BLOOMFIELD

BLOOMFIELD MINING OPERATIONS

Water Management Plan

Ver	Date	Description	By	Chk	App
1	31/03/10	Final Draft	KH	SD	SD
2	27/10/11	Final	GL	SG	SG
3	31/05/12	Final (Amended)	GL		SG
4	18/09/13	Final (Amended)	GL		SG
5	06/09/17	Revised and Updated	GL		BC
6	20/12/17	Revised Final – incorporating DPE consultation	CK		BC

BLOOMFIELD GROUP – INTEGRATED MANAGEMENT SYSTEMS

CONTENTS

APPENDICES

PART A – WATER MANAGEMENT PLAN

Overview

This water management plan (WMP) has been prepared in response to Project Approval (Approval) 07_0087 granted under section 75J of the Environmental Planning and Assessment Act (EP&A) and modifications to the Approval was granted in accordance with section 75W of the Environmental Planning and Assessment Act 1979. It has also been updated in accordance with a review as part of the Independent Environmental Audit 2013.

Condition 19 of Schedule 3 requires that:

Requirement	WMP Reference
The Proponent to prepare and implement a Water Management Plan for the project to the satisfaction of the Director-General. This plan must:	
(a) be prepared in consultation with OEH and NOW and be submitted to the Director-General for approval within 6 months of the date of this approval;	Appendix A
(b) be prepared by suitably qualified expert/s whose appointment/s have been approved by the Director-General; and	Appendix A
(c) include:	
❑ a Site Water Balance;	Part B
❑ an Erosion and Sediment Control Plan;	Part C
❑ a Surface Water Monitoring Plan;	Part D
❑ a Ground Water Monitoring Program; and	Part E
❑ a Surface and Ground Water Response Plan.	Part F

The water management plan takes into consideration the Environmental Management Strategy (EMS) for the site, commitments stated in the Part 3A Environmental Assessment, and the various conditions outlined in schedules 2 to 5 of the Approval granted under Section 75 J of the Environmental Planning and Assessment Act 1979.

The NSW Office of Water and EPA were consulted throughout the environmental assessment process and preparation of this plan. Their requirements taken into account in the preparation of the site water management plan. Evidence of consultation is provided in Appendix A.

Background to the Project

Bloomfield Colliery is an open cut mining operation located to the north of John Renshaw Drive, Buttai and east of Buchanan Road, Buchanan, approximately 20 km north-west of Newcastle (refer Figure 1).

Mining has occurred on the site for approximately 170 years. The approved Project Area includes approximately 576 hectares of land which the majority has been disturbed by mining and mining related activities. It is located within the Cessnock Local Government Area, and zoned 1(a) Rural 'A' under the Cessnock Local Environmental Plan 1989.

Mining is currently a multi-seam truck and excavator or face shovel operation, conducted in sequential mining blocks. It is proposed to continue this existing method using the same or similar equipment.

ROM coal is trucked to the ROM coal stockpile at the Bloomfield washery for processing, which occurs under the Abel Project Approval. The colliery is approved to operate 7 days per week, 24 hours per day.

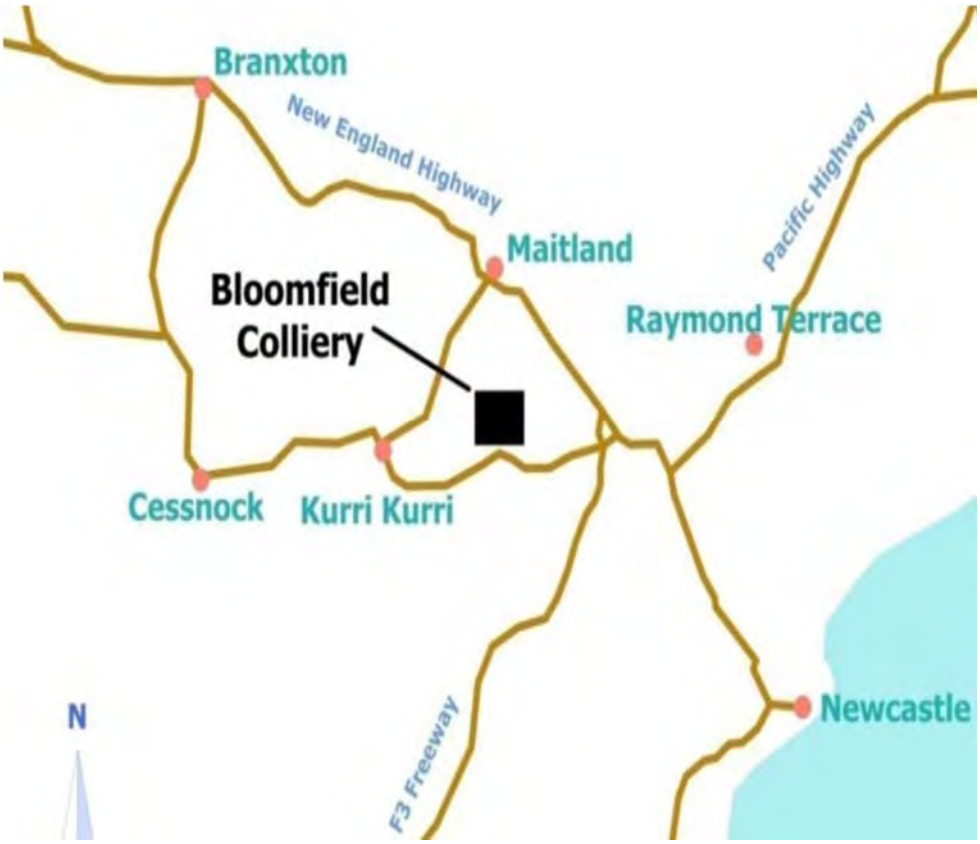


Figure 1 LOCALITY PLAN

Scope and Objectives

The WMP addresses water management issues within the Project Area covered by the EA (refer to Figure 2). The Approval allows for continued mining and operation of mine infrastructure including:

- current and proposed open cut mine areas;
- workshop;
- the road between the open cut pit areas and the ROM coal stockpile at the washery; and
- the road that links the workshop, open cut pits and washery.

The Modification (MOD 1) allows for:

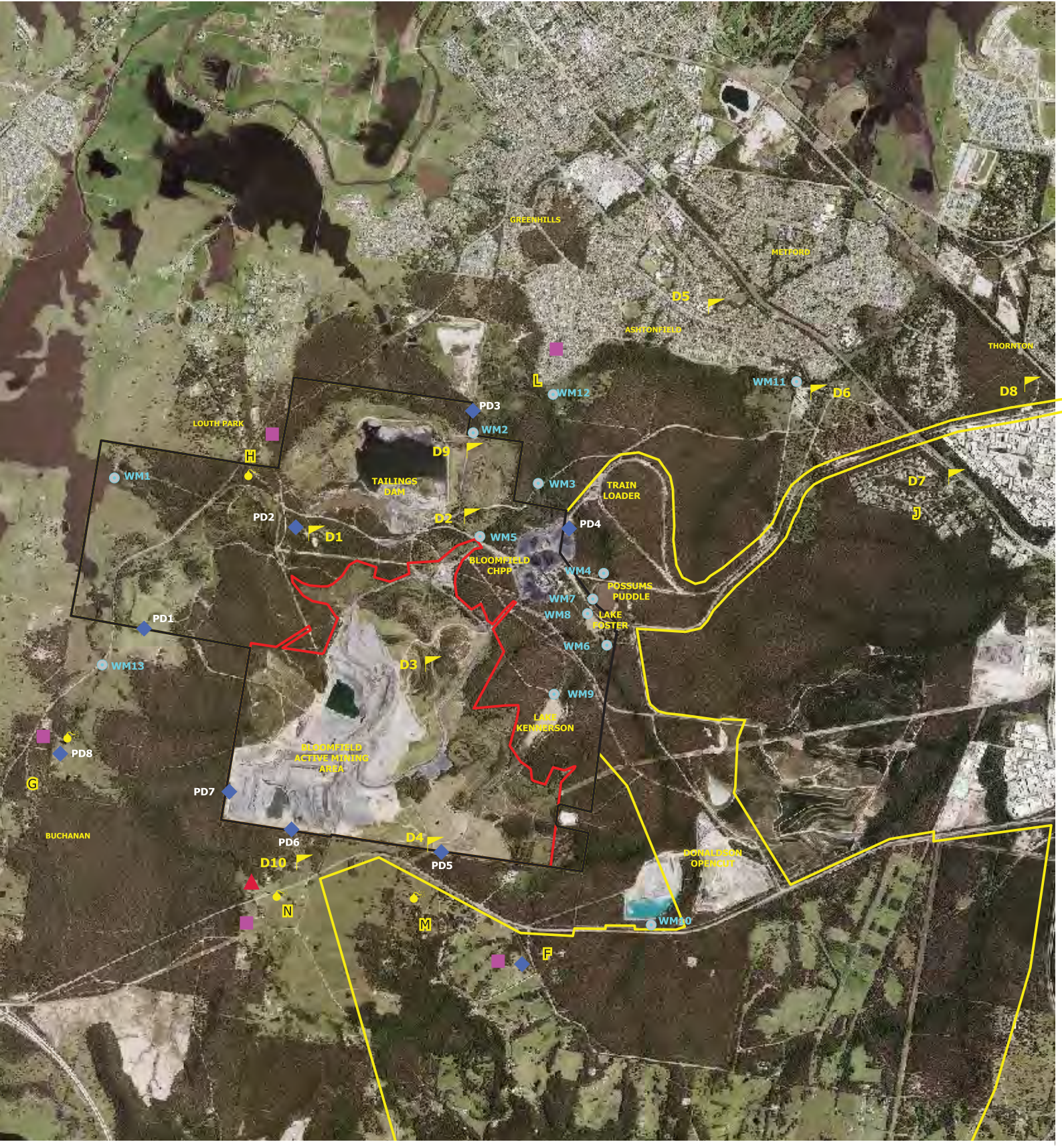
- upgrade and use of Wattle Tree Drive as an alternative haul route;
- additional overburden emplacement and rehabilitation - east of Save a Mile Haul Road;
- additional out-of-pit landform reshaping and rehabilitation – northern and south-eastern areas; and
- construction of a corridor and overhead powerline from an existing powerline onto the open cut mine site, together with some clearing for an associated infrastructure area.

This will enable Bloomfield to complete mining and rehabilitation of the site. Figure 2 shows the approved Project Area and general layout of monitoring sites.

The purpose of the WMP is to:

- address the relevant conditions of the Approval as modified;
- address relevant commitments made in the Environmental Assessment process; and
- address statutory requirements and relevant guidelines.

The WMP aims to ensure that the quality of water leaving the project area meets the appropriate quality standard. The plan includes a strategy to manage surface water including erosion and sediment controls, a ground and surface water monitoring program and develops a response program to mitigate potential impacts on surface and ground water.



LEGEND

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N

- Bloomfield Project Area
- Abel Mine Project Area
- Bloomfield Mining Lease
- Blast Monitor
- Dust Monitor
- High Volume Air Sampler
- Noise Monitor
- Peizometers
- Water Monitoring

THE Bloomfield GROUP

Bloomfield Colliery

Water Management Plan

Figure 2 Bloomfield Colliery Project Area

Scale: 1:33,333	Date: January 2016 Photo: January 2016	Drawing: A3

Relationship with Other Plans

The Environmental Management Strategy for the site establishes a frame work for environmental monitoring. The WMP is an integral component of the EMP and supports the overall environmental objectives for the site.

Report Structure

The water management plan is an integrated document that addresses the water management within the project area as shown on Figure 2. The document has been designed to address the requirements of Condition 19, Schedule 3 of the Approval and the structure of the Plan is summarised in Figure 3.

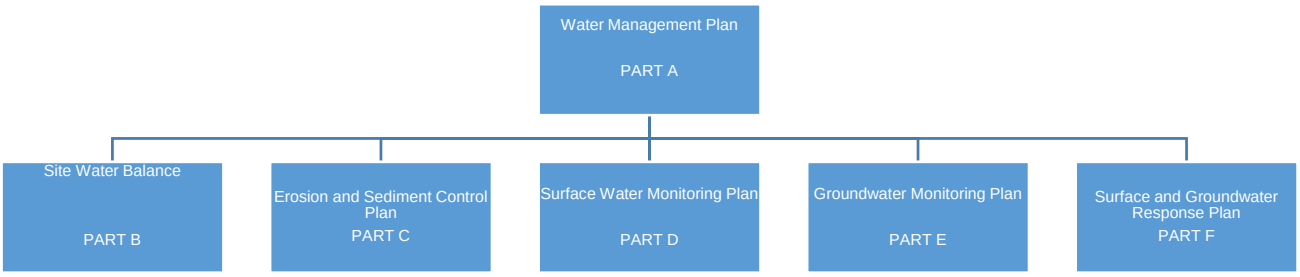

Figure 3 STRUCTURE OF THE WATER MANAGEMENT PLAN

In accordance with Condition 19 of Schedule 3 of the Approval, qualified experts were engaged to prepare the water management plan. Due to the complexity of the site and water management issues, three specialist consultancies were engaged to address the various requirements. Evidence of DPE approval of the qualified experts is provided in Appendix A.

Reports were provided by the consultants and are provided in full as Appendices to this document. They include the following:

- Site water balance prepared Evans and Peck (Appendix B);
- Erosion and sediment control management prepared by GSS Environmental (Appendix C);
- Surface water monitoring, and surface response plan prepared Evans and Peck (Appendix D); and
- Groundwater monitoring and groundwater response plan prepared by Aquaterra (Appendix E).

Roles and Responsibilities

The company directors are responsible for the overall environmental performance of Bloomfield Colliery. Senior operational managers have direct responsibility for their areas of control while the environmental officer provides direction and advice to ensure that site environmental conformance is maintained. The principal environmental and operational managers are shown in Table 1.

Table 1 MANAGEMENT TEAM

Position	Name
Managing Director	John Richards
Manager of Mining Development	Garry Bailey
Mine Manager	Brendon Clements
Manager Technical Services	Simon Grassby
Environmental Officer	Greg Lamb

Meteorological Monitoring

In accordance with the Project Approval, a meteorological station is installed on site. The station is located near the active mining areas adjacent to an existing communications tower. The meteorological station monitors:

- rainfall;
- temperature;
- relative humidity;
- wind speed; and
- wind direction.

PART B - SITE WATER BALANCE

A detailed report on the site water balance prepared by Evans and Peck is provided in Appendix B and should be referred to for detail. The key findings are summarised in the following section of the WMP.

The Environmental Assessment provides a detailed water balance for the site. The assessment concluded that the impact from the project would have a negligible impact on the approved integrated water management system for the three adjoining mines of Bloomfield, Abel Underground and Donaldson Open Cut (now complete). The water balance presented in this report relates specifically to the project area (outlined in red in Figure 2) covered by the modified Approval.

Condition of Approval

Condition 20 of Schedule 3 addresses the specific requirements for the site water balance. It is specified that the *Site Water Balance must:*

include details of:

- sources and security of water supply;
- water use and management on site;
- any off-site water transfers or discharges; and
- reporting procedures; and

(b) describe measures to minimise water use by the project.

Sources of Water

The water balance addresses those areas and activities assessed in the Project Area which includes:

- groundwater inflow to the mine pits;
- various are of the catchments that will be modified over time in terms of:
  - the location to which surface runoff will drain (the mine pits, Buttai Creek or Whites Creek and Lake Kennerson);
  - the runoff characteristics of the different land surfaces as mining progresses (existing natural conditions, mine pit, haul roads, placed overburden and rehabilitated overburden);
- use of water for dust suppression; and
- ‘export’ of excess water to Lake Kennerson and, if necessary, ‘import’ of water from Lake Kennerson to meet operational requirements for dust suppression.

Water Use

A schematic diagram of the water balance for the site is provided in Figure 4. The analysis shows that groundwater inflow are likely to provide sufficient water for operational purposes within the project area. Accordingly, the excess water will be directed to Lake Kennerson which then contributes to the water supply system for the Bloomfield CHPP. The operation of the CHPP and flows from Lake Kennerson are outside the scope of this assessment and addressed in the Project Approval for Abel Underground Mine.

Measures implemented at site to reduce water usage include the following;

- Established clean water diversions to minimise water take and allow environmental water to provide flows into Four Mile Creek.
- Progressive rehabilitation and re-establishment of clean water runoff
- Licensed discharge under the EPL to allow excess water to be returned to the environment.
- Recovery and reuse of raw water from tailings dam for re-use in dust suppression and coal processing.

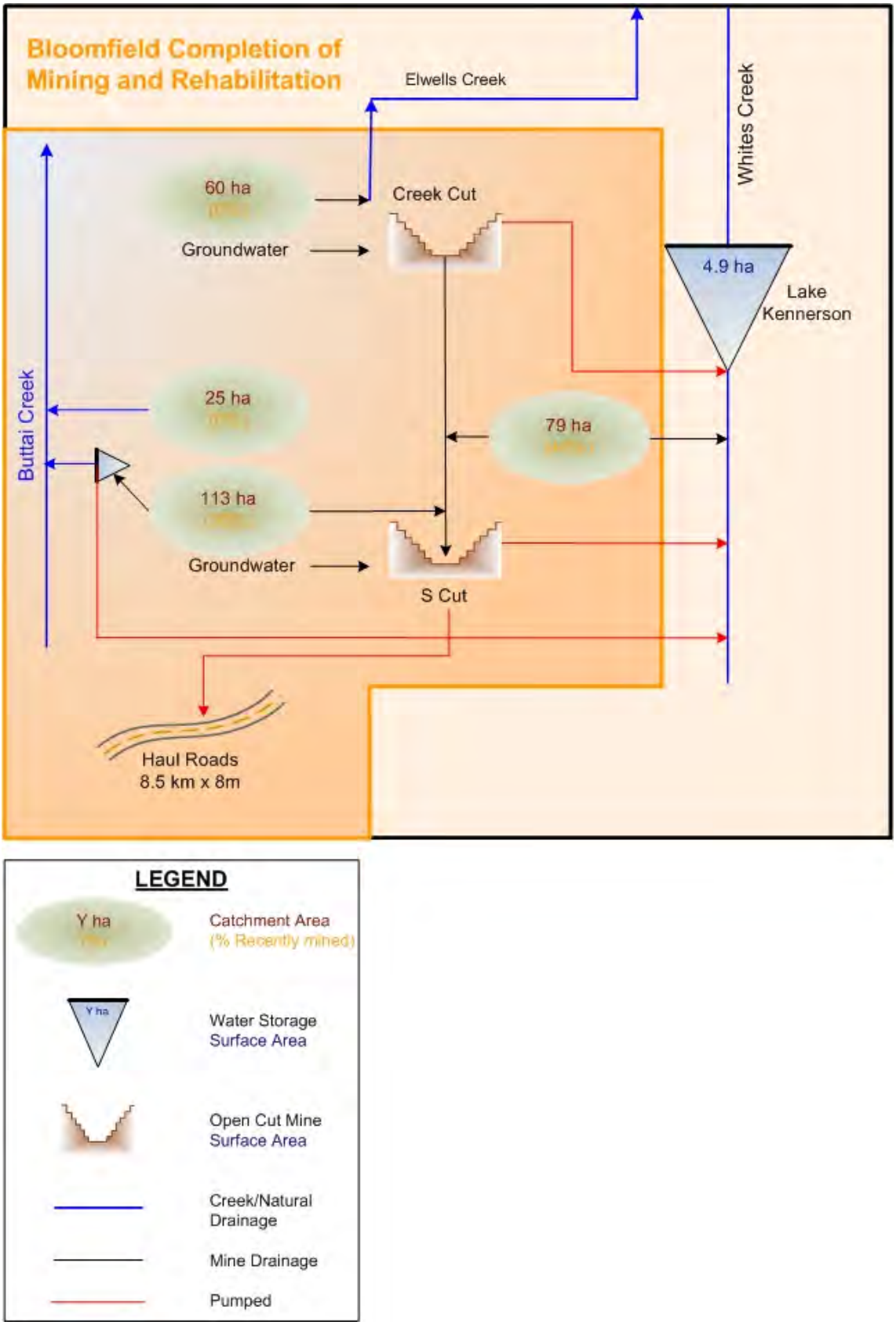

Figure 4 SCHEMATIC DIAGRAM OF CATCHMENTS AND FLOWS WITHIN PROJECT AREA

Water Balance Results

Summary water balance statistics are presented in Table 2 for each year of the project. The results show:

- for all remaining years of mining, there is expected to be a surplus of water that will contribute to the water available from Lake Kennerson for supply to the Bloomfield CHPP; and
- the volume of surplus water in any year will vary significantly depending on the groundwater inflow, the area of the mine pits and contributing overburden areas, and the area of haul roads that require water for dust suppression.

Table 2 SUMMARY WATER BALANCE

Year	**G/W**	**Runoff (ML/year)**			**Water Use (ML/year)**			**To Lake Kennerson (ML/year)**		
	(ML/Y)	Dry	Median	Wet	Dry	Median	Wet	Dry	Median	Wet
2010	615	197	342	514	160	141	129	652	816	1,000
2011	610	220	366	539	217	191	175	614	785	974
2012	747	238	389	564	272	240	219	713	896	1,092
2013	720	253	417	606	285	251	230	688	886	1,096
2014	260	339	518	716	298	263	240	301	516	736
2015	325	286	449	630	283	250	228	328	525	727
2016	351	249	397	559	266	235	215	334	513	695
2017	144	302	432	570	252	222	203	195	354	511

Use and on Site Management	Dust suppression is the main water use for the operations within the area covered by the Approval. Water carts are used for dust suppression within the active area of mining and haul roads. Estimates of water use for dust suppression on haul roads and work areas have been modelled using the relationship derived by Thompson & Viser (2002) which has been benchmarked against mine records. Dust suppression is an important amenity issue for residences in the vicinity of the mine, the estimates of water requirements for dust suppression purposes are deliberately conservative (i.e. make provision for liberal application of water). For modelling purposes, the water requirement takes account of changes in the area of active haul road at each particular stage of mine development represented in the model. It should be noted that other water use and systems on site such as the coal handling and preparation plant (CHPP) is accounted for under the Abel approval and not part of this assessment. The water management system is designed to minimise the volume of water reporting to the disturbed system. Opportunities to minimise water use have been incorporated within the operation and future opportunities will be incorporated as they arise.
Conclusion	The water balance model concludes that the project will: ❑ be capable of meeting all water needs for dust suppression from the groundwater inflows and surface runoff into the mine pits; and ❑ provide a net surplus of water that will contribute to the water available from Lake Kennerson for supply to the Bloomfield CHPP.

PART C -EROSION AND SEDIMENT CONTROL PLAN

The objective of the erosion and sediment control plan (ESCP) is to ensure that the discharge of all water from the site is managed and that it meets appropriate quality standards. The ESCP covers the area included in the Approval as shown in Figure 2.

The ESCP for the site was prepared by GSS Environmental and is presented in full in Appendix C. Key elements of the plan are summarised in the following sections of the WMP.

Conditions of Approval

Condition 21 of Schedule 3 specifies the requirements for the preparation of the erosion and sediment control which are reproduced as follows:

The Erosion and Sediment Control Plan must:

(a) be consistent with the requirements of Managing Urban Stormwater: Soils and Construction;

(Volume 2E – Mines and Quarries) manual (OEH 2008), or its latest version;

(b) identify activities that could cause soil erosion and generate sediment;

(c) describe measures to minimise soil erosion and the potential for transport of sediment downstream;

(d) describe the location, function and capacity of erosion and sediment control structures; and

(e) describe what measures would be implemented to maintain the structures over time.

General ESCP Principles

To minimise the potential for the generation of sediment the following key principles are applied to the site:

- coordination of mining to minimise exposure of disturbed soils;
- separation/diversion of 'clean' water catchments from disturbed areas to minimise sediment-laden and mine water volumes for management;
- collection and management of runoff sediment control devices;
- appropriate storage and handling of topsoil materials;
- revegetation of disturbed areas following site disturbance; and
- effective maintenance program for the site.

Potential sources of sediment

The activities associated with the workshop area and active mining areas have been identified as having the greatest potential for erosion and sediment generation on the site. Whilst the ESCP focuses on these key areas, consideration is also given to the runoff and maintenance of haul roads, clearing and rehabilitation of disturbed areas.

ESCP Control Measures

The regular inspection and maintenance of permanent structures ensures that the water management system and erosion controls remain effective. Measures to minimise erosion and sediment generation include:

- identification and review of surface activities that may change surface water flows and result in erosion;
- minimising the clearing of vegetation ahead of mining activities;
- regular monitoring of rehabilitated areas;
- installation of temporary and/or additional permanent controls to manage locations that have been identified as requiring attention;
- diversion of surface and road runoff away from disturbed areas;
- regular inspection and cleaning of catch drains and structures following storm events or other activities such as vehicle movements that may result in damage;
- and clearing of excessive vegetation and weeds along drainage lines.

The ESCP provides for long term permanent controls and short term structures that may be required in areas that are disturbed for short periods.

The figure showing the location of permanent controls is provided in the full report in Appendix C and should be referred to for details. Sediment dams vary in desirable location, dam shape and size and should be designed and constructed with regard to the contributing catchment area, erosivity of the soil, storm intensities and average recurrence intervals. In sizing sediment basins on site, the recommended minimum design criteria for temporary erosion and sediment control measures outlined in Table 6.1 from Managing Urban Stormwater Soils and Construction Vol 2 Mines and Quarries will be followed. Sediment dams will be constructed, where practical, in accordance with the Sediment Dam Standard Drawings (SD6-8) of the 'Blue Book'.

The plan provides details for the current stage of mining and will be reviewed and revised as mining and rehabilitation progresses.

Maintenance and Monitoring of ESCP Controls

The ESCP requires regular monitoring and management of controls to ensure runoff is managed appropriately. A summary of the regular monitoring schedule is provided in Table 3.

Table 3 ESCP MONITORING SCHEDULE

Element	**Management/Monitoring Strategy**	**Frequency**
CHPP Haul Road Drainage	Inspect status of erosion along the side of haul road to ensure the toe of the rehabilitated batter is stable and not undercutting. Grader maintenance of the haul road will be undertaken as required.	Weekly and following high intensity storm events.
Sediment Ponds/Dams (as marked on ESCP Figure 1)	Inspect sediment build-up and integrity of structures. De-silt dams as required.	Quarterly
Constructed Drainage Lines (as marked on ESCP Figure 1)	Inspect drainage lines to ensure stable, not actively eroding and has adequate capacity. Clean out or repair as required.	Quarterly
Natural drainage lines in Southwest corner of mine boundary	Inspect drainage lines for sedimentation from upstream catchment.	Quarterly
Pipe outflow from pit sumps	Inspect pipe outflow sites for erosion and scouring. Implement protection as required.	Monthly and following relocation
Rehabilitation areas and drainage lines on rehabilitated slopes	Inspect rehabilitation and drainage lines for adequate surface protection, ensuring sediment buildup in drainage lines is not adversely affecting drain capacity.	Within 12 months of establishment and then every 2 years
Proposed clearing activities ahead of mining	Inspect sites to be cleared ahead of mining, ensuring adequate sediment controls are established prior to surface disturbance.	Prior to clearing activities
Temporary sediment controls (silt fence, sandbag weirs etc)	Inspect sediment control structures for sediment build up and clean out as required to maintain adequate capacity.	Monthly and following high intensity storm events
Review of this ESCP	Undertake review and update of this ESCP to ensure all aspects associated with the site are captured.	Every two years or following any significant changes to the mine plan
Reporting of ESCP findings and inspections	Results of ESCP inspections, maintenance activities and construction of erosion and sediment control structures are to be reported to mine management.	Monthly

PART D - SURFACE WATER MONITORING

The Surface Water Monitoring Plan is an integral component of the WMP. The plan identifies locations and schedule for monitoring of surface water.

Conditions of Approval

Condition 22 of Schedule 3 specifies the requirements for the preparation of the surface water monitoring program control which are reproduced as follows:

The Surface Water Monitoring Program must include:

(a) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the project;

(b) surface water and stream health impact assessment criteria;

(c) a program to monitor the impact of the project on surface water flows, water quality and stream health; and

(d) reporting procedures for the results of the monitoring program.

Environment Protection Licence

The water management plan takes into consideration the Environment Protection Licence (No 396) which allows for the discharge of water under certain conditions. When sufficient rainfall is recorded and the quality of water meets the criteria specified in the Licence, discharge is permitted from licenced discharge point.

The specific requirements of the EPL in relation to the discharge of water is provided are provided in Table 4.

Table 4 ENVIRONMENT PROTECTION LICENCE CONDITIONS

	CONDITION
L1	**Pollution of Waters**
L 1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.
L2	**Concentration Limits**
L2.1	For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
L2.2	Where pH quality limit is specified in the table the specified percentage of samples must be within the specified ranges.
L2.3	To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the tables/s.
L2.4	Water and/or concentration limits Point 1: Conductivity: 6000 uS/cm pH: 6.5-8.5 Total Suspended Solids: 30 mg/L Filterable iron: 1mg/L

Table 4 ENVIRONMENT PROTECTION LICENCE CONDITIONS (CONT)

	CONDITION
L3	**Volume and Mass Limits**
L3.1	For each discharge point or utilisation are specified below (by a point number), the volume/mass of: (a) liquids discharged to water; or (b) solids or liquids applied to the area; must not exceed the volume/mass limit specified for that discharge point or area. Point 1 – 40,000 kL/day
L3.2	Discharge from Point 1 as referred to in Condition L3.1 is only permitted in the following conditions: ❑ in wet weather conditions following a 10mm or greater 24 hours rainfall event in the catchment in the first 24 hour period following the rainfall event; and ❑ in wet weather conditions following a 15mm or greater 24 hours rainfall event in the catchment in the second 24 hour period following the rainfall event; and ❑ in wet weather conditions following a 20mm or greater 24 hours rainfall event in the catchment in the third 24 hour period following the rainfall event.

The licensed discharge of water from the site is covered in the Abel Consent and is covered by the approval.

Hydrology and Baseline Data

A summary of baseline conditions for Elwells Creek and Buttai Creek at Lings Road is provided in the Table 3 of the full assessment which is provided in Appendix D.

Surface Water Impact Assessment Criteria

The proposed water quality trigger values for Buttai and Elwells Creeks have been based on historic data collected over a number of years. The upper and lower limit thresholds have been based on the 10% and 90% percentiles of collected baseline data as per ANZECC guidelines (rounded figures).

The trigger values provide an appropriate level of protection for the waterway and are reflective of the community values for the catchment areas. The results of monitoring will be reviewed annually. If required, the trigger values will be reviewed in consultation with the EPA and will be revised if found necessary.

Table 5 TRIGGER VALUES

Source	**Elwells Creek (WM5)**	**Buttai Creek at Buchanan Road (W13)**	**Buttai Creek at Lings Road ***
pH	5.2 – 8.0	6.4 – 7.8	6.0 – 7.5
EC (µS/cm	430 - 4,000	380 – 1,100	500 – 1,200
TSS (mg/L)	4 – 85	5 - 45	3 - 30

Notes (*) Monitored by Donaldson Coal

Surface Water Monitoring Program

The plan provides the locations of surface water monitoring and ground water monitoring locations. The location of surface water monitoring points are shown on Figure 2. The monitoring schedule outlines the frequency and analysis required at each location.

Table 6 SURFACE WATER MONITORING

LOCATION	FREQUENCY	PARAMETER
Elwells Creek at Haul Road (WM5) Buttai Creek at Buchanan Rd (WM13)	**Monthly** field monitoring at all listed sites for the range of parameters listed	Temperature pH EC DO Turbidity Oil and Grease (Visual observation) Flow (Visual observation)
	Quarterly grab sample at all listed sites and laboratory analysis for the range of parameters listed	TSS TDS pH EC
	Six monthly grab sample at all listed sites and laboratory analysis for the range of parameters listed	Chlorides Sulfates Alkalinity (Bicarb) Alkalinity (Carb) Calcium Magnesium Sodium Potassium

Note: Donaldson Coal monitor Buttai Creek at Lings Road

PART E - GROUNDWATER MONITORING

The Groundwater Monitoring Plan is an integral component of the WMP. The plan identifies locations and schedule for monitoring.

Groundwater levels in the Project Area show the accumulated effects of long-term mining. Due to the long period of time mining has occurred on the site, there is no evidence to suggest what pre-mining groundwater levels might have been. However, the influence of mining on water levels is apparent by the marked differences in groundwater levels between shallow and deeper coal measures.

Conditions of Approval

Condition 23 of Schedule 3 specifies the requirements for the preparation of the surface water monitoring program control which are reproduced as follows:

(a) *further development of the regional and local groundwater model;*

(b) detailed baseline data to benchmark the natural variation in groundwater levels, yield and quality (including at any privately owned bores in the vicinity of the site);

(c) groundwater impact assessment criteria;

(d) a program to monitor the impact of the project on groundwater levels, yield, quality, groundwater dependent ecosystems and riparian vegetation;

(e) procedures for the verification of the groundwater model; and

(f) reporting procedures for the results of the monitoring program and model verification.

Baseline data

Groundwater levels in the Project Area show the accumulated effects of long-term mining. Due to the long period of time mining has occurred on the site (170 years), there is no evidence to suggest what pre-mining groundwater levels might have been. However, the influence of mining on water levels is apparent.

Groundwater in the vicinity of the Project Area is saline and of negligible value for beneficial users. The Groundwater Assessment concludes that no adverse impacts on groundwater supply, quality or any groundwater dependent ecosystems are expected as a result of the Project (Appendix D).

Dewatering associated with the Project will cease before the completion of the Project. Groundwater levels will recover to levels above present levels before the completion of the Project. Groundwater levels are expected to stabilise within 20-30 years. Small impacts on stream base flows are predicted for Wallis and Buttai Creeks, with rapid recovery post-mining.

Further Development of the Groundwater Model

The Bloomfield Coal groundwater model was developed for the EA, to assess the groundwater impacts, associated with completion of mining and rehabilitation (Aquaterra, 2008a). The model included steady state calibration, sensitivity analysis, predictive scenario modeling and prediction uncertainty assessment for mine dewatering operations and post mining recovery. The steady state model included the simulation of past and present dewatering activities of the Bloomfield operations and the neighboring Donaldson open cut. Predictive modelling also included the Abel underground mine which is currently under development.

Environmental impact indicators such as groundwater levels are currently below model predictions for this stage of mining. The model can therefore be considered conservative. Circumstances which may trigger further development or refinement of the groundwater model include:

- a significant change to the mine plan;
- acquisition of new hydrogeological information, such as groundwater levels and aquifer properties (i.e. hydraulic conductivity) which are different to calibrated values used in the model; and
- groundwater drawdown and inflows which significantly exceed model predictions for that stage of mining.

Groundwater Impact Assessment Criteria

Impact assessment criteria are recommended for:

- Mine inflow rate;
- Mine inflow water quality;
- Near surface groundwater levels, in particular groundwater levels near Buttai and Wallis;
- Creeks;
- Impacts on surficial groundwater levels and/or creek base flows; and
- Impacts on existing licensed users.

Groundwater Water Monitoring Plan

The location of groundwater monitoring points are shown on Figure 2. The groundwater monitoring program will include:

- Quarterly measurement of water levels in the existing network of piezometers located on company land to be monitored through the life of the project.
- Six monthly sampling of all standpipe piezometers for analysis of electrical conductivity (EC), total dissolved solids (TDS) and pH.
- Annual collection of water samples from standpipe piezometers for laboratory analysis of a broader suite of parameters
  - Physical properties (EC, TDS and pH)
  - Major cations and anions (Ca, Mg, Na, K, Cl, SO4, HCO3 and CO3)
  - Nutrients
  - Dissolved metals.
- Record pump time from the pit to estimate the volume of mine water pumped from the open cut mine.

PART F - SURFACE AND GROUNDWATER RESPONSE PLAN

In the event of unexpected adverse impacts or water quality degradation an assessment of the causes will be undertaken and if required an approach developed to mitigate the impacts.

Conditions of Approval

Condition 24 of Schedule 3 specifies the requirements for the preparation of the surface and groundwater response program control which are reproduced as follows:

The Surface and Groundwater Response Plan must describe the measures and/or procedures that would be implemented to:

(a) investigate, notify and mitigate any exceedances of the surface water, stream health and ground water impact assessment criteria;

(b) compensate landowners of privately-owned land whose water supply is adversely affected by the project; and

(c) mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.

Surface and Groundwater Response Plan

In the event the monitoring results show an exceedance of the adopted water quality trigger values, an investigation into the potential sources and/or causes will be undertaken. If the company is found that it could be responsible for the exceedance further actions will be taken to address the matter.

The response actions listed below will be initiated. An action plan will be prepared to reflect these actions.

- Once an exceedance is detected the circumstances of the event will be immediately investigated including a review of relevant monitoring data, meteorological conditions etc;
- An assessment will be made to determine the reason for the exceedance, the potential magnitude of the impact and the level of future risk;
- If assessed as being caused by the mining operation, and it is further assessed to be likely to cause an adverse impact on an existing beneficial or environmental use of surface water, then an appropriate preventative and/or remedial strategy will be prepared for discussion with relevant authorities including the Department of Resources and Geoscience (DRG) and the Environmental Protection Authority (EPA), which may comprise:
  - Additional monitoring including assessment of ecological aspects;
  - Modification of mine water management procedures;
  - Modification to mine water management facilities; or
  - (If appropriate) no change to operations.

- A response/mitigation plan will be implemented to the satisfaction of the relevant authorities such as EPA; and
- If it is found that downstream water users have been adversely impacted the landholder(s) will be consulted regarding the provision of an alternative water supply or some other appropriate agreement negotiated between the parties. If a resolution cannot be reached the matter will be referred to the Secretary of the Department of Planning and Environment for resolution.
- If it is found that mining operations have demonstrably caused adverse impacts on groundwater dependent ecosystems or riparian vegetation, Bloomfield will investigate mitigation and or offset requirements with DPE and other relevant government agencies.

Investigation and Reporting of Exceedances

The report will:

(a) describe the date, time and nature of the exceedance/ incident;

(b) identify the cause (or likely cause) of the exceedance/ incident;

(c) describe what action has been taken to date; and

(d) describe the proposed measures to address the exceedance/incident.

Complaints

Bloomfield's Environmental Management Strategy details the procedures for addressing complaints including water related issues that may by raised the community. All complaints from the community and/or government agencies are recorded. Details for each are kept including:

- date and time of complaint;
- method by which the complaint was made;
- personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- nature of the complaint;
- the action(s) taken in relation to the complaint, including any follow up contact with the complainant; and
- if no action was taken, the reason why no action was taken.

The complainant will be followed up to explain the outcome of the investigations.

Audit and Review

The ongoing effectiveness and efficiency of this management system is monitored as part of the operation's day to day management. Feedback from this and other more formal reviews and/ or following special occurrences, form the basis for system improvement and re-design.

General Conditions of Review	In general Management Systems are reviewed and up-dated conditional as follows: ❑ Every three years; or ❑ Whenever there is a significant change to relevant legislation; or ❑ If required to do so by the Regulations; or ❑ Whenever there is a significant change to the operations; or ❑ If required (in writing) to do so by government department; or ❑ Whenever control measures are found to be ineffective either through: ♦ changes to the working environment; or ♦ changes to operating systems; or ♦ subsequent risk assessments; or ♦ the findings of an audit; or ♦ following a fatality or dangerous incident that could reasonably have been expected to result in a fatality; or ♦ following an assessment of a related safety alert.
Document Management	Copies of this document are managed under the Group Document Management, Management System. This document and other relevant documents are kept on site and are available to all employees.

APPENDIX A

Evidence of Agency Consultation and Approval of Experts.

53 C 19(B)

NSW GOVERNMENT | Planning

Major Projects Assessment
Industry & Mining
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23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Our ref: S07/01215

Mr John Richards
Director
Bloomfield Collieries Pty Limited
PO Box 4
EAST MAITLAND NSW 2323

Dear Mr Richards

Bloomfield Coal Project (07_0087)
Approval of experts to prepare management plans

I refer to your letter dated 3 November 2009 seeking approval for suitably qualified experts to prepare a Water Management Plan and a Rehabilitation Management Plan as required under the Minister's approval for the Bloomfield Colliery (07_0087).

The Department has reviewed the information you provided and the Director-General has approved the appointment of Mr Steve Perrens of Evans & Peck Pty Limited and Mr Andy Fulton of Aqua Terra Pty Limited to prepare the Water Management Plan.

The Department understands Mr Lachlan Crawford is no longer nominated to prepare the Rehabilitation Management Plan. Please provide an alternative nomination for approval at the earliest convenience.

If you wish to discuss this matter further please contact Paul Freeman.

Yours sincerely

DKitto 17/11/09

David Kitto
Director
Major Development Assessment
as Delegate for the Director-General

S3 C 19 (A)
OEH Consultation

THE Bloomfield GROUP

31 March 2010
Our Ref: Surv/761

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Head Regional Operations Unit - Hunter Region
Department Environment Climate Change & Water
PO Box 488G
NEWCASTLE NSW 2300

Attention: Mr Mitchell Bennett

Dear Mr Bennett

RE: BLOOMFIELD COLLIERY (PROJECT APPROVAL 07_0087)

Please find attached an electronic copy of the Water Management Plan for Bloomfield Colliery. The water management plan which incorporates the Site Water Balance, Erosion and Sediment Control Plan, Surface Water Monitoring Plan and the Surface and Groundwater Response Plan.

The plans have taken the issues into account issues raised by the Department during the preparation of the Environmental Assessment and the specific requirements of the Project Approval. Could you please advise if the Department has any comments or requires clarification of any matters. Once all relevant comments have been incorporated, each document will be issued as a final and included on the Company's website.

If you require hard copies of any of these documents please advise me so that we can forward to you. Thank you for your assistance with this matter.

Yours faithfully
BLOOMFIELD COLLIERIES PTY LIMITED

K Halliday

Keren Halliday
Environmental Officer

☎ (02) 49302689
🖷 (02) 49338940
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enc

Environment, Climate Change & Water

NSW GOVERNMENT

53 C 19 (A)

OEH Consultation

Your reference: SURV/761 & DECCW/001KH
Our reference: DOC10/15457, DOC10/15469, LIC09/250
Contact: Mitchell Bennett, 02 4908 6806

The Bloomfield Group
PO Box 4
EAST MAITLAND NSW 2323

Attention: Keren Halliday

23 APR 2010

Dear Ms Halliday

Bloomfield Colliery Water Management Plan and Environmental Management Strategy

Thank you for forwarding the above plan for our records. The Department of Environment, Climate Change and Water (DECCW) encourages the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, DECCW does not review these documents as our role is to set environmental objectives for environmental management, not to be directly involved in the development of strategies to achieve those objectives.

Should you have any questions please phone me on 02 4908 6806.

Yours sincerely

MITCHELL BENNETT
Head Regional Operations Unit – Hunter Region
Environment Protection and Regulation

APPENDIX B

WATER BALANCE

Bloomfield Collieries Pty Ltd

Completion of Mining and Rehabilitation Project

Water Management Plan

Site Water Balance

March 2010

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1 BACKGROUND

A detailed site water balance analysis was prepared as part of the Bloomfield Colliery - Completion of Mining and Rehabilitation Part 3A Environmental Assessment. The site water balance presented in the Environmental Assessment provided an analysis of the impacts associated with the project in the context of the integrated water management system that links the three adjoining mines (Bloomfield, Donaldson and Abel) and provides a source of supply for the Bloomfield CHPP.

The holistic water balance undertaken for the Environmental Assessment concluded that the impacts from the Completion of Mining and Rehabilitation project were consistent with, and would have a negligible impact on, the approved integrated water management system (Abel Mine Approval No. 05_0136).

The requirements of the Minister's Conditions of Approval for a site water balance assessment are referenced in **Table 1-1**.

The water balance presented in this report relates specifically to the area related to the Completion of Mining and Rehabilitation project (outlined in orange in **Figure 1-1**). A flow diagram which illustrates the main catchments and flows within the project area is included as **Figure 1-2**.

Table 1-1: Ministers Conditions of Approval

Conditions of Approval	Plan Reference
Site Water Balance 20. The Site Water Balance must:	
a) Include details of:	
• Sources and security of water supply	Section 2: Groundwater inflow Section 5: Catchment run-off
• Water use and management on site	Section 4: Water requirements for dust suppression
• Any off site water transfers or discharges	Section 2: Transfers discussed in model set-up
• Reporting procedures; and	Section 6: Reporting procedures
b) Describe the measures to minimise water use by the Project	Section 4.4: Justifies water use requirements

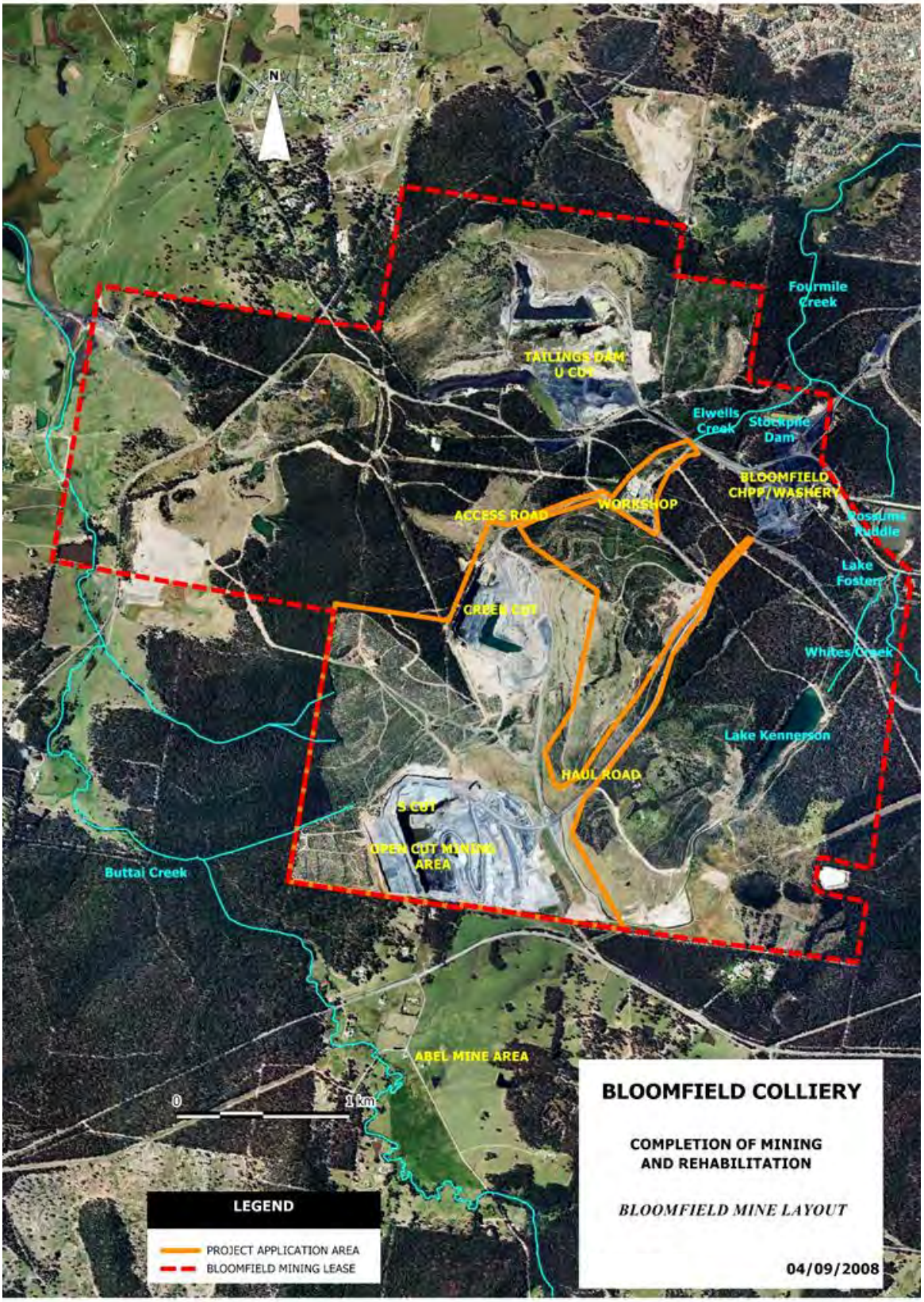

Figure 1-1: Completion of Mining and Rehabilitation Project Area

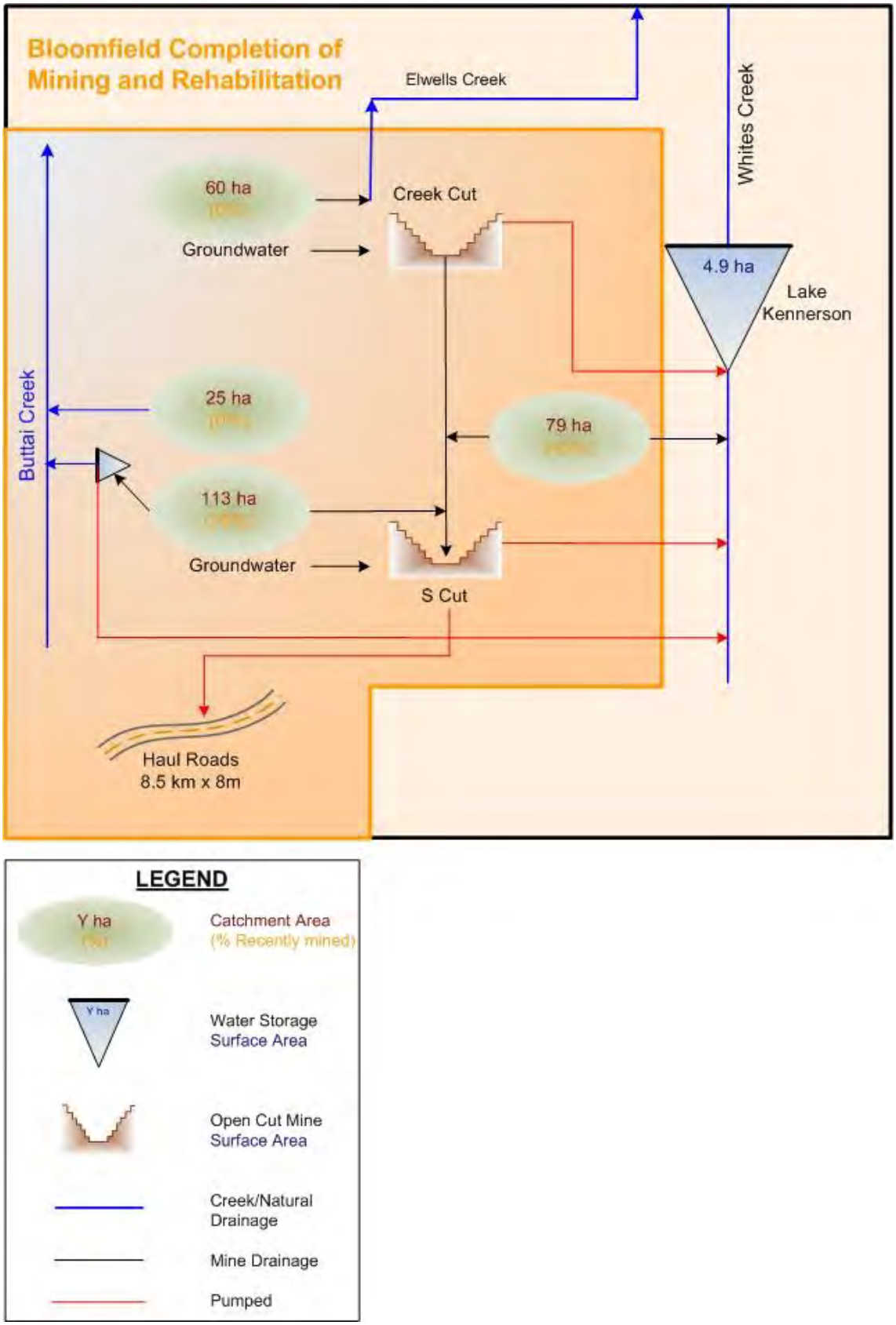

Figure 1-2: Schematic Diagram of Catchments and Flows within the Project Area

2 CATCHMENTS AND PITS

This water balance assessment is concerned with the operations that will occur within the project area defined for the Completion of Mining and Rehabilitation project. The facilities and operations included in this analysis comprise the following items that are illustrated in **Figure 1-2**:

- Groundwater inflow to the mine pits;
- Various catchment areas that will be modified over time in terms of:
  - The location to which surface runoff will drain (the mine pits, Buttai Creek or Whites Creek and Lake Kennerson);
  - The runoff characteristics of the different land surfaces as mining progresses (existing natural conditions, mine pit, haul roads, placed overburden and rehabilitated overburden);
- Use of water for dust suppression; and
- 'Export' of excess water to Lake Kennerson and, if necessary, 'import' of water from Lake Kennerson to meet operational requirements for dust suppression.

Table 2-1 summarises the changes over time in catchment areas draining to the mine pits, and the predicted groundwater inflows to the pits (provided by Aquaterra). Note that the catchment areas set out in **Table 2-1** are those that drain into the mine water management system and does not include areas that naturally drain to Buttai Creek or Whites Creek either before mining occurs or after rehabilitation is complete.

Table 2-1: Catchment Areas and Groundwater Inflows

Year	Pit and Haul Road	Recent Overburden	Established Overburden	Total Draining to Pit	Groundwater Inflow
	(ha)	(ha)	(ha)	(ha)	(ML/year)
2010	37.6	56.2	20.7	114.5	615
2011	40.7	48.7	27.9	117.2	610
2012	43.8	41.2	35.0	120.0	747
2013	45.3	40.2	44.7	130.1	720
2014	46.8	39.2	54.4	140.3	260
2015	42.0	31.7	54.6	128.2	325
2016	37.2	24.2	54.8	116.2	351
2017	32.4	16.8	55.0	104.2	144

Overall, the groundwater inflows alone are likely to provide sufficient water for operational purposes within the project area. Accordingly there will be an excess of water that will be directed to Lake Kennerson which will then contribute to the water supply system for the Bloomfield CHPP.

3 SURFACE RUNOFF MODELLING

The *Completion of Mining and Rehabilitation* project involves the progressive mining of land located within the Buttai Creek catchment and the subsequent placement of overburden into the mine void to create a landscape some of which will eventually drain to either Whites Creek or Buttai Creek.

This water balance analysis is concerned only with those areas that drain into the mine water management system. Once the overburden dumps have been rehabilitated to a standard sufficient to allow uncontrolled runoff, the diversion drains will be removed and runoff will be allowed to drain into the natural drainage systems that drain to Whites Creek or Buttai Creek.

As noted above, a variety of different land surfaces contribute to flow into the mine water management system including the mine pit, haul roads and overburden dumps in various stages of construction. The hydrologic response of these land surfaces to rainfall and evapotranspiration has been represented in the water balance model using the AWBM model. AWBM is a catchment water balance model, developed for Australian conditions, that uses rainfall and evaporation data to generate catchment daily runoff. The model represents a catchment as three surface moisture stores with different storage and runoff characteristics. Each of the three surface stores is assigned a surface storage capacity value as well as partial area which are adjusted as part of the calibration process. Runoff from each store is calculated independently of the other two stores.

At each time step (daily in this case), rainfall is added to each of the three surface moisture stores and evapotranspiration and deep drainage is subtracted from the stores. Runoff occurs when there is excess moisture in any of the stores.

The parameters for the AWBM model utilised in this report (**Table 3-1**) have been updated to reflect additional data that has become available since the preparation of the Environmental Assessment and now include:

- Calibration for "rural" landscape conditions in the lower Hunter Valley using flow records from Pokolbin Creek (Lyall & Macoun Consulting Engineers, 1998);
- Calibration for mine overburden dumps as reported in ACARP (2001)
- Calibration for mine pit and overburden dumps at Mt Thorley (John Pola, pers comm., 2010.)

Table 3-1: Adopted AWBM Paramaters

Parameter		Natural	Raw Overburden	Rehabilitated Overburden	Roads & Pits
Partial Area	A_1	0.115	0.1	0.1	0.1
	A_2	0.596	0.9	0.9	0.9
	A_3	0.286	0.0	0.0	0.0
Storage Capacities (mm)	C_1	15	1.7	27.5	6.6
	C_2	70	5.4	85.8	66
	C_3	160			
Baseflow Parameters	K_{base}	0.78	1	0.85	0.98
	K_{surf}	0	0	0	0
	BFI	0.182	0	0.70	0.15

4 SITE WATER BALANCE MODEL

4.1 Climate Data

For the site water balance model, the following daily rainfall and climatic data have been utilised for the period 1/1/1968 - 31/12/2009:

- daily rainfall data for Morpeth; and
- daily evaporation data for Paterson.

Where the Morpeth rainfall record was incomplete, rainfall data from the daily rainfall record at Bloomfield was substituted. Where there was missing evaporation data, the daily average for the month in question was substituted.

4.2 Catchment Runoff

Results from the AWBM model (expressed as depth of runoff (mm/day) for different land uses) were used to estimate the runoff from the various contributing sub-catchment areas within the mine water management area.

As shown in **Table 2-1**, the composition of the areas draining to the mine pits will vary throughout the period of mining. To account for this variation, each individual year has been assessed using the water balance model.

4.3 Water Storage

The model assumes that any water that is in excess of the immediate water requirements for the project and cannot be held within the pits will be pumped to Lake Kennerson and will then be available for use in the Bloomfield CHPP. Because of the complex interactions between the water management systems that link the Able and Donaldson mines, the remainder of the Bloomfield mine lease area (outside the area of the Completion of Mining and Rehabilitation project) including Lake Kennerson, Lake Foster and the Bloomfield CHPP; the modelling undertaken for this project treats Lake Kennerson as a 'external' storage to which excess water is sent and from which water can be returned if required.

4.4 Water Use

The water requirement for mine operations within the project area is limited to the use of water carts for dust suppression within the mine pits and on haul roads (water used in the Bloomfield CHPP is accounted for under a separate water management plan).

Estimates of water use for dust suppression on haul roads and work areas have been modelled using the relationship derived by Thompson & Viser (2002) which has been benchmarked against mine records. Because dust suppression is an important amenity issue for any residences in the vicinity of the mine, the estimates of water requirements for dust suppression purposes are deliberately conservative (i.e. make provision for liberal application of water). For modelling purposes, the water requirement takes account of changes in the area of active haul road at each particular stage of mine development represented in the model.

5 MODEL SCENARIOS AND RESULTS

5.1 Climate Scenarios

To assess the overall performance of the effect of the Completion of Mining and Rehabilitation project, the water balance model has been run to represent mining and operating conditions (as summarised in **Table 2-1**) for each year of the mine life.

For each mine year the model was run using the full 1968-2009 climate sequence in order to represent the range of possible rainfall conditions that might occur during mining. From the modelling results statistics were extracted for the representative years set out in **Table 5-1**.

Table 5-1: Climatic Scenarios Assessed in Water Balance Analysis

Rainfall Statistic	Annual Rainfall (mm)
Median rainfall year	947
10 percentile (dry) year	675
90 percentile (wet) year	1,140

5.2 Model Setup

Having adopted runoff characteristics for the various catchments based on catchment land use characteristics, the water balance model was configured to represent the mining conditions in each year. The main factors that change for each year are:

- The status of open cut pits in terms of active pit area and the area of overburden draining to the pits;
- Groundwater inflows to the mine pits (as set out in **Table 2-1**);
- The area of active haul road that requires water for dust suppression purposes.
- For most of the time that mining occurs in the Buttai Creek catchment, all runoff will drain into an active pit. Once the post-mining landform no longer drains to an active pit, it will drain to a sediment dam, water will be transferred to Lake Kennerson until rehabilitation is complete.

5.3 Model Results

Summary water balance statistics are presented in **Table 5-2** for each year of the project. The results show:

- For all remaining years of mining, there is expected to be a surplus of water that will contribute to the water available from Lake Kennerson for supply to the Bloomfield CHPP;
- The volume of surplus water in any year will vary significantly depending on the groundwater inflow, the area of the mine pits and contributing overburden areas, and the area of haul roads that require water for dust suppression.

Table 5-2: Summary Water Balance Statistics

Year	G/W	Runoff (ML/year)			Water Use (ML/year)			to L. Kennerson (ML/year)		
	(ML/y)	Dry	Median	Wet	Dry	Median	Wet	Dry	Median	Wet
2010	615	197	342	514	160	141	129	652	816	1,000
2011	610	220	366	539	217	191	175	614	785	974
2012	747	238	389	564	272	240	219	713	896	1,092
2013	720	253	417	606	285	251	230	688	886	1,096
2014	260	339	518	716	298	263	240	301	516	736
2015	325	286	449	630	283	250	228	328	525	727
2016	351	249	397	559	266	235	215	334	513	695
2017	144	302	432	570	252	222	203	195	354	511

6 REPORTING PROCEDURES

6.1 Annual Reporting

The following information relating to water management will be included in the AMER in accordance with Schedule 5, Condition 3 of the Project Approval:

(a) Description of works which were carried out in the previous year and the works that are proposed to be carried out over the next year;

(b) A review of the monitoring results over the past year including a comparison of these results against the:

- The monitoring results from the previous years;
- The relevant predictions made in the Environmental Assessment

(c) Reporting any non-compliance over the last year, and the actions taken to ensure compliance;

(d) Identifying any trends in the monitoring data over the life of the Project;

(e) Identifying any discrepancies between the predicted and the actual impacts of the Project, and analysis of the potential cause of any significant discrepancies; and

(f) A description of measures that will be implemented over the next year to improve the environmental performance of the Project.

6.2 Incident Reporting

Incident reporting will be undertaken in accordance with Condition 6 of Schedule 5 for the Project. Any incidents will be notified to the Director General and any other relevant agencies of any incident associated with Project as soon as practical after the incident is identified. A detailed report of the incident will be provided to the relevant departments within 7 days of identifying the incident.

7 CONCLUSIONS

The water balance model results presented in this report indicate that the Completion of Mining and Rehabilitation project will:

- Be capable of meeting all water needs for dust suppression from the groundwater inflows and surface runoff into the mine pits; and
- Provide a net surplus of water that will contribute to the water available from Lake Kennerson for supply to the Bloomfield CHPP.

8 REFERENCES

Australian Coal Association Research Program (2001), *Water Quality and Discharge Predictions for Final Void and Spoil Catchments*, ACARP Project No. C7007, prepared by PPK Environment & Infrastructure.

Aquaterra (2008). *Bloomfield Colliery Completion of Mining and Rehabilitation: Groundwater Modelling*. Prepared for Bloomfield Colliery.

Evans & Peck (2008*). Completion of Mining and Rehabilitation Project: Surface Water Assessment: Annexure C - Water Balance Modelling*. Prepared for Bloomfield Collieries Pty Ltd

Peter Dundon and Associates (2008). *Bloomfield Colliery Completion of Mining and Rehabilitation: Groundwater Impact Assessment*. Prepared for Bloomfield Colliery.

Lyall & Macoun Consulting Engineers (1998*). Catchment Management Study: Morpeth-Tenambit, Woodberry and Millers Forest Catchments*. Prepared for the Maitland Landcare Group.

Thompson and Visser (2002), *"Benchmarking and management of fugitive dust emissions from surface mine haul roads"* in Trans. Inst. Min. Metal. V110, SA, A28 –A34.

APPENDIX C

EROSION AND SEDIMENT CONTROL REPORT

BLOOMFIELD COLLIERIES LTD

FINAL

Erosion and Sedimentation Control Plan

Bloomfield Coal Project – Continued Operations: ***Stage 2****.*

September 2013

BLC01-004

GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

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APPENDICES

1.0 INTRODUCTION

1.1 Background and Scope

Bloomfield Colliery is an open cut coal mining operation located approximately 20km North West of Newcastle in NSW. The mine has been in operation for approximately 170 years utilising both open cut and underground extraction methods. This report has been prepared on behalf of Bloomfield Colliery for inclusion in the Site Water Management for the site. The purpose of this Erosion and Sediment Control Plan (ESCP) is to ensure the project area, as shown in **Figure 1**, has adequate erosion and sediment control measures in place to comply with the requirements of the Project Approval (07_0087) and commitments made in the Environmental Assessment for the Part 3A application for continuing operations.

1.2 Key Objective

The key objective of the erosion and sediment control plan (ESCP) for Bloomfield Coal Project (described in Mining Operation Plan 2012 -2016 Maps 3A to 3E) is to ensure that there is no uncontrolled discharge of water from the site and that the water quality leaving the site meets the appropriate quality standards. The ESCP plan addresses Stage 2 (years 1 - 5) of the project and Site Water Balance Table 2-1 identifies the Catchment Areas.

1.3 Erosion and Sediment Management Principles

The above key objective is intrinsic to erosion and sedimentation design of controls for mine sites and will be achieved by implementing the following principles:

- Conducting best practice land clearing procedures for all proposed disturbance areas;
- Coordinating mining sequences to minimise exposure of disturbed soils to the elements;
- Separation/diversion of ‘clean’ water catchment runoff from disturbed areas runoff to minimise sediment-laden and mine water volumes for management;
- Ensuring sediment-laden runoff is treated via designated sediment control devices;
- Minimising the disturbance footprint;
- Appropriate storage of topsoil stockpiles in areas away from roadways and other drainage lines;
- Revegetation of disturbed areas as soon as possible following the completion of construction activities; and
- Implementing an effective maintenance program for the site.

1.4 Runoff Water Definitions

The following definitions have been adopted in this ESCP:

- Clean water – Runoff water from undisturbed, long term regrowth (>5 years) or successfully established rehabilitation catchments.
- Dirty water – Runoff water from all exposed surfaces including hardstand areas, workshop, active pit and haul road areas. Note there is no distinction made between sediment laden water and mine water. All dirty water is combined and treated together for the project area in either Lake Kenerson or Lake Foster which area licensed discharged points. The exception to this definition is within the workshop area where potentially contaminated water is treated through the workshop underground sump, and sediment laden runoff water is treated in the sediment dam then flows into the adjacent creek.

1.5 Sources of Erosion and Sedimentation

The following activities have been identified as potential to cause soil erosion and generate sediment unless controlled:

- Stripping of vegetation and topsoil (Mining Operations Plan 2012-2016 Map 2 Mine Domains);
- General mining operations, including blasting and haulage (Mining Operations Plan 2012-2016 Map 2 Mine Domains);
- Cut and fill earthwork operations for road maintenance (Mining Operations Plan 2012-2016 Map 2 Mine Domains);
- Runoff from mine haul roads (Erosion and Sediment Control Plan section 2.2.3);
- Workshop area.

Apart from possible bare areas resulting from poorly established vegetation on reshaped landforms, the main activities identified as having potential erosion and sedimentation issues are active mining/disturbance areas, including haul roads and the workshop.

2.0 EROSION AND SEDIMENT CONTROL

The following sections outline the erosion and sediment control structures and principles that are currently operating effectively and only require monitoring and maintenance, and structures that are recommended to be implemented ahead of mining to ensure adequate protection from downstream environments. It is to be used as supporting documentation for the ESCP for the Workshop Plan (Figure 2.2 of the Bloomfield Colliery Surface Water Assessment).

2.1 General Practices on Site

2.1.1 Minimising Disturbance

Land disturbance will be minimised by clearing the smallest practical area of land ahead of mining, as well as ensuring the land is disturbed for the shortest possible and practical time. This will be achieved by;

- limiting the cleared width to that required to accommodate the proposed mining operations; and
- staging the clearing activities where ever possible so that only the areas which are actively being mined are cleared, therefore, limiting the time the areas are exposed.
- Rehabilitating reshaped overburden dumps as soon as practicable, following mining.

General vegetation clearing and soil stripping will not be undertaken until earthwork operations are ready to commence. All proposed erosion and sediment control measures will be implemented in advance of, or in conjunction with, clearing activities. Prior to clearing commencing, the limits of clearing should be marked by pegs placed at intervals on each side of the disturbed area. All operations will be planned to ensure that there is no damage to any trees and pasture areas outside the limits to be cleared.

2.1.2 Clean Water Diversion

In order to minimise the volume of dirty water to be treated downstream in Lake Kenerson or Lake Foster, all clean run-on water shall be diverted into clean water drainage lines and off site into the natural creek system. Suitably designed and constructed diversion drains will be implemented where practical in the project area in accordance with 'Blue Book' standards relating to channel design. These clean water catchments are located on the western side of the active mining area and comprise of existing vegetation and 6 year old regrowth. The part of the workshop area which captures sediment laden water is treated via a sediment dam and then enters the natural creek system which flows into four mile creek.

2.1.3 Stockpiles

Prior to any excavation or earthworks, the topsoil and associated vegetation will be placed immediately onto the reshaped overburden dumps for rehabilitation (Mining Operations Plan 2012-2016 Mine Domains). Given the nature of mining operations, this is not always practical and in these cases once the topsoil is stripped it should be stockpiles for later use in rehabilitation. The stockpiles are required to be placed away from roadways and other drainage lines and protected by constructing either sediment fencing around the perimeter or other suitable drainage structures. In the event of long term stockpiling (ie. greater than 3 months), the stockpile should be sewn immediately with a cover crop of pasture/grasses, which will protect the soil from raindrop impact and rill erosion.

The following cover crop specification is recommended:

- September –March sowing - Japanese Millet @ 50 kg/ha
- April – August sowing - Oats/Ryecorn @ 50 kg/ha and Tetila Rye @ 5 kg/ha

2.2 Long Term Erosion and Sediment Control Structures

2.2.1 Lake Kenerson & Lake Foster

Whilst Lake Kenerson and Lake Foster lie outside the project area, the dirty water (mine water and sediment laden water) from the active pits and haul road is transferred via pipes and drainage lines into these two lakes. Lake Kenerson is a licensed discharge point for the mine and is described in detail in the Surface Water Management Plan, which covers design, maintenance and operations.

2.2.2 Sediment Dams

There are several existing sediment dams currently filtering sediment laden runoff water from disturbed areas of the mining operation as shown on the ESCP **Appendix A Figure 1**. The sediment dams are designed to capture storm event runoff water, holding the water to allow the sediments to drop out of suspension and then release the clean water via infiltration and evaporation. The ESCP reflects the requirements for current mining activities and will be revised and updated periodically to reflect the requirements during the next stages of mining and rehabilitation.

Sediment dams vary in desirable location, dam shape and size and should be designed and constructed with regard to the contributing catchment area, erosivity of the soil, storm intensities and average recurrence intervals. In sizing sediment basins on site, the recommended minimum design criteria for temporary erosion and sediment control measures outlined in Table 6.1 from Managing Urban Stormwater Soils and Construction Vol 2 Mines and Quarries will be followed. It is expected that the criteria will include >3 years standard receiving environment 5 day duration 90th percentile events. Sediment dams will be constructed, where practical, in accordance with the Sediment Dam Standard Drawings (SD6-8) of the 'Blue Book' which is contained in **Appendix B**.

Sediment dams require regular monitoring and maintenance to ensure adequate capacity and effective operation. Dams should be inspected quarterly for sediment build up and prior to the capacity being reduced to threshold levels, which render the dam ineffective, an excavator is required to de silt the dam. It is noted that some sediment dams on site are well vegetated and stable, however maintenance and de-silting is required to ensure adequate capacity is maintained, despite the potential disturbance of existing vegetation within the dam.

2.2.3 Haul Road Drainage

Haul roads across the site are regularly graded to ensure runoff water is safely transported to designated drainage lines without severe erosion or sediment build-up along mine traffic areas. The current practice on site is to channel roadside water along the length of road to a suitable entry into a dirty water drainage line. Inpit roads convey flows to in-pit sumps in the mine void, which are then pumped to dirty water drainage lines to be conveyed to the main sediment dams of Lake Kenerson and/or Lake Foster beyond the Project Area.

It was noted that on the CHPP haul road the roadside drainage butted up against the toe of the rehabilitated batter. It is recommended to build up the toe of the rehabilitated batter to act as armouring against the erosive fast flowing runoff water during intense storm events. Shallow V drains along haul roads are adequate drainage for this site, providing suitable entry points into the designated drainage channels are constructed and maintained.

Inspections of the haul roads should be undertaken weekly or following heavy rainfall events to ensure the roads have not been subjected to severe rill or gully erosion, as well as to monitor the stability of the batter toe along the main CHPP haul road.

2.2.4 Workshop Drainage

The majority of the disturbed area surrounding the workshop is designed to flow to a sump, which drains to underground workings. A small area to the north, including car park, drains to a sediment basin prior to entering a small drainage line then into Four Mile Creek.

2.3 Short Term Erosion and Sediment Control Structures

2.3.1 Sediment Filter Fences

There may, on occasion, be a disturbance area which is either not protected by existing structures or requires additional temporary protection against erosion and sedimentation. In these cases it may be suitable to install sediment fencing. Sediment filter fences filter run-off leaving the site, trapping sediment and allowing filtered water to pass. Sediment silt fences should be constructed around the base of any areas of exposed land that are not subject to concentrated overland flow and that are not adequately protected by existing structures. Sediment filter fencing should be installed around the extent of the disturbance area where sediment-laden water could potentially enter clean downstream receiving waters.

Sediment filter fences are normally placed on the contour or slightly convex to the contour. The contour on each end of the fence should be turned to create a stilling pond up slope of the fence. Where possible, a silt fence system should consist of a series of overlapping fences. Each fence should be NO longer than about 40 metres. They should not intercept large concentrated or channelised flows. The fences should be constructed in accordance with the Sediment Fence Standard Drawing (SD6-8) of the 'Blue Book' which is contained in **Appendix B**. Silt fences require regular maintenance. Trapped sediments should be removed, pickets straightened, filter cloth re-secured and tightened.

2.3.2 Sandbag Weirs

Sandbag weirs may be installed within existing swale drains or existing drainage channels, which are not able to be regularly graded. The use of these devices must be limited to temporary erosion and sediment control in channels during construction or high disturbance phases mining

The weirs should typically be installed at a minimum of 40 metre intervals. As with sediment filter fences, sandbag weirs may be installed prior to any works commencing on the site in existing channels and immediately after the construction of new channels. A cross sectional drawing of the configuration of a sandbag weir within a channel is contained within **Appendix B**. Inspect the sandbag weirs after rain and remove the sediment as required. Damaged/shifted bags should be repaired or replaced.

3.0 REVEGETATION

The following section outlines the general principles for revegetation of newly constructed erosion and sediment control structures and drainage lines as well as maintenance of existing structures.

3.1 General

The most effective way of controlling erosion is to establish and/or maintain a healthy vegetation cover. Vegetation provides effective surface protection against raindrop impact, binds the underlying soil to resist detachment by surface flows, and improves and maintains the soil's infiltration capacity thereby decreasing the velocity and volume of runoff. Vegetation can also improve the aesthetic appearance of an area, and the operational efficiency and longevity of structural sediment and erosion control measures employed.

3.2 Drainage Lines & Slopes

3.2.1 Purpose on Site

The technique proposed for vegetative stabilisation of all disturbed areas outside those to be sealed or lined with crushed rock is through the use of pastures and grasses. Some sections of reshaped overburden dumps also include the establishment of trees via direct tree seeding or tubestock planting.

3.2.2 Construction Notes

- All rehabilitation slopes should be ripped and topdressed prior to the establishment of pasture seeds. Contour ripping generally provided the best surface for water capture and infiltration, therefore minimizing the volume of runoff water.
- In drainage channels, scarifying the topdressed surface provides a suitable environment for pasture seeds to germinate and establish.
- The larger high flow drainage lines may require rock scour protection in areas prone to high velocity flow rates and undercutting.

3.2.3 Maintenance

Rehabilitated slopes should be fertilized and sprayed for weeds in the first few years of establishment, in order to provide the best possible chance for thick pasture cover.

The spread of weeds should be minimised by ensuring that topsoil stockpiles are weed free prior to re-spreading topsoil on batter areas and monitoring & controlling weed populations should they occur. Weed control, if required, will be undertaken in a manner that will minimize soil disturbance. Any use of herbicides should be carried out in accordance with the NSW DPI requirements. It is anticipated that regular monitoring of weeds, combined with low base weed populations, will enable a simplified weed control program to be effective. If herbicides are required, selective application should be used in preference to broad area application.

4.0 GENERAL MAINTENANCE & MONITORING

The Mine Manager will ensure that all sediment and erosion control works are located as instructed in this ESCP or in any subsequent site instruction or updated ESCP. The Mine Manager will need to ensure that regular general inspections of the site are undertaken to ensure that all the environmental controls outlined in this report and shown in the ESCP figure are functioning effectively, and the responsibilies assigned in **Section 5.0** below are met. These inspections should coincide with regular environmental inspections and monitoring undertaken on site. Monthly checks will target temporary measures and controls with permanent features inspected more formally on a quarterly basis as part of the regular environmental monitoring undertaken onsite.. The Mine Manager will also ensure that operations staff and contractors are operating within the designated area protected by the environmental controls, and to inform them of their responsibilities in minimising the potential for soil erosion and pollution to downstream receiving waters.

Site drainage and sediment control structures should be inspected regularly and after runoff events (>15 mm of rain) during the clearing phase to check for scouring of drains and accumulation of materials in sediment devices (e.g. dams, sediment filter fences & sand bags). Inspection areas will include the following:

- Workshop Area
- Haul Roads
- Drainage lines
- Pipe outlets
- Rehabilitated areas.

Any signs of erosion along the length of the drains should be noted and remedial works undertaken as required. Where significant erosion is observed, additional erosion controls will be constructed eg. Establishment of vegetation cover, armouring of the channel surface and construction of rock scour protection at the entry and discharge locations. Regular visual checks will be made of any temporary sediment controls such as sediment filter fences, sandbag weirs etc to ensure that they are functioning adequately and repaired where required.

5.0 ESCP RESPONSIBILITIES SUMMARY

The following section outlines details of the proposed erosion and sediment controls that have been discussed in this ESCP and the responsibilities associated with construction, monitoring and maintenance. The details of the surface water monitoring program are contained in the Surface Water Management Plan and are therefore not dealt with in the below table.

Table 1 - ESCP Responsibilities Summary

Aspect	Management/Monitoring Strategy	Frequency	Responsibility
CHPP Haul Road Drainage	Inspect status of erosion along the side of haul road to ensure the toe of the rehabilitated batter is stable and not undercutting. Grader maintenance of the haul road will be undertaken as required.	Weekly and following high intensity storm events.	OCE
Sediment /Dams (as marked on ESCP Figure 1)	Inspect sediment build-up and integrity of structures. De-silt dams as required.	Quarterly	Environmental Officer
Constructed Drainage Lines (as marked on ESCP Figure 1)	Inspect drainage lines to ensure stable, not actively eroding and has adequate capacity. Clean out or repair as required.	Quarterly	Environmental Officer
Natural drainage lines in Southwest corner of mine boundary	Inspect drainage lines for sedimentation from upstream catchment.	Quarterly	Environmental Officer
Pipe outflow from pit sumps	Inspect pipe outflow sites for erosion and scouring. Implement protection as required.	Monthly and following relocation	OCE
Rehabilitation areas and drainage lines on rehabilitated slopes	Inspect rehabilitation and drainage lines for adequate surface protection, ensuring sediment buildup in drainage lines is not adversely affecting drain capacity.	Within 12 months of establishment and then every 2 years	Environmental Officer
Proposed clearing activities ahead of mining	Inspect sites to be cleared ahead of mining, ensuring adequate sediment controls are established prior to surface disturbance.	Prior to clearing activities	Environmental Officer
Temporary sediment controls (silt fence, sandbag weirs etc)	Inspect sediment control structures for sediment build up and clean out as required to maintain adequate capacity.	Monthly and following high intensity storm events	Environmental Officer
Review of this ESCP	Undertake review and update of this ESCP to ensure all aspects associated with the site are captured.	Every two years or following any significant changes to the mine plan	Environmental Officer
Reporting of ESCP findings and inspections	Results of ESCP inspections, maintenance activities and construction of erosion and sediment control structures are to be reported to mine management.	Monthly	Environmental Officer

6.0 SITE PHOTOS

The following section shows examples of erosion and sediment control measures currently operating effectively on site.

Plate 1 – Workshop area catchment draining to sediment dam

Plate 2 – Workshop area sediment dam

Plate 3 – Workshop area catchment draining to dirty water underground sump

Plate 4 – In pit dirty water sump pipeline over highwall

Plate 5 – On site sediment dam requiring regular de-silting

Plate 6 – Haul road drainage requiring regular grading

Plate 7 – Clean catchment 6 year regrowth

Plate 8 – Clean Catchment 6 year regrowth above dirty water pit catchment

7.0 REFERENCES & RELEVANT DOCUMENTS

Department of Environment and Climate Change (2007), Managing Urban Stormwater: Soils & Construction – Volume 2E Mines & Quarries.

Donaldson Coal Pty Ltd (2008). Abel Coal Project – Water Management Plan.

Evans & Peck (2008), Bloomfield Colliery Completion of Mining and Rehabilitation – Part 3A Environmental Assessment, **Appendix C – Environmental Risk Assessment** (GSS Environmental, 2008).

Evans & Peck (2008), Bloomfield Colliery Completion of Mining and Rehabilitation – Part 3A Environmental Assessment, **Appendix H – Surface Water Assessment** (Evans & Peck, 2008).

APPENDIX D

SURFACE WATER REPORT

Bloomfield Collieries Pty Ltd

Completion of Mining and Rehabilitation Project

Surface Water Management (Monitoring & Response Plan)

Saved: 31 March 2010

1 SURFACE WATER MONITORING & RESPONSE PLAN

This report has been prepared on behalf of the Bloomfield Group for inclusion in the Surface Water Monitoring Plan and the Surface and Groundwater Response Plan. A site water management plan (SWP) is being prepared in response to the recent Project Approval (07_0087) for the Completion of Mining and Rehabilitation which includes a Surface Water Monitoring Plan and Surface and Groundwater Response Plan.

This report addresses the monitoring and response requirements for surface waters within and adjacent to the area covered by the consent for Completion of Mining and Rehabilitation within the Bloomfield Mine Lease Area. This includes the following drainage systems:

- Buttai Creek, and
- Elwells Creek.

The relevant conditions from the Approval are summarised as follows:

Condition of Consent No. 22 - Surface Water Monitoring Program

The Surface Water Management and Monitoring Plan must include:

a) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could be affected by the project;

b) surface water and stream health impact assessment criteria;

c) a program to monitor the impact of the project on surface water flows, quality and stream health; and

d) reporting procedures for the results of the monitoring program.

Condition of Consent 24 – Surface and Groundwater Response PLan

The Surface and Groundwater Response Plan must describe the measures and/or procedures that would be implemented to:

a) Investigate, notify and mitigate any exceedances of the surface water, stream health and ground water impact assessment criteria;

b) Compensate landowners of privately-owned land whose water supply is adversely affected by the project; and

c) Mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.

1.1 SURFACE WATER MONITORING PROGRAM

An integrated surface water monitoring program has been in operation for the Bloomfield, Abel and Donaldson Mines for several years. A number of monitoring sites associated with the integrated monitoring program are located in positions which provide historic water quality data for two creeks which may potentially be affected by the Bloomfield Completion of Mining and Rehabilitation. The potentially affected creeks are named Elwells Creek and Buttai Creek.

There are presently no monitoring locations on Buttai Creek downstream of the area affected by the Project, so an additional monitoring location will be established at the junction of Buttai Creek and Buchanan Road.

The monitoring locations, frequency and parameters to be tested as part of the Completion of Mining and Rehabilitation Monitoring Program are outlined in Tables 1 and 2. Figure 1 shows the locations of the relevant current and proposed water quality monitoring sites.

Table 1: Routine Water Quality Monitoring Sites and Locations

Site	Location
Elwells Creek • WM5	Elwells Creek @ Haul Road
Buttai Creek • Lings Rd *	Buttai Ck @ Lings Road
• Buchanan Rd**	Immediately upstream of Buchanan Road

* Monitored by Donaldson Coal
** Proposed new monitoring site to be established by Bloomfield

Prior to disturbance in the south western corner of the site, a sediment basin will be constructed in the upper catchment of Buttai Creek to capture runoff from the south western area (refer to Figure 1 of Erosion Sediment Control Plan for details). Water collected in the basin will be transferred to the mine pit. In the event of an overflow from this structure, actions will be taken to minimise the discharge, contained on site and a sample taken for analysis (field and laboratory).

All other water within the Completion of Mining and Rehabilitation consent area either drains to the mine pits (from where any excess is pumped to Lake Kennerson), or in the case of some sections of the haul road, drains to Lake Foster. Both these lakes form part of the integrated water management system for the three mines and the Bloomfield Coal Handling and Processing Plant (CHPP). This integrated water management system was approved under the consent for the Able Mine and Expansion of the Bloomfield CHPP and will continue.

Table 2: Routine Water Quality Monitoring Frequency and Parameters

Frequency	Parameters
Monthly field monitoring at all listed sites for the range of parameters listed	• Temperature • pH • EC • DO • Turbidity • Oil and Grease (Visual observation) • Flow (Visual observation)
Quarterly grab sample at all listed sites and laboratory analysis for the range of parameters listed	• TSS • TDS • pH • EC
Six monthly grab sample at all listed sites and laboratory analysis for the range of parameters listed	• Chlorides • Sulfates • Alkalinity (Bicarb) • Alkalinity (Carb) • Calcium • Magnesium • Sodium • Potassium
Event Based field and grab samples from the sediment basin in the upper Buttai Creek catchment immediately after overflow event.	• Testing for parameters listed for monthly field and lab analysis

1.2 BASELINE DATA

Table 3 summarises the water quality data collected by Bloomfield Colliery at Elwells Creek, adjacent to the Haul Road (WM5) between 1996 to 2009. Water data for Buttai Creek, Lings Road (as monitored by Donaldson Coal since January 2008) is also presented in the table.

Table 3 – Baseline Data

Location	Elwells Creek Adj Haul Road	Lings Rd, Buttai Creek
Identification	**WM5**	**LR**
pH		
Number of Samples	195	20
Mean	6.7	6.7
Minimum	3.4	6.2
10% Percentile	5.2	6.3
90% Percentile	7.8	7.2
Maximum	8.4	7.8
EC (µS/cm)		
Number of samples	195	20
Mean	1,943	834
Minimum	9	330
10% Percentile	430	518
90% Percentile	3,970	1161
Maximum	6,620	1260
TDS (mg/L)		
Number of Samples	84	20
Mean	1,060	512
Minimum	100	220
10% Percentile	223	367
90% Percentile	2,290	714
Maximum	6,110	765
TSS (mg/L)		
Number of Samples	86	20
Mean	57	12.3
Minimum	1.0	3
10% Percentile	4.0	4
90% Percentile	86	31
Maximum	1001	40

1.3 SURFACE WATER AND STREAM HEALTH IMPACT ASSESSMENT CRITERIA

Water quality impacts for Buttai and Elwells Creek will be assessed in accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) and the water quality aspects of the Hunter-Central Rivers Catchment Management Authority's *Wallis and Fisheries Creeks Total Catchment Management (TCM) Strategy (2001).* The *Strategy* references the *NSW Water Quality and River Flow Objectives: Hunter River*, which in turn reference the ANZECC guidelines as the default water quality trigger values (upper and lower threshold limits).

The ANZECC guidelines recognise that each stream has its own unique physico-chemistry and biology. The ANZECC guidelines recommend that site specific studies be undertaken to formulate relevant trigger values for a particular stream. If no site specific studies have been undertaken, the ANZECC guidelines provide default trigger values.

Proposed water quality trigger values for Buttai and Elwells Creek have been based on site specific, historic water quality data. The trigger values are outlined in Section 1.4. Any subsequent exceedance of the trigger values will lead to further investigations to establish the cause of the exceedance and appropriate response action as set out in Section 2.1.

1.3.1 Water Quality

The following key water quality parameters will provide initial lead indicators of stream health. They will be measured by either field monitoring or laboratory analysis. Monitoring locations are discussed in 1.1 and illustrated in Figure 1. An explanation of the parameters to be measured and some interpretation of the background monitoring information is outlined below.

Physical Parameters

- **Temperature** influences many of the chemical reactions which occur in water as well as stimulating plant growth and animal activity. It also provides a measure of the degree of mixing within a water body. Temperatures of both creeks vary significantly between the seasons (Elwells' ranges from 8.7 to 23 degrees).
- **Turbidity/TSS** Turbidity directly measures the impedance of light which may be due to suspended solids or finer, more colloidal particles. The presence of clay in streams of the study area means that increased flow often resuspends sediment leading to high TSS values.

Chemical Parameters

- **Dissolved Oxygen (DO)** is a parameter which will be measured in the field and provides an immediate indicator of water quality to support aquatic biota. In the study area, DO can be highly variable with flow, season and time of day. The recorded values range from 8% – 80%. High flows lead to entrainment and higher DO levels.
- **Electrical Conductivity (EC)** / Salinity is a measure of the concentration of dissolved salts in an aquatic system. The geology of the Hunter, particularly in coal bearing regions, has led to elevated salinity of surface waters (Marine Pollution

Research, 1999). EC in the study area shows significant variability over time with observed EC over 6000µS/cm in the tributaries and lower reaches of Four Mile Creek. Total dissolved solids (TDS), sulphates, chlorides, fluorides, calcium, magnesium, sodium, potassium and alkalinity will be analysed in the laboratory to provide further information on the chemistry that contribute to EC levels.

- **pH** is a critical water quality parameter. Slight changes can have significant impacts on a waterways health. Collected pH baseline results indicates Elwells Creek has a variable pH which is due to the natural geology of the area. On the limited historic data available for Buttai Creek it appears to be more stable.

1.3.2 Water Level and Flow Monitoring

Surface water models predict the mining operation in the Upper Buttai Creek Catchment will have small, short term impacts on stream base flows with rapid recovery post-mining. Furthermore, as Buttai Creek has highly variable and episodic flow, it would be difficult to ascertain the flow fluctuations attributable to the mining operation as opposed to natural variability. Therefore, flow will be noted as an observation.

The potential for impacts on groundwater on Buttai Creek are addressed in the Groundwater Monitoring Program.

The Completion of Mining and Rehabilitation Project will not involve any changes in the catchment of Elwells Creek. Accordingly, there will be no impacts on flow levels in Elwells Creek.

1.4 WATER QUALITY TRIGGER VALUES

The proposed water quality trigger values for Buttai and Elwells Creek have been based on historic data collected over a number of years. The upper and lower limit thresholds have been based on the 10% and 90% percentiles of collected baseline data as per ANZECC guidelines (rounded figures).

The trigger values provide an appropriate level of protection for the waterway and are reflective of the community values for the catchment areas. The trigger values will be reviewed annually and revised if necessary.

Table 4 – Trigger Values

Source	WM5 - Elwells Creek	Buttai Creek at Lings Road
pH	5.2 – 8.0	6.0 – 7.5
EC (µS/cm)	430 - 4,000	500 – 1,200
TSS (mg/L)	4 – 85	3 - 30

For Buttai Creek at Buchanans Road, trigger values will be developed based on the first 12 months of monitoring. Trigger values for Dissolved Oxygen will also be developed.

2 RESPONSE PLAN

2.1 RESPONSE ACTIONS

In the event the monitoring results show an exceedance of the adopted water quality trigger values, an investigation into the potential sources and/or causes will be undertaken. If the company is found that it could be responsible for the exceedance further actions will be taken to address the matter.

The response actions listed below will be initiated. An action plan will be prepared to reflect these actions.

- Once an exceedance is detected the circumstances of the event will be immediately investigated including a review of relevant monitoring data, meteorological conditions etc;
- An assessment will be made to determine the reason for the exceedance, the potential magnitude of the impact and the level of future risk;
- If assessed as being caused by the mining operation, and it is further assessed to be likely to cause an adverse impact on an existing beneficial or environmental use of surface water, then an appropriate preventative and/or remedial strategy will be prepared for discussion with relevant authorities including the Department of Industry and Investment (DII - includes the former Department of Water & Energy and the Department of Primary Industry) and the Department of Environment, Climate Change and Water (DECCW), which may comprise:
    - Additional monitoring including assessment of ecological aspects;
    - Modification of mine water management procedures;
    - Modification to mine water management facilities; or
    - (If appropriate) no change to operations.
- A response/mitigation plan will be implemented to the satisfaction of the relevant authorities such as DECCW; and
- If it is found that downstream water users have been adversely impacted the landholder(s) will be consulted regarding the provision of an alternative water supply or some other appropriate agreement negotiated between the parties.

2.2 REPORTING PROCEDURES

In the situation where an exceedance is detected and investigated, a report will be prepared and provided to Department of Planning or other relevant agency. The report will:

(a) describe the date, time and nature of the exceedance/ incident;

(b) identify the cause (or likely cause) of the exceedance/ incident;

(c) describe what action has been taken to date; and

(d) describe the proposed measures to address the exceedance/incident.

In relation to surface water management, the following information will be included in the Annual Review in accordance with Schedule 5, Condition 3 of the Project Approval:

- Description of works which were carried out in the previous year and the works that are proposed to be carried out over the next year;
- A comprehensive review of the monitoring results and complaints records of the mine complex over the past year, which includes a comparison of these results against the:
    - Relevant statutory requirements, limits or performance measures / criteria;
    - The monitoring results from the previous years; and
    - The relevant predictions made in the Environmental Assessment.
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the Project;
- Identify any discrepancies between the predicted and the actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

2.3 INCIDENT REPORTING

Incident reporting will be undertaken in accordance with Condition 6 of Schedule 5 for the Project. Any incidents will be notified to the Director General (Department of Planning) and any other relevant agencies of any incident associated with Project as soon as practical after the incident is identified. A detailed report of the incident will be provided to the relevant departments within 7 days of identifying the incident.

APPENDIX E

GROUNDWATER REPORT

Water and Environment

BLOOMFIELD COLLIERY GROUNDWATER MANAGEMENT PLAN

Prepared for	Bloomfield Collieries Pty Limited
Date of Issue	25 March 2010
Our Reference	S78 005

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BLOOMFIELD COLLIERY GROUNDWATER MANAGEMENT PLAN	
Prepared for	Bloomfield Collieries Pty Limited
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BLOOMFIELD COLLIERY GROUNDWATER MANAGEMENT PLAN

	Date	Revision Description
Revision A	22/02/2010	Fist Draft
Revision B	03/03/2010	Second Draft
Revision C	25/03/2010	Final Report

	Name	Position	Signature	Date
Originator	Jason van den Akker	Project Hydrogeologist		25/03/2010
Reviewer	Peter Dundon	Senior Principal Hydrogeologist		25/03/2010

	Location	Address
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1 INTRODUCTION

1.1 BACKGROUND

Bloomfield Collieries (Bloomfield) is one of two open cut coal mines owned by its parent company, Big Ben Holdings Pty Limited (Big Ben). Bloomfield is located at East Maitland, NSW, and has approval to produce 1.3 million tones of ROM coal by open cut methods per year (**Figure 1.1**). Coal has been mined on the property for over 100 years. Underground mining by the current owner began in 1937, and open cut mining in 1964, and the operation has slowly increased in size to its current production rate. The last coal extracted from underground operations was in May 1992.

It is proposed to complete open cut mining over a 10 to 12 year period, which has been divided into 5 stages.

The first stage, representing 2007-2008 period, involved the mining of a maximum of 0.88 million tonnes per annum ('Mtpa') run-of-mine ('ROM') coal. Stages 2, 3 and 4 (Years 1-5, 5-7 and 7-10 respectively) propose to mine up to a maximum of 1.3 Mtpa ROM coal. Stage 5 (approximately Years 10-12) is for the completion of site rehabilitation.

The areas of current mining activity (Stage 2) and future mining (Stage 4) are discussed in detail in the Environmental Assessment- Completion of Mining and Rehabilitation and shown in Figures 7 to 10 of Volume 1. The mine plan aims to extract the remaining economically recoverable reserves by extending the existing S Cut and Creek Cut mine pits. These pits mine a range of coal seams within the Tomago Coal Measures.

A final void will remain at the end of mining which will be used as a reject emplacement area for the washery. The Abel Project Approval enables washery operations, including the emplacement of reject material, to continue after the completion of the Bloomfield Project.

1.2 OBJECTIVES

This Groundwater Management Plan and Groundwater Response Plan are intended for inclusion in an overall Water Management Plan for Bloomfield Mine. The Groundwater Monitoring Plan and Groundwater Response Plan have been prepared in accordance with the Specific Environmental Conditions 23 and 24, stipulated in Schedule 3 of the Project Approval, under Section 75J of the Environmental Planning Assessment Act 1979.

These conditions below are addressed under **Sections 2** and **3** of this report and are as follows:

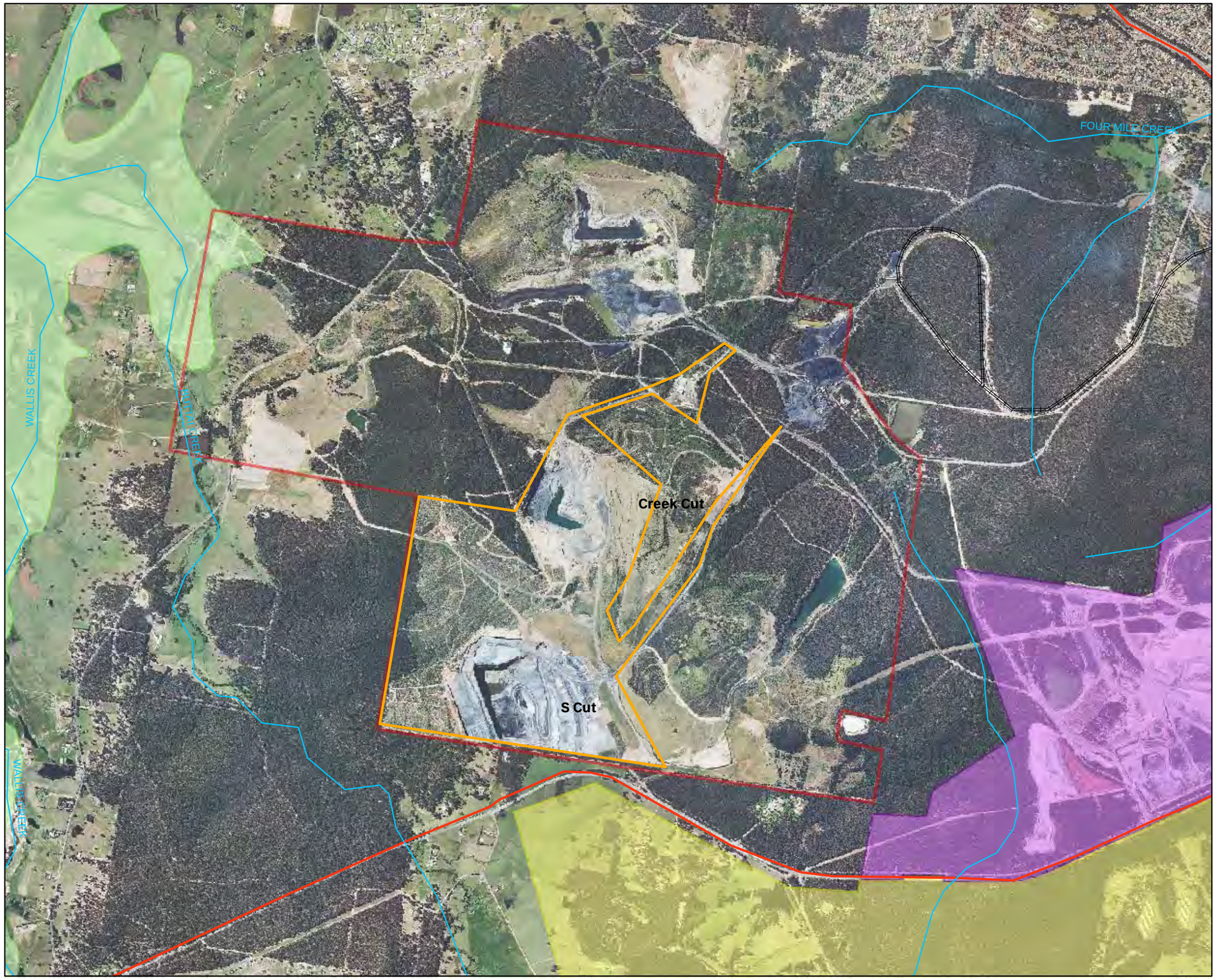
23) The Groundwater Monitoring Program must include:

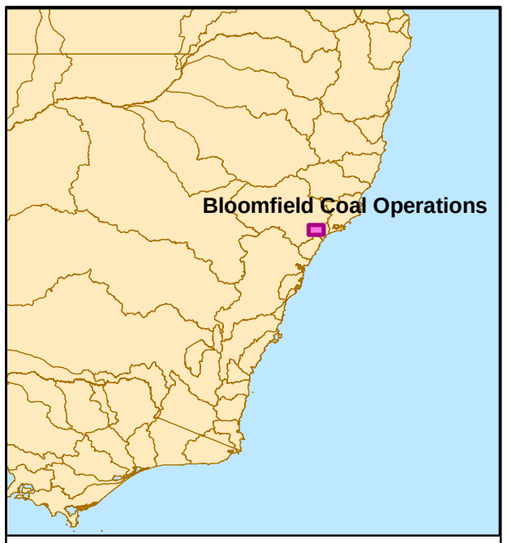
> *(a) further development of the regional and local groundwater model;*
>
> *(b) detailed baseline data to benchmark the natural variation in groundwater levels, yield and quality (including at any privately owned bores in the vicinity of the site);*
>
> *(c) groundwater impact assessment criteria;*
>
> *(d) a program to monitor the impact of the project on groundwater levels, yield, quality, groundwater dependent ecosystems and riparian vegetation;*
>
> *(e) procedures for the verification of the groundwater model; and*
>
> *(f) reporting procedures for the results of the monitoring program and model verification.*

24) The Surface and Groundwater Response Plan must describe the measures and/or procedures that would be implemented to:

> *(a) investigate, notify and mitigate any exceedances of the surface water, stream health and ground water impact assessment criteria;*
>
> *(b) compensate landowners of privately-owned land whose water supply is adversely affected by the project; and*

(c) mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.





0 400 800 1,600 Meters

Legend

Water Courses

- Non-perennial
- Perennial

Roads

- Principal Road
- Secondary Road
- Railways
- Project Area

Mine Lease

- Bloomfield
- Abel
- Donaldson
- Alluvium

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Drawing No. 001	Revision : A
Drawn: JVDA	Datum: WGS1984

Figure 1.1
Site Location Plan

1.3 POTENTIAL GROUNDWATER IMPACTS

A Groundwater Assessment was undertaken in 2007 (Aquaterra, 2008b) to assess key environmental issues for the completion and rehabilitation of open cut mining at Bloomfield.

Groundwater levels in the Project Area show the accumulated effects of long-term mining. Due to the long period of time mining has occurred on the site, there is no evidence to suggest what pre-mining groundwater levels might have been. However, the influence of mining on water levels is apparent by the marked differences in groundwater levels between shallow and deeper coal measures.

Groundwater in the vicinity of the Project Area is saline and of negligible value for beneficial users. No adverse impacts on groundwater supply, quality or any groundwater dependent ecosystems are expected as a result of the Project.

Dewatering associated with the Project is likely to lead to groundwater recovery levels occurring above present levels before the completion of the Project and then stabilizing within 20-30 years.

Small impacts on stream baseflows are predicted for Wallis and Buttai Creeks, with rapid recovery post-mining.

2 GROUNDWATER MONITORING

2.1 FURTHER DEVELOPMENT OF THE GROUNDWATER MODEL

The Bloomfield Coal groundwater model was developed for the EA, to assess the groundwater impacts, associated with completion of mining and rehabilitation (Aquaterra, 2008a).

The model included steady state calibration, sensitivity analysis, predictive scenario modelling and prediction uncertainty assessment for mine dewatering operations and post mining recovery. The steady state model included the simulation of past and present dewatering activities of the Bloomfield operations and the neighbouring Donaldson open cut. Predictive modelling also included the Abel underground mine which is currently under development.

Environmental impact indicators such as groundwater levels are currently below model predictions for this stage of mining. The model can therefore be considered conservative and no further development is currently required. Circumstances which may trigger further development or refinement of the groundwater model include:

- A significant change to the mine plan;
- Acquisition of new hydrogeological information, such as groundwater levels and aquifer properties (i.e. hydraulic conductivity) which are different to calibrated values used in the model; and
- Groundwater drawdown and inflows which significantly exceed model predictions for that stage of mining.

2.2 BASELINE DATA

Due to the long history of mining on the site and areas surrounding the site, pre mining baseline groundwater level and quality information is not available.

The available groundwater baseline data include monitoring records from Bloomfield as well as the neighboring Abel and Donaldson mines. Groundwater monitoring at Abel and Donaldson have been collected routinely since 2005 and 2001 respectively.

The Bloomfield groundwater monitoring network includes a combination of 24 standpipes and vibrating wire piezometers across 8 sites (**Figure 2.1, Table 2.1**). Seven of the sites have multi-level piezometers installed which monitor pressures of various coal seams. Seven piezometers are standpipes which target alluvium or coal measures and allow monitoring for both water level and water quality. In addition there are eight pre existing bores or old mine shafts (known as BL1 to BL8), however there is little information available about their construction details or what aquifers they target.

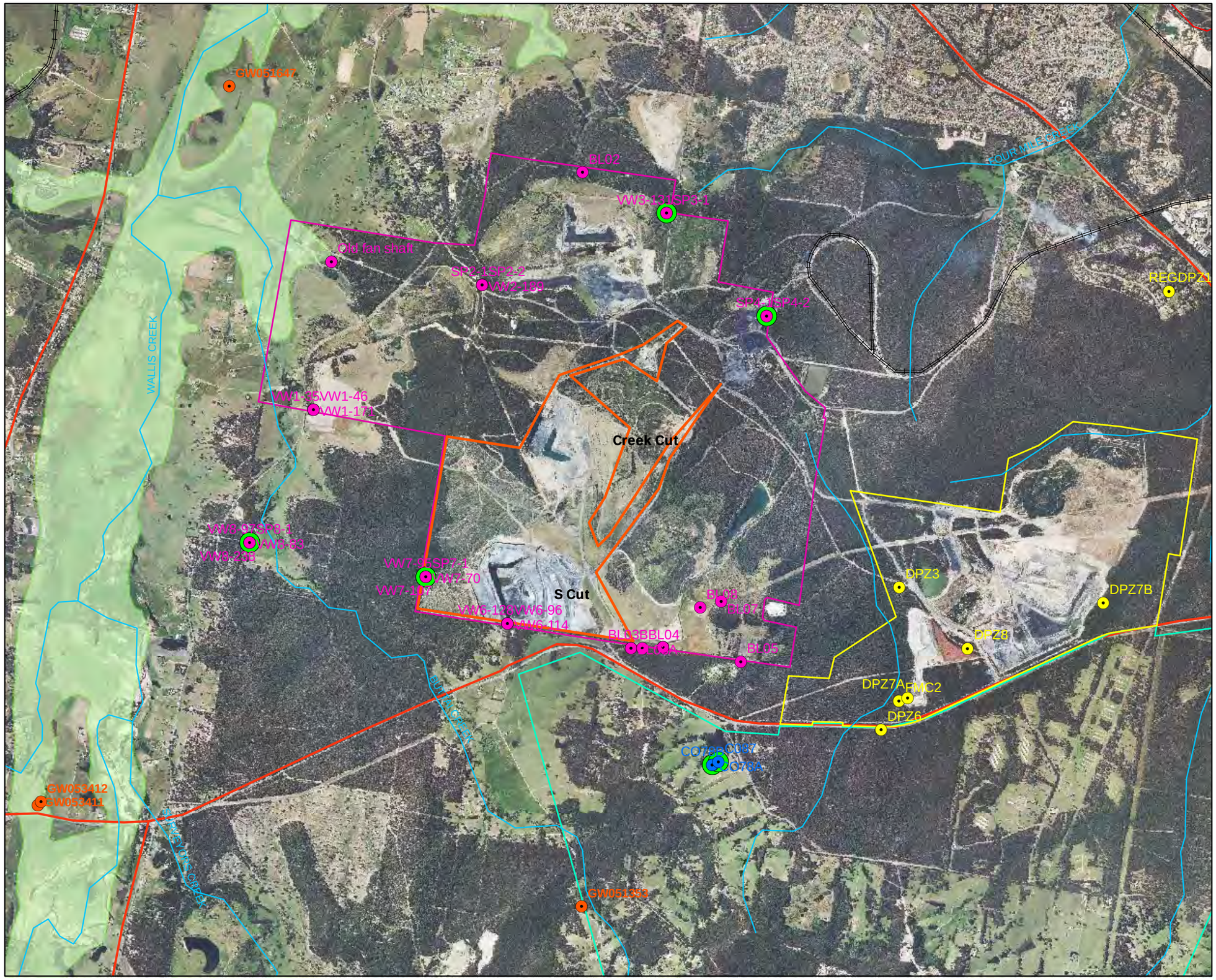
Bloomfield baseline groundwater monitoring commenced during the groundwater impact assessment program in 2007. Since this time groundwater elevations have been recorded regularly and one set of samples taken to analyse water quality. All available monitoring data are presented in **Appendix A.1** and **A.2**.

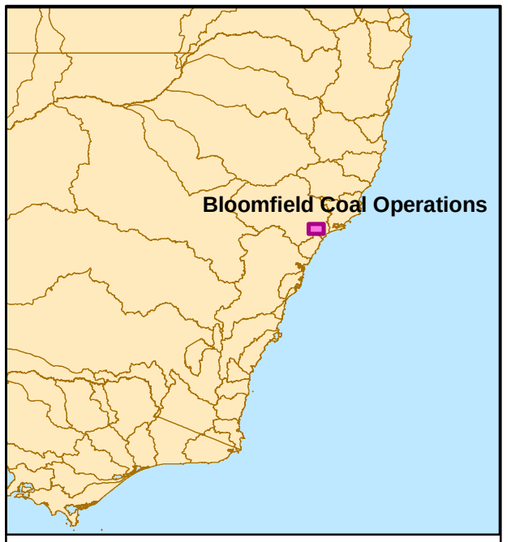
Table 2.1: Monitoring piezometers

Site	Piezometer	Easting	Northing	Surface RL (mAHD)	Depth	Screen Interval / Piezometer Level (m below surface)	Formation
Site 1	VW1-35	363632	6370167	17.4	171	35	Donaldson Seam (33.0 – 35.4 m)
	VW1-46	363632	6370167			46	Big Ben Seam (44.3 – 47.2 m)
	VW1-171	363632	6370167			171	Rathluba Seam (170 – 171 m)
Site 2	SP2-1	365112	6371264	65.2	65	50 – 53, 62 – 65	Donaldson Seam (55.2 – 61.4 m)
	SP2-2	365112	6371264	65.2	85	82 – 85	Big Ben Seam (79 – 94 m)
	VW2-189	365112	6371264	65.2	189	189	Rathluba Seam (187.8 – 191.3 m)
Site 3	SP3-1	366732	6371893	38.8	14	11 – 14	Alluvium/weathered Permian
	VW3-131	366732	6371893	38.8	131	131	Rathluba Seam (129.7 – 131.5 m)
Site 4	SP4-1	367612	6370989	27.8	78.4	75.4 – 78.4	Rathluba Seam (75.4 – 77.4 m)
	SP4-2	367612	6370989	27.8	9.4	6.4 – 9.4	Alluvium/weathered Permian
Site 5	VW5-62	366700	6368083	55.7	90	62	White Ck Seam (62.3 – 63.1 m)
	VW5-71	366700	6368083			71	Donaldson Seam (70.5 – 71.9 m)
	VW5-90	366700	6368083			90	Big Ben Seam (89.3 – 89.7 m)
Site 6	VW6-96	365337	6368293	52.5	130	96	White Ck Seam (95.1 – 96.7 m)
	VW6-114	365337	6368293			114	Donaldson Seam (113.2 – 114.7 m)
	VW6-128	365337	6368293			128	Big Ben Seam (128.0 – 129.3 m)
Site 7	SP7-1	364619	6368701	24.9	11.2	9.2 – 12.2	Alluvium/weathered Permian
	VW7-70	364619	6368701	24.9	110	70	White Ck Seam (67.9 – 69.8 m)
	VW7-95	364619	6368701			95	Donaldson Seam (90.0 – 91.8 m)
	VW7-107	364619	6368701			107	Big Ben Seam (104.7 – 107.7 m)

Site	Piezometer	Easting	Northing	Surface RL (mAHD)	Depth	Screen Interval / Piezometer Level (m below surface)	Formation
Site 8	SP8-1	363072	6369002	22.5	9.9	6.9 – 9.9	Alluvium/weathered Permian
	VW8-83	363072	6369002	22.5	238	83	Donaldson Seam (80.4 – 84.0 m)
	VW8-97	363072	6369002			97	Big Ben Seam (91.5 – 98.5 m)
	VW8-238	363072	6369002			238	Rathluba Seam (237.2 – 240.2 m)
BL01	Old fan shaft	363789	6371466	16.1		?	?
BL02	BL02	365994	6372249	26.7		?	?
BL03	BL03A	366422	6368077	63.6	72	?	?
	BL03B	366422	6368077		53	?	?
BL04	BL04	366519	6368076	61.5	52	?	?
BL05	BL05	367385	6367957	75.4	46	?	?
BL07	BL07	367211	6368485	57.6	26	?	?
BL08	BL08	367029	6368431	52.3	49	?	?
Abel Project	CO78A	367140	6367054	77	101	99-96, 90-87	Whites Creek Seam *(Abel's Donaldson Seam)*
	CO78B				24	24-18	Alluvium/weathered Permian
	C087	367187	6367079	74	18.3	18.3-12.3	Alluvium/weathered Permian
Donaldson Project	REGDPZ1	371142	6371207		33	27-33	No information
	FMC1						No information
	FMC2						No information
	DPZ3	368774	6368609	49.1	30	6.8-18.8	Undifferentiated coal measures below Whites Creek Seam *(Abel's Lower Donaldson Seam)*
	DPZ6			57.7	43	26.7-42.5	Whites Creek Seam *(Abel's U and L Donaldson Seams)*
	DPZ7A	368848	6367641	55.4	18	12.9-16.9	Overburden above Whites Creek Seam *(Abel's Upper Donaldson)*

Site	Piezometer	Easting	Northing	Surface RL (mAHD)	Depth	Screen Interval / Piezometer Level (m below surface)	Formation
	DPZ7B			55.4	41	22.9-34.9	Whites Creek Seam *(Abel's L Donaldson Seam)*
	DPZ8	369375	6368074	51.8	33	22.2-32.2	Whites Ck and Donaldson Seams *(Abel's L Donaldson and Big Ben)*





0 500 1,000 2,000 Meters

Legend

Project Area

Monitoring Bores

Mine

- Bloomfield
- Abel
- Donaldson
- Alluvium/Colluvium mon. bores
- Licensed bores

Water Courses

- Non-perennial
- Perennial

Mine Lease

- Abel
- Donaldson
- Bloomfield

Roads

- Principal Road
- Secondary Road
- Railways
- Alluvium

aquaterra

Project: S78	Date: 18/02/2010
Drawing No. 004	Revision : A
Drawn: JVDA	Datum: WGS1984

Figure 2.1
Monitoring Bores and
Registered Bore Location Plan

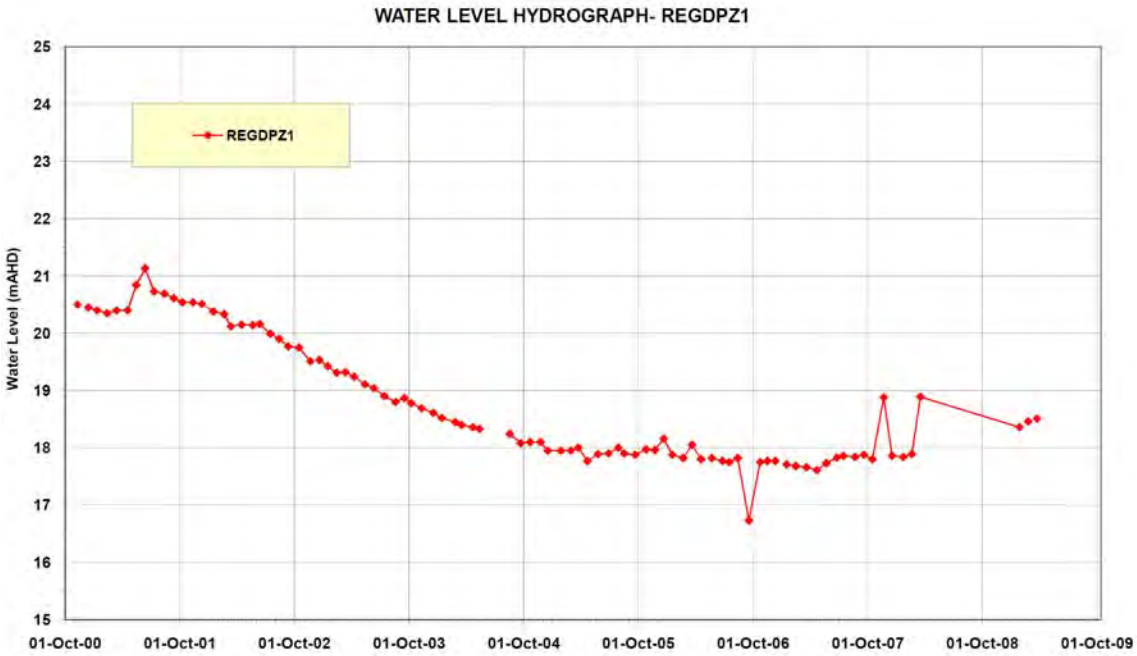
2.2.1 GROUNDWATER LEVELS

Groundwater levels in the Project Area show the accumulated effects of long-term mining. Due to the long period of time mining has occurred on the site (170 years), there is no evidence to suggest what pre-mining groundwater levels might have been. However, the influence of mining on water levels is apparent by the marked differences in groundwater levels between shallow and deeper coal measures.

Longer term hydrographs are available from some of the bores in the neighboring Donaldson monitoring network. In particular, bore REGDPZ1, located approximately 5km east of Bloomfield (**Figure 2.2**) and stratigraphically deeper than the strata being mined at both Donaldson and Bloomfield, was included in the Donaldson network to show only climatic and/or seasonal trends so that mining impacts could be distinguished from natural fluctuations. The hydrograph from REGDPZ1 has been responding to rainfall variability, showing a downward trend between 2001 and 2004, during periods of below average rainfall, and a steadily rising trend since 2005, in response to more normal rainfall.

The hydrographs from the Bloomfield piezometers show a gradual but steadily declining trend since monitoring began, with some also showing a temporary recharge response from a major rainfall event in June 2007 (**Appendix A.1**).

Figure 2.2: Hydrograph of Monitoring Bore REGDPZ1



2.2.2 GROUNDWATER QUALITY

Groundwater samples were collected from a number of Bloomfield standpipes as part of the groundwater impact assessment carried out in 2007. The laboratory analysis results are presented in **Appendix A.2** and the main water quality characteristics of groundwater within the Bloomfield Lease area are summarised below.

Salinity

Salinity is variable, ranging from less than 1000 to over 13,000 mg/L total dissolved solids (TDS). The December 2007 sample from SP2-1 (TDS of 230 mg/L) appears to be anomalous, as the earlier sample from this bore collected in May 2007 had a TDS of 5,820 mg/L, as do other samples collected from the Donaldson Seam. The very low TDS is most likely due to rainfall contamination.

The highest salinities are reported from the surficial groundwater, ie the colluvium / weathered Permian (13,000 mg/L TDS in C078B and over 11,000 mg/L in SP4-2). The lowest reported salinity of 1000 mg/L (apart from the anomalous result from SP2-1) was from the Whites Creek and Donaldson Seams at Donaldson bores DPZ7 and DPZ8.

pH

pH is close to neutral in all samples, discounting the anomalous value from C087, which reported a pH of 11.9. This elevated value is considered to have been due to residual effects of cement grout during bore construction.

Dissolved metals

Sampling of dissolved metals revealed generally low concentrations relative to ANZECC (2000) freshwater ecosystem protection guidelines, with the exception of copper and zinc. The concentrations of copper exceed the ANZECC guideline value of 0.0014 mg/L in all samples. The zinc guideline value of 0.008 mg/L is exceeded in all but 2 samples.

Exceedance of the cadmium guideline value of 0.0002 mg/L was reported from the two samples from SP4-2. Both samples from SP3-1 reported elevated manganese concentrations above the ANZECC guideline. The nickel guideline value was also exceeded in several samples. Finally, one exceedance for aluminium was reported (the December sample from SP3-1).

Dissolved iron concentrations are relatively high in some samples, although no ANZECC guideline value is set.

Nutrients

Limited sampling for nutrients revealed concentrations of all parameters to be generally within the ANZECC guidelines, with a very slight exceedance for ammonia only in the first sample from SP2-1.

2.3 IMPACT ASSESSMENT CRITERIA

Impact assessment criteria are recommended for:

- Mine inflow rate
- Mine inflow water quality
- Near surface groundwater levels, in particular groundwater levels near Buttai and Wallis Creeks
- Impacts on surficial groundwater levels and/or creek base flows
- Impacts on existing licensed users

2.3.1 MINE INFLOW RATES

The pit inflow rates have been predicted to decrease progressively from 1,737 m^3/d in 2007 to 393 m^3/d in 2017 (**Table 2.2**). A mine inflow rate substantially higher than predicted by the model may indicate a greater impact on near-surface groundwater.

Table 2.2: Predicted Mine Inflows

Year	Total Pit Inflow	
	m^3/d	ML/yr
2007	1,737	634
2008	1,717	627
2009	1,699	620
2010	1,686	615
2011	1,671	610
2012	2,046	747
2013	1,973	720
2014	711	260
2015	890	325
2016	961	351
2017	396	144

An observed inflow rate 100% in excess of the predicted inflow rate at any stage during the mine life sustained for 3 consecutive months would trigger a response plan as detailed in **Section 3.3** of this report to be initiated.

Water in the pit is derived from a combination of inputs such as groundwater inflow, surface water runoff and water/slurry pumped from the tailings storage facility. Hence, long term monitoring of all components of the pit water balance (i.e. rainfall, sump discharge) is required to ascertain groundwater inflow. It is proposed to monitor the volumes of water extracted by pumping from pit sumps estimated from pump times and pump capacity. This data can be evaluated over time, by comparing pumped discharges during rainy and dry periods, to differentiate between groundwater inflows and rainfall runoff.

2.3.2 MINE INFLOW WATER QUALITY

Water is pumped from the pit sump into Lake Kennerson. Surface water runoff from disturbed areas is also directed towards the lake. Water is then fed into Lake Foster (which also receives water from various sources) and ultimately discharged into Four Mile Creek. The water quality of the discharged water is monitored as part of the discharge monitoring requirements.

As the lake water is a mixture of both surface water runoff and mine inflows (groundwater, surface water and tailings water), the actual water chemistry of groundwater inflow alone is difficult to determine.

Since 2007 the water quality (EC, TDS, pH, and TSS) of mine water discharged into Four Mile Creek has been variable, with TDS in the range of 1,350 mg/L to 5,088 mg/L. Apart from an isolated number of exceedances, all water quality parameters have been within the EPL discharge thresholds.

The salinity and pH of mine water discharged to Four Mile Creek will be monitored throughout the mine life. An observed increase or decrease in salinity by more than 25 percent outside the expected range (1,300 mg/L to 6000 mg/L) sustained over a consecutive 6 month period would require a response action as detailed in **Section 2.3.5** of this report.

Mine inflow water quality significantly different from the above range would not itself be cause for concern, as groundwater within the coal measures is highly variable, with measured TDS ranging from 2700 mg/L to 13,100 mg/L.

A rapid change to a significantly lower or higher salinity at any time might indicate that a source of surface water or near surface groundwater may have been induced to inflow into the mine. Likewise a sudden change to the average pH of the mine inflow water may indicate the interception of a new source of inflows.

2.3.3 BASEFLOW IMPACTS AND GROUNDWATER LEVELS AROUND WALLIS AND BUTTAI CREEKS

The development of open cut and underground mines (including neighbouring sites) will form a sink into which groundwater in the coal measures will flow and will induce a cone of drawdown in the coal measures groundwater levels. The cones of drawdown predicted by numerical modelling are presented in Aquaterra (2008a).

The combined effects of Bloomfield, Donaldson and Abel are predicted to have a small impact on stream baseflows. The regional drawdown impacts from the three projects mutually interact and it is therefore not possible to totally isolate the effects of Bloomfield from the combined effects of all mines. However due to proximity to Wallis Creek and Buttai Creek, the baseflows in those creeks would be more sensitive to Bloomfield.

Model predictions show that predicted dewatering impacts on groundwater levels and baseflow contribution are not significant in relation to seasonal variations. The reduction in baseflow is expected to be about 20 m^3/d or (0.2 L/sec) in Wallis Creek by the end of Bloomfield open cut mining in Year 11. A much smaller baseflow reduction for Buttai Creek 5.1 m^3/d (0.06 L/s) in Year 8 is predicted.

Specific monitoring piezometers will be maintained to detect any unexpected impacts to near surface groundwater levels around the creeks due to dewatering impacts from the mine. These piezometers are being monitored (and will continue to be monitored) to establish baseline trends in response to natural climatic influences.

A deviation from these trends could indicate an unexpected adverse impact by mining operations on the alluvium/colluvium. As pre mining baseline conditions were not established, an additional drawdown of 1 m relative to the predicted drawdown in the near surface groundwater levels would require a response action, as detailed in **Section 3.3** of this report.

2.3.4 IMPACTS TO LICENSED USERS

Due to the generally high groundwater salinities and low bore yields, there is very limited existing groundwater abstraction in the study area other than for coal mine dewatering. Occasional small stock water supplies are drawn from near surface groundwater, such as the NOW registered bore GW51353.

Existing registered bores within a 5km radius of the project were identified as part of the EA. Nine of the registered bores within 5 km of Bloomfield are monitoring bores around the Bloomfield and Donaldson open cuts (**Figure 2.1**).

Two are water supply bores, viz:

- GW51353, a domestic/stock bore approximately 3 km south of Bloomfield; and
- GW51647, a stock bore approximately 4 km north-west of Bloomfield.

GW51353 is reported to be 50 m deep, with a water level at 15 m, yielded 0.2 L/s and has a salinity in the range 3000-7000 ppm. GW51647 is shallow (12 m deep), but no other details are recorded. Both bores were drilled in 1980. Neither bore is expected to be impacted adversely by the continuation of mining at Bloomfield.

The remaining two registered bores are GW53411 and GW53412, located more than 4 km southwest of Bloomfield within the Wallis Creek floodplain. They are beyond the range of potential impact from the completion of mining at Bloomfield.

2.4 MONITORING PROGRAM

The groundwater monitoring program that has been operating on the Bloomfield mine since 2007 will be continued and expanded to include the neighbouring Donaldson, Abel and Tasman

areas, as an integrated monitoring system covering all four sites. It will also be integrated with the surface water monitoring program.

The groundwater monitoring program will include:

- Quarterly measurement of water levels in the existing network of piezometers to be monitored through the life of the project.
- Six monthly sampling of all standpipe piezometers, for laboratory analysis of electrical conductivity (EC), total dissolved solids (TDS) and pH.
- Annual collection of water samples from all standpipe piezometers for laboratory analysis of a broader suite of parameters
    - Physical properties (EC, TDS and pH)
    - Major cations and anions (Ca, Mg, Na, K, Cl, SO_4, HCO_3 and CO_3)
    - Nutrients
    - Dissolved metals.
- Record pump time from the pit to estimate the volume of mine water pumped from the open cut mine.

2.5 MODEL VERIFICATION

At the end of Stage 2 of mining, a comprehensive review of the performance of the groundwater system will be undertaken. This will include re-running the groundwater model in transient calibration mode, to verify that the actual inflow rates and groundwater level impacts are in accordance with the model predictions described in this report. If necessary, further adjustment would be made to the model at that time, and new forward predictions of mine inflows and water level impacts would be undertaken.

2.6 REPORTING PROCEDURES

The following information will be included in the Annual Environmental Management Report (AEMR) in accordance with Condition 3 Schedule 5 of the Project Approval:

- A summary of the monitoring results for the project during the past year;
- An analysis of these monitoring results against the relevant:
    - impact assessment criteria/limits;
    - monitoring results from previous years; and
    - predictions in the EA;
- Identification of any trends in the monitoring results over the life of the project.

Incident reporting will be undertaken in accordance Condition 3 Schedule 5 of the Project Approval.

3 RESPONSE PLAN

3.1 CONTINGENCY MEASURES

In the event of any adverse impacts or water quality degradation beyond predictions in the EA, Bloomfield will commission an assessment of the causes, will develop a staged response program satisfactory to DoP to mitigate the adverse impacts, and will attempt to establish and implement measures to limit further adverse impact.

The identification process and response protocols to potential adverse outcomes are provided in the trigger action response plan (TARP) provided in **Table 3.1**. The responses proposed incorporate a staged assessment and development of management measures deemed appropriate for each individual event should it occur.

The EA and more recent monitoring data provide guidelines for trigger levels and take into account predicted responses to mining. Specific trigger levels have been designed to alert Bloomfield to observed parameter responses which are outside of normal variation and/or predicted responses, or where observed parameter values do not follow anticipated trends.

3.2 TRIGGER ACTION RESPONSE PLAN (TARP)

The Trigger Action Response Plan (TARP) provides appropriate triggers and corresponding response actions for prevention or mitigation of adverse impacts to nearby water users or the natural environment as a result of mining.

The monitoring program outlined in **Section 2** has been designed to detect changes to groundwater levels, groundwater quality or inflow rates, or to indicate that an abnormal condition relating to mining has developed.

Trigger levels have been set for particular impacts at which a response is needed, and to help define an appropriate response in each case (**Table 3.1**).

Aspects assessed to be at risk are summarised in **Section 2.3** of this report and fully explored in the Groundwater Impact Assessment Report (Aquaterra, 2008). These include both predicted and unpredicted impacts, and include:

- Groundwater level.
- Groundwater quality.
- Hydraulic connection to Wallis Creek and Buttai Creek.
- Groundwater users (Private Bores).
- Cumulative impacts.

3.3 RESPONSE ACTION

In the event of any exceedance detailed in **Sections 2.3.1** to **2.3.4** above, the following response action would be initiated:

- Initiate immediate review of circumstances including results of monitoring.
- Assessment undertaken to determine the likely reason(s) for the exceedance.
- If assessed as being caused by the mining operation, and it is further assessed to be likely to cause an adverse impact on an existing beneficial or environmental use of surface water or groundwater, then an appropriate preventative and/or remedial strategy would be recommended, which may comprise:
    - Additional monitoring;
    - Provision of alternative water supply or other negotiated agreement with landholders if found to be adversely impacted; or
    - (If appropriate) no change to operations.
- The above response program would be carried out in consultation with NOW and DII-Minerals.

Table 3.1: Trigger Action Response Plan

Aspect	Parameter	Frequency	Purpose	Trigger	Action	Responsibility	Timing	Purpose
Groundwater monitoring	Groundwater level in piezometers	Quarterly	To provide baseline water level data and to identify any water level impacts	Alluvium/Colluvium Piezometers: An additional drawdown of 1m relative to the predicted drawdown in the near surface groundwater levels	Repeat water level monitoring to confirm. Refer the matter to an independent hydrogeologist for review	Bloomfield Environmental Officer	Inform relevant agencies within 7 days. Investigation initiated within 1 week.	Inform agencies of baseline assessment and monitoring. Identify, investigate and report on impacts to groundwater levels.
	Groundwater quality in piezometers	6 monthly: pH, EC, TDS Yearly: Cations, Anions, Nutrients & Dissolved metals	To provide baseline water quality data and to identify any water quality impacts	An observed increase or decrease in salinity by more than 25 percent outside the min or max baseline range, sustained over a consecutive 6 month period	Repeat groundwater sampling to confirm. Refer the matter to an independent hydrogeologist for review	Bloomfield Environmental Officer	Inform relevant agencies within 7 days. Investigation initiated within 1 week	Inform agencies of baseline assessment and monitoring. Identify, investigate and report on impacts to groundwater quality.
Hydraulic connection with near surface groundwaters and baseflow impacts	Groundwater level in piezometers	Quarterly	To identify any baseflow impacts to the creeks	Alluvium/Colluvium Piezometers: An additional drawdown of 1m relative to the predicted drawdown in the near surface groundwater levels Coal Measures: Nil	Repeat water level monitoring to confirm. Refer the matter to an independent hydrogeologist for review	Bloomfield Environmental Officer	Inform relevant agencies within 7 days. Investigation initiated within 1 week	Ensure adequate baseflows are maintained to Wallis and Buttai Creeks
	Groundwater quality in piezometers	6 monthly: pH, EC, TDS Yearly: Cations, Anions, Nutrients & Dissolved metals	Identify any water quality impacts to near surface groundwaters	An observed increase or decrease in salinity by more than 25 percent outside the min or max baseline range, sustained over a consecutive 6 month period	Repeat groundwater sampling to confirm. Refer the matter to an independent hydrogeologist for review	Bloomfield Environmental Officer	Inform relevant agencies within 7 days. Investigation initiated within 1 week	Identify, investigate and report on water quality impacts to near surface groundwaters associated with Wallis and Buttai Creeks

Aspect	Parameter	Frequency	Purpose	Trigger	Action	Responsibility	Timing	Purpose
Mine inflows	Flow rate	Daily (record of pump times kept when pumping)	Identify unexpected high mine inflows and determine whether this will impact on near-surface groundwater	An observed inflow rate 100% in excess of the predicted inflow rate at any stage during the mine life sustained for 3 consecutive months	Refer the matter to an hydrogeologist for review	Bloomfield Environmental Officer	Inform relevant agencies within 7 days. Investigation initiated within 1 week	Identify, investigate and report on drawdown impacts to existing users and creeks
Licenced discharge	Water quality and volume	As per EPL requirement for TSS, EC, pH, TDS and Fe	Ensure mining activities are not polluting Four Mile Creek	Limits stipulated by EPL Licence 369	Repeat water quality sampling to confirm. Investigation to be undertaken and reported in accordance with Licence requirements	Bloomfield Environmental Officer	Inform relevant agencies within 1 day. Investigation initiated within 1 week	Identify, investigate and report on impacts to Four Mile Creek

4 REFERENCES

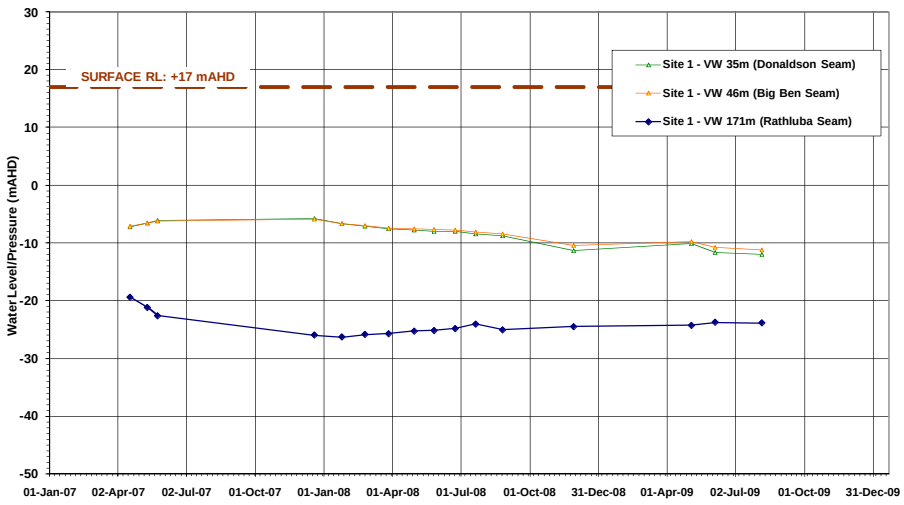
ANZECC, 2000. Australian and New Zealand Guidlines for Fresh and Marine Water Quality.

Aquaterra Consulting Pty Ltd, 2008a. Bloomfield Completion of Mining and Rehabilitation Groundwater Modelling. Report to Peter Dundon and Associates Pty Ltd. May 2008.

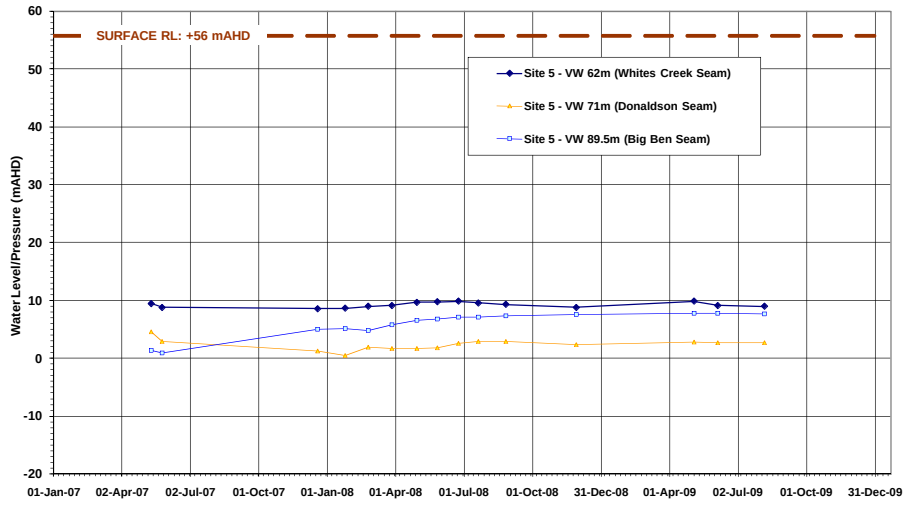
Aquaterra Consulting Pty Ltd, 2008b. Bloomfield Completion of Mining and Rehabilitation Groundwater Impact Assessment. Report to Peter Dundon and Associates Pty Ltd. September 2008.

APPENDIX A1 HYDROGRAPHS

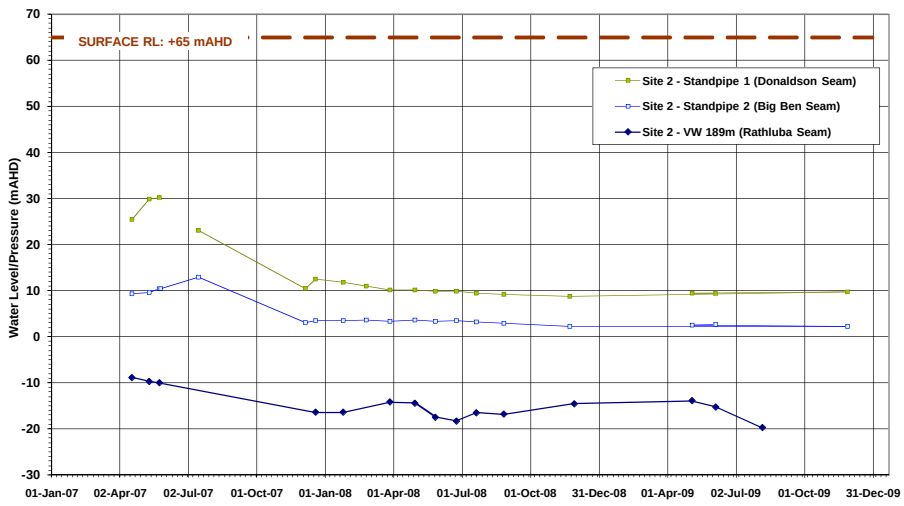
GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 1



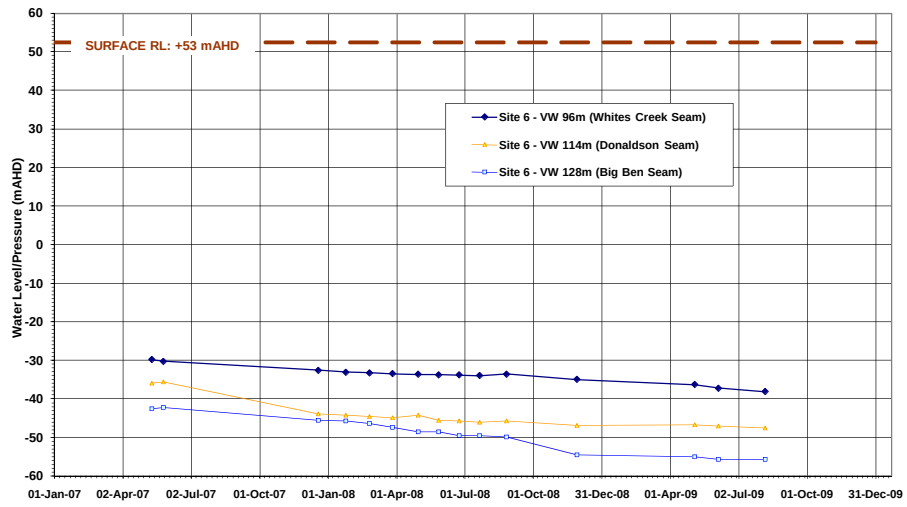
GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 5



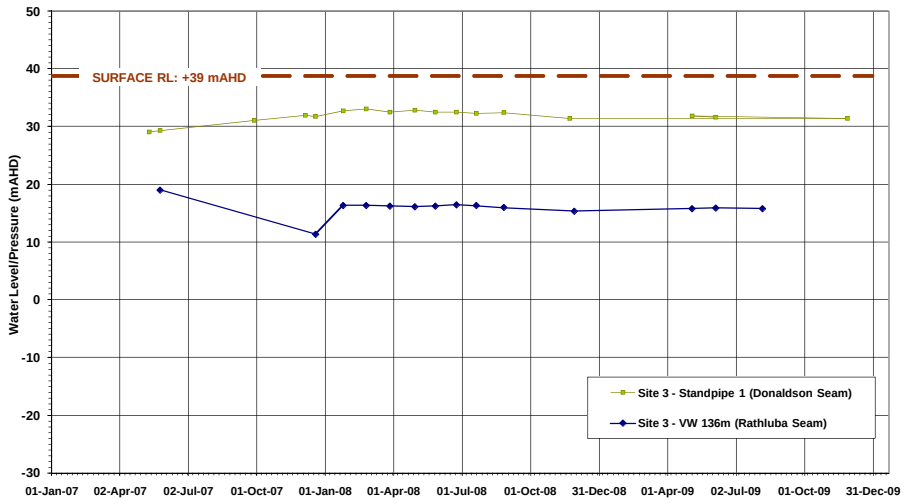
GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 2



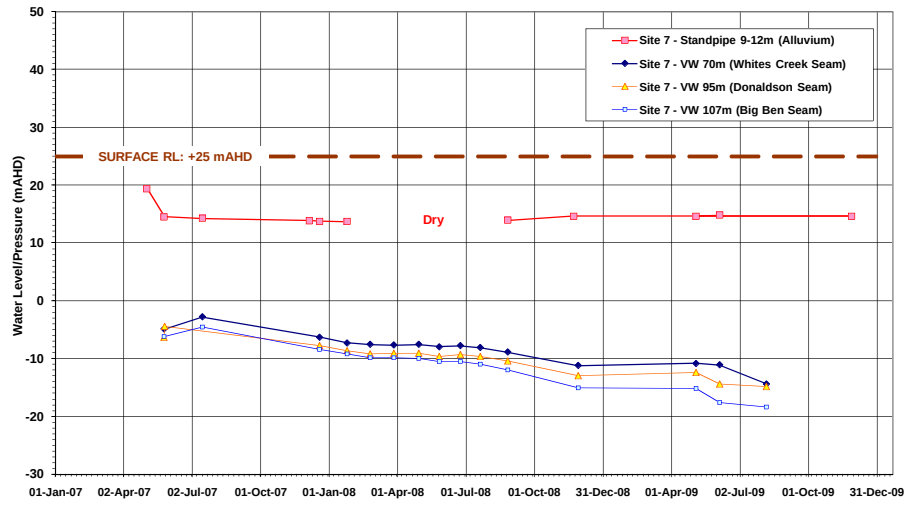
GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 6



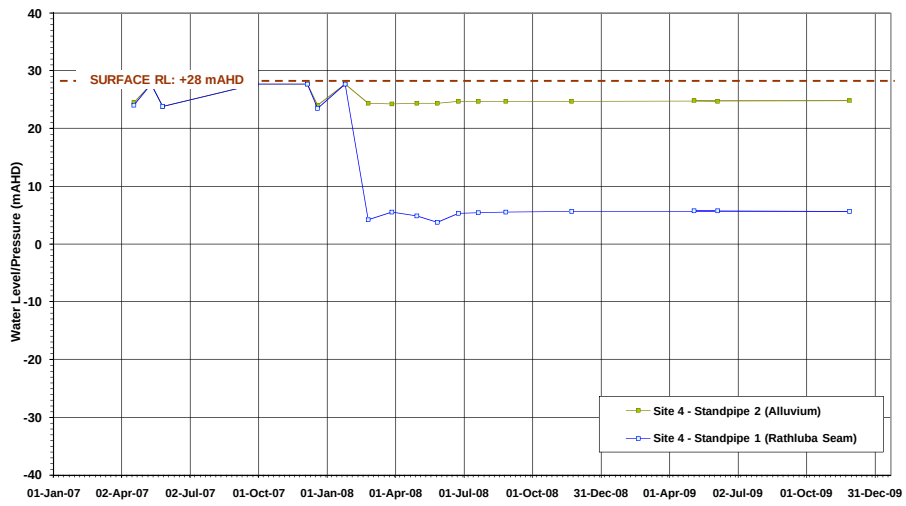
GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 3



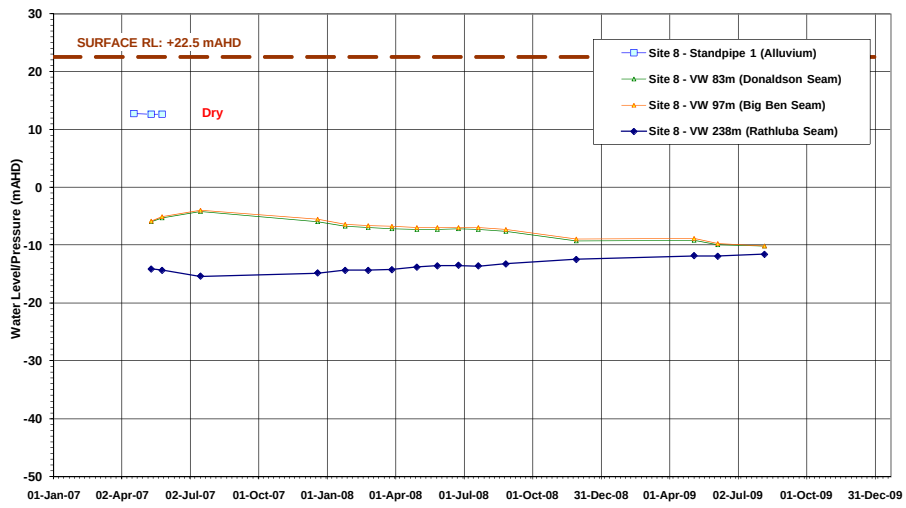
GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 7



GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 4



GROUNDWATER LEVEL HYDROGRAPH - BLOOMFIELD Site 8



APPENDIX A2 GROUNDWATER CHEMISTRY

Groundwater Sample Analysis Results
(page 1 of 2)

Bore/Stream				**SP2-1**		**SP2-2**		**SP3-1**		**SP4-1**		**SP4-2**		**SP4-2**		**BL01**	**BL04**
Parameter	Units	**LOR**	**ANZECC (2000) Guideline Value for Freshwater Ecosystem Protection**	27-May-07	06-Dec-07	27-May-07	06-Dec-07	27-May-07	06-Dec-07	27-May-07	06-Dec-07	27-May-07	06-Dec-07	27-May-07	06-Dec-07	12-Apr-06	14-Apr-06
pH Value		**0.01**		6.61	6.79	6.21	6.65	6.4	6	7.44	7.44	6.65	6.23	6.65	6.23	6.58	7.11
Sodium Adsorption Ratio				9.49	1.44	19.41	10.90	8.80	8.55	23.25	23.16	31.42	32.09	31.42	32.09	13.22	13.72
Conductivity @ 25°C	µS/cm	**1**		6840	300	5530	5970	6390	5670	13100	11800	16800	16500	16800	16500	2700	2970
Total Dissolved Solids (TDS)	mg/L	**1**		5820	230	3750	5200	4000	5110	7760	8780	11100	11400	11100	11400	2020	2110
Total Suspended Solids (TSS	mg/L																
Calcium	mg/L	**1**		373	24	33	266	280	176	188	174	49	37	49	37	67	76
Magnesium	mg/L	**1**		285	4	112	226	320	330	298	302	398	467	398	467	41	61
Sodium	mg/L	**1**		1000	29	1040	1000	908	833	2200	2180	3030	3310	3030	3310	557	662
Potassium	mg/L	**1**		24	2	30	25	32	37	40	44	53	58	53	58	11	19
Hydroxide Alk as $CaCO_3$	mg/L	**1**		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alk as $CaCO_3$	mg/L	**1**		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alk as $CaCO_3$	mg/L	**1**		314	60	185	335	444	122	498	569	198	159	198	159	288	753
Sulphate	mg/L	**1**		3050	32	1780	2600	2870	2690	464	394	631	736	631	736	573	247
Chloride	mg/L	**1**		474	36.4	598	586	401	603	4250	4150	5520	6590	5520	6590	573	757
Aluminium - Filtered	mg/L	**0.1/0.01**	**0.055**	<0.01	0.01	<0.01	<0.01	<0.01	0.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Arsenic - Filtered	mg/L	**0.01/0.001**	**0.013**	0.002	0.001	0.006	<0.001	0.002	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
Cadmium - Filtered	mg/L	**0.005/0.0001**	**0.0002**	0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	0.0029	0.0003	0.0029	0.0003		
Chromium - Filtered	mg/L	**0.01/0.001**	**ID**	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005		
Copper - Filtered	mg/L	**0.01/0.001**	**0.0014**	0.002	0.027	0.002	0.002	0.002	0.003	0.085	0.002	0.789	0.006	0.789	0.006		
Lead - Filtered	mg/L	**0.01/0.001**	**0.0034**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
Manganese - Filtered	mg/L	**0.01**	**1.9**	1.23	0.008	0.413	1.27	3.44	7.32	0.284	0.33	0.926	1.37	0.926	1.37		
Nickel - Filtered	mg/L	**0.01/0.001**	**0.011**	0.016	0.001	0.007	<0.001	0.065	0.336	0.013	<0.001	0.05	0.06	0.05	0.06		
Selenium - Filtered	mg/L	**0.01**	**0.005**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Silver - Filtered	mg/L	**0.001**	**0.00005**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Zinc - Filtered	mg/L	**0.01/0.001**	**0.008**	0.007	0.259	0.051	0.012	0.058	0.486	0.151	0.006	0.228	0.024	0.228	0.024		
Boron - Filtered	mg/L	**0.1/0.01**	**0.37**	0.24	<0.05	0.07	0.24	0.15	0.22	0.11	0.1	<0.05	<0.05	<0.05	<0.05		
Iron - Filtered	mg/L	**0.1**	**ID**	14.9	<0.05	18.7	13.4	16.7	77.6	<0.05	0.05	<0.05	0.58	<0.05	0.58		
Mercury - Filtered	mg/L	**0.0001**	**0.00006**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Ammonia as N	mg/L	**0.01**	**0.9**	1.28		0.247		0.349		0.342		0.173		0.173			
Nitrite as N	mg/L	**0.01**		<0.01		0.025		<0.01		<0.01		<0.01		<0.01			
Nitrate as N	mg/L	**0.01**	**0.7**	0.035		0.046		0.031		0.042		0.112		0.112			
Total Kjeldahl Nitrogen as N	mg/L	**0.1**		2.3		0.5		1		2.5		4.6		4.6			
Total Phosphorus as P	mg/L	**0.01**		0.02		0.37		0.08		0.07		1.21		1.21			
Reactive Phosphorus as P	mg/L	**0.01**		<0.01		0.078		<0.01		0.01		0.036		0.036			
Total Cations (reported)	meq/L	**0.01**		86.4	2.8	57	76.1	80.6	73.1	130	130	168	186	168	186	31.3	38.1
Total Anions (reported)	meq/L	**0.01**		83.2	2.9	57.5	77.4	79.9	75.4	139	137	173	204	173	204	33.8	41.5
Anion-Cation Difference (repo	meq/L	**0.01**															
Allowable Anion-Cation Differ	meq/L	**0.01**															
Anion-Cation Difference (repo	%			1.86%		0.49%	0.89%	0.45%	1.58%	3.33%	2.63%	1.38%	4.79%	1.38%	4.79%	4.00%	4.32%
Allowable Anion-Cation Differ	%																
Total Cations (calculated)	meq/L	**0.01**		86.17	2.84	56.87	76.00	80.61	73.11	130.62	129.48	168.34	185.73	168.34	185.73		
Total Anions (calculated)	meq/L	**0.01**		83.15	2.89	57.63	77.36	79.94	75.45	139.50	136.64	172.81	204.40	172.81	204.40		
% Difference (calculated)	%	**0.01**		1.79%	-0.92%	-0.66%	-0.88%	0.42%	-1.58%	-3.29%	-2.69%	-1.31%	-4.79%	-1.31%	-4.79%		
Allowed % Difference (calcula	%	**0.01**		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%		

Groundwater Sample Analysis Results
(page 2 of 2)

Bore/Stream				**C078A**	**C078B**	**C087**	**DPZ3**	**DPZ6**	**DPZ7**	**DPZ8**	**DPZ12**	**Four Mile Creek (at John Renshaw Drive)**			**Four Mile Creek (at north side of Donaldson lease)**		
Parameter	Units	**LOR**	**ANZECC (2000) Guideline Value for Freshwater Ecosystem Protection**	30-May-06	30-May-06	29-May-06						MINIMUM	**AVERAGE**	MAXIMUM	MINIMUM	**AVERAGE**	MAXIMUM
pH Value		**0.01**		6.94	7.23	11.90						5.90	**6.72**	7.15	5.80	**6.98**	7.4
Sodium Adsorption Ratio				10.91	34.65	28.94	17.45	11.30	11.59	9.28	19.60						
Conductivity @ 25°C	µS/cm	**1**		3140	23400	3220	5300	3800	2300	1900	3300	100	**395**	905	125	**172**	380
Total Dissolved Solids (TDS)	mg/L	**1**		2070	13000	1980	2500	1800	1100	1000	1600	70	**260**	520	70	**109**	240
Total Suspended Solids (TSS	mg/L											1	**34**	269	1	**14**	153
Calcium	mg/L	**1**		109	163	42	81	56	18	18	19	2.9	**8.6**	14			
Magnesium	mg/L	**1**		72	499	<1	96	71	36	34	36	3.9	**9.2**	21			
Sodium	mg/L	**1**		598	3950	681	980	540	370	290	630	16	**50**	120			
Potassium	mg/L	**1**		12	45	24	21	15	8.6	8.6	8.4	3	**6.2**	9			
Hydroxide Alk as $CaCO_3$	mg/L	**1**		<1	<1	87											
Carbonate Alk as $CaCO_3$	mg/L	**1**		<1	<1	88	0	0	0	0	0						
Bicarbonate Alk as $CaCO_3$	mg/L	**1**		515	1220	<1	590	300	85	60	210	8	**57**	90	5	**42**	70
Sulphate	mg/L	**1**		84	1070	235	170	56	47	75	330	1	**22**	136	1	**10**	32
Chloride	mg/L	**1**		1010	6970	930	1300	1000	620	510	600	14	**78**	206	14	**23**	56
Aluminium - Filtered	mg/L	**0.1/0.01**	**0.055**									0.13	**1.9**	9.8			
Arsenic - Filtered	mg/L	**0.01/0.001**	**0.013**									<0.001	**0.002**	0.004			
Cadmium - Filtered	mg/L	**0.005/0.0001**	**0.0002**									<0.00005	**0.00007**	0.00033			
Chromium - Filtered	mg/L	**0.01/0.001**	**ID**									<0.001	**0.004**	0.009			
Copper - Filtered	mg/L	**0.01/0.001**	**0.0014**									0.0013	**0.0032**	0.0045			
Lead - Filtered	mg/L	**0.01/0.001**	**0.0034**									0.0007	**0.0052**	0.014			
Manganese - Filtered	mg/L	**0.01**	**1.9**									0.02	**0.25**	0.98			
Nickel - Filtered	mg/L	**0.01/0.001**	**0.011**														
Selenium - Filtered	mg/L	**0.01**	**0.005**														
Silver - Filtered	mg/L	**0.001**	**0.00005**														
Zinc - Filtered	mg/L	**0.01/0.001**	**0.008**									0	**0.01**	0.02			
Boron - Filtered	mg/L	**0.1/0.01**	**0.37**														
Iron - Filtered	mg/L	**0.1**	**ID**				0.14	0.18	3.9	16	0.39	0.7	**4.4**	13			
Mercury - Filtered	mg/L	**0.0001**	**0.00006**														
Ammonia as N	mg/L	**0.01**	**0.9**														
Nitrite as N	mg/L	**0.01**															
Nitrate as N	mg/L	**0.01**	**0.7**									0.4	**1.1**	3.2	0.1	**0.73**	7
Total Kjeldahl Nitrogen as N	mg/L	**0.1**															
Total Phosphorus as P	mg/L	**0.01**										0.06	**0.36**	2.05	0.03	**0.51**	4
Reactive Phosphorus as P	mg/L	**0.01**															
Total Cations (reported)	meq/L	**0.01**		40.5	243	34.6											
Total Anions (reported)	meq/L	**0.01**		37.7	222	32.4											
Anion-Cation Difference (repo	meq/L	**0.01**		3.59%	4.58%	3.40%											
Allowable Anion-Cation Differ	meq/L	**0.01**		5.00%	5.00%	5.00%											
Anion-Cation Difference (repo	%																
Allowable Anion-Cation Differ	%																
Total Cations (calculated)	meq/L	**0.01**		37.68	222.16	32.33											
Total Anions (calculated)	meq/L	**0.01**		40.53	243.28	31.13											
% Difference (calculated)	%	**0.01**		-3.64%	-4.54%	1.90%											
Allowed % Difference (calcula	%	**0.01**		2.00%	2.00%	2.00%											

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Greg Lamb
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Dear Mr Lamb

Bloomfield Coal Project (MP 07_0087)
Review of Management Plans

I refer to your email dated 21 December 2017 providing the Department with several updated management plans addressing the Department's comments of 5 October and 19 December 2017.

The Department has reviewed the below management plans for the Bloomfield Coal Project, which have been prepared in accordance with the mine's project approval:

- Air Quality Monitoring Program dated December 2017 (condition 16 of Schedule 3); and
- Water Management Plan dated December 2017 (condition 19 of Schedule 3).

I advise that the Secretary approves the above management plans. Please provide final copies of these plans to the Department at your earliest convenience and place copies on your website.

Should you have any enquiries in relation to this matter, please contact Jessie Evans on the details above.

Yours sincerely,

Howard Reed 21.12.17

Howard Reed
Director
Resource Assessments
as nominee of the Secretary