Cullen graveolens</i>                       |      |       | <1%     | Excellent |           | F             |                            |       |
| <i>Digitaria brownii</i>                       |      |       | <5%     | senescing |           | S             |                            |       |
| <i>Gnephosis arachnoides</i>                   |      |       | <1%     | Very Good |           | F             | Cattle Grazing             |       |
| <i>Maireana aphylla</i> <sup>#</sup>           | 2    | 2     | <1%     | Excellent | I         | F             | insect                     |       |
| <i>Panicum decompositum</i>                    |      |       | <10%    | senescing |           | S             | Cattle Grazing             |       |
| <i>Salsola kali</i>                            |      |       | <1%     | Very Good |           | S             |                            |       |
| <i>Sclerolaena cuneata</i>                     |      |       | <2%     | Excellent |           | S             |                            |       |
| <i>Setaria constricta</i>                      |      |       | <2%     | senescing |           | S             | Cattle grazing             |       |
| <i>Sida cunninghamii</i>                       |      |       | <1%     | Excellent |           | F             |                            |       |
| <i>Solanum quadriloculatum</i>                 |      |       | <1%     | Excellent |           | S             | Native rats consuming seed |       |
| <i>Zygophyllum ammophilum</i>                  |      |       | <1%     | Excellent |           | S             |                            |       |
| <i>Zygophyllum howittii</i>                    |      |       | <1%     | Excellent |           | F             |                            |       |

| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex spongiosa</i> , <i>Maireana aphylla</i> , <i>Atriplex nummularia</i> complex <i>Cullen graveolens</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> , <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Zygophyllum howittii</i> , <i>Marsilea drummondii</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Recently grazed by cattle.<br><b>Leaf Litter:</b> 70% >3mm diam. <b>Cryptograms:</b> Lichen <1% |      |       |         |           |           |               |                |       |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD3-1 I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       |         |           |           |               |                |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | 10%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <5%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 18   | 29    | <10%    | Excellent |           | S             |                |       |  |
| <i>Atriplex nummularia</i> complex                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 21    | <10%    | Excellent |           | F,S           | Cattle grazing |       |  |
| <i>Atriplex vesicaria</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2    | 82    | <20%    | Excellent | I         |               | Cattle grazing |       |  |
| <i>Cullen graveolens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Excellent |           | F             |                |       |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | senescing |           | S             |                |       |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | Very Good |           | F             | Cattle Grazing |       |  |
| <i>Maireana aphylla</i> *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | 6     | <2%     | Excellent | I         | F             | insect         |       |  |
| <i>Marsilea drummondii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <5%     | Good      |           | S             | Cattle pugging |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <5%     | senescing |           | S             | Cattle Grazing |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Very Good |           | S             |                |       |  |
| <i>Sclerolaena cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <2%     | Excellent |           | S             |                |       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Excellent |           | F             |                |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <1%     | Excellent |           | S             | Native rats    |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | Excellent |           | F             |                |       |  |

| <b>Vegetation Community 100 x 100m:</b> <i>Aristida contorta</i> / <i>Panicum decompositum</i> / <i>Astrebla pectinata</i> Tussock Grassland +/- emergent <i>Atriplex vesicaria</i> , <i>Atriplex spongiosa</i> , <i>Atriplex lindleyi</i> ssp <i>conduplicata</i> , <i>Maireana aphylla</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> ,<br><b>Health:</b> Excellent rainfall in past 12 months. Native grassland dominates 90% of quadrat with chenopods restricted to drainage line.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Moss 0% |      |       |         |           |           |               |                |       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 3</u> PK SD 3-1 I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       |         |           |           |               |                |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | 20%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <5%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | 20%     | Very Good |           | S             | Cattle grazing |       |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4    | 5     | <2%     | Excellent |           | S             |                |       |  |
| <i>Atriplex lindleyi</i> ssp <i>conduplicata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6    |       | <1%     | Excellent | I         | F,S           |                |       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 67    | <20%    | Excellent | I         |               | Cattle grazing |       |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <10%    | senescing |           | S             |                |       |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <5%     | Very Good |           | F             | Cattle Grazing |       |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 3     | <1%     | Excellent | I         | F             | insect         |       |  |
| <i>Marsilea drummondii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Good      |           | S             | Cattle grazing |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <10%    | senescing |           | S             | Cattle Grazing |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | Very Good |           | S             |                |       |  |
| <i>Sclerolaena cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <2%     | Excellent |           | S             |                |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Excellent |           | S             | Native rats    |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | F             |                |       |  |



| WEED SPECIES                   | ABUNDANCE                                                  | FAUNAL HABITAT                                                                                                                                                                                                                                                               | FAUNAL SPECIES RECORDED              | Opportunity           |
|--------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|
| <i>Malvastrum americanum</i> * | Very Sparse introduced by cattle – widespread in bioregion | <p>Due to good seasonal rains the Sparse to Mid Dense shrub and Dense grass cover at the time of survey provides a higher habitat value for this landform than in average rainfall years.</p> <p>3 species of ant and 6 genera of spiders were recorded within quadrats.</p> |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Aphelocephala leucopsis</i>       | Southern White-face   |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Aquila audax</i>                  | Wedge Tail Eagle      |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Elanus scriptus</i>               | Letter Winged Kite    |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Ephthianura aurifrons</i>         | Orange Chat           |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Falco berigora</i>                | Brown Falcon          |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Falco subniger</i>                | Black Falcon          |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Peltohyas australis</i>           | Inland Dotterel       |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Taeniopygia guttata</i>           | Zebra Finch           |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Ctenophorus isolepis</i>          | Military Dragon       |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Tympanocryptis intima</i>         | Gibber Earless Dragon |
|                                |                                                            |                                                                                                                                                                                                                                                                              | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon |
|                                |                                                            |                                                                                                                                                                                                                                                                              |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                              |                                      |                       |



## PK03 Impact – Photo Point Image



### 3.1 – PK SD3-3 Control

| Site Location - ID                          |  | Surveyed by:                                                         |         | Project Controller                             |         | Date                                                                                                         |         |                                    |         |               |         |
|---------------------------------------------|--|----------------------------------------------------------------------|---------|------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------|---------|------------------------------------|---------|---------------|---------|
| PK SD3-3 Control                            |  | L. Bebbington – Land Management Consultant                           |         | Graeme Noll – Manager Env. Coober Pedy         |         | 2.11.11                                                                                                      |         |                                    |         |               |         |
|                                             |  | Weather<br><br>5% cloud cover<br>Ambient temperature 28 <sup>0</sup> |         | Rainfall past 30 days<br><br>Yes               |         | Landform / Aspect<br><br>Undulating outwash plain with north facing drainage depression falling to the south |         |                                    |         |               |         |
| Photographs                                 |  | General:                                                             |         | PPoint: 16                                     |         | Indicator Plants: 17, 18, 19                                                                                 |         |                                    |         |               |         |
| Photo point Map No. SD 3 C                  |  | Ref Tag No: PK 03 C                                                  |         |                                                |         |                                                                                                              |         |                                    |         |               |         |
| Quadrat Co-ordinates<br>Layout as per Pg. 6 |  | A                                                                    | B       | C                                              | D       | E                                                                                                            | F       | G                                  | H       | I             | J       |
| Easting                                     |  | 0515906                                                              | 0515891 | 0515912                                        | 0515933 | 0515957                                                                                                      | 0515974 | 0515954                            | 0515933 | 0515950       | 0515973 |
| Northing                                    |  | 6727459                                                              | 6727488 | 6727513                                        | 6727491 | 6727470                                                                                                      | 6727495 | 6727515                            | 6727534 | 6727558       | 6727540 |
| SOIL                                        |  |                                                                      |         |                                                |         |                                                                                                              |         |                                    |         |               |         |
|                                             |  | DUST DEPOSIT DEPTH                                                   |         | TYPE                                           |         | SOIL TEMP.                                                                                                   |         | pH                                 |         | MOISTURE %    |         |
|                                             |  | 0mm                                                                  |         |                                                |         | Dust Coated                                                                                                  |         | Natural                            |         |               |         |
|                                             |  |                                                                      |         | red cracking clay with strewn limestone rubble |         |                                                                                                              |         | 29.8 <sup>0</sup> <sub>8.30a</sub> |         | 7.2<br><br>4% |         |

| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex nummularia</i> complex, <i>Maireana aphylla</i> , <i>Cullen graveolens</i> , <i>Sclerolaena cuneata</i> , <i>Rhagodia spinescens</i> , <i>Salsola kali</i> , <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriculatum</i> , <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Zygophyllum ammophilum</i> ,<br><b>Health:</b> Excellent for landform type due to above average rainfall in past 12 months. Canopy cover averages 85% for transect. Annual herbs entering die back. Recently grazed by cattle.<br><b>Leaf Litter:</b> <15% >3mm diam. <b>Cryptograms:</b> Nil Moss / Lichens – very sparse <i>Podaxis</i> sp. fungal fruiting bodies |      |       |         |           |           |               |                    |       |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|--------------------|-------|--|
| <b>Species 30 x 30m Quadrat 1 PK SD3-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |         |           |           |               |                    |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact             | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <5%     | senescing |           | S             | Cattle grazing     |       |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | senescing |           |               | Cattle grazing     |       |  |
| <i>Atriplex nummularia</i> complex <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | 12    | <5%     | Excellent |           | F             | Cattle grazing     |       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      | 70    | 50%     | Very Good | I         | S             | Cattle grazing     |       |  |
| <i>Cullen graveolens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Excellent |           | F             |                    |       |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <5%     | Senescing |           | S             |                    |       |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | Very Good |           | F             | Cattle Grazing     |       |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 1     | <1%     | Excellent |           | F             | insect             |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | senescing |           | S             | Cattle Grazing     |       |  |
| <i>Rhagodia spinescens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | 5     | <1%     | Excellent |           | F             |                    |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <5%     | Very Good |           | S             |                    |       |  |
| <i>Sclerolaena cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <5%     | Very Good |           | S             |                    |       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | senescing |           | S             | Cattle grazing     |       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Fair      |           | S             |                    |       |  |
| <i>Solanum quadriculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Good      |           | S             | Native rats / mice |       |  |
| <i>Zygophyllum ammophilum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Very Good |           | F             |                    |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Fair      |           | S             |                    |       |  |

| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex spongiosa</i> , <i>Rhagodia spinescens</i> , <i>Maireana aphylla</i> , <i>Atriplex nummularia</i> complex <i>Cullen australasicum</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Aristida holathera ssp holathera</i> , <i>Zygophyllum howittii</i> ,<br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Recently grazed by cattle. Canopy cover 75%. Annuals entering dieback .<br><b>Leaf Litter:</b> 70% >3mm diam. <b>Cryptograms:</b> Lichen <1% |      |       |         |           |           |               |                |       |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Species 30 x 30m Quadrat 2 PK SD3-3 C</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       |         |           |           |               |                |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Aristida holathera ssp holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 19   | 5     | <5%     | Excellent |           | S             | Cattle grazing |       |  |
| <i>Atriplex nummularia</i> complex                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6    | 3     | <1%     | Excellent |           | F,S           | Cattle grazing |       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 15   | 16    | <10%    | Excellent | I         | F,S           | Cattle grazing |       |  |
| <i>Cullen australasicum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Excellent |           | F             |                |       |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | senescing |           | S             |                |       |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | senescing |           | S             | Cattle Grazing |       |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 3     | <1%     | Excellent |           | F,S           |                |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | senescing |           | S             | Cattle Grazing |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <5%     | Fair      |           | S             |                |       |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | Fair      |           | S             |                |       |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Very Good |           | F             |                |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Fair      |           | S             | Native rats    |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <5%     | Very Good |           | F,s           |                |       |  |

**Vegetation Community 100 x 100m:** *Atriplex vesicaria* Low Chenopod Shrubland +/- Sparse Rhagodia spinescens, *Cullen australasicum*, *Sclerolaena cuneata*, *Sclerolaena diacantha*, *Sclerolaena divaricata*, *Salsola kali*, *Solanum quadriculatum*, *Lotus cruentus*, *Eriophyllum eldieri*, *Astrebla pectinata*, *Enteropogon acicularis*, *Aristida contorta*, *Aristida holathera* ssp *holathera*, *Zygophyllum howittii*,  
**Health:** Excellent rainfall in past 12 months. Annual herbs and grasses entering dieback. Canopy cover 50%

**Leaf Litter:** <20% >3mm diam. **Cryptograms:** Moss 0% Fungi *Podaxis* sp.

| Species 30 x 30m Quadrat 3 PK SD 3-3 C  |      |       |         |           |          |               |                |       |
|-----------------------------------------|------|-------|---------|-----------|----------|---------------|----------------|-------|
| # = indicator Spp.                      | Juv. | Adult | % Cover | Health    | Increase | Flower / Seed | Impact         | Other |
| <i>Aristida contorta</i>                |      |       | <5%     | senescing |          | S             | Cattle grazing |       |
| <i>Aristida holathera ssp holathera</i> |      |       | <5%     | senescing |          | S             | Cattle grazing |       |
| <i>Astrebla pectinata</i>               |      |       | 5%      | Very Good |          | S             | Cattle grazing |       |
| <i>Atriplex quinif</i> <sup>#</sup>     |      |       | <1%     | Very good |          | S             |                |       |
| <i>Atriplex vesicaria</i> <sup>#</sup>  |      | 3     | <1%     | Excellent | I        | S             | Cattle grazing |       |
| <i>Brachyscome ciliaris</i>             |      |       | <5%     | Good      |          | S             |                |       |
| <i>Cullen australasicum</i>             |      |       | <2%     | Excellent |          | F             |                |       |
| <i>Digitaria brownii</i>                |      |       | <5%     | senescing |          | S             |                |       |
| <i>Gnephosis arachnoides</i>            |      |       | <10%    | Very Good |          | F             | Cattle Grazing |       |
| <i>Minuria rigida</i>                   |      |       | <5%     | Good      |          | S             |                |       |
| <i>Panicum decompositum</i>             |      |       | <10%    | senescing |          | S             | Cattle Grazing |       |
| <i>Rhagodia spinescens</i>              |      |       | <5%     | Excellent |          | F,S           |                |       |
| <i>Salsola kali</i>                     |      |       | <1%     | Very Good |          | S             |                |       |
| <i>Sclerolaena cuneata</i>              |      |       | <2%     | Excellent |          | S             |                |       |
| <i>Sida fibulifera</i>                  |      |       | <5%     | Very good |          | S             |                |       |
| <i>Zygophyllum howittii</i>             |      |       | <1%     | Excellent |          | F             |                |       |



| WEED SPECIES                   | ABUNDANCE                                                  | FAUNAL HABITAT                                                                                                                                                                                                                                                                                                                                                                                                                       | FAUNAL SPECIES RECORDED              | Opportunity           |
|--------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|
| <i>Malvastrum americanum</i> * | Very Sparse introduced by cattle – widespread in bioregion | Although the herbs and grasses at the site were entering dieback due to moisture stress it is obvious that the site in the month prior to survey would have provided very good habitat for a range of faunal species. Cracking clays provide refuge for a range of invertebrates and vertebrate species.<br><br>High numbers of foxes and feral cats.<br><br>2 species of ant and 5 genera of spiders were recorded within quadrats. |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Elanus axillaris</i>              | Black Shouldered Kite |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Elanus scriptus</i>               | Letter Winged Kite    |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Ephthianura aurifrons</i>         | Orange Chat           |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Falco berigora</i>                | Brown Falcon          |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Falco subniger</i>                | Black Falcon          |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Peltohyas australis</i>           | Inland Dotterel       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Taeniopygia guttata</i>           | Zebra Finch           |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Ctenophorus isolepis</i>          | Military Dragon       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                       |

## PK03 Control – Photo Point Image





#### 4.0 – PK SD4-1 Impact

| Site Location - ID                          |                    | Surveyed by:                                                          |                                       | Project Controller                     |             | Date                                                          |                                    |         |            |         |         |
|---------------------------------------------|--------------------|-----------------------------------------------------------------------|---------------------------------------|----------------------------------------|-------------|---------------------------------------------------------------|------------------------------------|---------|------------|---------|---------|
| PK SD4-1 Impact                             |                    | L. Bebbington – Land Management Consultant                            |                                       | Graeme Noll – Manager Env. Coober Pedy |             | 4.11.11                                                       |                                    |         |            |         |         |
|                                             |                    | Weather<br><br>85% cloud cover<br>Ambient temperature 28 <sup>o</sup> |                                       | Rainfall past 30 days<br><br>Yes       |             | Landform / Aspect<br><br>Undulating south facing gibber plain |                                    |         |            |         |         |
| Photographs                                 |                    | General:                                                              |                                       | PPoint: 35                             |             | Indicator Plants: 36,37                                       |                                    |         |            |         |         |
| Photo point Map No. SD 4 I                  |                    | Ref Tag No: PK 04 1                                                   |                                       |                                        |             |                                                               |                                    |         |            |         |         |
| Quadrat Co-ordinates<br>Layout as per Pg. 6 |                    | A                                                                     | B                                     | C                                      | D           | E                                                             | F                                  | G       | H          | I       | J       |
| Easting                                     |                    | 0525861                                                               | 0525847                               | 0525820                                | 0525832     | 0525844                                                       | 0525816                            | 0525805 | 0525795    | 0525764 | 0525776 |
| Northing                                    |                    | 6720007                                                               | 6721997                               | 6719910                                | 6720018     | 6720047                                                       | 6720059                            | 6720033 | 6720005    | 6720014 | 6720041 |
| SOIL                                        |                    |                                                                       |                                       |                                        |             |                                                               |                                    |         |            |         |         |
|                                             | DUST DEPOSIT DEPTH |                                                                       | TYPE                                  |                                        | SOIL TEMP.  |                                                               | pH                                 |         | MOISTURE % |         |         |
|                                             | 0mm                |                                                                       |                                       |                                        | Dust Coated |                                                               | Natural                            |         |            |         |         |
|                                             |                    |                                                                       | red clay with strewn limestone rubble |                                        |             |                                                               | 30.8 <sup>0</sup> <sub>9.30a</sub> |         | 7          |         | 2%      |

| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex spongiosa</i> , <i>Maireana astrotricha</i> , <i>Eremophila rotundifolia</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> , <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Zygophyllum ammophilum</i> ,<br><b>Health:</b> Excellent for landform type due to above average rainfall in past 12 months. Canopy cover averages 70% for transect.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Nil Moss / Lichens |      |       |         |           |           |               |        |       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|--------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 1</u> PK SD4-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       |         |           |           |               |        |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Very Good |           | S             |        |       |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1    | 21    | <20%    | Excellent |           | S             |        |       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 23    | <20%    | Excellent | I         | S             |        |       |  |
| <i>Austrostipa nitida</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Very Good |           | S             |        |       |  |
| <i>Eremophila rotundifolia</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Excellent |           | F             |        |       |  |
| <i>Maireana astrotricha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 2     | <1%     | Very Good | I         | B             |        |       |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Excellent |           | F             |        |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | senescing |           | S             |        |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <10%    | Very Good |           | S             |        |       |  |
| <i>Sclerolaena cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | Very Good |           | S             |        |       |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Fair      |           | S             |        |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Good      |           | S             |        |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Fair      |           | S             |        |       |  |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex spongiosa</i> , <i>Maireana astrotricha</i> , <i>Eremophila rotundifolia</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> , <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Zygophyllum ammophilum</i> ,<br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover 80%.<br><b>Leaf Litter:</b> 20% >3mm diam. <b>Cryptograms:</b> 0 |      |       |         |           |           |               |        |       |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|--------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD4-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       |         |           |           |               |        |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact | Other |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Very Good |           | S             |        |       |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1    | 34    | <5%     | Excellent |           | S             |        |       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3    | 130   | <60%    | Excellent | I         | F,S           |        |       |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | senescing |           | S             |        |       |  |
| <i>Enneapogon avenaceus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <1%     | senescing |           | S             |        |       |  |
| <i>Eremophila rotundifolia</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1    | 9     | <5%     | Excellent |           | F             |        |       |  |
| <i>Maireana astrotricha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 26    | <5%     | Excellent | I         | S             |        |       |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Excellent |           | F,S           |        |       |  |
| <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | Excellent |           | F,S           |        |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <5%     | Fair      |           | S             |        |       |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | Fair      |           | S             |        |       |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <5%     | Very Good |           | F             |        |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Fair      |           | S             |        |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Very Good |           | F,s           |        |       |  |

| <b>Vegetation Community 100 x 100m:</b> : Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex spongiosa</i> , <i>Maireana astrotricha</i> , <i>Eremophila rotundifolia</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> , <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Aristida contorta</i> , <i>Zygophyllum ammophilum</i> ,<br><b>Health:</b> Excellent rainfall in past 12 months. Annual herbs and grasses entering dieback. Canopy cover 85%<br><b>Leaf Litter:</b> <20% >3mm diam. <b>Cryptograms:</b> Moss 0% Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |        |                                                                |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|--------|----------------------------------------------------------------|--|
| <b>Species 30 x 30m Quadrat 3 PK SD 4-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       |         |           |           |               |        |                                                                |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact | Other                                                          |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | Very Good |           | S             |        | Background<br>Dusting (very light staining)<br>from bare areas |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3    | 57    | <10%    | Excellent |           | S             |        |                                                                |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5    | 140   | 60%     | Excellent | I         | F,S           |        |                                                                |  |
| <i>Austrostipa nitida</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <5%     | Very Good |           | F             |        |                                                                |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | senescing |           | S             |        |                                                                |  |
| <i>Enneapogon avenaceus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     | Excellent |           | S             |        |                                                                |  |
| <i>Eremophila rotundifolia</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 4     | <1%     | Excellent |           | F,S           |        |                                                                |  |
| <i>Maireana astrotricha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 50    | <10%    | Excellent | I         | B             |        |                                                                |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Excellent |           | F             |        |                                                                |  |
| <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | F             |        |                                                                |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | Excellent |           | F,S           |        |                                                                |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Excellent |           | S             |        |                                                                |  |
| <i>Sclerolaena cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Excellent |           | S             |        |                                                                |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | F             |        |                                                                |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | Excellent |           | F             |        |                                                                |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     | Excellent |           | S             |        |                                                                |  |



| WEED SPECIES                   | ABUNDANCE                                                  | FAUNAL HABITAT                                                                                                                                                                                                                                                                                                | FAUNAL SPECIES RECORDED              | Opportunity           |
|--------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|
| <i>Malvastrum americanum</i> * | Very Sparse introduced by cattle – widespread in bioregion | <p>Very Good at time of survey as gibber plains with Dense chenopod shrub and native grass cover provide habitat for a range of faunal species.</p> <p>3 species of ant and 5 genera of spiders were recorded within quadrats.</p> <p>Foxes, feral cats and feral dogs in high numbers in adjacent areas.</p> |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               | <i>Elanus axillaris</i>              | Black Shouldered Kite |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               | <i>Elanus scriptus</i>               | Letter Winged Kite    |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               | <i>Ephthianura aurifrons</i>         | Orange Chat           |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               | <i>Peltohyas australis</i>           | Inland Dotterel       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               | <i>Taeniopygia guttata</i>           | Zebra Finch           |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |
|                                |                                                            |                                                                                                                                                                                                                                                                                                               |                                      |                       |

## PK04 Control – Photo Point Image



#### 4.1 – PK SD4-3 Control

| Site Location - ID                                 | Surveyed by:                                                                 |                             | Project Controller                      | Date                                                              |          |                   |                                                  |           |                   |          |
|----------------------------------------------------|------------------------------------------------------------------------------|-----------------------------|-----------------------------------------|-------------------------------------------------------------------|----------|-------------------|--------------------------------------------------|-----------|-------------------|----------|
| <b>PK SD4-3 Control</b>                            | L. Bebbington – Land Management Consultant                                   |                             | Graeme Noll – Manager Env. Coober Pedy  | 2.11.11                                                           |          |                   |                                                  |           |                   |          |
|                                                    | <b>Weather</b><br><br><1% cloud cover<br>Ambient temperature 28 <sup>o</sup> |                             | <b>Rainfall past 30 days</b><br><br>Yes | <b>Landform / Aspect</b><br><br>Undulating ironstone gibber plain |          |                   |                                                  |           |                   |          |
| <b>Photographs</b>                                 | <b>General:</b>                                                              | <b>PPoint:</b> 20           | <b>Indicator Plants:</b> 21             |                                                                   |          |                   |                                                  |           |                   |          |
| <b>Photo point Map No. SD 4 C</b>                  | <b>Ref Tag No: PK 04 C</b>                                                   |                             |                                         |                                                                   |          |                   |                                                  |           |                   |          |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                     | <b>B</b>                    | <b>C</b>                                | <b>D</b>                                                          | <b>E</b> | <b>F</b>          | <b>G</b>                                         | <b>H</b>  | <b>I</b>          | <b>J</b> |
| <b>Easting</b>                                     | 0525975                                                                      | 0525963                     | 0525935                                 | 0525949                                                           | 0525963  | 0525933           | 0525921                                          | 0525905   | 0525877           | 0525895  |
| <b>Northing</b>                                    | 6720338                                                                      | 6720311                     | 6720324                                 | 6720351                                                           | 6720380  | 6720390           | 6720364                                          | 6720335   | 6720349           | 6720376  |
| <b>SOIL</b>                                        |                                                                              |                             |                                         |                                                                   |          |                   |                                                  |           |                   |          |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                                    |                             |                                         | <b>TYPE</b>                                                       |          | <b>SOIL TEMP.</b> |                                                  | <b>pH</b> | <b>MOISTURE %</b> |          |
|                                                    | 0mm                                                                          |                             |                                         |                                                                   |          | Dust Coated       | Natural                                          |           |                   |          |
|                                                    |                                                                              | red clay / ironstone gibber |                                         |                                                                   |          |                   | 56.4 <sup>o</sup><br>60 <sup>o</sup><br>(gibber) | 6.8       | 12%               |          |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |         |           |           |               |                |       |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex lindleyi</i> ssp <i>conduplicata</i> , ,<br><i>Maireana astrotricha</i> , <i>Sclerolaena cuneata</i> , <i>Rhagodia spinescens</i> , <i>Salsola kali</i> , <i>Enneapogon polyphyllus</i><br><b>Health:</b> Excellent for landform type due to above average rainfall in past 12 months. Canopy cover averages 40% for transect.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Nil Moss / Lichens Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |       |  |
| <b>Species 30 x 30m <u>Quadrat 1</u> PK SD4-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       |         |           |           |               |                |       |  |
| <b># = indicator Spp.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Atriplex lindleyi</i> ssp <i>conduplicata</i> #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 42    | 20%     | Excellent |           | S             | Cattle grazing |       |  |
| <i>Atriplex vesicaria</i> #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 19    | 10%     | Excellent | I         | F,S           |                |       |  |
| <i>Enneapogon polyphyllus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <5%     | senescing |           | S             |                |       |  |
| <i>Maireana astrotricha</i> #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 2     | <1%     | Excellent | I         | S             |                |       |  |
| <i>Rhagodia spinescens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 3     | <1%     | Excellent |           | S             |                |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Very Good |           | S             |                |       |  |
| <i>Sclerolaena cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Good      |           | S             |                |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |         |           |           |               |                |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |         |           |           |               |                |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |         |           |           |               |                |       |  |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Atriplex Lindleyi</i> ssp <i>conduplicata</i> ,<br><i>Maireana astrotricha</i> , <i>Sclerolaena cuneata</i> , <i>Salsola kali</i> , <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> , <i>Solanum quadriloculatum</i> , <i>Enneapogon polyphyllus</i> ,<br><i>Zygophyllum ammophilum</i> ,<br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover 70%.<br><b>Leaf Litter:</b> 20% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |       |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD4-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       |         |           |           |               |                |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Atriplex lindleyi</i> ssp <i>conduplicata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7    | 267   | 50%     | Excellent |           | F,S           | Cattle grazing |       |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | 28    | 10%     | Excellent | I         | F,S           | Cattle grazing |       |  |
| <i>Enneapogon polyphyllus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <5%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Maireana astrotricha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      | 12    | <5%     | Excellent | I         | F             | Cattle grazing |       |  |
| <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Very Good |           | F             |                |       |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <1%     | Excellent |           | S             |                |       |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     | senescing |           | S             |                |       |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Good      |           | S             |                |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | Very Good |           | S             |                |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | good      |           | S             |                |       |  |

**Vegetation Community 100 x 100m:** : Dense *Atriplex vesicaria* Low Chenopod Shrubland+/- Sparse *Atriplex nummularia* complex, *Maireana astrotricha*, *Sclerolaena cuneata*, *Salsola kali*, *Ptilotus sessilifolius* ssp *sessilifolius*, *Solanum quadriculatum*, *Aristida contorta*, *Zygophyllum ammophilum*,

**Health:** Excellent due to rainfall in past 12 months. Annual herbs and grasses entering dieback. Canopy cover 50%

**Leaf Litter:** <10% >3mm diam. **Cryptograms:** Moss 0% Fungi *Podaxis* sp.

| Species 30 x 30m Quadrat 3 PK SD 4- Control            |      |       |         |           |           |               |                |       |
|--------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|
| # = indicator Spp.                                     | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |
| <i>Aristida contorta</i>                               |      |       | <5%     | Very Good |           | S             | Cattle grazing |       |
| <i>Atriplex nummularia complex</i> <sup>#</sup>        |      | 5     | <1%     | Excellent | I         | F,S           | Cattle grazing |       |
| <i>Atriplex vesicaria</i> <sup>#</sup>                 |      | 44    | 20%     | Excellent | I         | F,S           | Cattle grazing |       |
| <i>Digitaria brownii</i>                               |      |       | <1%     | senescing |           | S             |                |       |
| <i>Enneapogon avenaceus</i>                            |      |       | <10%    | Good      |           | S             |                |       |
| <i>Enneapogon polyphyllus</i>                          |      |       | <1%     | senescing |           | S             |                |       |
| <i>Maireana astrotricha</i> <sup>#</sup>               |      | 3     | <1%     | Excellent | I         | B             | Cattle grazing |       |
| <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i> |      |       | <1%     | Excellent |           | F             |                |       |
| <i>Salsola kali</i>                                    |      |       | <5%     | Excellent |           | F,S           |                |       |
| <i>Sclerolaena diacantha</i>                           |      |       | <5%     | Excellent |           | S             |                |       |
| <i>Sclerolaena cuneata</i>                             |      |       | <1%     | Excellent |           | S             |                |       |
| <i>Sida fibulifera</i>                                 |      |       | <1%     | Excellent |           | F             |                |       |
| <i>Solanum quadriloculatum</i>                         |      |       | <1%     | Excellent |           | F             |                |       |
| <i>Zygophyllum howittii</i>                            |      |       | <1%     | Excellent |           | S             |                |       |



| WEED SPECIES                 | ABUNDANCE                              | FAUNAL HABITAT                                                                                                                                           | FAUNAL SPECIES RECORDED              | Opportunity                        |
|------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------------------------|
| <i>Heliotropium europeum</i> | Very Sparse<br>introduced by<br>cattle | Very Good at time of survey as<br>gibber plains with Dense<br>chenopod shrub and native<br>grass cover provide habitat for a<br>range of faunal species. |                                      |                                    |
|                              |                                        |                                                                                                                                                          |                                      |                                    |
|                              |                                        |                                                                                                                                                          | <i>Elanus scriptus</i>               | Letter Winged Kite                 |
|                              |                                        |                                                                                                                                                          | <i>Ephthianura aurifrons</i>         | Orange Chat                        |
|                              |                                        | 2 species of ant and 2 genera of<br>spiders were recorded within<br>quadrats.                                                                            | <i>Falco berigora</i>                | Brown Falcon                       |
|                              |                                        |                                                                                                                                                          | <i>Falco subniger</i>                | Black Falcon                       |
|                              |                                        |                                                                                                                                                          | <i>Peltohyas australis</i>           | Inland Dotterel                    |
|                              |                                        |                                                                                                                                                          | <i>Taeniopygia guttata</i>           | Zebra Finch                        |
|                              |                                        | Foxes, feral cats and feral dogs<br>in high numbers in adjacent<br>areas.                                                                                |                                      |                                    |
|                              |                                        |                                                                                                                                                          | <i>Tachydosaurus rugosa</i>          | Sleepy Lizard                      |
|                              |                                        |                                                                                                                                                          | <i>Tiliqua multifasciata</i>         | Centralian Blue Tongue             |
|                              |                                        |                                                                                                                                                          | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon              |
|                              |                                        |                                                                                                                                                          |                                      |                                    |
|                              |                                        |                                                                                                                                                          | <i>Leggadina forrestii</i>           | Forrest's mouse<br>(Pebble Mounds) |
|                              |                                        |                                                                                                                                                          |                                      |                                    |
|                              |                                        |                                                                                                                                                          |                                      |                                    |

## PK04 Control – Photo Point Image



### 5.0 – PK SD5-1 Impact

|                                                    |                                                                          |                         |                                        |                   |                                                                             |           |                   |          |          |          |
|----------------------------------------------------|--------------------------------------------------------------------------|-------------------------|----------------------------------------|-------------------|-----------------------------------------------------------------------------|-----------|-------------------|----------|----------|----------|
| <b>Site Location - ID</b>                          | <b>Surveyed by:</b>                                                      |                         | <b>Project Controller</b>              |                   | <b>Date</b>                                                                 |           |                   |          |          |          |
| <b>PK SD5-1 Impact</b>                             | L. Bebbington – Land Management Consultant                               |                         | Graeme Noll – Manager Env. Coober Pedy |                   | 4.11.11                                                                     |           |                   |          |          |          |
|                                                    | <b>Weather</b><br>85% cloud cover<br>Ambient temperature 23 <sup>o</sup> |                         | <b>Rainfall past 30 days</b><br>Yes    |                   | <b>Landform / Aspect</b><br>Tableland plain adjacent to major drainage line |           |                   |          |          |          |
| <b>Photographs</b>                                 | <b>General:</b>                                                          | <b>PPoint:</b> 32       | <b>Indicator Plants:</b> 33, 34        |                   |                                                                             |           |                   |          |          |          |
| <b>Photo point Map No. SD5 I</b>                   | <b>Ref Tag No: PK 05 I</b>                                               |                         |                                        |                   |                                                                             |           |                   |          |          |          |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                 | <b>B</b>                | <b>C</b>                               | <b>D</b>          | <b>E</b>                                                                    | <b>F</b>  | <b>G</b>          | <b>H</b> | <b>I</b> | <b>J</b> |
| <b>Easting</b>                                     | 0534936                                                                  | 0534913                 | 0534929                                | 0534953           | 0534975                                                                     | 0534993   | 0534968           | 0534945  | 0534961  | 0534985  |
| <b>Northing</b>                                    | 6718293                                                                  | 6718312                 | 6718339                                | 6718317           | 6718298                                                                     | 6718324   | 6718344           | 6718364  | 6718390  | 6718365  |
| <b>SOIL</b>                                        |                                                                          |                         |                                        |                   |                                                                             |           |                   |          |          |          |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                                | <b>TYPE</b>             |                                        | <b>SOIL TEMP.</b> |                                                                             | <b>pH</b> | <b>MOISTURE %</b> |          |          |          |
|                                                    | 0mm                                                                      |                         |                                        | Dust Coated       |                                                                             | Natural   |                   |          |          |          |
|                                                    |                                                                          | Red brown cracking clay |                                        | 21.8 <sup>o</sup> |                                                                             | 7         | 2%                |          |          |          |

| <p><b>Vegetation Community 100 x 100m:</b> Sparse <i>Maireana aphylla</i> Low Chenopod Shrubland +/- Sparse <i>Eremophila rotundifolia</i>, <i>Sclerolaena divaricata</i>, <i>Gnephosis arachnoides</i>, <i>Pycnosorus eremaeus</i>, <i>Marsilea drummondii</i>, <i>Muehlenbeckia florulenta</i>, <i>Frankenia serpyllifolia</i>, <i>Brachyscome ciliaris</i>, <i>Aristida contorta</i>, <i>Aristida holathera</i> ssp <i>holathera</i>, <i>Austrostipa nitida</i> / <i>scabra</i>, <i>Setaria constricta</i>, <i>Astrebla pectinata</i>, <i>Dissocarpus biflorus</i> v <i>biflorus</i>, <i>Zygophyllum ammophilum</i>, <i>Enneapogon avenaceus</i></p> <p><b>Health:</b> Excellent for landform type due to above average rainfall in past 12 months. Canopy cover averages 75% for transect of which 50% consists of dormant grass species. Recently grazed by cattle.</p> <p><b>Leaf Litter:</b> &lt;30% &gt;3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp.</p> |      |       |         |           |           |               |                |                                                               |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------------------------------------------------------------|--|
| <b>Species 30 x 30m Quadrat 1 PK SD5-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       |         |           |           |               |                |                                                               |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                                         |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | 20%     | senescing |           | S             | Cattle grazing | Cattle trampling and pugging of previously inundated Gilgai's |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <15%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Atriplex lindleyi</i> ssp <i>conduplicata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | Excellent |           | S             | Cattle grazing |                                                               |  |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                                               |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9    | 44    | <1%     | Excellent | I         | F,S           | insect         |                                                               |  |
| <i>Marsilea drummondii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | Fair      |           | S             | Cattle pugging |                                                               |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <10%    | senescing |           | S             | Cattle Grazing | Well represented                                              |  |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Very Good |           | F             | Native Rats    |                                                               |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <10%    | Excellent |           | S             |                |                                                               |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <20%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     | Excellent |           | F             |                |                                                               |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Very Good |           | S             | Native rats    |                                                               |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | Excellent |           | F             |                |                                                               |  |



| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Maireana aphylla</i> Low Chenopod Shrubland+/- Sparse <i>Eremophila rotundifolia</i> , <i>Sclerolaena divaricata</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Marsilea drummondii</i> , <i>Muehlenbeckia florulenta</i> , <i>Frankenia serpyllifolia</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Aristida holathera ssp holathera</i> , <i>Austrostipa nitida / scabra</i> , <i>Setaria constricta</i> , <i>Astrebla pectinata</i> , <i>Dissocarpus biflorus v biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Enneapogon avenaceus</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Recently grazed by cattle.<br><b>Leaf Litter:</b> 40% >3mm diam. <b>Cryptograms:</b> Lichen <1% Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |                                                               |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------------------------------------------------------------|--|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD5-1 I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       |         |           |           |               |                |                                                               |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                                         |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | 10%     | senescing |           | S             | Cattle grazing | Cattle trampling and pugging of previously inundated Gilgai's |  |
| <i>Aristida holathera ssp holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Atriplex lindleyi ssp conduplicata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <5%     | Excellent |           | S             | Cattle grazing |                                                               |  |
| <i>Austrostipa nitida / scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <2%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 7     | <1%     | Fair      | I         | S             | Cattle grazing |                                                               |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                                               |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4    | 42    | <1%     | Excellent | I         | F,S           | insect         |                                                               |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <15%    | senescing |           | S             | Cattle Grazing |                                                               |  |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <1%     |           |           | F             | Native Rats    | Well represented                                              |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <10%    | Excellent |           | S             |                |                                                               |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <25%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Sida cunninghamii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | F             |                |                                                               |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Very Good |           | S             | Native rats    |                                                               |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       |         |           |           |               |                |                                                               |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------------------------------------------------------------|--|
| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Maireana aphylla</i> Low Chenopod Shrubland+/- Sparse <i>Eremophila rotundifolia</i> , <i>Sclerolaena divaricata</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Marsilea drummondii</i> , <i>Muehlenbeckia florulenta</i> , <i>Frankenia serpyllifolia</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Aristida holathera ssp holathera</i> , <i>Austrostipa nitida / scabra</i> , <i>Setaria constricta</i> , <i>Astrebla pectinata</i> , <i>Dissocarpus biflorus v biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Enneapogon avenaceus</i><br><b>Health:</b> Excellent due to rainfall in past 12 months. Cattle trampling and grazing throughout.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |                                                               |  |
| <b>Species 30 x 30m Quadrat 3 PK SD 5-1 I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       |         |           |           |               |                |                                                               |  |
| <b># = indicator Spp.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                                         |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | 10%     | senescing |           | S             | Cattle grazing | Cattle trampling and pugging of previously inundated Gilgai's |  |
| <i>Aristida holathera ssp holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Atriplex lindleyi ssp conduplicata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Excellent |           | S             | Cattle grazing |                                                               |  |
| <i>Austrostipa nitida / scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <2%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 44   | 41    | <1%     | Fair      | I         | S             | Cattle grazing |                                                               |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Enneapogon cuneata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <5%     | Fair      |           | S             | Cattle grazing |                                                               |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                                               |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 12   | 36    | <1%     | Excellent | I         | F,S           | insect         |                                                               |  |
| <i>Marsilea drummondii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <30%    | Fair      |           | S             | Cattle Grazing |                                                               |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <10%    | senescing |           | S             | Cattle Grazing |                                                               |  |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     |           |           | F             | Native Rats    | Well represented                                              |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <10%    | Excellent |           | S             |                |                                                               |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <20%    | senescing |           | S             | Cattle grazing |                                                               |  |



| WEED SPECIES | ABUNDANCE | FAUNAL HABITAT                                                                                                                                                                                                                                                                                     | FAUNAL SPECIES RECORDED              | Opportunity             |
|--------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------|
|              |           | The Mid Dense shrub and Dense grass cover at the time of survey provides a higher habitat value for this landform than in average rainfall years. Cracking clays also provide refuge and habitat for a range of faunal species from invertebrates to vertebrates such as Plains Rats and reptiles. | <i>Anas gracilis</i>                 | Grey Teal               |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Circus approximans</i>            | Swamp Harrier           |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Circus assimilis</i>              | Spotted Harrier         |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Elanus scriptus</i>               | Letter Winged Kite      |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Ephthianura aurifrons</i>         | Orange Chat             |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Falco berigora</i>                | Brown Falcon            |
|              |           | 3 species of ant and 7 genera of spiders (including large burrowing Mygalomorph sp.) were recorded within quadrats.                                                                                                                                                                                | <i>Falco subniger</i>                | Black Falcon            |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Gallinula ventralis</i>           | Black Tailed Native Hen |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Malurus leucopterus</i>           | White Winged Fairy Wren |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Phaps listrionica</i>             | Flock Bronze wing       |
|              |           | Adjacent ephemeral pools in major drainage lines contained aquatic invertebrates including Corixids, Triops and Cladocera spp.                                                                                                                                                                     | <i>Peltohyas australis</i>           | Inland Dotterel         |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Taeniopygia guttata</i>           | Zebra Finch             |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Ctenophorus isolepis</i>          | Military Dragon         |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Tympanocryptis intima</i>         | Gibber Earless Dragon   |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon   |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Leggadina forrestii</i>           | Forrest's Mouse         |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Pseudomys australis</i>           | Plains Rat              |
|              |           |                                                                                                                                                                                                                                                                                                    | <i>Sminthopsis crassicaudata</i>     | Fat Tail Dunnart        |

## PK05 Impact – Photo Point Image



### 5.1 – PK SD5-3 Control

|                                                    |                                                                         |                                        |                             |                                                                             |
|----------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------|-----------------------------|-----------------------------------------------------------------------------|
| <b>Site Location - ID</b>                          | <b>Surveyed by:</b>                                                     |                                        | <b>Project Controller</b>   | <b>Date</b>                                                                 |
| <b>PK SD5-3 Control</b>                            | L. Bebbington – Land Management Consultant                              | Graeme Noll – Manager Env. Coober Pedy |                             | 4.11.11                                                                     |
|                                                    | <b>Weather</b><br>5% cloud cover<br>Ambient temperature 29 <sup>o</sup> | <b>Rainfall past 30 days</b><br>Yes    |                             | <b>Landform / Aspect</b><br>Tableland plain adjacent to major drainage line |
| <b>Photographs</b>                                 | <b>General:</b>                                                         | <b>PPoint:</b> 22                      | <b>Indicator Plants:</b> 23 |                                                                             |
| <b>Photo point Map No. SD 5 C</b>                  | <b>Ref Tag No: PK 05 C</b>                                              |                                        |                             |                                                                             |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                | <b>B</b>                               | <b>C</b>                    | <b>D</b>                                                                    |
| <b>Easting</b>                                     | 0534705                                                                 | 0534723                                | 0534696                     | 0534679                                                                     |
| <b>Northing</b>                                    | 6718186                                                                 | 6718160                                | 6718144                     | 6718172                                                                     |
| <b>SOIL</b>                                        |                                                                         |                                        |                             |                                                                             |
|                                                    | <b>DUST DEPOSIT DEPTH</b><br>0mm                                        | <b>TYPE</b>                            |                             | <b>SOIL TEMP.</b>                                                           |
|                                                    |                                                                         |                                        |                             | <b>Dust Coated</b>                                                          |
|                                                    |                                                                         |                                        |                             | <b>Natural</b>                                                              |
|                                                    |                                                                         | Red brown cracking clay                |                             | 48.2 <sup>o</sup>                                                           |
|                                                    |                                                                         | 6.6                                    |                             | 55%                                                                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       |         |           |           |               |                |                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------------------------------------------------------------|
| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse <i>Maireana aphylla</i> , <i>Sclerolaena divaricata</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Marsilea drummondii</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Astrebla pectinata</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Enneapogon avenaceus</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover averages 80% for transect of which 50% consists of dormant grass species. Recently grazed by cattle.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |                                                               |
| <b>Species 30 x 30m <u>Quadrat 1</u> PK SD5-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       |         |           |           |               |                |                                                               |
| <b># = indicator Spp.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                                         |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | 20%     | senescing |           | S             | Cattle grazing | Cattle trampling and pugging of previously inundated Gilgai's |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <15%    | senescing |           | S             | Cattle grazing |                                                               |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3    | 102   | 20%     | Very Good | I         | F,S           | Cattle grazing |                                                               |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |
| <i>Convolvulus remotus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Very Good |           | F             |                |                                                               |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <5%     | Excellent |           | S             |                |                                                               |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                                               |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      | 28    | <1%     | Excellent | I         | F,S           | insect         |                                                               |
| <i>Marsilea drummondii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Fair      |           | S             | Cattle pugging |                                                               |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <10%    | senescing |           | S             | Cattle Grazing |                                                               |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <1%     | Very Good |           | F             | Native Rats    |                                                               |
| <i>Pycnosorus eremaeus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Very Good |           | F             |                |                                                               |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <10%    | Excellent |           | S             |                |                                                               |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <20%    | senescing |           | S             | Cattle grazing |                                                               |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Excellent |           | F             |                |                                                               |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Very Good |           | S             | Native rats    |                                                               |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Excellent |           | F             |                |                                                               |

**Vegetation Community 100 x 100m:** Sparse *Atriplex vesicaria* Low Chenopod Shrubland+/- Sparse *Maireana aphylla*, *Sclerolaena divaricata*, *Gnephosis arachnoides*, *Pycnosorus eremaeus*, *Marsilea drummondii*, *Brachyscome ciliaris*, *Aristida contorta*, *Aristida holathera* ssp *holathera*, *Austrostipa nitida* / *scabra*, *Setaria constricta*, *Astrelba pectinata*, *Dissocarpus biflorus* v *biflorus*, *Zygophyllum ammophilum*, *Enneapogon avenaceus*, *Convolvulus remotus*, *Digitaria brownii*, *Eragrostis setifolia*

**Health:** Excellent due to above average rainfall in past 12 months. Recently grazed by cattle.

**Leaf Litter:** 10% >3mm diam. **Cryptograms:** Fungi *Podaxis* sp.

**Species 30 x 30m Quadrat 2 PK SD5-3 Control**

| # = indicator Spp.                             | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                                         |
|------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------------------------------------------------------------|
| <i>Aristida contorta</i>                       |      |       | 20%     | senescing |           | S             | Cattle grazing | Cattle trampling and pugging of previously inundated Gilgai's |
| <i>Aristida holathera</i> ssp <i>holathera</i> |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |
| <i>Astrelba pectinata</i>                      |      |       | <15%    | senescing |           | S             | Cattle grazing |                                                               |
| <i>Atriplex vesicaria</i> <sup>#</sup>         | 3    | 24    | <10%    | Very Good | I         | F,S           | Cattle grazing |                                                               |
| <i>Austrostipa nitida</i> / <i>scabra</i>      |      |       | <1%     | senescing |           | S             | Cattle grazing |                                                               |
| <i>Convolvulus remotus</i>                     |      |       | <1%     | Very Good |           | F             |                |                                                               |
| <i>Digitaria brownii</i>                       |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>  |      |       | <10%    | Excellent |           | S             |                |                                                               |
| <i>Gnephosis arachnoides</i>                   |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                                               |
| <i>Maireana aphylla</i> <sup>#</sup>           | 3    | 23    | <1%     | Excellent | I         | F,S           | insect         |                                                               |
| <i>Marsilea drummondii</i>                     |      |       | <1%     | Fair      |           | S             | Cattle pugging |                                                               |
| <i>Panicum decompositum</i>                    |      |       | <10%    | senescing |           | S             | Cattle Grazing | Well represented                                              |
| <i>Podaxis</i> sp.                             |      |       | <1%     | Very Good |           | F             | Native Rats    |                                                               |
| <i>Pycnosorus eremaeus</i>                     |      |       | <1%     | Very Good |           | F             |                |                                                               |
| <i>Sclerolaena divaricata</i>                  |      |       | <10%    | Excellent |           | S             |                |                                                               |
| <i>Setaria constricta</i>                      |      |       | <20%    | senescing |           | S             | Cattle grazing |                                                               |
| <i>Sida fibulifera</i>                         |      |       | <1%     | Excellent |           | F             |                |                                                               |
| <i>Solanum quadriloculatum</i>                 |      |       | <1%     | Very Good |           | S             | Native rats    |                                                               |
| <i>Zygophyllum howittii</i>                    |      |       | <1%     | Excellent |           | F             |                |                                                               |



| <b>Vegetation Community 100 x 100m:</b> Sparse <i>Atriplex vesicaria</i> Low Chenopod Shrubland +/- Sparse <i>Maireana aphylla</i> , <i>Pittosporum angustifolium</i> , <i>Cullen graveolens</i> , <i>Sclerolaena divaricata</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Aristida holathera</i> ssp <i>holathera</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Astrebla pectinata</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Enneapogon avenaceus</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to rainfall in past 12 months. Cattle trampling and grazing throughout.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |                                                               |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------------------------------------------------------------|--|
| <b>Species 30 x 30m Quadrat 3 PKSD 5-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       |         |           |           |               |                |                                                               |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                                         |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | 20%     | senescing |           | S             | Cattle grazing | Cattle trampling and pugging of previously inundated Gilgai's |  |
| <i>Aristida holathera</i> ssp <i>holathera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <15%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Atriplex vesicaria</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 11   | 105   | <10%    | Very Good | I         | F,S           | Cattle grazing |                                                               |  |
| <i>Cullen graveolens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     |           |           |               |                |                                                               |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <5%     | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <10%    | Excellent |           | S             |                |                                                               |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                                               |  |
| <i>Gunniopsis papillata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | Excellent |           | F             |                |                                                               |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3    | 34    | <1%     | Excellent | I         | F,S           | insect         |                                                               |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <10%    | senescing |           | S             | Cattle Grazing |                                                               |  |
| <i>Pittosporum angustifolium</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14   |       |         |           |           |               |                |                                                               |  |
| <i>Pycnosorus eremaeus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | Very Good |           | F             |                |                                                               |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <10%    | Excellent |           | S             |                |                                                               |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <10%    | senescing |           | S             | Cattle grazing |                                                               |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Excellent |           | F             |                |                                                               |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Very Good |           | S             | Native rats    |                                                               |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | Excellent |           | F             |                |                                                               |  |



| WEED SPECIES                   | ABUNDANCE   | FAUNAL HABITAT                                                                                                                                                                                                                                                                                                                               | FAUNAL SPECIES RECORDED              | Opportunity           |
|--------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|
| <i>Malvastrum americanum</i> * | Very sparse | <p>The Mid Dense shrub and Dense grass cover at the time of survey provides a high habitat value. Cracking clays in Gilgai's provide refuge and habitat for a range of faunal species from invertebrates to vertebrates such as Plains Rats and reptiles.</p> <p>3 species of ant and 4 genera of spiders were recorded within quadrats.</p> |                                      |                       |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Circus approximans</i>            | Swamp Harrier         |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Elanus scriptus</i>               | Letter Winged Kite    |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Epethianura aurifrons</i>         | Orange Chat           |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Phaps listrionica</i>             | Flock Bronze wing     |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Peltohyas australis</i>           | Inland Dotterel       |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Taeniopygia guttata</i>           | Zebra Finch           |
|                                |             |                                                                                                                                                                                                                                                                                                                                              |                                      |                       |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Tympanocryptis intima</i>         | Gibber Earless Dragon |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Leggadina forrestii</i>           | Forrest's Mouse       |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Pseudomys australis</i>           | Plains Rat            |
|                                |             |                                                                                                                                                                                                                                                                                                                                              | <i>Sminthopsis crassicaudata</i>     | Fat Tail Dunnart      |

## PK05 Control – Photo Point Image



### 6.0 – PK SD6-1 Impact

|                                                    |                                                                          |                                        |                             |                                                          |                   |                   |           |                   |          |          |
|----------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------|-----------------------------|----------------------------------------------------------|-------------------|-------------------|-----------|-------------------|----------|----------|
| <b>Site Location - ID</b>                          | <b>Surveyed by:</b>                                                      |                                        | <b>Project Controller</b>   | <b>Date</b>                                              |                   |                   |           |                   |          |          |
| <b>PK SD6-1 Impact</b>                             | L. Bebbington – Land Management Consultant                               | Graeme Noll – Manager Env. Coober Pedy |                             | 3.11.11                                                  |                   |                   |           |                   |          |          |
|                                                    | <b>Weather</b><br>70% cloud cover<br>Ambient temperature 27 <sup>o</sup> | <b>Rainfall past 30 days</b><br>Yes    |                             | <b>Landform / Aspect</b><br>Elevated plain minimal slope |                   |                   |           |                   |          |          |
| <b>Photographs</b>                                 | <b>General:</b>                                                          | <b>PPoint:</b> 27                      | <b>Indicator Plants:</b> 28 |                                                          |                   |                   |           |                   |          |          |
| <b>Photo point Map No. SD 6 I</b>                  | <b>Ref Tag No: PK 06 I</b>                                               |                                        |                             |                                                          |                   |                   |           |                   |          |          |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                 | <b>B</b>                               | <b>C</b>                    | <b>D</b>                                                 | <b>E</b>          | <b>F</b>          | <b>G</b>  | <b>H</b>          | <b>I</b> | <b>J</b> |
| <b>Easting</b>                                     | 0537416                                                                  | 0537447                                | 0537444                     | 0537414                                                  | 0537384           | 0537382           | 0537413   | 0537441           | 0537438  | 0537408  |
| <b>Northing</b>                                    | 6726385                                                                  | 6726390                                | 6726359                     | 6326356                                                  | 6726352           | 6726320           | 6726325   | 6726329           | 6726300  | 6726295  |
| <b>SOIL</b>                                        |                                                                          |                                        |                             |                                                          |                   |                   |           |                   |          |          |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                                |                                        |                             | <b>TYPE</b>                                              | <b>SOIL TEMP.</b> |                   | <b>pH</b> | <b>MOISTURE %</b> |          |          |
|                                                    | 0mm                                                                      |                                        |                             |                                                          | Dust Coated       | Natural           |           |                   |          |          |
|                                                    |                                                                          | Red brown cracking clay                |                             |                                                          |                   | 44.2 <sup>o</sup> | 6.9       | 20%               |          |          |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex holocarpa</i> Low Chenopod Shrubland+/- Sparse – Mid Dense <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover averages 90% for transect – note A. holocarpa Shrubland is classified as an annual community therefore in average rainfall years the cover may be very sparse. Lightly grazed by cattle.<br><b>Leaf Litter:</b> <50% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|-----------------------------------------|
| Species 30 x 30m Quadrat 1 PK SD6 –1 Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       |         |           |           |               |                                         |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact                                  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | 10%     | senescing |           | S             | Cattle grazing                          |
| <i>Atriplex holocarpa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 28   | 391   | 90%     | Very Good |           | F,S           | Cattle grazing<br>House mouse<br>(seed) |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <5%     | senescing |           | S             | Cattle grazing                          |
| <i>Convolvulus remotus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <5%     | Very Good |           | F             |                                         |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | senescing |           | S             | Cattle grazing                          |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Excellent |           | S             |                                         |
| <i>Enchylaena tomentosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | 1     | <1%     | Excellent |           | S             |                                         |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Very Good |           | F             | Cattle Grazing                          |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | senescing |           | S             | Cattle Grazing                          |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | Very Good |           | F             | Well represented                        |
| <i>Pycnosorus eremaeus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Very Good |           | F             |                                         |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | Excellent |           | S             |                                         |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | senescing |           | S             | Cattle grazing                          |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <5%     | Excellent |           | F             |                                         |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Very Good |           | S             |                                         |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | F             |                                         |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex holocarpa</i> Low Chenopod Shrubland+/- Sparse <i>Maireana aphylla</i> , <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Lightly grazed by cattle. Dominated by annual <i>A. holocarpa</i><br><b>Leaf Litter:</b> 40% >3mm diam. <b>Cryptograms:</b> |      |       |         |           |           |               |                                      |                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|--------------------------------------|------------------------------------|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD6-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       |         |           |           |               |                                      |                                    |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact                               | Other                              |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | senescing |           | S             | Cattle grazing                       | Light Cattle trampling and grazing |
| <i>Atriplex holocarpa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 11   | 178   | <70%    | Very Good |           | F,S           | Cattle grazing<br>House Mouse (seed) |                                    |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <10%    | senescing |           | S             | Cattle grazing                       |                                    |
| <i>Convolvulus remotus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Very Good |           | F             |                                      |                                    |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | senescing |           | S             | Cattle grazing                       |                                    |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | Excellent |           | S             |                                      |                                    |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Very Good |           | F             | Cattle Grazing                       |                                    |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 1     | <1%     | Excellent | I         | F,S           | insect                               |                                    |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <10%    | senescing |           | S             | Cattle Grazing                       |                                    |
| <i>Pycnosorus eremaeus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Very Good |           | F             |                                      |                                    |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <5%     | Excellent |           | S             |                                      |                                    |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | senescing |           | S             | Cattle grazing                       |                                    |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Excellent |           | F             |                                      |                                    |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Very Good |           | S             |                                      |                                    |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | F             |                                      |                                    |

| <b>Vegetation Community 100 x 100m:</b> : Mid Dense <i>Atriplex holocarpa</i> Low Chenopod Shrubland+/- Sparse <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Dissocarpus biflorus v biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to rainfall in past 12 months. Light Cattle trampling and grazing throughout. Canopy cover consists of 25% annual A. <i>holocarpa</i> remaining 25% cover is dominated by annual forbs and grasses<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> |      |       |         |           |           |               |                |       |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|--|
| <b>Species 30 x 30m Quadrat 3 PK SD6-1 Impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       |         |           |           |               |                |       |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |  |
| <i>Atriplex holocarpa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3    | 81    | <25%    | Very Good |           | F,S           | Cattle grazing |       |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <5%     | senescing |           | S             | Cattle grazing |       |  |
| <i>Dissocarpus biflorus v biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <10%    | Excellent |           | S             |                |       |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <10%    | senescing |           | S             | Cattle Grazing |       |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <10%    |           |           |               |                |       |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <20%    | Excellent |           | S             |                |       |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <15%    | senescing |           | S             | Cattle grazing |       |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <5%     | Excellent |           | F             |                |       |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Very Good |           | S             |                |       |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <5%     | Excellent |           | F             |                |       |  |





| WEED SPECIES                   | ABUNDANCE   | FAUNAL HABITAT                                                                                                                                                                                  | FAUNAL SPECIES RECORDED          | Opportunity           |
|--------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------|
| <i>Malvastrum americanum</i> * | Very sparse | The Mid Dense to Dense annual shrub and Dense grass cover at the time of survey provides a high habitat value for native fauna (as to average rainfall years when canopy cover is very sparse). | <i>Ephthianura aurifrons</i>     | Orange Chat           |
|                                |             |                                                                                                                                                                                                 | <i>Taeniopygia guttata</i>       | Zebra Finch           |
|                                |             |                                                                                                                                                                                                 | <i>Turnix velox</i>              | Little Button Quail   |
|                                |             |                                                                                                                                                                                                 |                                  |                       |
|                                |             | 3 species of ant and 4 genera of spiders were recorded within quadrats.                                                                                                                         | <i>Tympanocryptis intima</i>     | Gibber Earless Dragon |
|                                |             |                                                                                                                                                                                                 |                                  |                       |
|                                |             |                                                                                                                                                                                                 | <i>Leggadina forrestii</i>       | Forrest's Mouse       |
|                                |             |                                                                                                                                                                                                 | <i>Pseudomys australis</i>       | Plains Rat            |
|                                |             |                                                                                                                                                                                                 | <i>Sminthopsis crassicaudata</i> | Fat Tail Dunnart      |
|                                |             |                                                                                                                                                                                                 |                                  |                       |
|                                |             |                                                                                                                                                                                                 |                                  |                       |
|                                |             |                                                                                                                                                                                                 |                                  |                       |

## PK06 Impact – Photo Point Image



### 6.1 – PK SD6-3 Control

| Site Location - ID                                 | Surveyed by:                                                             |                                       | Project Controller                     | Date                                                                           |                   |                   |           |                   |          |          |
|----------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|-------------------|-------------------|-----------|-------------------|----------|----------|
| <b>PK SD6-3 Control</b>                            | L. Bebbington – Land Management Consultant                               |                                       | Graeme Noll – Manager Env. Coober Pedy | 3.11.11                                                                        |                   |                   |           |                   |          |          |
|                                                    | <b>Weather</b><br>90% cloud cover<br>Ambient temperature 21 <sup>0</sup> |                                       | <b>Rainfall past 30 days</b><br>Yes    | <b>Landform / Aspect</b><br>Elevated north facing plain with calcareous rubble |                   |                   |           |                   |          |          |
| <b>Photographs</b>                                 | <b>General:</b>                                                          | <b>PPoint:</b> 29                     | <b>Indicator Plants:</b> 30, 31        |                                                                                |                   |                   |           |                   |          |          |
| <b>Photo point Map No. SD 6 C</b>                  | <b>Ref Tag No: PK 06 C</b>                                               |                                       |                                        |                                                                                |                   |                   |           |                   |          |          |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                 | <b>B</b>                              | <b>C</b>                               | <b>D</b>                                                                       | <b>E</b>          | <b>F</b>          | <b>G</b>  | <b>H</b>          | <b>I</b> | <b>J</b> |
| <b>Easting</b>                                     | 0536322                                                                  | 0536291                               | 0536299                                | 0536331                                                                        | 0536360           | 0536369           | 0536336   | 0536307           | 0536315  | 0536346  |
| <b>Northing</b>                                    | 6722496                                                                  | 6722501                               | 6722533                                | 6722525                                                                        | 6722520           | 6722551           | 6722556   | 6722560           | 6722590  | 6722584  |
| <b>SOIL</b>                                        |                                                                          |                                       |                                        |                                                                                |                   |                   |           |                   |          |          |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                                |                                       |                                        | <b>TYPE</b>                                                                    | <b>SOIL TEMP.</b> |                   | <b>pH</b> | <b>MOISTURE %</b> |          |          |
|                                                    | 0mm                                                                      |                                       |                                        |                                                                                | Dust Coated       | Natural           |           |                   |          |          |
|                                                    |                                                                          | Red brown clay with calcareous rubble |                                        |                                                                                |                   | 33.4 <sup>0</sup> | 7         | 5%                |          |          |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex vesicaria</i> Low Chenopod Shrubland+/- Sparse – Mid Dense <i>Maireana astrotricha</i> , <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover averages 80% for transect. Grazed by cattle.<br><b>Leaf Litter:</b> <50% >3mm diam. <b>Cryptograms:</b> |      |       |         |           |           |               |                |                                      |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|--------------------------------------|--|
| Species 30 x 30m Quadrat 1 PK SD6–3 Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       |         |           |           |               |                |                                      |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <5%     | senescing |           | S             | Cattle grazing | Cattle trampling and grazing Rabbits |  |
| <i>Atriplex vesicaria complex</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 62   | 1131  | 70%     | Very Good | I         | F,S           | Cattle grazing |                                      |  |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | senescing |           | S             | Cattle grazing |                                      |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | senescing |           | S             | Cattle grazing |                                      |  |
| <i>Enneapogon polyphyllus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Fair      |           | S             |                |                                      |  |
| <i>Maireana astrotricha</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Excellent |           | S             |                |                                      |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | senescing |           | S             | Cattle Grazing |                                      |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Excellent |           | F             |                |                                      |  |
| <i>Ptilotus sessilifolius</i> ssp <i>sessilifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Excellent |           | F             |                |                                      |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Excellent |           | S             |                |                                      |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Excellent |           | F             |                |                                      |  |
| <i>Solanum quadriloculatum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Very Good |           | S             |                |                                      |  |
| <i>Zygophyllum howittii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Excellent |           | F             |                |                                      |  |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex spongiosa</i> Low Chenopod Shrubland +/- Sparse <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Lightly grazed by cattle. Dominated by annual <i>A. spongiosa</i> .<br><b>Leaf Litter:</b> 10% >3mm diam. <b>Cryptograms:</b> |      |       |         |           |           |               |                |                                      |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|--------------------------------------|--|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD6-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       |         |           |           |               |                |                                      |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | senescing |           | S             | Cattle grazing | Cattle trampling and grazing rabbits |  |
| <i>Atriplex spongiosa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 29   | 343   | <50%    | Excellent |           | F,S           | Cattle grazing |                                      |  |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <1%     | senescing |           | S             | Cattle grazing |                                      |  |
| <i>Convolvulus remotus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Very Good |           | F             | Cattle grazing |                                      |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <5%     | senescing |           | S             | Cattle grazing |                                      |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <10%    | senescing |           | S             | Cattle Grazing |                                      |  |
| <i>Ptilotus obovatus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       | <1%     | Very Good |           | F             |                |                                      |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <5%     | Excellent |           | S             |                |                                      |  |
| <i>Salsola kali</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <5%     | Excellent |           |               |                |                                      |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       | <5%     | senescing |           | S             | Cattle grazing |                                      |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       | <1%     | Excellent |           | F             |                |                                      |  |

**Vegetation Community 100 x 100m:** : Mid Dense *Atriplex spongiosa* Low Chenopod Shrubland+/- Sparse *Sclerolaena divaricata*, *Salsola kali*, *Gnephosis arachnoides*, *Pycnosorus eremaeus*, *Brachyscome ciliaris*, *Aristida contorta*, *Austrostipa nitida* / *scabra*, *Setaria constricta*, *Dissocarpus biflorus v biflorus*, *Zygophyllum ammophilum*, *Convolvulus remotus*, *Digitaria brownii*, *Eragrostis setifolia*

**Health:** Excellent due to rainfall in past 12 months. Light Cattle trampling and grazing throughout. Canopy cover consists of 70% annual A. *spongiosa* remaining cover is dominated by annual forbs and grasses

**Leaf Litter:** <10% >3mm diam. **Cryptograms:**

| Species 30 x 30m Quadrat 3 PK SD6-3 Control   |      |       |         |           |           |               |                |         |
|-----------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|---------|
| # = indicator Spp.                            | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other   |
| <i>Atriplex spongiosa</i> <sup>annual</sup>   | 94   | 382   | <70%    | Very Good | I         | F,S           | Cattle grazing | rabbits |
| <i>Digitaria brownii</i>                      |      |       | <1%     | senescing |           | S             | Cattle grazing |         |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i> |      |       | <1%     | Excellent |           | S             |                |         |
| <i>Enneapogon polyphyllus</i>                 |      |       | <1%     | Very Good |           | S             | Cattle Grazing |         |
| <i>Panicum decompositum</i>                   |      |       | <10%    | senescing |           | S             | Cattle Grazing |         |
| <i>Sclerolaena diacantha</i>                  |      |       | <1%     | Excellent |           |               |                |         |
| <i>Sclerolaena divaricata</i>                 |      |       | <1%     | Excellent |           | S             |                |         |
| <i>Setaria constricta</i>                     |      |       | <5%     | senescing |           | S             | Cattle grazing |         |
| <i>Sida fibulifera</i>                        |      |       | <1%     | Excellent |           | F             |                |         |





| WEED SPECIES                   | ABUNDANCE | FAUNAL HABITAT                                                                                                                                                                                  | FAUNAL SPECIES RECORDED       |                     | Opportunity |
|--------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------|-------------|
| <i>Malvastrum americanum</i> * | Mid Dense | The Mid Dense to Dense annual shrub and Dense grass cover at the time of survey provides a high habitat value for native fauna (as to average rainfall years when canopy cover is very sparse). | <i>Aquila audax</i>           | Wedge-tailed Eagle  |             |
|                                |           |                                                                                                                                                                                                 | <i>Cincloramphus cruralis</i> | Brown Songlark      |             |
|                                |           |                                                                                                                                                                                                 | <i>Taeniopygia guttata</i>    | Zebra Finch         |             |
|                                |           |                                                                                                                                                                                                 | <i>Turnix velox</i>           | Little Button Quail |             |
|                                |           |                                                                                                                                                                                                 |                               |                     |             |
|                                |           | 2 species of ant and 3 genera of spiders were recorded within quadrats.                                                                                                                         | <i>Leggadina forrestii</i>    | Forrest's Mouse     |             |
|                                |           |                                                                                                                                                                                                 | <i>Pseudomys australis</i>    | Plains Rat          |             |
|                                |           |                                                                                                                                                                                                 |                               |                     |             |
|                                |           |                                                                                                                                                                                                 |                               |                     |             |
|                                |           |                                                                                                                                                                                                 |                               |                     |             |
|                                |           |                                                                                                                                                                                                 |                               |                     |             |

## PK06 Control – Photo Point Image



## 7.0 – PK SD7-1 Impact

|                                                    |                                                                          |                                        |                           |                                                          |          |          |                   |                   |           |                            |
|----------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------|---------------------------|----------------------------------------------------------|----------|----------|-------------------|-------------------|-----------|----------------------------|
| <b>Site Location - ID</b>                          | <b>Surveyed by:</b>                                                      |                                        | <b>Project Controller</b> | <b>Date</b>                                              |          |          |                   |                   |           |                            |
| <b>PK SD7-1 Impact</b>                             | L. Bebbington – Land Management Consultant                               | Graeme Noll – Manager Env. Coober Pedy |                           | 3.11.11                                                  |          |          |                   |                   |           |                            |
|                                                    | <b>Weather</b><br>70% cloud cover<br>Ambient temperature 27 <sup>o</sup> | <b>Rainfall past 30 days</b><br>Yes    |                           | <b>Landform / Aspect</b><br>Elevated plain falling to SE |          |          |                   |                   |           |                            |
| <b>Photographs</b>                                 | <b>General:</b>                                                          | <b>PPoint:</b> 26                      | <b>Indicator Plants:</b>  |                                                          |          |          |                   |                   |           |                            |
| <b>Photo point Map No. SD 7 I</b>                  | <b>Ref Tag No: PK 07 I</b>                                               |                                        |                           |                                                          |          |          |                   |                   |           |                            |
| <b>Quadrat Co-ordinates</b><br>Layout as per Pg. 6 | <b>A</b>                                                                 | <b>B</b>                               | <b>C</b>                  | <b>D</b>                                                 | <b>E</b> | <b>F</b> | <b>G</b>          | <b>H</b>          | <b>I</b>  | <b>J</b>                   |
| <b>Easting</b>                                     | 0537335                                                                  | 0537335                                | 0537367                   | 0537366                                                  | 0537363  | 0537395  | 0537396           | 0537399           | 0537429   | 0537427                    |
| <b>Northing</b>                                    | 6727927                                                                  | 6727957                                | 6727954                   | 6727924                                                  | 6727894  | 6727892  | 6727925           | 6727954           | 6727953   | 6727922                    |
| <b>SOIL</b>                                        |                                                                          |                                        |                           |                                                          |          |          |                   |                   |           |                            |
|                                                    | <b>DUST DEPOSIT DEPTH</b>                                                |                                        |                           | <b>TYPE</b>                                              |          |          | <b>SOIL TEMP.</b> |                   | <b>pH</b> | <b>MOISTURE %</b>          |
|                                                    | 0mm                                                                      |                                        |                           |                                                          |          |          | Dust Coated       | Natural           |           |                            |
|                                                    |                                                                          |                                        |                           | Red brown clay with calcareous rubble                    |          |          |                   | 46.4 <sup>o</sup> | 6.9       | 5%<br>(95% in minor drain) |

| <b>Vegetation Community 100 x 100m:</b> Dense <i>Atriplex holocarpa</i> Low Chenopod Shrubland+/- Sparse – Sparse <i>Atriplex spongiosa</i> , <i>Atriplex nummularia</i> complex, <i>Maireana aphylla</i> , <i>Cullen graveolens</i> , <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Zygophyllum ammophilum</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> , <i>Eragrostis setifolia</i> . <i>Drains contain: Eleocharis pallens</i> , <i>Marsilea drummondii</i> , <i>Cyperus alterniflorus</i><br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover averages 90% for transect – note <i>A. holocarpa</i> Shrubland is classified as an annual community therefore in average rainfall years the cover may be very sparse. Lightly grazed by cattle.<br><b>Leaf Litter:</b> <10% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |                                               |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-----------------------------------------------|--|
| Species 30 x 30m <u>Quadrat 1</u> PK SD7 –1 Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       |         |           |           |               |                |                                               |  |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                         |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | 10%     | senescing |           | S             | Cattle grazing | Cattle trampling, pugging (drain) and grazing |  |
| <i>Atriplex holocarpa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 83   | 36    | <10%    | Very Good |           | F,S           | Cattle grazing |                                               |  |
| <i>Atriplex nummularia</i> complex <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4    | 20    | <10%    | Excellent | I         | F,S           |                |                                               |  |
| <i>Atriplex spongiosa</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 9     | <1%     | senescing |           | S             |                |                                               |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Convolvulus remotus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Very Good |           | F             |                |                                               |  |
| <i>Cullen graveolens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      | 12    | <1%     | Excellent |           | F             |                |                                               |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Excellent |           | S             |                |                                               |  |
| <i>Eleocharis pallens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | Very Good |           | F             | Cattle grazing |                                               |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                               |  |
| <i>Gunniopsis papillata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <1%     | Excellent |           | S             |                |                                               |  |
| <i>Maireana aphylla</i> <sup>#</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 1     | <1%     | Excellent | I         | F             |                |                                               |  |
| <i>Marsilea drummondii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <5%     | Good      |           | S             | Cattle pugging |                                               |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |       | <5%     | senescing |           | S             | Cattle Grazing |                                               |  |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       | <1%     | Very Good |           | F             |                |                                               |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | <1%     | Very Good |           | S             |                |                                               |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <5%     | Excellent |           | S             |                |                                               |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Sida fibulifera</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <5%     | Excellent |           | F             |                | Well represented                              |  |

**Vegetation Community 100 x 100m:** Very Sparse *Atriplex holocarpa* Low Chenopod Shrubland+/- Very Sparse *Atriplex spongiosa*, *Cullen graveolens*, *Sclerolaena divaricata*, *Salsola kali*, *Gnephosis arachnoides*, *Pycnosorus eremaeus*, *Brachyscome ciliaris*, *Aristida contorta*, *Austrostipa nitida* / *scabra*, *Setaria constricta*, *Dissocarpus biflorus* v *biflorus*, *Convolvulus remotus*, *Digitaria brownii*,

**Health:** Excellent due to above average rainfall in past 12 months. Grazed by cattle. Dominated by annual *A. holocarpa* / *A. spongiosa*

**Leaf Litter:** 40% >3mm diam. **Cryptograms:**

**Species 30 x 30m Quadrat 2 PK SD7-1 Impact**

| # = indicator Spp.                            | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                        |
|-----------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|------------------------------|
| <i>Aristida contorta</i>                      |      |       | <1%     | senescing |           | S             | Cattle grazing | Cattle trampling and grazing |
| <i>Astrebla pectinata</i>                     |      |       | <5%     | senescing |           | S             | Cattle grazing |                              |
| <i>Atriplex holocarpa</i> <sup>annual</sup>   |      | 11    | <10%    | Very Good |           | F,S           | Cattle grazing |                              |
| <i>Atriplex spongiosa</i> <sup>annual</sup>   |      | 7     |         |           |           |               |                |                              |
| <i>Austrostipa nitida</i> / <i>scabra</i>     |      |       | <5%     | senescing |           | S             | Cattle grazing |                              |
| <i>Convolvulus remotus</i>                    |      |       | <1%     | Very Good |           | F             |                |                              |
| <i>Cullen graveolens</i>                      |      | 4     | <1%     | Excellent |           | F             |                |                              |
| <i>Digitaria brownii</i>                      |      |       | <5%     | senescing |           | S             | Cattle grazing |                              |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i> |      |       | <5%     | Excellent |           | S             |                |                              |
| <i>Gnephosis arachnoides</i>                  |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                              |
| <i>Panicum decompositum</i>                   |      |       | <10%    | senescing |           | S             | Cattle Grazing |                              |
| <i>Pycnosorus eremaeus</i>                    |      |       | <1%     | Very Good |           | F             |                |                              |
| <i>Sclerolaena divaricata</i>                 |      |       | <5%     | Excellent |           | S             |                |                              |
| <i>Setaria constricta</i>                     |      |       | <1%     | senescing |           | S             | Cattle grazing |                              |
| <i>Sida fibulifera</i>                        |      |       | <1%     | Excellent |           | F             |                |                              |
| <i>Solanum quadriloculatum</i>                |      |       | <1%     | Very Good |           | S             |                |                              |
| <i>Zygophyllum howittii</i>                   |      |       | <1%     | Excellent |           | F             |                |                              |

**Vegetation Community 100 x 100m:** : Very Sparse *Atriplex holocarpa* Low Chenopod Shrubland+/- Very Sparse *Atriplex nummularia* complex, *Atriplex spongiosa*, *Sclerolaena divaricata*, *Salsola kali*, *Gunnipopsis papillata*, *Frankenia serpyllifolia*, *Pycnosorus eremaeus*, *Brachyscome ciliaris*, *Aristida contorta*, *Astrebla pectinata*, *Setaria constricta*, *Dissocarpus biflorus v biflorus*, *Digitaria brownii*, *Eragrostis setifolia*  
**Health:** Excellent due to rainfall in past 12 months. Cattle trampling and grazing throughout. Canopy cover consists of <5% annual *A. holocarpa* / *A. spongiosa* remaining very sparse cover is dominated by forbs and grasses  
**Leaf Litter:** <5% >3mm diam. **Cryptograms:**

| Species 30 x 30m Quadrat 3 PK SD7-1 Impact    |      |       |         |           |           |               |                |       |
|-----------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-------|
| # = indicator Spp.                            | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other |
| <i>Astrebla pectinata</i>                     |      |       | <1%     | Excellent |           |               | Cattle grazing |       |
| <i>Atriplex holocarpa</i> <sup>annual</sup>   |      | 3     | <5%     | Very Good |           | F,S           | Cattle grazing |       |
| <i>Atriplex nummularia</i> complex            |      | 1     | <1%     | Excellent | I         | F,S           |                |       |
| <i>Atriplex spongiosa</i> <sup>annual</sup>   |      | 4     | <1%     | Excellent |           | S             | Cattle grazing |       |
| <i>Digitaria brownii</i>                      |      |       | <5%     | senescing |           | S             | Cattle grazing |       |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i> |      |       | <5%     | Excellent |           | S             |                |       |
| <i>Frankenia serpyllifolia</i> <sup>#</sup>   | 1    | 1     | <1%     | Excellent |           | F             |                |       |
| <i>Panicum decompositum</i>                   |      |       | <1%     | senescing |           | S             | Cattle Grazing |       |
| <i>Sclerolaena diacantha</i>                  |      |       | <5%     |           |           |               |                |       |
| <i>Sclerolaena divaricata</i>                 |      |       | <1%     | Excellent |           | S             |                |       |
| <i>Setaria constricta</i>                     |      |       | <1%     | senescing |           | S             | Cattle grazing |       |
|                                               |      |       |         |           |           |               |                |       |
|                                               |      |       |         |           |           |               |                |       |



| WEED SPECIES | ABUNDANCE | FAUNAL HABITAT                                                                                                                                                                                                                                                                             | FAUNAL SPECIES RECORDED      |                       | Opportunity |
|--------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------|-------------|
|              |           | Although the very sparse annual shrub and Sparse grass cover provide limited habitat value for native fauna adjacent minor drainage lines linked to the transect provide valuable habitat for native fauna.<br><br>2 species of ant and 3 genera of spiders were recorded within quadrats. |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            | <i>Taeniopygia guttata</i>   | Zebra Finch           |             |
|              |           |                                                                                                                                                                                                                                                                                            | <i>Turnix velox</i>          | Little Button Quail   |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            | <i>Tympanocryptis intima</i> | Gibber Earless Dragon |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |
|              |           |                                                                                                                                                                                                                                                                                            |                              |                       |             |



**PK07 Impact – Photo Point Image**

### 7.1 – PK SD7-3 Control

| Site Location - ID                          |                    | Surveyed by:                                                          |                                                 | Project Controller                     |         | Date                                                                       |         |         |         |            |         |
|---------------------------------------------|--------------------|-----------------------------------------------------------------------|-------------------------------------------------|----------------------------------------|---------|----------------------------------------------------------------------------|---------|---------|---------|------------|---------|
| PK SD7-3 Control                            |                    | L. Bebbington – Land Management Consultant                            |                                                 | Graeme Noll – Manager Env. Coober Pedy |         | 3.11.11                                                                    |         |         |         |            |         |
|                                             |                    | Weather<br><br>90% cloud cover<br>Ambient temperature 23 <sup>0</sup> |                                                 | Rainfall past 30 days<br><br>Yes       |         | Landform / Aspect<br><br>Elevated plain - numerous<br>minor drainage lines |         |         |         |            |         |
| Photographs                                 |                    | General:                                                              |                                                 | PPoint: 24                             |         | Indicator Plants: 25                                                       |         |         |         |            |         |
| Photo point Map No. SD 7 C                  |                    | Ref Tag No: PK 07 C                                                   |                                                 |                                        |         |                                                                            |         |         |         |            |         |
| Quadrat Co-ordinates<br>Layout as per Pg. 6 |                    | A                                                                     | B                                               | C                                      | D       | E                                                                          | F       | G       | H       | I          | J       |
| Easting                                     |                    | 0537047                                                               | 0537034                                         | 0537062                                | 0537075 | 0537088                                                                    | 0537118 | 0537103 | 0537090 | 0537117    | 0537129 |
| Northing                                    |                    | 6728350                                                               | 6728378                                         | 6728390                                | 6728362 | 6728337                                                                    | 6728347 | 6728373 | 6728400 | 6728413    | 6728386 |
| SOIL                                        |                    |                                                                       |                                                 |                                        |         |                                                                            |         |         |         |            |         |
|                                             | DUST DEPOSIT DEPTH |                                                                       | TYPE                                            |                                        |         | SOIL TEMP.                                                                 |         | pH      |         | MOISTURE % |         |
|                                             | 0mm                |                                                                       |                                                 |                                        |         | Dust Coated<br>Natural                                                     |         |         |         |            |         |
|                                             |                    |                                                                       | Alluvial clayey sand with gibber strewn surface |                                        |         | 21.8 <sup>0</sup><br>8.30am                                                |         | 6.4     |         | 80%        |         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       |         |           |           |               |                |                                               |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|-----------------------------------------------|--|
| <p><b>Vegetation Community 100 x 100m:</b> Very Sparse <i>Atriplex holocarpa</i> Low Chenopod Shrubland+/- Sparse – Sparse <i>Astrebla pectinata</i>, <i>Sclerolaena divaricata</i>, <i>Salsola kali</i>, <i>Gnephosis arachnoides</i>, <i>Frankenia serpyllifolia</i>, <i>Rhagodia spinescens</i>, <i>Pycnosorus eremaeus</i>, <i>Brachyscome ciliaris</i>, <i>Aristida contorta</i>, <i>Austrostipa nitida</i> / <i>scabra</i>, <i>Setaria constricta</i>, <i>Dissocarpus biflorus</i> v <i>biflorus</i>, <i>Gunniopsis papillata</i>, <i>Digitaria brownii</i>, <i>Eragrostis setifolia</i>.</p> <p><b>Health:</b> Excellent due to above average rainfall in past 12 months. Canopy cover averages 50% for transect – note <i>A. holocarpa</i> Shrubland is classified as an annual community therefore in average rainfall years the cover may be very sparse. Grazed by cattle.</p> <p><b>Leaf Litter:</b> &lt;5% &gt;3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp.</p> |      |       |         |           |           |               |                |                                               |  |
| <b>Species 30 x 30m Quadrat 1 PK SD7-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       |         |           |           |               |                |                                               |  |
| <b># = indicator Spp.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                                         |  |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | senescing |           | S             | Cattle grazing | Cattle trampling, pugging (drain) and grazing |  |
| <i>Atriplex holocarpa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6    | 25    | <10%    | Very Good |           | F,S           | Cattle grazing |                                               |  |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <1%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <1%     | Excellent |           | S             | Cattle grazing | Cattle trampling, pugging (drain) and grazing |  |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                                               |  |
| <i>Gunniopsis papillata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Excellent |           | S             |                |                                               |  |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | senescing |           | S             | Cattle Grazing |                                               |  |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       | <1%     | Very Good |           | F             |                |                                               |  |
| <i>Sclerolaena diacantha</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |       | <1%     | Very Good |           | S             |                | Sparse                                        |  |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |       | <5%     | Excellent |           | S             |                |                                               |  |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <5%     | senescing |           | S             | Cattle grazing |                                               |  |

| <b>Vegetation Community 100 x 100m:</b> Mid Dense <i>Atriplex holocarpa</i> Low Chenopod Shrubland+/- Dense <i>Atriplex nummularia</i> complex, <i>Cullen graveolens</i> , <i>Frankenia serpyllifolia</i> , <i>Cullen graveolens</i> , <i>Abutilon halophilum</i> , <i>Rhagodia spinescens</i> , <i>Sclerolaena divaricata</i> , <i>Salsola kali</i> , <i>Gnephosis arachnoides</i> , <i>Pycnosorus eremaeus</i> , <i>Brachyscome ciliaris</i> , <i>Aristida contorta</i> , <i>Austrostipa nitida</i> / <i>scabra</i> , <i>Setaria constricta</i> , <i>Dissocarpus biflorus</i> v <i>biflorus</i> , <i>Convolvulus remotus</i> , <i>Digitaria brownii</i> ,<br><b>Health:</b> Excellent due to above average rainfall in past 12 months. Grazed by cattle. Dominated by annual <i>A. holocarpa</i> . Canopy cover 90%<br><b>Leaf Litter:</b> 20% >3mm diam. <b>Cryptograms:</b> Fungi <i>Podaxis</i> sp. |      |       |         |           |           |               |                |                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------|-----------|-----------|---------------|----------------|------------------------------|
| <b>Species 30 x 30m <u>Quadrat 2</u> PK SD7-3 Control</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |         |           |           |               |                |                              |
| # = indicator Spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Juv. | Adult | % Cover | Health    | Increaser | Flower / Seed | Impact         | Other                        |
| <i>Abutilon halophilum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 6     | <1%     | Excellent |           | F             |                |                              |
| <i>Aristida contorta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <1%     | senescing |           | S             | Cattle grazing | Cattle trampling and grazing |
| <i>Astrebla pectinata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <10%    | senescing |           | S             | Cattle grazing |                              |
| <i>Atriplex holocarpa</i> <sup>annual</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7    | 44    | <20%    | Very Good |           | F,S           | Cattle grazing |                              |
| <i>Atriplex nummularia</i> complex                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2    | 20    | <20%    | Excellent |           | F,S           |                |                              |
| <i>Austrostipa nitida</i> / <i>scabra</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <5%     | senescing |           | S             | Cattle grazing |                              |
| <i>Convolvulus remotus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Very Good |           | F             |                |                              |
| <i>Cullen graveolens</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 5     | <1%     | Excellent |           | F             |                |                              |
| <i>Digitaria brownii</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       | <5%     | senescing |           | S             | Cattle grazing |                              |
| <i>Dissocarpus biflorus</i> v <i>biflorus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Excellent |           | S             |                |                              |
| <i>Frankenia serpyllifolia</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 14    | <5%     | Excellent |           | S             |                |                              |
| <i>Gnephosis arachnoides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <1%     | Very Good |           | F             | Cattle Grazing |                              |
| <i>Gunnipopsis papillata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |       | <5%     | Excellent |           | F             |                |                              |
| <i>Panicum decompositum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       | <10%    | senescing |           | S             | Cattle Grazing |                              |
| <i>Podaxis</i> sp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       | <1%     | Excellent |           | F             |                |                              |
| <i>Pycnosorus eremaeus</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       | <1%     | Very Good |           | F             |                |                              |
| <i>Sclerolaena divaricata</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |       | <5%     | Excellent |           | S             |                |                              |
| <i>Setaria constricta</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       | <1%     | senescing |           | S             | Cattle grazing |                              |





| WEED SPECIES | ABUNDANCE | FAUNAL HABITAT                                                                                                                                                                                                                                                                                                                                                                                                                  | FAUNAL SPECIES RECORDED              | Opportunity             |
|--------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------|
|              |           | <p>Although the annual shrub and mid dense grass cover at time of survey provide limited habitat value for native fauna, the adjacent minor drainage lines linked to the transect provide valuable habitat for native fauna. Ephemeral pools in drainage lines contain aquatic invertebrates including Corixids.</p> <p>3 species of ant and 4 genera of spider (including Mygalomorph spp.) were recorded within quadrats.</p> | <i>Anas gracilis</i>                 | Grey Teal               |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Circus assimilis</i>              | Spotted Harrier         |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Elanus scriptus</i>               | Letter Winged Kite      |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Ephthianura aurifrons</i>         | Orange Chat             |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Falco subniger</i>                | Black Falcon            |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Malurus leucopterus</i>           | White Winged Fairy Wren |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Phaps listrionica</i>             | Flock Bronze wing       |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Peltohyas australis</i>           | Inland Dotterel         |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Taeniopygia guttata</i>           | Zebra Finch             |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Ctenophorus isolepis</i>          | Military Dragon         |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Tympanocryptis intima</i>         | Gibber Earless Dragon   |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Tympanocryptis tetraporophora</i> | Eyrean Earless Dragon   |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Leggadina forrestii</i>           | Forrest's Mouse         |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Pseudomys australis</i>           | Plains Rat              |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Sminthopsis crassicaudata</i>     | Fat Tail Dunnart        |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                      |                         |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                      |                         |
|              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                      |                         |

### PK07 Control – Photo Point Image













| APPENDIX B Number of Indicator Plant Species Recorded per Quadrat Peculiar Knob Mine Monitoring Sites 2011 |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
|------------------------------------------------------------------------------------------------------------|--|----|--|----|-------|---|----|----|----|--------------------|---|----|---|----|-------|----|----|----|----|----|--|
|                                                                                                            |  |    |  |    |       |   |    |    |    | Monitoring Site ID |   |    |   |    |       |    |    |    |    |    |  |
| PK 1 I                                                                                                     |  |    |  |    | PK1 C |   |    |    |    | PK2 I              |   |    |   |    | PK2 C |    |    |    |    |    |  |
| Q1                                                                                                         |  | Q2 |  | Q3 | Q1    |   | Q2 |    | Q3 | Q1                 |   | Q2 |   | Q3 | Q1    |    | Q2 |    | Q3 |    |  |
| Species Name                                                                                               |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Acacia aneura#                                                                                             |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Atriplex nummularia complex#                                                                               |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Atriplex quinii                                                                                            |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Atriplex spongiosa                                                                                         |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| 2                                                                                                          |  | 10 |  | 6  |       | 1 |    |    |    |                    | 4 |    | 3 |    | 19    |    | 46 |    | 12 |    |  |
| Eremophila rotundifolia                                                                                    |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Frankenia serpyllifolia#                                                                                   |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Maireana astrotricha#                                                                                      |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Maireana aphylla#                                                                                          |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| 20                                                                                                         |  | 2  |  | 20 |       | 4 |    | 46 |    | 6                  |   | 2  |   | 76 |       | 11 |    | 32 |    | 12 |  |
| Maireana eriantha                                                                                          |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Maireana georgei#                                                                                          |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Maireana sedifolia#                                                                                        |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Rhagodia spinescens#                                                                                       |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| 17                                                                                                         |  | 17 |  | 10 |       | 9 |    | 13 |    | 23                 |   | 20 |   | 3  |       | 1  |    | 4  |    | 19 |  |
| Senna ft gawlerensis#                                                                                      |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |
| Senna ft petiolaris#                                                                                       |  |    |  |    |       |   |    |    |    |                    |   |    |   |    |       |    |    |    |    |    |  |





|                              | MONITORING SITE ID |    |    |    |    |   |           |   |    |    |    |    |  |  |
|------------------------------|--------------------|----|----|----|----|---|-----------|---|----|----|----|----|--|--|
|                              | PK 7 I             |    |    |    |    |   | PK 7 C    |   |    |    |    |    |  |  |
|                              | Q1                 |    | Q2 |    | Q3 |   | Q1        |   | Q2 |    | Q3 |    |  |  |
| Species Name                 | J                  | A  | J  | A  | J  | A | J         | A | J  | A  | J  | A  |  |  |
| Acacia aneura#               |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Atriplex nummularia complex# | 4                  | 20 |    |    | 1  |   |           |   | 2  | 20 | 3  | 12 |  |  |
| Atriplex quinii              |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Atriplex spongiosa           |                    | 9  |    | 11 |    |   | Annual    |   |    |    |    |    |  |  |
| Atriplex vesicaria complex#  |                    |    |    |    |    |   | Atriplex  |   |    |    |    |    |  |  |
| Eremophila rotundifolia      |                    |    |    |    |    |   | holocarpa |   |    |    |    |    |  |  |
| Frankenia serpyllifolia#     |                    |    | 1  |    | 1  |   |           |   | 14 |    | 5  |    |  |  |
| Maireana astrotricha#        |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Maireana aphylla#            | 1                  |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Maireana eriantha            |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Maireana george#             |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Maireana sedifolia#          |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Senna ft gawlerensis#        |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |
| Senna ft petiolaris#         |                    |    |    |    |    |   |           |   |    |    |    |    |  |  |



## APPENDIX C – Status Codes

(1) Cover Abundance Scale adapted from Braun-Blanquet system utilised by DENR Biological Survey of SA as standard methodology.

|                                                       | Analysis Score <sup>Heard &amp; Channon</sup> |
|-------------------------------------------------------|-----------------------------------------------|
| N = Not many (1-10 plants and <5%)                    | 1                                             |
| T = sparsely present; (cover small <5%)               | 2                                             |
| 1 = plentiful, but of small cover (<5%)               | 3                                             |
| 2 = any number of individuals covering 5-25% of area  | 4                                             |
| 3 = any number of individuals covering 25-50% of area | 5                                             |
| 4 = any number of individuals covering 50-70% of area | 6                                             |
| 5 = covering more than 75% of area                    | 7                                             |

### (2) Field Data Sheet Abbreviations

LEAF DUST LOAD = light (staining only), Moderate (surface but not full depth of hairs), Heavy (full depth of mealy coating or hairs, visible on canopy)

LEAF TYPE = Glossy, Mealy, Abaxial / Adaxial hair (AXH, ADH), channelised, in-rolled

PLANT HEIGHT = average <5% above rule

I = Increaser species based on known response of species following disturbance

Juvenile = <100mm in height with no woody stem<sup>(Lay 2005)</sup>

### Botanical Abbreviations

? = identification uncertain, \* = Introduced Species, var. = variety, ssp. = subspecies, gp = Group, nothosp. = hybrid of subspecies, \_\_ = intergrade, x = hybrid (secondary intergrade), sp. = identification only possible to genus level

**Vegetation Structural Formations:** Vegetation Structural Formations- from Heard & Channon (1997) - adapted from Forward and Robinson (1996) (table originally derived from Specht (1972) and Muir (1997).

Neagle (1995) *“An update of the Conservation Status of the Major plant Associations of South Australia”*.

### **Conservation Status Codes for Plant Associations:**

**E** = Excellent, **R** = Reasonable, **M** = Moderate, **P** = Poor, **N** = Nil for the whole of the state

### **Understorey Rankings:** adapted from Specht (1972)

Very Sparse = (**VS**) <10% cover, Sparse = (**S**) 10 - 30% cover, Mid-Dense = (**MD**) 30-70%, Dense = (**D**) >70%

### **Vegetation Canopy Cover:**

Based on Specht (1972) - Vegetation Classification.

Very Sparse = (**VS**) <10% cover, Sparse = (**S**) 10-30%, Mid-dense = (**MD**) 30-70%, Dense = (**D**) 70-100%

### **Condition Class** Neagle (1995)

**S** = 1) virgin, or  
2) slight weed invasion and/or only light grazing in the past with no resultant loss of plant species richness

**M** = moderate weed invasion and/or moderately grazed in the past resulting in some loss of plant species richness and with significant competition from exotic species in places.

**H** = heavy weed invasion and/or heavily grazed in the past resulting in complete or almost complete destruction of the native understorey

**U** = unknown

### **Fauna:**

**Habitat & Ecological Ratings:** (Bebbington L. - 1996): Ratings based on suitable available habitat for native fauna (reptiles, birds, amphibians, invertebrates & mammals) includes food sources, nest hollows and shelter. Ecological value includes parameters such as plant diversity within a community, health of vegetation, disturbances, weeds present, linkages to other vegetation and historical clearance.

Poor = Little habitat remains, frequent disturbance by overgrazing or clearance, poor plant diversity, severe weed infestation.

Moderate = Some habitat although altered to a large degree, considerable disturbance, and weed infestation, some semblance of diversity remains.

Good = Suitable habitat remains for a range of native fauna, disturbances are restricted to grazing and pasture species still provide habitat, plant diversity and linkages are still intact across community to a larger degree, weed infestation not a major threat.

Very Good = Even if community is modified it still provides habitat and linkages for a range of native fauna, Tree hollows and rock shelters present, disturbances minimal to nil, Plant diversity is extensive across community with minimal weed disturbance.

Excellent = Provides a full suite of habitat for native fauna, disturbances predominately nil, extensive plant diversity, minimal weeds confined to fringes.

## APPENDIX D - Leaf Surface Dust Load Field Indicators Bebbington L. (c) 2011

### Leaf Types and Dust Indicator Loadings

**Glossy** – appears smooth and shiny to the naked eye. Waxy coatings, oil glands and veins can be present. Light Load – faint dusting on leaf surface but oil glands / veins still visible with naked eye. Moderate Load – oil glands or veins only visible with 8x hand lens. Heavy Load – venation not readily visible under hand lens, oil glands hard to distinguish under 30x lens, stoma still visible

**Mealy** – (Chenopods) leaf adaxial surface when viewed under a 30x lens appears to be covered in a layer of uniform bladder like structures with minute hairs.

- Light Load – dusting on upper leaf surface bladders, faintly visible with naked eye, cuticle not covered, abaxial surface not dusted.
- Moderate Load – visible as a coating with naked eye & with 8x hand lens on leaf surface but not covering mealy scales, abaxial surface not dusted, Heavy Load – Visible with naked eye, under hand lens mealy coating and cuticle is completely covered, abaxial surface dusted



**Adaxial Hairs** – fine covering of hairs on the upper leaf surface

**Abaxial Hairs** – generally sparser hair covering on lower leaf surface

- Light Load – dusting on upper leaf surface hairs faintly visible with naked eye, cuticle not covered, abaxial surface not dusted
- Moderate Load – visible as a coating with naked eye & with 8x hand lens on leaf surface but not covering adaxial hairs, abaxial surface not dusted, Heavy Load – Visible with naked eye, under hand lens abaxial and adaxial hair coating is completely covered



## APPENDIX E – References

<sup>2</sup>Arup Environmental – *The Environmental Effects of Dust from Surface Mineral Workings* – Department of Environment 1995

<sup>1</sup>Bureau of Meteorology (BOM) website Rainfall records Coober Pedy region

<sup>4</sup>Paling E.I., Humphries G., McCardle I., Thomson G. – *The Effects of Iron Ore Dust on Mangroves in Western Australia* – Wetland Ecology and Management Volume 9 October 2001

Parsons Brinckerhoff - *Peculiar Knob Iron Ore Mining Project MARP* - 2011

<sup>3</sup>Western Ecological Research Centre – *Dust Deposition Effects on Growth and physiology of Endangered Fabaceae* – U.S.A. 2007

# Appendix B

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS







## Arrium Mining

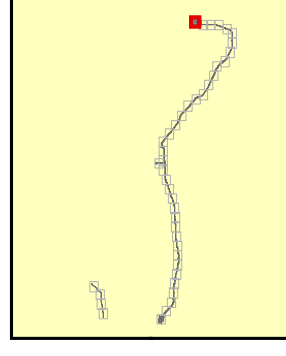
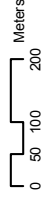
Peculiar Knob Iron Ore Mine

Vegetation Clearance -ML6314- 1

### Legend

- Railway Line
- ML Boundary
- EML Boundary
- As Cleared/Clearance Permit Area - Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

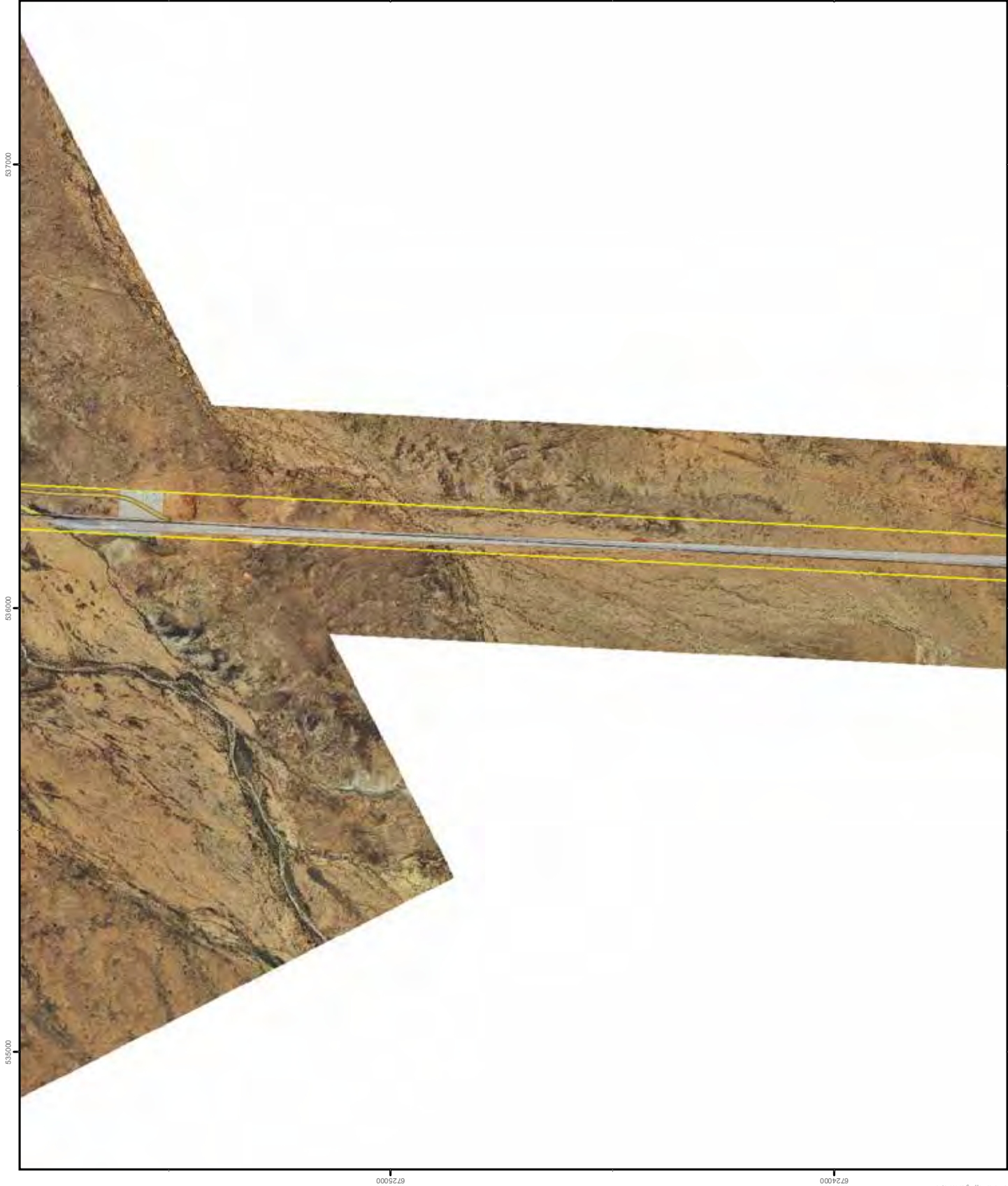


Page1 of 43

GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
Avante Mapping Solutions  
Data Source: DP LG, DTPi, Arrium

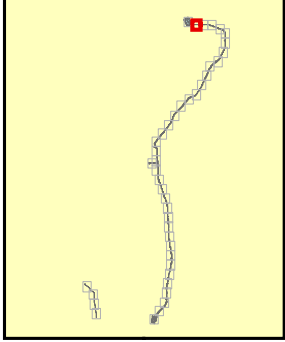
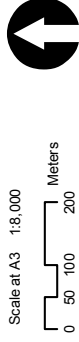
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**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL130- 1

- Legend**
- Railway Line
  - ML Boundary
  - MPL Boundary
  - EML Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary



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# Arrium Mining

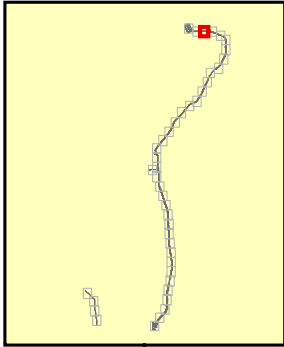
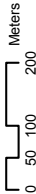
Peculiar Knob Iron Ore Mine

Vegetation Clearance -MPL130- 2

## Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EM Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000



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## Arrium Mining

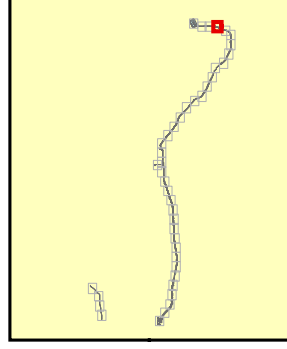
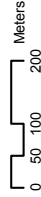
Peculiar Knob Iron Ore Mine

Vegetation Clearance -MPL125- 1

### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000



Page4 of 43

GDA 94 - MGA Zone 53  
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Data Source: DPLG, DTP, Arrium

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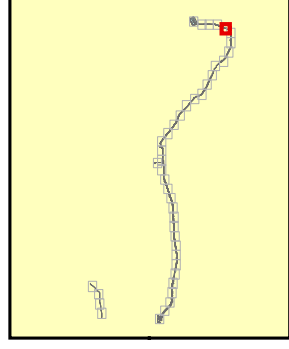


**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL125- 2

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EML Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



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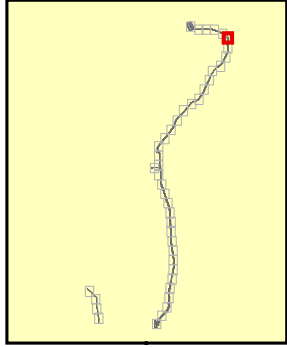
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL125- 3

- Legend**
- Railway Line
  - ML Boundary
  - MPL Boundary
  - EML Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



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# Arrium Mining

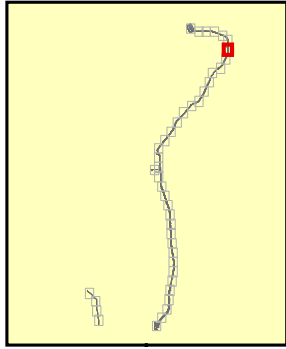
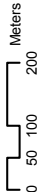
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL125- 4

#### Legend

- Railway Line
- ML Boundary
- MPL Boundary
- EM Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000



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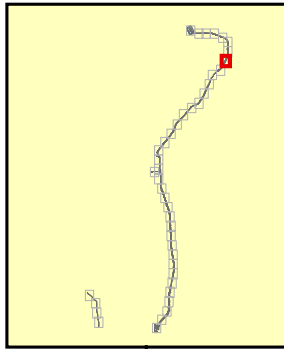
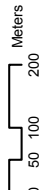
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL125- 5

#### Legend

- Railway Line
- ML Boundary
- MP-L Boundary
- EM-L Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000





## Arrium Mining

Peculiar Knob Iron Ore Mine

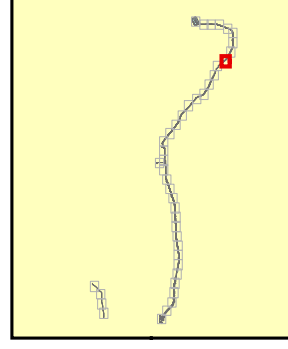
Vegetation Clearance -MPL125- 6

### Legend

- Railway Line
- ML Boundary
- MPL Boundary
- EM Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters





# Arrium Mining

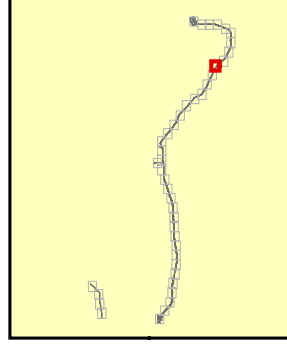
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL125- 7

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EM Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters

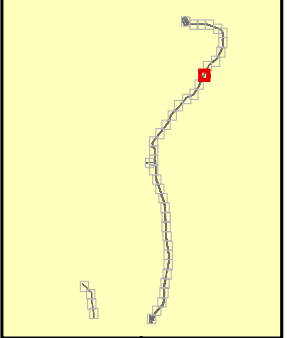
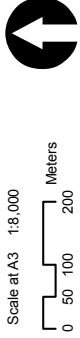






**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL125- 8

- Legend**
- Railway Line
  - ML Boundary
  - MP-L Boundary
  - EM-L Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary



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# Arrium Mining

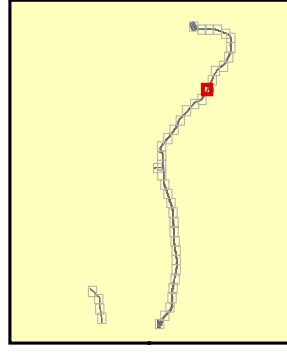
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL125- 9

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EM Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 18,000

0 50 100 200 Meters



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## Arrium Mining

Peculiar Knob Iron Ore Mine

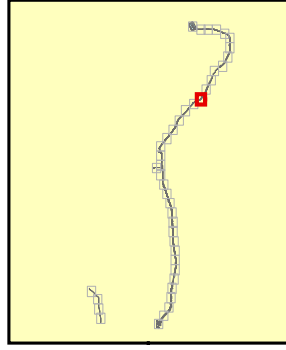
Vegetation Clearance -MPL126- 1

### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EM Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



Page 13 of 43

GDA 94 - MGA Zone 53

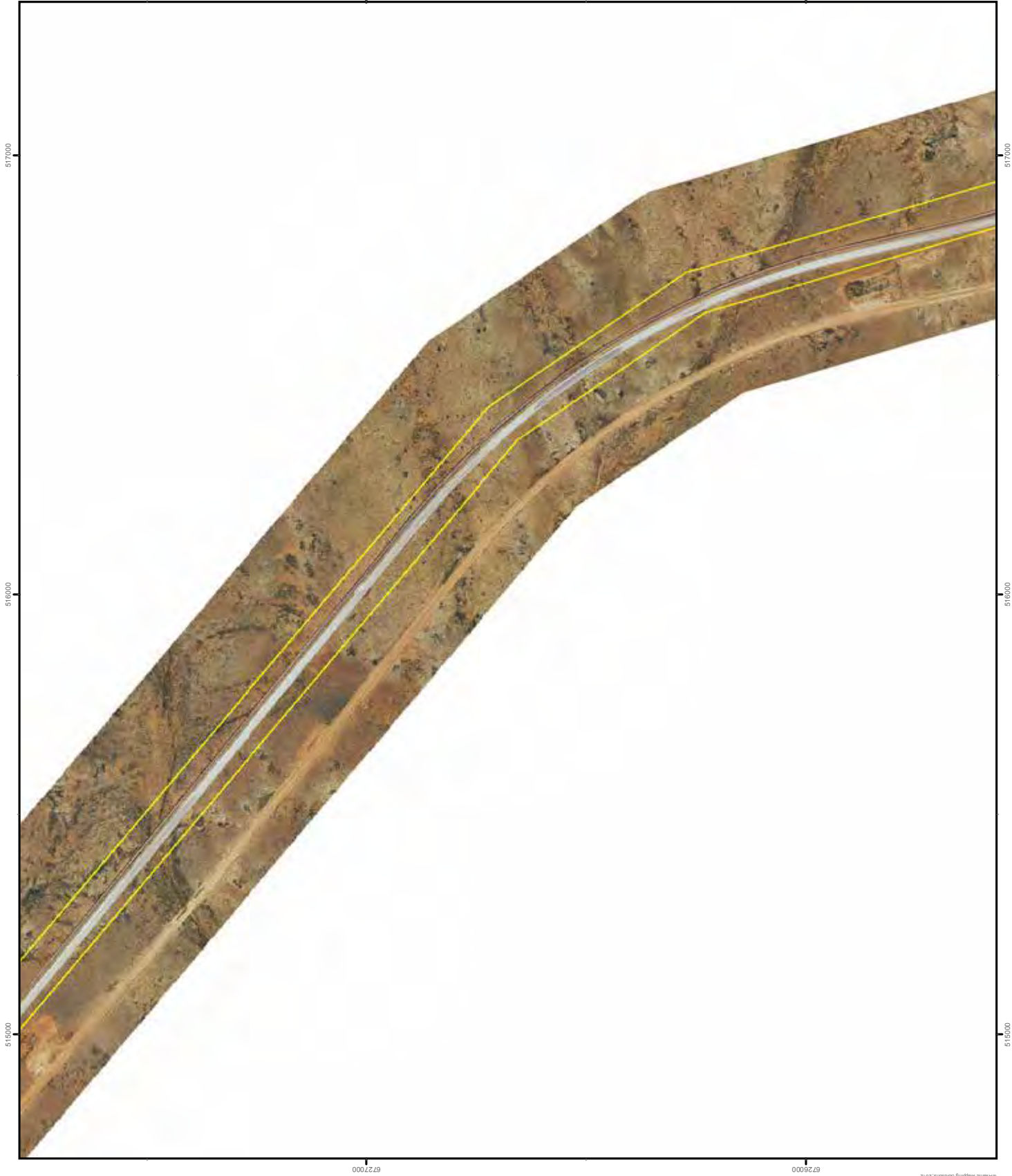
Map generated Aug 2012 by

Avante Mapping Solutions

Data Source: DPLG, DTP, Arrium

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## Arrium Mining

Peculiar Knob Iron Ore Mine

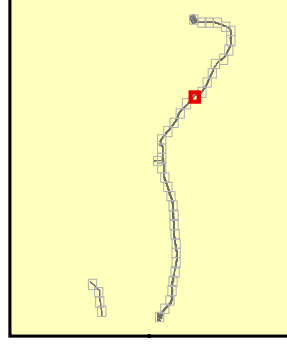
Vegetation Clearance -MPL126- 2

### Legend

- Railway Line
- ML Boundary
- MP-L Boundary
- EM-L Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

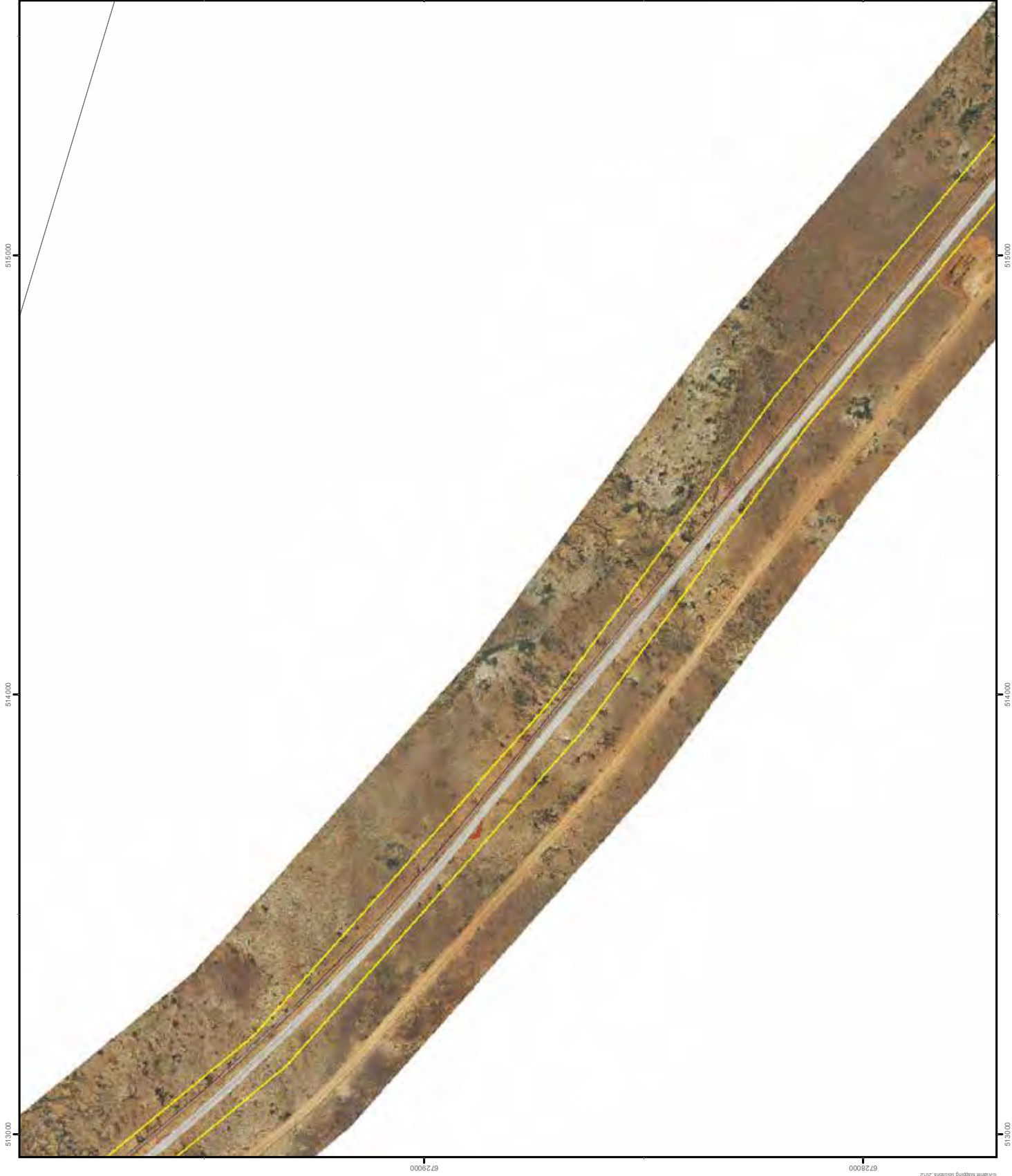
0 50 100 200 Meters



Page 14 of 43

GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
Avante Mapping Solutions  
Data Source: DPLG, DTP, Arrium

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# Arrium Mining

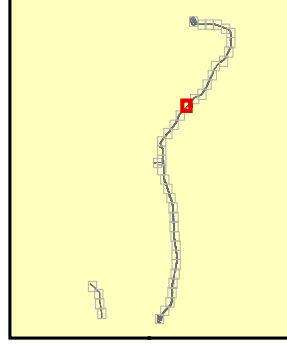
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL126- 3

- Legend**
- Railway Line
  - ML Boundary
  - MP-L Boundary
  - EM-L Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



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# Arrium Mining

## Peculiar Knob Iron Ore Mine

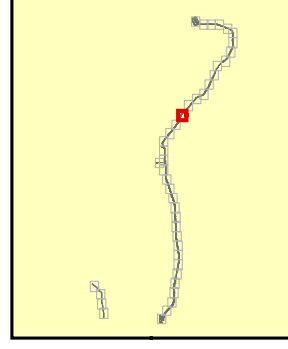
### Vegetation Clearance -MPL126- 4

#### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EM Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



Page 16 of 43

GDA 94 - MGA Zone 53  
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# Arrium Mining

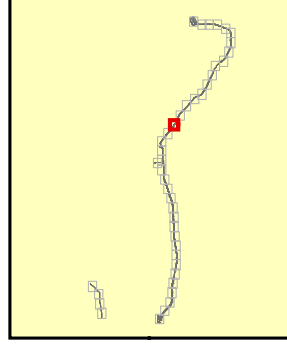
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL126- 5

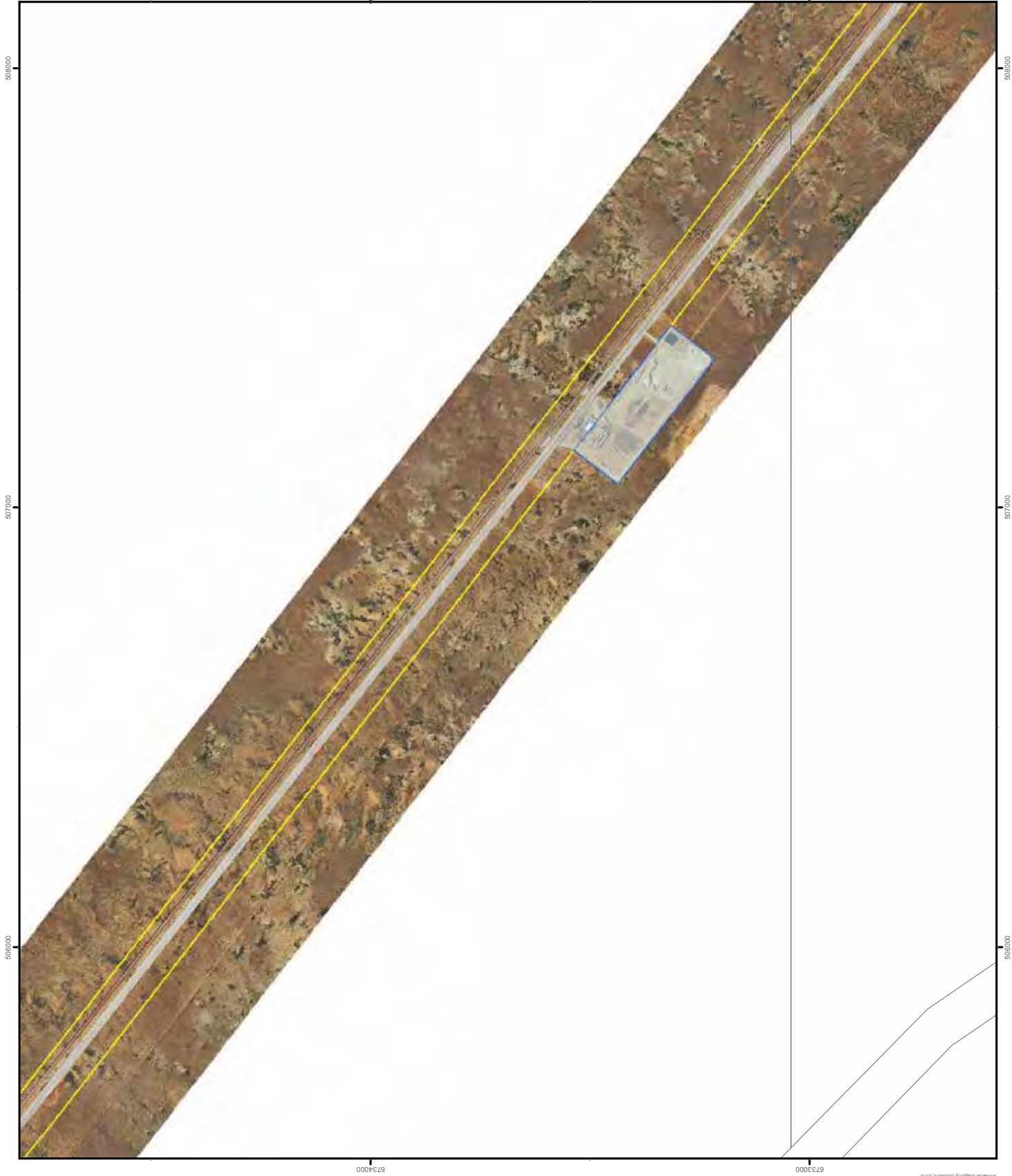
- Legend**
- Railway Line
  - ML Boundary
  - MP-L Boundary
  - EM-L Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



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## Arrium Mining

Peculiar Knob Iron Ore Mine

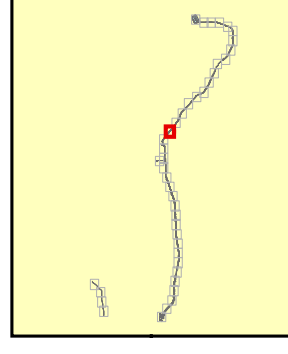
Vegetation Clearance -MPL126- 6

### Legend

- Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 18,000

0 50 100 200 Meters

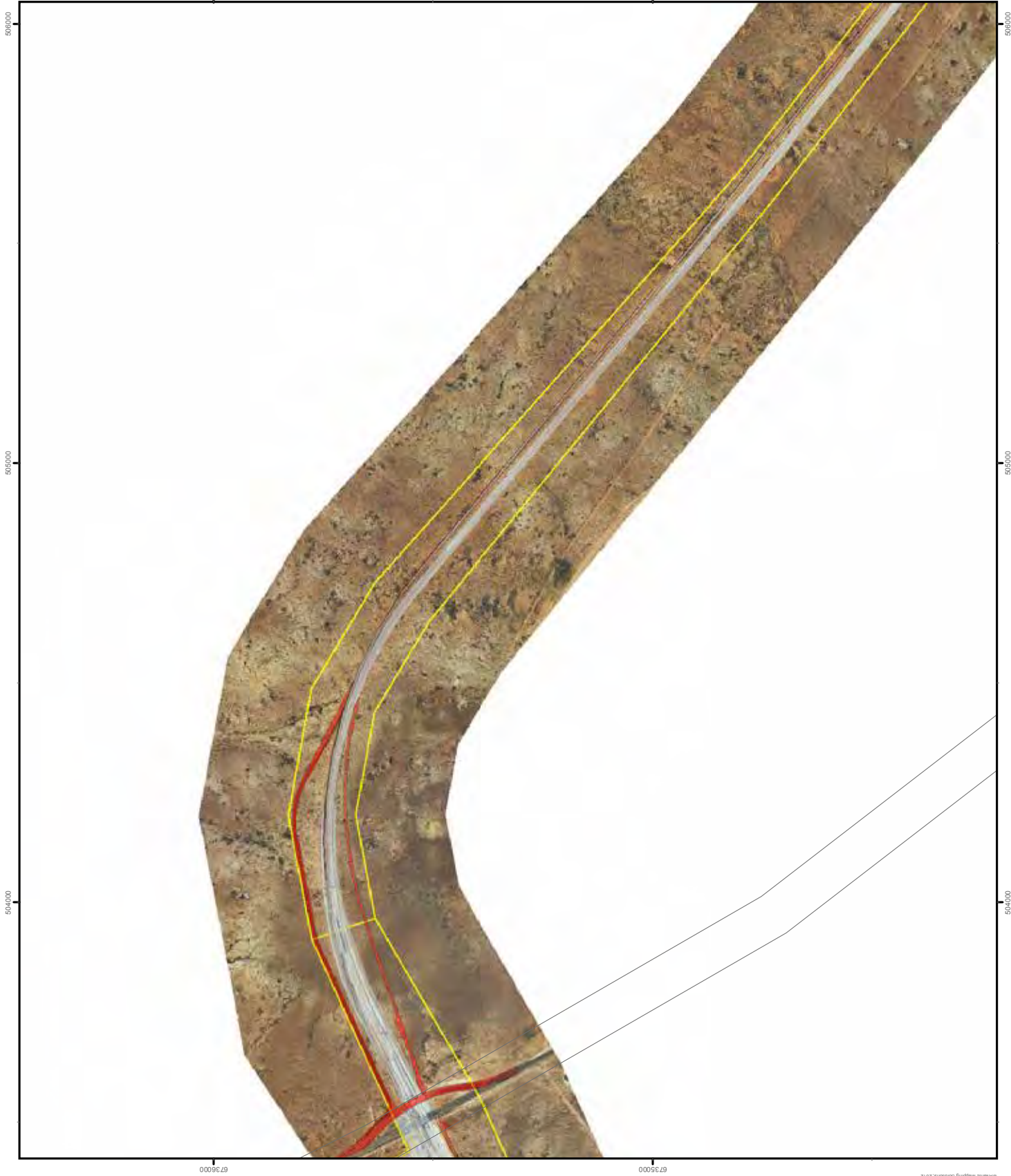


Page 18 of 43

GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
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Data Source: DPLG, DTP, Arrium

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# Arrium Mining

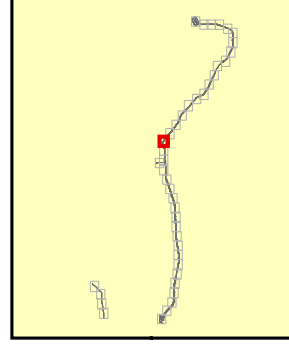
## Peculiar Knob Iron Ore Mine

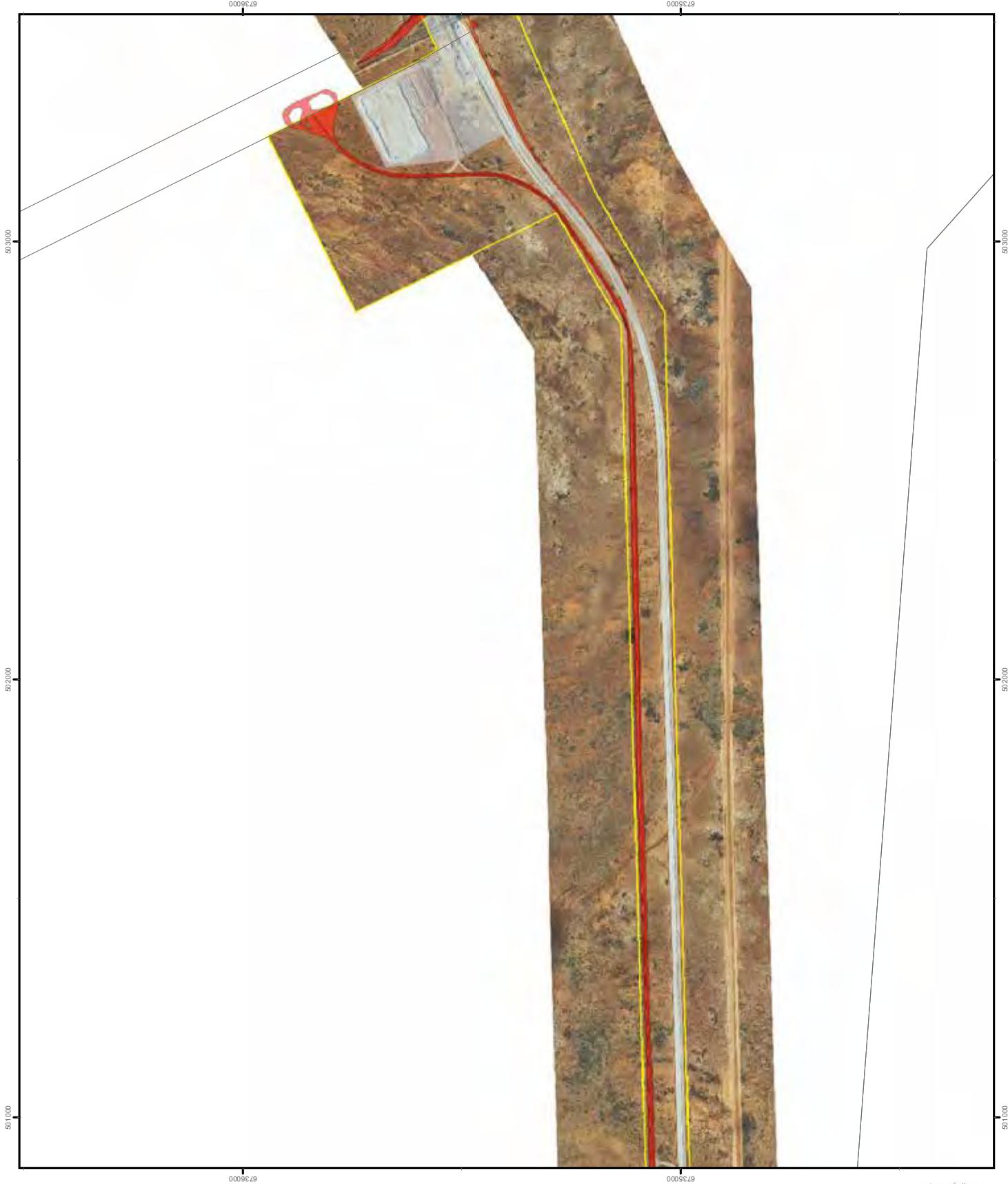
### Vegetation Clearance -MPL126- 7

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EM Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 18,000

0 50 100 200 Meters





## Arrium Mining

Peculiar Knob Iron Ore Mine

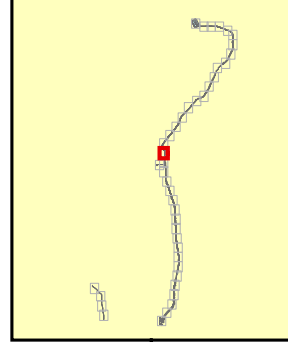
Vegetation Clearance -MPL127- 1

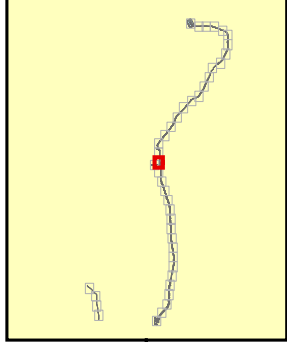
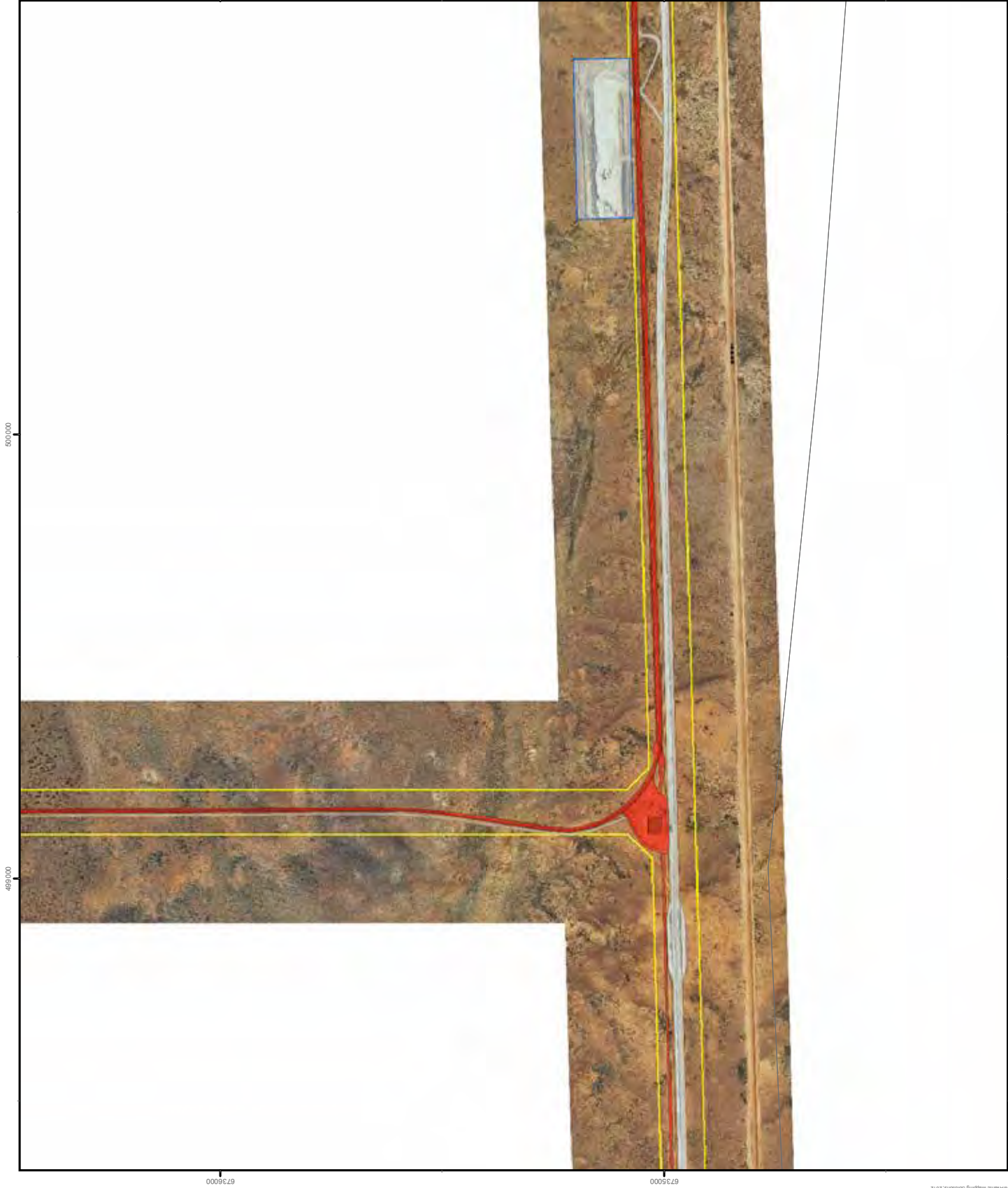
### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:18,000

0 50 100 200 Meters







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## Arrium Mining

Peculiar Knob Iron Ore Mine

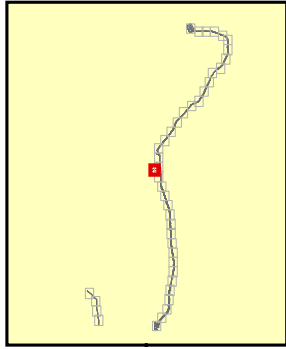
Vegetation Clearance -MPL127- 3

### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



Page 22 of 43

GDA 94 - MGA Zone 53  
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# Arrium Mining

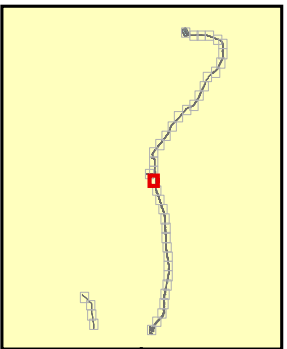
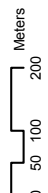
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL127- 4

#### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EM Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 18,000



GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
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Data Source: DPLG, DTP, Arrium

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6735000

6734000

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## Arrium Mining

Peculiar Knob Iron Ore Mine

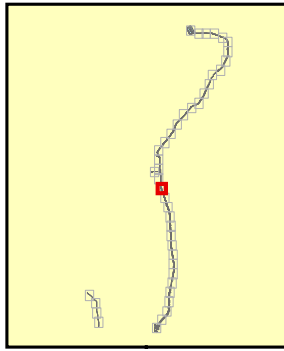
Vegetation Clearance -MPL128- 1

### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



Page 24 of 43

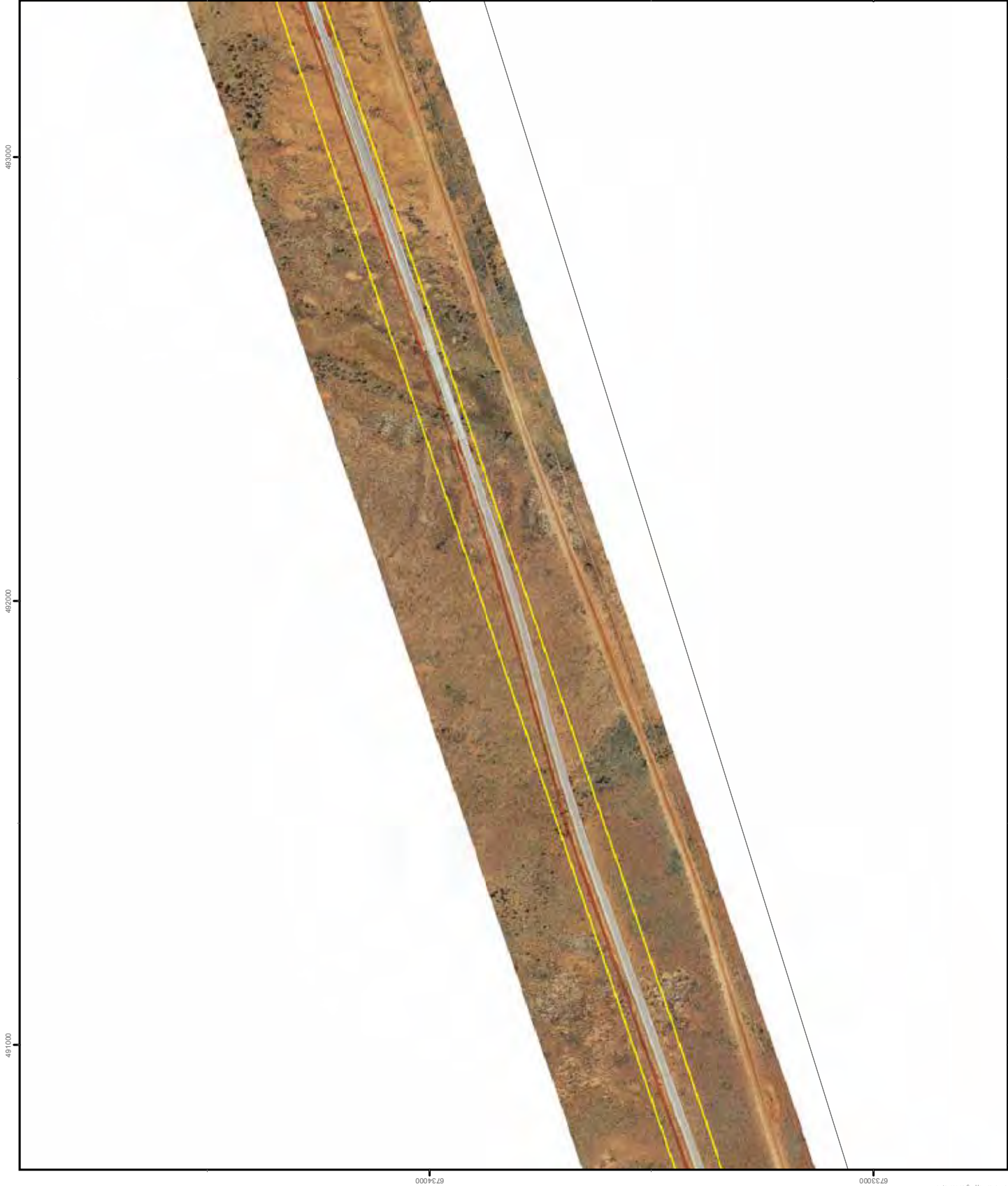
GDA 94 - MGA Zone 53

Map generated Aug 2012 by

Avante Mapping Solutions

Data Source: DPLG, DTP, Arrium

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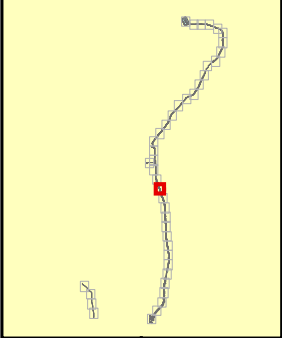


**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL128- 2

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EM Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

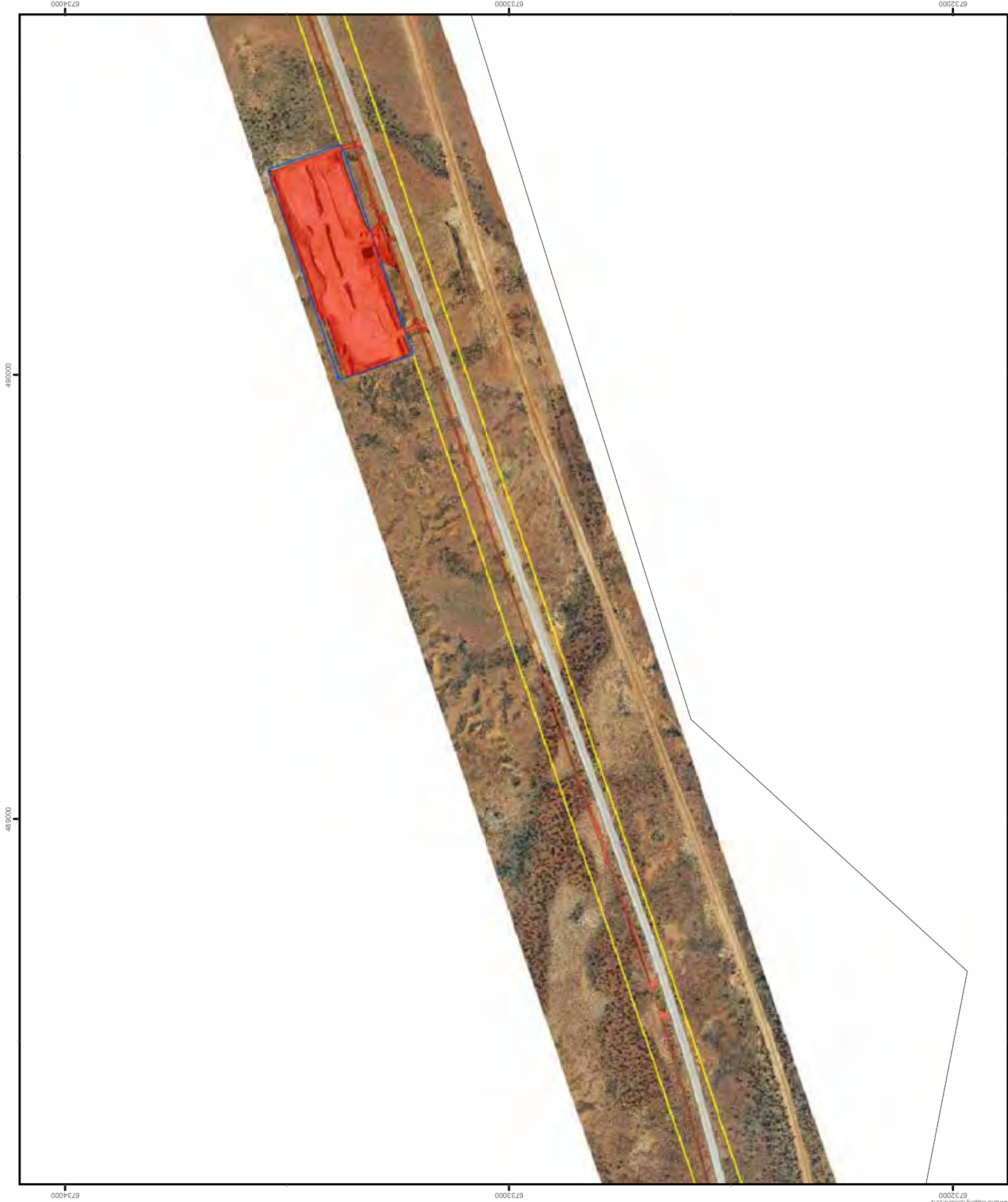
Scale at A3 1:8,000

0 50 100 200 Meters



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## Arrium Mining

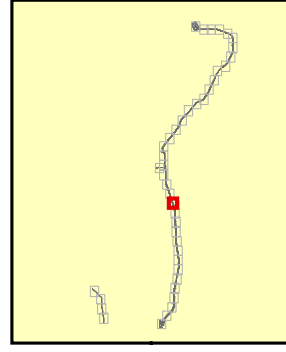
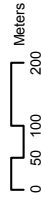
Peculiar Knob Iron Ore Mine

Vegetation Clearance -MPL128- 3

### Legend

- +— Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000



Page 26 of 43

GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
Avante Mapping Solutions  
Data Source: DPLG, DTPi, Arrium

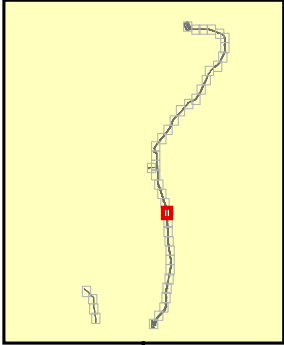
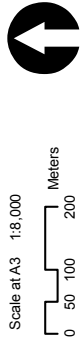
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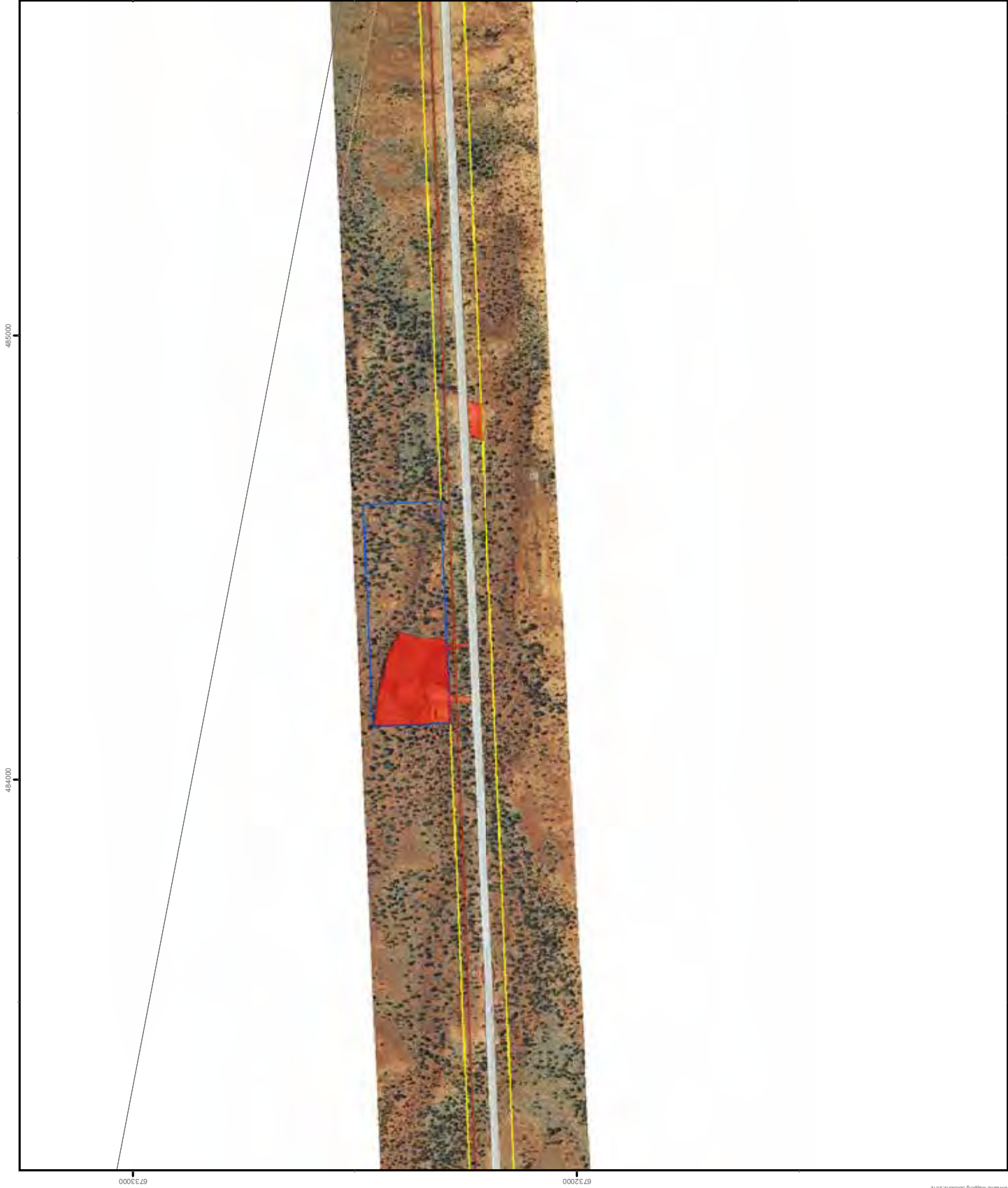


**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL128- 4

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EML Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary



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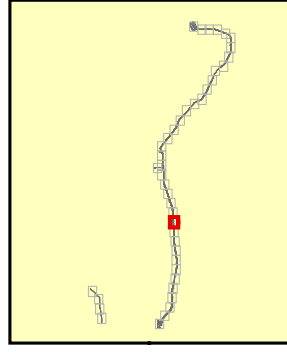
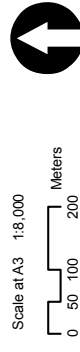


# Arrium Mining

## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL128- 5

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EML Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary



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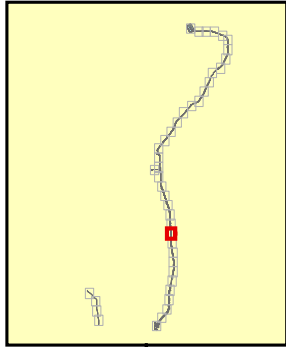
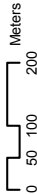


**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL128- 6

**Legend**

- +— Railway Line
- ML Boundary
- MPL Boundary
- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000





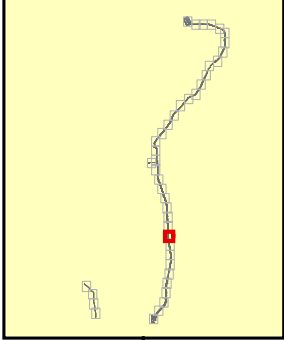
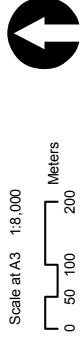


**Arrium Mining**

Peculiar Knob Iron Ore Mine

Vegetation Clearance -MPL128- 7

- Legend**
- Railway Line
  - ML Boundary
  - MPL Boundary
  - EML Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary



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# Arrium Mining

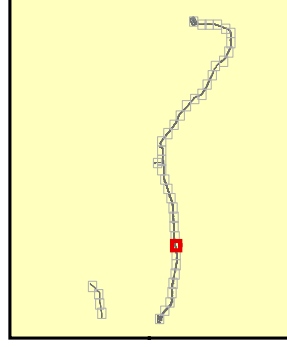
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL128- 8

- Legend**
- +— Railway Line
  - ML Boundary
  - MPL Boundary
  - EM Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters



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# Arrium Mining

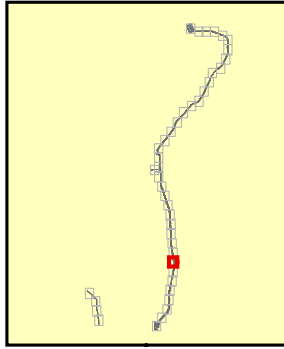
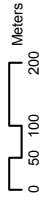
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL129- 1

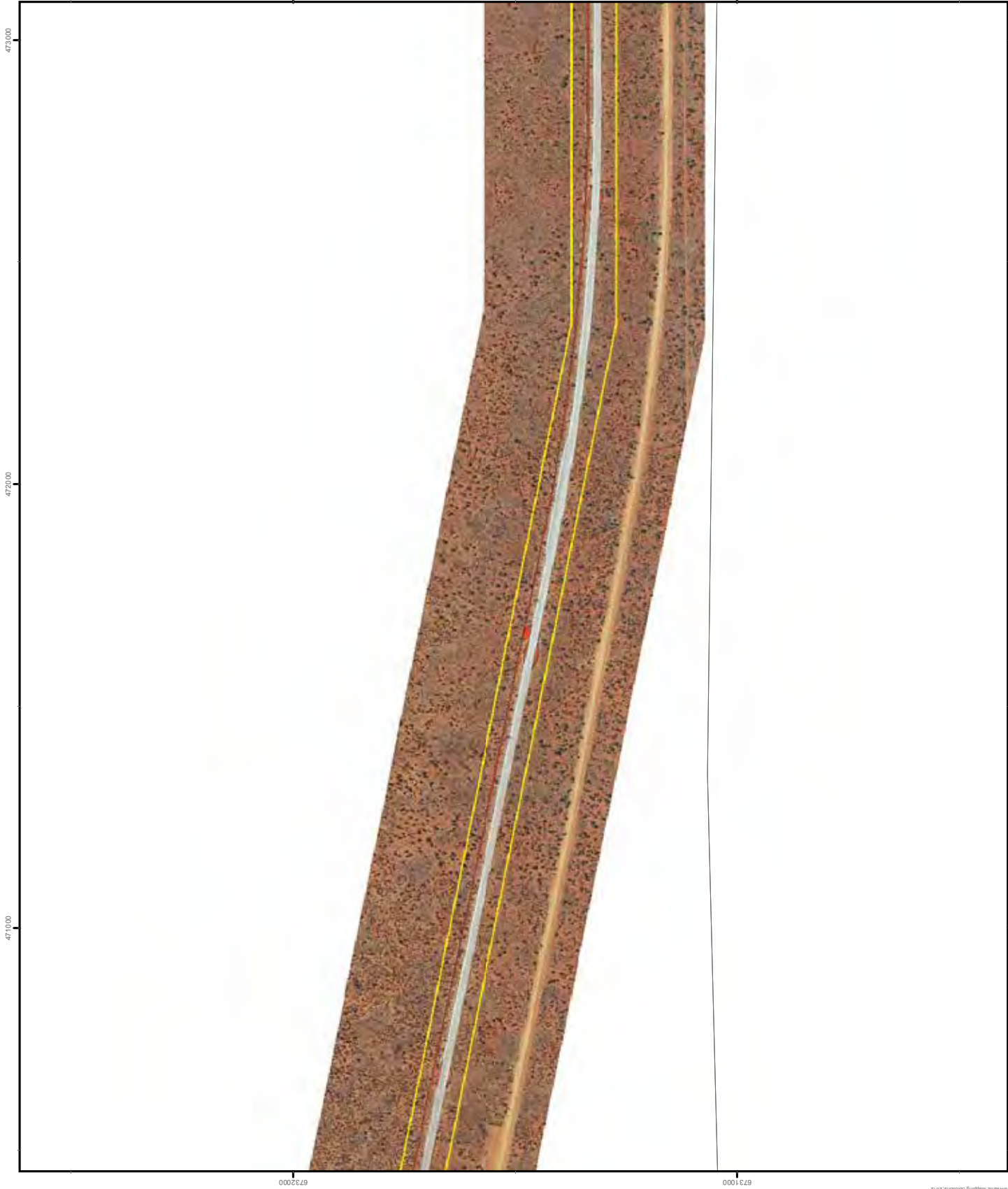
#### Legend

- Railway Line
- ML Boundary
- MP-L Boundary
- EM-L Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 18,000







# Arrium Mining

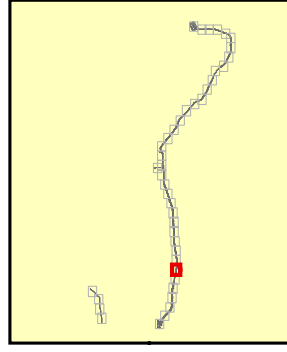
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### Vegetation Clearance -MPL129- 2

- Legend**
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  - MP-L Boundary
  - EM-L Boundary
  - As Cleared/Clearance Permit Area -Mine Site
  - As Cleared Area
  - Clearance Permit Area
  - Cadastral Boundary

Scale at A3 18,000

0 50 100 200 Meters



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## Arrium Mining

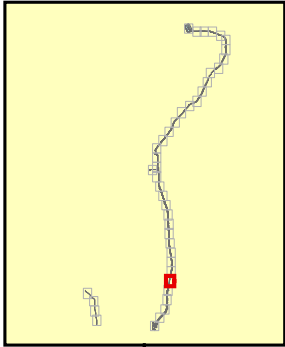
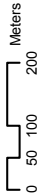
Peculiar Knob Iron Ore Mine

Vegetation Clearance -MPL129- 3

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- MPL Boundary
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- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000



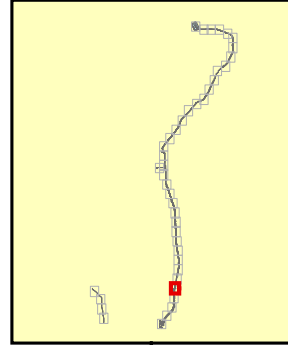
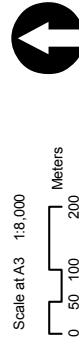
Page 34 of 43

GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
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Data Source: DPLG, DTPi, Arrium

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Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL129-4



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## Arrium Mining

Peculiar Knob Iron Ore Mine

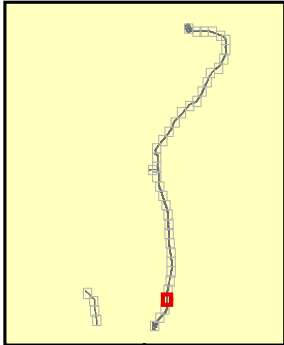
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- Clearance Permit Area
- Cadastral Boundary

Scale at A3 18,000

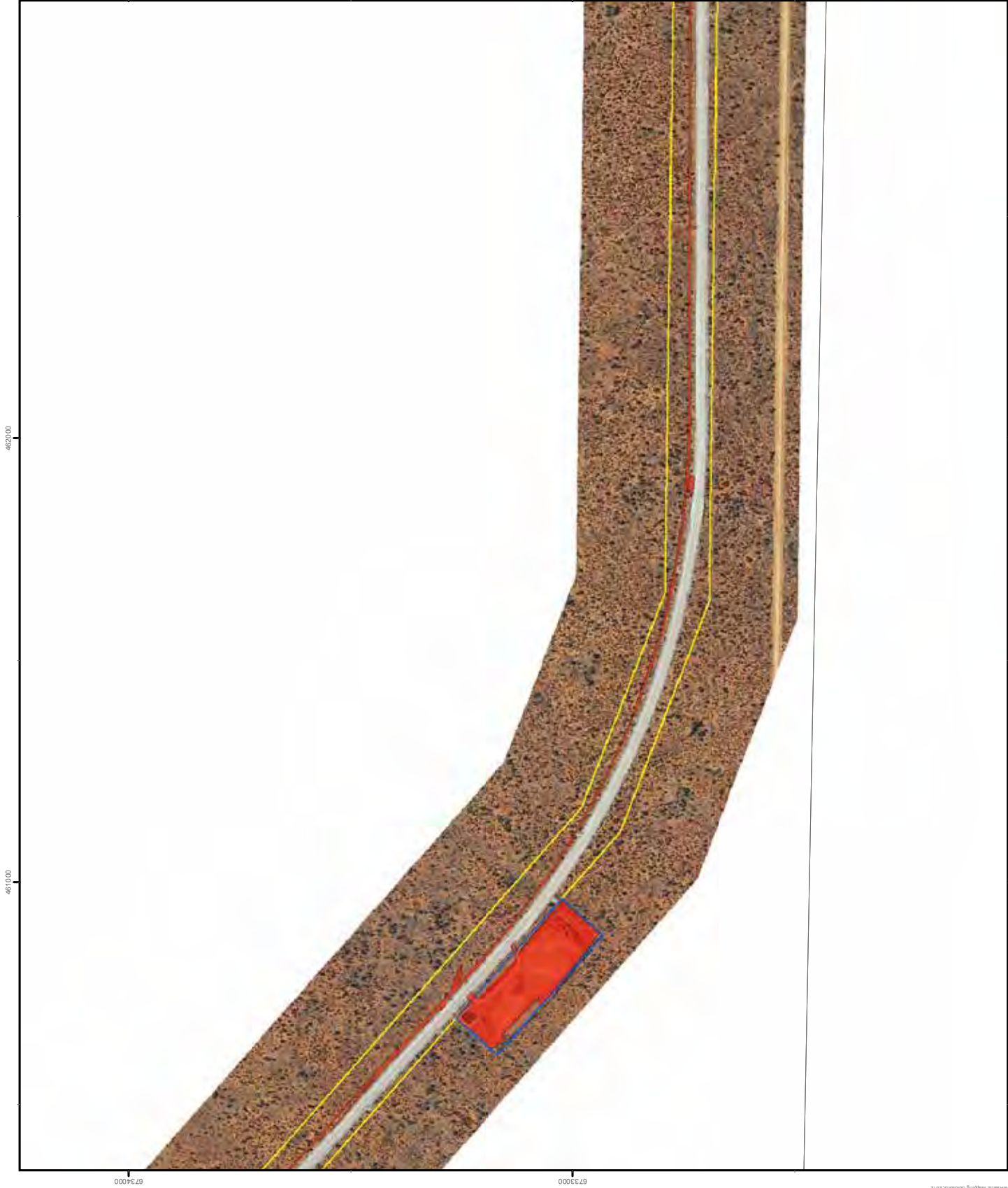
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Page 36 of 43

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Map generated Aug 2012 by  
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Data Source: DPLG, DTPi, Arrium

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## Arrium Mining

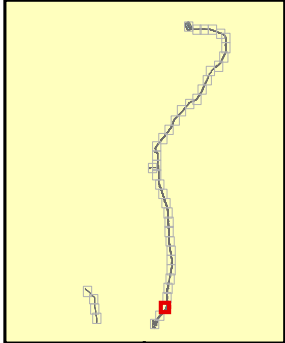
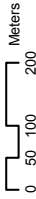
Peculiar Knob Iron Ore Mine

Vegetation Clearance -MPL129- 6

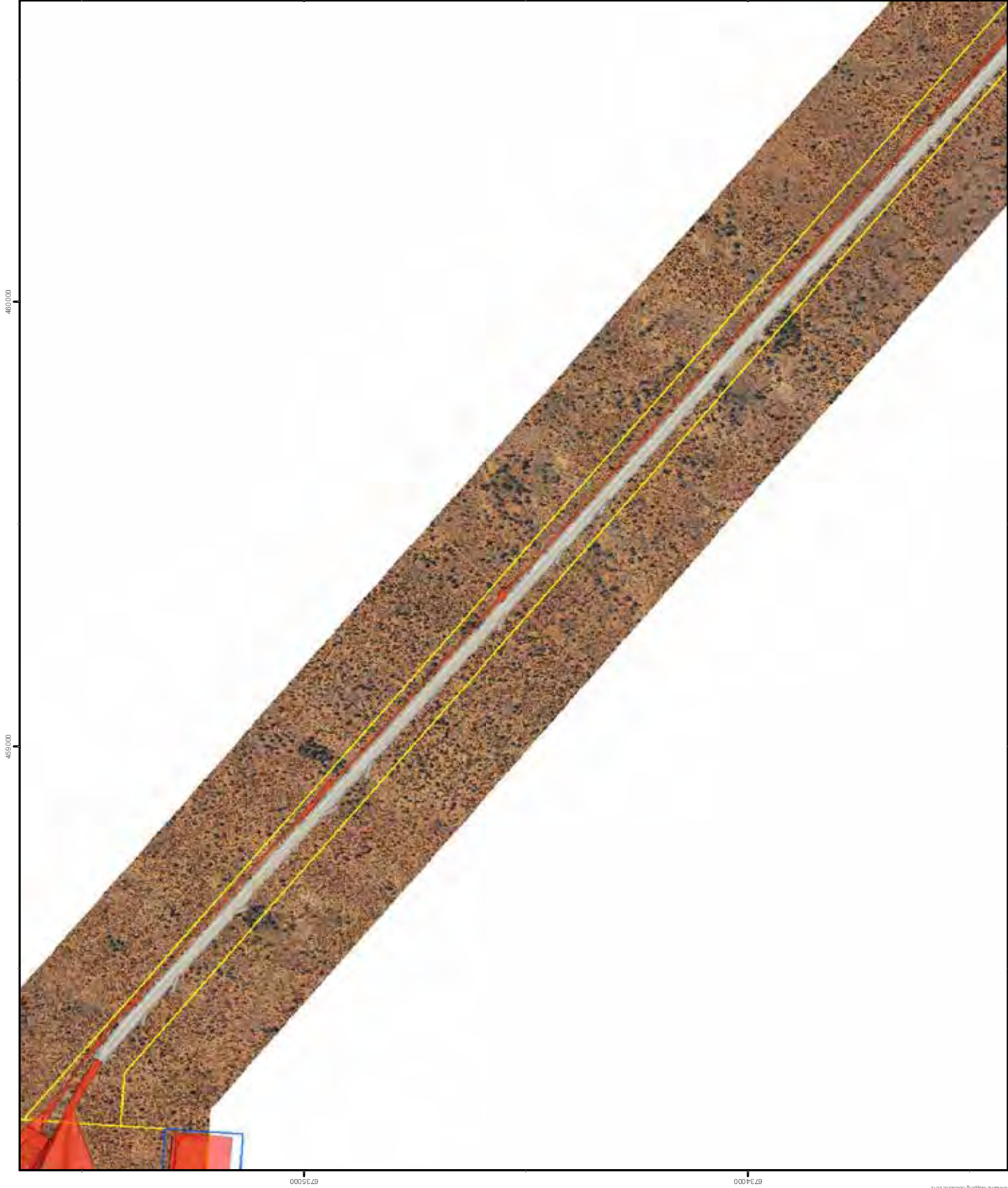
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- Cadastral Boundary

Scale at A3 1:8,000







## Arrium Mining

Peculiar Knob Iron Ore Mine

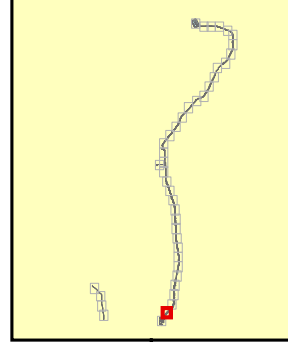
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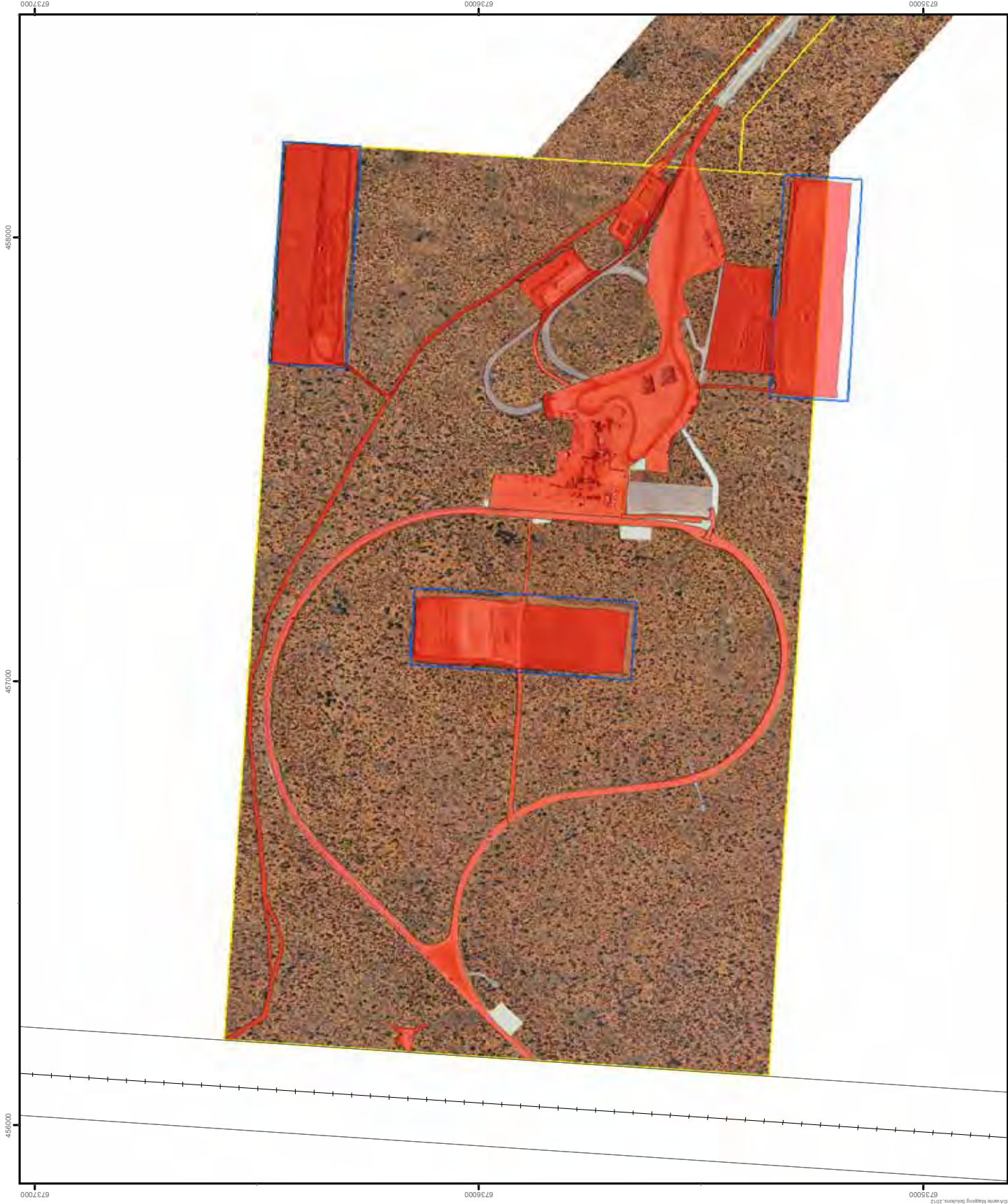
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- EML Boundary
- As Cleared/Clearance Permit Area -Mine Site
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- Cadastral Boundary

Scale at A3 1:8,000

0 50 100 200 Meters





## Arrium Mining

Peculiar Knob Iron Ore Mine

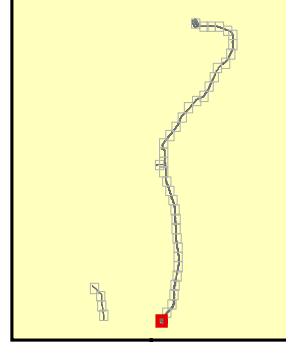
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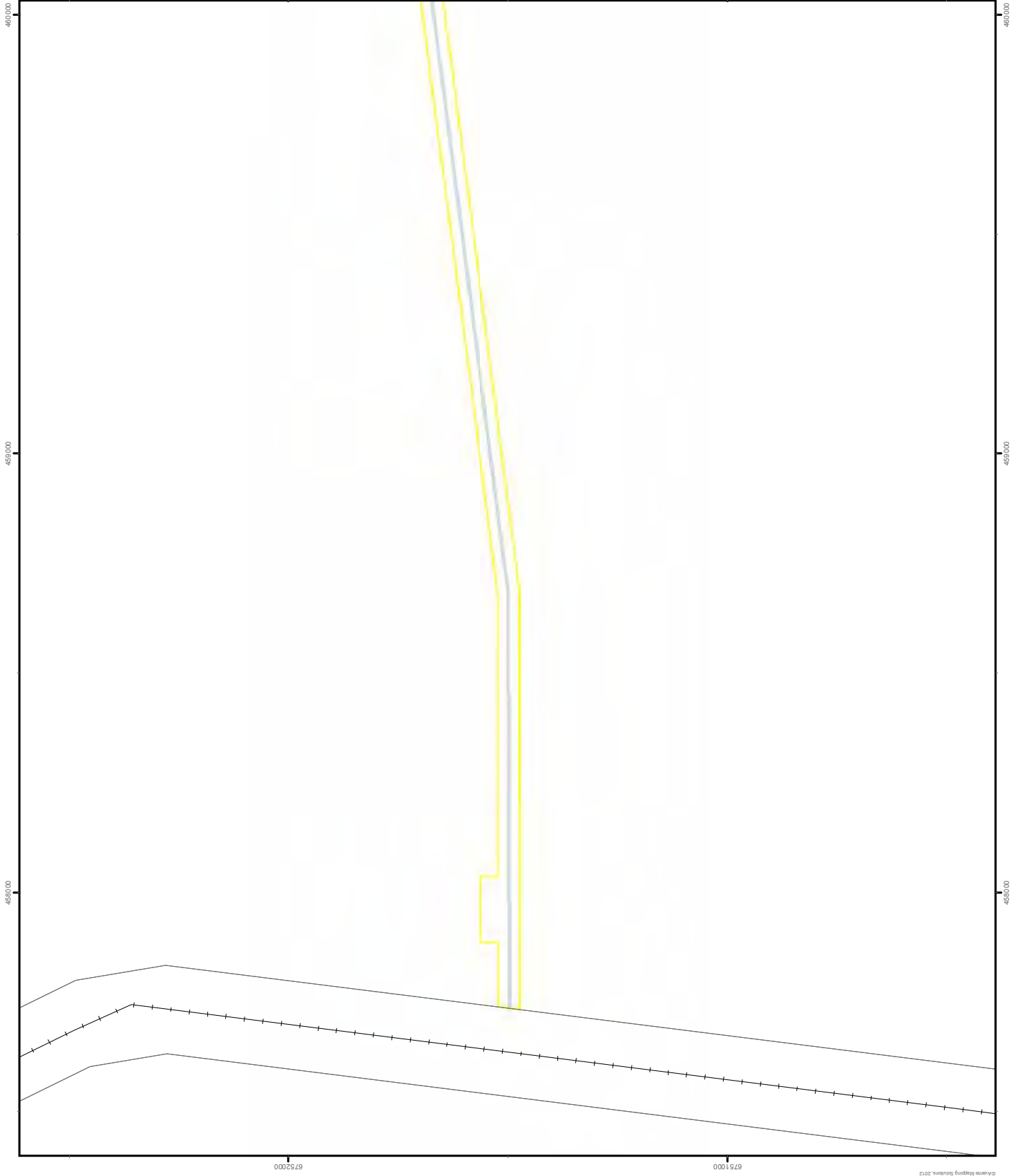
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- Cadastral Boundary

Scale at A3 18,000

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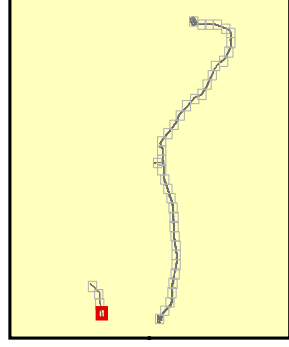


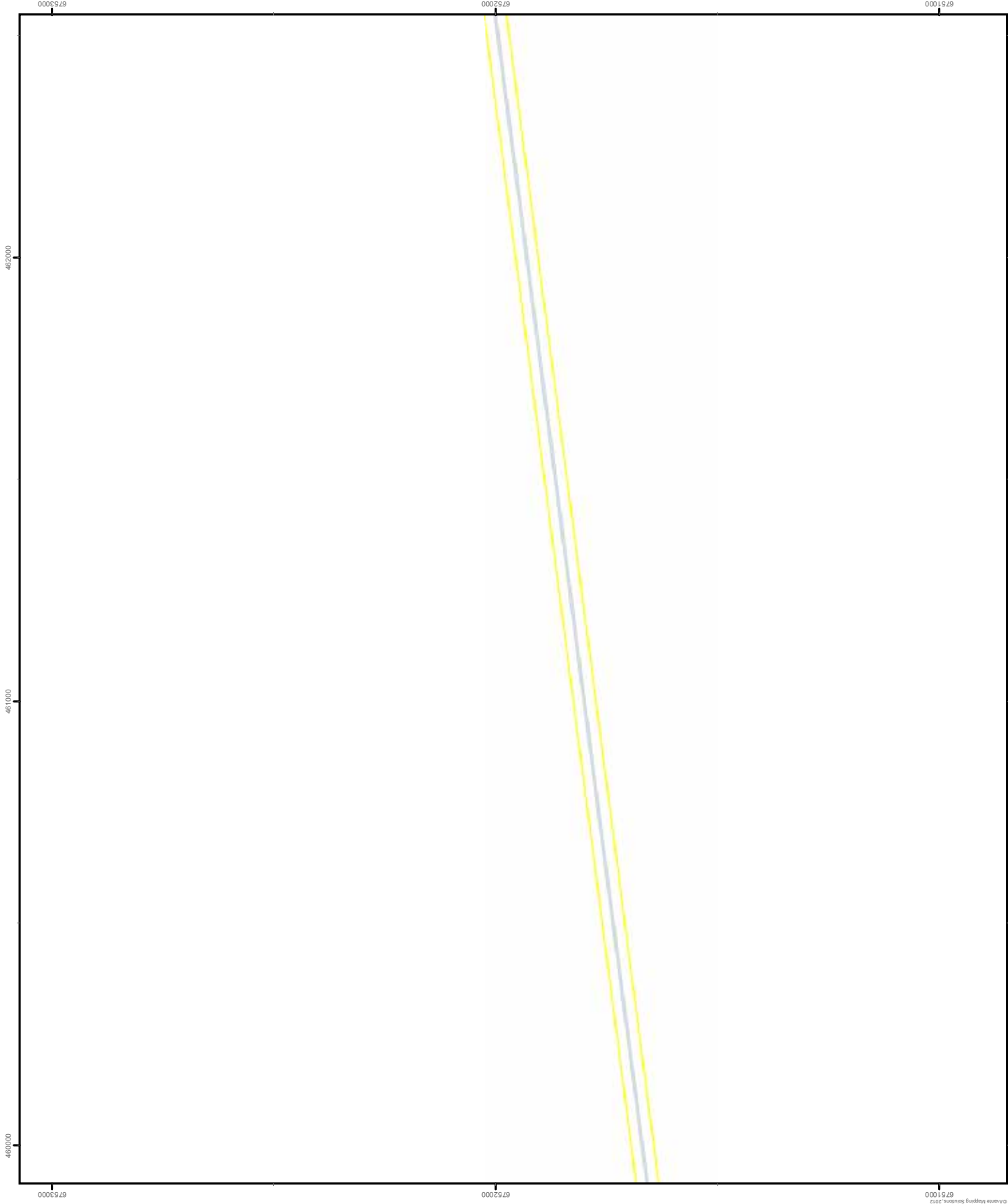
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Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL133- 1

- Legend**
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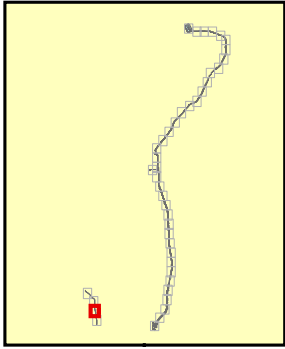


**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL133- 2

**Legend**

- +— Railway Line
- ML Boundary
- MP-L Boundary
- EM-L Boundary
- As Cleared/Clearance Permit Area -Mine Site
- As Cleared Area
- Clearance Permit Area
- Cadastral Boundary

Scale at A3 1:8,000  
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# Arrium Mining

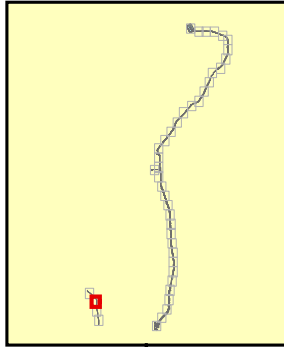
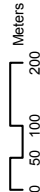
## Peculiar Knob Iron Ore Mine

### Vegetation Clearance -MPL133- 3

#### Legend

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- ML Boundary
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- Cadastral Boundary

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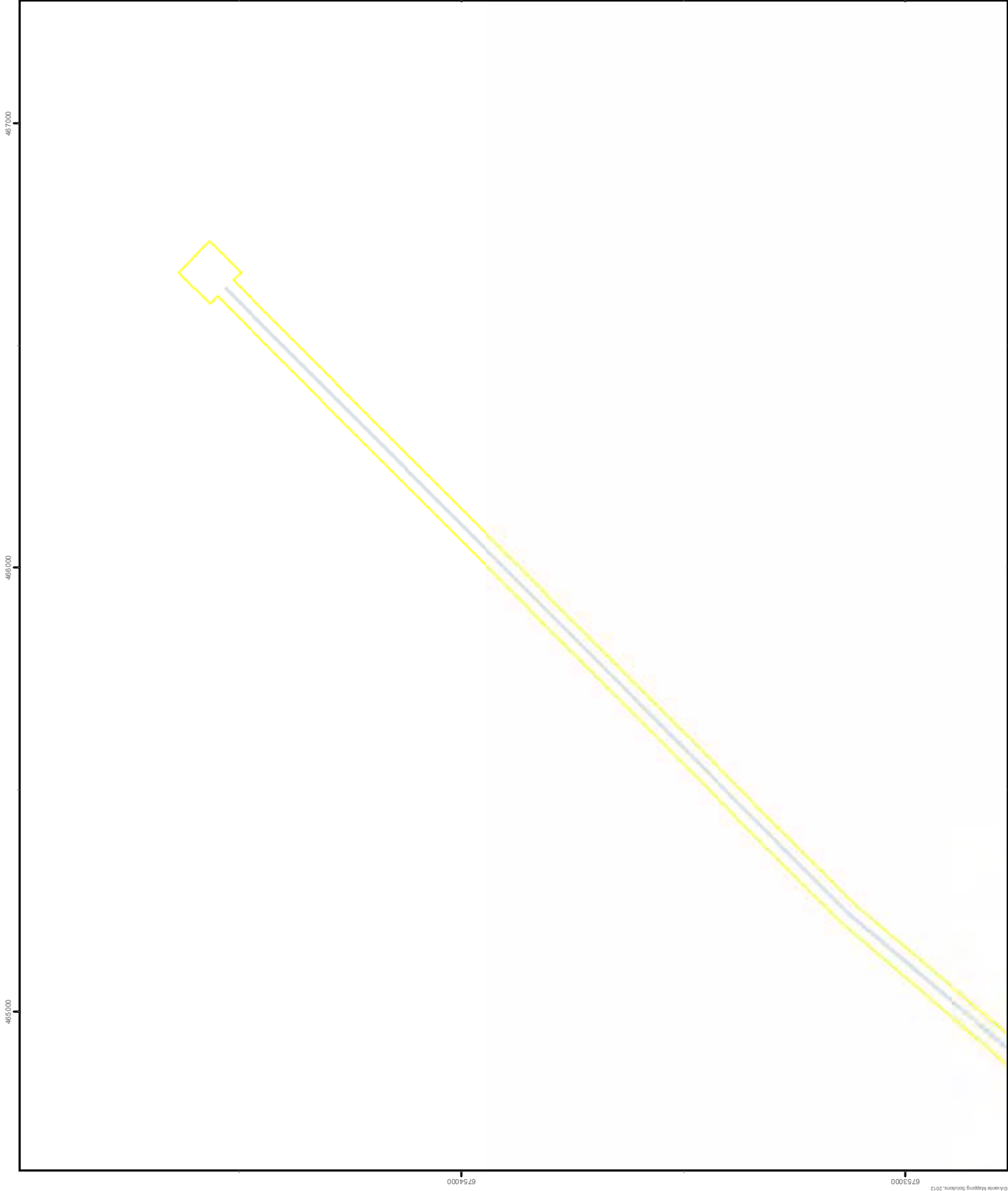


Page 42 of 43

GDA 94 - MGA Zone 53  
Map generated Aug 2012 by  
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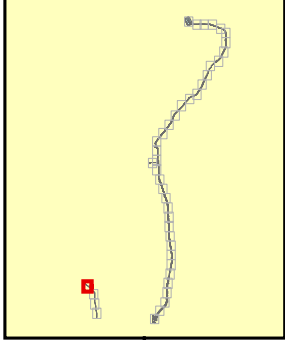
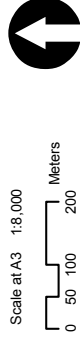
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**Arrium Mining**  
Peculiar Knob Iron Ore Mine  
Vegetation Clearance -MPL133- 4

- Legend**
- +— Railway Line
  - ML Boundary
  - MP-L Boundary
  - EM-L Boundary
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  - Clearance Permit Area
  - Cadastral Boundary



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# Appendix C

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS



## **Peculiar Knob fauna monitoring program**

**November 2011**

Ecological Horizons Pty Ltd



Future Peculiar Knob minesite (centre background)

### **Limitations Statement**

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## Introduction

OneSteel through their newly acquired wholly owned subsidiary Southern Iron Pty Ltd intend commencing mining at the Peculiar Knob Iron Ore Deposit, approximately 60 km south of Coober Pedy in December 2011. This small, high grade deposit is located in the outwash plain of the Stuart Range breakaways in northern South Australia. The mine takes its name from one, of several, ochre-coloured mesa remnants of the Stuart Range (see cover image).

Ore will be carted along a 96 km purpose-built haul road to the railway siding at Wirrida. This haul road runs parallel with, and less than 300 m from the Prominent Hill haul road for most of its distance. Peculiar Knob have constructed a camp 4km west of the Stuart Highway, roughly half way between the mine and the loading facilities. The mine life is expected to be approximately 5 years, after which rehabilitation will commence.

The minesite is situated on a low stony rise, sparsely vegetated by perennial chenopod shrubs and ephemeral vegetation. Bisecting the minesite and also immediately to the east are ephemeral watercourses, originating in the Stuart Range breakaways and redistributing water to the cracking gypseous clay plains downstream. The haul road traverses the Stuart Range before crossing a long gibber plain, bisected by a number of small, ephemeral watercourses. Wirrida is located in dunefields and sandplains, supporting low open acacia grassland. More details on the vegetation associations of the study region are provided in the MARP (Parsons Brinckerhoff 2011). Initial fauna surveys of the region conducted in the drought period of 2007 recorded 8 species of mammals, 17 species of reptiles and 28 species of birds, with the only EPBC-listed species recorded being the Thick-billed Grasswren (EBS 2007).

## Scope

Southern Iron Pty Ltd are obliged to select and establish paired control and impact fauna monitoring sites at five of the seven paired flora monitoring sites identified in the Peculiar Knob PEPR, Figure 10.6 (Parsons Brinckerhoff 2011).

To meet these obligations, Ecological Horizons Pty Ltd were contracted to design a scientifically defensible method of monitoring fauna in order to compare species diversity, abundance, habitat assemblages, feral animal presence and linkages between fauna and vegetation communities. The November 2011 survey will serve as the baseline and will be monitored annually through a BACI style monitoring program, whereby capture rates of mammals and reptiles and observations of birds will be compared at Control and nominal Impact sites both before and after potential mining disturbance.

Specific deliverables were:

- Provide expert advice regarding monitoring site location and comparative methodology
- Supply and establish permanent pit trap lines at impact and control sites
- Provide a written report containing but not limited to the following;
  - Vertebrate species list
  - Numbers of individual species trapped or observed
  - General observations about the health and abundance of individual species
  - Observations about the general health of habitat
  - All other information that will satisfy the requirements of the extent of work.
  - Map showing trap locations and significant observations
  - Site photos that add value to the report
  - GPS coordinates of all trap site locations and other recorded sightings
  - Discussion on significance of habitat to species
- In order to secure and maintain permits to conduct fauna monitoring, details of all captures need to be submitted to the South Australian Department for Environment and Natural Resources Biological Records Database.

## Rationale for site selection

The principal pervasive impacts of the Peculiar Knob operations to regional fauna communities are anticipated to be related to:

- 1) increased disturbance (dust and noise) associated with the mining, haulage and loading of ore
- 2) disruption to surface flows and concentration of resources in run-on areas
- 3) increases in distribution or abundance of feral species and weeds.

Therefore, potential impact sites were established adjacent to the Mine Lease (ML6314), the haul road and the crushing and loading facilities, where dust and noise levels are expected to increase (Table 1). Three main habitat types were identified in these areas, mulga woodlands, stony plains with cracking clay gilgais and drainage lines, and Acacia dunefield and grasslands. Two sites (PK06I and PK07I) were immediately adjacent to the mine lease and PK01I was sited immediately north of the crushing and loading facilities at the Wirrida Railway siding. These were considered to be the most likely regions disturbed by the mining and hauling operations. Sites PK03I and PK05I were located immediately adjacent to the haul road, where increased dust load, noise and vehicle fauna interactions are likely. In addition, two of the five sites (PK03I and PK07I) were situated in drainage lines that may be affected by changes to surface water flow.

Detecting and monitoring the nature and extent of any impacts to EPBC-listed species is an additional requirement for Southern Iron. During initial site inspection, Ecological Horizons suggested that there was a high likelihood that two species nationally-listed as threatened under the EPBC Act, the Plains Rat (*Pseudomys australis*) and Thick-billed Grasswren (*Amytornis textilis*) were likely to occur in cracking clay drainage lines or gilgais with emergent perennial chenopods. Therefore sites PK03I, PK05I and PK07I were selected in these habitats. Woodlands typically support the most diverse assemblages of birds in the region (Badman and Read 1999), hence PK01I was selected in mulga woodland habitat. The final monitoring site, PK06I, was selected in habitat most closely matching the mine area to determine the nature of any impacts on the low stony rise habitat.

Natural variability in fauna assemblages, driven by dynamism in climate, feral and domestic animals and other ecological factors are likely to affect fauna densities and relative abundances at local and regional scales by at least the same degree as land use impacts (Read *et al.* 2011). Therefore, to differentiate mining-related impacts from regional fauna dynamics unrelated to mining, control sites were established at 'undisturbed' areas that matched key habitat values at impact sites. Control sites were at least 300 m from the source of disturbance and their paired impact sites. These matched control sites also allow investigation into differential responses of species or species groups to particular disturbance regimes. Hence, monitoring matched impact and control sites will also enable responsive bio-indicator species to be distinguished, which will enhance the precision of future impact footprint monitoring.



Five pairs of monitoring sites alone are unlikely to provide sufficient data to generate a comprehensive inventory of vertebrate species or to define key sites for all species, particularly birds. Therefore, standardised searches were conducted at other sites throughout the study area, focusing on likely habitat for Thick-billed Grasswrens and the South Australian endemic Chestnut-breasted Whiteface (*Aphaelocephala pectoralis*).

## Methods

Lines of 6 pitfall traps, each separated by 8-10 m and linked by a 30 cm high flymesh fence were installed at 8 of the 10 sites (not PK03I and PK03C where the soil was too hard for digging). Pits were 150 mm diameter and at least 500 mm deep, with at least 3 x 600 mm deep pits installed at sites with sandy substrate where hopping mice (*Notomys* sp.) were potentially present. Ants were deterred by Coopex insecticide powder and traps were checked within 3 hrs of dawn on four successive mornings in November 2011. At the conclusion of the trapping session the pits were capped with tight fitting sewer caps. A pair of appropriately shaded funnel traps was set either side of the pitfall drift fence. A line of 10 small Elliott traps, baited with peanut paste and oats and each separated by approximately 10 m, was laid out at each site, generally on the opposite side of the vegetation quadrat midline from the pitfall traps. These traps were also protected from ants by Coopex powder and from morning sun by placement on the western side of bushes. Elliotts were checked at the same time as the pitfall traps for 4 consecutive mornings. Captured mammals were marked by clipping fur on their rump (Plate 4) and reptiles by a texta mark on their belly to identify same-session recaptures.

At each site opportunistic records of vertebrates or their sign were recorded within approximately 100m of the pitline. A 20 minute x 2 ha bird count was conducted on one morning at each site, with all individuals counted. Additional species recorded at other times were added to the site inventory. Playback of recorded calls of cryptic whitefaces and grasswrens were used to increase their detection rate at both permanent monitoring sites and opportunistic survey sites.

An Anabat Bat detector was set for one night at the Peculiar Knob camp near the Stuart Highway, one night at PK01I in the sandplain and for one night adjacent to the haul road route in the breakaways. Additional information on the regional ecology was derived from opportunistic observations, particularly targeting leaf-litter mats in the breakaways and vehicle-based spotlight surveys on two evenings.

Regional expert ecologists John Read and Lynn Pedler selected and installed the sites, supervised the trapping, conducted the opportunistic searches and identified all captures and were ably assisted by Graeme Noll and Geoff Mills as Southern Iron representatives.

## Results

Coordinates for the 10 permanent fauna monitoring sites are provided in Table 1. Temperatures during the monitoring period were milder than average for November, with minima measured at Coober Pedy ranging from 16-19C and maxima from 21-34C. No rain fell during the monitoring period (Table 2), however the above average rainfall of the previous 2 years was clearly evident in the luxuriant plant growth.

### MAMMALS

Seven native terrestrial mammal species were trapped during the quantitative monitoring period, with an additional 3, probably 4, species observed opportunistically (Table 3). Plains Rats were trapped at all sites with a remarkable total of 99 individuals captured (not including recaptures). Plains Rats were captured in all stages of the breeding cycle (perforate females, pregnant females, dependent young, independent young, subadults) and their densities were so high that their burrows, scats and even recently-deceased adult animals were readily observed. Capture rates of this EPBC listed rodent were highest in their favoured cracking-clay habitats of PK07, PK05 and PK03 but they were also trapped in the sandplain at PK01 impact and control, sighted at the Peculiar Knob camp and spotlighted in the gibber plains near the Old Stuart Highway (Fig. 1, Table 4). Several Plains Rats specimens that were either found deceased on the surface or died in traps were deposited at the South Australian Museum. Sites PK07 and PK05 also yielded the highest captures of Forrest's Mice (*Leggadina forresti*) and dunnarts (*Sminthopsis crassicaudata* and *S. macroura*), whereas Spinifex Hopping Mice (*Notomys alexis*) and Bolam's Mice (*Pseudomys bolami*) were trapped most frequently in the sandplain habitat at PK01 (Table 4).

Two Desert Mouse (*Pseudomys desertor*), readily distinguished by their hairy tail and orange eye ring were caught at site PK05C and a Kultarr (*Antichinomys laniger*) was tentatively identified whilst spotlighting approximately 10 km west of the Peculiar Knob camp. The bipedal animal sighted on a gibber plain had a long tail but a different gait to *Notomys alexis* that had been observed minutes before in sandier habitat. Red Kangaroos (*Macropus rufus*), Euros (*Macropus robustus*) and Echidnas (*Tachyglossus acculeatus*) were observed opportunistically.

The introduced House Mouse (*Mus musculus*) was abundant at all sites and were captured most prevalently in Elliott traps (Fig. 1, Table 3). The capture of 182 individuals was almost certainly limited by near full-occupancy of Elliott traps on some nights. By contrast all native mammals, including the high-jumping Hopping Mice, were captured most frequently in pitfall traps (Table 3). High ratios of House Mice to native mammals may be indicative of disturbed sites (Read et al. 2005) and this ratio exceeded parity at four nominal impact sites (PK01I, PK05I, PK06I & PK07I) and only one control site (PK03C, Fig. 1). Rabbits were generally scarce but foxes abundant, with one sighted roughly every 2 km along spotlighting transects (Table 4).



All small mammal species represented by 15 or more captures were relatively evenly spread between mine impact and control sites (Fig. 2), which suggests that the paired sites were closely matched as planned.

## REPTILES

Despite the mild conditions, a total of 26 reptile species were recorded during the monitoring period (Table 3). The skinks *Liopholis inornata* and *Ctenotus olympicus* and the Sand Goanna (*Varanus gouldii*) were the most abundant reptiles captured, but their capture rates were considerably lower than abundant mammals (Fig. 1, Table 3). Two particularly interesting, yet not EPBC-listed reptiles, were captured either on or immediately adjacent to the proposed minesite. The Gibber Dragon (*Ctenophorus gibba*) is restricted to the clay plains of the south-western Lake Eyre Basin, entirely within South Australia and was only described in 1974. The proposed minesite and adjacent plains are prime habitat for this species (Plates 1 and 2) and lie close to the south-western extent of their range. The slender bluetongue (*Cyclodomorphus venustus*) is a rarely recorded inhabitant of self-mulching clays and represents only the second animal recorded by John Read despite thousands of trapping-nights in this habitat (Plate 3). This specimen was deposited at the South Australian Museum as a voucher. Other significant and likely inhabitants of these cracking-clay plains, the EPBC Woomera Slider (*Lerista elongata*) and the Inland Taipan (*Oxyuranus microlepidotus*) (Read 1994) were not detected during this survey (although an Inland Taipan was recovered by the author only 62km north of the mine in very similar habitat on 1/12/2011). Despite a brief search through leaf-litter on the breakaways, the EPBC-listed Bronze-backed Legless Lizard (*Ophidiocephalus taeniatus*) was not recorded, although this species is recorded from similar breakaways habitats at Coober Pedy (Pedler 2010). Bronze-backs have recently been recorded from mine shafts in unwooded breakaways, where they would typically be difficult to locate, hence there is a high likelihood that they inhabit the Peculiar Knob region (Reece Pedler pers. comm.).

Two distinct suites of reptiles reflected the main habitat types surveyed. Typical of the cracking gypseous clay plains were *Ctenophorus gibba*, *Tympanocryptis tetraporophora*, *Ctenotus olympicus*, *Cyclodomorphus venustus* and *Diplodactylus byrnei*, whereas the sandy PK01 site was inhabited by *Ctenophorus isolepis*, *Ctenotus schomburgkii* and *Nephrurus levis*.

Table 1. Coordinates (WGS84) of the Peculiar Knob fauna monitoring sites.

| Site  | Zone | Easting | Northing |
|-------|------|---------|----------|
| PK01I | 53J  | 457793  | 6736526  |
| PK01C | 53J  | 458243  | 6736917  |
| PK03I | 53J  | 515527  | 6727454  |
| PK03C | 53J  | 515909  | 6727460  |
| PK05I | 53J  | 534953  | 6718228  |
| PK05C | 53J  | 534742  | 6718190  |
| PK06I | 53J  | 537441  | 6726376  |
| PK06C | 53J  | 536278  | 6722470  |
| PK07I | 53J  | 537339  | 6727935  |
| PK07C | 53J  | 537096  | 6729390  |

Table 2 Weather conditions during the fauna survey

|          | Minimum (C) | Maximum (C) | Rainfall (mm) |
|----------|-------------|-------------|---------------|
| 31/10/11 | 16.4        | 21.0        | 0             |
| 01/11/11 | 16.8        | 28.4        | 0             |
| 02/11/11 | 16.6        | 32.0        | 0             |
| 03/11/11 | 17.4        | 31.6        | 0             |
| 04/11/11 | 19.2        | 32.2        | 0             |
| 05/11/11 | 19.6        | 34.1        | 0             |



Plate 1 (left) PK07C drainage line used by Flock Bronzewing for drinking  
(right) Gibber Dragon basking on rock in front of mining equipment at minesite



Plate 2 *Ctenophorus gibba*, a characteristic yet rarely recorded inhabitant of gypseous clay plains in the southern Lake Eyre basin



Plate 3 *Cyclodomorphus venustus* recorded from the cracking clay site PK07C



Plate 4 *Sminthopsis macroura* showing fur clipping used to distinguish recaptures

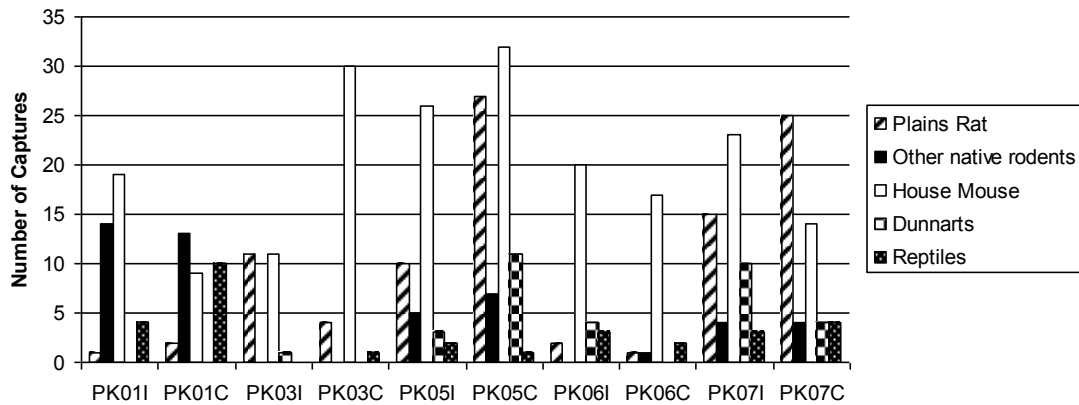


Figure 1. Number of Plains Rats, introduced House Mice and other fauna groups captured at each monitoring site. NB only Elliot traps set at sites PK03I and PK03C

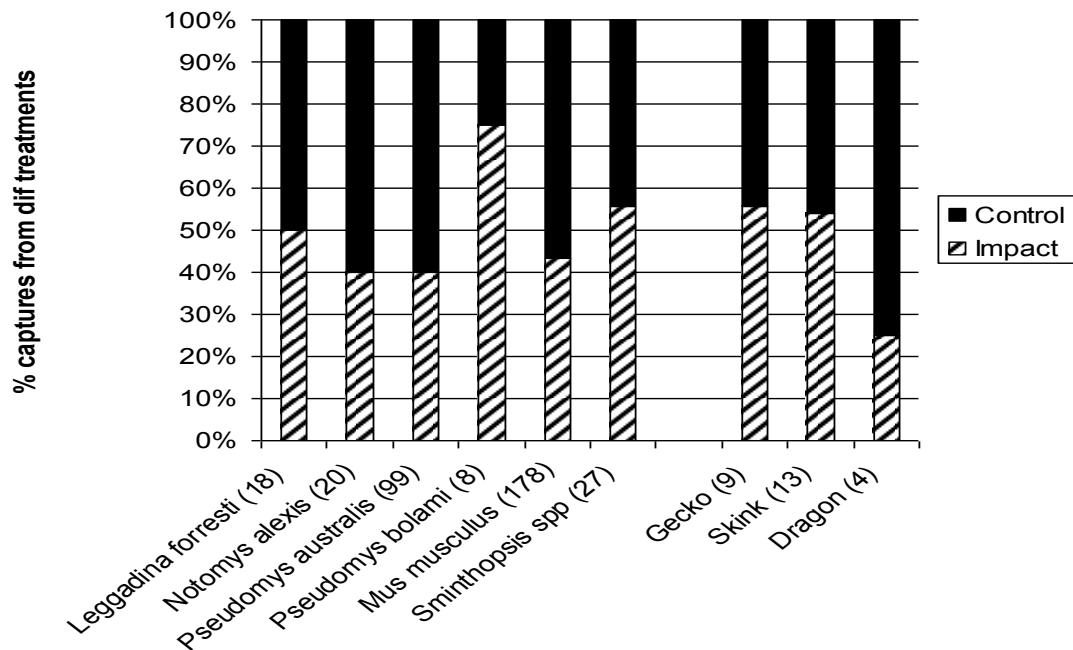


Figure 2. Percentage of captures from Impact or Control sites, Peculiar Knob Nov 2011. Total number captures indicated in brackets.



## Birds

A total of 61 bird species were recorded during the November 2011 survey, bringing the site inventory to 64 species (Table 4). Zebra Finches and Orange Chats were the most widespread species, although both are likely to have bred up in the wet season conditions preceding the survey. Paired control and impact sites were relatively well matched in terms of bird species richness (Fig. 3, Table 4), with the only exception being the greater range of species found at PK07C (with free water available at the time of survey) compared to PK07I. The acacia woodland sites PK01I and PK01C supported significantly more species of birds (15 and 17 respectively) compared with sites on the stony plain where less than 10 species were typically recorded (Table 4). The only Crested Bellbird recorded during the quantitative bird counts was from these acacia woodland sites and more insectivorous feeding flock birds (thornbills, Southern Whiteface, fairy wrens, Table 4) were recorded at Site PK01C than most cracking clay sites (Fig. 4). This suite of birds are expected to be the most responsive to disturbance (Read *et al.* 2000).

The EPBC-listed Thick-billed Grasswren was recorded from 3 monitoring sites (PK02C, PK05I and PK07C, Fig. 1, Table 4). Of the nine opportunistically-searched sites considered most likely to support the species, Thick-billed Grasswrens were detected at five sites (Table 5), including one on the Peculiar Knob Mine Lease. These birds were typically recorded alone or in pairs in close proximity to emergent chenopod shrubs, especially *Maireana aphylla* and *Atriplex omissa*. Although not recorded from any of the trap sites, the South Australian endemic Chestnut-breasted Whiteface was recorded from vegetation monitoring sites PK02C and PK02I (Table 4) and three of the seven additional opportunistically-searched localities adjacent to the haul road (Table 5). Most of these whitefaces were recorded when they responded to broadcast contact calls, but despite revisiting two of the same localities on subsequent days the birds failed to be detected. This inconsistency in recording suggests that the birds had either moved out of the search area or exhibited variable response to the playback recordings.

The Flock Pigeon (*Phaps histrionica*), recorded drinking and feeding at Site PK07C is an State-listed Rare species that moves south into the southern Lake Eyre Basin after favourable rains stimulate seeding of *Astrelba* and other grasses (Read *et al.* 1996). Other significant or interesting bird records included the close proximity of the Chirruping Wedgebill (*Psophodes cristatus*), which is found to the west of the study area and it's typically allopatric sister-species, the Chiming Wedgebill (*P. occidentalis*), found to the north and west.

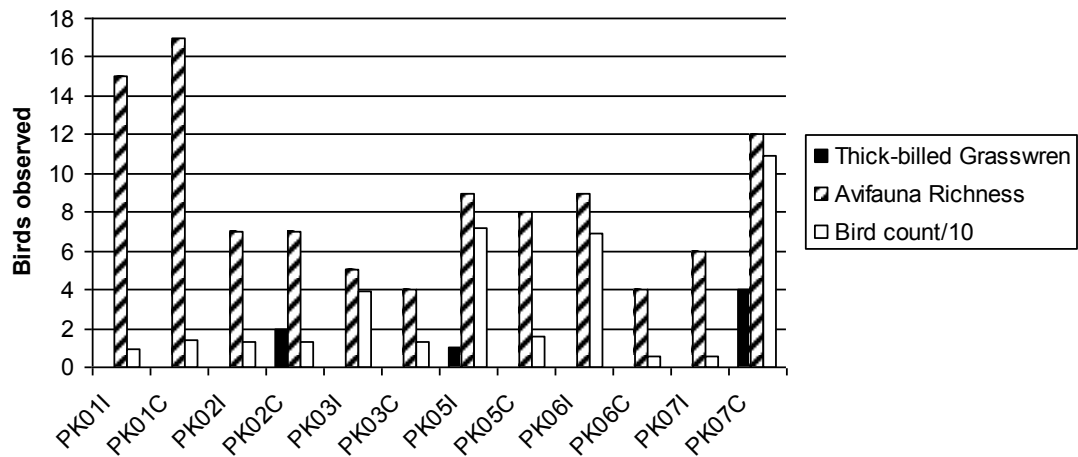


Figure 3. Counts of Thick-billed Grasswrens and total birds (/10) made during the 20minute quantitative surveys and total avifauna species richness recorded at all monitoring sites.

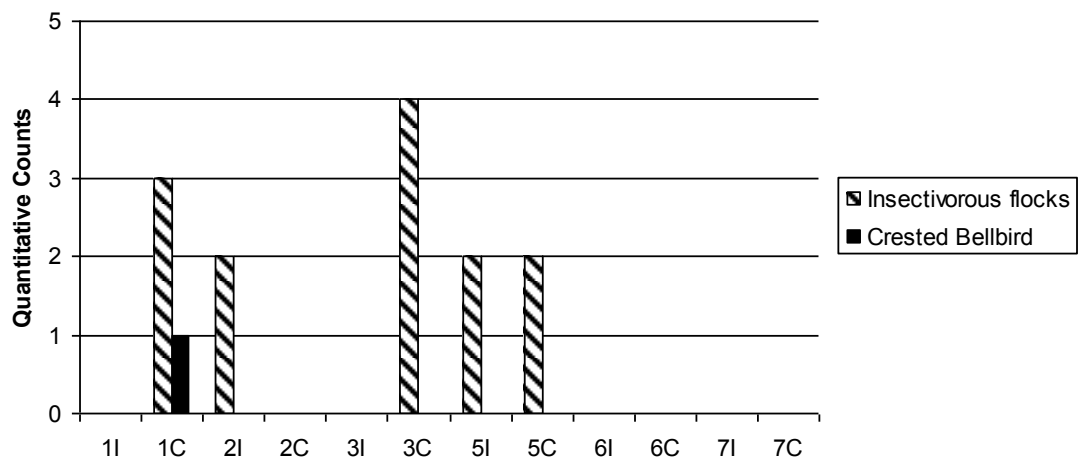


Figure 4. Counts of disturbance responsive birds at Peculiar Knob monitoring sites in November 2011, prior to major disturbance

## Discussion

This inaugural Peculiar Knob fauna monitoring survey provided a useful baseline dataset against which future changes can be compared at impact and control sites. New species were also added to the site inventory. Perhaps the most important outcome was recognition that the mine and haul road are superimposed upon high-density habitat for the EPBC-listed Plains Rat, a species not recorded in the original site survey (EBS 2008). This species, which infrequently irrupts in response to favourable rainfall as has been evident in 2011 baseline, was recorded from all habitats sampled. However, its regional persistence is likely tied to key refuge habitats (Brandle *et al.* 1999, Moseby 2011). Identification and, where possible protection, of these high value refuge areas is an important consideration for Southern Iron. Large expanses of deeply-cracked gilgais and ephemeral creeklines, such as those found at Sites PK07, PK05 and to a lesser extent PK03 are likely to be key habitats for Plains Rats. By contrast, records of Plains Rats from sites PK06 and especially PK01 are likely indicative of this typically rare species 'plaguing' outside its typical habitat and range and continued captures at these sites would be unlikely once the current rain-induced irruption inevitably declines.

The cracking clay habitats were also important for Thick-billed Grasswrens, Flock Pigeons, Forrest Mice, dunnarts, and two uncommon species (Desert Mouse, Read *et al.* 1999 and Slender Bluetongue, Read and Owens 1999), which provides added incentive to minimise disturbance to these areas. The rarely recorded Woomera Slider (*Lerista elongata*) is also likely to be found in these habitats ([http://www.saalnm.sa.gov.au/Portals/8/Publications\\_Resources/Project\\_Reports/SAAL-Bronze\\_Legless\\_Lizard\\_And\\_Floodplains\\_Skink\\_Survey-122009.pdf](http://www.saalnm.sa.gov.au/Portals/8/Publications_Resources/Project_Reports/SAAL-Bronze_Legless_Lizard_And_Floodplains_Skink_Survey-122009.pdf)). Although the Peculiar Knob area lies within the most extensive and abundant population of Chestnut-breasted Whiteface, (Birds Australia, Important Bird Areas), this species' cryptic nature and potentially inconsistent response to call-back recordings may render it a suboptimal bioindicator for assessing mining impacts.

Animal species may respond divergently, or not at all, to perceived environmental stresses such as increased noise or dust loading associated with mining. Building on from this baseline, future monitoring will be able to detect changes in the relative abundance of key taxa and functional groups at impact vs control sites. For example, if fauna at Peculiar Knob respond to mining disturbance in a similar manner to the well-researched fauna at Olympic Dam, increased disturbance would be expected to contribute to an increase in the ratio of House Mice to native rodents, an increase in the ratio of dragons to skinks, a decline in breeding geckoes and a decline in Crested Bellbirds and insectivorous feeding flocks (Read *et al.* 2005). Future monitoring will allow comparisons of these scores compared with this baseline.

Understanding, interpreting and mitigating against any potential impacts will be best informed by appraisal of responses to similar disturbance regimes at nearby mine sites, with similar geochemistry and ecological associations. Inclusion of monitoring data from these minesites into a regional meta-analysis of responses to seasonal conditions and mining stresses would improve the statistical robustness of individual monitoring



programs. Where these data are not available, the precautionary principle and modern mining expectations dictate that disturbance should be minimised wherever possible. Southern Iron should also take care not to introduce preventable additional threats to regional fauna. Increased densities of predators (both feral and native) supported by inappropriately managed camp waste and increased incidence or distribution of weeds are risks. The greatest new risk to the regional fauna and flora are considered to be the potential for the introduction of exotic and highly flammable buffel grass, particularly to sandy areas near Wirrida railway siding. Buffel grass has transformed large areas diverse acacia grasslands and other habitats of central Australia into virtual monocultures over the past 20 years with serious consequences for plant and animal communities. Buffel invasion is virtually impossible to stop once it becomes established and can potentially change the ecological setting of native grasslands, woodlands and their faunal inhabitants.

Another important, and potentially mitigatable risk, is the interruption to surface water flows that are integral to the natural redistribution of water and nutrients in this dry, infertile environment. Careful engineering of roadway crossings of even minor drainage lines should minimise flooding of upstream environments and ‘starving’ of downstream habitats.

The terrestrial fauna of the Peculiar Knob area are already exposed to a number of threatening processes largely unrelated to the proposed mining operations. High densities of feral foxes and cats, former high densities of rabbits, pervasive potential impacts from the adjacent Prominent Hill haul road, and cattle which typically feed, drink and trample in wetter refuge areas, all likely impact the distribution, abundance and status of the endemic wildlife species. Whilst these pre-existing and ongoing factors complicate delineation of the nature and extent of any Peculiar Knob impacts on the regional fauna, they also provide opportunities for Southern Iron to reduce the net impacts on significant species in the region. For example, reduction in feral animal predation or cattle impacts on sensitive habitats may provide greater benefits to Plains Rats and other species than localised mining impacts.

## Recommendations

- 1) Creation of a regional environmental coalition/MOU between Prominent Hill, Cairn Hill and Peculiar Knob in order to predict and mediate environmental impacts and to adopt regionally-significant weed and feral management programs. The robustness of the Peculiar Knob (and other regional mine's) fauna monitoring program would benefit from amalgamation of datasets to increase sample sizes and replication. Prediction of the likely impacts of the Peculiar Knob mining, haulage, and screening/loading facilities on biodiversity (and EPBC listed species in particular) would be informed by analyses of the response of key species to the adjacent established Prominent Hill mine. To date there has been little research into the effects of high dust loads on plants and animals in these arid environments, and such studies would greatly benefit from a regional approach. Likewise, mapping and control of invasive weeds (especially buffel grass) and management of feral predators would benefit from a coordinated regional approach. Such an alliance could perhaps be facilitated by a third party.
- 2) Focus monitoring on key habitats or sites for species of interest to increase statistical robustness of impact monitoring. This baseline monitoring program has revealed that bird diversity is greatest in woodlands and mammal diversity (and Plains Rat captures) are greatest in cracking clay habitats. Reptile diversity is likely to be highest in chenopod shrubland (Read and Owens 1999). Monitoring of Plains Rats response to mining would benefit from addition of replicate sites in cracking clay creeklines, especially another paired site in the creekline immediately east of the Peculiar Knob mine. Sites PK03, PK05, PK07 and new sites PK08 could serve as replicates. Monitoring of avifauna communities may be best achieved by conducting 20 minute 2 ha bird counts at sites already identified as Thick-billed Grasswren habitat and at 3 more sites in the Wirrida sandplain, ca 1km from PK01.
- 3) Management of feral predators  
Reduction in fox (and cat) numbers could provide a net benefit to populations of EPBC listed species, especially Plains Rats and Thick-billed Grasswrens, over and above negative mining impacts. These predators could be controlled by a combination of shooting, trapping, poisoning, thorough food waste management and ripping of rabbit warrens. Ideally these feral control activities would be coordinated on a regional scale.

#### 4) Reduction in cattle impacts

Each of the high value sites supporting high Plains Rat populations were accessed, and likely impacted, by cattle that were also attracted to these isolated wetter, well grassed areas. These sites may also be important refuges for other species, including Thick-billed Grasswrens, Flock Pigeons, Desert Mice and Forrest's Mice. Although cattle management is not the typical domain of mining companies, any initiatives to lessen the numbers of cattle accessing these regions (or the number of refugia that cattle have access to) should contribute to regional conservation values and help counteract any negative mining impacts. Fencing cattle off the minelease, haul road easement and potentially adjacent high value refuge areas could minimise collisions with livestock, inconveniences of gates and additional disturbance to stressed environments, since heavily browsed chenopod shrubs have been demonstrated to be more susceptible to drought than unbrowsed shrubs (Read 2004). Should buffel grass inadvertently be introduced to the Peculiar Knob easement, exclusion of cattle may be important for controlling its spread beyond the margins of disturbed area.

#### 5) Establishment and promotion of site fauna register

The Peculiar Knob mine and haul road both occur in relatively poorly-studied, remote environments that potentially support a range of cryptic but significant animal species. Potential species that may be sighted by vigilant mine-workers include Woma Python, Bronzeback Legless Lizard, Plains Wanderer, Letter-winged Kite, Inland Taipan, Woomera Slider and many other less-likely species. Southern Iron staff and contractors could make scientifically-valuable observation of these species, or changes in abundance of other species, if they are equipped with identification guides and encouraged to submit their observations to a register.

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PK01I November 2011



PK01C November 2011



PK02I November 2011





PK02C November 2011 NB typical Chestnut-breasted Whiteface habitat



PK03I November 2011



PK03C November 2011





PK06I November 2011



PK06C November 2011 with Peculiar Knob in the background



Table 3 Vertebrate captures at Peculiar Knob fauna monitoring sites, November 2011 (ex recaps).

|                                  | 1I    | 1C   | 3I   | 3C  | 5I    | 5C    | 6I    | 6C    | 7I    | 7C        | Opp |
|----------------------------------|-------|------|------|-----|-------|-------|-------|-------|-------|-----------|-----|
| <b>Mammals</b>                   |       |      |      |     |       |       |       |       |       |           |     |
| <i>Leggadina forresti</i>        |       |      |      |     | 2E3P  | 1E 4P |       |       | 1E 3P | 1E 3P     |     |
| <i>Notomys alexis</i>            | 3E5P  | 8E4P |      |     |       |       |       |       |       |           |     |
| <i>Pseudomys australis</i>       | 1P    | 2P   | 8E3P | 4E  | 1E9P  | 2E25P | 2P    | 1P    | 15P   | 9E 16P 1F |     |
| <i>Pseudomys bolami</i>          | 3E3P  | 1E   |      |     |       |       |       | 1P    |       |           |     |
| <i>Pseudomys desertor</i>        |       |      |      |     |       | 2P    |       |       |       |           |     |
| <i>Mus domesticus</i>            | 17E2P | 9E   | 11E  | 30E | 25E1P | 28E4P | 17E3P | 14E3P | 23E   | 13E 1P    |     |
| <i>Antichinomys laniger</i>      |       |      |      |     |       |       |       |       |       |           | 1O? |
| <i>Macropus robustus</i>         |       |      |      |     |       |       |       |       |       |           | 2O  |
| <i>Macropus rufus</i>            |       |      |      |     |       |       |       |       |       |           | 9O  |
| <i>Sminthopsis crassicaudata</i> |       |      |      |     | 1P    |       | 1P    |       | 1P    |           |     |
| <i>Sminthopsis macroura</i>      |       |      | 1P   |     | 2P    | 11P   | 3P    |       | 9P    | 4P        |     |
| <i>Oryctolagus cuniculus</i>     |       |      |      |     |       |       |       |       |       |           | 4O  |
| <i>Felis catus</i>               |       |      |      |     |       |       |       |       |       |           | 3O  |
| <i>Vulpes vulpes</i>             |       |      |      |     | 1O    |       |       |       |       |           | 20O |
| <b>Reptiles</b>                  |       |      |      |     |       |       |       |       |       |           |     |
| <i>Delma australis</i>           |       |      |      |     |       | 1P    |       |       |       |           |     |
| <i>Diplodactylus byrnei</i>      |       |      |      |     |       |       | 1P    |       |       |           |     |
| <i>Diplodactylus tessellatus</i> |       |      |      | 1O  | 1P    |       |       |       |       |           |     |
| <i>Heteronotia binoei</i>        |       |      |      |     |       |       |       |       |       | 1P        |     |
| <i>Lucasium stenodactylum</i>    | 1F    |      |      |     |       |       |       |       |       |           |     |
| <i>Nephruirus levis</i>          | 1P    | 1P   |      |     |       |       |       |       |       |           |     |
| <i>Nephruirus millii</i>         |       |      |      |     |       |       |       |       |       |           | 1O  |
| <i>Rhynchoedura ornata</i>       |       |      |      |     |       |       |       | 2P    |       |           |     |
| <i>Ctenotus leonhardii</i>       |       |      |      |     |       |       |       |       |       |           | PK2 |
| <i>Ctenotus olympicus</i>        |       |      |      |     |       |       | 2P    |       | 3P    |           |     |
| <i>Ctenotus regius</i>           |       |      |      |     |       |       |       |       |       |           | 2O? |

|                                      | 1I | 1C | 3I | 3C | 5I | 5C | 6I | 6C | 7I | 7C | Opp |
|--------------------------------------|----|----|----|----|----|----|----|----|----|----|-----|
| <i>Ctenotus schomburgkii</i>         |    | 2P |    |    |    |    |    |    |    |    |     |
| <i>Cyclodomorphus venustus</i>       |    |    |    |    |    |    |    |    |    | 1P |     |
| <i>Eremiascincus richardsonii</i>    |    |    |    |    |    |    |    |    |    |    | 1O  |
| <i>Liopholis inornata</i>            | 1P | 2P |    |    |    |    |    |    |    |    |     |
| <i>Tiliqua rugosa</i>                |    |    |    |    | 2O |    |    |    |    |    |     |
| <i>Ctenophorus isolepis</i>          | 2O |    |    |    |    |    |    |    |    |    |     |
| <i>Ctenophorus gibba</i>             |    |    |    |    |    |    |    |    |    |    | 5O  |
| <i>Ctenophorus nuchalis</i>          |    | 1P |    |    |    |    |    |    |    |    |     |
| <i>Pogona vitticeps</i>              | 1O |    |    | 1O |    |    |    |    | 1O |    | 4O  |
| <i>Tympanocryptis intima</i>         |    |    |    |    |    |    |    |    | 1O |    |     |
| <i>Tympanocryptis tetraporophora</i> |    |    |    |    | 1P |    |    |    |    | 2P | 6O  |
| <i>Varanus gouldii</i>               | 1P | 3P |    | 1O |    |    |    |    |    |    | 4O  |
| <i>Pseudonaja aspidorhyncha</i>      |    |    |    |    |    |    |    | 1O |    |    |     |
| <i>Pseudonaja modesta</i>            |    | 1P |    |    |    |    |    |    |    |    |     |
| <i>Suta suta</i>                     |    |    |    |    |    |    |    |    |    |    | 1O  |

\*\*\* E = Elliott Trap, P = Pitfall trap, F=Funnel trap, O = Opportunistic capture

Table 4. Spotlight observations: Peculiar Knob November 2011.

| date     | startpoint                        | Mileage | Observations                                             |
|----------|-----------------------------------|---------|----------------------------------------------------------|
| 31/10/11 | Pec Knob camp – heading west      | 0-5km   | 3x Red Roo                                               |
|          |                                   | 5-10km  | 1 x cat, 2 x fox, 1 x TFM                                |
|          |                                   | 10-15km | 4 x fox, 2 x IND                                         |
|          |                                   | 15-20km | 2 x BAO, 1 x Notomys                                     |
| 31/10/11 | Old Stuart Highway – heading east | 0-5 km  | 1 x plains rat                                           |
|          |                                   | 5-10km  | 1 x fox, 1 x plains rat                                  |
|          |                                   | 10-15km | 2 x fox, 3 x red roo                                     |
|          |                                   | 15-20km | Prob kultarr, 1 x fox                                    |
| 4/11/11  | minesite                          | 0-5km   | 1x plains rat, 1x Forrest's mouse, 1x IND, 1x curl snake |
|          |                                   | 5-10km  | 1 x tessellated gecko, 2 x mouse                         |
|          | Breakaway creek heading west      | 0-5km   | 1 x cat, 3 x rabbit, 1 x fox, 1 x cat or fox, 1 x SPN    |
|          |                                   | 5-10km  | 2 x red roo, 3 x fox, 1 x Barking gecko,                 |
|          |                                   | 10-15km | 1 x Broadbanded sandswimmer, 2 x fox                     |
|          |                                   | 15-20km | 4 x fox, 1 x cat                                         |

Table 5 Numbers of individual birds recorded from 20 minute counts at each site.

|                         |     | 1I | 1C | 2I | 2C | 3I | 3C | 5I | 5C | 6I | 6C | 7I | 7C | Opp |
|-------------------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Emu                     | EMU | *  |    |    |    |    |    |    |    |    |    |    | *  |     |
| Bustard                 | BUS |    |    |    |    |    |    |    |    |    |    |    |    | *   |
| Wood Duck               | WOD |    |    |    |    |    |    |    |    |    |    | *  |    |     |
| Wedge-tailed Eagle      | WTE |    |    |    |    |    |    |    | *  |    |    | *  |    |     |
| Brown Falcon            | BRF |    |    | *  |    | 1  |    |    |    |    |    |    | 1  |     |
| Black Falcon            | BRF |    |    |    |    |    |    |    |    |    |    |    | *  | 1   |
| Spotted Harrier         | SPH |    |    |    |    |    |    |    |    | *  |    |    |    |     |
| Swamp Harrier           | SWH |    |    |    |    |    |    |    |    |    |    |    | 1  |     |
| Black-shouldered Kite   | BSK |    |    |    |    |    |    |    |    |    |    |    | *  |     |
| Kestrel                 | KES |    |    |    |    |    |    |    |    |    | 1  | 1  | 1  |     |
| Little Button Quail     | LBQ | 1  |    |    |    | *  |    | *  |    |    |    |    | 1  |     |
| Black-tailed Native Hen | BTN |    |    |    |    |    |    |    |    |    |    |    | 2  |     |
| Banded Lapwing          | BAL |    |    |    |    |    |    |    |    |    |    |    |    | *   |
| Inland Dotterel         | IND |    |    |    |    |    |    |    |    | *  |    |    |    |     |
| Australian Pratincole   | PRA |    |    |    |    |    |    |    | *  |    |    |    |    |     |
| Flock Pigeon            | FLP |    |    |    |    |    |    |    |    | 61 |    | 1  | 62 |     |
| Crested Pigeon          | CRP |    | *  |    |    |    |    | *  |    |    |    |    |    |     |
| Diamond Dove            | DDV |    |    |    |    |    |    |    |    |    |    |    |    | *   |
| Galah                   | GAL | *  |    |    |    |    |    |    |    |    |    |    |    |     |
| Corella                 | COR |    |    |    |    |    |    |    |    |    |    |    |    | *   |
| Bluebonnet              | BBN |    |    |    |    |    |    |    |    |    |    |    |    | *   |
| Mulga Parrot            | MUL |    | *  |    |    |    |    |    |    |    |    |    |    |     |
| Bourkes Parrot          | BKP |    | *  |    |    |    |    |    |    |    |    |    |    |     |
| Budgerigar              | BUD | 1  |    |    |    |    |    |    |    |    |    |    |    |     |
| Barn Owl                | BOW |    |    |    |    |    |    |    |    |    |    |    |    | *   |
| Spotted Nightjar        | SPN |    |    |    |    |    |    | *  |    |    |    |    |    |     |
| Red-backed Kingfisher   | RBK |    | *  |    |    |    |    |    |    |    |    |    |    |     |

|                             |     |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------------------|-----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Horsfields Bronze-cuckoo    | HBC |   | 1I | 1C | 2I | 2C | 3I | 3C | 5I | 5C | 6I | 6C | 7I | 7C | *  |
| Welcome Swallow             | WES |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| White-backed Swallow        | WBS |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| Tree Martin                 | TRM |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| Richards' Pipit             | PIP | * |    |    | *  |    |    | 1  | *  | 1  |    | 1  |    |    |    |
| Brown Songlark              | BSL | * |    |    | *  |    | *  | 1  |    |    | 1  | *  |    | 1  |    |
| Rufous Songlark             | RUS |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| White-winged Fairywren      | WWW |   |    | 1  | 2  |    |    | 4  | 2  | 2  |    |    |    |    |    |
| Variegated Fairywren        | VFW |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| Rufous Fieldwren            | RUW |   |    |    | 1  | 1  |    |    |    |    | 3  |    | 2  |    |    |
| Thick-billed Grasswren      | TBG |   |    |    |    | 2  |    | 1  | 1  |    |    |    |    | 4  |    |
| Yellow-throated Miner       | YTM |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| Singing Honeyeater          | SHE | 1 | 1  |    |    |    |    |    | *  |    |    |    |    |    |    |
| Spiny-cheeked Honeyeater    | SCH | 1 | *  |    |    |    |    |    |    |    |    |    |    |    |    |
| White-fronted Honeyeater    | WFH |   |    |    |    |    |    |    |    |    |    |    |    |    | PR |
| Varied Sitella              | SIT |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| Gibberbird                  | GIB |   |    |    |    |    |    |    |    |    |    |    | 2  |    |    |
| Orange Chat                 | OCH |   |    |    | 6  | 6  | 13 | 7  | 1  |    | 2  | 4  |    |    |    |
| Crimson Chat                | CRC | 1 | 1  |    |    |    |    |    |    |    |    |    |    |    |    |
| Chestnut-rumped Thornbill   | CRT |   | *  |    |    |    |    |    |    |    |    |    |    |    |    |
| Chestnut-breasted Whiteface | CBW |   |    | 6  | 2  |    |    |    |    |    |    |    |    |    |    |
| Southern Whiteface          | SWF | * | 2  |    |    |    |    |    |    |    |    |    |    |    |    |
| Zebra Finch                 | ZEB | 4 | 2  | 4  | 2  | 2  | 25 |    | 65 | 8  |    |    |    | 46 |    |
| Hooded Robin                | HOR |   |    |    |    |    |    |    |    | *  |    |    |    |    |    |
| Jacky Winter                | JWI |   |    |    |    |    |    |    |    |    |    |    |    |    | PR |
| Black-faced Woodswallow     | BFW | 2 | 2  |    |    |    |    | 3  |    |    |    |    |    |    |    |
| Chirruping Wedgebill        | CRW |   |    |    |    |    |    |    |    |    |    |    |    |    | *  |
| Chiming Wedgebill           | CMW | * | *  |    |    |    |    |    |    |    |    |    |    |    |    |
| Cinnamon Quailthrush        | CQT |   |    |    | *  |    |    |    |    |    | 2  |    |    |    |    |





Table 5. Fauna records from opportunistically-searched localities near Peculiar Knob, November 2011.

| <b>Species</b>              | <b>Eastings</b> | <b>Northing</b> | <b>Comments</b>                                    | <b>Other spp</b>                                           |
|-----------------------------|-----------------|-----------------|----------------------------------------------------|------------------------------------------------------------|
| Thick-billed Grasswren      | 514300          | 6728945         | 1 bird, cottonbush drainage                        |                                                            |
| Thick-billed Grasswren      | 536200          | 6726050         | 2 Ood saltbush depression ML boundary              |                                                            |
| Thick-billed Grasswren      | 533410          | 6717125         | 1 Cottonbush, Rh spinescens on hard gibber         |                                                            |
| Thick-billed Grasswren      | 530400          | 6716960         | 1 cottonbush drainage across haulroad              |                                                            |
| Thick-billed Grasswren      | 500100          | 6736400         | 2 extensive cottonbush depression with dead finish | CQT, VFW, SHE, WWW, BSK, SPH                               |
| No TBG                      | 499300          | 6737400         | Cottonbush depression                              | CMW, BSK, KES, WWW, ZEB, OCH, LIC, IND, BSL, CQT, MAG      |
| No TBG                      | 486800          | 6732400         | Cottonbush flat                                    | WWW, ZEB, OCH, PIP                                         |
| No TBG                      | 492400          | 6734300         | Cottonbush flat, Mulga                             | ZEB, SWF, SCH, RUS, BFW, CMW, RBK, SHE, WWW, BUD, Pog vitt |
| No TBG                      | 522850          | 6721800         | Cottonbush, Ood Saltbush drainage                  | ZEB, OCH, BSL, WWW                                         |
| Chestnut-breasted Whiteface | 492200          | 6734200         | 7 low bluebush/blackbush                           | CQT, SHE, ZEB                                              |
| Chestnut-breasted Whiteface | 499300          | 6735700         | 3 dense chenopod plain                             | CQT, RFW, WWW, OCH, ZEB, BSK, KES, SPH, LBQ, BUS           |
| Chestnut-breasted Whiteface | 500480          | 6736550         | 3 open low bluebush, dead finish                   | RUF, OCH, ZEB, WWW, BSL, SpH                               |
| No CBW                      | 507150          | 6733600         | Scattered low bluebush on gibber rise              |                                                            |
| No CBW                      | 513250          | 6729300         | Low bluebush gibber rise                           | 38 IND, BSL, OCH, PIP, WWW                                 |
| No CBW                      | 531200          | 6716900         | Open low bluebush rise                             | OCH, BSL                                                   |
| No CBW                      | 521118          | 6722600         | Low bluebush patch                                 | OCH, BSL                                                   |
| Chiming Wedgebill           | 465650          | 6732666         | Mulga                                              | GAL, WBB, EMU                                              |
| Gibberbird                  | 536100          | 6724280         | 2                                                  |                                                            |
| <i>Pogona vitticeps</i>     | 536280          | 6725840         | 1                                                  |                                                            |
| Chirruping Wedgebill        | 536200          | 6722100         | Breakaways, Bullock bush creekline                 | BOW, WBS, SHE, RBK(nest), BFW, BTNH, WWW, KES, TRM, DDV,   |

|         |        |         |  |                               |                                                                 |
|---------|--------|---------|--|-------------------------------|-----------------------------------------------------------------|
|         |        |         |  |                               | Echidna, Euro                                                   |
|         | 469600 | 6731911 |  | Teatree coolibah watercourse  | WAG, YTM, GBB, GAL, CRP, SCH, SHE, LIC, AML, CRC, KES, ZEB, Emu |
|         | 482000 | 6732180 |  | Open mulga gravelly flat      | SIT, SCH, SWF, DDV, CRT, BFW, CRC, BRF                          |
| Echidna | 516400 | 6726630 |  | Animal in rabbit warren       |                                                                 |
|         | 484880 | 6732300 |  | Tall mulga tussock grass flat | RCR, WBB, CRT, RBK, LIC, ZEB, WWW feeding HBC, SWF, SHE         |
|         |        |         |  |                               | BBN, COR near 1                                                 |
|         |        |         |  |                               | AML, WES at camp                                                |

\*\*\* Particular attention was paid to surveying likely habitats for Thick-billed Grasswrens and Chestnut-breasted Whitefaces and locality information is also provided where these species (No TBG, No CBW respectively) were detected. NB: opportunistic data will not be used in statistical annual comparison, but represent the passive nature of birds.

# Appendix D

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS



Appendix D. Soil EC and pH Monitoring Program Interim Baseline Results 2011-12

| Site                 | Location | 04-Nov-11 |        | 22-Feb-12 |        | 05-May-12 |        |
|----------------------|----------|-----------|--------|-----------|--------|-----------|--------|
|                      |          | Ave EC    | Ave pH | Ave EC    | Ave pH | Ave EC    | Ave pH |
| Site 1 Soil Salinity | SS1I     | 55.9      | 7.0    | 41.1      | 7.1    | 67.9      | 6.6    |
|                      | SS1T     | 68.5      | 7.0    | 44.7      | 7.5    | 45.1      | 6.9    |
|                      | SS1C     | 48.2      | 7.0    | 36.9      | 6.9    | 42.9      | 6.9    |
| Site 2 Soil Salinity | SS2I     | 74.5      | 7.0    | 97.0      | 7.0    | 439.7     | 6.6    |
|                      | SS2T     | 73.2      | 6.9    | 54.6      | 7.0    | 90.9      | 6.9    |
|                      | SS2C     | 66.4      | 7.0    | 74.3      | 7.2    | 191.6     | 6.9    |
| Site 3 Soil Salinity | SS3I     | 150.4     | 6.9    | 231.3     | 7.7    | 225.2     | 7.3    |
|                      | SS3T     | 170.8     | 6.9    | 122.1     | 7.5    | 129.6     | 7.3    |
|                      | SS3C     | 114.8     | 6.9    | 205.2     | 7.8    | 117.2     | 7.3    |
| Site 5 Soil Salinity | SS5I     | 123.1     | 7.0    | 147.9     | 7.3    | 156.6     | 7.2    |
|                      | SS5T     | 168.8     | 6.9    | 175.1     | 7.2    | 191.6     | 7.3    |
|                      | SS5C     | 209.6     | 7.0    | 183.9     | 7.5    | 122.5     | 7.4    |
| Site 7 Soil Salinity | SS7I     | 331.1     | 7.0    | 210.5     | 7.3    | 180.4     | 7.1    |
|                      | SS7T     | 86.9      | 6.9    | 194.1     | 7.2    | 331.8     | 7.0    |
|                      | SS7C     | 196.7     | 6.3    | 1982.7    | 6.8    | 567.3     | 6.9    |



# Appendix E

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS



## Photo Monitoring Environmental Inspection Report

Peculiar Knob Iron Ore Project

### Photo Monitoring Details – Inspection of Working Areas

|                           |                               |                              |             |
|---------------------------|-------------------------------|------------------------------|-------------|
| <b>Date</b>               | 28/12/2011                    | <b>Environmental Advisor</b> | Graeme Noll |
| <b>Weather Conditions</b> | 41° 5-10km winds from the NNE |                              |             |
| <b>Time</b>               | 10:25am                       |                              |             |

Weekly Visual and 3 Monthly Photographic Inspection of Sensitive areas.

| No.          | Action Required                                         | Comment                                                                              | Reportable Y/N |
|--------------|---------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|
| <b>PKPM1</b> | Visual / Photo Inspection of WRD Monitoring Point PKPM1 |  |                |

| No.          | Action Required                                               | Comment                                                                             | Reportable Y/N |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|
| <b>PKPM2</b> | Visual / Photo Inspection of Monitoring Point PM2-1 AND PM2-2 |  |                |



| No.          | Action Required                                               | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reportable Y/N |
|--------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>PKPM3</b> | Visual / Photo Inspection of Monitoring Point PM3-1 AND PM3-2 |  <p>The image consists of two vertically stacked photographs showing a wide, flat landscape. The ground is dry and sandy, covered with low-lying, scrubby vegetation in shades of green and brown. The horizon is flat and distant, with a clear, pale blue sky above. The overall scene appears to be a natural, undisturbed area, likely a monitoring point in a dry region.</p> |                |



| No.          | Action Required                                  | Comment                                                                            | Reportable Y/N |
|--------------|--------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| <b>PKPM4</b> | Visual / Photo Inspection of Monitoring Point M4 |  |                |

### General Inspection

| No.          | Action Required                                              | Comment                                                                              | Reportable Y/N |
|--------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|
| <b>PKPM5</b> | Visual / Photo Inspection of Monitoring Point M5-1 AND PM5-2 |  |                |

|              |                                                                           |                                                                                     |  |
|--------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                                           |   |  |
| <b>PKPM6</b> | Visual / Photo<br>Inspection of<br>Monitoring<br>Point PM6-1<br>AND PM6-2 |  |  |

|              |                                                               |                                                                                     |  |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                               |   |  |
| <b>PKPM7</b> | Visual / Photo Inspection of Monitoring Point PM7-1 AND PM7-2 |  |  |



|           |                                                               |                                                                                     |  |
|-----------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|           |                                                               |   |  |
| <b>M8</b> | Visual / Photo Inspection of Monitoring Point PM8-1 and PM8-2 |  |  |

|              |                                                               |                                                                                     |  |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                               |   |  |
| <b>PKPM9</b> | Visual / Photo Inspection of Monitoring Point PM9-1 and PM9-2 |  |  |

|               |                                                      |                                                                                     |  |
|---------------|------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|               |                                                      |   |  |
| <b>PKPM10</b> | Visual / Photo Inspection of Monitoring Point PM10-1 |  |  |

**PKPM11**

Visual / Photo  
Inspection of  
Monitoring  
Point M11-1





|               |                                                                                                                                                   |                                                                                                                                                                        |  |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>PKPM12</b> | <p>Visual / Photo<br/>Inspection of<br/>Monitoring<br/>Point PKPM12A</p> <p>Visual / Photo<br/>Inspection of<br/>Monitoring<br/>Point PKPM12B</p> |   |  |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|



**PKPM13**

Visual / Photo  
Inspection of  
Monitoring  
Point PKPM13A



Visual / Photo  
Inspection of  
Monitoring  
Point PKPM13B



|               |                                                               |                                                                                     |  |
|---------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
| <b>PKPM14</b> | Visual / Photo<br>Inspection of<br>Monitoring<br>Point PKPM14 |   |  |
| <b>PKPM15</b> | Visual / Photo<br>Inspection of<br>Monitoring<br>Point PKPM15 |  |  |



Signed: \_\_\_\_\_



## Photo Monitoring Environmental Inspection Report

Peculiar Knob Iron Ore Project

### Photo Monitoring Details – Inspection of Working Areas

|                           |                                                  |                              |                |
|---------------------------|--------------------------------------------------|------------------------------|----------------|
| <b>Date</b>               | 9,10/3/2012                                      | <b>Environmental Advisor</b> | Giles Standish |
| <b>Weather Conditions</b> | 1 week after significant rainfall in area >100mm |                              |                |
| <b>Time</b>               |                                                  |                              |                |

Event driven inspection of Photo Monitoring Points.

| No.          | Action Required                                         | Comment                                                                              | Reportable Y/N |
|--------------|---------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|
| <b>PKPM1</b> | Visual / Photo Inspection of WRD Monitoring Point PKPM1 |  |                |

| No.          | Action Required                                               | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Reportable Y/N |
|--------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>PKPM2</b> | Visual / Photo Inspection of Monitoring Point PM2-1 AND PM2-2 |  <p>The image consists of two photographs stacked vertically. Both show a wide, flat landscape under a clear blue sky. The ground is covered with low-lying, dry vegetation and patches of bare soil. In the distance, there are some low, rounded hills or mounds of earth. The overall scene appears to be a natural, undisturbed area, possibly a monitoring point for environmental assessment.</p> |                |

| No.          | Action Required                                               | Comment                                                                             | Reportable Y/N |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|
| <b>PKPM3</b> | Visual / Photo Inspection of Monitoring Point PM3-1 AND PM3-2 |  |                |



| No.          | Action Required                                  | Comment                                                                            | Reportable Y/N |
|--------------|--------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| <b>PKPM4</b> | Visual / Photo Inspection of Monitoring Point M4 |  |                |

### General Inspection

| No.          | Action Required                                              | Comment                                                                              | Reportable Y/N |
|--------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|
| <b>PKPM5</b> | Visual / Photo Inspection of Monitoring Point M5-1 AND PM5-2 |  |                |

|              |                                                               |                                                                                     |  |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                               |   |  |
| <b>PKPM6</b> | Visual / Photo Inspection of Monitoring Point PM6-1 AND PM6-2 |  |  |

|              |                                                               |                                                                                     |  |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                               |   |  |
| <b>PKPM7</b> | Visual / Photo Inspection of Monitoring Point PM7-1 AND PM7-2 |  |  |



|           |                                                               |                                                                                     |  |
|-----------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|           |                                                               |   |  |
| <b>M8</b> | Visual / Photo Inspection of Monitoring Point PM8-1 and PM8-2 |  |  |

|              |                                                               |                                                                                     |  |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                               |   |  |
| <b>PKPM9</b> | Visual / Photo Inspection of Monitoring Point PM9-1 and PM9-2 |  |  |

|               |                                                      |                                                                                     |  |
|---------------|------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|               |                                                      |   |  |
| <b>PKPM10</b> | Visual / Photo Inspection of Monitoring Point PM10-1 |  |  |

**PKPM11**

Visual / Photo  
Inspection of  
Monitoring  
Point M11-1





**PKPM12**

Visual / Photo  
Inspection of  
Monitoring  
Point PKPM12A



Visual / Photo  
Inspection of  
Monitoring  
Point PKPM12B



**PKPM13**

Visual / Photo  
Inspection of  
Monitoring  
Point PKPM13A



Visual / Photo  
Inspection of  
Monitoring  
Point PKPM13B



|               |                                                      |                                                                                     |  |
|---------------|------------------------------------------------------|-------------------------------------------------------------------------------------|--|
| <b>PKPM14</b> | Visual / Photo Inspection of Monitoring Point PKPM14 |   |  |
| <b>PKPM15</b> | Visual / Photo Inspection of Monitoring Point PKPM15 |  |  |



|                      |                                                                                                                          |                                                                                     |  |
|----------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
| <p><b>PKPM16</b></p> | <p>Visual / Photo<br/>Inspection of<br/>Monitoring<br/>Point PKPM16A</p>                                                 |   |  |
|                      | <p>Visual / Photo<br/>Inspection of<br/>Monitoring<br/>Point PKPM16B</p>                                                 |  |  |
| <p>***</p>           | <p>Other. Additional comment relating to this work including periodic audit against other applicable EMP items here.</p> |                                                                                     |  |

Signed: \_\_\_\_\_

## Photo Monitoring Environmental Inspection Report

Peculiar Knob Iron Ore Project

### Photo Monitoring Details – Inspection of Working Areas

|                           |                                                  |                              |                |
|---------------------------|--------------------------------------------------|------------------------------|----------------|
| <b>Date</b>               | 3-5/6/2012                                       | <b>Environmental Advisor</b> | Giles Standish |
| <b>Weather Conditions</b> | Light rain 2/5/2012 (approx. 3mm), Temp 16-18°C. |                              |                |
| <b>Time</b>               |                                                  |                              |                |

3 Monthly inspection of Photo Monitoring Points.

| No.          | Action Required                                         | Comment                                                                              | Reportable Y/N |
|--------------|---------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|
| <b>PKPM1</b> | Visual / Photo Inspection of WRD Monitoring Point PKPM1 |  |                |

| No.          | Action Required                                               | Comment                                                                             | Reportable Y/N |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|
| <b>PKPM2</b> | Visual / Photo Inspection of Monitoring Point PM2-1 AND PM2-2 |  |                |



| No.          | Action Required                                               | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reportable Y/N |
|--------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>PKPM3</b> | Visual / Photo Inspection of Monitoring Point PM3-1 AND PM3-2 |  The 'Comment' column contains two photographs stacked vertically. Both images show a wide, flat landscape under a clear blue sky. The ground is covered with low-lying, dry vegetation in shades of brown, tan, and green. In the distance, a low, dark horizon line is visible. The top photograph shows a slightly different angle or lighting than the bottom one, but both depict a similar arid environment. |                |

| No.          | Action Required                                  | Comment                                                                            | Reportable Y/N |
|--------------|--------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| <b>PKPM4</b> | Visual / Photo Inspection of Monitoring Point M4 |  |                |

### General Inspection

| No.          | Action Required                                              | Comment                                                                              | Reportable Y/N |
|--------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|
| <b>PKPM5</b> | Visual / Photo Inspection of Monitoring Point M5-1 AND PM5-2 |  |                |

|              |                                                                                 |                                                                                     |  |
|--------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                                                 |   |  |
| <b>PKPM6</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point PM6-1<br>AND PM6-2 |  |  |



|              |                                                                                 |                                                                                     |  |
|--------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                                                 |   |  |
| <b>PKPM7</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point PM7-1<br>AND PM7-2 |  |  |

|           |                                                                                 |                                                                                     |  |
|-----------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|           |                                                                                 |   |  |
| <b>M8</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point PM8-1<br>and PM8-2 |  |  |



|              |                                                                                 |                                                                                     |  |
|--------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|              |                                                                                 |   |  |
| <b>PKPM9</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point PM9-1<br>and PM9-2 |  |  |

|               |                                                                         |                                                                                     |  |
|---------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
|               |                                                                         |   |  |
| <b>PKPM10</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point PM10-<br>1 |  |  |



**PKPM11**

Visual /  
Photo  
Inspection  
of  
Monitoring  
Point M11-1



**PKPM12**

Visual /  
Photo  
Inspection  
of  
Monitoring  
Point  
PKPM12A



Visual /  
Photo  
Inspection  
of  
Monitoring  
Point  
PKPM12B



**PKPM13**

Visual /  
Photo  
Inspection  
of  
Monitoring  
Point  
PKPM13A



Visual /  
Photo  
Inspection  
of  
Monitoring  
Point  
PKPM13B





|               |                                                                        |                                                                                     |                                                                                                |
|---------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| <b>PKPM14</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point<br>PKPM14 |   |                                                                                                |
| <b>PKPM15</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point<br>PKPM15 |  | <b>This site has<br/>been<br/>relocated<br/>due to<br/>change in<br/>construction<br/>plan</b> |

|               |                                                                         |                                                                                     |  |
|---------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|
| <b>PKPM16</b> | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point<br>PKPM16A |   |  |
|               | Visual /<br>Photo<br>Inspection<br>of<br>Monitoring<br>Point<br>PKPM16B |  |  |

|     |                                                                                                                   |
|-----|-------------------------------------------------------------------------------------------------------------------|
| *** | Other. Additional comment relating to this work including periodic audit against other applicable EMP items here. |
|-----|-------------------------------------------------------------------------------------------------------------------|

Signed: \_\_\_\_\_



# Appendix F

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS







**Rockwater**  
P R O P R I E T A R Y L I M I T E D

**SOUTHERN IRON PTY LTD**

**GROUNDWATER MONITORING  
ANNUAL REPORT FOR  
PECULIAR KNOB IRON ORE  
PROJECT**

**JULY 2012**

**REPORT FOR  
SOUTHERN IRON PTY LTD**

(Report No. 344.0/12/01)  
)

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## TABLE OF CONTENTS

|                                                | PAGE |
|------------------------------------------------|------|
| 1 INTRODUCTION                                 | 1    |
| 1.1 Scope of Report                            | 1    |
| 1.2 Summary of Monitoring Programme            | 1    |
| 1.3 Summary of Licence Conditions              | 2    |
| 2 PHYSICAL SETTING                             | 3    |
| 2.1 Location and Topography                    | 3    |
| 2.2 Climate                                    | 3    |
| 3 HYDROGEOLOGICAL SETTING                      | 4    |
| 3.1 Regional                                   | 4    |
| 3.2 Penrhyn Borefield                          | 4    |
| 3.3 Accommodation Camp Borefield               | 5    |
| 3.4 Stafford Borefield                         | 5    |
| 4 BOREFIELD CONSTRUCTION DATA                  | 6    |
| 5 MONITORING RESULTS                           | 7    |
| 5.1 Pumpage                                    | 7    |
| 5.1.1 Penrhyn Borefield                        | 8    |
| 5.1.2 Accommodation Camp Borefield             | 8    |
| 5.1.3 Stafford Borefield                       | 8    |
| 5.2 Water Levels                               | 8    |
| 5.2.1 Penrhyn Borefield                        | 9    |
| 5.2.2 Accommodation Camp Borefield             | 9    |
| 5.2.3 Stafford Borefield                       | 9    |
| 5.2.4 Summary of Water Levels                  | 10   |
| 5.3 Water Quality                              | 11   |
| 5.3.1 Penrhyn Borefield                        | 11   |
| 5.3.2 Accommodation Camp Borefield             | 11   |
| 5.3.3 Stafford Borefield                       | 12   |
| 5.3.4 Discussion of Water Quality Measurements | 12   |
| 6 MONITORING PROGRAMME ASSESSMENT              | 13   |
| 6.1 Operation Of Programme                     | 13   |
| 6.1.1 Penrhyn Borefield                        | 13   |
| 6.1.2 Accommodation Camp Borefield             | 14   |
| 6.1.3 Stafford Borefield                       | 15   |
| 6.2 Compliance With Water Allocations          | 16   |
| 7 DISCUSSION OF IMPACTS                        | 16   |
| 8 CONCLUSIONS ON MONITORING PROGRAMME          | 16   |
| 9 RECOMMENDATIONS                              | 17   |
| REFERENCES                                     | 18   |



## TABLE OF CONTENTS (Continued)

### Tables

|                                                                                                                                 |    |
|---------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1 : Summary of Bore Licences                                                                                              | 1  |
| Table 2 : Summary of Groundwater Monitoring Programme for Penrhyn, Accommodation Camp, and Stafford Borefields.                 | 2  |
| Table 3 : Coober Pedy Average Monthly Rainfall and 2011-12 Monthly Values                                                       | 4  |
| Table 4 : Penrhyn Borefield: Production and Monitoring Bore Data                                                                | 6  |
| Table 5 : Accommodation Camp Borefield: Production and Monitoring Bore Data                                                     | 6  |
| Table 6 : Stafford Borefield: Production and Monitoring Bore Data                                                               | 7  |
| Table 7 : Summary of Actual Water Pumpages and Allocations                                                                      | 8  |
| Table 8 : Water Trigger Levels for the Penrhyn and Accommodation Camp borefields                                                | 10 |
| Table 9 : Drawdown Thresholds and Measured Water-level changes in Monitoring Bores at Penrhyn and Accommodation Camp Borefields | 10 |
| Table 10 : Penrhyn Production-Bore Performance Monitoring Schedule, and Compliance                                              | 13 |
| Table 11 : Penrhyn Borefield Groundwater Monitoring Schedule Compliance                                                         | 14 |
| Table 12 : Accommodation Camp Production-Bore Performance Monitoring Schedule and Compliance                                    | 14 |
| Table 13 : Accommodation Camp Groundwater Monitoring Schedule and Compliance                                                    | 15 |
| Table 14 : Stafford Borefield Groundwater Monitoring Schedule Compliance                                                        | 15 |
| Table 15 : Water Licences and Allocation Compliance                                                                             | 16 |

### Figures

|    |                                                                                               |
|----|-----------------------------------------------------------------------------------------------|
| 1  | Topographic Map Peculiar Knob Environs                                                        |
| 2  | Penrhyn Borefield Bore Locations                                                              |
| 3  | Accommodation Camp Borefield Bore Locations                                                   |
| 4  | Stafford Borefield Bore Locations                                                             |
| 5  | Hydrogeological Map of South-Western Sector of Eromanga Basin                                 |
| 6  | Penrhyn and Accommodation Camp Borefield Hydrogeological Cross Section A-B                    |
| 7  | Stafford Borefield Hydrogeological Cross Section A-A                                          |
| 8  | Monthly Pumpage, Hydrographs and Salinities of Penrhyn Production Bores                       |
| 9  | Hydrographs, pH and Salinities of Penrhyn Monitoring Bores – 1 <sup>st</sup> Group            |
| 10 | Hydrographs, pH and Salinities of Penrhyn Monitoring Bores – 2 <sup>nd</sup> Group            |
| 11 | Monthly Pumpage, Hydrographs and Salinities of Accommodation Camp Production Bores            |
| 12 | Hydrographs, pH and Salinities of Accommodation Camp Monitoring Bores – 1 <sup>st</sup> Group |
| 13 | Hydrographs, pH and Salinities of Accommodation Camp Monitoring Bores – 2 <sup>nd</sup> Group |



## **TABLE OF CONTENTS (Continued)**

### **Figures (cont.)**

- 14 Hydrographs and Salinities of Stafford Production Bores
- 15 Hydrographs, pH and Salinities of Stafford Monitoring Bores – 1<sup>st</sup> Group
- 16 Hydrographs, pH and Salinities of Stafford Monitoring Bores – 2<sup>nd</sup> Group

### **Appendices**

- I Groundwater Licences
- II Monitoring data from 1 July 2011 to 30 June 2012
- III Summary Table of Water Quality Analyses
- IV Water Chemistry Laboratory Certificates



# 1 INTRODUCTION

Production and monitoring bores located in and near the three borefields operated by Southern Iron Pty Ltd (SI) – a wholly-owned subsidiary of Arrium Mining – are monitored regularly to allow assessment of the groundwater response to pumping. The borefields, named Penrhyn, Camp Accommodation and Stafford, were constructed to supply water for the Peculiar Knob Iron Ore project. Penrhyn and Accommodation Camp borefields commenced operation in September 2011 and February 2012, respectively; Stafford borefield has not yet operated.

The locations of the borefields are shown in Figures 1 to 4.

Seven production bores have been constructed and licensed to produce a total of 1.55 GL/a of water for mining and accommodation uses. The construction and testing data are contained in reports by Rockwater (2008a and b, 2010a, 2011a and b). Three Groundwater Monitoring Plans (Rockwater, 2010b, 2011c and d) and two Management Plans (Rockwater, 2011c and d) have been submitted. The relevant licences issued by the Department for Water are listed in Table 1 and are reproduced in Appendix 1.

**Table 1 : Summary of Bore Licences**

| Licence No. | Borefield          | S.I. Bore No. | DfW No.  | Water Allocation | Licence Expiry Date | Bore Location (MGA) |         |
|-------------|--------------------|---------------|----------|------------------|---------------------|---------------------|---------|
|             |                    |               |          | kL/a             |                     | mE                  | mN      |
| 193858      | Penrhyn            | PCWP-02A      | 5839-808 | 378,000          | 30/06/22            | 466670              | 6754576 |
| 193860      | Penrhyn            | TNB-01        | 5839-198 | 158,000          | 30/06/22            | 457970              | 6751494 |
| 205010      | Accommodation Camp | PKWB-01A      | 5839-815 | 347,000          | 30/06/22            | 497317              | 6739981 |
| 205011      | Accommodation Camp | PKWB-03A      | 5938-945 | 158,000          | 30/06/22            | 500482              | 6736489 |
| 165398      | Stafford           | HN48          | Far }    | 507,350          | 30/06/22            | 514748              | 6680689 |
|             |                    | HN73          | North }  |                  |                     | 514545              | 6681300 |
|             |                    | HN77          | PWA }    |                  |                     | 514474              | 6681250 |

## 1.1 SCOPE OF REPORT

In this report, the monitoring data to June 2012 are presented and assessed with respect to regional groundwater levels and quality, and pre-pumping data. The assessment takes into account the licence conditions and the principles of the Water Allocation Plan for the Far North Prescribed Wells Area (SAALNRMB, 2009).

## 1.2 SUMMARY OF MONITORING PROGRAMME

The groundwater monitoring programme comprises measurements of water levels and water quality as outlined in Table 2.

**Table 2 : Summary of Groundwater Monitoring Programme for Penrhyn, Accommodation Camp, and Stafford Borefields.**

| Parameter                    | Sampling Site                                                                                                             | Frequency          |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------|
| Accommodation Camp Borefield |                                                                                                                           |                    |
| Water Pumpage (kL)           | Production Bores:<br>PKWB-01A & PKWB-03A                                                                                  | Weekly             |
| Water Levels                 |                                                                                                                           | Opportunistically  |
| Water quality (EC & pH)      |                                                                                                                           | Monthly            |
| Major component analyses     |                                                                                                                           | Annually           |
| Water Levels                 | Monitoring Bores:<br>PKWB-01, PKWB-02,<br>PKWB-03, PKWB-04A,<br>PKWB-05, PKWB-06, Site F<br>and Inactive Production Bores | Monthly            |
| Water quality (EC & pH)      |                                                                                                                           | Quarterly          |
| Major component analyses     |                                                                                                                           | Annually           |
| Penrhyn Borefield            |                                                                                                                           |                    |
| Water Pumpage (kL)           | Production Bores:<br>PCWP-02A & TNB-01                                                                                    | Weekly             |
| Water Levels                 |                                                                                                                           | Opportunistically* |
| Water quality (EC & pH)      |                                                                                                                           | Monthly            |
| Major component analyses     |                                                                                                                           | Annually           |
| Water Levels                 | Monitoring Bores:<br>PCWP-02, TNB-01A,<br>PMB-01 to PMB-05;<br>and Inactive Production Bores                              | Monthly/Weekly^    |
| Water quality (EC & pH)      |                                                                                                                           | Quarterly          |
| Major component analyses     |                                                                                                                           | Annually           |
| Stafford Borefield           |                                                                                                                           |                    |
| Water Pumpage (kL)           | Production Bores:<br>HN48, HN73, HN77                                                                                     | Weekly             |
| Water Levels                 |                                                                                                                           | Occasionally       |
| Water quality (EC & pH)      |                                                                                                                           | 6 monthly          |
| Major component analyses     |                                                                                                                           | 2 yearly           |
| Water Levels                 | Bedrock Monitoring<br>Bore HNPR-102                                                                                       | Monthly            |
| Water Levels                 | Algebuckina-Cadna-Owie aquifer<br>monitoring bores                                                                        | Monthly            |
| Water Levels                 | New Hodges, Black Oak,<br>Woolshed, Hawks Nest                                                                            | Monthly            |
| Water quality (EC & pH)      |                                                                                                                           | 6 monthly          |

\* = water levels are taken when the pump is shut down for maintenance

^ = water levels in monitoring bores PCWP-02 and TNB-01A are taken weekly, water levels in the other bores are taken monthly

### 1.3 SUMMARY OF LICENCE CONDITIONS

The summary presented below, comprises selected items from the licence conditions contained in the groundwater licences presented in Appendix I to this report.

- The water allocations must be used only on the lands described in the licences.
- The water allocations must only be used for the purpose described: industrial; mining.



### **Licences No. 193858, 193860, 205010 and 205011**

- The proponent must submit an Annual Report, as per the approved Groundwater Management and Monitoring Plan, as per Section 9.3 of the Water Allocation Plan for the Far North Prescribed Wells Area.
- Annual review will ensure water quality changes (salinity) remain in line with Principle 19 of the Far North Prescribed Wells Area Water Allocation Plan and drawdown impacts are in line with Principle 27.

### **Licence No. 165398**

- The licensee must develop a “Groundwater Monitoring Program Plan” to the satisfaction of the Minister.

This Groundwater Monitoring Report fulfils the regulatory reporting required for the five bore licences (Appendix I) covering the three borefields at the Peculiar Knob project.

## **2 PHYSICAL SETTING**

### **2.1 LOCATION AND TOPOGRAPHY**

The three borefields are separately located south-south-westerly to south-south-easterly from Coober Pedy at distances of between 30 and 120 km (Fig. 1).

The region has low topography, with elevations in the range 100 to 250 m AHD. Drainage is predominantly south-westerly via shallow creeks that rarely flow, and terminate in claypans and small ephemeral lakes. A topographic divide runs south-easterly from Coober Pedy, and its northern part is followed by the Stuart Highway. Drainages on the eastern side of the divide are up to 100 km or more in length, run generally north-easterly, and terminate in small to large salt lakes of the Australian interior, overlying the Great Artesian Basin. Those on the western side are generally shorter, and terminate in small lakes and swamps. The Southern Iron borefields all lie on the western side of the divide.

### **2.2 CLIMATE**

The area lies in the central arid part of South Australia, with hot dry summers (maximum temperatures 35° to 47°) and mild winters with mainly warm days and cold nights. Table 3 lists the average monthly rainfall for Coober Pedy, and the rainfall received in 2011-12.

**Table 3 : Coober Pedy Average Monthly Rainfall and 2011-12 Monthly Values**

| Month                      | Jul  | Aug | Sept | Oct  | Nov  | Dec  | Jan  | Feb  | Mar  | Apr | May  | June | Total |
|----------------------------|------|-----|------|------|------|------|------|------|------|-----|------|------|-------|
| Mean Monthly Rainfall (mm) | 7.8  | 9.3 | 8.9  | 15.1 | 12   | 17.1 | 16.4 | 23.3 | 13.3 | 6.6 | 13.5 | 13.9 | 156.3 |
| 2011-12 (Airport) (mm)     | 15.0 | 1.2 | 0.2  | 17.0 | 12.6 | 16.2 | 7.0  | 17.8 | 43.2 | 5.2 | 0    | 0.2  | 135.4 |

Annual rainfall averages 156 mm per annum. Rainfall is erratic, with occasional intense rainfalls giving rise to flooding. Average monthly values for Coober Pedy townsite range from 6.6 to 23.3 mm, being highest in February. The rainfall for financial year 2011-12 was 13% below average, and characterised by a large amount (three times average) in March 2012.

Evaporation is very high, with Class A pan annual values ranging from 2,800 to 3,200 mm/yr.

### 3 HYDROGEOLOGICAL SETTING

#### 3.1 REGIONAL

All three borefields lie in the south-western part of the Eromanga sedimentary basin (Fig. 5), which is one of the three conjoined basins that make up the Great Artesian Basin. The borefields lie to the west of the 'artesian' part of the basin, and groundwater levels are tens of metres below the ground surface. In this sector of the basin, the main aquifer comprises the Cadna-Owie Formation and the Algebuckina Sandstone, of Lower Cretaceous and Jurassic ages respectively, generally up to about 30 m thick. These strata are overlain regionally by the Bulldog Shale, of Cretaceous age.

In the Stafford borefield the basin sediments are thin (about 20 m) deposits over a bedrock high of Proterozoic-age rocks, and the bores produce groundwater from the bedrock. To the east and west of the borefield, the basin strata are deeper and contain saturated aquifer – mainly Algebuckina Formation.

Groundwater levels in the borefield environs are at 130 to 140 m AHD, and slope downwards to the east towards groundwater discharge areas (springs) up to 200 km distant.

#### 3.2 PENRHYN BOREFIELD

In the Penrhyn borefield the main aquifer (Cadna-Owie Fm and Algebuckina SS) is characterised by fine- to coarse-grained feldspathic quartz sand, conglomeratic in places. It commonly contains silt and clay as both matrix material and thin lenses. The sand is typically poorly to weakly consolidated; it is about 20 to 40 m thick, and contains saline groundwater. In nine bores sampled in 2011, the salinity range was 15,000 to 71,000 milligrams per litre total dissolved solids (mg/L TDS).

A hydrogeological cross section which illustrates part of the Penrhyn borefield is presented in Figure 6. It extends south-easterly to the Accommodation Camp borefield. It shows that at Penrhyn the Algebuckina Sandstone is fully saturated, although it is locally partially-saturated further to the south-east at bore CPC9. Production bore PCWP-02A is shown to be screened near the base of the formation (as are bores TNB-01 and TNB-01A, not included in this hydrogeological section). The overlying Cadna-Owie Formation is partially-saturated.

Groundwater levels stand at 20 to 50 m below ground surface (bgs) at Penrhyn, and in 2011 they were at 124 to 130 m AHD. There is a low hydraulic gradient, about 0.0005, downwards in an easterly direction.

### **3.3 ACCOMMODATION CAMP BOREFIELD**

The main aquifer at the Accommodation Camp borefield is the Algebuckina Sandstone, apparently in continuity with the aquifer at Penrhyn, as shown in Figure 6. The Cadna-Owie Formation is largely unsaturated in this area, as the groundwater level lies near or below its base. In the several bores drilled at the Accommodation Camp borefield (Rockwater, 2011), the Algebuckina aquifer is 16 to 23 m thick, with its base at 71 to 82 m below ground surface (bgs). Groundwater levels are at 53 to 62 m bgs, being 117 to 122 m AHD and slope downwards to the south at low hydraulic gradients.

Groundwater in the Algebuckina aquifer at Accommodation Camp borefield is moderately saline, with salinities in the range 15,000 to 25,000 mg/l TDS.

### **3.4 STAFFORD BOREFIELD**

Bedrock provides groundwater at the Stafford borefield located within the Hawks Nest project area (Rockwater, 2008 and 2010b). Regionally, the bedrock comprises adamellite, granulite paragneiss, and metasedimentary rocks including schist and banded iron formation (BIF). At the bore locations the strata dip steeply to the south-east, with metasediments overlying hematitic and magnetitic BIF. Most of the groundwater supplies were encountered in BIF at depths between 50 and 100 m bgs.

Groundwater levels at the borefield are 32 to 34 m bgs, and the sedimentary basin strata are essentially unsaturated. To the east and west of the borefield the Algebuckina Sandstone becomes deep enough to be saturated (Fig.7). This aquifer provides water to some of the pastoralist's stock-watering bores. The groundwater levels slope downwards to the east, in the direction of groundwater flow.

Water salinities in the bores tested at Stafford are in the range 2000 to 5000 mg/l TDS.

## 4 BOREFIELD CONSTRUCTION DATA

The data for the production and monitoring bores at the three borefields are listed in Tables 4 to 6.

**Table 4 : Penrhyn Borefield: Production and Monitoring Bore Data**

| Bore No          | Location |          | Depth Drilled<br><br>m bgl* | Ground Level<br><br>m AHD | Top of Casing (toc)<br><br>m agl** | Cased Depth<br><br>m bgl | Slotted/Screened Interval<br><br>m bgl | Static Water Level<br><br>m btoc*** | Water Salinity (est. from EC)<br><br>mg/L TDS |
|------------------|----------|----------|-----------------------------|---------------------------|------------------------------------|--------------------------|----------------------------------------|-------------------------------------|-----------------------------------------------|
|                  | mE (MGA) | mN (MGA) |                             |                           |                                    |                          |                                        |                                     |                                               |
| Production Bores |          |          |                             |                           |                                    |                          |                                        |                                     |                                               |
| PCWP-02A         | 466670   | 6754576  | 69                          | 151                       | 0.48                               | 68                       | 59-67                                  | 27.9                                | 59,100                                        |
| TNB-01           | 457970   | 6751494  | 39.5                        | 147                       | 0.22                               | 39.5                     | 28-36                                  | 22.8                                | 53,300                                        |
| Monitoring Bores |          |          |                             |                           |                                    |                          |                                        |                                     |                                               |
| PCWP-02          | 466662   | 6754566  | 70                          | 151                       | 0.35                               | 70                       | 63-69                                  | 27.7                                | 55,400                                        |
| TNB-01A          | 457971   | 6751503  | 42                          | 147                       | 0.15                               | 40.5                     | 33.5-39.5                              | 22.5                                | 57,400                                        |
| PMB-01           | 461346   | 6751909  | 65                          | 158                       | 0.8                                | 54                       | 47-53                                  | 25.4                                | 15,300                                        |
| PMB-02           | 467787   | 6751575  | 75                          | 168                       | 0.8                                | 74                       | 67-73                                  | 42.6                                | 50,000                                        |
| PMB-03           | 471702   | 6753403  | 65                          | 157                       | 0.4                                | 65                       | 57.5-63                                | 36.0                                | 68,400                                        |
| PMB-04           | 464599   | 6752386  | 58                          | 154                       | 0.61                               | 57                       | 50-56                                  | 31.6                                | 41,200                                        |
| PMB-05           | 459991   | 6757750  | 59                          | 145                       | 0.64                               | 59                       | 47-53                                  | 19.6                                | 55,200                                        |

\* m bgl = metres below ground level

\*\* m agl = metres above ground level

\*\*\*m btoc = metres below top of collar

**Table 5 : Accommodation Camp Borefield: Production and Monitoring Bore Data**

| Bore No          | Location |          | Depth Drilled<br><br>m bgl* | Ground Level<br><br>m AHD | Top of Casing (toc)<br><br>m agl** | Cased Depth<br><br>m bgl | Slotted/Screened Interval<br><br>m bgl | Static Water Level<br><br>m btoc*** | Water Salinity (est. from EC)<br>mg/L TDS |
|------------------|----------|----------|-----------------------------|---------------------------|------------------------------------|--------------------------|----------------------------------------|-------------------------------------|-------------------------------------------|
|                  | mE (MGA) | mN (MGA) |                             |                           |                                    |                          |                                        |                                     |                                           |
| Production Bores |          |          |                             |                           |                                    |                          |                                        |                                     |                                           |
| PKWB-01A         | 497317   | 6739981  | 84                          | 180.5                     | 0.6                                | 83                       | 77-82                                  | 59.5                                | 24,800                                    |
| PKWB-03A         | 500482   | 6736489  | 77                          | 174.9                     | 0.25                               | 76.5                     | 67.5-69.5, 71.5-75.5                   | 57.1                                | 19,500                                    |
| Monitoring Bores |          |          |                             |                           |                                    |                          |                                        |                                     |                                           |
| PKWB-01          | 497318   | 6739994  | 82                          | 180.5                     | 0.3                                | 81                       | 76-81                                  | 59.4                                | 22,600                                    |
| PKWB-02          | 498200   | 6738801  | 77                          | 174.7                     | 0.3                                | 76                       | 70-75                                  | 54.9                                | 22,200                                    |
| PKWB-03          | 500501   | 6736497  | 75.5                        | 174.9                     | 0.21                               | 75.5                     | 69-74                                  | 57.8                                | 18,900                                    |
| PKWB-04A         | 499791   | 6740907  | 82                          | 183.1                     | 0.79                               | 81.5                     | 60.5-66.5, 70-79                       | 62.0                                | 15,100                                    |
| PKWB-05          | 498750   | 6737345  | 73                          | 175.2                     | 0.24                               | 73                       | 67.5-72                                | 53.2                                | 16,500                                    |
| PKWB-06          | 499135   | 6737350  | 72.5                        | 176.4                     | 0.25                               | 72                       | 66-71                                  | 54.3                                | 19,400                                    |
| Site F           | 498390   | 6737078  | 72                          | 169.8                     | 0.4                                | 70                       | 48-54                                  | 51.5                                | ND                                        |

\* m bgl = metres below ground level

\*\* m agl = metres above ground level

\*\*\*m btoc = metres below top of collar

ND = Not Determined

**Table 6 : Stafford Borefield: Production and Monitoring Bore Data**

| Bore No                              | Location |          | Depth Drilled | Ground Level       | Top of Casing (toc) | Cased Depth | Slotted/ Screened Interval | Static Water Level | Water Salinity (est. From EC) |
|--------------------------------------|----------|----------|---------------|--------------------|---------------------|-------------|----------------------------|--------------------|-------------------------------|
|                                      | mE (MGA) | mN (MGA) |               |                    |                     |             |                            |                    |                               |
|                                      |          |          | m bgl*        | m AHD <sup>3</sup> | m agl**             | m bgl       | m bgl                      | m bgl              | mg/L TDS                      |
| <b>Production Bores</b>              |          |          |               |                    |                     |             |                            |                    |                               |
| HN48                                 | 514758   | 6680689  | 102           | 164.3              | 0.46                | 100         | 70-94                      | 33                 | 4800                          |
| HN73                                 | 514545   | 6681300  | 102           | 164.7              | 0.3                 | 102         | 54-96                      | 31                 | 2700                          |
| HN 77                                | 514474   | 6681250  | 108           | 164.6              | 0.28                | 102         | 54-96                      | 31                 | 2300                          |
| <b>Monitoring Bores</b>              |          |          |               |                    |                     |             |                            |                    |                               |
| HNWPR-102                            | 511325   | 6681870  | 102           | 164.1              | 0                   | N/A         | N/A                        | 16.5               | ND                            |
| HNWPR-105                            | 516430   | 6681669  | 51            | 165.0              |                     | 50          | 43.5-47                    | 38                 | ND                            |
| HNWPR62A Hawks nest                  | 514754   | 6680622  |               | -                  |                     |             |                            |                    |                               |
| 5937-6 Algebuckina                   | 513507   | 6675814  |               | -                  |                     |             |                            |                    |                               |
| 5937-015 Algebuckina                 | 521173   | 6675259  |               | -                  |                     |             |                            |                    |                               |
| 5838-40 Algebuckina                  | 507581   | 6694959  |               | -                  |                     |             |                            |                    |                               |
| HN49 Hawks nest                      | 514754   | 6680621  | 102           | -                  | 0.3                 | 100         | 72-96                      | 33.96              | 3,500                         |
| New Hodges                           | 500303   | 6684615  | 24            | 163.4              | 0.4                 |             |                            |                    |                               |
| Black Oak                            | 524842   | 6683040  | 61            | 188.3              | 0.3                 |             |                            |                    |                               |
| 5837-459 (Woolshed Bore replacement) | 494784   | 6678961  | 24            | -                  | 0.4                 |             |                            |                    |                               |
| Hawks Nest                           | 513430   | 6684751  | 61.5          | -                  | 0.3                 |             |                            |                    |                               |

\* m bgl = metres below ground level

\*\* m agl = metres above ground level

## 5 MONITORING RESULTS

The monitoring data for the 12-month period 1 July 2011 to 30 June 2012 are presented in Appendix II. They are plotted in Figures 8 to 16.

### 5.1 PUMPAGE

The volumes pumped from the borefields in the 2011-2012 monitoring period are summarised in Table 7. Measured pumpages were in all cases less than the licensed volumes per annum.

**Table 7 : Summary of Actual Water Pumpages and Allocations**

| Borefield          | S/Bore No | Water Pumpage<br>kL | Water Allocation<br>kL/a |
|--------------------|-----------|---------------------|--------------------------|
| Penrhyn            | PCWP-02A  | 238,938             | 378,000                  |
|                    | TNB-01    | 62,673              | 158,000                  |
| Accommodation Camp | PKWB-01A  | 67,701              | 347,000                  |
|                    | PKWB-03A  | 5,258               | 158,000                  |
| Stafford           | HN48      | 0                   | 507,350                  |
|                    | HN73      |                     |                          |
|                    | HN77      |                     |                          |

### 5.1.1 Penrhyn Borefield

Pumping of the Penrhyn Borefield commenced on 16 September 2011 at PCWP-02A and on 3 November 2011 at TNB-01. Figure 8 illustrates the monthly extraction rates from the two production bores. The average pumping rates were 11.3 and 3.7 L/s for PCWP-02A and TNB-01 respectively.

The total of 301611 kL of water pumped from the two Penrhyn bores is 56 per cent of their combined allocation of 536,999 kL.

### 5.1.2 Accommodation Camp Borefield

Pumping of the Accommodation Camp Borefield commenced on 3 February 2012 at PCWB-03A and 23 March 2012 at PKWB-01A. Figure 11 illustrates the monthly extraction rates from the two production bores. The average pumping rates were 4.9 and 9.9 L/s for PCWB-03A and PKWB-01A respectively.

The total of 72,959 kL of water pumped from the two Accommodation Camp bores is 14 per cent of their combined allocation of 505,000 kL.

### 5.1.3 Stafford Borefield

The Stafford borefield is yet to be pumped.

## 5.2 WATER LEVELS

The water-level monitoring data presented herein have been obtained from the monitoring bores and from the production bores at the Penrhyn, Accommodation Camp, and Stafford borefields. The data are presented in Appendix II, and plotted in Figures 8 to 16. Locations of the bores are shown in Figures 2 to 4



### **5.2.1 Penrhyn Borefield**

Groundwater levels have been measured regularly in the eight monitoring bores at the Penrhyn borefield; there was one reading from a production bore. It should be noted that the Groundwater Monitoring Program has recently been amended by Southern Iron (2012) so that the weekly measurements of water levels in production bores PCWP-02A and TNB-01 have been replaced by weekly measurements of water levels in monitoring bores PCWP-02 and TNB-01A, which are nearby to and slotted at a similar depth as the production bores (Table 4). However, the production bores will still be monitored opportunistically, such as when they have been shut down for maintenance.

Hydrographs for the monitoring bores (Figs. 9 and 10) show negligible change in six of them, and small reductions, 0.5 and 1.3 m, in bores PCWP-02 and TNB-01A respectively, over the year of monitoring. The water-level reductions reflect hydraulic connection and drawdown in the aquifer at small distances from the pumped bores. Two of the bores, PCWP-02 and 5839-14, are yet to be levelled-in to AHD.

### **5.2.2 Accommodation Camp Borefield**

Hydrographs of the production bores, prior to pumping, are presented in Figure 11 and the monitoring-bore hydrographs for the whole monitoring period are plotted in Figures 12 and 13. Water levels in the production bores showed no change, prior to pumping. Water levels in the bores PKWB-02 and PKWB-04 showed negligible change through the monitoring period. Site F and PKWB-05 and PKWB-06 showed small fluctuations and slight water-level reductions (less than 0.2 m).

Bores PKWB-01 and PKWB-03 showed reductions of about 2 m, although the water level in PKWB-01 appears to have recovered for most of June 2012 (Fig. 12). The 2 m fluctuations were apparently associated with the commissioning and pumping of the borefield. These bores are adjacent to production bores and the water level fluctuations during pumping indicate that the production and monitoring bores have effective hydraulic connection.

### **5.2.3 Stafford Borefield**

Groundwater levels were measured in three production bores and eleven monitoring bores. Water levels in all the bores remained almost constant as indicated by the hydrographs in Figures 14–16. The monitoring bores have not yet been levelled-in, therefore their water levels are presented in metres below a reference point, typically the top of the bore casing.

## 5.2.4 Summary of Water Levels

Trigger water levels and the lowest measured water levels in the production bores in the Accommodation Camp borefield and in the monitoring bores in the Penrhyn borefield – listed in Table 8 - are taken from the groundwater database of Southern Iron Pty Ltd. No trigger levels were breached during the 2011–2012 monitoring period; however, the water levels were measured prior to the main period of pumping, and do not indicate the responses of the water levels in the production bores during the period of borefield operation. It would be beneficial to equip each production bore with a dip tube (or similar) to allow water levels to be measured alongside the pump column.

**Table 8 : Water Trigger Levels for the Penrhyn and Accommodation Camp borefields**

| Bore                  | Trigger Level (m bgl*) | Lowest measured water level during monitoring period (m bgl*) |
|-----------------------|------------------------|---------------------------------------------------------------|
| PKWB-01A (prod. bore) | 64.6                   | 58.76                                                         |
| PKWB-03A (prod. bore) | 61.5                   | 56.61                                                         |
| TNB-01A (mon. bore)   | 27.8                   | 21.64                                                         |
| PCWP-02 (mon. bore)   | 32.9                   | 27.61                                                         |

\*m bgl = metres below ground level

Reports by Rockwater (2011c and d) outlined drawdown thresholds and an action criterion if the thresholds were exceeded in the nominated monitoring bores in the Penrhyn and Accommodation Camp borefields. The thresholds (listed in Table 9) were not exceeded; in fact, the water levels increased in 70 per cent the monitoring bores. Thus, Principle 6.2.27 in the Water Allocation Plan for the Far North Prescribed Wells Area has been adhered to.

**Table 9 : Drawdown Thresholds and Measured Water-level changes in Monitoring Bores at Penrhyn and Accommodation Camp Borefields**

| Borefield          | Bore     | Drawdown Threshold (m) | Water-Level Changes (m) over the monitoring period |
|--------------------|----------|------------------------|----------------------------------------------------|
| Penrhyn            | PMB-01   | 0.6                    | -0.17                                              |
|                    | PMB-02   | 0.6                    | +0.12                                              |
|                    | PMB-03   | 0.6                    | +0.09                                              |
|                    | PMB-04   | 0.6                    | +0.10                                              |
|                    | PMB-05   | 0.6                    | -0.01                                              |
| Accommodation Camp | PKWB-02  | 1.5                    | +0.02                                              |
|                    | PKWB-04A | 1.0                    | +0.04                                              |
|                    | PKWB-05  | 1.5                    | +0.04                                              |
|                    | PKWB-06  | 1.5                    | -0.03                                              |
|                    | Site F   | 1.0                    | +0.03                                              |

## **5.3 WATER QUALITY**

Sampling for salinity and pH measurements was conducted at the times shown in Figures 8 to 16, and in Appendix III: generally three-monthly or more often. Groundwater sampling for major components analysis was conducted in the last week of March 2012. A chemical analyses summary table is presented in Appendix III and laboratory certificates are included in Appendix IV.

### **5.3.1 Penrhyn Borefield**

Salinities at Penrhyn Borefield ranged from 14,000 to 50,000 TDS mg/L and fluctuated strongly in some bores (Figs. 8 to 10). Bores PCWP-02, TNB-01A and PMB-01 showed increases in salinity between January and April 2012. The increases in total dissolved solids could be attributed to the close proximity to the production bores in the Penrhyn borefield, as the elevated levels coincide with the commissioning of the borefield. The April 2012 salinity value for PMB-01 is anomalous, and should be checked at the next sampling.

The total dissolved solids (TDS) values in all samples submitted to the laboratory are high, and the water is classified as hypersaline. Groundwater at Penrhyn Borefield is slightly acidic with pH values in the range 5.3 to 6.8 (Fig. 9). The samples had high levels of sulphate, chloride and sodium.

Metals were elevated in some samples. Manganese levels in more than 25% of samples - and nickel levels in more than 50% of samples - exceeded health guidelines (which are referenced to drinking water). Because the raw water will not be consumed, the exceedences of health values (Australian Drinking Water Guidelines, 2011) for manganese and nickel are unlikely to be relevant, but might be reviewed with respect to OH&S issues.

### **5.3.2 Accommodation Camp Borefield**

Salinities for the borefield were high, ranging from 13,000 to 32,000 (Figs. 11-13; App III). During the monitoring period the TDS values remained relatively constant in all bores except at Site F (where the April result is anomalous, and should be checked at the next sampling). The pH values for all bores were in the range 6.4 to 6.9. There were high levels of sulphate, chloride and sodium. More than 50% of the samples analysed breached ADWG health values for nickel and more than 20% breached selenium AWDG health values. The exceedences of health values for nickel and selenium might need to be reviewed with respect to OH&S issues. The water is not currently used for domestic consumption, but desalination to produce consumable water might be undertaken in future.

### 5.3.3 Stafford Borefield

The water produced from the Stafford borefield has considerably lower salinity than that from the other borefields, with values in the range 2,700 to 6,500 mg/L TDS (Fig 14). Four monitoring bores were sampled during the monitoring period: New Hodge, Black Oak, 5937-459 and Hawks Nest. Of these, both Hawks Nest and 5937-459 showed large increases in TDS (Fig 15), with the May 2012 data probably being the most accurate. The pH range of all samples was 7.0 to 7.4. While the water is brackish to saline, it should be suitable for mining, dust-suppression, and desalination purposes.

Similar to the results from the other two borefields, the analyses indicated high proportions of sulphate, chloride and sodium. Total metals in bore HN48 exceeded aesthetic guidelines for aluminium, manganese and iron, but these are unlikely to be relevant as the water will not be consumed unless treated by desalination.

### 5.3.4 Discussion of Water Quality Measurements

Field measurements of salinity (from electrical conductivity) of the pumped water at Penrhyn (Fig. 8) indicate no net change at production bore TNB-01 since pumping began, and an 11.5% increase at bore PCWP-02A. However, laboratory measurements indicate increases of 0.8% and 1.6% in electrical conductivity of water produced at TNB-01 and PCWP-02A respectively since March 2011 when the bores were test-pumped. The changes in salinity in the Penrhyn production bores are apparently small and not significant, based on the laboratory data.

At Accommodation Camp borefield, the field measurements of salinity indicate reductions of 12% and 7% in production bores PKWB-01A and PKWB-03A respectively (Fig. 11). The laboratory measurements of electrical conductivity indicate a salinity increase of 2.3% at PKWB01A, and a decrease of 4% at PKWB03A. Field measurements on samples from the monitoring bores indicated mainly small net increases or decreases in salinity, and strong fluctuations in three bores which are within the limits of measurement error.

At Stafford borefield, where there was no production pumping, field measurements indicated negligible salinity changes in the production bores, and variations from 2.6% increase to 8% decrease in salinity in three monitoring bores. Two monitoring bores showed improbable increases of 1000%, which were identified as procedural sampling errors by SI when the data and sampling methods were reviewed.

## 6 MONITORING PROGRAMME ASSESSMENT

### 6.1 OPERATION OF PROGRAMME

#### 6.1.1 Penrhyn Borefield

Recommended pumping rates outlined in a report by Rockwater (2011c) were 12 L/s for PCWP-02A and 5 L/s for TNB-01. Actual average pumping rates over the monitoring period were slightly less at 11.3 and 3.7 L/s for PCWP-02A and TNB-01 respectively.

In accordance with the amended Water Management Plan (Southern Iron, 2012), water levels were not measured in the production bores when they were pumping. One water level measurement (prior to pumping) is available for production bore TNB-01. Production bore water quality measurements for EC and pH were taken approximately monthly from October 2011. A major component analysis was conducted at the end of March 2012. Table 10, below, is a summary of the borefield performance monitoring schedule (Rockwater, 2011c) together with an indication of the programme's compliance.

**Table 10 : Penrhyn Production Bore Performance Monitoring Schedule, and Compliance**

| Sampling Site                             | Parameter                | Recommended Frequency | Compliance |
|-------------------------------------------|--------------------------|-----------------------|------------|
| Production Bores:<br>PCWP-02A &<br>TNB-01 | Water Pumpage (kL)       | Weekly                | Full       |
|                                           | Water Levels             | Opportunisticly       | Compliant  |
|                                           | Water quality (EC & pH)  | Monthly               | Full       |
|                                           | Major component analyses | Annually              | Full       |

Water levels in monitoring bores were measured approximately weekly in bores TNB-01A and PCWP-02 commencing in October 2011. The remainder of the monitoring bores (PMB-01 to PMB-05 & 5839-14) were measured less frequently, with 9 or 10 samplings between October 2011 and the end of June 2012. Water quality (EC and pH) for all monitoring bores (except 5839-14) was measured quarterly commencing in October 2011 and a major component analysis was conducted at the end of March. Table 11 includes an assessment of the compliance of the conditions of the groundwater monitoring schedule.

**Table 11 : Penrhyn Borefield Groundwater Monitoring Schedule Compliance**

| Sampling Site                                                                                | Parameter                | Recommended Frequency | Compliance                          |
|----------------------------------------------------------------------------------------------|--------------------------|-----------------------|-------------------------------------|
| Monitoring Bores:<br>PCWP-02, TNB-01A,<br>PMB-01 to PMB-05;<br>and Inactive Production Bores | Water Levels             | Monthly               | Compliant from October 2011 onwards |
|                                                                                              | Water quality (EC & pH)  | Quarterly             | Full                                |
|                                                                                              | Major component analyses | Annually              | Full                                |

### 6.1.2 Accommodation Camp Borefield

Recommended pumping rates outlined in a report by Rockwater (2011d) were 11 L/s for PKWB-01A and 5 L/s for PKWB-03A. Actual average pumping rates over the monitoring period were slightly less at 9.9 and 4.9 L/s for PKWB-01A and PKWB-03A respectively. Water levels in production bores were measured about monthly, pre-pumping, but only one measurement was taken thereafter. Production bore water quality measurement for pH and EC were taken monthly commencing in October and a major components analysis was conducted at the end of March 2012. Table 12 comprises a summary of the recommended performance monitoring schedule (Rockwater, 2011d) together with an assessment of the programme's compliance.

**Table 12 : Accommodation Camp Production-Bore Performance Monitoring Schedule and Compliance**

| Sampling Site                               | Parameter                | Recommended Frequency | Compliance |
|---------------------------------------------|--------------------------|-----------------------|------------|
| Production Bores:<br>PKWB-01A &<br>PKWB-03A | Water Pumpage (kL)       | Weekly                | Full       |
|                                             | Water Levels             | Opportunisticly       | Compliant  |
|                                             | Water quality (EC & pH)  | Monthly               | Full       |
|                                             | Major component analyses | Annually              | Full       |

Water levels in monitoring bores were measured at weekly to monthly intervals. Water quality (EC and pH) for all monitoring bores was measured quarterly commencing in October 2011 and a major component analysis was conducted at the end of March 2012. Table 13 includes an assessment of the compliance of the conditions of the groundwater monitoring schedule.

**Table 13 : Accommodation Camp Groundwater Monitoring Schedule and Compliance**

| Sampling Site                                                                                                             | Parameter                | Recommended Frequency | Compliance                          |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------|-------------------------------------|
| Monitoring Bores:<br>PKWB-01, PKWB-02,<br>PKWB-03, PKWB-04A,<br>PKWB-05, PKWB-06, Site F<br>and Inactive Production Bores | Water Levels             | Monthly               | Compliant from October 2011 onwards |
|                                                                                                                           | Water quality (EC & pH)  | Quarterly             | Full                                |
|                                                                                                                           | Major component analyses | Annually              | Full                                |

### 6.1.3 Stafford Borefield

The Stafford borefield has not yet begun operating. A groundwater monitoring schedule was outlined by Rockwater (2010b). This schedule and compliance with it is summarised in Table 14 below.

**Table 14 : Stafford Borefield Groundwater Monitoring Schedule Compliance**

| Sampling Site                                                                                                                                                                                               | Parameter                | Recommended Frequency          | Compliance                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-------------------------------------|
| Production Bores:<br>HN48, HN73 & HN77                                                                                                                                                                      | Water Pumpage (kL)       | Weekly                         | n/a                                 |
|                                                                                                                                                                                                             | Water Levels             | Occasionally while not pumping | Full                                |
|                                                                                                                                                                                                             | Water quality (EC & pH)  | Biannually                     | Full                                |
|                                                                                                                                                                                                             | Major component analyses | 2 yearly                       | Full                                |
| Monitoring Bores:<br>Black Oak, 5837-459, Hawks Nest, HNWPR62A<br>Hawks Nest, HNWPR102,<br>HNWPR105, 5937-6<br>Algebuckina, 5937-015,<br>Algebuckina, 5938-40<br>Algebuckina, HN49<br>Hawks Nest, New Hodge | Water Levels             | Monthly                        | Compliant from October 2011 onwards |
|                                                                                                                                                                                                             | Water quality (EC & pH)  | Biannually                     | Full                                |
|                                                                                                                                                                                                             | Major component analyses | Not included                   | n/a                                 |

Generally, there has been excellent compliance with groundwater and borefield performance monitoring schedules.



## 6.2 COMPLIANCE WITH WATER ALLOCATIONS

The volumes pumped from the borefields have complied with the water allocations endorsed in the licences listed in Table 15. Water has been taken for industrial and mining purposes as per the conditions of the licences.

**Table 15 : Water Licences and Allocation Compliance**

| Licence No. | Borefield          | S.I. Bore No.        | Water Allocation | Total volume monitoring period 2011-2012 | Unused Allocation |
|-------------|--------------------|----------------------|------------------|------------------------------------------|-------------------|
|             |                    |                      | kL               | kL                                       | kL                |
| 193858      | Penrhyn            | PCWP-02A             | 378,000          | 238,938                                  | 139,062           |
| 193860      | Penrhyn            | TNB-01               | 158,000          | 62,673                                   | 95,327            |
| 205010      | Accommodation Camp | PKWB-01A             | 347,000          | 67,700                                   | 279,300           |
| 205011      | Accommodation Camp | PKWB-03A             | 158,000          | 52,579                                   | 105,421           |
| 165398      | Stafford           | HN48<br>HN73<br>HN77 | 507,350          | 0                                        | 507,350           |

## 7 DISCUSSION OF IMPACTS

At Penrhyn borefield, measurable drawdowns of groundwater levels are only 0.5 m and 1.3 m in monitoring bores located alongside (at 12 and 9 m distances from) the production bores (PCWP-02 and TNB-01A). The amounts of drawdown and the possible related impacts in the surrounding area are negligible, as confirmed by the lack of drawdown in all other monitoring bores, following the several months of pumping.

At Accommodation Camp borefield, drawdowns in monitoring bores alongside (at distances of 13 and 20.5 m from) the production bores PKWB-01A and PKWB-03A were 2.4 and 2.6 m respectively. In more distant monitoring bores, the measured drawdowns were between 0 and 0.2 m. The amounts of drawdown and the possible related impacts in the surrounding area are negligible.

There has been no pumping and no impact in the Stafford borefield area.

## 8 CONCLUSIONS ON MONITORING PROGRAMME

It is concluded that the monitoring programme has been conducted substantially in accordance with the Groundwater Monitoring and Management Programmes, and the conditions of the Groundwater Licences. The absence of water-level measurements from the

production bores, after pumping commenced, is of little consequence to the aquifer monitoring, as monitoring bores are located very close to the production bores. The monitoring has indicated no substantial drawdown of water levels in the aquifer, and no deleterious effects are predicted. Salinity changes are believed to be small, although anomalous readings from some monitoring bores need to be assessed. Possibly, increased purging of bores prior to sampling is required.

## 9 RECOMMENDATIONS

It is recommended that further effort be made to measure water levels in the equipped production bores by installing an access tube ('dip tube') alongside the pump column when a pump is being re-installed after maintenance. This would be done as much for operational reasons as for aquifer monitoring: water levels measured during pump operation can give useful information on bore performance and condition.

For completeness of information and to allow future contouring of groundwater levels, it is recommended that the several unsurveyed bores be levelled-in.

The monitoring programme should continue to be conducted in its effective and consistent manner.

**Dated: 24 July 2012**

**Rockwater Pty Ltd**



**R Wroe**  
**Hydrogeologist**



**J R Passmore**  
**Principal**

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- NHMRC & NRMCC (National Health and Medical Research Council and Natural Resources Management Ministerial Council), 2011. Australian Drinking Water Guidelines: National Water Quality Management Strategy Publication 6, Commonwealth of Australia, Canberra.
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South Australian Arid Lands Natural Resources Management Board (SAALNRMB), 2009 – Water Allocation Plan for the Far North Prescribed Wells Area, Natural Resources Management Act 2004, Government of South Australia

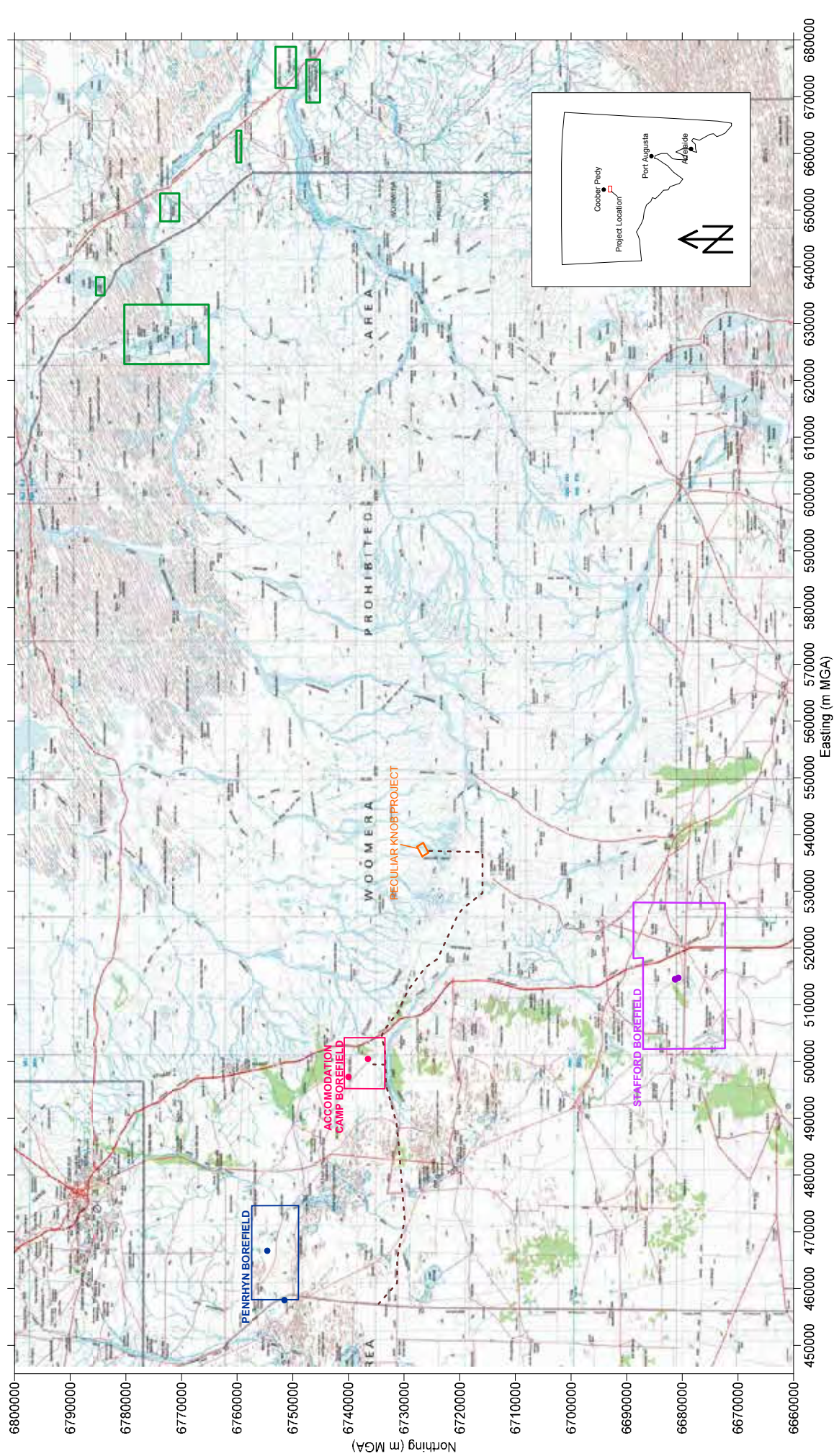
Southern Iron, 2012 – PEDR (ADP2011/012) Notification of Amendments to the Groundwater Monitoring Program. Unpublished Report WPC-092A, May 2012



## FIGURES



FIGURE 1



1/244\_0/5/inferr/2/0/FT1 Topo Locality.srf

CLIENT: Southern Iron Pty Ltd  
PROJECT: Groundwater Monitoring Annual Report  
DATE: July 2012  
Dwg. No: 344.0/12/1-1

● Penrhyn Borefield production bore  
● Accommodation Camp Borefield production bore  
● Stafford Borefield production bore  
--- Proposed Haul Road and Infrastructure

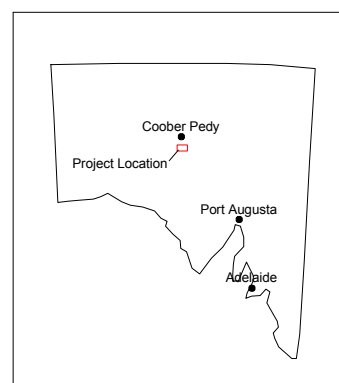
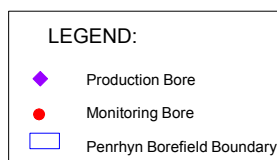
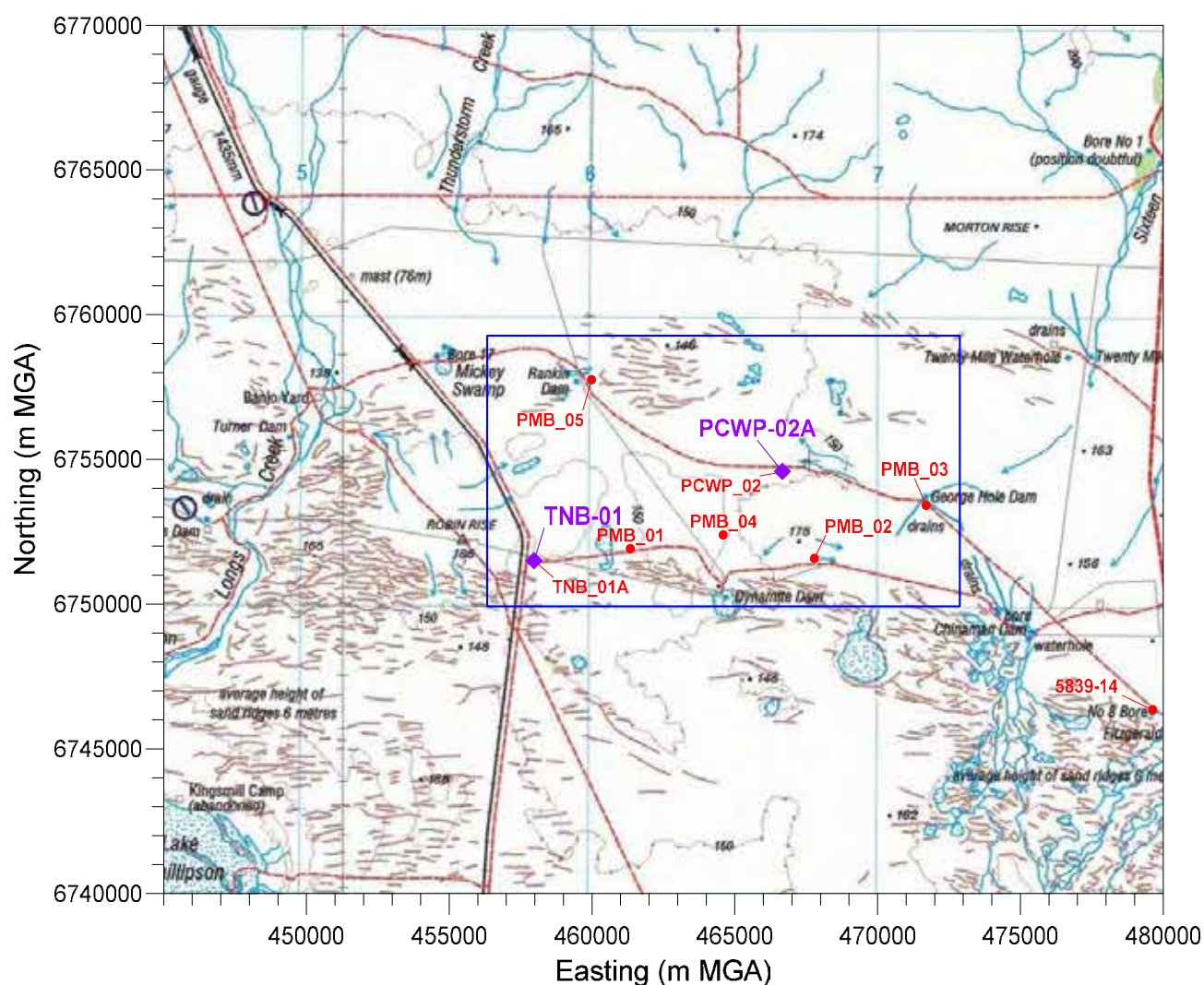
Spring areas  
Penrhyn Borefield boundary  
Accommodation Camp Borefield boundary  
Stafford Borefield boundary  
Peculiar Knob tenement boundary

TOPOGRAPHIC MAP  
PECULIAR KNOB ENVIRONS





FIGURE 2



344-0/Surfer/12-01/ F2 Locality Map Penrhyn.srf

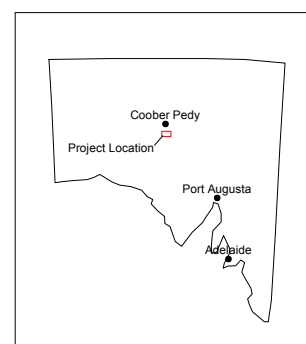
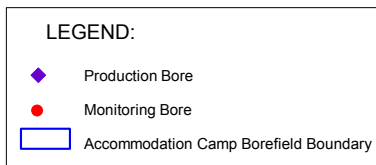
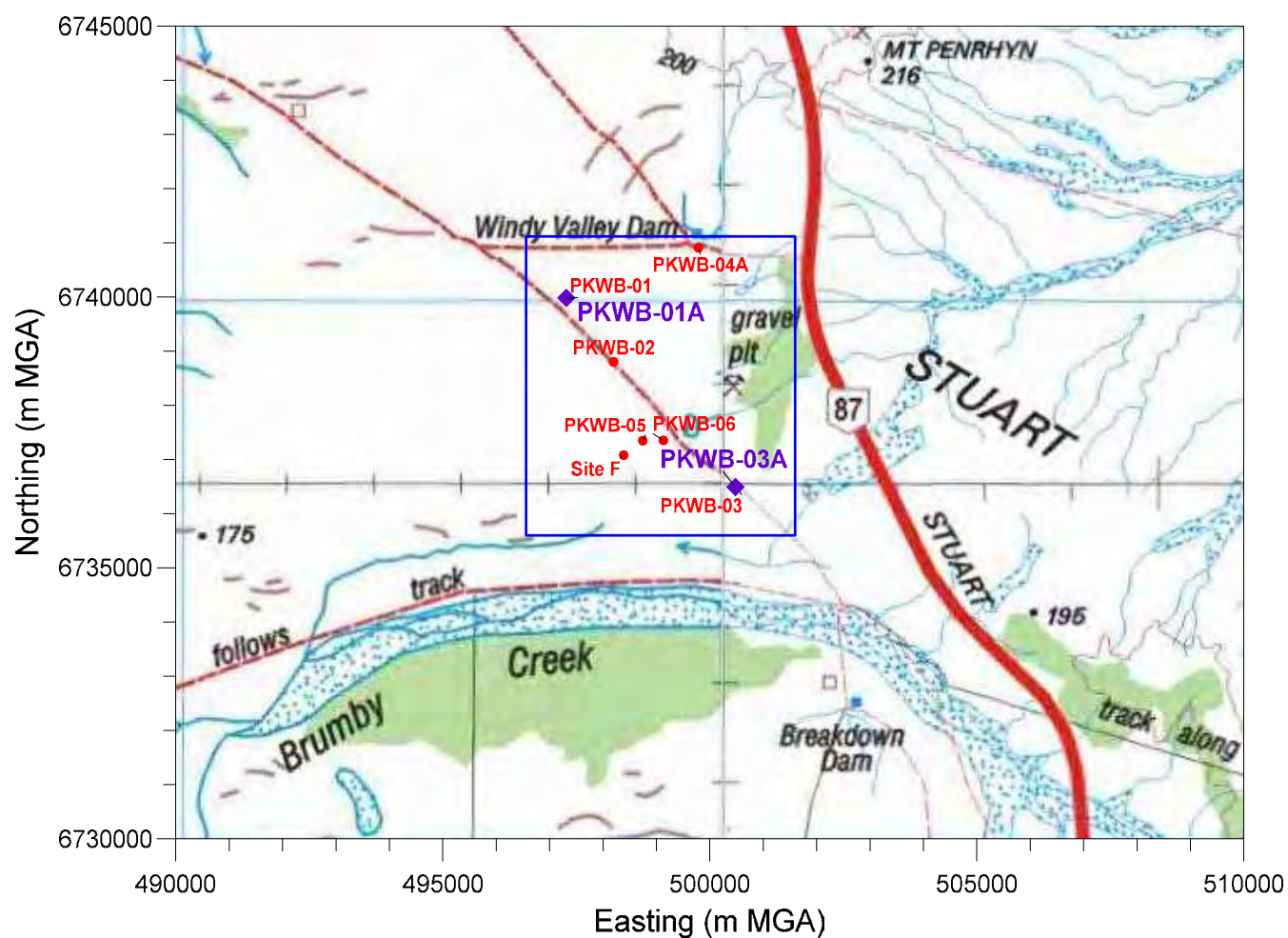
CLIENT: Southern Iron Pty Ltd  
 PROJECT: Groundwater Monitoring Annual Report  
 DATE: July 2012  
 Dwg. No: 344-0/12/1-2

## PENRHYN BOREFIELD BORE LOCATIONS





FIGURE 3



344-0/Surfer/12-01/F3 Accom. Camp

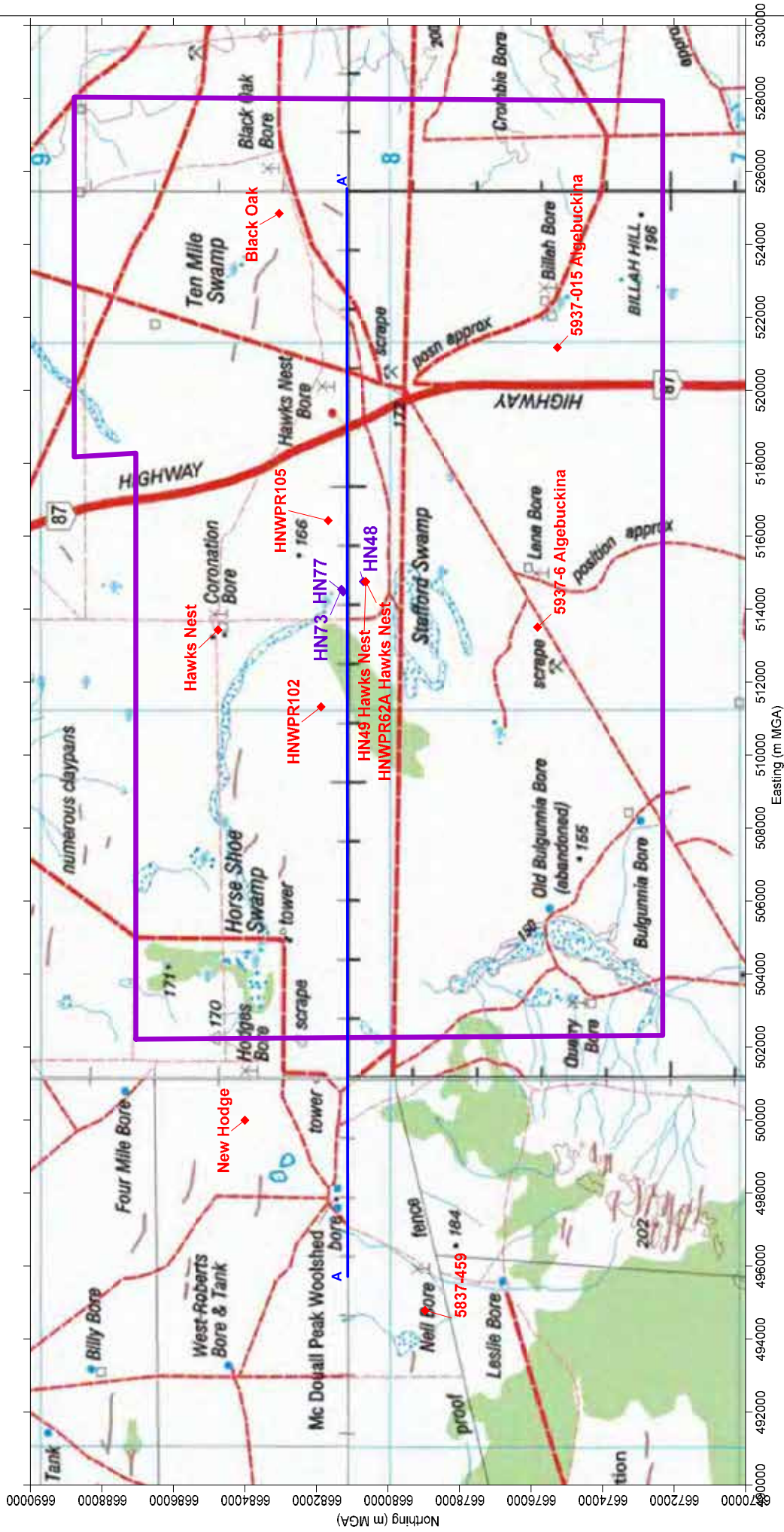
CLIENT: Southern Iron Pty Ltd  
 PROJECT: Groundwater Monitoring Annual Report  
 DATE: July 2012  
 Dwg. No: 344-0/12/1-3

## ACCOMMODATION CAMP BOREFIELD

### BORE LOCATIONS



FIGURE 4



I:\244.0\Sunfire\11-05\F4 Locality Map Stafford.srf

CLIENT: Southern Iron Pty Ltd

PROJECT: Groundwater Monitoring Annual Report

DATE: June 2012

Dwg. No: 344.0/12/1-4



STAFFORD BOREFIELD

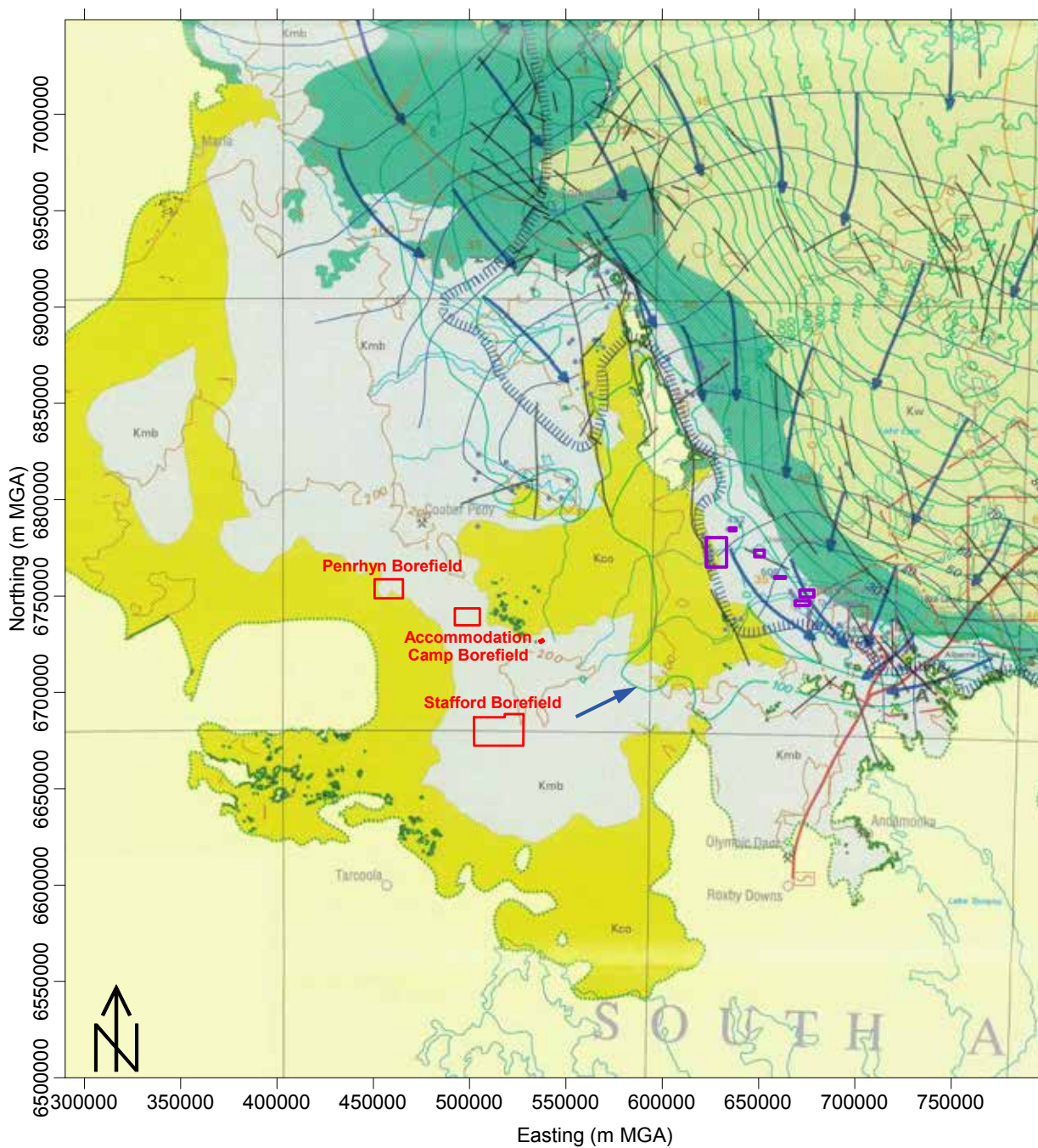
BORE LOCATIONS

Production Bore  
Monitoring Bore  
Hawks Nest tenement boundary





FIGURE 5



-  Spring areas  
 Borefield Location  
 Edge of sandstone strata (Algebuckina SS and Canda-owie Fm)  
 Edge of artesian part of Eromanga Basin  
 Direction of groundwater flow

344-0/Surfer/12-01/F5 GAB Hydro.srf

Source: Habermehl and Lau (1997)

|          |                                      |
|----------|--------------------------------------|
| CLIENT:  | Southern Iron Pty Ltd                |
| PROJECT: | Groundwater Monitoring Annual Report |
| DATE:    | July 2012                            |
| Dwg. No: | 344-0/12/1-5                         |

# HYDROGEOLOGICAL MAP SOUTH-WESTERN SECTOR OF EROMANGA BASIN



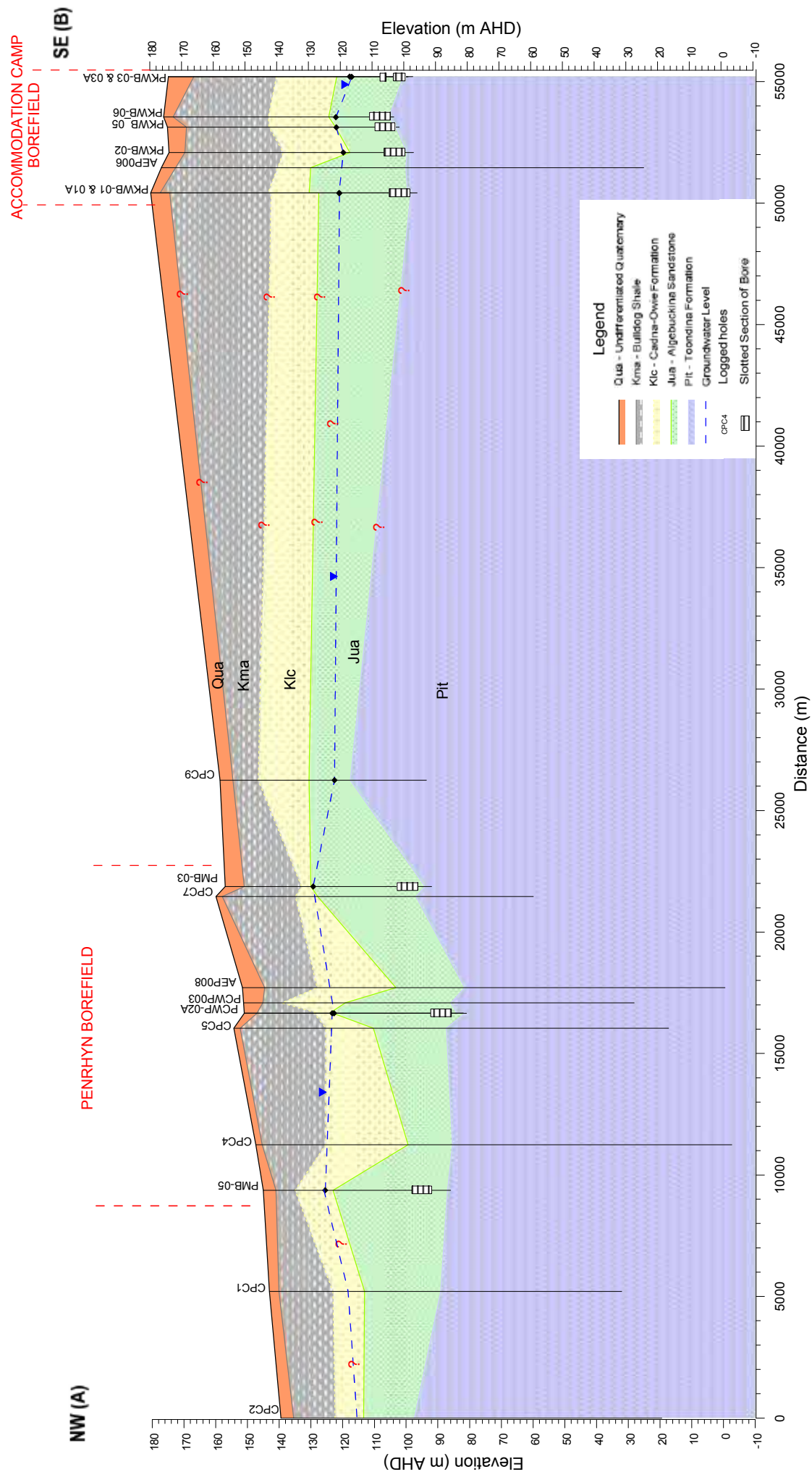
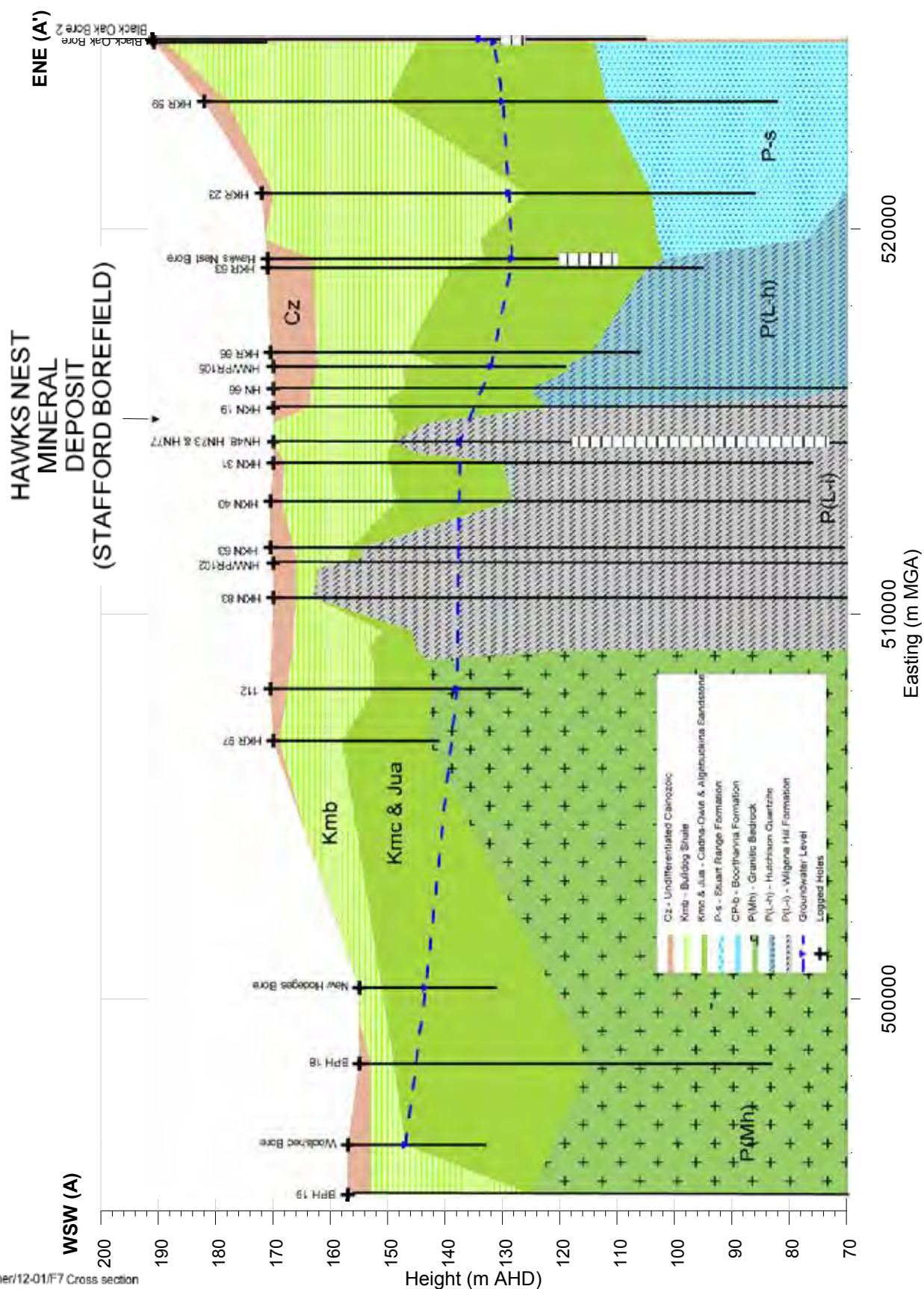




FIGURE 7



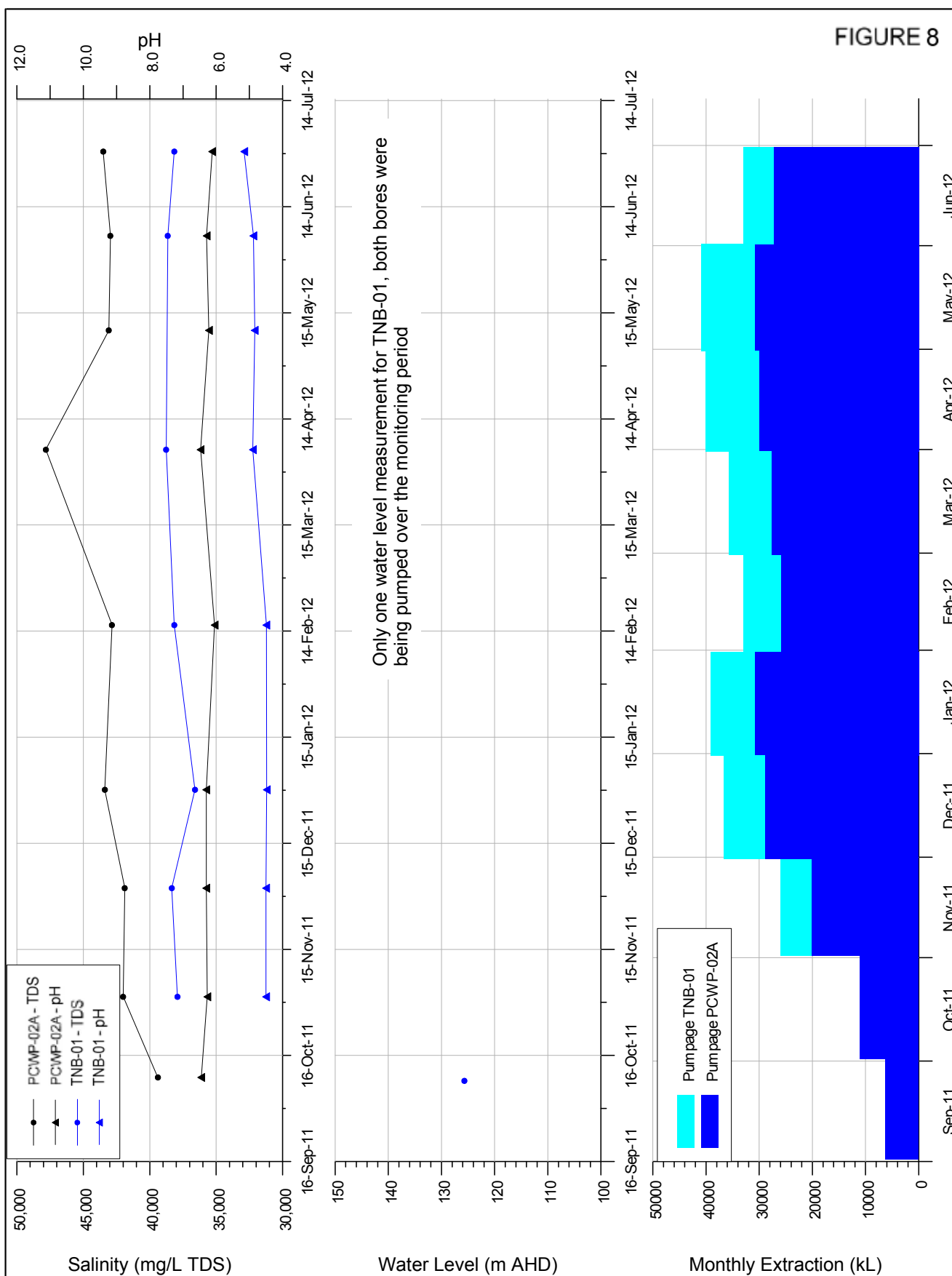
I:344-0/Grapher/12-01/F7 Cross section

Client : Southern Iron Pty Ltd  
 Project : Groundwater Monitoring Annual Report  
 Date : July 2012  
 Dwg No : 344-0/12/01-7

**STAFFORD BOREFIELD**  
**HYDROGEOLOGICAL**  
**CROSS SECTION A - A'**



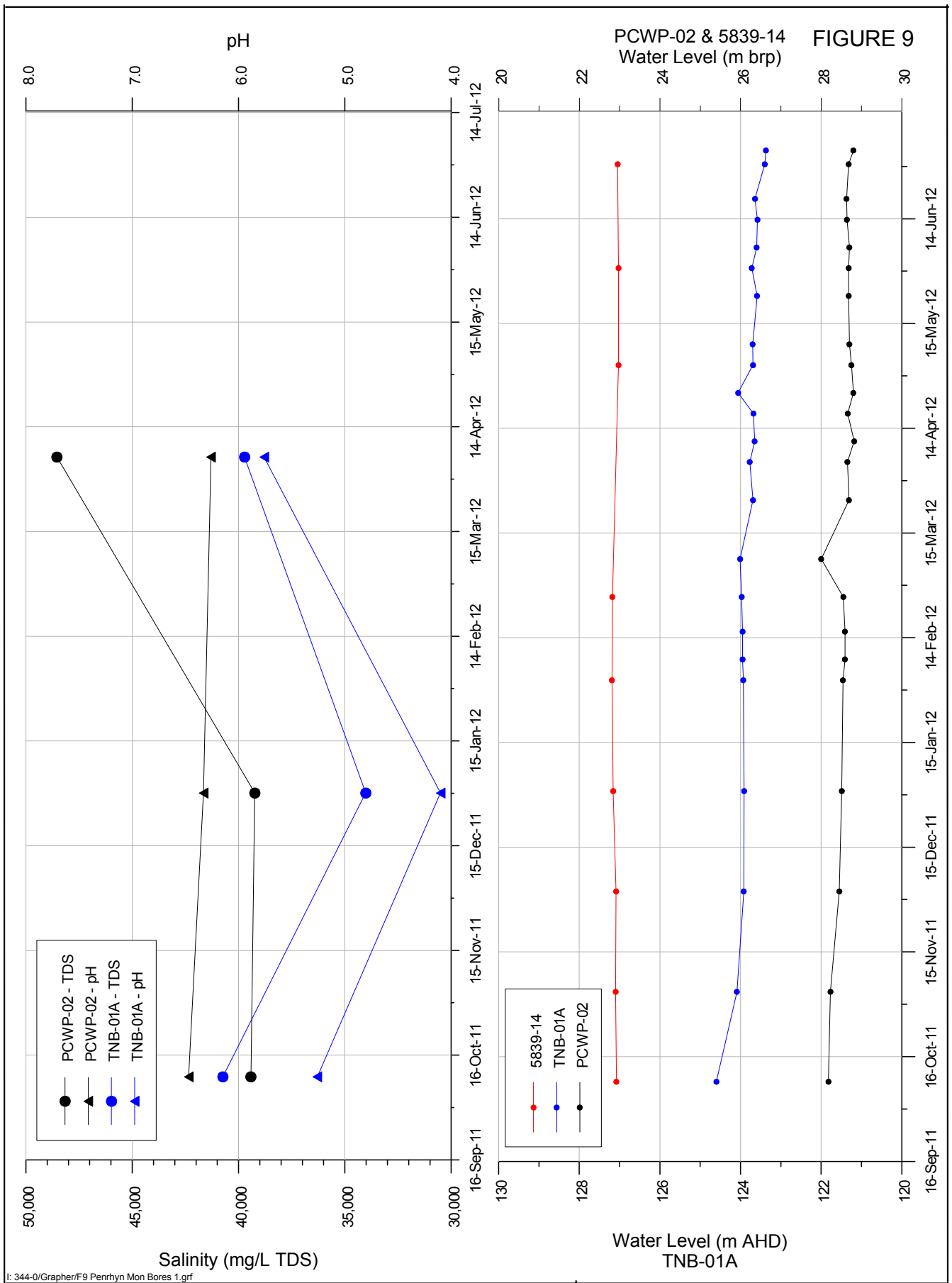
FIGURE 8



Client: Southern Iron Pty Ltd  
 Project : Groundwater Monitoring Annual Report  
 Date : July 2012  
 Dwg. No: 344.0/12/1-8

**MONTHLY PUMPAGE, HYDROGRAPHS  
 AND SALINITIES OF  
 PENRHYN PRODUCTION BORES**  
 (PCWP-02A & TNB-01)





I: 344-0/Grapher/F9 Penryhn Mon Bores 1.grf

Client: Southern Iron Pty Ltd

Project : Groundwater Monitoring Annual Report

Date : July 2012

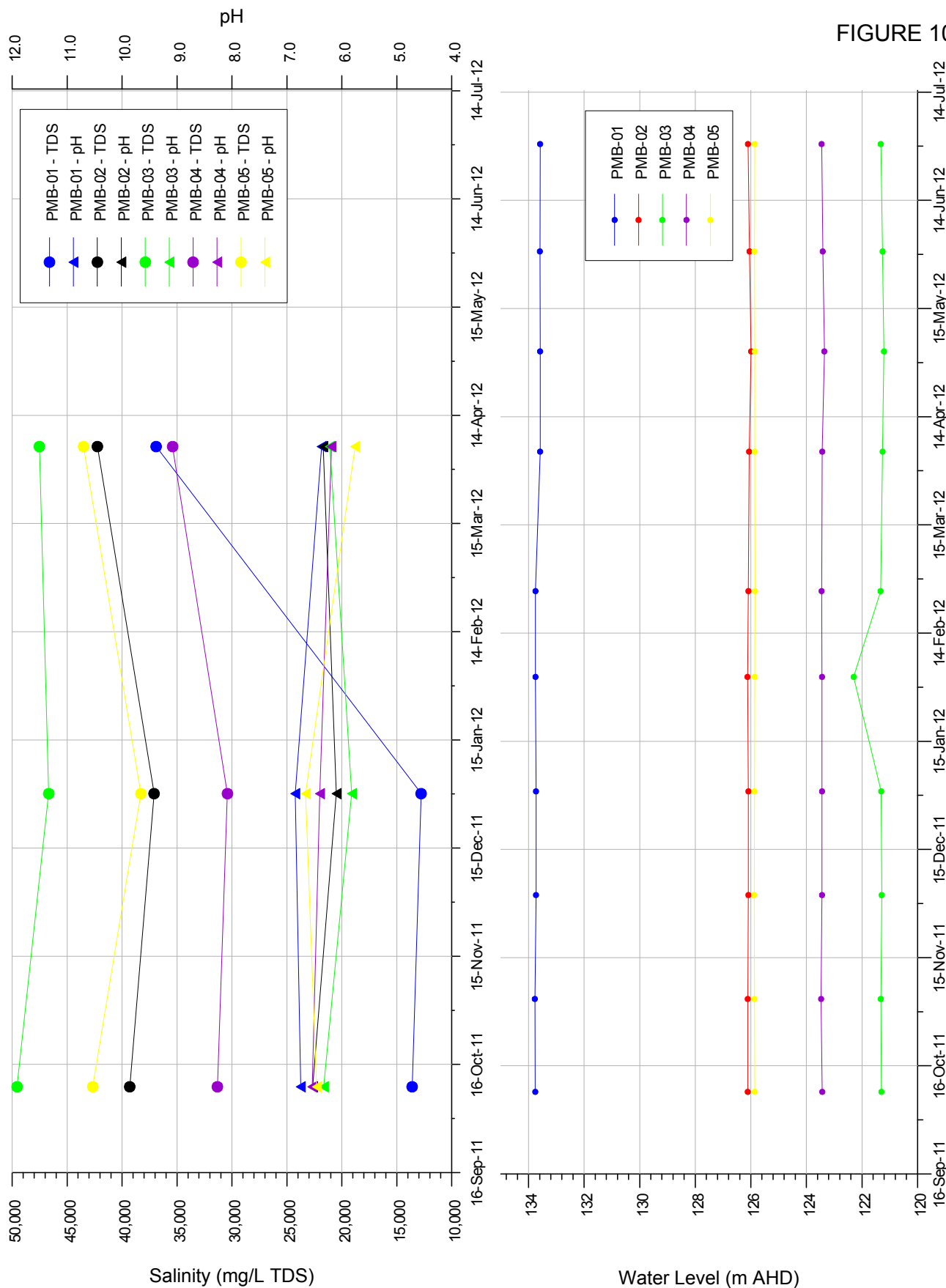
Dwg. No: 344.0/12/1-9

**HYDROGRAPHS, pH AND  
SALINITIES OF PENRYHN  
MONITORING BORES - 1<sup>st</sup> GROUP**  
(TNB-01A, PCWP-02 & 5839-14)





FIGURE 10



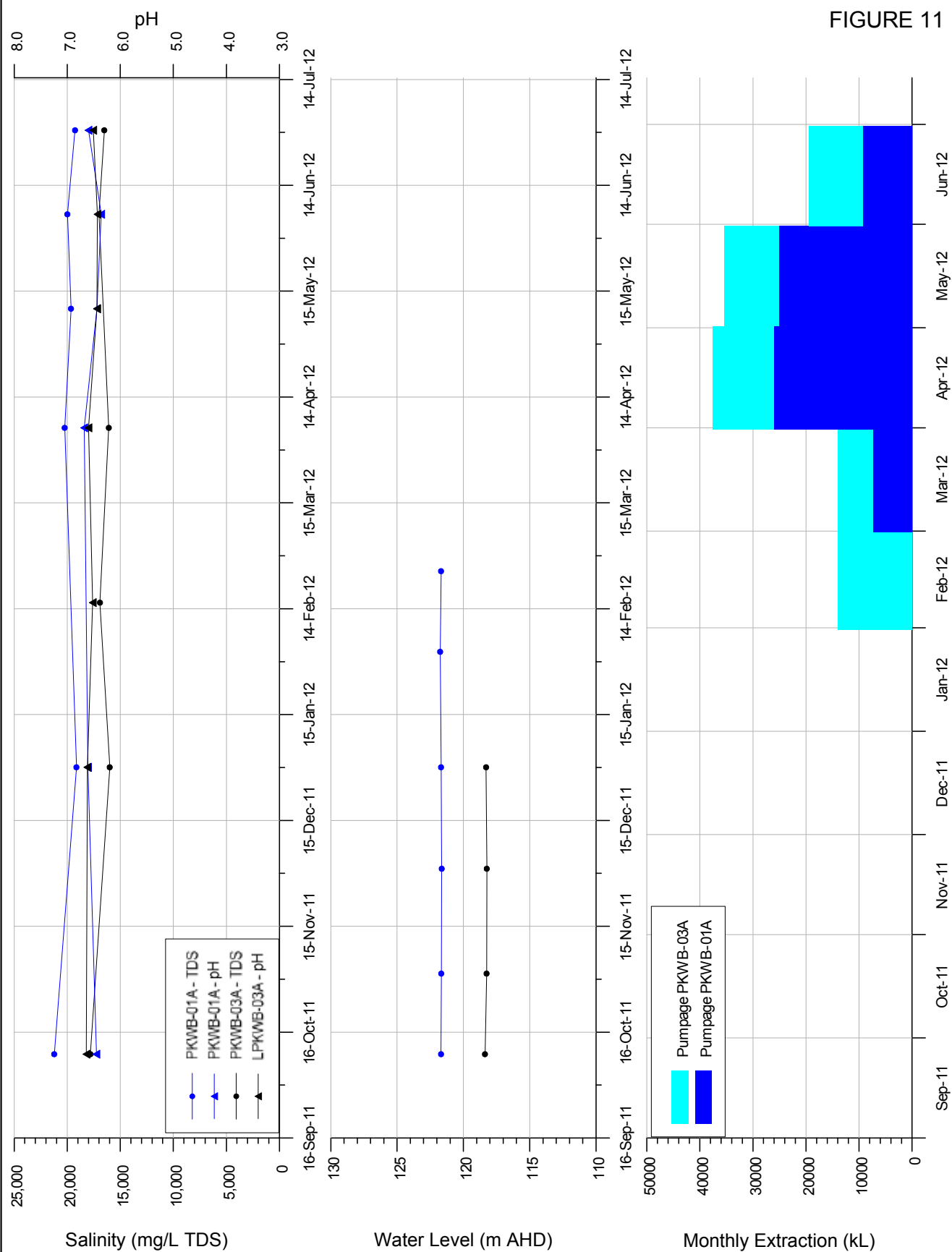
I: 344-0/Grapher/F10 Penryhn Mon Bore 2.grf

Client: Southern Iron Pty Ltd  
 Project : Groundwater Monitoring Annual Report  
 Date : July 2012  
 Dwg. No: 344.0/12/1-10

**HYDROGRAPHS, pH AND  
 SALINITIES OF PENRYHN  
 MONITORING BORES - 2<sup>nd</sup> GROUP**  
 (PMB-01 TO PMB-05)



FIGURE 11



I: 344-0/Grapher/F11 Camp Prob Bores.grf

Client: Southern Iron Pty Ltd

Project : Groundwater Monitoring Annual Report

Date : July 2012

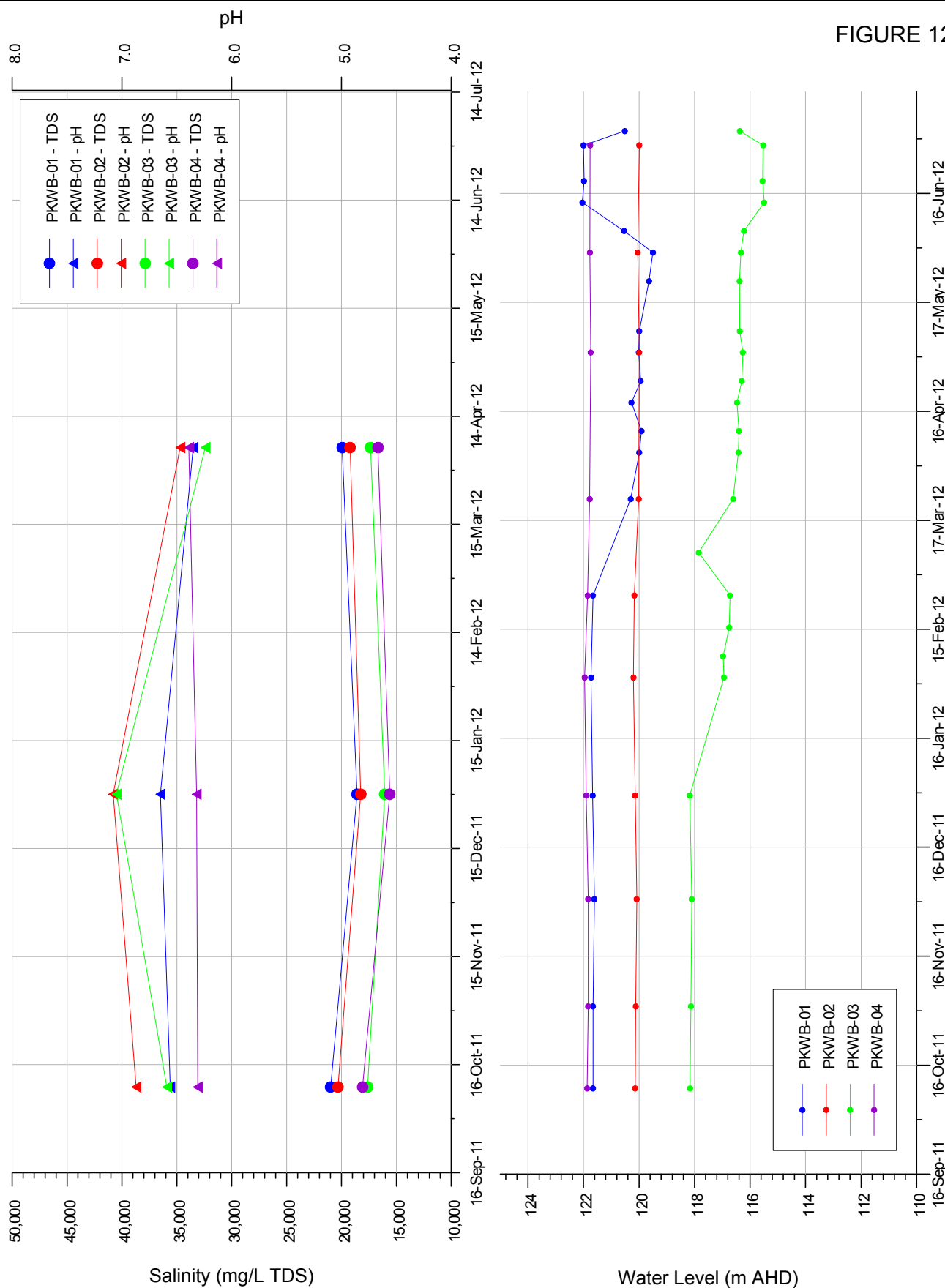
Dwg. No: 344.0/12/1-11

# MONTHLY PUMPAGE, HYDROGRAPHS AND SALINITIES OF ACCOMMODATION CAMP PRODUCTION BORES

(PKWB-01A & PKWB-03A)



FIGURE 12



I: 344-0/Grapher/F12 Camp Mon Bores 1.grf

Client: Southern Iron Pty Ltd

Project : Groundwater Monitoring Annual Report

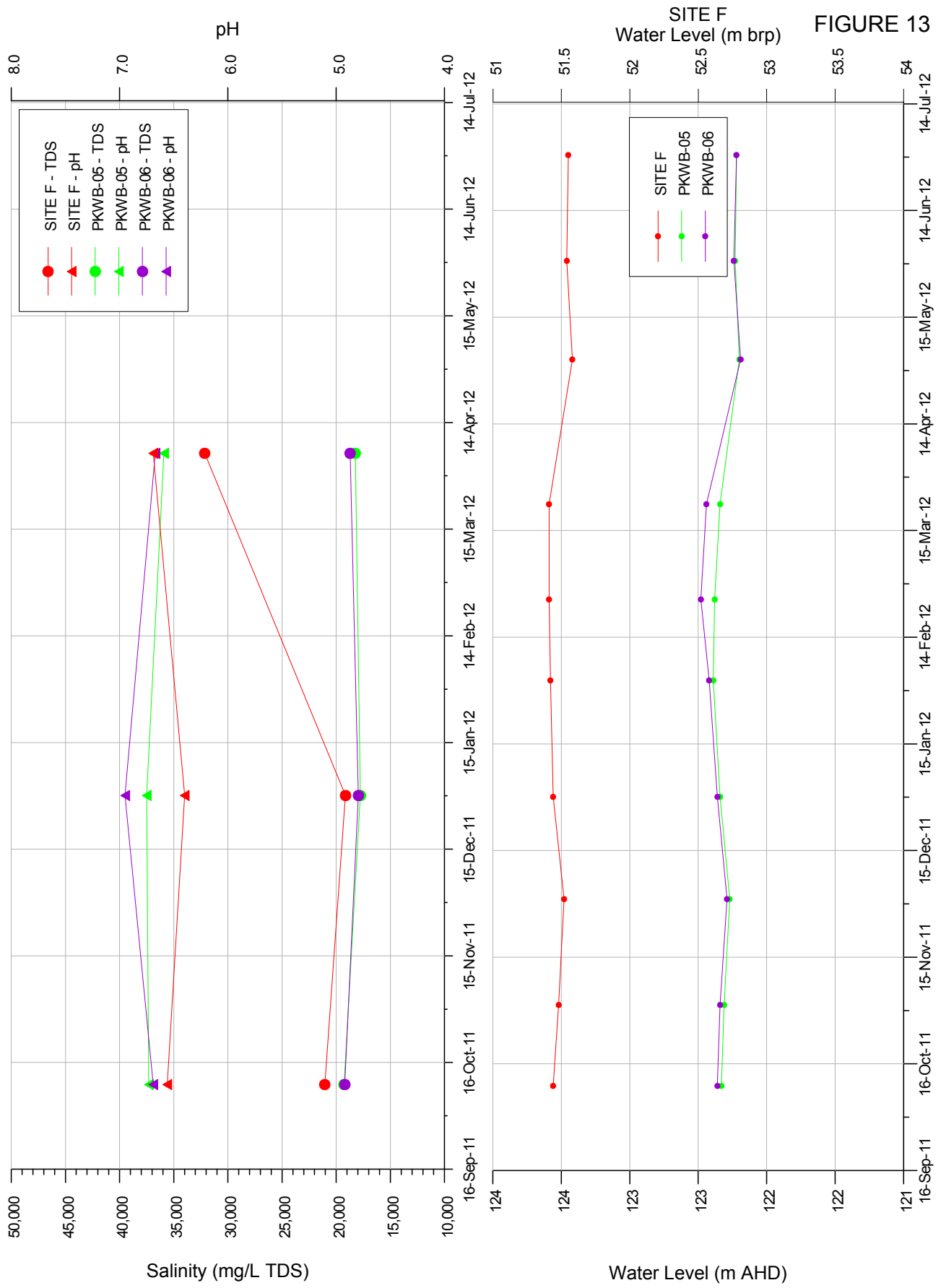
Date : July 2012

Dwg. No: 344.0/12/1-12

**HYDROGRAPHS, pH AND  
SALINITIES OF  
ACCOMMODATION CAMP  
MONITORING BORES - 1st GROUP  
(PKWB-01 TO PMB-04)**



FIGURE 13



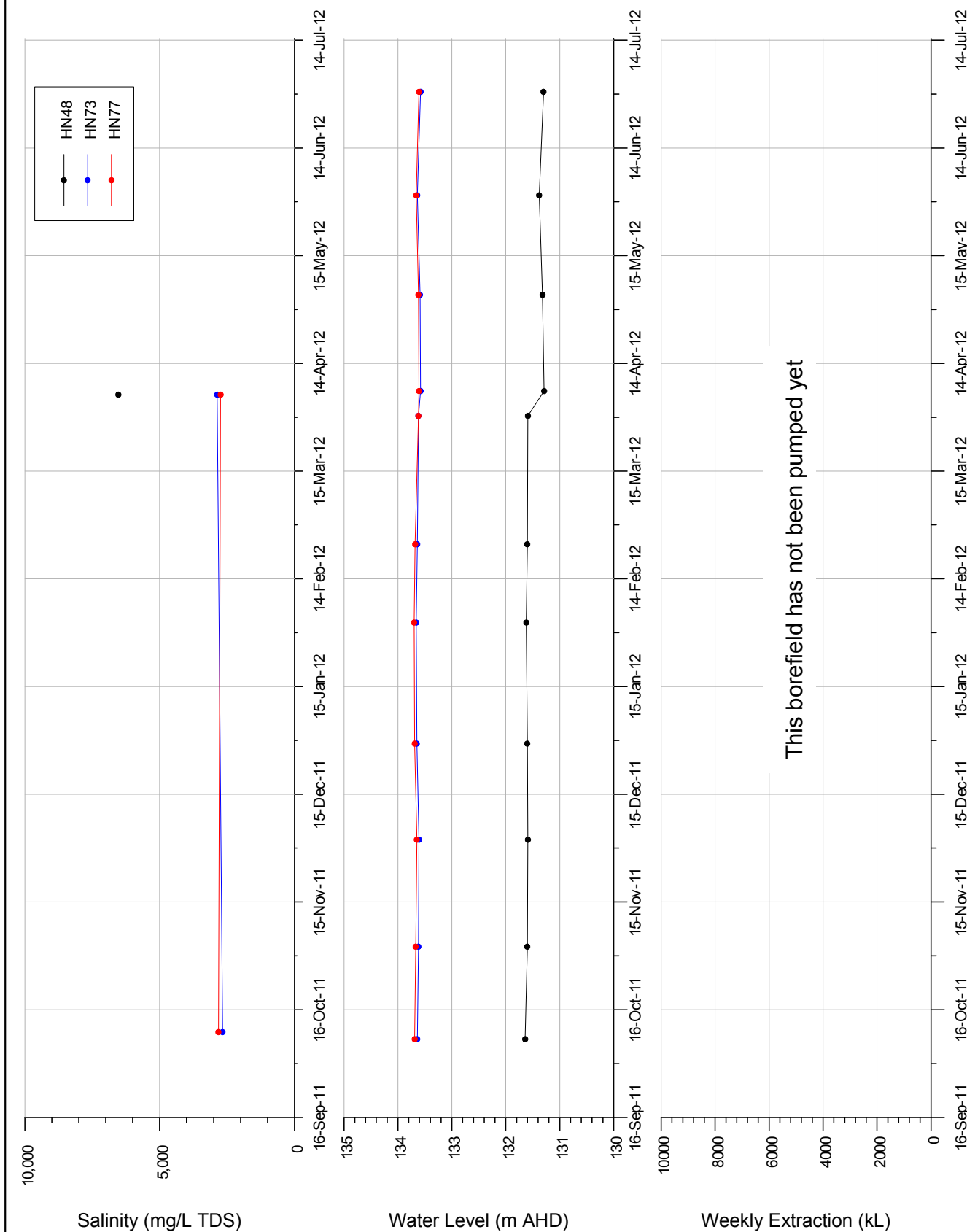
I: 344-0/Grapher/F13 Camp Mon Bores 2.grf

Client: Southern Iron Pty Ltd  
Project : Groundwater Monitoring Annual Report  
Date : July 2012  
Dwg. No: 344.0/12/1-13

**HYDROGRAPHS, pH AND  
SALINITIES OF  
ACCOMMODATION CAMP  
MONITORING BORES - 2<sup>nd</sup> GROUP**  
(PKWB-05, PKWB-06 & SITE F)



FIGURE 14



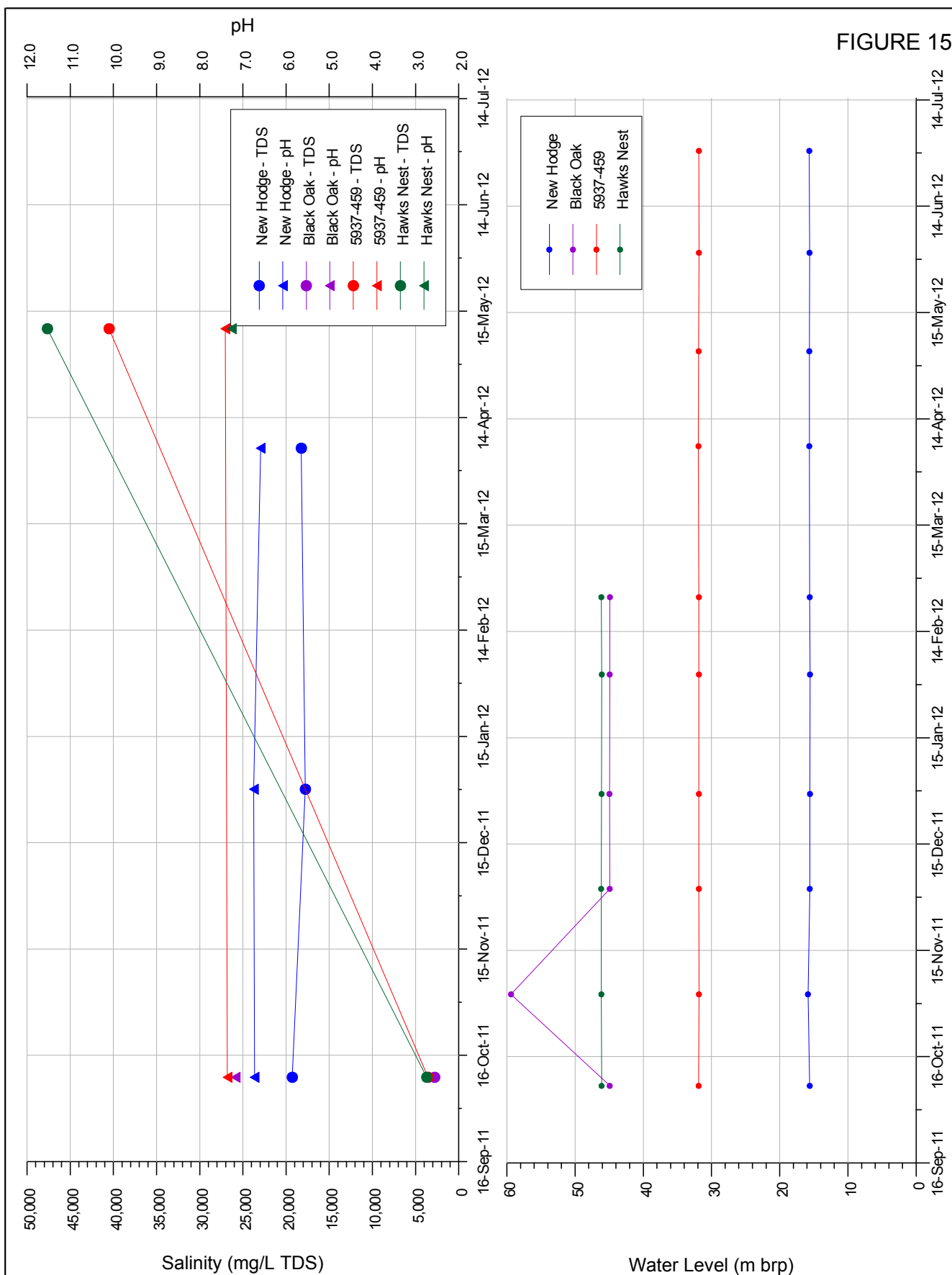
I: 344.0/Grapher/F14 Stafford Prod Bores.grf

Client: Southern Iron Pty Ltd  
 Project : Groundwater Monitoring Annual Report  
 Date : July 2012  
 Dwg. No: 344.0/12/1-14

**HYDROGRAPHS AND SALINITIES  
 OF STAFFORD  
 PRODUCTION BORES**  
 (HN48, HN73 & HN78)



FIGURE 15



I: 344-0/Grapher/F15 Stafford Mon Bores 1.grf

Client: Southern Iron Pty Ltd

Project : Groundwater Monitoring Annual Report

Date : July 2012

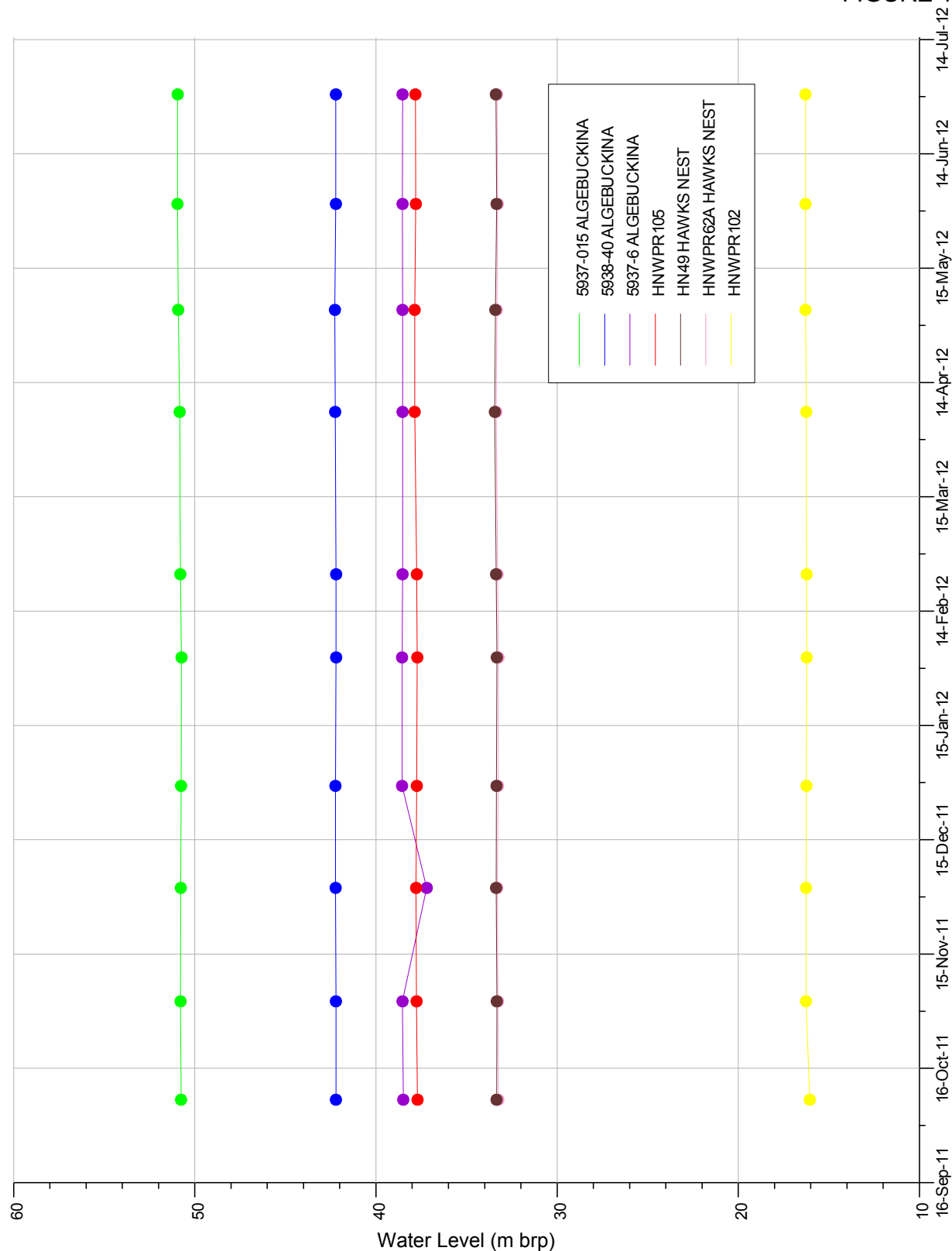
Dwg. No: 344.0/12/1-15

**HYDROGRAPHS, pH AND  
SALINITIES OF STAFFORD  
MONITORING BORES - 1<sup>st</sup> GROUP**  
(NEW HODGE, BLACK OAK, 5837-459  
& HN49 HAWKS NEST)





FIGURE 16



I: 344-0/Grapher/F16 Stafford Mon Bores 2.grf

Client: Southern Iron Pty Ltd

Project : Groundwater Monitoring Annual Report

Date : July 2012

Dwg. No: 344.0/12/1-16

**HYDROGRAPHS OF STAFFORD  
MONITORING BORES - 2<sup>ND</sup> GROUP**  
(HNWR102, HNWR105,  
5937-6 ALGEBUCKINA, 5937-015 ALGEBUCKINA,  
5938-40 ALGEBUCKINA, HNWR62A HAWKS NEST  
& HN49 HAWKS NEST)



## **APPENDIX I**





Government of South Australia  
Department for Water

## Water Planning and Management Division

Ref: Licence 193858

Southern Iron Pty Ltd  
ACN 119 611 068  
Level 9, Kyle House  
27-31 Macquire Place  
SYDNEY NSW 2000

Attention: Heath Roberts

Level 3 Grenfell Centre  
25 Grenfell Street  
Adelaide  
South Australia 5000  
DX 169

GPO Box 2534 Adelaide  
South Australia 5001  
Australia

Contact: Beth Tomlin  
Telephone: (08) 8463 6874  
Facsimile: (08) 8463 6840  
<http://www.sa.gov.au>

Dear Mr Roberts

Approval is granted, pursuant to section 146(1) of the *Natural Resources Management Act 2004* (the 'Act'), to your application for a water licence for the taking and use of underground water for industrial water supply purposes for the Peculiar Knob Mine Project.

Please find enclosed Licence 193858 issued pursuant to the Act. The water licence is the personal property of the company; it states the water allocation, the prescribed water resource and the purpose for use of the water. The water allocation endorsed on this licence is 378,000 kilolitres per annum. The water allocation has an expiry date of 30 June 2022.

The Annual Water Use Report for this water licence must be developed to the satisfaction of the Minister by 30 September 2011. In addition to the details listed in condition 5 of your water licence, please include the following details of your Groundwater Monitoring Program Plan:

1. Introduction
  - Scope
  - Responsible personnel
  - Monitoring program – review and modification
  - Regulatory reporting
  - Designated area
2. Borefield Performance Monitoring
  - Overview
  - Pumping schedule
  - Performance monitoring
3. Regional Environmental Monitoring
  - Overview
  - Water levels and quality
  - Drawdown thresholds
  - Monitoring priority

4. Existing Groundwater users

- Overview
- Regional

5. References

The conditions of the water licence may vary from time to time in accordance with the Act or where it is necessary or desirable to more effectively regulate the use of water from the resource in accordance with the relevant water allocation plan and the Act.

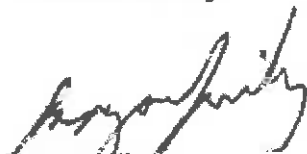
Conditions may also be imposed or varied by consent, or part of a transfer approval, or due to a breach of a licence.

The Act contains information on other rights and obligations that do not appear on your water licence. Copies of the Act can be purchased by contacting Service SA on 13 23 24.

**Under section 202(1)(b)(ii) of the Act, you have a right of appeal to the Environment Resources and Development Court against the imposition of any condition on the licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon the department within that time. For your information the procedure for the institution of an appeal is enclosed.**

Should you have any enquiries regarding your water licence please contact Beth Tomlin on 8463 6874.

Yours sincerely



Bryan Kiley  
**MANAGER LICENSING METROPOLITAN  
DELEGATE OF MINISTER FOR ENVIRONMENT AND CONSERVATION**

Date: 10/6/2011

GOVERNMENT OF SOUTH AUSTRALIA  
**DEPARTMENT FOR WATER**  
WATER RESOURCES ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph 8463 6815 Fax 8463 6840

PCWP-02A  
Penhryn

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **193858**

Management Area

**Licensee(s):** SOUTHERN IRON PTY LTD  
ACN 119 611 068  
LEVEL 9, KYLE HOUSE  
27-31 MACQUARIE PLACE  
SYDNEY NSW 2000

**PRESCRIBED WATER RESOURCES:** The underground water to which a well in the Far North Prescribed Wells Area has access.

**TOTAL WATER ALLOCATION PER ANNUM** Taking 378,000.0 kL

| COMPONENTS OF ALLOCATION | PURPOSE           | EXPIRY DATE |
|--------------------------|-------------------|-------------|
| 378,000.0 kL             | Taking Industrial | 30/06/2022  |

**DETAILED SOURCE OF WATER**

| Description          | Meter |
|----------------------|-------|
| Underground 5839-808 |       |

Intervals at which conditions of this licence may be varied by the Minister (sections 146(6)(f) and 147(1)(b) of the *Natural Resources Management Act 2004* ('the Act')):

Yearly (on or about 30 June each year)

This licence is subject to the Act, and any conditions which may be specified from time to time in the Regulations, or by the Minister under the Act, and to the following further conditions:

1. The water allocation(s) endorsed on this licence must only be used on the land described below:

CL 1628/71  
Block 1269  
Hundred of OH(Coober Pedy)

CL 1628/71  
Block 1269  
Hundred of OH(Billakalina)

CL 1159/4  
Block 473  
Hundred of OH(Billakalina)

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION

GPO Box 2834 Adelaide SA 5001

Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2003*

Licence No. 193858

Management Area

CL 1292/41  
Block 1139  
Hundred of OH(Coober Pedy)

CL 1292/41  
Block 1139  
Hundred of OH(Billakalina)

- 2 The water allocation(s) endorsed on this licence must only be used for the purpose(s) described above.
- 3 The water allocation(s) endorsed on this licence must only be taken from the source(s) described above and where specified the amount of water taken from each source must not exceed the component of the allocation assigned to it.
- 4 The licensee must not cause, suffer or permit any water to be used for or in relation to any activity which is an offence under the provisions of the Act or any other legislation with effect in South Australia
- 5 The proponent must submit an Annual Report, as per the approved Groundwater Management and Monitoring plan, in conjunction with the Mining and Rehabilitation Compliance Report, as per Section 9.3 of the Far North Prescribed Wells Area Water Allocation Plan.
- 6 All monitoring data is to be submitted to the Department annually, in electronic Excel compatible format.
- 7 Data supplied in accordance with the Groundwater Management and Monitoring Plan will undergo review when submitted annually. Annual review will ensure water quality changes (salinity) remain in line with Principle 19 of the Far North Prescribed Wells Area Water Allocation Plan, and drawdown impacts are in line with Principle 27.
- 8 The Groundwater Management and Monitoring Plan is to be reviewed at a minimum on an annual basis and amended as agreed by the Minister and the Licence Holder.
- 9 Upon cessation of the mineral lease relating to the Peculiar Knob Mine, that this allocation becomes zero ML as per Principles 15, 16 and 38 of the Far North Wells Area Water Allocation Plan.
- 10 Any update to the Mining and Rehabilitation Plan associated with the current Mineral Lease for the Peculiar Knob Mine (ML 6314) will trigger a review of the conditions of this water licence.
- 11 The licensee must not take water except through the meter.
- 12 The licensee must not adjust or alter the meter without the Minister's authority.
- 13 The licensee must not damage or destroy a meter.
- 14 The licensee must not cause, suffer or permit any interference with a meter used for the purposes of measuring the quantity of water under this Act, or any interference with pipes or fittings that may affect the accuracy of a meter, without the Minister's authority
- 15 The licensee must immediately report any fault or suspected fault in a meter.
- 16 The licensee must not permit deposits of sand, soil or any other material to build up around

GOVERNMENT OF SOUTH AUSTRALIA  
**DEPARTMENT FOR WATER**

WATER RESOURCES ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **193858**

Management Area

the meter.

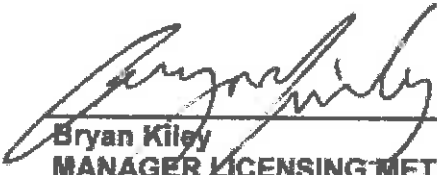
17. The licensee must keep vegetation cleared away from the meter.
18. For the purposes of this water licence, the term 'per annum' means the period between 1 July in any calendar year and 30 June in the following calendar year.
19. If the company name or name of licence holder(s) and/or the postal address of the licence holder(s) changes, then the licence holder(s) must notify this Department in writing within 21 days of the change occurring.

**Notes:**

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon this department within that time.

**TAKE NOTE** that the licensee, or a person acting on behalf of the licensee, who contravenes or fails to comply with a condition of this licence is guilty of an offence, and such acts or omissions may also result in cancellation, suspension or variation (including a reduction in the water allocation) of the licence by seven days written notice.

Date: 10/06/2011



Bryan Kiley

**MANAGER LICENSING METROPOLITAN**  
Delegate of Minister for Environment and Conservation





Government of South Australia

Department for Water

## Water Planning and Management Division

Ref: Licence 193860

Southern Iron Pty Ltd  
ACN 119 611 068  
Level 9, Kyle House  
27-31 Macquire Place  
SYDNEY NSW 2000

Attention: Heath Roberts

Level 5 Grantell Centre  
25 Grantell Street  
Adelaide  
South Australia 5000  
DX 168

GPO Box 2634 Adelaide  
South Australia 5001  
Australia

Contact: Beth Forlin  
Telephone: (08) 8463 6874  
Facsimile: (08) 8463 6840  
<http://www.sa.gov.au>

Dear Mr Roberts

Approval is granted, pursuant to section 146(1) of the *Natural Resources Management Act 2004* (the 'Act'), to your application for a water licence for the taking and use of underground water for industrial water supply purposes for the Peculiar Knob Mine Project.

Please find enclosed Licence 193860 issued pursuant to the Act. The water licence is the personal property of the company; it states the water allocation, the prescribed water resource and the purpose for use of the water. The water allocation endorsed on this licence is 158,000 kilolitres per annum. The water allocation has an expiry date of 30 June 2022.

The Annual Water Use Report for this water licence must be developed to the satisfaction of the Minister by 30 September 2011. In addition to the details listed in condition 5 of your water licence, please include the following details of your Groundwater Monitoring Program Plan:

1. Introduction
  - Scope
  - Responsible personnel
  - Monitoring program – review and modification
  - Regulatory reporting
  - Designated area
2. Borefield Performance Monitoring
  - Overview
  - Pumping schedule
  - Performance monitoring
3. Regional Environmental Monitoring
  - Overview
  - Water levels and quality
  - Drawdown thresholds
  - Monitoring priority

4. Existing Groundwater users

- Overview
- Regional

5. References

The conditions of the water licence may vary from time to time in accordance with the Act or where it is necessary or desirable to more effectively regulate the use of water from the resource in accordance with the relevant water allocation plan and the Act.

Conditions may also be imposed or varied by consent, or part of a transfer approval, or due to a breach of a licence.

The Act contains information on other rights and obligations that do not appear on your water licence. Copies of the Act can be purchased by contacting Service SA on 13 23 24.

Under section 202(1)(b)(ii) of the Act, you have a right of appeal to the Environment Resources and Development Court against the imposition of any condition on the licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon the department within that time. For your information the procedure for the institution of an appeal is enclosed.

Should you have any enquiries regarding your water licence please contact Beth Tomlin on 8463 6874.

Yours sincerely



Bryan Kiley

**MANAGER LICENSING METROPOLITAN  
DELEGATE OF MINISTER FOR ENVIRONMENT AND CONSERVATION**

Date: 10/6/2011

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION

GPO Box 2834 Adelaide SA 5001

Ph. 8463 6815 Fax 8463 6840

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TNB-01

**WATER LICENCE**

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **193860**

Management Area

**Licensee(s):** SOUTHERN IRON PTY LTD  
ACN 119 611 068  
LEVEL 9, KYLE HOUSE  
27-31 MACQUARIE PLACE  
SYDNEY NSW 2000

**PRESCRIBED WATER RESOURCES:** The underground water to which a well in the Far North Prescribed Wells Area has access.

**TOTAL WATER ALLOCATION PER ANNUM** Taking 158,000.0 kL

| COMPONENTS OF ALLOCATION | PURPOSE           | EXPIRY DATE |
|--------------------------|-------------------|-------------|
| 158,000.0 kL             | Taking Industrial | 30/06/2022  |

**DETAILED SOURCE OF WATER**

Description

Meter

Underground 5839-198

Intervals at which conditions of this licence may be varied by the Minister (sections 146(6)(f) and 147(1)(b) of the *Natural Resources Management Act 2004* ('the Act')):

Yearly (on or about 30 June each year)

This licence is subject to the Act, and any conditions which may be specified from time to time in the Regulations, or by the Minister under the Act, and to the following further conditions:

1. The water allocation(s) endorsed on this licence must only be used on the land described below:

CL 1159/4  
Block 473  
Hundred of OH(Billakalina)

CL 1292/41  
Block 1139  
Hundred of OH(Cooper Pedy)

CL 1292/41  
Block 1139  
Hundred of OH(Billakalina)

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION

GPO Box 2834 Adelaide SA 5001

Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No **193860**

Management Area

CL 1628/71

Block 1269

Hundred of OH(Coober Pedy)

CL 1628/71

Block 1269

Hundred of OH(Biliakalina)

2. The water allocation(s) endorsed on this licence must only be used for the purpose(s) described above.
3. The water allocation(s) endorsed on this licence must only be taken from the source(s) described above and where specified the amount of water taken from each source must not exceed the component of the allocation assigned to it.
4. The licensee must not cause, suffer or permit any water to be used for or in relation to any activity which is an offence under the provisions of the Act or any other legislation with effect in South Australia.
5. The proponent must submit an Annual Report, as per the approved Groundwater Management and Monitoring plan, in conjunction with the Mining and Rehabilitation Compliance Report, as per Section 9.3 of the Far North Prescribed Wells Area Water Allocation Plan.
6. All monitoring data is to be submitted to the Department annually, in electronic Excel compatible format.
7. Data supplied in accordance with the Groundwater Management and Monitoring Plan will undergo review when submitted annually. Annual review will ensure water quality changes (salinity) remain in line with Principle 19 of the Far North Prescribed Wells Area Water Allocation Plan, and drawdown impacts are in line with Principle 27.
8. The Groundwater Management and Monitoring Plan is to be reviewed at a minimum on an annual basis and amended as agreed by the Minister and the Licence Holder.
9. Upon cessation of the mineral lease relating to the Peculiar Knob Mine, that this allocation becomes zero ML as per Principles 15, 16 and 38 of the Far North Wells Area Water Allocation Plan.
10. Any update to the Mining and Rehabilitation Plan associated with the current Mineral Lease for the Peculiar Knob Mine (ML 6314) will trigger a review of the conditions of this water licence.
11. The licensee must not take water except through the meter.
12. The licensee must not adjust or alter the meter without the Minister's authority.
13. The licensee must not damage or destroy a meter.
14. The licensee must not cause, suffer or permit any interference with a meter used for the purposes of measuring the quantity of water under this Act, or any interference with pipes or fittings that may affect the accuracy of a meter, without the Minister's authority.
15. The licensee must immediately report any fault or suspected fault in a meter.
16. The licensee must not permit deposits of sand, soil or any other material to build up around

12

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION

GPO Box 2834 Adelaide SA 5001

Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

|             |        |
|-------------|--------|
| Licence No. | 193860 |
|-------------|--------|

|                 |  |
|-----------------|--|
| Management Area |  |
|-----------------|--|

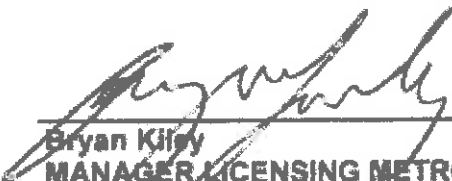
- the meter.
17. The licensee must keep vegetation cleared away from the meter.
  18. For the purposes of this water licence, the term 'per annum' means the period between 1 July in any calendar year and 30 June in the following calendar year.
  19. If the company name or name of licence holder(s) and/or the postal address of the licence holder(s) changes, then the licence holder(s) must notify this Department in writing within 21 days of the change occurring.

**Notes:**

1. Under section 202(1)(b)(ii) of the *Natural Resources Management Act 2004*, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon this department within that time.

**TAKE NOTE** that the licensee, or a person acting on behalf of the licensee, who contravenes or fails to comply with a condition of this licence is guilty of an offence, and such acts or omissions may also result in cancellation, suspension or variation (including a reduction in the water allocation) of the licence by seven days written notice.

Date: 10/06/2011

  
Bryan Kiley

MANAGER LICENSING METROPOLITAN

Delegate of Minister for Environment and Conservation

# Water Planning and Management Division



Government of South Australia

Department for Water

Ref: Licence 205010

Southern Iron Pty Ltd  
ACN 119 611 068  
Level 9, Kyle House  
27-31 Macquarie Place  
SYDNEY NSW 2000

Level 3 Grenfell Centre  
25 Grenfell Street  
Adelaide  
South Australia 5000  
DX 168

GPO Box 2834 Adelaide  
South Australia 5001  
Australia

Contact: Shane Cosenza  
Telephone (08) 8463 6863  
Facsimile (08) 8463 6840  
<http://www.sa.gov.au>

Attention: Larissa Brown

Dear Ms Brown

Approval is granted, pursuant to section 146(1) of the *Natural Resources Management Act 2004* (the 'Act'), to your application for a water licence for the taking and use of underground water for industrial water supply purposes for the Peculiar Knob Mine Project.

Please find enclosed Licence 205010 issued pursuant to the Act. The water licence is the personal property of the company; it states the water allocation, the prescribed water resource and the purpose for use of the water.

The water allocation endorsed on this licence is 347,000 kilolitres per annum. The water allocation has an expiry date of 30 June 2022, which is the end of the water use year during which Mineral Lease 6314 expires.

I draw your attention to condition number 5, which states that an Annual Water Use Report must be submitted as per Section 9.3 of the Far North Prescribed Wells Area Water Allocation Plan.

The conditions of the water licence may vary from time to time in accordance with the Act or where it is necessary or desirable to more effectively regulate the use of water from the resource in accordance with the relevant water allocation plan and the Act.

Conditions may also be imposed or varied by consent, or part of a transfer approval, or due to a breach of a licence.

The Act contains information on other rights and obligations that do not appear on your water licence. Copies of the Act can be purchased by contacting Service SA on 13 23 24.

**Under section 202(1)(b)(ii) of the Act, you have a right of appeal to the Environment Resources and Development Court against the imposition of any condition on the licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon the department within that time. For your information the procedure for the institution of an appeal is enclosed.**

Should you have any enquiries regarding your water licence please contact Shane Cosenza on 8463 6863.

Yours sincerely

A handwritten signature in cursive script, appearing to read 'J L Tardrew'.

Jenny Tardrew

**MANAGER LICENSING METROPOLITAN**

**DELEGATE OF MINISTER FOR ENVIRONMENT AND CONSERVATION**

Date: 5/12/2011



DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION

GPO Box 2834 Adelaide SA 5001

Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **205010**

Management Area

**Licensee(s):** SOUTHERN IRON PTY LTD  
ACN 119 611 068  
LEVEL 9, KYLE HOUSE  
27-31 MACQUARIE PLACE  
SYDNEY NSW 2000

**PRESCRIBED WATER RESOURCES:** The underground water to which a well in the Far North Prescribed Wells Area has access.

**TOTAL WATER ALLOCATION PER ANNUM** Taking 347,000.0 kL

| COMPONENTS OF ALLOCATION | PURPOSE           | EXPIRY DATE |
|--------------------------|-------------------|-------------|
| 347,000.0 kL             | Taking Industrial | 30/06/2022  |

**DETAILED SOURCE OF WATER**

**Description**

Underground 5839-00815

**Meter**

**Intervals at which conditions of this licence may be varied by the Minister (sections 146(6)(f) and 147(1)(b) of the *Natural Resources Management Act 2004* ('the Act')):**

**Yearly (on or about 30 June each year)**

**This licence is subject to the Act, and any conditions which may be specified from time to time in the Regulations, or by the Minister under the Act, and to the following further conditions:**

1. The water allocation(s) endorsed on this licence must only be used on the land described below:

CL 1628/71  
Block 1269  
Hundred of OH(Coober Pedy)

CL 1628/71  
Block 1269  
Hundred of OH(Billakalina)

CL 1292/41  
Block 1139  
Hundred of OH(Coober Pedy)

**DEPARTMENT FOR WATER**

WATER RESOURCES ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **205010**

Management Area

CL 1292/41  
Block 1139  
Hundred of OH(Billakalina)

CL 1159/4  
Block 473  
Hundred of OH(Billakalina)

2. The water allocation(s) endorsed on this licence must only be used for the purpose(s) described above.
3. The water allocation(s) endorsed on this licence must only be taken from the source(s) described above and where specified the amount of water taken from each source must not exceed the component of the allocation assigned to it.
4. The licensee must not cause, suffer or permit any water to be used for or in relation to any activity which is an offence under the provisions of the Act or any other legislation with effect in South Australia.
5. The proponent must submit an Annual Report, as per the approved Groundwater Management and Monitoring plan, in conjunction with the Mining and Rehabilitation Compliance Report, as per Section 9.3 of the Far North Prescribed Wells Area Water Allocation Plan.
6. If drawdown thresholds are exceeded, additional hydrogeological assessment should be conducted and submitted for review.
7. Any update to the Mining and Rehabilitation Plan associated with the current Mineral Lease for the Peculiar Knob Mine (ML 6314) will trigger a review of the conditions of this water licence.
8. Upon cessation of the mineral lease relating to the Peculiar Knob Mine, that this allocation becomes zero ML as per Principles 15, 16 and 38 of the Far North Wells Area Water Allocation Plan.
9. All monitoring data is to be submitted to the Department annually, in electronic Excel compatible format.
10. The licensee must not take water except through the meter.
11. The licensee must not adjust or alter the meter without the Minister's authority.
12. The licensee must not damage or destroy a meter.
13. The licensee must not cause, suffer or permit any interference with a meter used for the purposes of measuring the quantity of water under this Act, or any interference with pipes or fittings that may affect the accuracy of a meter, without the Minister's authority.
14. The licensee must immediately report any fault or suspected fault in a meter.
15. The licensee must not permit deposits of sand, soil or any other material to build up around the meter.
16. The licensee must keep vegetation cleared away from the meter.
17. For the purposes of this water licence, the term 'per annum' means the period between 1 July in any calendar year and 30 June in the following calendar year.

**DEPARTMENT FOR WATER**

WATER RESOURCES ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

**WATER LICENCE**

pursuant to section 146 of the *Natural Resources Management Act 2004*

|             |        |                 |  |
|-------------|--------|-----------------|--|
| Licence No. | 205010 | Management Area |  |
|-------------|--------|-----------------|--|

18. If the company name or name of licence holder(s) and/or the postal address of the licence holder(s) changes, then the licence holder(s) must notify this Department in writing within 21 days of the change occurring.

**Notes:**

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon this department within that time.

**TAKE NOTE that the licensee, or a person acting on behalf of the licensee, who contravenes or fails to comply with a condition of this licence is guilty of an offence, and such acts or omissions may also result in cancellation, suspension or variation (including a reduction in the water allocation) of the licence by seven days written notice.**

Date: 5/12/2011



Jenny Tardrew  
MANAGER LICENSING METROPOLITAN  
Delegate of Minister for Environment and Conservation

# Water Planning and Management Division



Government of South Australia

Department for Water

Ref: Licence 205011

Southern Iron Pty Ltd  
ACN 119 611 068  
Level 9, Kyle House  
27-31 Macquarie Place  
SYDNEY NSW 2000

Level 3 Grenfell Centre  
25 Grenfell Street  
Adelaide  
South Australia 5000  
DX 168

GPO Box 2834 Adelaide  
South Australia 5001  
Australia

Contact: Shane Cosenza  
Telephone (08) 8463 6863  
Facsimile (08) 8463 6840  
<http://www.sa.gov.au>

Attention: Larissa Brown

Dear Ms Brown

Approval is granted, pursuant to section 146(1) of the *Natural Resources Management Act 2004* (the 'Act'), to your application for a water licence for the taking and use of underground water for industrial water supply purposes for the Peculiar Knob Mine Project.

Please find enclosed Licence 205011 issued pursuant to the Act. The water licence is the personal property of the company; it states the water allocation, the prescribed water resource and the purpose for use of the water.

The water allocation endorsed on this licence is 158,000 kilolitres per annum. The water allocation has an expiry date of 30 June 2022, which is the end of the water use year during which Mineral Lease 6314 expires.

I draw your attention to condition number 5, which states that an Annual Water Use Report must be submitted as per Section 9.3 of the Far North Prescribed Wells Area Water Allocation Plan.

The conditions of the water licence may vary from time to time in accordance with the Act or where it is necessary or desirable to more effectively regulate the use of water from the resource in accordance with the relevant water allocation plan and the Act.

Conditions may also be imposed or varied by consent, or part of a transfer approval, or due to a breach of a licence.

The Act contains information on other rights and obligations that do not appear on your water licence. Copies of the Act can be purchased by contacting Service SA on 13 23 24.

**Under section 202(1)(b)(ii) of the Act, you have a right of appeal to the Environment Resources and Development Court against the imposition of any condition on the licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon the department within that time. For your information the procedure for the institution of an appeal is enclosed.**

Should you have any enquiries regarding your water licence please contact Shane Cosenza on 8463 6863.

Yours sincerely

A handwritten signature in cursive script, appearing to read 'J Tardrew'.

Jenny Tardrew

**MANAGER LICENSING METROPOLITAN**

**DELEGATE OF MINISTER FOR ENVIRONMENT AND CONSERVATION**

Date: 5/12/2011

DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION

GPO Box 2834 Adelaide SA 5001

Ph. 8463 6815 Fax 8463 6840

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **205011**

Management Area

**Licensee(s):** SOUTHERN IRON PTY LTD  
ACN 119 611 068  
LEVEL 9, KYLE HOUSE  
27-31 MACQUARIE PLACE  
SYDNEY NSW 2000

**PRESCRIBED WATER RESOURCES:** The underground water to which a well in the Far North Prescribed Wells Area has access.

**TOTAL WATER ALLOCATION PER ANNUM** Taking **158,000.0 kL**

| COMPONENTS OF ALLOCATION | PURPOSE           | EXPIRY DATE |
|--------------------------|-------------------|-------------|
| 158,000.0 kL             | Taking Industrial | 30/06/2022  |

**DETAILED SOURCE OF WATER**

**Description**

Underground 5938-00945

**Meter**

**Intervals at which conditions of this licence may be varied by the Minister (sections 146(6)(f) and 147(1)(b) of the *Natural Resources Management Act 2004* ('the Act')):**

**Yearly (on or about 30 June each year)**

**This licence is subject to the Act, and any conditions which may be specified from time to time in the Regulations, or by the Minister under the Act, and to the following further conditions:**

1. The water allocation(s) endorsed on this licence must only be used on the land described below:

CL 1628/71  
Block 1269  
Hundred of OH(Coober Pedy)

CL 1628/71  
Block 1269  
Hundred of OH(Billakalina)

CL 1292/41  
Block 1139  
Hundred of OH(Coober Pedy)

DEPARTMENT FOR WATER

WATER RESOURCES ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

**WATER LICENCE**

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **205011**

Management Area

CL 1292/41  
Block 1139  
Hundred of OH(Billakalina)

CL 1159/4  
Block 473  
Hundred of OH(Billakalina)

2. The water allocation(s) endorsed on this licence must only be used for the purpose(s) described above.
3. The water allocation(s) endorsed on this licence must only be taken from the source(s) described above and where specified the amount of water taken from each source must not exceed the component of the allocation assigned to it.
4. The licensee must not cause, suffer or permit any water to be used for or in relation to any activity which is an offence under the provisions of the Act or any other legislation with effect in South Australia.
5. The proponent must submit an Annual Report, as per the approved Groundwater Management and Monitoring plan, in conjunction with the Mining and Rehabilitation Compliance Report, as per Section 9.3 of the Far North Prescribed Wells Area Water Allocation Plan.
6. If drawdown thresholds are exceeded, additional hydrogeological assessment should be conducted and submitted for review.
7. Any update to the Mining and Rehabilitation Plan associated with the current Mineral Lease for the Peculiar Knob Mine (ML 6314) will trigger a review of the conditions of this water licence.
8. Upon cessation of the mineral lease relating to the Peculiar Knob Mine, that this allocation becomes zero ML as per Principles 15, 16 and 38 of the Far North Wells Area Water Allocation Plan.
9. All monitoring data is to be submitted to the Department annually, in electronic Excel compatible format.
10. The licensee must not take water except through the meter.
11. The licensee must not adjust or alter the meter without the Minister's authority.
12. The licensee must not damage or destroy a meter.
13. The licensee must not cause, suffer or permit any interference with a meter used for the purposes of measuring the quantity of water under this Act, or any interference with pipes or fittings that may affect the accuracy of a meter, without the Minister's authority.
14. The licensee must immediately report any fault or suspected fault in a meter.
15. The licensee must not permit deposits of sand, soil or any other material to build up around the meter.
16. The licensee must keep vegetation cleared away from the meter.
17. For the purposes of this water licence, the term 'per annum' means the period between 1 July in any calendar year and 30 June in the following calendar year.



**DEPARTMENT FOR WATER**

WATER RESOURCES ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

**WATER LICENCE**

pursuant to section 146 of the *Natural Resources Management Act 2004*

Licence No. **205011**

Management Area

18. If the company name or name of licence holder(s) and/or the postal address of the licence holder(s) changes, then the licence holder(s) must notify this Department in writing within 21 days of the change occurring.

**Notes:**

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon this department within that time.

**TAKE NOTE** that the licensee, or a person acting on behalf of the licensee, who contravenes or fails to comply with a condition of this licence is guilty of an offence, and such acts or omissions may also result in cancellation, suspension or variation (including a reduction in the water allocation) of the licence by seven days written notice.

Date: 5/12/2011



Jenny Tardrew  
MANAGER LICENSING METROPOLITAN  
Delegate of Minister for Environment and Conservation



## Resource Allocation Division

Ref: Licence 165398

Southern Iron Pty Ltd  
ACN 119 611 068  
PO Box N239  
GROSVENOR PLACE NSW 1220

Attention: Heath Roberts

Dear Mr Roberts

Approval is granted, pursuant to section 146 of the *Natural Resources Management Act 2004* ('the Act'), to your application for a water licence for the taking and use of underground water for mining purposes for the Peculiar Knob mine.

Please find enclosed Licence 165398 issued pursuant to the Act. The water licence is the personal property of the company; it states the water allocation, the prescribed water resource and the purpose for use of the water.

The water allocation endorsed on this licence is 507,350 kilolitres per annum. The water allocation has an expiry date of 30 June 2022, which is the end of the water use year during which Mining Lease 6314 expires.

The groundwater monitoring program plan for this water licence must be developed to the satisfaction of the Minister by 30 November 2009. The plan must include the following

1. Introduction
  - Scope
  - Responsible personnel
  - Monitoring program – review and modification
  - Regulatory reporting
  - Designated area
2. Borefield Performance Monitoring
  - Overview
  - Pumping Schedule
  - Performance monitoring
3. Regional Environmental Monitoring
  - Overview
  - Water Levels and quality
  - Drawdown thresholds
  - Monitoring priority
4. Existing Groundwater users
  - Overview
  - Regional
5. References

Level 1 Grenfell Centre  
25 Grenfell Street  
Adelaide  
South Australia 5000  
DX 168

GPO Box 2834 Adelaide  
South Australia 5001  
Australia

Contact: Rachael Kelly  
Telephone (08) 8463 6885  
Facsimile (08) 8463 6840  
<http://www.dwlbc.sa.gov.au>

The conditions of the water licence may vary from time to time in accordance with the Act or where it is necessary or desirable to more effectively regulate the use of water from the resource in accordance with the relevant water allocation plan and the Act.

Conditions may also be imposed or varied by consent, or part of a transfer approval, or due to a breach of a licence.

The Act contains information on other rights and obligations that do not appear on your water licence. Copies of the Act can be purchased via the Government Information website at [www.info.sa.gov.au](http://www.info.sa.gov.au) or by calling 132324.

**Under section 202(1)(b)(ii) of the Act, you have a right of appeal to the Environment Resources and Development Court against the imposition of any condition on the licence. The appeal must be instituted within six weeks of the date of licence issue. The appeal must also be served upon the department within that time. For your information the procedure for the institution of an appeal is enclosed.**

Should you have any enquiries regarding your water licence please contact Rachael Kelly on 8463 6885.

Yours sincerely



Mike Fuller

**MANAGER LICENSING ADMINISTRATION  
DELEGATE OF MINISTER FOR ENVIRONMENT AND CONSERVATION**

Date:

28/4/09

GOVERNMENT OF SOUTH AUSTRALIA  
DEPARTMENT OF WATER, LAND AND BIODIVERSITY CONSERVATION

RESOURCE ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

STAFFORD  
HN48, HN73, HN77

# WATER LICENCE

pursuant to section 146 of the *Natural Resources Management Act 2004*

|             |        |                 |  |
|-------------|--------|-----------------|--|
| Licence No. | 165398 | Management Area |  |
|-------------|--------|-----------------|--|

**Licensee(s):** SOUTHERN IRON PTY LTD  
ACN 119 611 068  
PO BOX N239  
GROSVENOR PLACE NSW 1220

**PRESCRIBED WATER RESOURCES:** The underground water to which a well in the Far North Prescribed Wells Area has access.

**TOTAL WATER ALLOCATION PER ANNUM** Taking 507,350.0 kL

| COMPONENTS OF ALLOCATION | PURPOSE       | EXPIRY DATE |
|--------------------------|---------------|-------------|
| 507,350.0 kL             | Taking Mining | 30/06/2022  |

**DETAILED SOURCE OF WATER**

**Description**

Underground FAR NORTH PWA

**Meter**

Intervals at which conditions of this licence may be varied by the Minister (sections 146(6)(f) and 147(1)(b) of the *Natural Resources Management Act 2004* ('the Act')):

Yearly (on or about 30 June each year)

This licence is subject to the Act, and any conditions which may be specified from time to time in the Regulations, or by the Minister under the Act, and to the following further conditions:

1. The water allocation(s) endorsed on this licence must only be used on the land described below:  
  
CL 1159/4  
Block 473  
Hundred of OH(Billakalina)
2. The water allocation(s) endorsed on this licence must only be used for the purpose(s) described above.
3. The water allocation(s) endorsed on this licence must only be taken from the source(s) described above and where specified the amount of water taken from each source(s) must not exceed the component of the allocation assigned to it.
4. The specific wells from which water can be taken are HN48, HN73 and HN 77 located on CL1292/42 as depicted in Figure 2 of the report 'Groundwater Testing at Hawks Nest for Peculiar Knob Project SA' which is attached to and forms part of this licence.

GOVERNMENT OF SOUTH AUSTRALIA  
**DEPARTMENT OF WATER, LAND AND BIODIVERSITY CONSERVATION**

RESOURCE ALLOCATION DIVISION  
GPO Box 2834 Adelaide SA 5001  
Ph. 8463 6815 Fax 8463 6840

## **WATER LICENCE**

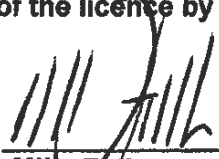
pursuant to section 146 of the *Natural Resources Management Act 2004*

|             |               |                 |  |
|-------------|---------------|-----------------|--|
| Licence No. | <b>165398</b> | Management Area |  |
|-------------|---------------|-----------------|--|

5. The licensee must not cause, suffer or permit any water to be used for or in relation to any activity which is an offence under the provisions of the Act or any other legislation with effect in South Australia.
6. The licensee must develop a 'Groundwater Monitoring Program plan' to the satisfaction of the Minister by 30 November 2009.
7. Any update to the Mining and Rehabilitation Plan associated with the current Mineral Lease for the Peculiar Knob Mine (ML 6314) will trigger a review of the conditions of this water licence.
8. The licensee must not take water except through the meter.
9. The licensee must not adjust or alter the meter without the Minister's authority.
10. The licensee must not damage or destroy a meter.
11. The licensee must not cause, suffer or permit any interference with a meter used for the purposes of measuring the quantity of water under this Act, or any interference with pipes or fittings that may affect the accuracy of a meter, without the Minister's authority.
12. The licensee must immediately report any fault or suspected fault in a meter.
13. The licensee must not permit deposits of sand, soil or any other material to build up around the meter.
14. The licensee must keep vegetation cleared away from the meter.
15. For the purposes of this water licence, the term 'per annum' means the period between 1 July in any calendar year and 30 June in the following calendar year.
16. If the company name or name of licence holder(s) and/or the postal address of the licence holder(s) changes, then the licence holder(s) must notify the Department in writing within 21 days of the change occurring.

**TAKE NOTE** that the licensee, or a person acting on behalf of the licensee, who contravenes or fails to comply with a condition of this licence is guilty of an offence, and such acts or omissions may also result in cancellation, suspension or variation (including a reduction in the water allocation) of the licence by seven days written notice.

Date: 28/04/2009

  
\_\_\_\_\_  
**Mike Fuller**  
**MANAGER LICENSING ADMINISTRATION**  
**Delegate of Minister for Environment and Conservation**

## APPENDIX II



| CAMP BOREFIELD - WATER LEVELS |             |         |             |         |             |         |             |         |             |         |             |         |             |         |             |         |             |         |
|-------------------------------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|
| Date                          | PKWB-01A    |         | PKWB-03A    |         | PKWB-01     |         | PKWB-02     |         | PKWB-03     |         | PKWB-04A    |         | PKWB-05     |         | PKWB-06     |         | Site-F      |         |
|                               | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         |
|                               | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) |
| 10/10/2011                    | 59.46       | 121.69  | 56.91       | 118.37  | 59.37       | 121.66  | 54.83       | 120.14  | 57.04       | 118.16  | 62.03       | 121.87  | 53.13       | 122.33  | 54.28       | 122.36  | 51.44       |         |
| 2/11/2011                     | 59.49       | 121.66  | 57.03       | 118.25  | 59.37       | 121.66  | 54.85       | 120.12  | 57.07       | 118.13  | 62.07       | 121.83  | 53.15       | 122.31  | 54.30       | 122.34  | 51.48       |         |
| 2/12/2011                     | 59.51       | 121.64  | 57.05       | 118.23  | 59.42       | 121.61  | 54.89       | 120.08  | 57.10       | 118.10  | 62.07       | 121.83  | 53.19       | 122.27  | 54.35       | 122.29  | 51.52       |         |
| 31/12/2011                    | 59.47       | 121.68  | 56.99       | 118.29  | 59.36       | 121.67  | 54.83       | 120.14  | 57.03       | 118.17  | 62.00       | 121.90  | 53.12       | 122.34  | 54.28       | 122.36  | 51.44       |         |
| 2/02/2012                     | 59.40       | 121.75  |             |         | 59.30       | 121.73  | 54.77       | 120.20  | 58.26       | 116.94  | 61.94       | 121.96  | 53.07       | 122.39  | 54.22       | 122.42  | 51.42       |         |
| 8/02/2012                     |             |         |             |         |             |         |             |         | 58.23       | 116.97  |             |         |             |         |             |         |             |         |
| 16/02/2012                    |             |         |             |         |             |         |             |         | 58.45       | 116.75  |             |         |             |         |             |         |             |         |
| 25/02/2012                    | 59.47       | 121.68  |             |         | 59.37       | 121.66  | 54.80       | 120.17  | 58.48       | 116.72  | 62.05       | 121.85  | 53.08       | 122.38  | 54.16       | 122.48  | 51.41       |         |
| 8/03/2012                     |             |         |             |         |             |         |             |         | 57.35       | 117.85  |             |         |             |         |             |         |             |         |
| 23/03/2012                    |             |         |             |         | 60.73       | 120.30  | 54.96       | 120.01  | 58.59       | 116.61  | 62.12       | 121.78  | 53.12       | 122.34  | 54.20       | 122.44  | 51.41       |         |
| 5/04/2012                     |             |         |             |         | 61.04       | 119.99  |             |         | 58.78       | 116.42  |             |         |             |         |             |         |             |         |
| 11/04/2012                    |             |         |             |         | 61.12       | 119.91  |             |         | 58.80       | 116.40  |             |         |             |         |             |         |             |         |
| 19/04/2012                    |             |         |             |         | 60.76       | 120.27  |             |         | 58.73       | 116.47  |             |         |             |         |             |         |             |         |
| 25/04/2012                    |             |         |             |         | 61.09       | 119.94  |             |         | 58.90       | 116.30  |             |         |             |         |             |         |             |         |
| 3/05/2012                     |             |         |             |         | 61.02       | 120.01  | 54.98       | 119.99  | 58.94       | 116.26  | 62.16       | 121.74  | 53.26       | 122.20  | 54.45       | 122.19  | 51.58       |         |
| 9/05/2012                     |             |         |             |         | 61.04       | 119.99  |             |         | 58.83       | 116.37  |             |         |             |         |             |         |             |         |
| 23/05/2012                    |             |         |             |         | 61.39       | 119.64  |             |         | 58.82       | 116.38  |             |         |             |         |             |         |             |         |
| 31/05/2012                    |             |         |             |         | 61.53       | 119.50  | 54.92       | 120.05  | 58.87       | 116.33  | 62.13       | 121.77  | 53.23       | 122.23  | 54.40       | 122.24  | 51.54       |         |
| 6/06/2012                     |             |         |             |         | 60.49       | 120.54  |             |         | 58.98       | 116.22  |             |         |             |         |             |         |             |         |
| 14/06/2012                    |             |         |             |         | 58.99       | 122.04  |             |         | 59.71       | 115.49  |             |         |             |         |             |         |             |         |
| 20/06/2012                    |             |         |             |         | 59.05       | 121.98  |             |         | 59.65       | 115.55  |             |         |             |         |             |         |             |         |
| 30/06/2012                    |             |         |             |         | 59.03       | 122.00  | 54.98       | 119.99  | 59.67       | 115.53  | 62.14       | 121.76  | 53.24       | 122.22  | 54.42       | 122.22  | 51.55       |         |
| 4/07/2012                     |             |         |             |         | 60.52       | 120.51  |             |         | 58.83       | 116.37  |             |         |             |         |             |         |             |         |



| PENRHYN BOREFIELD - WATER LEVELS |             |         |             |         |             |         |             |         |             |         |             |         |             |         |             |         |             |         |
|----------------------------------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|
| Date                             | HN48        |         | HN73        |         | HN77        |         | HNWPR102    |         | HNWPR105    |         | 5937-6      |         | 5937-015    |         | 5938-40     |         | HNWPR62A    |         |
|                                  | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         |
|                                  | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) |
|                                  | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) |
| 8/10/2011                        | 33.12       | 131.64  | 31.36       | 133.64  | 31.19       | 133.69  | 16.05       | 148.05  | 37.71       |         | 38.49       |         | 50.76       |         | 42.21       |         | 33.25       |         |
| 3/11/2011                        | 33.16       | 131.60  | 31.38       | 133.62  | 31.21       | 133.67  | 16.26       | 147.84  | 37.76       |         | 38.54       |         | 50.79       |         | 42.21       |         | 33.27       |         |
| 3/12/2011                        | 33.17       | 131.59  | 31.39       | 133.61  | 31.23       | 133.65  | 16.26       | 147.84  | 37.79       |         | 37.20       |         | 50.78       |         | 42.23       |         | 33.30       |         |
| 30/12/2011                       | 33.16       | 131.60  | 31.35       | 133.65  | 31.19       | 133.69  | 16.24       | 147.86  | 37.75       |         | 38.56       |         | 50.76       |         | 42.24       |         | 33.26       |         |
| 2/02/2012                        | 33.14       | 131.62  | 31.34       | 133.66  | 31.18       | 133.70  | 16.22       | 147.88  | 37.72       |         | 38.56       |         | 50.74       |         | 42.20       |         | 33.24       |         |
| 24/02/2012                       | 33.16       | 131.60  | 31.36       | 133.64  | 31.20       | 133.68  | 16.23       | 147.87  | 37.75       |         | 38.53       |         | 50.80       |         | 42.20       |         | 33.29       |         |
| 31/03/2012                       | 33.17       | 131.59  | 31.38       | 133.62  | 31.26       | 133.62  |             |         |             |         |             |         |             |         |             |         |             |         |
| 7/04/2012                        | 33.47       | 131.29  | 31.42       | 133.58  | 31.27       | 133.61  | 16.25       | 147.85  | 37.86       |         | 38.53       |         | 50.84       |         | 42.25       |         | 33.36       |         |
| 4/05/2012                        | 33.44       | 131.32  | 31.41       | 133.59  | 31.26       | 133.62  | 16.29       | 147.81  | 37.86       |         | 38.53       |         | 50.92       |         | 42.27       |         | 33.33       |         |
| 1/06/2012                        | 33.38       | 131.38  | 31.36       | 133.64  | 31.22       | 133.66  | 16.29       | 147.81  | 37.80       |         | 38.54       |         | 50.96       |         | 42.22       |         | 33.28       |         |
| 30/06/2012                       | 33.46       | 131.30  | 31.42       | 133.58  | 31.27       | 133.61  | 16.29       | 147.81  | 37.82       |         | 38.53       |         | 50.95       |         | 42.22       |         | 33.32       |         |

| Date       | HN49 Hawks nest |         | New Hodge   |         | Black Oak   |         | 5837-459    |         | Hawks Nest  |         |
|------------|-----------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|
|            | Water level     |         | Water level |         | Water level |         | Water level |         | Water level |         |
|            | (m brp)         | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) |
| 8/10/2011  | 33.34           |         | 15.60       |         | 44.91       |         | 31.89       |         | 46.11       |         |
| 3/11/2011  | 33.33           |         | 15.85       |         | 59.39       |         | 31.83       |         | 46.15       |         |
| 3/12/2011  | 33.37           |         | 15.59       |         | 44.91       |         | 31.86       |         | 46.17       |         |
| 30/12/2011 | 33.35           |         | 15.58       |         | 44.95       |         | 31.85       |         | 46.12       |         |
| 2/02/2012  | 33.33           |         | 15.56       |         | 44.92       |         | 31.86       |         | 46.09       |         |
| 24/02/2012 | 33.37           |         | 15.60       |         | 44.89       |         | 31.86       |         | 46.15       |         |
| 31/03/2012 |                 |         |             |         |             |         |             |         |             |         |
| 7/04/2012  | 33.44           |         | 15.65       |         | DRY         |         | 31.92       |         |             |         |
| 4/05/2012  | 33.41           |         | 15.65       |         | DRY         |         | 31.89       |         |             |         |
| 1/06/2012  | 33.34           |         | 15.62       |         | DRY         |         | 31.83       |         |             |         |
| 30/06/2012 | 33.38           |         | 15.68       |         | DRY         |         | 31.85       |         |             |         |

| STAFFORD BOREFIELD - WATER LEVELS |             |         |             |         |             |         |             |         |             |         |             |         |             |         |
|-----------------------------------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|
| Date                              | TNB-01      |         | PCWP-02     |         | TNB-01A     |         | PMB-01      |         | PMB-02      |         | PMB-03      |         | PMB-04      |         |
|                                   | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         | Water level |         |
|                                   | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) | (m brp)     | (m AHD) |
| 9/10/2011                         | 21.85       | 125.67  | 28.18       |         | 22.69       | 124.60  | 25.17       | 133.76  | 42.63       | 126.11  | 36.06       | 121.30  | 31.56       | 123.43  |
| 4/11/2011                         |             |         | 28.23       |         | 23.20       | 124.09  | 25.16       | 133.77  | 42.63       | 126.11  | 36.04       | 121.32  | 31.52       | 123.47  |
| 3/12/2011                         |             |         | 28.45       |         | 23.37       | 123.92  | 25.20       | 133.73  | 42.65       | 126.09  | 36.07       | 121.29  | 31.55       | 123.44  |
| 1/01/2012                         |             |         | 28.51       |         | 23.38       | 123.91  | 25.20       | 133.73  | 42.65       | 126.09  | 36.05       | 121.31  | 31.55       | 123.44  |
| 2/02/2012                         |             |         | 28.54       |         | 23.36       | 123.93  | 25.18       | 133.75  | 42.62       | 126.12  | 35.06       | 122.30  | 31.55       | 123.44  |
| 8/02/2012                         |             |         | 28.59       |         | 23.34       | 123.95  |             |         |             |         |             |         |             |         |
| 16/02/2012                        |             |         | 28.59       |         | 23.34       | 123.95  |             |         |             |         |             |         |             |         |
| 26/02/2012                        |             |         | 28.55       |         | 23.32       | 123.97  | 25.18       | 133.75  | 42.65       | 126.09  | 36.03       | 121.33  | 31.54       | 123.45  |
| 8/03/2012                         |             |         | 28.00       |         | 23.28       | 124.01  |             |         |             |         |             |         |             |         |
| 25/03/2012                        |             |         | 28.69       |         | 23.60       | 123.69  |             |         |             |         |             |         |             |         |
| 5/04/2012                         |             |         | 28.65       |         | 23.52       | 123.77  | 25.35       | 133.58  | 42.68       | 126.06  | 36.10       | 121.26  | 31.56       | 123.43  |
| 11/04/2012                        |             |         | 28.82       |         | 23.64       | 123.65  |             |         |             |         |             |         |             |         |
| 19/04/2012                        |             |         | 28.66       |         | 23.61       | 123.68  |             |         |             |         |             |         |             |         |
| 25/04/2012                        |             |         | 28.80       |         | 23.23       | 124.06  |             |         |             |         |             |         |             |         |
| 3/05/2012                         |             |         | 28.75       |         | 23.60       | 123.69  | 25.35       | 133.58  | 42.75       | 125.99  | 36.15       | 121.21  | 31.64       | 123.35  |
| 9/05/2012                         |             |         | 28.70       |         | 23.59       | 123.70  |             |         |             |         |             |         |             |         |
| 23/05/2012                        |             |         | 28.68       |         | 23.70       | 123.59  |             |         |             |         |             |         |             |         |
| 31/05/2012                        |             |         | 28.68       |         | 23.57       | 123.72  | 25.34       | 133.59  | 42.69       | 126.05  | 36.10       | 121.26  | 31.58       | 123.41  |
| 6/06/2012                         |             |         | 28.70       |         | 23.69       | 123.60  |             |         |             |         |             |         |             |         |
| 14/06/2012                        |             |         | 28.64       |         | 23.71       | 123.58  |             |         |             |         |             |         |             |         |
| 20/06/2012                        |             |         | 28.63       |         | 23.65       | 123.64  |             |         |             |         |             |         |             |         |
| 30/06/2012                        |             |         | 28.68       |         | 23.89       | 123.40  | 25.35       | 133.58  | 42.64       | 126.10  | 36.04       | 121.32  | 31.54       | 123.45  |
| 4/07/2012                         |             |         | 28.80       |         | 23.92       | 123.37  |             |         |             |         |             |         |             |         |

| CAMP BOREFIELD - WATER QUALITY (FIELD MEASUREMENTS) |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
|-----------------------------------------------------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|
| Date                                                | PKWB-01A      |               |              |      | PKWB-03A      |               |              |      | PKWB-01       |               |              |      | PKWB-02       |               |              |      | PKWB-03       |               |              |      |
|                                                     | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   |
| 8/10/11 to<br>10/10/11                              | 35,360        | 21,216        | 29.6         | 6.45 | 29,690        | 17,814        | 29.4         | 6.64 | 34,990        | 20,994        | 28.8         | 6.56 | 33,870        | 20,322        | 30.6         | 6.87 | 29,370        | 17,622        | 29.5         | 6.59 |
| 31/12/2011                                          | 31,870        | 19,122        | 31.2         | 6.61 | 26,650        | 15,990        | 28.6         | 6.62 | 30,990        | 18,594        | 32.2         | 6.65 | 30,410        | 18,246        | 32           | 7.08 | 26,780        | 16,068        | 28.6         | 7.05 |
| 16/02/2012                                          |               |               |              |      | 28,200        | 16,920        | 27.3         | 6.52 |               |               |              |      |               |               |              |      |               |               |              |      |
| 23/03/2012 to<br>6/04/2012                          | 33,720        | 20,232        | 27.4         | 6.68 | 26,800        | 16,080        | 27.1         | 6.6  | 33,230        | 19,938        | 27           | 6.35 | 32,030        | 19,218        | 28.3         | 6.47 | 28,930        | 17,358        | 27.7         | 6.24 |
| 3/5/2012 to<br>10/5/2012                            | 32,730        | 19,638        | 24           | 6.44 | 28            |               | 24.7         | 6.44 |               |               |              |      |               |               |              |      |               |               |              |      |
| 1/06/2012 to<br>6/6/2012                            | 33,300        | 19,980        | 22.1         | 6.36 | 28,350        | 17,010        | 24.6         | 6.43 |               |               |              |      |               |               |              |      |               |               |              |      |
| 6/6/2012 to<br>30/06/2012                           | 32,100        | 19,260        | 23.7         | 6.6  | 27,500        | 16,500        | 24.2         | 6.51 |               |               |              |      |               |               |              |      |               |               |              |      |

| Date                       | PKWB-04A      |               |              |      | PKWB-05       |               |              |      | PKWB-06       |               |              |      | Site - F      |               |              |      |
|----------------------------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|
|                            | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   |
| 8/10/11 to<br>10/10/11     | 30,130        | 18,078        | 32.3         | 6.31 | 32,140        | 19,284        | 29.4         | 6.73 | 32,020        | 19,212        | 29.2         | 6.69 | 35,090        | 21,054        | 28.5         | 6.56 |
| 31/12/2011                 | 26,010        | 15,606        | 32.2         | 6.32 | 29,610        | 17,766        | 28.1         | 6.75 | 29,930        | 17,958        | 27.9         | 6.95 | 31,910        | 19,146        | 32.4         | 6.4  |
| 16/02/2012                 |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 23/03/2012 to<br>6/04/2012 | 27,810        | 16,686        | 28.2         | 6.39 | 30,400        | 18,240        | 27.1         | 6.59 | 31,200        | 18,720        | 27.1         | 6.67 | 53,560        | 32,136        | 26.5         | 6.69 |
| 3/5/2012 to<br>10/5/2012   |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 1/06/2012 to<br>6/6/2012   |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 6/6/2012 to<br>30/06/2012  |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |

| PENRHYN BOREFIELD - WATER QUALITY (FIELD MEASUREMENTS) |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
|--------------------------------------------------------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|
| Date                                                   | PCWP-02A      |               |              |      | TNB-01        |               |              |      | PCWP-02       |               |              |      | TNB-01A       |               |              |      | PMB-01        |               |              |      |
|                                                        | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   |
| 8/10/11 to<br>10/10/11                                 | 65,650        | 39,390        | 28.1         | 6.45 |               |               |              |      | 65,700        | 39,420        | 28           | 6.47 | 67,900        | 40,740        | 27.2         | 5.26 | 22,680        | 13,608        | 29.3         | 6.75 |
| 2/11/2011                                              | 70,000        | 42,000        | 27.9         | 6.27 | 63,200        | 37,920        | 26.8         | 4.5  |               |               |              |      |               |               |              |      |               |               |              |      |
| 3/12/2011                                              | 69,800        | 41,880        | 28.1         | 6.3  | 63,900        | 38,340        | 26.9         | 4.5  |               |               |              |      |               |               |              |      |               |               |              |      |
| 31/12/2011                                             | 72,300        | 43,380        | 28.6         | 6.3  | 61,000        | 36,600        | 30.2         | 4.48 | 65,400        | 39,240        | 29.3         | 6.33 | 56,700        | 34,020        | 29.1         | 4.1  | 21,320        | 12,792        | 27.7         | 6.85 |
| 16/02/2012                                             | 71,400        | 42,840        | 29.8         | 6.05 | 63,600        | 38,160        | 29           | 4.49 |               |               |              |      |               |               |              |      |               |               |              |      |
| 23/03/2012 to<br>6/04/2012                             | 79,700        | 47,820        | 26.1         | 6.47 | 64,600        | 38,760        | 26.2         | 4.9  | 80,900        | 48,540        | 26.8         | 6.26 | 66,200        | 39,720        | 26.3         | 5.76 | 61,500        | 36,900        | 27.6         | 6.37 |
| 3/5/2012 to<br>10/5/2012                               | 71,800        | 43,080        | 26.3         | 6.22 |               |               | 25.4         | 4.84 |               |               |              |      |               |               |              |      |               |               |              |      |
| 1/06/2012 to<br>6/6/2012                               | 71,600        | 42,960        | 21.9         | 6.29 | 64,400        | 38,640        | 20.6         | 4.88 |               |               |              |      |               |               |              |      |               |               |              |      |
| 30/06/2012                                             | 72,500        | 43,500        | 22.7         | 6.12 | 63,600        | 38,160        | 24.1         | 5.16 |               |               |              |      |               |               |              |      |               |               |              |      |

| Date                    | PMB-02        |               |              |      | PMB-03        |               |              |      | PMB-04        |               |              |      | PMB-05        |               |              |      |
|-------------------------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|---------------|---------------|--------------|------|
|                         | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   | EC<br>(µS/cm) | TDS<br>(mg/L) | Temp<br>(C°) | pH   |
| 8/10/11 to 10/10/11     | 65,500        | 39,300        | 28.5         | 6.53 | 82,600        | 49,560        | 29           | 6.33 | 52,200        | 31,320        | 28.2         | 6.54 | 71,110        | 42,666        | 27.4         | 6.46 |
| 2/11/2011               |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 3/12/2011               |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 31/12/2011              | 61,800        | 37,080        | 29.9         | 6.1  | 77,800        | 46,680        | 27.6         | 5.82 | 50,700        | 30,420        | 29.5         | 6.4  | 63,800        | 38,280        | 30.6         | 6.66 |
| 16/02/2012              |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 23/03/2012 to 6/04/2012 | 70,400        | 42,240        | 27.8         | 6.34 | 79,200        | 47,520        | 27.2         | 6.22 | 59,000        | 35,400        | 27.8         | 6.19 | 72,500        | 43,500        | 24.8         | 5.76 |
| 3/5/2012 to 10/5/2012   |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 1/06/2012 to 6/6/2012   |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |
| 30/06/2012              |               |               |              |      |               |               |              |      |               |               |              |      |               |               |              |      |

| STAFFORD BOREFIELD - WATER QUALITY (FIELD MEASUREMENTS) |                                   |               |                                |      |                                   |               |                                |      |                                   |               |                                |      |                                   |               |                                |                                   |               |                                |      |
|---------------------------------------------------------|-----------------------------------|---------------|--------------------------------|------|-----------------------------------|---------------|--------------------------------|------|-----------------------------------|---------------|--------------------------------|------|-----------------------------------|---------------|--------------------------------|-----------------------------------|---------------|--------------------------------|------|
| Date                                                    | HN48                              |               |                                |      | HN73                              |               |                                |      | HN77                              |               |                                |      | New Hodge                         |               |                                | Black Oak                         |               |                                |      |
|                                                         | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | pH   | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | pH   | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | pH   | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | pH   |
| 8/10/11 to<br>10/10/11                                  | 267                               | 160           | 26.2                           | 5.76 | 4,448                             | 2,669         | 25.8                           | 7.24 | 4,700                             | 2,820         | 28.4                           | 7.36 | 3,673                             | 2,204         | 27.5                           | 4,641                             | 2,785         | 23.2                           | 7.17 |
| 23/03/2012 to<br>6/04/2012                              | 10,880                            | 6,528         | 27.1                           | 7.07 | 4,777                             | 2,866         | 27.9                           | 6.87 | 4,567                             | 2,740         | 26.9                           | 7.14 |                                   |               |                                |                                   |               |                                |      |
| 3/5/2012 to<br>10/5/2012                                |                                   |               |                                |      |                                   |               |                                |      |                                   |               |                                |      |                                   |               |                                |                                   |               |                                |      |

| STAFFORD BOREFIELD - WATER QUALITY (FIELD MEASUREMENTS) |                                   |               |                                |      |  |                                   |               |                                |      |
|---------------------------------------------------------|-----------------------------------|---------------|--------------------------------|------|--|-----------------------------------|---------------|--------------------------------|------|
| Date                                                    | Woolshed 5937-459                 |               |                                |      |  | Hawks Nest                        |               |                                |      |
|                                                         | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | pH   |  | EC<br>( $\mu\text{S}/\text{cm}$ ) | TDS<br>(mg/L) | Temp<br>( $^{\circ}\text{C}$ ) | pH   |
| 8/10/11 to<br>10/10/11                                  | 5,910                             | 3,546         | 28.5                           | 7.36 |  | 6,180                             | 3,708         | 27.2                           | 6.92 |
| 23/03/2012 to<br>6/04/2012                              |                                   |               |                                |      |  |                                   |               |                                |      |
| 3/5/2012 to<br>10/5/2012                                | 67,500                            | 40,500        | 16.8                           | 7.41 |  | 79,400                            | 47,640        | 13                             | 7.26 |

| CAMP BOREFIELD - WATER PUMPAGE    |                  |                                   |                  |                                   |
|-----------------------------------|------------------|-----------------------------------|------------------|-----------------------------------|
| Date                              | PKWB-01A         |                                   | PKWB-03A         |                                   |
|                                   | Meter Value (kL) | Usage Since Previous Reading (kL) | Meter Value (kL) | Usage Since Previous Reading (kL) |
| 3/02/2012                         | 4,216            |                                   |                  |                                   |
| 8/02/2012                         | 6,395            | 2,179                             |                  |                                   |
| 16/02/2012                        | 9,727            | 3,332                             |                  |                                   |
| 26/02/2012                        | 13,537           | 3,810                             |                  |                                   |
| 8/03/2012                         | 15,644           | 2,107                             |                  |                                   |
| 23/03/2012                        | 18,842           | 3,198                             | 4,777            |                                   |
| 5/04/2012                         | 22,787           | 3,945                             | 12,364           | 7,587                             |
| 11/04/2012                        | 24,389           | 1,602                             | 18,551           | 6,187                             |
| 19/04/2012                        | 27,504           | 3,115                             | 25,356           | 6,805                             |
| 25/04/2012                        | 29,998           | 2,494                             | 29,739           | 4,383                             |
| 3/05/2012                         | 33,298           | 3,300                             | 34,053           | 4,315                             |
| 9/05/2012                         | 35,379           | 2,081                             | 38,074           | 4,021                             |
| 17/05/2012                        |                  |                                   | 45,400           | 7,326                             |
| 23/05/2012                        | 39,843           | 4,464                             | 51,047           | 5,647                             |
| 31/05/2012                        | 42,411           | 2,568                             | 58,430           | 7,384                             |
| 6/06/2012                         | 44,523           | 2,112                             | 59,412           | 981                               |
| 14/06/2012                        | 48,201           | 3,678                             |                  |                                   |
| 30/06/2012                        | 52,579           | 4,378                             | 67,701           | 8,289                             |
| PENRHYN BOREFIELD - WATER PUMPAGE |                  |                                   |                  |                                   |
| Date                              | PCPW-02A         |                                   | TNB-01           |                                   |
|                                   | Meter Value (kL) | Usage Since Previous Reading (kL) | Meter Value (kL) | Usage Since Previous Reading (kL) |
| 16/9/2011                         | 1,105            |                                   |                  |                                   |
| 23/09/2011                        | 3,609            | 2,504                             |                  |                                   |
| 1/10/2011                         | 6,652            | 3,043                             |                  |                                   |
| 8/10/2011                         | 7,517            | 866                               |                  |                                   |
| 16/10/2011                        | 9,491            | 1,973                             |                  |                                   |
| 21/10/2011                        | 11,521           | 2,031                             |                  |                                   |
| 28/10/2011                        | 15,465           | 3,944                             |                  |                                   |
| 3/11/2011                         | 19,166           | 3,701                             | 658              |                                   |
| 10/11/2011                        | 23,249           | 4,083                             | 1,109            | 451                               |
| 17/11/2011                        | 25,689           | 2,440                             | 3,009            | 1,900                             |
| 23/11/2011                        | 32,450           | 6,761                             | 4,332            | 1,323                             |
| 1/12/2011                         | 38,256           | 5,806                             | 5,980            | 1,648                             |
| 8/12/2011                         | 44,648           | 6,392                             | 7,736            | 1,756                             |
| 15/12/2011                        | 52,530           | 7,882                             | 9,718            | 1,982                             |
| 23/12/2011                        | 59,956           | 7,426                             | 11,639           | 1,921                             |
| 1/01/2012                         | 67,283           | 7,327                             | 13,669           | 2,030                             |
| 8/01/2012                         | 75,324           | 8,041                             | 15,501           | 1,832                             |
| 15/01/2012                        | 82,969           | 7,645                             | 17,789           | 2,288                             |
| 22/01/2012                        | 89,672           | 6,703                             | 19,550           | 1,761                             |
| 27/01/2012                        | 93,397           | 3,725                             | 20,619           | 1,069                             |
| 3/02/2012                         | 100,235          | 6,838                             | 22,508           | 1,889                             |
| 8/02/2012                         | 105,466          | 5,231                             | 23,887           | 1,379                             |
| 16/02/2012                        | 113,378          | 7,912                             | 25,923           | 2,036                             |
| 26/02/2012                        | 123,249          | 9,871                             | 28,348           | 2,425                             |
| 8/03/2012                         |                  |                                   | 29,693           | 1,345                             |
| 23/03/2012                        | 145,890          | 22,641                            | 35,271           | 5,578                             |
| 5/04/2012                         | 153,977          | 153,977                           | 37,731           | 2,460                             |
| 11/04/2012                        | 161,868          | 15,978                            | 40,947           | 3,216                             |
| 19/04/2012                        | 169,924          | 15,947                            | 43,805           | 2,858                             |
| 25/04/2012                        | 175,772          | 13,904                            |                  |                                   |
| 3/05/2012                         | 183,886          | 13,962                            | 48,761           | 4,956                             |
| 9/05/2012                         | 189,811          | 14,039                            | 50,818           | 2,057                             |
| 17/05/2012                        | 197,806          | 13,920                            | 53,630           | 2,812                             |
| 23/05/2012                        | 203,949          | 14,138                            | 55,805           | 2,175                             |
| 31/05/2012                        | 211,644          | 13,838                            | 56,944           | 1,139                             |
| 6/06/2012                         | 216,305          | 12,356                            | 58,812           | 1,868                             |
| 14/06/2012                        | 223,949          | 12,305                            | 61,863           | 3,051                             |
| 20/06/2012                        | 226,485          | 10,180                            | 61,921           | 58                                |
| 30/06/2012                        | 238,938          | 14,989                            | 62,673           | 752                               |

### **APPENDIX III**





### APPENDIX III : CHEMICAL ANALYSES OF WATER SAMPLES (by ALS Laboratory Group)

[illegible]

## **APPENDIX IV**





Environmental Division

**CERTIFICATE OF ANALYSIS**

|                     |                                                              |                                |                                                           |
|---------------------|--------------------------------------------------------------|--------------------------------|-----------------------------------------------------------|
| <b>Work Order</b>   | <b>: EM1203963</b>                                           | <b>Page</b>                    | <b>: 1 of 3</b>                                           |
| <b>Client</b>       | <b>: SOUTHERN IRON PTY LTD</b>                               | <b>Laboratory</b>              | <b>: Environmental Division Melbourne</b>                 |
| <b>Contact</b>      | <b>: MR GRAEME NOLL</b>                                      | <b>Contact</b>                 | <b>: Client Services</b>                                  |
| <b>Address</b>      | <b>: 173 SOUTH TERRACE<br/>ADELAIDE SOUTH AUSTRALIA 5001</b> | <b>Address</b>                 | <b>: 4 Westall Rd Springvale VIC Australia 3171</b>       |
| <b>E-mail</b>       | <b>: nollg@onesteel.com</b>                                  | <b>E-mail</b>                  | <b>: Melbourne.Enviro.Services@alsglobal.com</b>          |
| <b>Telephone</b>    | <b>: ----</b>                                                | <b>Telephone</b>               | <b>: +61-3-8549 9600</b>                                  |
| <b>Facsimile</b>    | <b>: ----</b>                                                | <b>Facsimile</b>               | <b>: +61-3-8549 9601</b>                                  |
| <b>Project</b>      | <b>: SI01 Peculiar Knob</b>                                  | <b>QC Level</b>                | <b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b> |
| <b>Order number</b> | <b>: ----</b>                                                | <b>Date Samples Received</b>   | <b>: 11-APR-2012</b>                                      |
| <b>C-O-C number</b> | <b>: ----</b>                                                | <b>Issue Date</b>              | <b>: 17-APR-2012</b>                                      |
| <b>Sampler</b>      | <b>: ----</b>                                                | <b>No. of samples received</b> | <b>: 2</b>                                                |
| <b>Site</b>         | <b>: ----</b>                                                | <b>No. of samples analysed</b> | <b>: 2</b>                                                |
| <b>Quote number</b> | <b>: ----</b>                                                |                                |                                                           |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

|                                                           |                                               |                                                                                                                                                                                                |                                     |
|-----------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <p><b>NATA</b><br/>WORLD RECOGNISED<br/>ACCREDITATION</p> | NATA Accredited Laboratory 825                | <b>Signatories</b>                                                                                                                                                                             |                                     |
|                                                           | Accredited for compliance with ISO/IEC 17025. | This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11. |                                     |
|                                                           |                                               | <i>Signatories</i>                                                                                                                                                                             | <i>Accreditation Category</i>       |
|                                                           |                                               | Dilani Fernando                                                                                                                                                                                | Senior Inorganic Chemist            |
|                                                           |                                               | Nikki Stepniewski                                                                                                                                                                              | Senior Inorganic Instrument Chemist |
|                                                           |                                               |                                                                                                                                                                                                | Melbourne Inorganics                |
|                                                           |                                               |                                                                                                                                                                                                | Melbourne Inorganics                |

Page : 2 of 3  
Work Order : EM1203963  
Client : SOUTHERN IRON PTY LTD  
Project : S101 Peculiar Knob



### General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.**



## Analytical Results

Sub-Matrix: GROUNDWATER

| Compound                                                    | Client sample ID |       | Client sampling date / time |        |
|-------------------------------------------------------------|------------------|-------|-----------------------------|--------|
|                                                             | CAS Number       | LOR   | Unit                        |        |
| EA005: pH                                                   |                  |       |                             |        |
| pH Value                                                    |                  | 0.01  | pH Unit                     | 7.35   |
| EA010: Conductivity                                         |                  |       |                             |        |
| Electrical Conductivity @ 25°C                              |                  | 1     | µS/cm                       | 4570   |
| EA015: Total Dissolved Solids                               |                  |       |                             |        |
| Total Dissolved Solids @180°C                               | GIS-210-010      | 10    | mg/L                        | 2860   |
| ED037P: Alkalinity by PC Titrator                           |                  |       |                             |        |
| Hydroxide Alkalinity as CaCO <sub>3</sub>                   | DMO-210-001      | 1     | mg/L                        | <1     |
| Carbonate Alkalinity as CaCO <sub>3</sub>                   | 3812-32-6        | 1     | mg/L                        | <1     |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                 | 71-52-3          | 1     | mg/L                        | 172    |
| Total Alkalinity as CaCO <sub>3</sub>                       |                  | 1     | mg/L                        | 172    |
| ED040F: Dissolved Major Anions                              |                  |       |                             |        |
| Silicon                                                     | 7440-21-3        | 0.05  | mg/L                        | 12.7   |
| ED041G: Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by DA |                  |       |                             |        |
| Sulfate as SO <sub>4</sub> - Turbidimetric                  | 14808-79-8       | 1     | mg/L                        | 401    |
| ED045G: Chloride Discrete analyser                          |                  |       |                             |        |
| Chloride                                                    | 16887-00-6       | 1     | mg/L                        | 1100   |
| ED093F: Dissolved Major Cations                             |                  |       |                             |        |
| Calcium                                                     | 7440-70-2        | 1     | mg/L                        | 182    |
| Magnesium                                                   | 7439-95-4        | 1     | mg/L                        | 89     |
| Sodium                                                      | 7440-23-5        | 1     | mg/L                        | 614    |
| Potassium                                                   | 7440-09-7        | 1     | mg/L                        | 49     |
| EG020T: Total Metals by ICP-MS                              |                  |       |                             |        |
| Aluminium                                                   | 7429-90-5        | 0.01  | mg/L                        | <0.01  |
| Arsenic                                                     | 7440-38-2        | 0.001 | mg/L                        | <0.001 |
| Copper                                                      | 7440-50-8        | 0.001 | mg/L                        | 0.008  |
| Manganese                                                   | 7439-96-5        | 0.001 | mg/L                        | 0.005  |
| Molybdenum                                                  | 7439-98-7        | 0.001 | mg/L                        | 0.002  |
| Nickel                                                      | 7440-02-0        | 0.001 | mg/L                        | 0.002  |
| Selenium                                                    | 7782-49-2        | 0.01  | mg/L                        | <0.01  |
| Uranium                                                     | 7440-61-1        | 0.001 | mg/L                        | 0.005  |
| Zinc                                                        | 7440-66-6        | 0.005 | mg/L                        | 0.056  |
| Iron                                                        | 7439-89-6        | 0.05  | mg/L                        | 0.07   |
| EN055: Ionic Balance                                        |                  |       |                             |        |
| Total Anions                                                |                  | 0.01  | meq/L                       | 42.8   |
| Total Cations                                               |                  | 0.01  | meq/L                       | 44.4   |
| Ionic Balance                                               |                  | 0.01  | %                           | 1.78   |



Environmental Division

**CERTIFICATE OF ANALYSIS**

|                     |                                                              |                                |                                                           |
|---------------------|--------------------------------------------------------------|--------------------------------|-----------------------------------------------------------|
| <b>Work Order</b>   | <b>: EM1203314</b>                                           | <b>Page</b>                    | <b>: 1 of 4</b>                                           |
| <b>Client</b>       | <b>: SOUTHERN IRON PTY LTD</b>                               | <b>Laboratory</b>              | <b>: Environmental Division Melbourne</b>                 |
| <b>Contact</b>      | <b>: MR GRAEME NOLL</b>                                      | <b>Contact</b>                 | <b>: Client Services</b>                                  |
| <b>Address</b>      | <b>: 173 SOUTH TERRACE<br/>ADELAIDE SOUTH AUSTRALIA 5001</b> | <b>Address</b>                 | <b>: 4 Westall Rd Springvale VIC Australia 3171</b>       |
| <b>E-mail</b>       | <b>: nollg@onesteel.com</b>                                  | <b>E-mail</b>                  | <b>: Melbourne.Enviro.Services@alsglobal.com</b>          |
| <b>Telephone</b>    | <b>: ----</b>                                                | <b>Telephone</b>               | <b>: +61-3-8549 9600</b>                                  |
| <b>Facsimile</b>    | <b>: ----</b>                                                | <b>Facsimile</b>               | <b>: +61-3-8549 9601</b>                                  |
| <b>Project</b>      | <b>: SI01 Peculiar Knob</b>                                  | <b>QC Level</b>                | <b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b> |
| <b>Order number</b> | <b>: ----</b>                                                | <b>Date Samples Received</b>   | <b>: 27-MAR-2012</b>                                      |
| <b>C-O-C number</b> | <b>: ----</b>                                                | <b>Issue Date</b>              | <b>: 04-APR-2012</b>                                      |
| <b>Sampler</b>      | <b>: ----</b>                                                | <b>No. of samples received</b> | <b>: 10</b>                                               |
| <b>Site</b>         | <b>: ----</b>                                                | <b>No. of samples analysed</b> | <b>: 10</b>                                               |
| <b>Quote number</b> | <b>: ----</b>                                                |                                |                                                           |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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|  | NATA Accredited Laboratory 825                | <b>Signatories</b>                                                                                                                                                                             |                               |
|  | Accredited for compliance with ISO/IEC 17025. | This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11. |                               |
|  |                                               | <i>Signatories</i>                                                                                                                                                                             | <i>Position</i>               |
|  |                                               | Dilani Fernando                                                                                                                                                                                | Senior Inorganic Chemist      |
|  |                                               | Herman Lin                                                                                                                                                                                     | Laboratory Coordinator        |
|  |                                               | Varsha Ho Wing                                                                                                                                                                                 | Non-Metals Team Leader        |
|  |                                               |                                                                                                                                                                                                | <i>Accreditation Category</i> |
|  |                                               |                                                                                                                                                                                                | Melbourne Inorganics          |
|  |                                               |                                                                                                                                                                                                | Melbourne Inorganics          |
|  |                                               |                                                                                                                                                                                                | Melbourne Inorganics          |

**Environmental Division Melbourne**

Part of the **ALS Laboratory Group**

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Page : 2 of 4  
Work Order : EM1203314  
Client : SOUTHERN IRON PTY LTD  
Project : SI01 Peculiar Knob

### General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

<sup>A</sup> = This result is computed from individual analyte detections at or above the level of reporting

- EG020T: EM1203314 #7, positive total aluminium and Zinc results were confirmed by re-analysis.
- Ionic Balance out of acceptable limits for EM1203314 #2 due to analytes not quantified in this report.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.







## Analytical Results

Sub-Matrix: WATER

| Sub-Matrix: WATER                               |             | Client sample ID |         |                   |                   | Client sampling date / time |                   |                   |  |
|-------------------------------------------------|-------------|------------------|---------|-------------------|-------------------|-----------------------------|-------------------|-------------------|--|
| Compound                                        | CAS Number  | LOR              | Unit    | PKWB-01A          | PKWB-01           | PKWB-02                     | PKWB-03A          | PKWB-03           |  |
|                                                 |             |                  |         | 25-MAR-2012 06:00 | 25-MAR-2012 06:30 | 25-MAR-2012 10:00           | 25-MAR-2012 12:00 | 25-MAR-2012 12:15 |  |
|                                                 |             |                  |         | EM1203314-001     | EM1203314-002     | EM1203314-003               | EM1203314-004     | EM1203314-005     |  |
| EA005: pH                                       |             |                  |         |                   |                   |                             |                   |                   |  |
| pH Value                                        | ----        | 0.01             | pH Unit | 6.83              | 6.62              | 6.68                        | 6.86              | 6.52              |  |
| EA010: Conductivity                             |             |                  |         |                   |                   |                             |                   |                   |  |
| Electrical Conductivity @ 25°C                  | ----        | 1                | µS/cm   | 31000             | 26800             | 27600                       | 23800             | 22400             |  |
| EA015: Total Dissolved Solids                   |             |                  |         |                   |                   |                             |                   |                   |  |
| Total Dissolved Solids @180°C                   | GIS-210-010 | 10               | mg/L    | 22400             | 17000             | 16900                       | 14600             | 13200             |  |
| ED037P: Alkalinity by PC Titrator               |             |                  |         |                   |                   |                             |                   |                   |  |
| Hydroxide Alkalinity as CaCO3                   | DMO-210-001 | 1                | mg/L    | <1                | <1                | <1                          | <1                | <1                |  |
| Carbonate Alkalinity as CaCO3                   | 3812-32-6   | 1                | mg/L    | <1                | <1                | <1                          | <1                | <1                |  |
| Bicarbonate Alkalinity as CaCO3                 | 71-52-3     | 1                | mg/L    | 103               | 85                | 90                          | 69                | 60                |  |
| Total Alkalinity as CaCO3                       | ----        | 1                | mg/L    | 103               | 85                | 90                          | 69                | 60                |  |
| ED040F: Dissolved Major Anions                  |             |                  |         |                   |                   |                             |                   |                   |  |
| Silicon                                         | 7440-21-3   | 0.05             | mg/L    | 2.32              | 1.14              | 2.90                        | 1.12              | 0.65              |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA |             |                  |         |                   |                   |                             |                   |                   |  |
| Sulfate as SO4 - Turbidimetric                  | 14808-79-8  | 1                | mg/L    | 3860              | 3590              | 3460                        | 3530              | 3390              |  |
| ED045G: Chloride Discrete analyser              |             |                  |         |                   |                   |                             |                   |                   |  |
| Chloride                                        | 16887-00-6  | 1                | mg/L    | 9740              | 7560              | 8240                        | 6700              | 5720              |  |
| ED093F: Dissolved Major Cations                 |             |                  |         |                   |                   |                             |                   |                   |  |
| Calcium                                         | 7440-70-2   | 1                | mg/L    | 644               | 483               | 570                         | 490               | 447               |  |
| Magnesium                                       | 7439-95-4   | 1                | mg/L    | 577               | 409               | 494                         | 389               | 369               |  |
| Sodium                                          | 7440-23-5   | 1                | mg/L    | 6040              | 4470              | 5120                        | 4430              | 4340              |  |
| Potassium                                       | 7440-09-7   | 1                | mg/L    | 138               | 112               | 122                         | 104               | 98                |  |
| EG020T: Total Metals by ICP-MS                  |             |                  |         |                   |                   |                             |                   |                   |  |
| Aluminium                                       | 7429-90-5   | 0.01             | mg/L    | <0.01             | 0.01              | <0.01                       | <0.01             | 0.02              |  |
| Arsenic                                         | 7440-38-2   | 0.001            | mg/L    | 0.003             | 0.003             | 0.003                       | 0.003             | 0.002             |  |
| Copper                                          | 7440-50-8   | 0.001            | mg/L    | 0.012             | 0.034             | 0.046                       | 0.009             | 0.027             |  |
| Manganese                                       | 7439-96-5   | 0.001            | mg/L    | 0.033             | <0.001            | 0.207                       | 0.257             | 0.005             |  |
| Molybdenum                                      | 7439-98-7   | 0.001            | mg/L    | 0.004             | 0.003             | 0.004                       | <0.001            | <0.001            |  |
| Nickel                                          | 7440-02-0   | 0.001            | mg/L    | 0.011             | 0.015             | 0.025                       | 0.021             | 0.025             |  |
| Selenium                                        | 7782-49-2   | 0.01             | mg/L    | <0.01             | 0.01              | <0.01                       | <0.01             | <0.01             |  |
| Uranium                                         | 7440-61-1   | 0.001            | mg/L    | 0.006             | 0.008             | 0.007                       | <0.001            | 0.001             |  |
| Zinc                                            | 7440-66-6   | 0.005            | mg/L    | 0.058             | 0.070             | 0.086                       | 0.139             | 0.158             |  |
| Iron                                            | 7439-89-6   | 0.05             | mg/L    | 0.17              | 0.12              | 0.78                        | 1.10              | 0.05              |  |
| EN055: Ionic Balance                            |             |                  |         |                   |                   |                             |                   |                   |  |
| Total Anions                                    | ----        | 0.01             | meq/L   | 357               | 290               | 306                         | 264               | 233               |  |
| Total Cations                                   | ----        | 0.01             | meq/L   | 346               | 255               | 295                         | 252               | 244               |  |
| Ionic Balance                                   | ----        | 0.01             | %       | 1.62              | 6.37              | 1.90                        | 2.35              | 2.25              |  |



## Analytical Results

Sub-Matrix: WATER

| Compound                                                    | CAS Number  | LOR   | Client sample ID            |         | PKWB-04A          | PKWB-04           | PKWB-05           | PKWB-06           | Site-F            |
|-------------------------------------------------------------|-------------|-------|-----------------------------|---------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                                                             |             |       | Client sampling date / time | Unit    | 25-MAR-2012 15:00 | 26-MAR-2012 06:00 | 25-MAR-2012 17:00 | 24-MAR-2012 16:00 | 24-MAR-2012 18:00 |
| EA005: pH                                                   |             |       |                             |         |                   |                   |                   |                   |                   |
| pH Value                                                    | ----        | 0.01  |                             | pH Unit | 6.67              | 6.42              | 6.59              | 6.67              | 6.94              |
| EA010: Conductivity                                         |             |       |                             |         |                   |                   |                   |                   |                   |
| Electrical Conductivity @ 25°C                              | ----        | 1     |                             | µS/cm   | 24000             | <1                | 30400             | 31200             | 31600             |
| EA015: Total Dissolved Solids                               |             |       |                             |         |                   |                   |                   |                   |                   |
| Total Dissolved Solids @180°C                               | GIS-210-010 | 10    |                             | mg/L    | 15200             | <10               | 21200             | 20000             | 19200             |
| ED037P: Alkalinity by PC Titrator                           |             |       |                             |         |                   |                   |                   |                   |                   |
| Hydroxide Alkalinity as CaCO <sub>3</sub>                   | DMO-210-001 | 1     |                             | mg/L    | <1                | <1                | <1                | <1                | <1                |
| Carbonate Alkalinity as CaCO <sub>3</sub>                   | 3812-32-6   | 1     |                             | mg/L    | <1                | <1                | <1                | <1                | <1                |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                 | 71-52-3     | 1     |                             | mg/L    | 101               | 4                 | 103               | 110               | 102               |
| Total Alkalinity as CaCO <sub>3</sub>                       | ----        | 1     |                             | mg/L    | 101               | 4                 | 103               | 110               | 102               |
| ED040F: Dissolved Major Anions                              |             |       |                             |         |                   |                   |                   |                   |                   |
| Silicon                                                     | 7440-21-3   | 0.05  |                             | mg/L    | 1.90              | 1.32              | 2.16              | 1.52              | <0.50             |
| ED041G: Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by DA |             |       |                             |         |                   |                   |                   |                   |                   |
| Sulfate as SO <sub>4</sub> - Turbidimetric                  | 14808-79-8  | 1     |                             | mg/L    | 3410              | <1                | 3760              | 4070              | 3890              |
| ED045G: Chloride Discrete analyser                          |             |       |                             |         |                   |                   |                   |                   |                   |
| Chloride                                                    | 16887-00-6  | 1     |                             | mg/L    | 6700              | <1                | 9250              | 9590              | 9200              |
| ED093F: Dissolved Major Cations                             |             |       |                             |         |                   |                   |                   |                   |                   |
| Calcium                                                     | 7440-70-2   | 1     |                             | mg/L    | 516               | <1                | 624               | 680               | 651               |
| Magnesium                                                   | 7439-95-4   | 1     |                             | mg/L    | 393               | <1                | 540               | 580               | 570               |
| Sodium                                                      | 7440-23-5   | 1     |                             | mg/L    | 4350              | <1                | 5450              | 5920              | 6020              |
| Potassium                                                   | 7440-09-7   | 1     |                             | mg/L    | 102               | <1                | 140               | 146               | 143               |
| EG020T: Total Metals by ICP-MS                              |             |       |                             |         |                   |                   |                   |                   |                   |
| Aluminium                                                   | 7429-90-5   | 0.01  |                             | mg/L    | 0.08              | 0.01              | 1.03              | 1.99              | 0.15              |
| Arsenic                                                     | 7440-38-2   | 0.001 |                             | mg/L    | 0.008             | <0.001            | 0.005             | 0.005             | 0.002             |
| Copper                                                      | 7440-50-8   | 0.001 |                             | mg/L    | 0.030             | <0.001            | 0.020             | 0.023             | 0.037             |
| Manganese                                                   | 7439-96-5   | 0.001 |                             | mg/L    | 0.289             | <0.001            | 0.315             | 0.238             | 0.474             |
| Molybdenum                                                  | 7439-98-7   | 0.001 |                             | mg/L    | 0.002             | <0.001            | 0.002             | 0.002             | 0.005             |
| Nickel                                                      | 7440-02-0   | 0.001 |                             | mg/L    | 0.016             | <0.001            | 0.015             | 0.027             | 0.037             |
| Selenium                                                    | 7782-49-2   | 0.01  |                             | mg/L    | <0.01             | <0.01             | <0.01             | 0.01              | <0.01             |
| Uranium                                                     | 7440-61-1   | 0.001 |                             | mg/L    | <0.001            | <0.001            | 0.003             | 0.002             | 0.003             |
| Zinc                                                        | 7440-66-6   | 0.005 |                             | mg/L    | 0.038             | 0.011             | 0.082             | 0.099             | 0.034             |
| Iron                                                        | 7439-89-6   | 0.05  |                             | mg/L    | 2.24              | <0.05             | 1.39              | 3.37              | 1.58              |
| EN055: Ionic Balance                                        |             |       |                             |         |                   |                   |                   |                   |                   |
| Total Anions                                                | ----        | 0.01  |                             | meq/L   | 262               | 0.08              | 341               | 357               | 342               |
| Total Cations                                               | ----        | 0.01  |                             | meq/L   | 250               | <0.01             | 316               | 343               | 345               |
| Ionic Balance                                               | ----        | 0.01  |                             | %       | 2.38              | ----              | 3.82              | 2.09              | 0.33              |



Environmental Division

**CERTIFICATE OF ANALYSIS**

|              |                                                      |                         |                                                    |
|--------------|------------------------------------------------------|-------------------------|----------------------------------------------------|
| Work Order   | : EM1203707                                          | Page                    | : 1 of 5                                           |
| Amendment    | : 1                                                  |                         |                                                    |
| Client       | : SOUTHERN IRON PTY LTD                              | Laboratory              | : Environmental Division Melbourne                 |
| Contact      | : MR GRAEME NOLL                                     | Contact                 | : Client Services                                  |
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| Project      | : SI01 Peculiar Knob                                 | QC Level                | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Order number | : ----                                               |                         |                                                    |
| C-O-C number | : ----                                               | Date Samples Received   | : 03-APR-2012                                      |
| Sampler      | : ----                                               | Issue Date              | : 17-APR-2012                                      |
| Site         | : ----                                               |                         |                                                    |
| Quote number | : ----                                               | No. of samples received | : 12                                               |
|              |                                                      | No. of samples analysed | : 12                                               |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825  
Accredited for compliance with  
ISO/IEC 17025.

**Signatories**

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| Signatories     | Position                 | Accreditation Category |
|-----------------|--------------------------|------------------------|
| Dilani Fernando | Senior Inorganic Chemist | Melbourne Inorganics   |
| Eric Chau       | Metals Team Leader       | Melbourne Inorganics   |
| Varsha Ho Wing  | Non-Metals Team Leader   | Melbourne Inorganics   |

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## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- ED037-P : EM1203697#3 duplicate failed for Carbonate Alkalinity due to sample matrix. This has been confirmed by re-analysis.
- Ionic Balance out of acceptable limits for EM1203707 #5 & #10 due to analytes not quantified in this report.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- This report has been amended following changes to the analytical data reported. The quality system is being utilised to resolve this issue. The specific data affected includes results for EM1203707 #11 for EC results. ( 17/04/2011)





## Analytical Results

Sub-Matrix: WATER

| Compound                                                    | Client sample ID |       | Client sampling date / time |  | PMB-01            |  | PMB-02            |  | PMB-03            |  | PMB-04            |  | PMB-05            |  |
|-------------------------------------------------------------|------------------|-------|-----------------------------|--|-------------------|--|-------------------|--|-------------------|--|-------------------|--|-------------------|--|
|                                                             | CAS Number       | LOR   | Unit                        |  | 31-MAR-2012 06:00 |  | 31-MAR-2012 06:30 |  | 31-MAR-2012 10:00 |  | 31-MAR-2012 12:00 |  | 31-MAR-2012 12:15 |  |
| EA005: pH                                                   |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| pH Value                                                    | ----             | 0.01  | pH Unit                     |  | 6.39              |  | 6.37              |  | 6.50              |  | 6.68              |  | 6.36              |  |
| EA010: Conductivity                                         |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Electrical Conductivity @ 25°C                              | ----             | 1     | µS/cm                       |  | 57300             |  | 66200             |  | 76000             |  | 54900             |  | 83500             |  |
| EA015: Total Dissolved Solids                               |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Total Dissolved Solids @180°C                               | GIS-210-010      | 10    | mg/L                        |  | 39700             |  | 49600             |  | 54500             |  | 40000             |  | 60100             |  |
| ED037P: Alkalinity by PC Titrator                           |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Hydroxide Alkalinity as CaCO <sub>3</sub>                   | DMO-210-001      | 1     | mg/L                        |  | <1                |  | <1                |  | <1                |  | <1                |  | <1                |  |
| Carbonate Alkalinity as CaCO <sub>3</sub>                   | 3812-32-6        | 1     | mg/L                        |  | <1                |  | <1                |  | <1                |  | <1                |  | <1                |  |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                 | 71-52-3          | 1     | mg/L                        |  | 62                |  | 60                |  | 67                |  | 35                |  | 60                |  |
| Total Alkalinity as CaCO <sub>3</sub>                       | -----            | 1     | mg/L                        |  | 62                |  | 60                |  | 67                |  | 35                |  | 60                |  |
| ED040F: Dissolved Major Anions                              |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Silicon                                                     | 7440-21-3        | 0.05  | mg/L                        |  | 14.7              |  | 2.43              |  | 0.91              |  | 1.12              |  | 1.38              |  |
| ED041G: Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by DA |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Sulfate as SO <sub>4</sub> - Turbidimetric                  | 14808-79-8       | 1     | mg/L                        |  | 5240              |  | 4300              |  | 8790              |  | 5570              |  | 6980              |  |
| ED045G: Chloride Discrete analyser                          |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Chloride                                                    | 16887-00-6       | 1     | mg/L                        |  | 15900             |  | 13300             |  | 30600             |  | 21400             |  | 33500             |  |
| ED093F: Dissolved Major Cations                             |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Calcium                                                     | 7440-70-2        | 1     | mg/L                        |  | 521               |  | 340               |  | 512               |  | 488               |  | 680               |  |
| Magnesium                                                   | 7439-95-4        | 1     | mg/L                        |  | 992               |  | 910               |  | 1550              |  | 902               |  | 1410              |  |
| Sodium                                                      | 7440-23-5        | 1     | mg/L                        |  | 10600             |  | 8670              |  | 18400             |  | 12800             |  | 18700             |  |
| Potassium                                                   | 7440-09-7        | 1     | mg/L                        |  | 281               |  | 208               |  | 372               |  | 236               |  | 405               |  |
| EG020T: Total Metals by ICP-MS                              |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Aluminium                                                   | 7429-90-5        | 0.01  | mg/L                        |  | 0.49              |  | 0.06              |  | 0.01              |  | 0.03              |  | 0.06              |  |
| Arsenic                                                     | 7440-38-2        | 0.001 | mg/L                        |  | 0.002             |  | 0.003             |  | 0.004             |  | 0.004             |  | 0.006             |  |
| Copper                                                      | 7440-50-8        | 0.001 | mg/L                        |  | 0.084             |  | 0.048             |  | 0.075             |  | 0.039             |  | 0.046             |  |
| Manganese                                                   | 7439-96-5        | 0.001 | mg/L                        |  | 0.453             |  | 0.499             |  | 0.649             |  | 0.260             |  | 0.285             |  |
| Molybdenum                                                  | 7439-98-7        | 0.001 | mg/L                        |  | 0.002             |  | 0.002             |  | 0.002             |  | 0.002             |  | 0.002             |  |
| Nickel                                                      | 7440-02-0        | 0.001 | mg/L                        |  | 0.009             |  | 0.010             |  | 0.020             |  | 0.015             |  | 0.022             |  |
| Selenium                                                    | 7782-49-2        | 0.01  | mg/L                        |  | <0.01             |  | <0.01             |  | <0.01             |  | <0.01             |  | <0.01             |  |
| Uranium                                                     | 7440-61-1        | 0.001 | mg/L                        |  | <0.001            |  | <0.001            |  | <0.001            |  | <0.001            |  | <0.001            |  |
| Zinc                                                        | 7440-66-6        | 0.005 | mg/L                        |  | 0.073             |  | 0.062             |  | 0.081             |  | 0.075             |  | 0.085             |  |
| Iron                                                        | 7439-89-6        | 0.05  | mg/L                        |  | 8.17              |  | 2.49              |  | 9.42              |  | 1.81              |  | 7.48              |  |
| EN055: Ionic Balance                                        |                  |       |                             |  |                   |  |                   |  |                   |  |                   |  |                   |  |
| Total Anions                                                | -----            | 0.01  | meq/L                       |  | 559               |  | 466               |  | 1050              |  | 720               |  | 1090              |  |
| Total Cations                                               | -----            | 0.01  | meq/L                       |  | 576               |  | 474               |  | 963               |  | 661               |  | 974               |  |
| Ionic Balance                                               | -----            | 0.01  | %                           |  | 1.48              |  | 0.88              |  | 4.22              |  | 4.28              |  | 5.72              |  |



## Analytical Results

Sub-Matrix: WATER

| Sub-Matrix: WATER                               |             | Client sample ID |         |        |         | Client sampling date / time |          |        |  |
|-------------------------------------------------|-------------|------------------|---------|--------|---------|-----------------------------|----------|--------|--|
| Compound                                        | CAS Number  | LOR              | Unit    | TNB-01 | TNB-01A | PCWP-02                     | PCWP-02A | HN48   |  |
| EA005: pH                                       |             |                  |         |        |         |                             |          |        |  |
| pH Value                                        | ----        | 0.01             | pH Unit | 5.29   | 5.60    | 5.99                        | 6.05     | 7.02   |  |
| EA010: Conductivity                             |             |                  |         |        |         |                             |          |        |  |
| Electrical Conductivity @ 25°C                  | -----       | 1                | µS/cm   | 54800  | 61100   | 80100                       | 65200    | 11200  |  |
| EA015: Total Dissolved Solids                   |             |                  |         |        |         |                             |          |        |  |
| Total Dissolved Solids @180°C                   | GIS-210-010 | 10               | mg/L    | 40400  | 44400   | 73400                       | 48000    | 6450   |  |
| ED037P: Alkalinity by PC Titrator               |             |                  |         |        |         |                             |          |        |  |
| Hydroxide Alkalinity as CaCO3                   | DMO-210-001 | 1                | mg/L    | <1     | <1      | <1                          | <1       | <1     |  |
| Carbonate Alkalinity as CaCO3                   | 3812-32-6   | 1                | mg/L    | <1     | <1      | <1                          | <1       | <1     |  |
| Bicarbonate Alkalinity as CaCO3                 | 71-52-3     | 1                | mg/L    | 1      | 28      | 66                          | 56       | 249    |  |
| Total Alkalinity as CaCO3                       | -----       | 1                | mg/L    | 1      | 28      | 66                          | 56       | 249    |  |
| ED040F: Dissolved Major Anions                  |             |                  |         |        |         |                             |          |        |  |
| Silicon                                         | 7440-21-3   | 0.05             | mg/L    | 7.35   | 4.41    | 1.75                        | 2.41     | 5.47   |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA |             |                  |         |        |         |                             |          |        |  |
| Sulfate as SO4 - Turbidimetric                  | 14808-79-8  | 1                | mg/L    | 7200   | 5990    | 6560                        | 5570     | 543    |  |
| ED045G: Chloride Discrete analyser              |             |                  |         |        |         |                             |          |        |  |
| Chloride                                        | 16887-00-6  | 1                | mg/L    | 22100  | 15500   | 18900                       | 16500    | 3350   |  |
| ED093F: Dissolved Major Cations                 |             |                  |         |        |         |                             |          |        |  |
| Calcium                                         | 7440-70-2   | 1                | mg/L    | 484    | 472     | 418                         | 485      | 174    |  |
| Magnesium                                       | 7439-95-4   | 1                | mg/L    | 1050   | 1130    | 1370                        | 1060     | 146    |  |
| Sodium                                          | 7440-23-5   | 1                | mg/L    | 13600  | 10700   | 13300                       | 11200    | 1760   |  |
| Potassium                                       | 7440-09-7   | 1                | mg/L    | 281    | 310     | 379                         | 332      | 32     |  |
| EG020T: Total Metals by ICP-MS                  |             |                  |         |        |         |                             |          |        |  |
| Aluminium                                       | 7429-90-5   | 0.01             | mg/L    | 7.58   | 2.62    | 0.10                        | 0.05     | 0.22   |  |
| Arsenic                                         | 7440-38-2   | 0.001            | mg/L    | 0.002  | 0.004   | 0.002                       | 0.005    | 0.005  |  |
| Copper                                          | 7440-50-8   | 0.001            | mg/L    | 0.018  | 0.068   | 0.062                       | 0.019    | 0.030  |  |
| Manganese                                       | 7439-96-5   | 0.001            | mg/L    | 0.152  | 0.210   | 0.677                       | 0.474    | 0.158  |  |
| Molybdenum                                      | 7439-98-7   | 0.001            | mg/L    | 0.001  | 0.002   | 0.002                       | 0.001    | <0.001 |  |
| Nickel                                          | 7440-02-0   | 0.001            | mg/L    | 0.065  | 0.046   | 0.008                       | 0.040    | 0.002  |  |
| Selenium                                        | 7782-49-2   | 0.01             | mg/L    | <0.01  | <0.01   | <0.01                       | <0.01    | <0.01  |  |
| Uranium                                         | 7440-61-1   | 0.001            | mg/L    | 0.002  | <0.001  | <0.001                      | <0.001   | 0.002  |  |
| Zinc                                            | 7440-66-6   | 0.005            | mg/L    | 0.288  | 0.237   | 0.111                       | 0.228    | 0.105  |  |
| Iron                                            | 7439-89-6   | 0.05             | mg/L    | 2.08   | 2.41    | 7.86                        | 8.30     | 2.11   |  |
| EN055: Ionic Balance                            |             |                  |         |        |         |                             |          |        |  |
| Total Anions                                    | -----       | 0.01             | meq/L   | 773    | 562     | 671                         | 582      | 111    |  |
| Total Cations                                   | -----       | 0.01             | meq/L   | 709    | 590     | 722                         | 607      | 98.1   |  |
| Ionic Balance                                   | -----       | 0.01             | %       | 4.34   | 2.36    | 3.63                        | 2.05     | 6.10   |  |



## Analytical Results

Sub-Matrix: WATER

| Sub-Matrix: WATER                               |             | Client sample ID |         |  |  | Client sampling date / time |  | HN73          |  | HN73A         |  |  |  |  |  |
|-------------------------------------------------|-------------|------------------|---------|--|--|-----------------------------|--|---------------|--|---------------|--|--|--|--|--|
| Compound                                        | CAS Number  | LOR              | Unit    |  |  |                             |  | EM1203707-011 |  | EM1203707-012 |  |  |  |  |  |
| EA005: pH                                       |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| pH Value                                        | -----       | 0.01             | pH Unit |  |  |                             |  | 7.33          |  | 6.79          |  |  |  |  |  |
| EA010: Conductivity                             |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Electrical Conductivity @ 25°C                  | -----       | 1                | µS/cm   |  |  |                             |  | 4810          |  | <1            |  |  |  |  |  |
| EA015: Total Dissolved Solids                   |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Total Dissolved Solids @180°C                   | GIS-210-010 | 10               | mg/L    |  |  |                             |  | 2890          |  | <10           |  |  |  |  |  |
| ED037P: Alkalinity by PC Titrator               |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Hydroxide Alkalinity as CaCO3                   | DMO-210-001 | 1                | mg/L    |  |  |                             |  | <1            |  | <1            |  |  |  |  |  |
| Carbonate Alkalinity as CaCO3                   | 3812-32-6   | 1                | mg/L    |  |  |                             |  | <1            |  | <1            |  |  |  |  |  |
| Bicarbonate Alkalinity as CaCO3                 | 71-52-3     | 1                | mg/L    |  |  |                             |  | 198           |  | 4             |  |  |  |  |  |
| Total Alkalinity as CaCO3                       | -----       | 1                | mg/L    |  |  |                             |  | 198           |  | 4             |  |  |  |  |  |
| ED040F: Dissolved Major Anions                  |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Silicon                                         | 7440-21-3   | 0.05             | mg/L    |  |  |                             |  | 7.84          |  | <0.05         |  |  |  |  |  |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Sulfate as SO4 - Turbidimetric                  | 14808-79-8  | 1                | mg/L    |  |  |                             |  | 365           |  | <1            |  |  |  |  |  |
| ED045G: Chloride Discrete analyser              |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Chloride                                        | 16887-00-6  | 1                | mg/L    |  |  |                             |  | 1000          |  | <1            |  |  |  |  |  |
| ED093F: Dissolved Major Cations                 |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Calcium                                         | 7440-70-2   | 1                | mg/L    |  |  |                             |  | 166           |  | <1            |  |  |  |  |  |
| Magnesium                                       | 7439-95-4   | 1                | mg/L    |  |  |                             |  | 90            |  | <1            |  |  |  |  |  |
| Sodium                                          | 7440-23-5   | 1                | mg/L    |  |  |                             |  | 517           |  | <1            |  |  |  |  |  |
| Potassium                                       | 7440-09-7   | 1                | mg/L    |  |  |                             |  | 41            |  | <1            |  |  |  |  |  |
| EG020T: Total Metals by ICP-MS                  |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Aluminium                                       | 7429-90-5   | 0.01             | mg/L    |  |  |                             |  | 0.02          |  | <0.01         |  |  |  |  |  |
| Arsenic                                         | 7440-38-2   | 0.001            | mg/L    |  |  |                             |  | <0.001        |  | <0.001        |  |  |  |  |  |
| Copper                                          | 7440-50-8   | 0.001            | mg/L    |  |  |                             |  | 0.011         |  | <0.001        |  |  |  |  |  |
| Manganese                                       | 7439-96-5   | 0.001            | mg/L    |  |  |                             |  | 0.033         |  | <0.001        |  |  |  |  |  |
| Molybdenum                                      | 7439-98-7   | 0.001            | mg/L    |  |  |                             |  | 0.001         |  | <0.001        |  |  |  |  |  |
| Nickel                                          | 7440-02-0   | 0.001            | mg/L    |  |  |                             |  | <0.001        |  | <0.001        |  |  |  |  |  |
| Selenium                                        | 7782-49-2   | 0.01             | mg/L    |  |  |                             |  | <0.01         |  | <0.01         |  |  |  |  |  |
| Uranium                                         | 7440-61-1   | 0.001            | mg/L    |  |  |                             |  | 0.006         |  | <0.001        |  |  |  |  |  |
| Zinc                                            | 7440-66-6   | 0.005            | mg/L    |  |  |                             |  | 0.153         |  | <0.005        |  |  |  |  |  |
| Iron                                            | 7439-89-6   | 0.05             | mg/L    |  |  |                             |  | <0.05         |  | <0.05         |  |  |  |  |  |
| EN055: Ionic Balance                            |             |                  |         |  |  |                             |  |               |  |               |  |  |  |  |  |
| Total Anions                                    | -----       | 0.01             | meq/L   |  |  |                             |  | 39.8          |  | 0.08          |  |  |  |  |  |
| Total Cations                                   | -----       | 0.01             | meq/L   |  |  |                             |  | 39.2          |  | 0.04          |  |  |  |  |  |
| Ionic Balance                                   | -----       | 0.01             | %       |  |  |                             |  | 0.68          |  | -----         |  |  |  |  |  |



# Appendix G

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MINING  
SOUTHERN IRON OPERATIONS



Appendix G. Soil ARD Monitoring Program, baseline average over three monitoring events 2011-12

|        | pH soil | EC     | Moisture content | Al     | Fe      | Mn    | As    | Cd    | Cr    | Cu    | Pb    | Ni    | Zn    | Hg    | Nitrate + Nitrite | Total Kjeldahl Nitrogen as N | Total Nitrogen as N | Total Phosphorus as P |
|--------|---------|--------|------------------|--------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|------------------------------|---------------------|-----------------------|
| Unit   | pH unit | uS/cm  | %                | mg/kg  | mg/kg   | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg             | mg/kg                        | mg/kg               | mg/kg                 |
| WRD 1  | 6.7     | 8149.9 | 10.0             | 8923.3 | 24313.3 | 141.7 | 8.0   | <1    | 13.3  | 13.5  | 7.0   | 8.9   | 29.1  | <0.1  | 55.8              | 488.0                        | 539.3               | 308.1                 |
| WRD 2  | 7.3     | 1129.9 | 5.5              | 6949.3 | 30666.7 | 264.7 | 11.0  | <1    | 20.2  | 12.0  | 7.3   | 9.7   | 32.3  | <0.1  | 10.7              | 447.3                        | 457.3               | 457.9                 |
| WRD 3  | 7.1     | 444.6  | 4.5              | 5861.8 | 33511.8 | 234.5 | 7.4   | <1    | 24.6  | 12.1  | 10.3  | 7.9   | 27.0  | <0.1  | 8.4               | 266.5                        | 275.3               | 330.8                 |
| REG 4C | 6.6     | 4408.2 | 6.8              | 9761.3 | 28373.3 | 114.8 | 9.5   | <1    | 13.1  | 15.7  | 8.5   | 7.1   | 29.0  | <0.1  | 5.7               | 385.3                        | 389.3               | 399.7                 |



# Appendix H

**arrium**  
MINING  
SOUTHERN IRON OPERATIONS





**SOUTHERN IRON PTY LTD**

**PECULIAR KNOB**

## **LANDFILL ENVIRONMENTAL MANAGEMENT PLAN**

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9<sup>th</sup> September 2011

| Revision | Details                                             | Date                           | Amended By                                                                                         |
|----------|-----------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| 00       | Original                                            | 30 <sup>th</sup> August 2011   | Graeme Noll                                                                                        |
| 0A       | Final (final amendments after EPA comment 6/9/2011) | 9 <sup>th</sup> September 2011 | Graeme Noll<br> |
|          |                                                     |                                |                                                                                                    |
|          |                                                     |                                |                                                                                                    |
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|          |                                                     |                                |                                                                                                    |
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|          |                                                     |                                |                                                                                                    |



# Southern Iron Pty Ltd

ABN 52 119 611 068

## **ENVIRONMENTAL MANAGEMENT POLICY**

Southern Iron Pty Ltd (SI) shares the community's desire to both develop resources and protect and preserve the environment.

All SI activities will meet statutory requirements as a minimum standard and be planned and performed so that adverse effects on the environment are either avoided or appropriately managed.

In fulfilling this policy, SI will:

- Establish a set of environmental policies, objectives and commitments for all its activities;
- Identify its legal environmental responsibilities and comply with all applicable laws and regulations;
- Develop and apply responsible management where laws and regulations do not exist;
- Assess potential environmental impacts before conducting new activities;
- Institute a management system that, amongst other aspects, identifies environmental responsibilities for all its employees and contractors;
- Design and implement a system of work procedures and training programs that will encourage concern and respect for the environment and allow its employees and contractors to know exactly how they are to achieve their environmental objectives and discharge their environmental responsibilities;
- Implement monitoring and auditing systems that will ensure the Company's environmental commitments and objectives are being achieved;
- Develop and foster a corporate culture that encourages continuous improvement in environmental performance.

## Table of Contents

|       |                                                                |    |
|-------|----------------------------------------------------------------|----|
| 1     | Project Overview.....                                          | 6  |
| 1.1   | Project overview.....                                          | 6  |
| 1.2   | Introduction.....                                              | 7  |
| 2     | Local Environmental Factors .....                              | 10 |
| 2.1   | Climate.....                                                   | 10 |
| 2.1.1 | Temperature .....                                              | 10 |
| 2.1.2 | Rainfall .....                                                 | 11 |
| 2.1.3 | Humidity and evaporation .....                                 | 11 |
| 2.1.4 | Wind.....                                                      | 12 |
| 2.2   | Topography and landscape .....                                 | 12 |
| 2.3   | Geology and soils .....                                        | 13 |
| 2.3.1 | Geology .....                                                  | 13 |
| 2.3.2 | Soils.....                                                     | 15 |
| 2.4   | Surface water.....                                             | 15 |
| 2.5   | Groundwater.....                                               | 18 |
| 2.6   | Flora and Fauna, Accommodation MPL 127 .....                   | 19 |
| 2.7   | Landholder Consultation (Pastoralist).....                     | 19 |
| 3     | Landfill Environmental Management Plan (LEMP) .....            | 20 |
| 3.1   | Project Predicted Waste Volumes and SA Landfill Category ..... | 20 |
| 3.2   | Landfill Design and Closure design .....                       | 21 |
| 3.2.1 | Landfill Design and Construction.....                          | 21 |
| 3.2.2 | Landfill Closure Design.....                                   | 21 |
| 3.3   | Operational Procedure .....                                    | 22 |
| 3.4   | Monitoring Requirements and Reporting Schedule .....           | 22 |
| 4     | References .....                                               | 26 |
| 5     | Appendix A.....                                                | 27 |

## LIST of TABLES

|           |                                                                                |    |
|-----------|--------------------------------------------------------------------------------|----|
| Table 1.1 | Southern Iron Tenements covered by the MARP.....                               | 7  |
| Table 2.1 | Annual temperature data .....                                                  | 10 |
| Table 2.2 | Monthly temperature data (°C).....                                             | 10 |
| Table 2.3 | Estimated mean monthly evaporation data.....                                   | 12 |
| Table 2.4 | Accommodation Borefield Details.....                                           | 18 |
| Table 2.5 | Accommodation Borefield Chemical Analysis.....                                 | 18 |
| Table 3.1 | Waste breakdown per day and total for mine life (Tonnes and Cubic metres)..... | 20 |

## LIST of FIGURES

|            |                                                                             |    |
|------------|-----------------------------------------------------------------------------|----|
| Figure 1.1 | Project Location.....                                                       | 8  |
| Figure 1.2 | ML and MPL locations and operational functions .....                        | 9  |
| Figure 2.1 | Rainfall averages at Coober Pedy, Tarcoola, McDouall Peak and Mirikata..... | 11 |
| Figure 2.2 | Regional geology .....                                                      | 14 |
| Figure 3.1 | Accommodation MPL layout.....                                               | 23 |



|            |                          |    |
|------------|--------------------------|----|
| Figure 3.2 | Excavation Details ..... | 24 |
| Figure 3.3 | Closure Details .....    | 25 |

# 1 Project Overview

## 1.1 Project overview

Southern Iron Pty Ltd developed a Mining and Rehabilitation Plan (MARF) and was granted approval by PIRSA to commence mining at Peculiar Knob iron ore mine on the 7<sup>th</sup> of July 2011. The project involves the establishment of an open cut iron ore mine approximately 90 km south east of Coober Pedy (30 km east of the Stuart Highway). Figure 1.1 shows the location of the mining operations in relation to Coober Pedy and Adelaide.

Located approximately 700 km north west of Adelaide, the operation will involve the mining of an estimated 16.7 million tonnes (Mt) of haematite reserve to a vertical depth of approximately 175 metres. Mining will predominantly occur in the south-eastern portion of the ML6314 area using open pit mining techniques and will involve extracting iron ore at a rate of 3.3 Mt/a for approximately six years.

The project also has numerous Miscellaneous Purposes Leases (MPL) for associated mine infrastructure which include haul road/access road, rail loop and crusher plant as well as the accommodation village (Table 1.1). The Stafford Borefield and the Penrhyn Borefield water supply infrastructure for the construction and operations of the Peculiar Knob project will also be developed on MPL areas. Figure 1.2 shows the location of the MPLs in relation to the mine operations. In addition to the Mine Lease (ML) and MPLs for the operations, Extractive Minerals Leases (EML's) have been established in order to source material to facilitate project construction — primarily the haul/access road. The landfill location has been proposed for the accommodation MPL as per reference from the Peculiar Knob MARF.

An EML has also been established over the entire ML area. This allows for the use of overburden and waste rock material in the construction of ancillary infrastructure including the haul road/access road and potentially suitable material for landfill design criteria.

Up to 16 additional EML's will also be established along the haul road/access road and up to 3 within the rail loop/siding. The Southern Iron EML's located outside the mineral lease area are required in order to source material for the construction of the Peculiar Knob haul/access road, accommodation village, rail loop/siding and crusher plant. These EML's include:

- Ten borrow pits within the proposed haul/access road corridor to the west of the Stuart Highway for the construction of the haul/access road
- Six borrow pits within the proposed haul/access road corridor to the east of the Stuart Highway for the construction of the haul/access road
- Three borrow pits within the rail loop/siding and crusher plant
- The use of overburden and waste rock material from the mining operation to construct ancillary infrastructure including the haul/access road.

**Table 1.1 Southern Iron Tenements covered by the MARP**

| Tenement Number                                                                                                                                                           | Tenement Description           | Operational Infrastructure                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------|
| ML6314                                                                                                                                                                    | Mineral Lease                  | Mine pit, waste rock dump, Run of Mine (ROM) pad |
| MPL127                                                                                                                                                                    | Miscellaneous Purposes Licence | Accommodation village                            |
| MPL125, MPL126 and MPL130                                                                                                                                                 | Miscellaneous Purposes Licence | Haul road/access road (east of Stuart Highway)   |
| MPL127, MPL128 and MPL129                                                                                                                                                 | Miscellaneous Purposes Licence | Haul road/access road (west of Stuart Highway)   |
| MPL131                                                                                                                                                                    | Miscellaneous Purposes Licence | Rail loop and crusher plant                      |
| EML6366                                                                                                                                                                   | Extractive Mineral Lease       | Borrow pit over the Mineral Lease                |
| MPL134                                                                                                                                                                    | Miscellaneous Purposes Licence | Penrhyn Borefield water supply infrastructure    |
| MPL133                                                                                                                                                                    | Miscellaneous Purposes Licence | Stafford Borefield water supply infrastructure   |
| EML6363, EML6364, EML6365, EML6367, EML6368, EML6369, EML6370, EML6371, EML6372, EML6373, EML6374, EML6375, EML6376, EML6377, EML6378, EML6379, EML6380, EML6381, EML6382 | Extractive Mineral Lease       | Borrow pits along/adjacent to the Haul Road      |

## 1.2 Introduction

Southern Iron through the Environment Protection Authority (EPA) wishes to propose and apply for works approval and licensing to operate an SB- landfill on MPL 127.

The development and operation of a landfill in South Australia must be carried out in accordance with the Environment Protection Act 1993. The intent of this document is to provide sufficient details on how Southern Iron will maintain a precautionary approach to environmental management to ensure the facility remains compliant with the Environmental Protection Act (1993). As part of the application process a Landfill Environmental Management Plan (LEMP) will be developed taking into consideration the local climate, site geology, groundwater, potential surface water, flora, fauna and community consultation requirements.

The LEMP will document key operational procedures, the landfill design, volumetric considerations, waste type considerations, long term monitoring and the associated reporting time frames/requirements to demonstrate that Southern Iron will be prepared to operate an SB- landfill facility in line with regulatory guidelines prior to construction.



Figure 1.1 Project Location



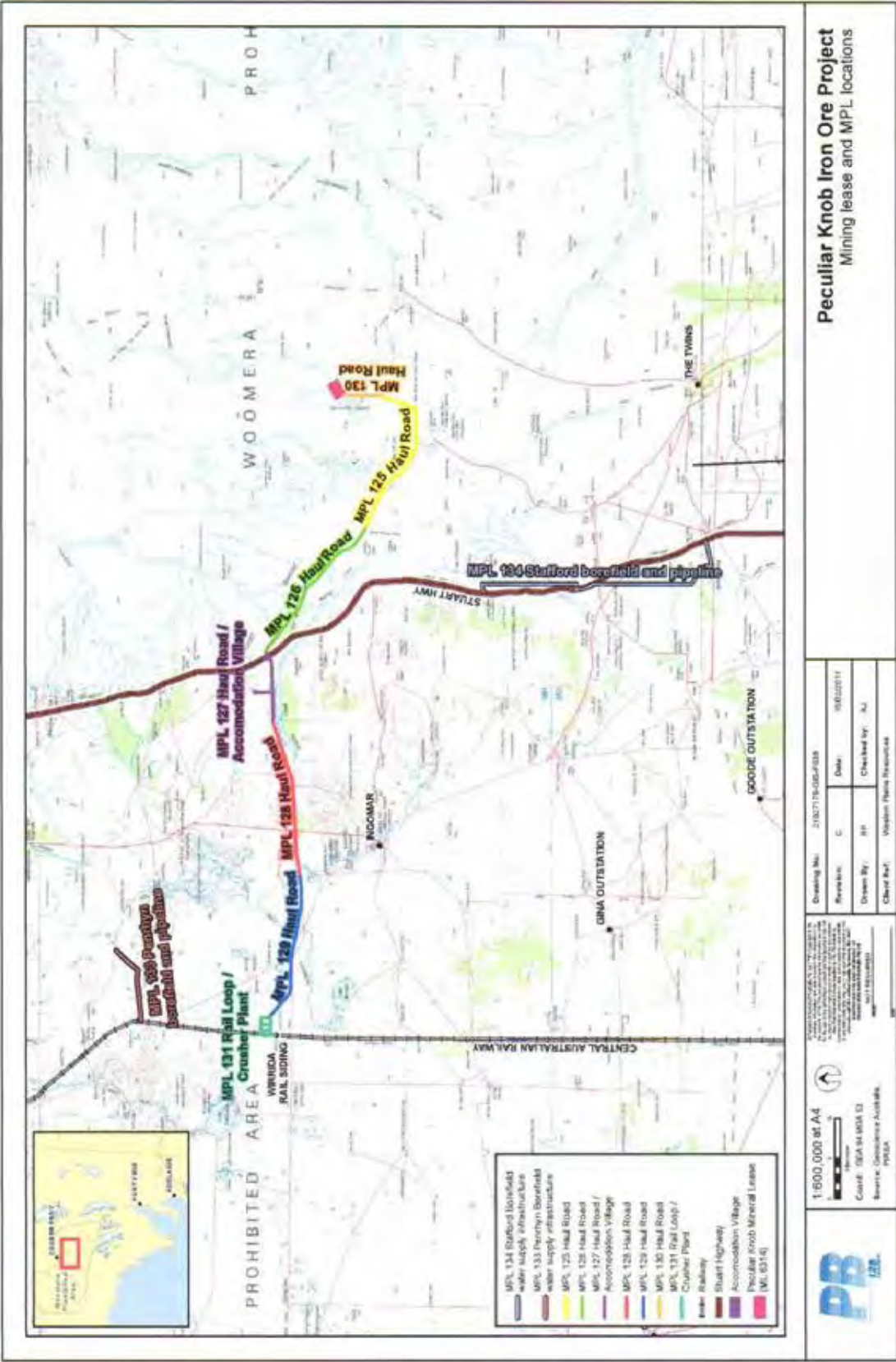


Figure 1.2 ML and MPL locations and operational functions

## 2 Local Environmental Factors

### 2.1 Climate

The climate of the Peculiar Knob region is typical of a semi-arid, desert conditions characterised by mild to hot days, warm nights in the summer months and cold nights from May to September.

The Bureau of Meteorology (BOM) weather stations located at Tarcoola, Coober Pedy, Mirikata, McDouall Peak and Coober Pedy Airport were used to assemble climate data for the Peculiar Knob project area. There are large variations in recorded conditions at each of these sites despite their proximity. The large distance between the weather stations allows the potential for some uncertainty in the application of the data to the mine site but provides an overall idea of the likely climate of the project area.

#### 2.1.1 Temperature

The summer months have the highest temperatures with January being the hottest month. Summer temperatures tend to exceed 33°C with the highest temperature recorded in the region being 48°C at Tarcoola. Minimum winter temperatures are typically less than 10°C in both Coober Pedy and Tarcoola with July being the coldest month. Temperature trends are similar in Coober Pedy and Tarcoola however Tarcoola is a few degrees cooler.

Temperature data for the Tarcoola and Coober Pedy weather stations are summarised in Table 2.1 and Table 2.2.

**Table 2.1 Annual temperature data**

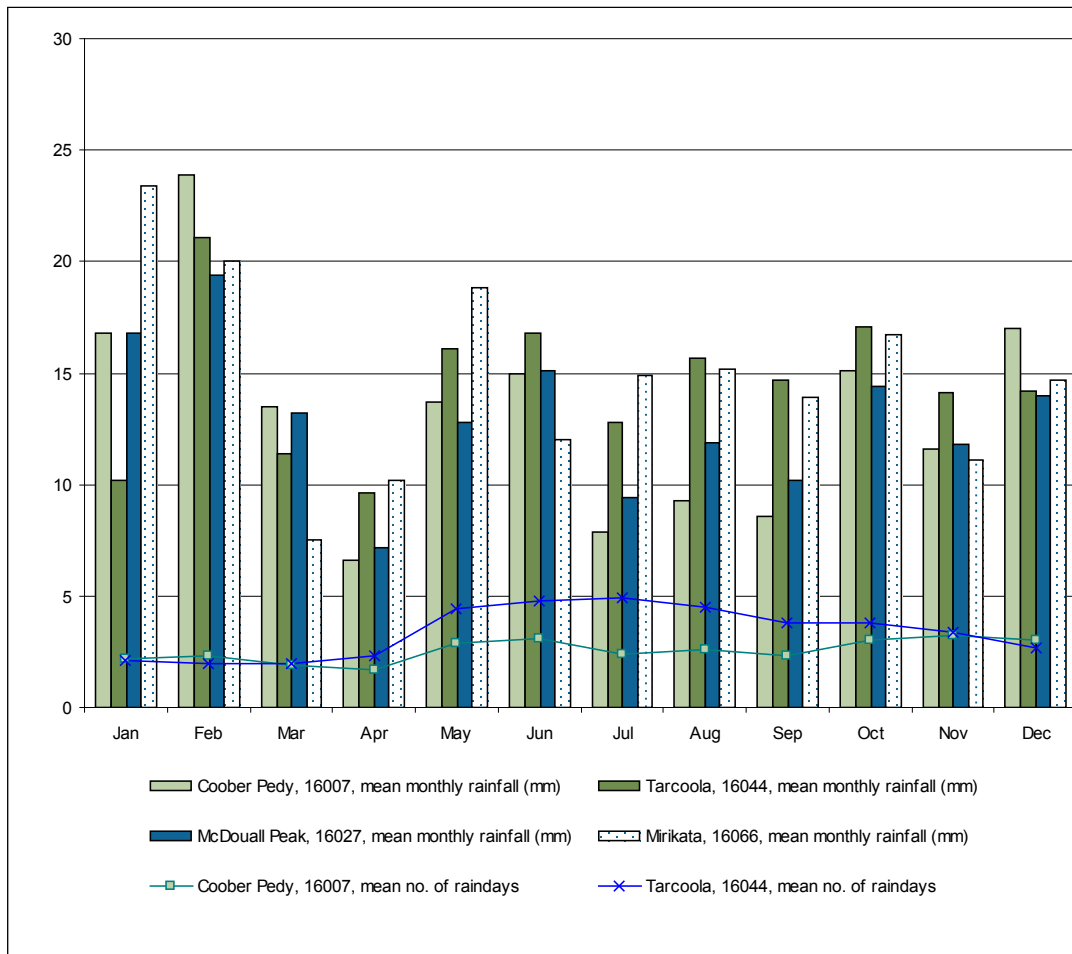
|                          | <b>Tarcoola</b> | <b>Coober Pedy</b> |
|--------------------------|-----------------|--------------------|
| Annual average maximum   | 26.8°C          | 27.5°C             |
| Number of days over 40°C | 20.9            | 23.7               |
| Number of days over 35°C | 64.8            | 76.3               |
| Number of days over 30°C | 129.3           | 142.3              |
| Annual average minimum   | 11.2°C          | 13.4°C             |
| Number of days under 2°C | 22.7            | 2.3                |
| Number of days under 0°C | 5.6             | 0.1                |

**Table 2.2 Monthly temperature data (°C)**

| Station            | Jan  | Feb  | Mar  | Apr  | May  | June | July | Aug  | Sept | Oct  | Nov  | Dec  |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>Tarcoola</b>    |      |      |      |      |      |      |      |      |      |      |      |      |
| <b>Max</b>         | 35   | 34.5 | 31.7 | 26.4 | 21.8 | 18.4 | 18.2 | 20.2 | 23.9 | 27.5 | 30.9 | 33.5 |
| <b>Min</b>         | 17.9 | 17.9 | 15.5 | 11.2 | 7.9  | 5.2  | 4.2  | 5.3  | 8.1  | 11.2 | 14.1 | 16.5 |
| <b>Coober Pedy</b> |      |      |      |      |      |      |      |      |      |      |      |      |
| <b>Max</b>         | 36.2 | 35.5 | 32.7 | 27.6 | 22.2 | 18.8 | 18.7 | 20.9 | 24.6 | 28.8 | 32.2 | 34.4 |
| <b>Min</b>         | 20.6 | 20.7 | 18.2 | 14.1 | 10.1 | 7.3  | 6.3  | 7.4  | 10.1 | 13.6 | 16.6 | 19.1 |

### 2.1.2 Rainfall

Annual rainfall at the four weather stations surrounding the Peculiar Knob project area range from 152.6 mm at McDouall Peak to 184.4 mm at Mirikata. February is the wettest month at three of the four sites where mean monthly rainfall ranges between 19.4 mm and 23.9 mm at Tarcoola, Coober Pedy and McDouall Peak. January is the wettest month at Mirikata with a mean monthly rainfall of 23.4 mm. The maximum number of rain days is five days at Tarcoola during June and July. Temporal rainfall distribution for each site is shown in Figure 2.1.



**Figure 2.1 Rainfall averages at Coober Pedy, Tarcoola, McDouall Peak and Mirikata**

### 2.1.3 Humidity and evaporation

Relative humidity levels at Coober Pedy and Tarcoola are similar with higher recordings at 9 am than 3 pm. Humidity peaks in June (75% at Tarcoola) and is lowest in November (18% at Coober Pedy).

Little evaporation data exists for the area, though the following potential evaporation information (Table 2.3) for the north of the Kingoonya Soil Conservation District (which incorporates McDouall Peak and Ingomar Stations) shows that evaporation far exceeds rainfall in the area ([http://www.soil.pir.sa.gov.au/images/kin\\_rep\\_fig1\\_pg8.gif](http://www.soil.pir.sa.gov.au/images/kin_rep_fig1_pg8.gif)).



**Table 2.3 Estimated mean monthly evaporation data**

| January | April  | July   | October |
|---------|--------|--------|---------|
| 450 mm  | 225 mm | 125 mm | 300 mm  |

#### **2.1.4 Wind**

The nearest wind rose data available was obtained from the Cooper Pedy Airport weather station. In summer the prevailing wind direction is from the south and south east. Based on the differences between the 9 am and 3 pm recordings, winds are generally stronger in the mornings. During the winter months wind direction is from the north to north-east in the morning and by 3 pm has developed into a dominant northerly.

## **2.2 Topography and landscape**

The project area occurs within both the Stony Plains and Gawler Interim Biogeographic Regionalisation for Australia (IBRA) bioregions, specifically within the Breakaway Environmental Association ("Breakaways") as described by Laut et al (1977). The Breakaways is characterised by a dissected silcrete tableland, mesas and extensive gibber-covered foot slopes on deeply weathered shales (refer Photo 2.1).

The project area is located on a gently undulating, elevated, broad plateau. Minor drainage lines are located within the lower relief areas of the site. The broad stony tableland landform supports cracking clays in parts, however, gilgais are shallow and limited across the landscape.



**Photo 2.1 Stony plains at Peculiar Knob with mesas in distance**

## **2.3 Geology and soils**

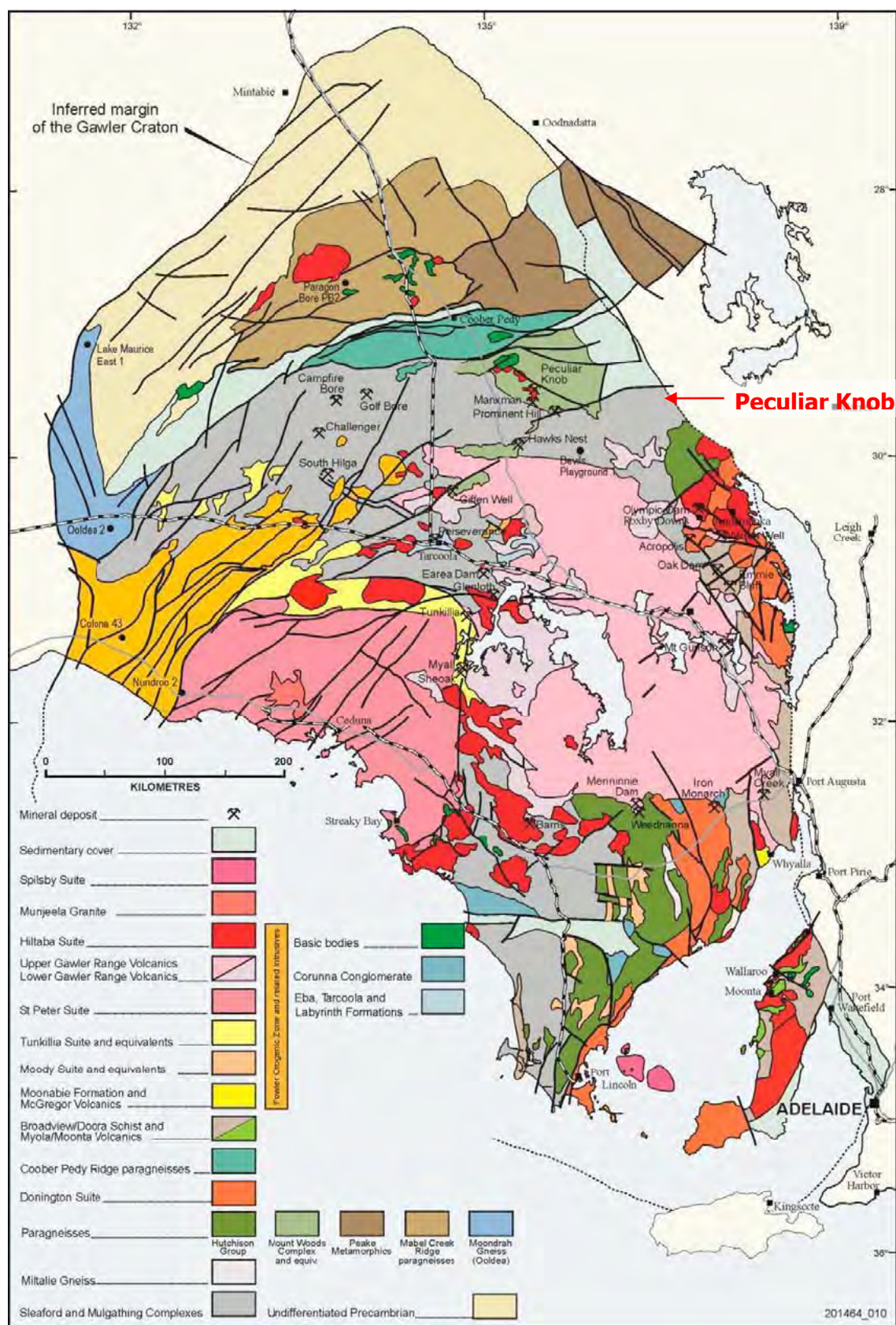
### **2.3.1 Geology**

#### **Regional**

The Peculiar Knob hematite deposit is located in the Mount Woods Inlier of the Gawler Craton (refer Figure 2.2). The Gawler Craton is a stable region of crystalline basement which ranges in age from Archaean to Mesoproterozoic (2,700 to 1,450 million years). Regional aeromagnetic surveys have shown that the Craton is host to separate deformed sedimentary sequences which contain magnetic, iron-rich sediments, known as banded iron formations (BIFs). These basement rocks are poorly exposed and are mostly overlain by thin soils and flay-lying sediments.

#### **Local**

Local geology is shown in Figure 5.4. At Peculiar Knob, the area is completely covered by Quaternary red-brown clay, sand and silt over Cretaceous Bulldog Shale. This shale is highly to moderately weathered, pale brown to grey with minor gypsum (refer Photo 2.2). Some minor sandstone/conglomerate identified as Cadna-owie Formation may occur but generally Bulldog Shale directly overlies bedrock. Bedrock comprises a metasedimentary sequence of BIF, quartzite and quartz-microcline-sillimanite gneiss (Morris *et al.*, 1998) with a metamorphic grade of upper amphibolite facies.



Source: PIRSA 2004 Solid Geology Interpretation of the Gawler (Gawler Craton 2004 – State Of Play)

**Figure 2.2 Regional geology**



### 2.3.2 Soils

The soils of the Peculiar Knob area are of the broad shallow calcareous loamy soil type. Gibbers (pebble size rocks generally quartz rich) commonly occur on the soil surface and form a partial protection from erosion. Gilgais (a hummocky micro-relief pattern of small depressions or raised areas) with cracking clays also occur, and soils developed on alluvium may be sandier.

Where developed on Bulldog Shale the soil profiles are up to 0.5 metres deep. The soils are typically of low biological activity and low in nutrients.



**Photo 2.2 Weathered bulldog shale with gypsum in core**

### 2.4 Surface water

As for most areas within the arid zone of South Australia, the normal condition for lakes and creeks in the region is dry and runoff is ephemeral, occurring only after significant and intense rainfall events, which may be either localised or regional. Rainfall is highly variable with average annual totals ranging from 150 mm to around 200 mm and there is no apparent seasonality of rainfall. Evaporation rates are high and this limited presence of water in lakes and creeks restricts their use to aquatic fauna and flora that can tolerate long periods of drought. However, these creeks and lakes would be appealing to stock and other fauna after a significant rainfall event. Due to this limited naturally occurring permanent water in the region water supplies for stock, industrial and domestic purposes are generally sourced from local groundwater, local surface water stored in dams and natural ephemeral waters or from outside of the district (SAAL NRM Board 2011).

The Peculiar Knob project area lies approximately 225 km northwest of Lake Eyre which is a playa lake, acting as a collection area for surface water flows and a discharge zone for

groundwater flows. The Peculiar Knob accommodation MPL lies at an elevation approximately 175-180 metres above sea level in the upper catchment of Lake Wirrida 20km away (refer Figure 2.3).

The accommodation village/ proposed landfill MPL is located off the mineral lease and in relatively flat terrain with runoff being shallow by nature with relatively low flow velocities. Flood protection will consist of cut-off drains/diversion channels constructed to suit the site conditions, with silt traps as appropriate constructed to prevent sediment entering natural water courses around the accommodation MPL.



**Photo 2.3 Ill-defined creek line with mesas in the background**





## 2.5 Groundwater

The accommodation Camp Borefield is located near the south-western margin of the Eromanga Basin (part of the Great Artesian Basin). In the area the aquifer is non-artesian and unconfined (draft report, Rockwater 2011). Groundwater in the area occurs in sandstone of the Cadna-Owie formation and the Algebuckina Sandstone. The surface water level (SWL) in production and monitoring bores range from 54.5 to 61 metres from surface level (Table 2.4). The water body is saline, with electrical conductivity (EC) ranging from 17,800 to 71,200  $\mu\text{S}/\text{cm}$ , and is proposed to be used for construction and operation of the Peculiar Knob mine.

**Table 2.4 Accommodation Borefield Details**

|                         | eMGA (9)  | nMGA       | Bore ID  | Depth | SWL  |
|-------------------------|-----------|------------|----------|-------|------|
| Accommodation Borefield | 497317.00 | 6739981.00 | PKWB-01A | 84    | 59   |
|                         | 500482.00 | 6736489.00 | PKWB-03A | 77    | 56.5 |
|                         | 497318.44 | 6739993.61 | PKWB-01  | 82    | 59   |
|                         | 498199.91 | 6738801.18 | PKWB-02  | 77    | 54.5 |
|                         | 500500.84 | 6736497.13 | PKWB-03  | 75.5  | 56.5 |
|                         | 499791.05 | 6740907.05 | PKWB-04A | 82    | 61   |
|                         | 498750.00 | 6737345.00 | PKWB-05  | 73    | 56   |
|                         | 499135.00 | 6737350.00 | PKWB-06  | 72.5  | 54.5 |

**Table 2.5 Accommodation Borefield Chemical Analysis**

|                                   |                         | PCWP-02   | PCWP-02A  | TNB-01    | TNB-01A   | PMB-01    | PMB-02    | PMB-03    | PMB-04    | PMB-05    |
|-----------------------------------|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Date Sampled                      | Units                   | 3/17/2011 | 3/11/2011 | 3/19/2011 | 3/15/2011 | 3/17/2011 | 3/17/2011 | 3/17/2011 | 3/17/2011 | 3/17/2011 |
| pH                                | pH units                | 6.84      | 6.94      | 4.59      | 7.08      | 7.49      | 7.2       | 7.1       | 7.26      | 7.05      |
| Electrical Conductivity           | $\mu\text{S}/\text{cm}$ | 57500     | 64200     | 56500     | 60600     | 17800     | 54000     | 71200     | 42600     | 62500     |
| Total Dissolved Solids            | mg/L                    | 55400     | 59100     | 53300     | 57400     | 15300     | 50000     | 68400     | 41200     | 55200     |
| Calcium                           | mg/L                    | 735       | 764       | 742       | 767       | 292       | 726       | 755       | 639       | 863       |
| Magnesium                         | mg/L                    | 1540      | 1860      | 1660      | 1990      | 365       | 1520      | 2350      | 983       | 1750      |
| Sodium                            | mg/L                    | 15000     | 17500     | 14900     | 16800     | 3870      | 14000     | 19500     | 10500     | 16000     |
| Potassium                         | mg/L                    | 477       | 549       | 471       | 509       | 109       | 375       | 575       | 298       | 526       |
| Chloride                          | mg/L                    | 28100     | 32100     | 23000     | 29800     | 6270      | 26500     | 35200     | 19200     | 31000     |
| Sulphate                          | mg/L                    | 5230      | 6640      | 6220      | 7220      | 1560      | 5410      | 9140      | 4050      | 6070      |
| Total Hardness as $\text{CaCO}_3$ | mg/L                    | 8160      | 9560      | 8700      | 10100     | 2230      | 8060      | 11600     | 5640      | 9360      |
| Bicarbonate as $\text{CaCO}_3$    | mg/L                    | 52        | 55        | <1        | 42        | 114       | 54        | 58        | 43        | 45        |
| Carbonate as $\text{CaCO}_3$      | mg/L                    | <1        | <1        | <1        | <1        | <1        | <1        | <1        | <1        | <1        |
| Iron (Total)                      | mg/L                    | <0.25     | 9         | <0.25     | <0.25     | 2.84      | <0.25     | 4.65      | 0.46      | <0.05     |
| Manganese                         | mg/L                    | 0.557     | 0.608     | 0.171     | 0.258     | 0.553     | 0.472     | 0.882     | 0.197     | 0.524     |
| Aluminium                         | mg/L                    | <0.05     | <0.05     | 8.64      | <0.05     | 0.05      | <0.05     | <0.01     | <0.01     | <0.01     |
| Nitrate as N                      | mg/L                    | 0.08      | <0.01     | <0.01     | <0.01     | 0.04      | 0.47      | 0.47      | <0.01     | 0.07      |
| Nitrite as N                      | mg/L                    | <0.01     | <0.01     | <0.01     | <0.01     | <0.01     | <0.01     | <0.01     | <0.01     | 0.03      |
| Silica                            | mg/L                    | 11.9      | 10.6      | 25.4      | 17.2      | 9.91      | 10.8      | 10.2      | 13.5      | 12        |
| Reactive Phosphorus as P          | mg/L                    | <0.01     | <0.01     | <0.01     | <0.01     | 0.02      | <0.01     | <0.01     | <0.01     | <0.01     |
| Anion/Cation Balance              | %                       | 4.18      | 3.99      | 3.54      | 2.28      | 0.99      | 4.98      | 4.03      | 4.29      | 5.58      |



## **2.6 Flora and Fauna, Accommodation MPL 127**

Vegetation that is associated with MPL 127 consists of low open woodlands over scattered gibber plains (EBS, 2007). Southern Iron has a budget agreement setup as part of the Significant Environmental Benefit Scheme within the MARP for offsetting clearing. Also, as part of the EPBC referral Southern Iron has made a donation to support research programs into rare and endangered species in the area, particularly the Thick-billed Grasswren. Effect on vegetation would only be during site clearing, to setup cells and Southern Iron will track and monitor this process as part of the clearing permit procedure.

The risk to flora and fauna is deemed minor for the purpose of operating a landfill.

## **2.7 Landholder Consultation (Pastoralist).**

Community consultation regarding the Peculiar Knob landfill site and operating procedure will be communicated to the pastoralist as per the conditions in the Peculiar Knob MARP. All community consultation meetings are documented, recorded and reported in the annual MARCR to PIRSA.

The local pastoralists comments will be included into the LEMP where necessary.

### 3 Landfill Environmental Management Plan (LEMP)

#### 3.1 Project Predicted Waste Volumes and SA Landfill Category

Domestic wastes from the accommodation village and service areas, and industrial wastes such as waste oils, packaging, construction material and drums will be generated during operations.

The above waste such as municipal solid waste and industrial general waste will be stored in the landfill within the accommodation village MPL in accordance with EPA landfill guidelines and EPA regulations.

Paper and recyclables including plastic, metal and glass will be collected by a contractor for off-site re-use. Scrap metals and tyres will also be collected on site for recycling.

Hazardous materials (mainly hydrocarbons and explosives) require specific transport, storage, handling and disposal procedures and will be segregated. These materials will be stored in designated bunded operational areas with periodic collection and disposal by a licensed contractors (or suppliers).

The predicted volumes of waste for the project have been calculated based on a similar sized mining accommodation village and mining project, then quantified for the life of the project (six years) (Table 3.1).

**Table 3.1 Waste breakdown per day and total for mine life (Tonnes and Cubic metres)**

|                          | Population | kg/day | total kg waste per day |
|--------------------------|------------|--------|------------------------|
| waste per person per day | 200        | 1.5    | 300                    |

| <b>Breakdown</b>                   | %  | Total kg/day | Mine Life/T | Cubic metres/day | Mine Life/M3 |
|------------------------------------|----|--------------|-------------|------------------|--------------|
| Compostables / Putrescibles<br>40% | 40 | 120          | 262.8       | 1.5              | 3285         |
| Paper 10% -                        | 10 | 30           | 65.7        | 1                | 2190         |
| Cans 10% -                         | 10 | 30           | 65.7        | 1                | 2190         |
| General Waste 40%                  | 40 | 120          | 262.8       | 1.5              | 3285         |
|                                    |    | <b>300</b>   | <b>657</b>  | <b>5</b>         | <b>10950</b> |

\*\*\*Note – real time volumes and kg/day provided by Australian Camp Services.

Construction waste during the initial phase of operations have been estimated conservatively at approximately 50 tonnes, although Southern Iron have made a commitment to Reduce, Re-use and Recycle (3R) where ever possible. It is envisaged that large volumes of construction waste will be subject the Southern Iron's 3R's program.

Based on the waste type and projected volume (tonnes) for total mine life the Peculiar Knob Landfill facility will be category SB-. Although, there is a potential for extending the mine life as mining operations and further drilling takes place (potentially approximately 12 years).

### **3.2 Landfill Design and Closure design**

The landfill design was created and references EPA guidelines for Environmental management of landfill facilities (municipal solid waste and commercial and industrial general waste, 2007), in accordance with the regulations for an SB- facility. The landfill construction and closure design can be seen in Figure 3.2 and Figure 3.3 and the layout in relation to the accommodation MPL is shown in Figure 3.1 (cells marked in green).

#### **3.2.1 Landfill Design and Construction**

Cells will be constructed in phases (four individual phases), this will be based on the level of demand for space. Based on the volume of material Southern Iron may need four separate cells over the life of the project. It is proposed that once one cell is at capacity a new cell is constructed, then the original cell is rehabilitated to the point of closure.

As can be seen in Figure 3.2 the minimum cell grading is 2% for the length of any cell, therefore draining any potential leachate away from the active cell (EPA guidelines- Environmental management of landfill facilities, 2007). The base of each constructed cell will be compacted sub-grade material or another suitable alternative to a thickness of 0.15m (minimum dry density ratio of 95% standard compaction AS 1289 5.1.1). Each cell will be 20m wide, 100m long and be between 1 and 2m deep after the compaction of the subgrade base liner. It is proposed that excavated material be used as berms around each cell providing wind protection and a physical barrier, only the tip face will not have a berm. This will then be used as periodical fill as per operation procedure in section 3.3. If necessary Southern Iron have several EML leases (Table 1.1) to source extra subsoil and subgrade if necessary during backfill and closure.

The leachate control system will be simple and consist of grading each cell so that the overall fall is towards the collection sump. Collection sump will be made of concrete in the dimensions of 1m x 1m x 1m and will be inspected weekly, via the inspection standpipe (4" schedule 120 poly pipe). In the event that leachate needs to be emptied, the environmental officer will pump the material into 205L drums for evaporation and subsequent disposal of the remaining solids.

The landfill site has been located to utilise existing fence lines associated with the accommodation MPL, however, where necessary fences will be constructed to minimise fauna interaction with the landfill.

#### **3.2.2 Landfill Closure Design**

The landfill closure design can be seen in Figure 3.3, for the purpose of the design the compacted layer of subgrade material is shown on the drawing above the waste material, this is also referred to as the minimum cover required in the daily operation procedure in section 3.3. In addition to the 0.3m subgrade, 0.6m subsoil will be spread over the full landfill cell and an additional layer of topsoil between 0.1 and 0.3m will be spread on top of this layer (Figure 3.3). It should be noted that topsoil in the Peculiar Knob area is thin and at times consist of gibber soil, therefore limited re-grow is common (refer Photo 2.3, uncleared gibber plain).

As per the closure design, the land formation in Figure 3.3 has been designed to promote low velocity water runoff and limit erosion. Also, the structure has a combined trans-evaporation layer that will promote long term evaporation and therefore reduce the risk of leachate build-up.

### 3.3 Operational Procedure

The major source of waste will be from the accommodation facilities located onsite. Southern Iron has contracted Australian Camp Services Pty Ltd to manage the camp and will also handle the majority of the waste disposal duties. It is not envisaged that waste material will be disposed on a daily basis, therefore the dot-point procedure below provides a guide for a typical end of week disposal event:

- Collect waste from various sources at the accommodation and operations areas.
- Carryout 3R's assessment.
- Segregate potentially hazardous waste for pickup by licensed contractor.
- Transport waste to the landfill
- Deposit waste material at the tip face and compress waste into tip face.
- Drive the boundary of the landfill site and return any wind blow material back to the tip face.
- Using an excavator or bulldozer push berm sections over the freshly deposited waste to minimise wind blown waste and minimise fauna interaction.
- Where necessary undertake compaction of tip face to secure subgrade soils and conserve landfill space (0.3m coverage as a minimum).
- Dip check the leachate level within concrete sump. Leachate will be pumped when sump capacity reaches 50%.

Once waste has been deposited Southern Iron intends to cover material on an each occasion basis.

### 3.4 Monitoring Requirements and Reporting Schedule

Monitoring requirements will be undertaken as per the Peculiar Knob MARP, and reported in the MARCR document annually to PIRSA. This includes monitoring groundwater, surface water, flora, fauna, dust and land management.

In addition to the requirements stated in the Peculiar Knob MARP, Southern Iron will as a requirement, monitor and record waste volumes weekly in cubic meters and tonnes and report quantities to the SA EPA as part of the annual licensing for a landfill facility in South Australia.

As part of the Peculiar Knob operations the landfill site will be audited as part of the weekly site audit. Any non-conformances will be report to the Site Environmental Officer, who will follow the Southern Iron corrective action procedure to record and implement corrective actions to resolve the issue.

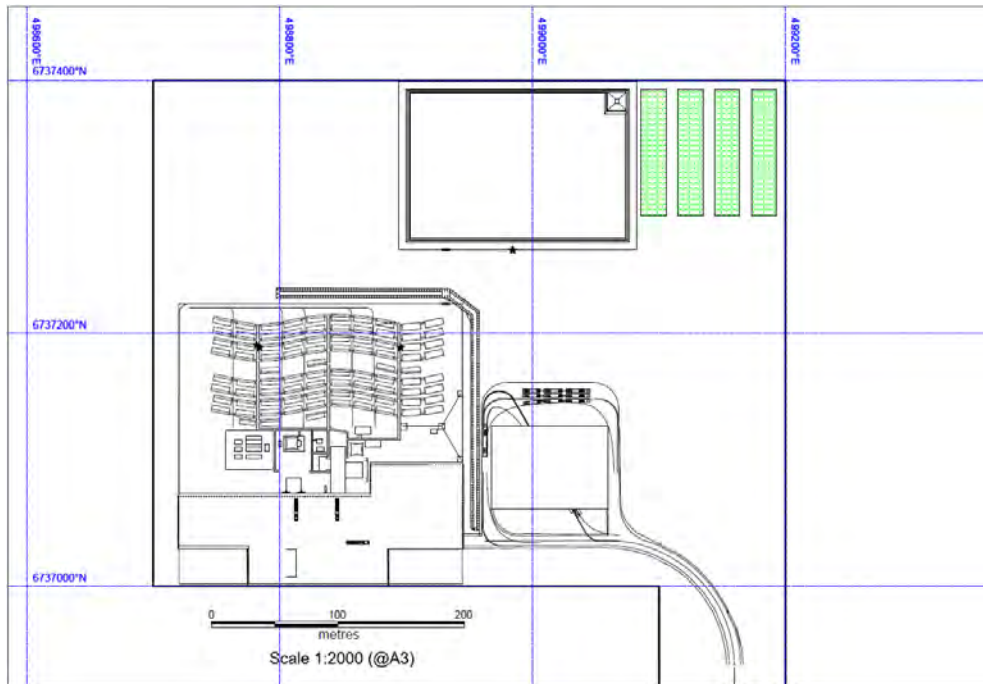
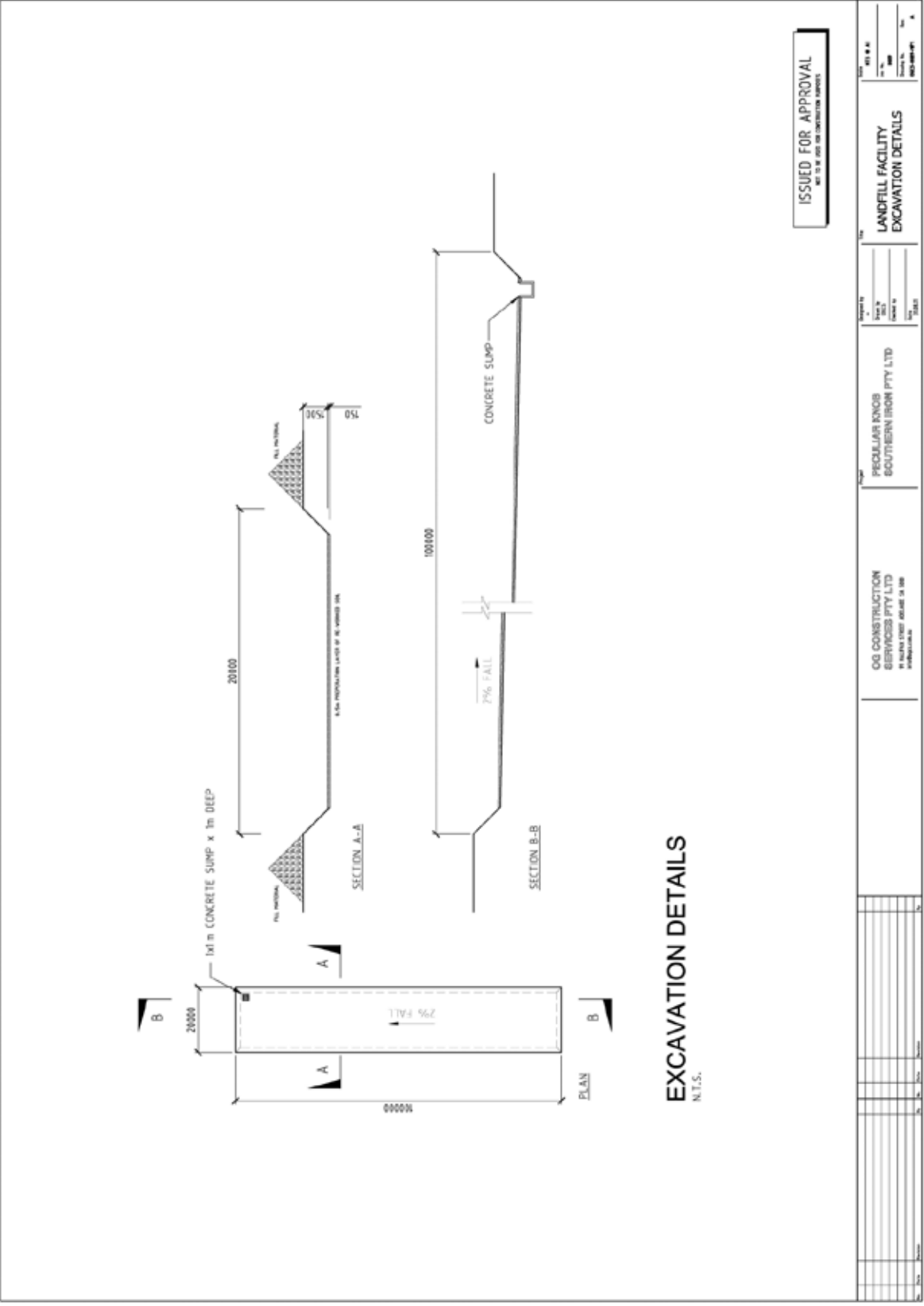


Figure 3.1 Accommodation MPL layout.



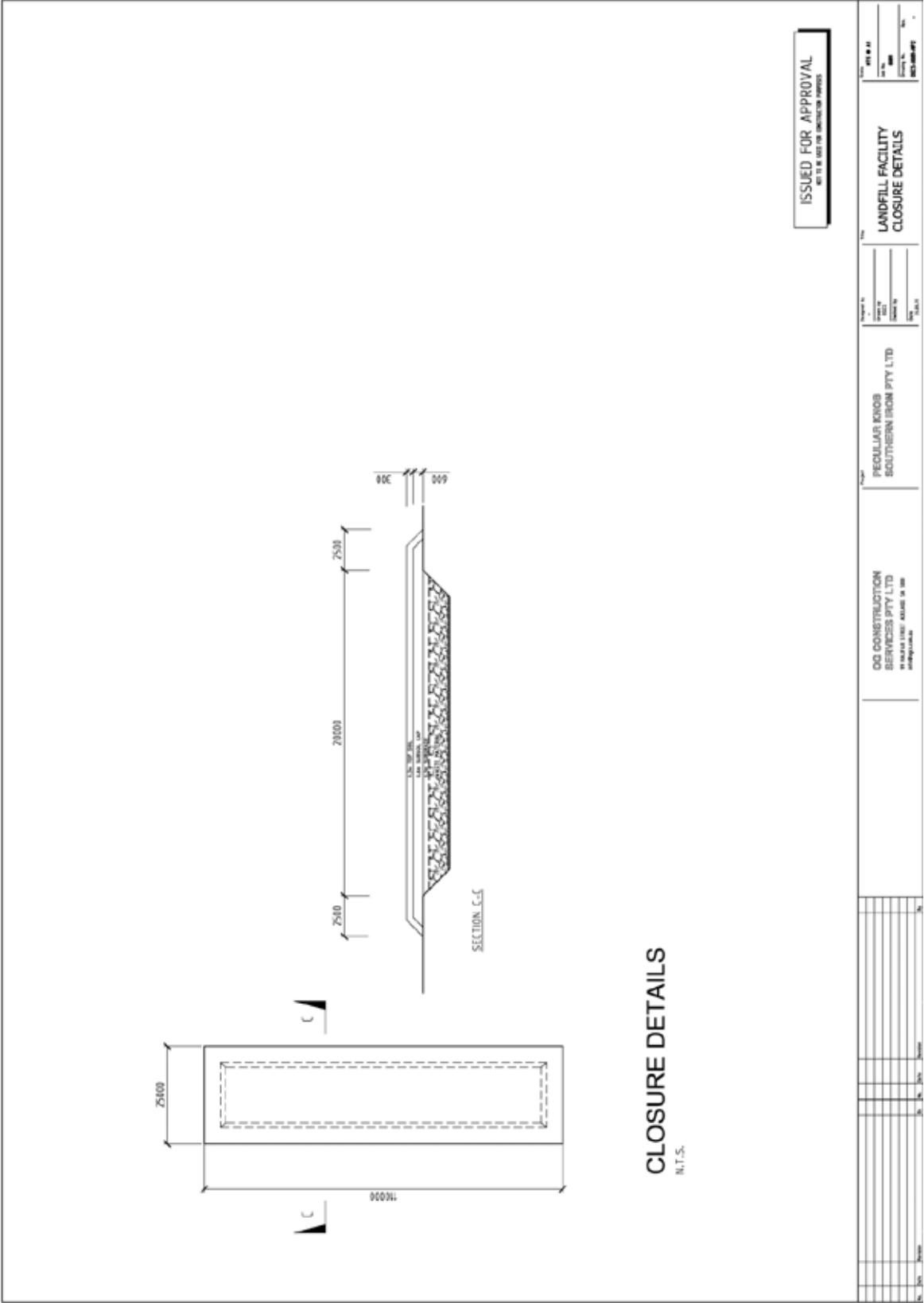


Figure 3.3 Closure Details



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## **5 Appendix A**

Landfill License application

Works Approval application

# Appendix I

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|             |   |        |         |   |            |     |       |         |         |          |
|-------------|---|--------|---------|---|------------|-----|-------|---------|---------|----------|
| PK_EML_6372 | 1 | 507369 | 6733340 | 2 | 22/04/2012 | 1   | 184.9 | 369.8   | 184.9   |          |
| PIT 6       | 2 | 507225 | 6733456 |   | 22/04/2012 |     |       |         |         |          |
|             | 1 | 507328 | 6733234 | 3 | 22/04/2012 | 1.5 | 221.7 | 665.1   | 498.825 |          |
|             | 2 | 507153 | 6733370 |   | 22/04/2012 |     |       |         |         |          |
| PK_EML_6378 | 1 | 478829 | 6732158 | 6 | 23/04/2012 | 2   | 261.2 | 1567.2  | 1567.2  |          |
| PIT 12      | 2 | 478576 | 6732093 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 478835 | 6732097 | 5 | 23/04/2012 | 1.5 | 220.5 | 1102.5  | 826.875 |          |
|             | 2 | 478620 | 6732048 |   | 23/04/2012 |     |       |         |         |          |
| PK_EML_6379 | 1 | 473310 | 6731380 | 6 | 23/04/2012 | 2   | 274   | 1644    | 1644    |          |
| PIT 13      | 2 | 473584 | 6731377 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 473582 | 6731476 | 6 | 23/04/2012 | 2   | 300.5 | 1803    | 1803    |          |
|             | 2 | 473282 | 6731458 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 473582 | 6731385 | 3 | 23/04/2012 | 1   | 103.1 | 309.3   | 154.65  |          |
|             | 2 | 473584 | 6731488 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 473283 | 6731480 | 7 | 23/04/2012 | 3   | 50    | 350     | 525     |          |
|             | 2 | 473233 | 6731481 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 473233 | 6731481 | 5 | 23/04/2012 | 2   | 62.3  | 311.5   | 311.5   |          |
|             | 2 | 473245 | 6731420 |   | 23/04/2012 |     |       |         |         |          |
| PK_EML_6380 | 1 | 468489 | 6732260 | 6 | 23/04/2012 | 2   | 308.1 | 1848.6  | 1848.6  |          |
| PIT 14      | 2 | 468189 | 6732330 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 468181 | 6732334 | 4 | 23/04/2012 | 2   | 27.9  | 111.6   | 111.6   |          |
|             | 2 | 468155 | 6732344 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 468186 | 6732269 | 6 | 23/04/2012 | 1.5 | 24    | 144     | 108     |          |
|             | 2 | 468210 | 6732269 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 468188 | 6732219 | 6 | 23/04/2012 | 2   | 283.9 | 1703.4  | 1703.4  |          |
|             | 2 | 468468 | 6732172 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 468474 | 6732172 | 4 | 23/04/2012 | 1.5 | 93.9  | 375.6   | 281.7   |          |
|             | 2 | 468497 | 6732263 |   | 23/04/2012 |     |       |         |         |          |
| PK_EML_     | 1 | 457940 | 6735446 |   | 23/04/2012 | 3   |       | 4361.05 |         | 13083.15 |
| PIT 17      | 2 | 457928 | 6735354 |   | 23/04/2012 |     |       |         |         |          |
|             | 3 | 457834 | 6735360 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 457820 | 6735348 | 5 | 23/04/2012 | 3   | 125   | 625     | 937.5   |          |
|             | 2 | 457695 | 6735351 |   | 23/04/2012 |     |       |         |         |          |
|             | 1 | 457696 | 6735359 |   | 23/04/2012 | 3   |       | 6183.45 |         | 18550.35 |
|             | 2 | 457713 | 6735413 |   | 23/04/2012 |     |       |         |         |          |
|             | 3 | 457826 | 6735391 |   | 23/04/2012 |     |       |         |         |          |
|             | 4 | 457810 | 6735350 |   | 23/04/2012 |     |       |         |         |          |

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# Appendix J

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## **Thick-billed Grasswren Biodiversity Offset Strategy for Southern Iron's Peculiar Knob Iron Ore Project**

### **July 2012 Update**

Nature Foundation SA is undertaking a project to research the ecology and behaviour of the Thick-billed Grasswren as a Biodiversity Offset Strategy. The project's official name is "Biodiversity Offset Strategy for impacts to the Thick-billed Grasswren (Eastern subspecies) (*Amytornis textilis modestus*)".

Southern Iron Pty Ltd's approval for the development of the Peculiar Knob Iron Ore Project contains a condition from the Commonwealth Government that a strategy is implemented to offset impacts resulting from the removal of Thick-billed Grasswren habitat. This is a special condition as this wren is an endangered species listed by the Commonwealth Environment Protection and Biodiversity Conservation Act.

Nature Foundation SA has selected the BirdLab at Flinders University, directed by highly experienced researchers Dr Sonia Kleindorfer and Dr Jeremy Robertson, to undertake the research project planned to run until December 2015. The research aims are to assess if habitat alteration from mining activity, including habitat restoration, is correlated with grasswren gene flow, song behaviour, phenotypic variation, and predation risk. It will focus on learning more about the fundamental biology of grasswrens and will also explore what factors affect the distribution and abundance of birds across the landscape.

The researchers will monitor the Thick-billed Grasswren at sites in the Peculiar Knob area and 220 km to the east at Witchelina Nature Reserve, owned by Nature Foundation SA and where 27 territories of the wren have been identified in the same Chenopod Shrublands habitat.

The research is in the project development phase with the main focus on recruiting additional members to the research team. Flinders University has advertised for two new PhD positions. The first is a Molecular Ecologist to develop microsatellites to study the genetic diversity and gene flow between the disjunct populations of grasswrens. The second is a Behavioural Ecologist to undertake field studies of individually marked grasswrens, comparing their morphology and determining their foraging strategies. One PhD candidate has been secured and the second role will be filled by September. The in-field research team, comprising the PhD students and supplemented with Flinders University Honours students in biology, will be



supervised by an experienced post-doctorate to be added to the team by September for the first breeding season field study in September-October.

Research design and monitoring site selection will be complete by December 2012 after the first round of field visits. Researchers will be developing the study methodology in the following research areas:

- Understanding specific habitat requirements
- Response to management actions (vegetation changes and interactions with habitat requirements)
- Abundance and population viability
- Population genetics, Social system and Taxonomy
- Predation and population viability
- Radio-tracking and dispersal (within existing habitat and management induced changes)

Nature Foundation SA has also recruited Dr Greg Johnston, formerly of the University of South Australia, who commences in July as our Conservation Ecologist and will project manage the Foundation's relationship with Flinders University.

The first research progress report is due in December 2012.

Andrew Reilly

Chief Executive, Nature Foundation SA

10<sup>th</sup> July 2012