



# **DONALDSON COAL PTY LIMITED**

## **ABEL MINE**

### **Subsidence Management Plan**

### **Environmental Management Plan SMP Area 1**


**July 2010**

# Document Control

## Description

<b>Document No.</b>	Abel SMP Area 1
<b>Title</b>	Environmental Management Plan
<b>General Description</b>	To monitor surface and groundwater (quality and quantity and flow patterns, flora, fauna and develop a response and management strategy in relation to any impacts in any surface areas, including final landform and intended post mining use, that may be affected by subsidence from mining in Area 1 at Abel Mine.
<b>Key Support Documents</b>	Abel Mine SMP Area 1

## Approvals

<b>ORIGINATOR</b>	Phillip Brown	Position Environmental Manager	Signed 	Date 2/7/10
<b>REVIEWED</b>	Tony Sutherland	Position Technical Services Manager- Underground Operations	Signed 	Date 2/7/10
<b>APPROVED</b>	Matthew Blackham	Position Manager of Mining Engineering	Signed 	Date 2-7-10
<b>APPROVED</b>	Name	Position Director Environmental Sustainability NSW Department of Primary Industries Mineral Resources	Signed	Date

## Revisions

Version #	Date	Description	By	Checked	Approved	
					Name	Signed
1	16 June 2010	DECC-NOW Review	Fergus Hancock	TS		
2	2 July 2010	Coal & Allied Review		TS		

The nominated Coordinator for this document is	Manager of Mining Engineering
--	-------------------------------

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/7/2010	Revision date	16/06/2011	Page 2 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

## TABLE OF CONTENTS

<b>1</b>	<b>PURPOSE SCOPE AND OBJECTIVES</b>	<b>5</b>
<b>2</b>	<b>RESPONSIBILITIES AND RESOURCES</b>	<b>5</b>
<b>3</b>	<b>CONSULTATION AND SUBMISSION</b>	<b>5</b>
<b>4</b>	<b>BACKGROUND</b>	<b>5</b>
<b>5</b>	<b>APPROACH TO ENVIRONMENTAL MONITORING</b>	<b>6</b>
<b>6</b>	<b>IDENTIFICATION OF RISKS</b>	<b>7</b>
<b>7</b>	<b>MONITORING AND INSPECTION SCHEDULE</b>	<b>9</b>
7.1	Subsidence Monitoring	9
7.2	Subsidence Inspections	9
7.3	Scope and Frequency of Inspections	9
7.4	Surface Water	13
7.4.1	Predicted Impacts .....	13
7.4.2	Quality .....	13
7.4.3	Quantity.....	13
7.5	Groundwater	13
7.5.1	Predicted Impacts .....	16
7.5.2	Quality .....	16
7.5.3	Quantity.....	17
7.6	Aboriginal Sites	18
7.6.1	Predicted Impacts .....	18
7.7	Flora and Fauna	18
7.7.1	Predicted Impacts .....	18
<b>8</b>	<b>MANAGEMENT OF IMPACTS</b>	<b>19</b>
8.1	Trigger	20
8.2	Action / Response	20
8.3	Notification	20
8.4	Mitigation / Remediation	20
<b>9</b>	<b>REPORTING AND ACCESS TO INFORMATION</b>	<b>29</b>
<b>10</b>	<b>REVIEW</b>	<b>29</b>
	<b>APPENDIX A – RISK ASSESSMENT RESULTS TABLE</b>	<b>30</b>

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 3 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

## LIST OF FIGURES

<i>Figure 1 – SMP Plan 2 – Natural and man made features .....</i>	<i>10</i>
<i>Figure 2 - Location of existing Piezometer network .....</i>	<i>14</i>
<i>Figure 3 – Location of proposed surface extensometers and piezometers.....</i>	<i>15</i>

## LIST OF TABLES

<i>Table 1 – Inspection and Survey Schedule.....</i>	<i>11</i>
<i>Table 2 Groundwater and surface water monitoring program .....</i>	<i>17</i>
<i>Table 3 – Ecology Monitoring Program.....</i>	<i>19</i>
<i>Table 4 – Triggers, Actions and Management responses .....</i>	<i>22</i>

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 4 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

---

## 1 PURPOSE SCOPE AND OBJECTIVES

---

This Environmental Management Plan (EMP) describes the processes developed, to monitor and manage any impacts in any surface areas that may be affected by subsidence arising from mining (pillar extraction) by Abel Mine in the Subsidence Management Plan Area 1.

This EMP has the following objectives:

- Monitoring to identify any subsidence impacts,
- Establish trigger levels for subsidence impacts that require actions and / or responses,
- Establish procedures, including a notification protocol, to be followed in the event that monitoring indicates a trigger level exceedance, and
- Measures to mitigate, remediate and / or compensate for any identified impacts, and
- Develop a contingency plan to ensure impacts are within approved levels and completion of subsidence in extracted areas, in relation to Surface and groundwater (quality, quantity and flow patterns Flora and fauna, and Final land form and intended post mining land use

---

## 2 RESPONSIBILITIES AND RESOURCES

---

The Donaldson Environmental Manager is responsible for monitoring the implementation of this plan.

The Abel Manager of Mining Engineering is responsible for ensuring that sufficient resources are available to implement the requirements of this Plan.

Each of the strategies developed in relation to the Environmental Management Plan allocates responsibilities in relation to their implementation. Relevant personnel will be provided with a copy of appropriate documents. Training will be provided.

---

## 3 CONSULTATION AND SUBMISSION

---

This plan is submitted to the Director Environmental Sustainability for approval and relevant landholders and government agencies for review in accordance with Condition 13 of the Subsidence Management Plan Approval 09/3641for Abel Pillar Extraction Area 1.

---

## 4 BACKGROUND

---

Abel commenced coal production in May 2008 and will progressively increase production to 4.5mtpa. The SMP Area 1 contains 200 ha, less than 8% of the current lease area of 2755 ha.

Mining will take place SMP Area 1 under a combination of land owned by Black Hill Land Pty Limited, the Catholic Diocese of Maitland and Newcastle and a narrow strip traversing the area owned by Hunter Water Corporation. Mining in the area is by the pillar extraction method from the Upper Donaldson Seam at depths of cover ranging generally from 50 to 135 metres.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 5 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

The layout of the panels has been designed to provide management outcomes of subsidence impacts in line with the Statement of Commitments and Project Approval while optimising resource recovery in the area. The proposed extraction panels are bounded by the lease boundary / John Renshaw Drive and cover restrictions to the north, the lease boundary / F3 Newcastle to Sydney Freeway to the east and existing and proposed main underground development workings to the south and west.

This design includes long term stable barrier pillars between panels and an extraction method designed so that final and total subsidence will be completed within a time frame agreed with the landowners, as part of the Project Approval, such that future development of the surface will not be precluded.

No substantial adverse environmental effects due to subsidence are predicted for the surface above the application area. The SMP application area surface is a combination of native bushland, cleared grazing land previously used for poultry farms and a small section of industrial land in the north east corner of the application area.

Natural features are generally limited to Viney Creek, a Schedule 2 stream and associated tributaries. No Threatened Ecological Communities are located within the application area and no adverse impacts are predicted for flora and fauna.

Man – made features include :

- Boral Asphalt Plant;
- Transgrid 330kV power line;
- Energy Australia (EA) 132kV power line;
- EA rural 11kV power lines;
- Optus fibre optic cable;
- Redundant Telstra copper communication cables;
- Hunter Water Corporation water pipeline;
- Scattered aboriginal artefacts (outside of zone of influence of subsidence);
- Disused, unoccupied dwellings proposed for demolition;
- Catholic Diocese Stock water supply line;
- Access roads and tracks;
- Various fences; and
- One small disused dam.

---

## 5 APPROACH TO ENVIRONMENTAL MONITORING

---

The Mine's overall strategy, to ensure all items listed in the Scope, Purpose and Objectives relating to the surface areas that may be affected by subsidence arising from pillar extraction are addressed, is:

1. **Measure baseline information** – Establish background data for the surface above the mining area by initial monitoring, inspection and in certain areas also subsidence survey.
2. **Regular Monitoring of the effects of mining** - Continue monitoring and inspection of identified key positions relating to the extraction position
3. **Regularly assess and interpret monitoring and inspections** – Monitoring and inspection data is analysed to identify any variations from predictions, unexpected

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 6 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

anomalies, visual impact or items presenting potential impact on the environment with particular reference to the Trigger, Action, and Management Response levels.

4. **Implement Immediate Responses** – If potential impact on the environment or safety is observed or reported implement an immediate response including relevant notification.
5. **Subsidence Management Status Reports** - Four monthly reports will be supplied to the landholder and relevant stakeholders, along with periodic consultation meetings. Such updates will review the monitoring results, review the requirement to reassess subsidence effects and identify/implement remedial actions (see below).
6. **Reporting of monitoring results** – as described in **Section 9**.
7. **Assessment of any impacts** – where variations and/or impacts are greater than predictions made in the SMP, as nominated in the Trigger Actions and Management Responses or noted under the Approval Conditions appropriate notification and additional assessment/investigation of impacts will be undertaken. This will be carried out by specialist consultants, Abel personnel, the landholder and appropriate stakeholders where required.
8. **Management of Impacts: Identify, prepare and implement appropriate rehabilitation / remediation / additional management actions** – if assessments indicate a requirement for rehabilitation, mitigation, management and/or remedial action, the initial remedial action will be implemented as outlined in the TARP. Following this, inspections and advice will be sought from a suitably qualified external consultant as noted in the TARP. Any actions will be implemented following consultation, in conjunction and to a program agreed with the landholder and appropriate relevant agency.
9. **Rehabilitation objectives** – to effectively rehabilitate / remediate impacts to satisfy agreed safety, environmental and/or aesthetic criteria.
10. Conduct a review of subsidence and ecological monitoring results in relation to predictions prior to the commencement of Panel 4 to assess the adequacy of management plans, response actions and procedures.

---

## 6 IDENTIFICATION OF RISKS

---

The surface to be undermined is described in **Section 4**.

As part of the application process a Risk Assessment was conducted to examine the potential impact created by subsidence on the mining area. No environmental risks in the high risk category were identified once existing controls were taken into account. All risks identified had either existing controls or additional controls / further actions which have been implemented or are available to identify, control or remediate these risks. The possible Environmental (natural features, farm land and facilities and areas of archaeological and/or cultural significance) risks are listed below with a summary of the Risk Assessment results relating to these items attached as **Appendix A**.

- Disruption of stream flow to Viney Creek, loss of flow to Weakley's Flat Creek;
- Erosion and bed and bank instability (Schedule 1 and 2 watercourses); drainage of groundwater from perched regolith aquifer;

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 7 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

- Increased inundation of swamp or drainage of swamp;
- Harm to groundwater dependent ecosystems;
- Physical loss of monitoring bores;
- Decline in water quality of watercourses;
- Depressurisation of coal measures aquifer impacting on groundwater users;
- Temporary loss of access to grazing area, temporary loss of reticulated water supply to particular areas and damage to fences rendering them unserviceable;.
- Subsidence increases the extent of flooding in flood prone land; and
- Falling tree striking person

Controls, monitoring and mitigation / remedial actions identified as core risk items have been addressed in either this Management Plan or the relevant Property Management Plan in respect to temporary loss of access, temporary loss of reticulated water service, damage to fencing and extent of flooding.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 8 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				



## **7 MONITORING AND INSPECTION SCHEDULE**

The subsidence from mining, in SMP Area 1, is not expected to have any substantial impact on the surface.

### **7.1 Subsidence Monitoring**

A description of the surface, relevant features and improvements above the proposed extraction area is contained in **Section 4** with locations of these items shown on **Plan 2** of the SMP Application (copy attached as **Figure 1**).

Monitoring is conducted as per the various Management Plans and Programs submitted, consisting of a combination of subsidence surveys, surface monitoring, inspections and monitoring of ecological conditions.

These Plans and Programs generally focus on intensive monitoring in the initial stages of pillar extraction and the long term monitoring of subsidence effects that may develop over time.

Subsidence surveys are conducted as detailed in the Subsidence Monitoring Program – Surface which is submitted to the Principal Subsidence Engineer for agreement prior to extraction of each Panel.

The results of this subsidence monitoring form part of the Panel layout review program where the mine design is continually updated to reflect these results.

### **7.2 Subsidence Inspections**

Inspections are to be conducted as per the various Management Plans and Programs submitted, consisting of a combination of visual and photographic inspections. These are detailed in the Management Plans and Programs and referenced in **Table 1**.

### **7.3 Scope and Frequency of Inspections**

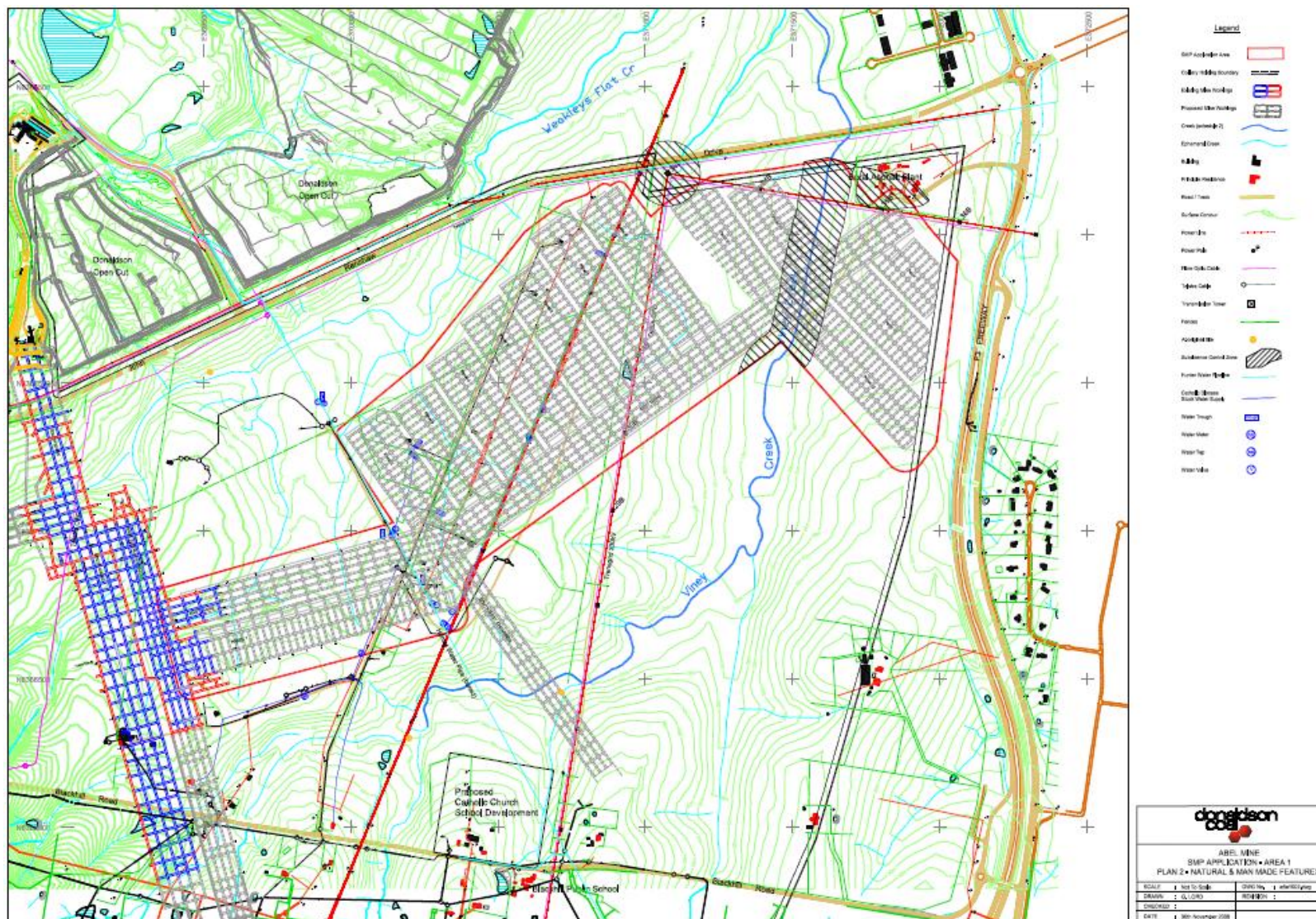
Regular inspections, at frequencies detailed in the Management Plans and Programs are to be initially concentrated on the current mining area of each panel, mining location and potential subsidence area of 26.5 degrees angle of draw. Inspections are concentrated on items identified in the initial pre-mining survey.

Inspections are carried out by experienced persons and follow an inspection checklist to include the items noted above.

At the completion of mining in each panel a full surface inspection will be conducted and results included in an end of panel report (as part of the regular Subsidence Management Status Report).

Listed below is a schedule of inspections (visual and photographic) and subsidence survey frequencies (**Table 1**).

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 9 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				



Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 10 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

**TABLE 1 – INSPECTION AND SURVEY SCHEDULE**

Item	Inspection / Monitoring Type	Parameters Monitored / Impacts	Monitoring Frequency	Responsibility	Notes / Comments
<b>Roads &amp; access tracks</b>	Visual	Surface cracking Mining induced erosion Public safety	Pre-mining Weekly during extraction mining of relevant panel (see comments), or frequency as amended by TARP Post-mining	Abel Environmental Manager or nomination	Weekly monitoring is to commence when approaching extraction face is 100m from road and to be continued until extraction face is 100m past road  Refer to <i>Public Safety Management Plan</i> for specific details regarding public safety.
	Photographic	Surface cracking Mining induced erosion Public safety	Pre-mining If changes noted during visual inspection and as required by TARP Post-mining	Abel Environmental Manager or nomination	
	Survey	Subsidence, strain and tilt	Pre-mining Post-mining	Abel Mine Surveyor	

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 11 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Item	Inspection / Monitoring Type	Parameters Monitored / Impacts	Monitoring Frequency	Responsibility	Notes / Comments
<b>General surface areas</b> (focusing on fences, any steep slopes and banks of watercourses – see comments)	Visual	Surface cracking Mass movement Mining induced erosion Public safety	Pre-mining Weekly during extraction mining of relevant panel (see comments), or frequency as amended by TARP Post-mining	Abel Environmental Manager or nomination	Weekly monitoring to be undertaken in area 100m in advance of, and 100m behind, extraction face position. Refer to <u>Public Safety Management Plan</u> for specific details regarding public safety.
	Photographic	Surface cracking Mining induced erosion Public safety	Pre-mining If changes noted during visual inspection and as required by TARP Post-mining	Abel Environmental Manager or nomination	
	Survey	Subsidence, strain and tilt	Pre-mining Post mining	Abel Mine Surveyor	

A report will be completed following each inspection or survey, with results summarised in the *Four Monthly Subsidence Management Status Report*. Also, results of each survey will be forwarded promptly following completion to the Principal Subsidence Engineer and the Landholder.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 12 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				



## 7.4 Surface Water

Viney Creek, a Schedule 2 stream and associated tributaries occurs above Panels 10, 13 and the East Mains. An exclusion zone has been established to protect Viney Creek. The exclusion zone is based on providing a minimum barrier of 40m between the 20 millimetre line of subsidence and the bank of Viney Creek as shown on Plan 2 (Fig 1).

Monthly water quality monitoring is undertaken of Viney Creek at its juncture with John Renshaw Drive.

Surface water flow above the other panels consists of very minor ephemeral drainage lines.

### 7.4.1 Predicted Impacts

Viney creek will not be impacted by subsidence as a result of the Protection Zone. The predicted subsidence, tilts and strains are unlikely to cause any impacts or damage to the ephemeral drainage lines which cannot be mitigated by minor earthworks.

### 7.4.2 Quality

Sampling techniques for monitoring water quality downstream of the surface area above SMP Area 1 include baseline, daily and monthly and opportunistic sampling. The required analyses include non-filterable residues (NFR), pH, turbidity and conductivity.

### 7.4.3 Quantity

Monitoring of surface flows will consist of qualitative estimate on a monthly basis and observational estimates when stream is flowing.

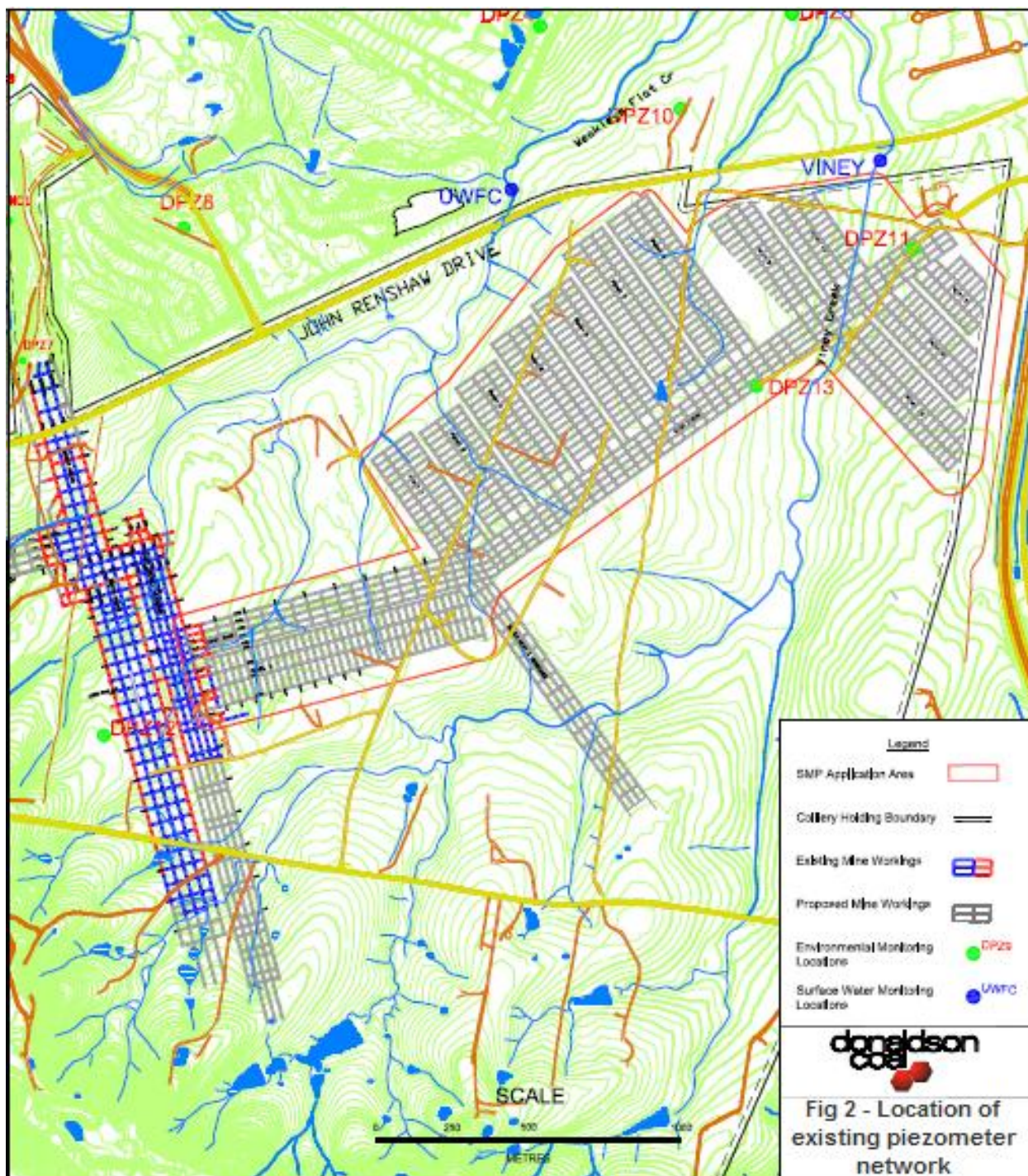
Inspection and photographic recording of the drainage lines and any erosion will be taken over panels underlying drainage lines before and after extraction at the estimated maximum subsidence locations of each panel with additional visual inspections at weekly intervals during extraction beneath the drainage lines.

## 7.5 Groundwater

In accordance with the Site Water Management Plan (Dundon, 2006), baseline monitoring of groundwater levels and quality will be continued through the life of the Abel mining project, and for at least 5 years after completion. Three vibrating wire piezometers and one open hole piezometer are currently being monitored (Refer Figure 2). As well, Dundon (2006) stated that a monitoring network of multi-level piezometers and extensometers be installed above the first 4 – 5 extraction panels, which will be near the northern – central and north-eastern part of the project area. This will identify/verify associate impacts on groundwater levels/pressures and hydraulic properties of the strata. It is planned to install a groundwater monitoring network on the first 4 panels (refer Figure 3).

One extensometer and one piezometer cluster is proposed for each of the first panels due to the relatively small area of the panels.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 13 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				



**FIGURE 2 - LOCATION OF EXISTING PIEZOMETER NETWORK**

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 14 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				



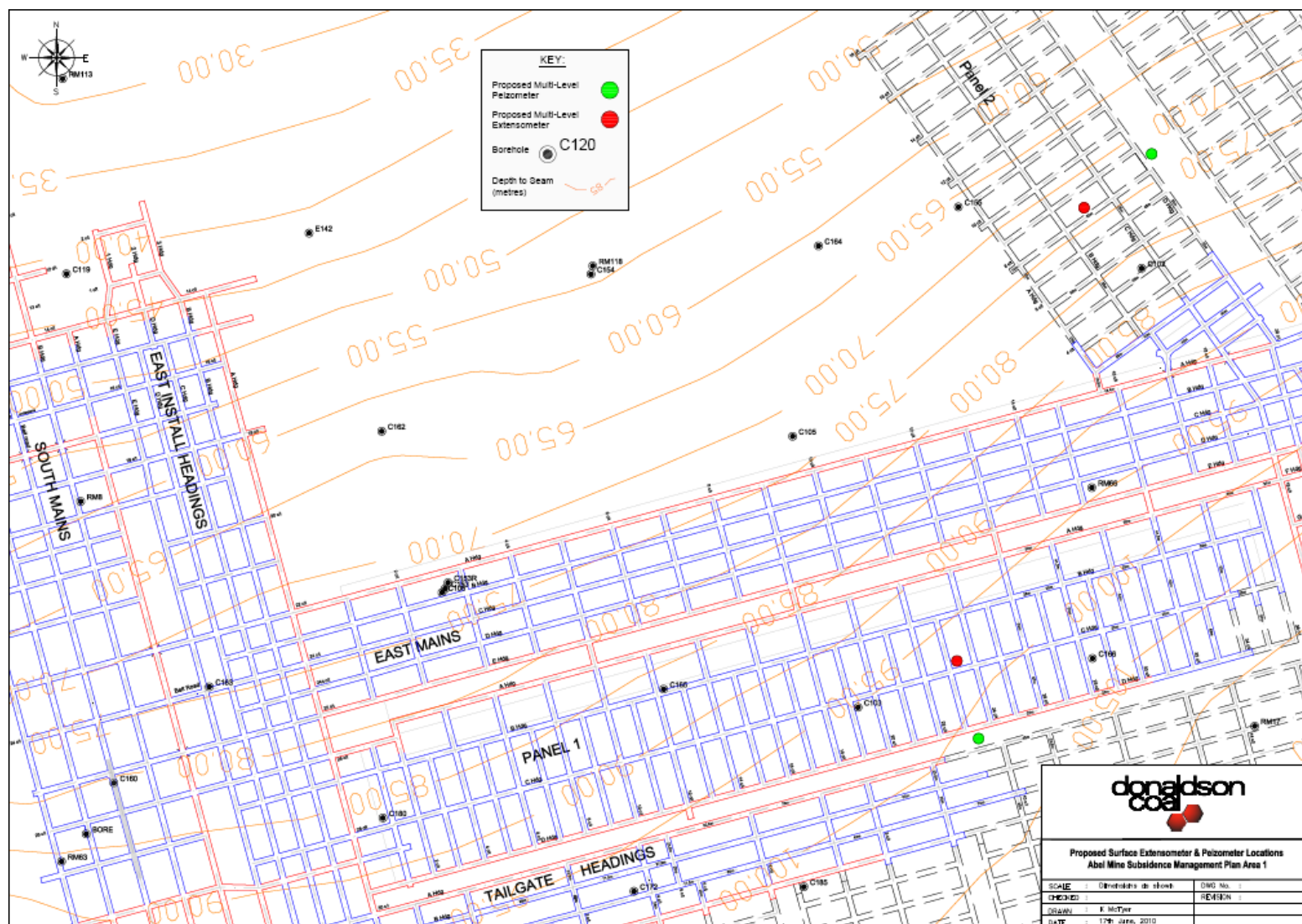


FIGURE 3 – LOCATION OF PROPOSED SURFACE EXTENSOMETERS AND PIEZOMETERS

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 15 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

The locations indicated for panels 3 and 4 will be subject to review of the previous panels' results.

The proposed detail of the monitoring network is as follows:

**Deep vibrating wire Piezometers:**

- Proposed anchor heights are at 10m, 30m and 50m above the seam in Panel 1.
- That is, 80m, 60m and 40m depth from surface in Panel 1 and 70m, 50m and 30m in Panel 2.
- Location of the deep piezometer in the barrier between panels aims to monitor depressurization of the UD Seam during mining.
- Location in the barrier will significantly reduce the potential of lost function due to caving.
- Location in the barrier increases the potential for long-term groundwater response monitoring.

**Shallow Standpipe Piezometers:**

- Standpipe piezometers are proposed to be located adjacent to the deep piezometer bores.
- These will be drilled to the base of the colluvium / weathered bedrock.
- The shallow piezometers aim to monitor the surface unconfined aquifer.
- Standpipes will allow long-term testing of water level and water quality.

**Deep Borehole Extensometers:**

- The borehole extensometers will be located centrally in each panel.
- Anchor heights are proposed to be set at 10m intervals in Panel 1.
- That is, 10m, 20m, 30m, 40m, 50m, 60m, 70m, and 80m depth from surface in Panel 1.
- And 10m, 20m, 30m, 40m, 50m, 60m and 70m in Panel 2.
- Locations aim to measure height of fracturing.

This monitoring network aims to verify predicted fracture heights, the associated impacts on groundwater levels and pressures, and hydraulic properties of the strata.

**7.5.1 Predicted Impacts**

Minimal impact expected on a regional level. Negligible impact predicted on water quality.

**7.5.2 Quality**

The EC and pH of the mine water will be measured on site weekly. Water samples will also be collected from the mine water inflows and submitted

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 16 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				



quarterly for laboratory analysis of physical parameters, major cations and anions, and selected dissolved metals.

### 7.5.3 Quantity

Groundwater inflows (volumes pumped from the mine less water supply imports) will be monitored continuously by means of appropriate flow meters and recorded on site weekly. Groundwater in Panels 1 to 5 will be monitored by piezometers in the Upper Donaldson Seam (as per Dundon's recommendation). The existing

The groundwater monitoring program is detailed in **Table 2**.

Total inflow rates will be monitored using in-line flow-meters on the pipework conveying dewatering discharge. Separate flow-meters may be used if necessary on pipework from different sections of the mine, so that the spatial distribution of inflows can be assessed. Flow meters will be read weekly to enable average rates of inflow to be determined.

The frequency of monitoring will be re-assessed following the completion of Panels 1 to 3, based on the impacts detected during this period, and may be modified to a less frequent regime if appropriate, in consultation with the NSW Office of Water.

The results of monitoring will be reviewed by a qualified hydrogeologist at the end of Year 2 and thereafter every five years. The observed impacts on groundwater levels, groundwater quality and surface water flows and quality will be assessed against the impacts predicted by the groundwater model. If appropriate, the groundwater model will be recalibrated at each review date, and future impact predictions will be re-determined using the re-calibrated model.

**TABLE 2 GROUNDWATER AND SURFACE WATER MONITORING PROGRAM**

Item	Method	Parameter	Frequency	Responsible Personnel
Groundwater inflows to mine	Flow meters – each separate mine sector and total from mine	Volume pumped	Weekly	Abel Environmental Manager or nomination - design by Qualified hydrogeologist/ hydrologist
Groundwater levels	Standpipe piezometers	Direct water level measurement	Monthly	
Groundwater quality	Existing and proposed Piezometer	pH and EC	Three-Monthly	
	Existing and proposed Standpipe piezometers	pH, EC, TDS, Ca Mg Na K Cl SO <sub>4</sub> HCO <sub>3</sub> Fe Mn As Cu Zn	Six-monthly	

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 17 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Surface water flows	Qualitative estimate	Presence or absence of flow	Monthly	
	Observational, non-quantitative estimate	Stream flow and duration	When stream is flowing	
Surface water quality	Grab sample	pH and EC	If flowing	
	Grab sample	pH, EC, TDS, Ca Mg Na K Cl SO <sub>4</sub> HCO <sub>3</sub> Fe Mn As Cu Zn	Six-monthly	

## 7.6 Aboriginal Sites

South East Archaeology has undertaken an assessment of Aboriginal Heritage for Abel. Three scattered artefact sites exist within the mine area but outside the subsidence zone due to the mine layout (Donaldson Coal 2007).

### 7.6.1 Predicted Impacts

Assessed as very unlikely that these sites will be impacted by subsidence.

## 7.7 Flora and Fauna

The Flora and Fauna Monitoring Program sets out a program to monitor the effectiveness of conservation measures proposed in the EA for the overall operation of the mine. It includes the Compensatory Habitat Monitoring Plan and the Conservation Measures Monitoring Plan.

Due to the lack of aquatic habitat within SMP Area 1, quantitative aquatic ecological monitoring is not required.

### 7.7.1 Predicted Impacts

Unlikely to be impacted by small changes in landform resulting from subsidence.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 18 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

**TABLE 3 – ECOLOGY MONITORING PROGRAM**

Item	Method	Parameter	Frequency	Responsible Personnel
General area	Visual inspection	Vegetation structure and condition	Pre and post mining of each Panel	Abel Environmental Manager or nomination / Qualified Ecologist
	Visual inspection	Vegetation structure and condition / weed presence	Weekly during undermining	Abel Environmental Manager or nomination

## **8 MANAGEMENT OF IMPACTS**

Abel will install appropriate warning signage, positioned along access roads and property boundaries, prior to the commencement of pillar extraction, advising of the potential for subsidence impacts. The objective of the signage is to ensure any users of the access roads, and surrounding area are aware of potential hazards resulting from subsidence. Mine contact details shall be included to enable any damage or impact noted to be reported.

Visual inspections will identify initial impacts on access roads, general surface area or natural features.

Results from the inspection and monitoring schedule are to be reported to Abel immediately following each inspection. The appropriate level of management action or response will then be initiated, where necessary, in accordance with the Trigger Action Response Plan (TARP); refer **Table 4**.

A feature of Abel's approach to the management of impacts is the inclusion of a collaborative, inter-disciplinary and inter-agency process. In the case of a minor impact or irregular result, Abel will liaise directly with the landholder and an expert consultant if deemed necessary, to determine the most suitable and mutually agreeable course of action.

In instances where an increased irregular result has been noted or where a major impact has occurred, Abel will immediately convene a site inspection and meeting with the landholder(s), any Agency with a regulatory role and a recognised expert consultant to determine the most appropriate course of action.

This collaborative methodology is illustrated in the Monitoring and Management Flow Chart, included as **Appendix B**.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 19 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

## 8.1 Trigger

If the inspections or monitoring reveal any impact identified in the Trigger, Action Management Responses (see **Table 4**) the person conducting the inspection or monitoring shall :

- Immediately notify the Manager of Mining Engineering and/or Environmental Manager of the findings.
- Erect “NO ROAD” or barrier tape and warning signs if a safety issue is considered to exist.
- The Manager of Mining Engineering shall notify the Director Environmental Sustainability , DECCW and landholder in accordance with the Trigger, Action and Management Responses.

## 8.2 Action / Response

Following completion of the above the Manager of Mining Engineering or his nominee shall:

- Arrange inspections of area at regular intervals including installation of appropriate barriers if required, until mitigation / remediation works, if required, are carried out.
- Arrange for inspections, assessment and mitigation / remediation works, if required, as detailed in **Table 4**. This may require consultation with the landholder, DECCW, Industry & Investment NSW and possibly specialist consultants and appropriate stakeholder, as noted in current Management Plans and Programs, to prepare appropriate mitigation / remediation plan relating to the particular item.

## 8.3 Notification

Notification is detailed in sections 8.1, 8.2 and **Table 4**.

## 8.4 Mitigation / Remediation

Mitigation / remediation may include any of the following after consultation with the landholder, DECCW, Industry & Investment NSW and possibly specialist consultants and appropriate stakeholder:

Drainage Lines -

Grading of unconsolidated banks and revegetation where subsidence monitoring indicates instability;

Ripping of exposed surface and revegetation where exposed surfaces indicate erosion of any subsidence cracks, together with the installation of contour banks above the area to divert surface runoff away from subsidence impacted areas, and silt fencing installed downstream of works in the drainage line;

Surface cracks –

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 20 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Grading or other options such as pouring concrete or grout into any large deep cracks may need to be implemented if cracks appear in the roads and any ephemeral watercourses that do not infill naturally with sediment due to natural geomorphic processes ( to be determined by regular monitoring).

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 21 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

**TABLE 4 – TRIGGERS, ACTIONS AND MANAGEMENT RESPONSES**

Monitoring / Surface Element	Trigger / Response	Results within predicted / acceptable range	Irregular result - Director Environmental Sustainability and DECCW to be notified	Increased irregular result- Director Environmental Sustainability and DECCW to be notified
<b>Subsidence Monitoring</b>	Trigger	Subsidence results are not greater than 15% above predictions	Subsidence results are greater than 15% but less than 25% above predictions or visible surface impacts above predictions.	Subsidence results are greater than 25% above predictions
	Notification	N/A	Notify Industry & Investment NSW– Mines Safety Operations Principal Subsidence Engineer (PSE) and appropriate parties under the SMP Approval.	Notify Industry & Investment NSW – Mines Safety Operations Principal Subsidence Engineer (PSE) and appropriate parties under the SMP Approval.
	Action / Response	Continue to monitor at specified frequency	Field inspections. Review predictions. Obtain opinion from appropriate consultant, review program and consult with PSE	Review predictions. Review program and obtain opinion from appropriate consultant.
	Mitigation / Remediation	N/A	Review mine plan in consultation with appropriate consultant and Industry & Investment NSW– Mines Safety Operations	Review mine plan in relation to surface features in consultation with Industry & Investment NSW– Mines Safety Operations

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 22 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Monitoring Element / Method	Trigger / Response	Results within predicted / acceptable range	Irregular result / Minor impact	Increased irregular result / Major impact
<b>Surface cracking / erosion on roads &amp; access tracks (by visual inspection)</b>	Triggers	Surface cracking up to 100mm No noticeable increase in erosion.	Surface cracking 100-400mm. Noticeable increase in level of recent rill erosion along track and/or table drains.	Surface cracking > 400mm. Perceived imminent threat to public safety from anomalous situation (ie. adjacent mass movement,).
	Notification	N/A	Landholder, I & I NSW – Minerals and Energy PSE and appropriate parties under the SMP Approval (notification to landholder only for subsidence < 260mm and cover <80m)	Landholder, Interagency Committee and PSE. Other appropriate parties under the SMP Approval
	Action / Response	Maintain warning signs. Inspect and isolate by temporary fencing if required  Continue to review and monitor cracks periodically to ensure they do not expand or create a public safety hazard.	Note GPS location and orientation of crack or erosion and photograph. Review public safety aspect.  Maintain warning signs and erect additional signs and/or temporary fencing in immediate area.  Increase monitoring frequency to twice weekly until area has been satisfactorily remediated.  Discuss / confirm appropriate level of action / remediation with landholders, and any other relevant Government Department.  Review subsidence predictions with expert consultant, review monitoring program and/or consult with PSE if required.	Note GPS location and orientation of crack or erosion and photograph. Review public safety aspect.  Maintain warning signs and erect additional signs and/or temporary fencing in immediate area including barricades and NO ROAD signs.  Increase monitoring frequency to daily until area has been satisfactorily remediated and/or made safe.  Site inspection with specialist soil conservationist, landholder and other relevant Government Departments to discuss / confirm appropriate level of action / remediation.  Undertake detailed review of subsidence predictions with expert consultant, review monitoring program and consult with PSE.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 23 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Monitoring Element / Method	Trigger / Response	Results within predicted / acceptable range	Irregular result / Minor impact	Increased irregular result / Major impact
<b>Continued... Surface cracking / erosion on roads &amp; access tracks</b>	Mitigation / Remediation	Repair by grading, excavation and fill, or by concrete grout if required for erosion control in accordance with a program agreed by the landholder and appropriate authorities.	Repair cracks by excavation, fill and/or grading, concrete or grout, and install drainage structures if required, in accordance with a program agreed by the landholder and appropriate authorities.  Review mine plan in consultation with appropriate consultant and PSE.	Repair cracks by excavation, fill, and/or grading, concrete or grout, and install drainage structures if required, following consultation with and in accordance with a program agreed with the landholder, appropriate authorities and specialist consultants.  Review mine plan in consultation with appropriate consultant and PSE.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 24 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				



Monitoring Element / Method	Trigger / Response	Results within predicted / acceptable range	Irregular result / Minor impact	Increased irregular result / Major impact
<b>Surface cracking, mining induced erosion in other <u>general surface areas</u> (by visual inspection)</b>	Triggers	Surface cracking < 100mm. No evidence of mass movement or slumping. No evidence of accelerated rill or gully erosion.	Surface cracking 100-400mm. Some minor areas of mass movement or slumping can be observed (<100m <sup>2</sup> ). Surface rilling to a depth < 300mm.	Surface cracking > 400mm. Large areas of mass movement or slumping identified (>100m <sup>2</sup> ). Surface rilling and/or gully to a depth > 300mm.
	Notification	N/A	Landholder, I & I NSW – Minerals and Energy PSE and appropriate parties under the SMP Approval (notification to landholder only for subsidence < 260mm and cover <80m)	Landholder, Interagency Committee and PSE. Other appropriate parties under the SMP Approval
	Action / Response	Maintain warning signs. Inspect and isolate by temporary fencing if required  Continue to review and monitor cracks periodically to ensure they do not expand or create a public safety hazard.	Note GPS location and orientation of anomaly and photograph. Review public safety aspect.  Maintain warning signs and erect additional signs and/or barrier tape or temporary fencing in immediate area.  Increase monitoring frequency to twice weekly until area has been satisfactorily remediated and/or made safe.  Discuss / confirm appropriate level of action / remediation with landholder and other relevant Government Departments  Review subsidence predictions with expert consultant, review monitoring program and/or consult with PSE if required.	Note GPS location and orientation of anomaly and photograph. Review public safety aspect.  Maintain warning signs and erect additional signs in immediate area including barricade and NO ROAD signs.  Increase monitoring to daily until area has been satisfactorily remediated and/or made safe.  Site inspection with specialist soil conservationist, landholder and other relevant Government Departments to discuss / confirm appropriate level of action / remediation.  Undertake detailed review of subsidence predictions with expert consultant, review monitoring program and consult with PSE.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 25 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Continued... Surface cracking, mining induced erosion in other general surface areas	Mitigation / Remediation	Repair by grading, excavation and fill, or by concrete grout if required for erosion control in accordance with a program agreed by the landholder and appropriate authorities.	Repair cracks by excavation, fill and/or grading, concrete or grout, and install drainage structures if required, in accordance with a program agreed by the landholder and appropriate authorities.  Review mine plan in consultation with appropriate consultant and PSE.	Repair cracks by excavation, fill, and/or grading, concrete or grout, and install drainage structures if required, following consultation with and in accordance with a program agreed with the landholder, appropriate authorities and specialist consultants.  Review mine plan in consultation with appropriate consultant and PSE.
---	--------------------------	---	---	--

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 26 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Visual Inspection / Photographic / Environmental Monitoring	Trigger / Response	Results within predicted / acceptable range	Irregular result - Director Environmental Sustainability and DECCW to be notified	Increased irregular result- Director Environmental Sustainability and DECCW to be notified
Surface water	Trigger	Monitoring within 10% of baseline results or predictions	Monitoring >10% but <25% of baseline results or predictions	Monitoring >25% of baseline or predictions
	Notification	N/A	Notification to Director Environmental Sustainability and DECCW-NOW	Notification to Director Environmental Sustainability and DECCW-NOW
	Action / Response	N/A	Review results of monitoring, field inspections to determine cause. Assess if cause is temporary or requires action and design remedial action with appropriate consultant, landholder and government agencies.	Review results of monitoring, field inspections to determine cause. Assess if cause is temporary or requires action and design remedial action with appropriate consultant, landholder and government agencies.
	Mitigation / Remediation	N/A	If cracking, repair any cracks as noted for general surface areas.	If cracking, repair any cracks as noted for general surface areas.
Groundwater	Trigger	Monitoring within 10% of baseline results or predictions	Enduring change in groundwater level that cannot be explained.	Total loss of groundwater
	Notification	N/A	Notification to Director Environmental Sustainability and DECCW-NOW	Notification to Director Environmental Sustainability and DECCW-NOW
	Action / Response	N/A	Additional monitoring, obtain opinion from hydrogeological expert	Additional monitoring, obtain opinion from hydrogeological expert
	Mitigation / Remediation	N/A		Review mine plan in consultation with appropriate consultant and Industry & Investment NSW

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 27 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Visual Inspection / Photographic / Environmental Monitoring	Trigger / Response	Results within predicted / acceptable range	Irregular result - Director Environmental Sustainability and DECC to be notified	Increased irregular result- Director Environmental Sustainability and DECC to be notified
Flora / Fauna	Trigger	Monitoring demonstrates no change or impact	Decline in population numbers compared to baseline monitoring not related to rainfall / drought conditions	Major dieback of flora, lack of fauna species diversity or change in species composition compared to baseline monitoring, not related to rainfall / drought conditions. Significant changes in flora species diversity.
	Notification	N/A	Notification to Director Environmental Sustainability and DECCW-NOW	Notification to Director Environmental Sustainability and DECCW-NOW
	Action / Response	N/A	Field inspection, additional monitoring, obtain opinion from ecological expert	Field inspection, additional monitoring, obtain opinion from ecological expert
	Mitigation / Remediation	N/A		Review mine plan in consultation with appropriate consultant and Industry & Investment NSW

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 28 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

---

## 9 REPORTING AND ACCESS TO INFORMATION

---

All monitoring programs contain an element of visual inspection. An integral part of these programs is the reporting of any impacts, including cracking, soil erosion, soil slumping or land degradation, to the Environmental Officer.

The information is then reviewed and consideration given to the appropriate remediation / rehabilitation and timing of such actions in relation to the mining program as noted in the TARP.

Consultation, incident and ongoing management reporting will be undertaken in accordance with the requirements of:

- The Trigger Action Response Plan, and
- The Monitoring and Management Flow Chart (**Appendix B**),

Essentially, these require a summary of monitoring results, anomalies, incidents, management actions and responses to be provided to all relevant stakeholders (including landholders) in a Four Monthly Subsidence Management Status Report which will include an End of Panel Report where appropriate.

Relevant stakeholders (including landholders) will also be notified within a specified time period in compliance with the requirements of the Trigger Action and Response Plan. Specific written incident reports may also be prepared to satisfy any appropriate approval condition.

An annual summary will also be included and distributed in Abel's Annual Environmental Management report (AEMR).

---

## 10 REVIEW

---

This Plan will be reviewed as necessary including:

- Prior to the commencement of extraction of Panel 4, in the event that the landholder, Director Environmental Sustainability or government agencies raise issues that necessitate a review;
- there are changes in the monitoring program, such as changes in the number of monitoring installations or changes in the monitoring frequency;
- unexpected anomalous conditions arise, and the response to these conditions indicates that a review of the program is required; or
- ongoing monitoring demonstrates that subsidence effects are such that a review is warranted.

Any review of this document will be undertaken in consultation with Industry & Investment NSW – Minerals and Energy, landholder any relevant stakeholders. In the event this document is revised, a copy will be sent to the relevant landholder, stakeholder(s) and agencies and also placed on the Donaldson website.

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 29 of 34
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

## APPENDIX A – RISK ASSESSMENT RESULTS TABLE

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.01	Disruption of stream flow to Viney Creek	1. Cracking of stream bed 2. Development of ponding and storage areas	1. Mine design and layout (1,2) 2. Provision of an exclusion zone (1,2) 3. Baseline stream monitoring as per Surface water management plan (EMP) 4. Natural healing of cracks 5. Size of cracks will be limited by soil cover	R	3	D	17	M	1. Subsidence and stream flow monitoring 2. Refine model based on monitoring results 3. Consider Surveying creek location	Yes
1	Natural Features	1.01	Creeks	1.01.03	Erosion and bed and bank instability (Schedule 2)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds 2. Mine design Schedule 2 (Viney Creek)	R	3	D	17	M	1. Refine model based on monitoring results	Yes
1	Natural Features	1.07	Natural Vegetation	1.07.01	Falling trees striking person	1. Cracking and tilting 2. Low soil cover	1. Public Safety Management Plan, includes signage 2. Private property - no public access	P	3	D	17	M		

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 30 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.04	Erosion and bed and bank instability (Schedule 1)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds	R	4	C	18	M		Yes
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Drainage of groundwater from perched regolith aquifer	1. Cracking of surface and subsurface	1. Monitoring 2. Mine design	R	4	C	18	M	1. Continued Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.01	Increased inundation of swamp	1. Subsidence	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	C	18	M	1. Monitoring review (Panel 13)	Yes
3	Farm Land and Facilities	3.05	Wells, bores	3.05.01	Physical loss of monitoring bores	1. Subsidence 2. Cracking	Nil identified	A	4	C	18	M	1. Replace bores if required	Yes
1	Natural Features	1.01	Creeks	1.01.05	Decline in water quality (Schedule 2)	1. Increased erosion	1. Dense native and introduced vegetation along creek beds 2. Mine design 3. Water quality monitoring	R	4	D	21	L	1. Monitoring	Yes

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 31 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.02	Internal Access tracks	3.02.01	Cracking of road surface resulting in potential vehicle accident	1. Subsidence	1. Speed limited road 2. Property Management Plan for the site 3. Restricted access	P	4	D	21	L	1. Appropriate signage 2. Develop MP	
1	Natural Features	1.01	Creeks	1.01.02	Associated loss of flow to Weakley's Flat Creek	1. Disruption of stream flow to Schedule 1 streams 2. Cracking of stream bed 3. Development of ponding and storage areas	1. Post mining remediation as per Project Approval 2. Natural healing of cracks 3. Size of cracks will be limited by soil cover 4. Sufficient surface gradients to minimise ponding potential and prevent stream capture 5. Baseline stream flow monitoring of Weakley's Flat Creek as per SWMP	R	5	C	22	L	1. Refine model based on monitoring results	Yes
1	Natural Features	1.01	Creeks	1.01.06	Decline in water quality (Schedule 1)	1. Increased erosion	1. Dense native and introduced vegetation along creek beds 2. Water quality monitoring	R	5	C	22	L	1. Monitoring	Yes

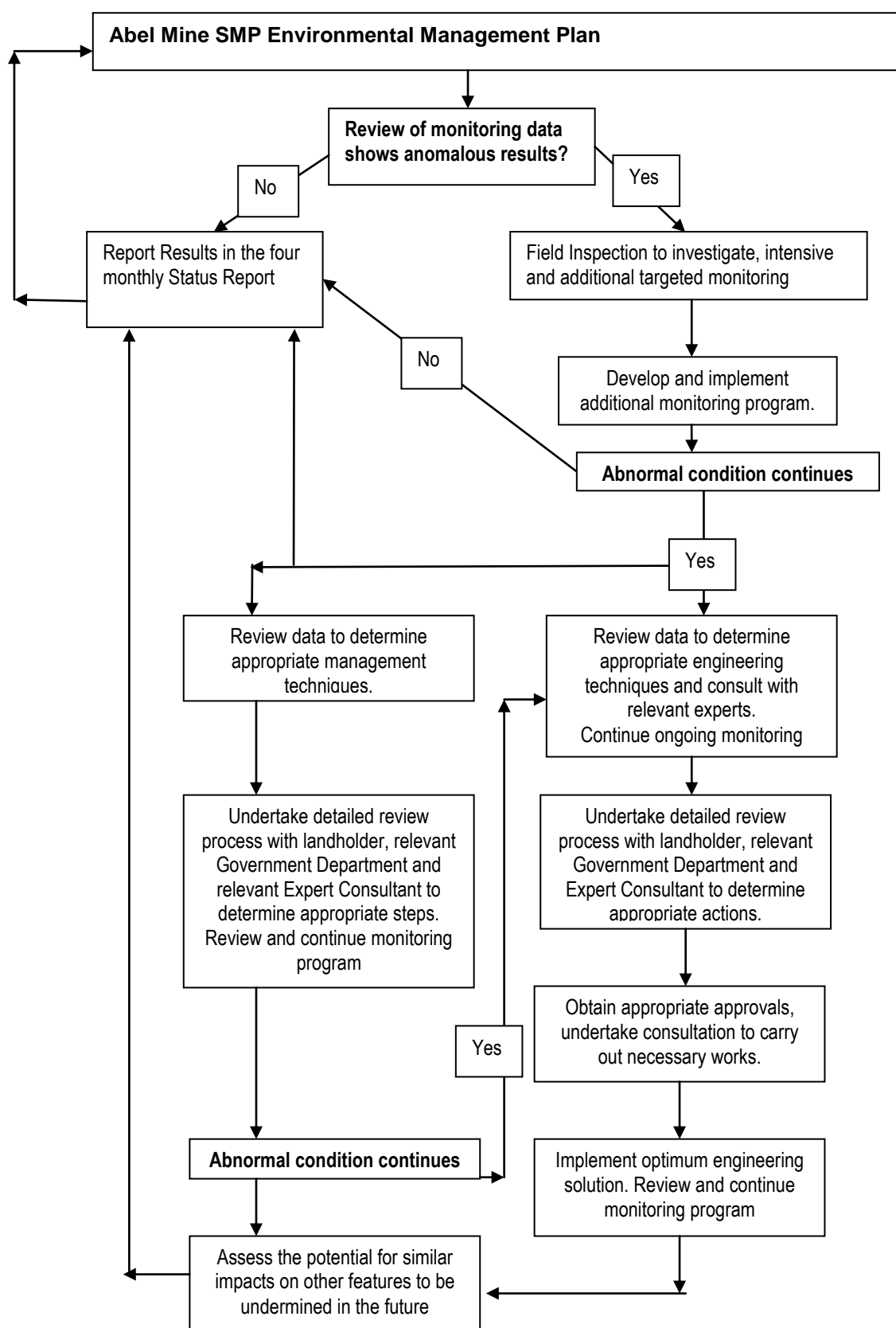
Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 32 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				



P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Temporary loss of access to grazing area	1. Need for mitigation work		A	5	C	22	L	1. Review agistments arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3	Fences	3.03.01	Fences become unserviceable due to damage	1. Subsidence	1. Existing property management plan for the site	A	5	C	22	L	1. Review agistments arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3.07	Water Reticulation systems	3.07.01	Temporary loss of water supply to particular areas	1. Subsidence	1. Multiple troughs	A	5	C	22	L	1. Sufficient repair supplies onsite	Yes
3	Farm Land and Facilities	3.04	Farm dams	3.04.01	Water loss from dam adjacent to Transgrid Tower 31B	1. Tilting 2. Cracking of dam, wall or floor	1. Empty dam - no longer used	A	5	D	24	L		Yes
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Subsidence increases the extent of flooding	1. Quantity of subsidence	1. Mine design				n/a	n/a	1. Review flood studies undertaken by Coal & Allied	
3	Farm Land and Facilities	3.06	Any other feature considered significant	3.06.01	Nil identified - Derelict cottages to be demolished						n/a	n/a		

Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 33 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

## APPENDIX B – MONITORING AND MANAGEMENT FLOW CHART



Prepared by	Phillip Brown	Document No		Abel Mine SMP Area 1 - Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	02/ 7/2010	Revision date	02/07/2011	Page 34 of 34
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				