



# **DONALDSON COAL PTY LIMITED**

## **ABEL MINE**

### **Subsidence Management Plan**

#### **SMP Area 2**

### **Environmental Management Plan**

**May 2011**

## Document Control

### Description

<b>Document No.</b>	Abel SMP Area 2
<b>Title</b>	Environmental Management Plan
<b>General Description</b>	To monitor surface and groundwater (quality, 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 SMP Area 2 at Abel Mine.
<b>Key Support Documents</b>	Abel Mine SMP Area 2

### Approvals

<b>ORIGINATOR</b>	Kevin Price	Brunskill Pty Limited	Signed 	Date 3/05/2011
<b>REVIEWED</b>	Tony Sutherland	Position Technical Services Manager- Underground Operations	Signed 	Date 24/5/11
<b>APPROVED</b>	Phillip Brown	Position Environmental Manager	Signed 	Date 25.5.11
<b>APPROVED</b>	Name	Position Director Environmental Sustainability Industry & Investment NSW Minerals and Energy	Signed	Date

### Revisions

Version #	Date	Description	By	Checked	Approved	
					Name	Signed
1	May 2011					

The nominated Coordinator for this document is

Manager of Mining Engineering

Prepared by	Phillip Brown	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Tony Sutherland	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 2 of 32
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

## TABLE OF CONTENTS

1	PURPOSE SCOPE AND OBJECTIVES.....	4
2	RESPONSIBILITIES AND RESOURCES.....	4
3	CONSULTATION AND SUBMISSION.....	4
4	BACKGROUND.....	4
5	APPROACH TO ENVIRONMENTAL MONITORING.....	5
6	IDENTIFICATION OF RISKS.....	6
7	MONITORING AND INSPECTION SCHEDULE.....	8
7.1	Subsidence Monitoring.....	8
7.2	Subsidence Inspections.....	8
7.3	Scope and Frequency of Inspections.....	8
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.....	14
7.5.2	Quality.....	14
7.5.3	Quantity.....	14
7.6	Aboriginal Sites.....	15
7.6.1	Predicted Impacts.....	15
7.7	Flora and Fauna.....	16
7.7.1	Predicted Impacts.....	16
8	MANAGEMENT OF IMPACTS.....	17
8.1	Trigger.....	18
8.2	Action / Response.....	18
8.3	Notification.....	18
8.4	Mitigation / Remediation.....	18
9	REPORTING AND ACCESS TO INFORMATION.....	27
10	REVIEW.....	27
	APPENDIX A – RISK ASSESSMENT RESULTS TABLE.....	28

### LIST OF FIGURES

Figure 1	SMP Plan 2 – Natural and Man Made Features.....	9
Figure 2	Environmental Monitoring Locations.....	10

### LIST OF TABLES

Table 1	Inspection and Survey Schedule.....	11
Table 2	Groundwater and Surface Water Monitoring Program.....	15
Table 3	Ecology Monitoring Program.....	17
Table 4	Triggers, Actions and Management Responses.....	20

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 3 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

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## 1 PURPOSE SCOPE AND OBJECTIVES

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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 2.

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 (quantity, quality and flow patterns), flora, fauna, final land form and intended post mining use.

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## 2 RESPONSIBILITIES AND RESOURCES

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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.

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## 3 CONSULTATION AND SUBMISSION

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This plan is submitted to the relevant landholders and government agencies for review and the Director Environmental Sustainability for approval.

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## 4 BACKGROUND

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Abel commenced coal production in May 2008 and will progressively increase production to 4.5mtpa. The SMP application area contains 211 ha, approximately 8% of the current lease area of 2755 ha.

Mining will take place in the application area under a combination of land owned by Black Hill Land Pty Limited, the Catholic Diocese of Maitland and Newcastle, a narrow strip traversing the area owned by Hunter Water Corporation and ten privately owned rural residential landholdings. The current application seeks approval to mine coal by the pillar extraction method from the Upper Donaldson Seam at depths of cover ranging generally from 100 to 150 metres.

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 and to conduct the mining operations in a responsible manner, considering the existing and

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 4 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

future environment and the community, while optimising resource recovery in the area in accordance with the principles of ecologically sustainable development. It is proposed to conduct mining in the proposed extraction panels that are generally bounded by the previously approved SMP Area 1 to the north, the lease boundary / F3 Newcastle to Sydney Freeway / resource thickness / quality to the east, Black Hill Road for part and resource thickness / quality to the south and existing and proposed main underground development workings to the south.

Maximum subsidence predicted for the pillar extraction panels in the application area ranges between 760 mm and 1,450 mm, maximum predicted strains from 5 to 24 mm/m and tilts from 14 to 36 mm/m excluding areas nominated to be protected.

The SMP application area surface is a combination of native bushland, cleared grazing land (some previously used for poultry farms) and rural residential. Management measures are proposed to address any predicted environmental impacts, due to subsidence, for the surface above the application area.

Natural features are generally limited to Viney Creek, a Schedule 2 stream, associated tributaries and some groundwater. A large portion of the SMP area is covered by a Lower Hunter Spotted Gum – Ironbark Forest, an Endangered Ecological Community. No adverse impacts are predicted for this EEC nor flora and fauna.

Man – made features include:

- Principal residences, Other Surface Structures and outbuildings;
- Disused, unoccupied residences;
- Transgrid 330kV power line;
- Energy Australia (EA) 132kV power line;
- Energy Australia rural 11kV and 415V domestic power lines;
- Optus fibre optic cable;
- Active and redundant Telstra copper communication cables;
- Hunter Water Corporation water pipeline;
- Permanent survey control marks;
- Buried stock and domestic water supply lines;
- Public roads and culverts (Black Hill and Taylors Road);
- Access roads and tracks;
- Cattle stockyards, holding areas and water troughs;
- Various fences, gates and cattle grids;
- Several buried and clay liner capped contaminated material areas; and
- Several small (<1ML capacity) stock watering dams.

## 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

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 5 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

3. **Regularly assess and interpret monitoring and inspections** – Monitoring and inspection data is analysed to identify any variations from predictions, unexpected 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 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 requirements to reassess subsidence effects and identify/implement 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 any Approval Conditions appropriate notification and additional assessment/investigation of impacts will be undertaken. This will be carried out by specialist consultants, Abel personnel 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, 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 with 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 aesthetic criteria.

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## 6 IDENTIFICATION OF RISKS

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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 lands 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;
- Erosion and bed and bank instability (Schedule 1 and 2 watercourses);
- Contamination of groundwater through leachate;
- Connective cracking through stream beds;

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 6 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

- Long term effect on aquatic ecosystem;
- Decline in water quality of watercourses;
- Temporary loss of access to grazing areas, temporary loss of reticulated water supply to particular areas and damage to fencing rendering them unserviceable; and
- Subsidence increases the extent of flooding in flood prone land.

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

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 7 of 35
<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 this SMP Area 2, 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 and underground monitoring and inspections and monitoring of ecological conditions. Details of the environmental monitoring locations is shown in **Figure 2**.

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 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**

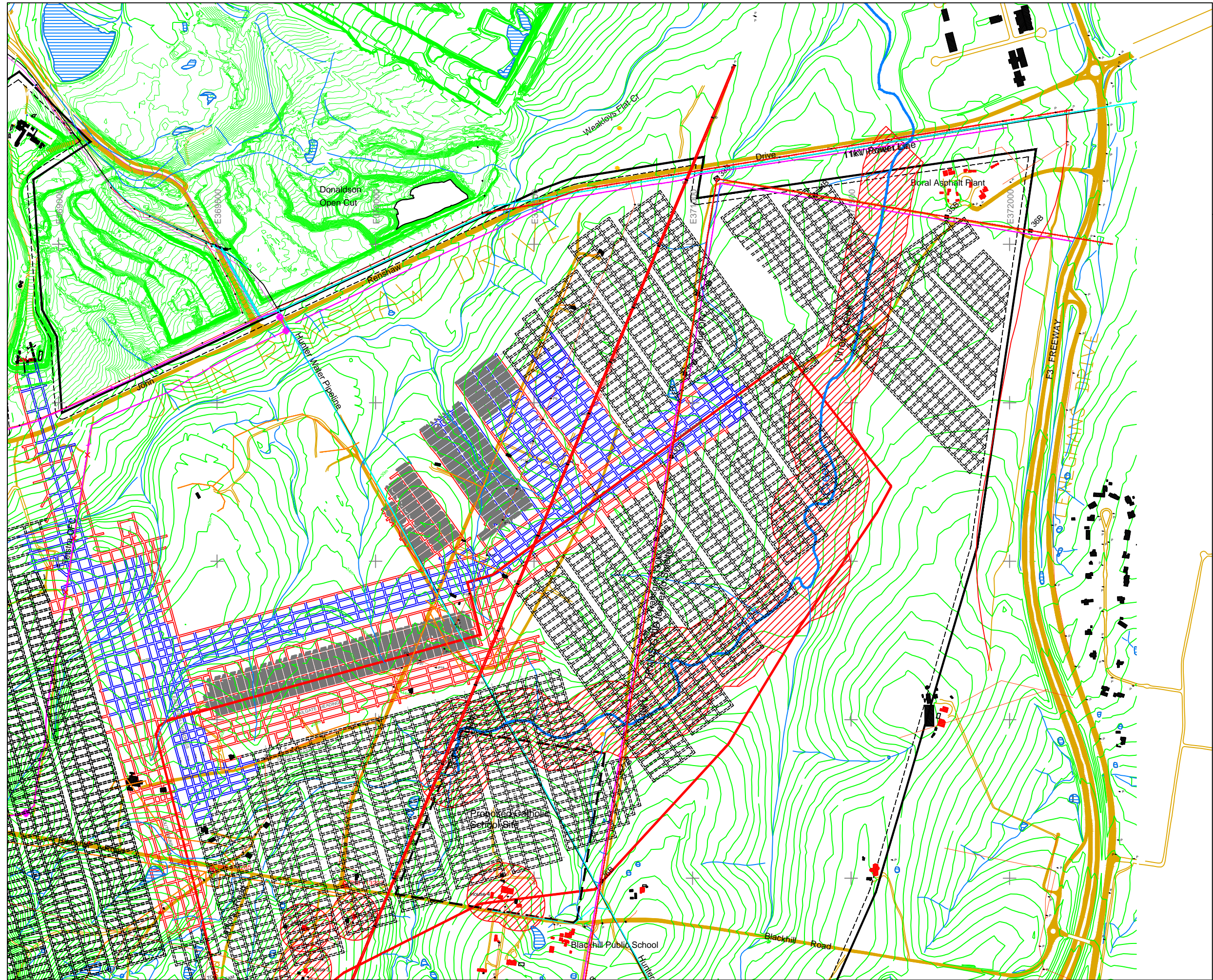
Regular inspections, at frequencies detailed in the Management Plans and Programs are to be initially concentrated on the current mining area of each panel, mining location and potential subsidence area of 26.5 degrees angle of draw). Inspections are concentrated on items identified in the initial pre-mining 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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 8 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				



Legend

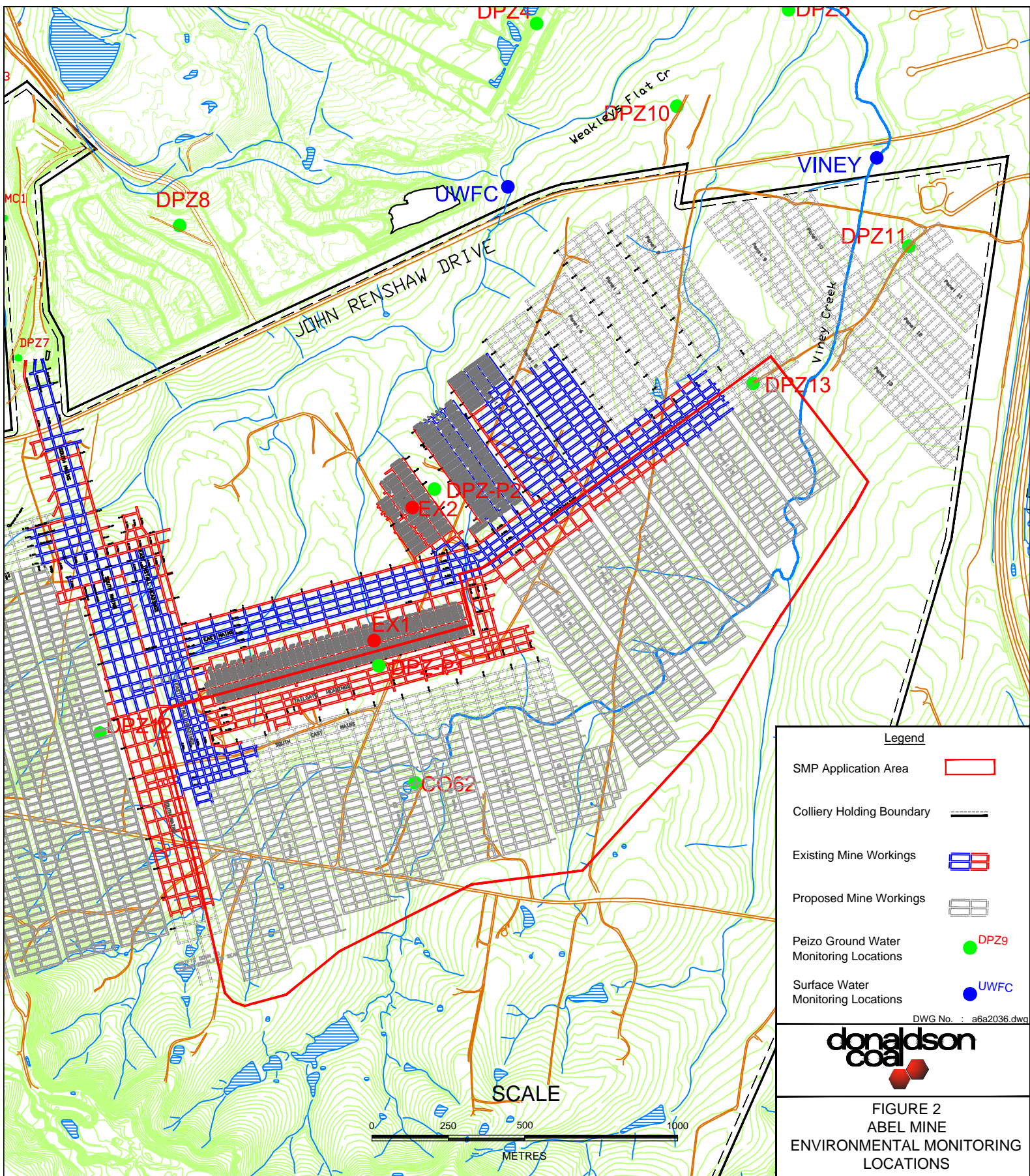
- SMP Application Area
- Colliery Holding Boundary
- Existing Mine Workings
- Proposed Mine Workings
- Creek (schedule 2)
- Ephemeral Creek
- Building / Other Structures
- Principal Residence
- Road / Track
- Surface Contour
- Power Line
- Power Pole
- Fibre Optic Cable
- Telstra Cable
- Transmission Tower
- Fences
- Aboriginal Site
- Subsidence Control Zone
- Hunter Water Pipeline
- Catholic Diocese Stock Water Supply
- Water Trough
- Water Meter
- Water Tap
- Water Valve
- Survey Stations



ABEL MINE  
SMP APPLICATION - AREA 1  
PLAN 2 - NATURAL & MAN MADE FEATURES

SCALE : Not To Scale	DWG No. : a6a1022.dwg
DRAWN : G. LORD	REVISION :
CHECKED :	
DATE : 21st April 2011	





**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	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 <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	Environmental Manager or nomination	
	Survey	Subsidence, strain and tilt	Pre-mining Post-mining	Abel Mine Surveyor	Subject to Subsidence Monitoring Program approval

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 11 of 35
<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	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	Environmental Manager or nomination	
	Survey	Subsidence, strain and tilt	Pre-mining Post mining	Abel Mine Surveyor	Subject to Subsidence Monitoring Program approval

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 subsidence survey will be forwarded promptly following completion to the Principal Subsidence Engineer.

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 12 of 35
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 occur above parts of SMP Area 2. A Subsidence Control Zone (SCZ) has been established to protect Viney Creek. The SCZ 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. (**Figure 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 SCZ. 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 2 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. Additionally, Dundon (2006) stated that a monitoring network of multi-level piezometers and extensometers be installed above the first extraction panels in SMP Area 1, to identify/verify associate impacts on groundwater levels/pressures and hydraulic properties of the strata.

A Deep Borehole Extensometers extensometer, deep vibrating wire Piezometer and Shallow Standpipe Piezometer were installed in Panel 1 and 2 to monitor height of fracturing, depressurization of the Upper Donaldson Seam during mining and the surface unconfined aquifer respectively (**refer Fig 2**).

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 13 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Preliminary results from the monitoring over Panels 1 and 2 in SMP Area 1 note that impacts on groundwater levels to date are limited to areas at close proximity to mining. No impact from mining activities at Abel Underground Mine has been seen at other monitoring locations within the local and regional monitoring network.

The location of further groundwater monitoring installations will be subject to review of Panel 1 and Panel 2 results.

#### 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 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 the early Panels of SMP Area 1 has been monitored by piezometer in the Upper Donaldson Seam (as per Dundon's recommendation).

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, in SMP Area 1 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 7 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.

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 14 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

**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	Piezometer 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	
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. Two scattered artefact sites have been identified in the SMP Area 2 but are located within the Subsidence Control Zone associated with Viney Creek.

### 7.6.1 Predicted Impacts

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

In relation to Aboriginal heritage, consistent with the Project Approval and Section 4.6 of the Aboriginal Heritage Management Plan, prior to secondary extraction commencing staged systematic archaeological survey will occur for each section proposed to be undermined. This will ensure that any Aboriginal heritage evidence that may be susceptible to impacts is identified and managed according to the AHMP and Part 3A Approval. As specified in

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 15 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Section 4.6 of the AHMP, the survey will be conducted by a suitably qualified and experienced archaeologist and involve:

- ❑ Description of the existing environment and potential impacts;
- ❑ An archaeological survey to identify and record any Aboriginal heritage evidence or areas of potential evidence within the SMP area;
- ❑ Assessing the significance of any identified heritage evidence within the SMP area;
- ❑ Assessing the potential impacts of subsidence upon the identified or potential Aboriginal heritage evidence;
- ❑ Consultation with the local Aboriginal community, including the participation of relevant LALC representatives in the archaeological survey;
- ❑ Identification and assessment of management and mitigation options for any Aboriginal heritage evidence identified, consistent with the AHMP and Part 3A Approval;
- ❑ Provision and implementation of recommendations for the most appropriate management and mitigation options, consistent with the AHMP and Part 3A Approval;
- ❑ Provision of a report detailing the above, produced with reference to the DECCW *Aboriginal Heritage Standards and Guidelines Kit* (1997), with copies distributed to DPI, DECC and the LALC within 25 working days of finalisation.

## 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 2, 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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 16 of 35
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 public and property access roads and property boundaries, prior to the commencement of pillar extraction, advising of the potential for subsidence impacts in accordance with the Public Safety Management Plan. 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 the Environmental Manager (or nominee) 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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 17 of 35
<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, NSW Department of Industry & Investment 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, NSW Department of Industry & Investment 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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 18 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 19 of 35
<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	Increased irregular result
<b>Subsidence Monitoring</b>	Trigger	Subsidence results are not greater than 10% above predictions	Subsidence results are greater than 10% but less than 15% above predictions or visible surface impacts above predictions.	Subsidence results are greater than 15% above predictions
	Notification	N/A	Notify NSW I & I – Minerals and Energy Principal Subsidence Engineer (PSE), Mine Safety Operations, landholder and appropriate parties under the SMP Approval.	Notify NSW I & I – Minerals and Energy Principal Subsidence Engineer (PSE), Mine Safety Operations, landholder and appropriate parties under the SMP Approval.
	Action / Response	Continue to monitor at specified frequency	Conduct 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. Consult with PSE
	Mitigation / Remediation	N/A	Review mine plan in consultation with appropriate consultant and PSE	Review mine plan in relation to surface features in consultation with PSE

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 20 of 35
<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 100-380mm. Noticeable increase in level of recent rill erosion along track and/or table drains.	Surface cracking > 380mm. Perceived imminent threat to public safety from anomalous situation (ie. adjacent mass movement,).
	Notification	N/A	Landholder, NSW I & I – Minerals and Energy PSE and appropriate parties under the SMP Approval ( including Director Environmental Sustainability and DECCW) if cracking over 190mm	Landholder, Interagency Committee and PSE. Other appropriate parties under the SMP Approval ( including Director Environmental Sustainability and DECCW)
	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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 21 of 35
<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
Continued... Surface cracking / erosion on roads & access tracks	Mitigation / Remediation	Repair by grading, excavation and fill, or by concrete grout if required for erosion control.	Repair cracks by excavation, fill and/or grading, concrete or grout, and install drainage structures if required, in program agreed by 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 landholder, appropriate authorities and specialist consultants.  Review mine plan in consultation with appropriate consultant and PSE.

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 22 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

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 100-380mm. Some minor areas of mass movement or slumping can be observed (<100m <sup>2</sup> ). Surface rilling to a depth < 300mm.	Surface cracking > 380mm. 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, NSW I & I – Minerals and Energy PSE and appropriate parties under the SMP Approval ( including Director Environmental Sustainability and DECCW) if cracking over 190mm	Landholder, Interagency Committee and PSE. Other appropriate parties under the SMP Approval ( including Director Environmental Sustainability and DECCW)
	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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 23 of 35
<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, mining induced erosion in other general surface areas</b>	Mitigation / Remediation	Repair by grading, excavation and fill, or by concrete grout if required for erosion control.	Repair cracks by excavation, fill and/or grading, concrete or grout, and install drainage structures if required, in program agreed by 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 landholder, appropriate authorities and specialist consultants.  Review mine plan in consultation with appropriate consultant and PSE.

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 24 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

Visual Inspection / Photographic / Environmental Monitoring	Trigger / Response	Results within predicted / acceptable range	Irregular result	Increased irregular result
<b>Surface water</b>	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	Notification to Director Environmental Sustainability and DECCW
	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 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 and government agencies.
	Mitigation / Remediation	N/A	If cracking, repair any cracks as noted	If cracking, repair any cracks as note.
<b>Groundwater</b>	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	Notification to Director Environmental Sustainability and DECCW
	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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 25 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

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 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 DECC	Notification to Director Environmental Sustainability and DECC
	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	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 26 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

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## 9 REPORTING AND ACCESS TO INFORMATION

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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 stakeholders in a Four Monthly Subsidence Management Status Report and again in an End of Panel Report.

Relevant stakeholders 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).

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## 10 REVIEW

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This Plan will be reviewed as necessary including:

- Within one year of the approval date
- 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 NSW Department of Industry & Investment – Minerals and Energy and any relevant stakeholders. In the event this document is revised, a copy will be forwarded to the relevant stakeholder(s) and agencies and also placed on the Donaldson website.

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 27 of 35
<b>Controlled Documents of the Abel Mine Safety Management System have blue text in this cell</b>				

## APPENDIX A – RISK ASSESSMENT RESULTS TABLE

Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Natural Features	Tributaries	1.02.02	Hydraulic connection from surface to underground	1. Connective cracking from stream bed to seam 2. Shallow cover depth 3. Mining height	1. Cover depth is greater than 100m 2. Mining height is less than 3.2m at this location	A	3	C	13	S	1. Mining height can be varied 2. Extraction ratio can be varied	Yes
Natural Features	Tributaries	1.02.06	Long term impact on aquatic ecosystem	1. Change in flow regime 2. Change in water quality	1. EMP TARPs includes remediation and mine plan review 2. Property Management Plans to be developed 3. No known acid sulphate soils 4. No upward gradient of groundwater	E	3	C	13	S	1. Assess remediation works of contaminated areas 2. Update CAD data with contaminated areas 3. Review contaminated areas studies (Douglas Partners)	Yes
Natural Features	Aquifers, known groundwater resources	1.03.04	Contamination of groundwater through leachate from waste areas	1. Connective cracking		E	3	C	13	S	1. Assess remediation works of contaminated areas 2. Update CAD data with contaminated areas 3. Review contaminated areas studies (Douglas Partners)	

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 28 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Natural Features	Tributaries	1.02.03	Ponding or reversal of flow	1. Tilting 2. Subsidence	1. EMP TARPs includes remediation and mine plan review 2. Property Management Plans (PMP) to be developed	E	4	B	14	S	1. Mining height can be varied 2. Extraction ratio can be varied	Yes
Natural Features	Tributaries	1.02.04	Destabilisation of bank and / or bed	1. Tilting 2. Subsidence 3. Gradient change	1. EMP TARPs includes remediation and mine plan review 2. Property Management Plans to be developed	E	4	B	14	S	1. Include tributary management in PMP	Yes
Natural Features	Schedule 2 Creeks	1.01.02	Hydraulic connection from surface to underground	1. Connective cracking from stream bed to seam 2. Pillar extraction within SCZ	1. Mine design and layout 2. Subsidence control zones (SCZ) 40m + to the 20mm subsidence contour (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Monitoring arrangements (Subsidence, surface and groundwater) 5. Environmental Monitoring Program (EMP) 6. Site water balance review 7. TARP	A	2	E	16	M	1. Include visual inspection of stream flow and pool depth in checklist	Yes

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 29 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Natural Features	Schedule 2 Creeks	1.01.01	Loss of overland flow	1. Surface cracking of stream bed 2. Pillar extraction within SCZ	1. Mine design and layout 2. Subsidence control zones (SCZ) 40m + to the 20mm subsidence contour (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Monitoring arrangements (Subsidence, surface and groundwater)	R	3	D	17	M	1. Include visual inspection of stream flow and pool depth in checklist	Yes
Natural Features	Schedule 2 Creeks	1.01.06	Long term impact on aquatic ecosystem	1. Change in flow regime 2. Change in water quality 3. Pillar extraction within SCZ	1. Mine design and layout 2. Subsidence control zones (SCZ) 40m + to the 20mm subsidence contour (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Monitoring arrangements (Subsidence, surface and groundwater)	E	3	D	17	M		Yes
Natural Features	Tributaries	1.02.05	Long term effects of change in stream water quality	1. Tilting 2. Subsidence 3. Gradient change 4. Contaminants from waste disposal areas	1. EMP TARPs includes remediation and mine plan review 2. Property Management Plans to be developed	E	3	D	17	M	1. Update CAD data with contaminated areas 2. Review contaminated areas studies (Douglas Partners)	Yes

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 30 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Natural Features	Tributaries	1.02.01	Cumulative loss of overland flow from tributaries	1. Surface cracking of stream bed	1. EMP TARPs includes remediation and mine plan review	E	4	C	18	M	1. Include visual inspection of stream flow and pool depth in checklist	Yes
Farm Land and Facilities	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Temporary loss of access to grazing areas	1. Surface cracking	1. Property Management Plans 2. Ongoing consultation with property owners	A	4	C	18	M		
Farm Land and Facilities	Internal Access tracks	3.02.01	Damage to internal property access tracks	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Reduction in sight distance on road 5. Change in drainage 6. Tree falling	1. Develop Public Safety Management Plan 2. Ongoing consultation 3. Property Management Plans	A	4	C	18	M	1. Ground truthing of surface features	
Farm Land and Facilities	Fences, gates and cattle grids	3.03.01	Damage to fences and / or gates including resulting loss of livestock	1. Strain 2. Subsidence 3. Falling tree	1. Property Management Plans 2. Ongoing consultation with property owners 3. Monitoring arrangements	A	4	C	18	M		
Farm Land and Facilities	Farm dams	3.04.01	Damage to dams resulting in loss of serviceability and integrity of dam wall	1. Cracking 2. Tilting	1. Dam monitoring and management strategy (DMMS) will be developed for all dams prior to mining impact 2. Statement of commitments to provide water in the event of interruption of supply of water from dam	A	4	C	18	M		

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 31 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Farm Land and Facilities	Water Reticulation systems	3.07.01	Damage to water reticulation system resulting in loss of service	1. Subsidence impacts	1. Property Management Plan 2. Monitoring arrangements 3. Statement of commitments to provide water in the event of interruption of supply of water from reticulation system	A	4	C	18	M	1. Complete identification of water reticulation systems within SMP Area 2	
Farm Land and Facilities	Capping of remediated areas	3.08.01	Loss of integrity of capping	1. Subsidence impacts	1. See above	A	4	C	18	M		
Natural Features	Schedule 2 Creeks	1.01.03	Ponding or reversal of flow	1. Tilting 2. Subsidence 3. Pillar extraction within SCZ	1. Mine design and layout 2. Subsidence control zones (SCZ) 40m + to the 20mm subsidence contour (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Monitoring arrangements (Subsidence, surface and groundwater)	E	4	D	21	L		Yes
Natural Features	Schedule 2 Creeks	1.01.04	Destabilisation of bank and / or bed	1. Tilting 2. Subsidence 3. Gradient change 4. Pillar extraction within SCZ	1. Mine design and layout 2. Subsidence control zones (SCZ) 40m + to the 20mm subsidence contour (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Monitoring arrangements (Subsidence, surface and groundwater)	A	4	D	21	L		Yes

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 32 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

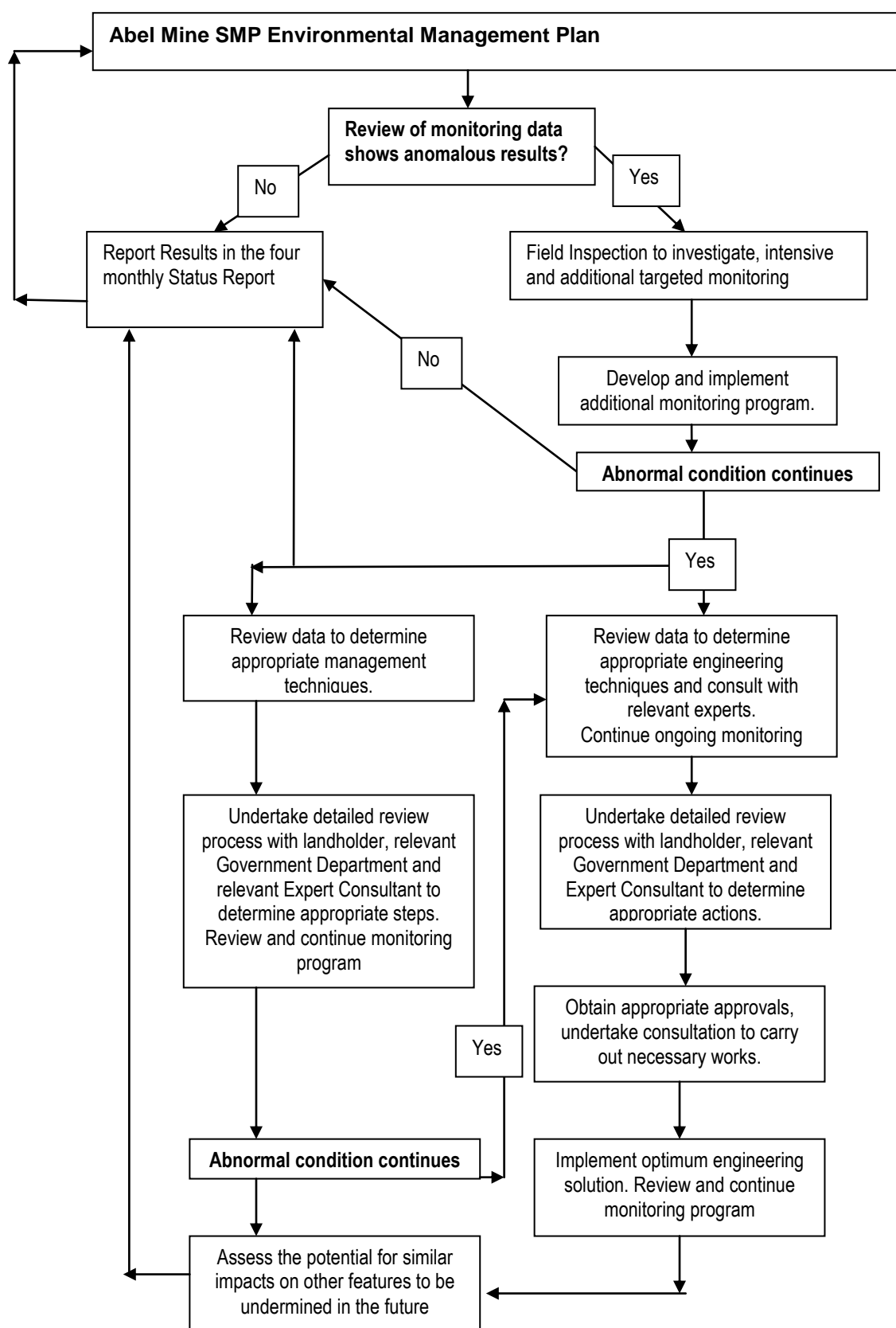
Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Natural Features	Schedule 2 Creeks	1.01.05	Change in stream water quality	1. Tilting 2. Subsidence 3. Gradient change 4. Pillar extraction within SCZ	1. Mine design and layout 2. Subsidence control zones (SCZ) 40m + to the 20mm subsidence contour (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Monitoring arrangements (Subsidence, surface and groundwater)	E	4	D	21	L		Yes
Natural Features	Aquifers, known groundwater resources	1.03.02	Additional flow to underground workings	1. Connective cracking	1. Water Management Plan 2. Pumping capacity is approximately 3 times current flows 3. Underground water storage area available	A	4	D	21	L		
Natural Features	Aquifers, known groundwater resources	1.03.03	Quality change of groundwater inflows through mine workings	1. Aquifer depressurisation	1. Water Management Plan	A	4	D	21	L		
Natural Features	Natural Vegetation	1.08.01	Change in habitat / fauna	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works	E	4	D	21	L		
Natural Features	Natural Vegetation	1.08.02	Visual impact	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Ongoing Consultation	R	4	D	21	L		

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 33 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

Process	Sub-process	H#	Risk Issue	Causes	Existing Controls and planned Management Plans	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
Areas of Archaeological and/or Cultural Significance	Areas of Archaeological and / or Heritage Significance	5.01.01	Disturbance of archaeological significant area contained within Area 2	1. Subsidence impacts	1. Located within Viney Creek SCZ 2. ATM 3. PEMP	A	4	D	21	L	1. Confirm details on sites and location	
Natural Features	Aquifers, known groundwater resources	1.03.01	Reduction in bore yield and adverse effects on groundwater dependent ecosystems	1. Connective cracking	1. No groundwater dependent ecosystems in area 2. No bores in area	E	5	C	22	L		

Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 34 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				

## APPENDIX B – MONITORING AND MANAGEMENT FLOW CHART



Prepared by	Tony Sutherland	Document No		Abel SMP Area 2 – Environmental Management Plan
Approved by	Phil Brown	Version No	1	
Issue date	May 2011	Revision date	May 2012	Page 35 of 35
Controlled Documents of the Abel Mine Safety Management System have blue text in this cell				