Narrabri Mine

WATER MANAGEMENT PLAN

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I, Saul Martinez, a qualified Water Specialist approved by the NSW Department of Planning, Certify that I have prepared this Water Management Plan.

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URS Australia Pty Ltd

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CHPP	**Coal Handling and Processing Plant**
OEH	**Office of Environment and Heritage**
DoPI	**Department of Planning and Infrastructure**
EA	**Environmental Assessment** Narrabri Coal Mine Stage 2 Longwall Project
Raffinate	Treated Process Water from the Water Conditioning Plant
NCOPL	**Narrabri Coal Operations Pty Ltd**
ROM	**Run-of-mine Coal**. Raw coal delivered to the Processing Facility with varying particle size and moisture content. ROM coal often contains contaminates introduced by the mining process.
SoC	**Statement of Commitments** from Section 5 of Surface Water Management Plan for the Narrabri Coal Mine Stage 2 Longwall Project Stage 2 Environmental Assessment.
TARP	**Trigger Action Response Plan**

1 INTRODUCTION

1.1 Background

The Narrabri Mine is located approximately 30km southeast of Narrabri and approximately 10km northwest of Baan Baa in north-western New South Wales. Surface operations are located adjacent and accessed by the Kamilaroi Highway across Lot 151-152 DP816020; Lot 60 &115 DP757124, Lot 381-382 DP1028753.

Narrabri Coal Operations Pty Ltd (NCOPL) (formerly Narrabri Coal Pty Ltd) was granted consent for Stage 1 of the development in 2007 (PA 05_0102). Supporting documentation for this application included the Narrabri Coal Project Environmental Assessment (2007) and the Stage 1 Construction Phase Site Water Management Plan dated February 2008. The Construction Phase Site Water Management Plan was subsequently replaced with an operational plan prior to the commencement of active mining, and incorporated consideration of component activities associated with modification to the Stage 1 approval. These modifications included the key components of construction of a Coal Handling and Preparation Facility (CHPP), construction of west mains and rear of panel ventilation shafts, gas drainage infrastructure and associated disturbance.

Stage 2 of the development has been approved subject to the conditions listed in the approval document; PA 08_0144 Narrabri Coal Project Stage 2. Stage 2 will result in the mine achieving full production by long wall mining techniques. Supporting documentation for the Stage 2 application included a new Environmental Assessment (2009) and this updated Water Management Plan is intended to meet the requirements of the Stage 2 approval condition.

The installation of the long wall is expected to be completed in early 2012, whilst the completion of the CHPP is expected by August 2011. Production of ROM coal is expected to be around 2.5 Million tonnes for 2011. The Stage 2 approval will enable ROM production to increase to 8 Million Tonnes per annum once the long wall is fully operational.

1.2 Management Plan Requirements

Schedule 4, Condition 13 of PA 08_0144 requires that, prior to 30 June 2011, the proponent shall revise the Water Management Plan for the stage 1 project to encompass all proposed mining activities and potential impacts associated with water management (Stage 1 and 2) at the site.

The Stage 1 Water Management Plan was developed in two parts. Firstly, Construction Phase Water Management Plan (CPWMP) which was prepared by Coffey Geotechnics (2008). The plan was to cover construction works with an operational plan to be developed prior to underground mining commencing. The CPWMP was approved by the Director-General on the 20th February 2008. This plan was subsequently updated to the Stage 1 Site Water Management Plan to account for commencement of underground mining activities and works associated

with the Stage 1 modification approval. This was subsequently approved by the DoPI on 13th July 2010.

This revision of the Plan has been undertaken for the Stage 2 operational phase of the mine and incorporates the following requirements from PA 08_0144:

- Site Water Balance;
- Erosion and Sediment Control Plan;
- Surface Water Monitoring Plan;
- Groundwater Monitoring Program; and
- Surface and Groundwater Response Plan, setting out the procedures for:
  - Investigating, and if necessary mitigating, any exceedances of the surface or groundwater assessment criteria (see below); and
  - Responding to any unforeseen impacts of the project.

This report responds to the relative sections of the project approval. **Table 1-1** outlines Section 4 conditions 9 to 21 and Section 6 condition 2 of the project approval and the relevant sections in this report that address these conditions.

Table 1-1 Relevant Sections of the Project Approval

Condition	Refer to Sections
Schedule 4	
9. Within two years and every 5 years thereafter a review and transient calibration of the groundwater model presented in the EA, in consultation with NOW and to the satisfaction of the Director general including forward impacts predictions of the re-injection of brine.	Not required as the review period of this document is within the time frame and changes to modelling would be incorporated into the new revision of this document.
10. No Discharge is allowed from disturbed areas of the site except for Raffinate from the water conditioning plant that may be transferred to water users in accordance with this Plan.	Section 2.1
11. Any Raffinate discharged to the Namoi River must comply with the conditions of an EPL and meet required water quality testing.	Not required as there are no intended discharge prior to review of document. Refer to Section 5.3
12. Commissioning of the Conditioning Plant.	Section 2.2.2
13. Water Management Plan	
a) Site Water Balance	Section 5
b) Erosion and Sediment Control	Section 4
c) Surface Water Monitoring Plan	Section 6
d) Raffinate Discharge, Transfer Control and Monitoring Plan	Not required as there are no intended discharge prior to review of document. Refer to Section 5.3
e) Groundwater Monitoring Program; and	Section 7
f) Surface and Groundwater Response Plan, setting out the procedures for:	
• Investigating, and if necessary	Section 6.5

mitigating, any exceedances of the surface or groundwater assessment criteria (see conditions 16(b) and 18(c))	
• Responding to any unforeseen impacts of the project.	Section 6.6
14. The Site Water Balance must:	
a) Include details of:	
• Sources and security of water supply;	Section 5.2
• Underground water make;	Section 7.3.2
• Water use on site;	Refer to Diagram in Section 2.1 and Section 5.1.
• Water management on site;	Refer to Diagram in Section 2.1 and Section 2
• Off-site water transfers;	Section 5.3
• Reporting procedures	Section 5.4
b) Describe measures to minimise water use by the project	Section 5.2.6 and Section 5.2.7
c) Be reviewed and recalculated each year with recent water monitoring data	Refer to Section 5.1 for reviewed monitoring data.
15. The Erosion and sediment Control Plan must:	
a) In accordance with (Landcom 2004) or latest version.	Section 4.1
b) Identify sources of soil erosion and generated sediment;	Section 4.2
c) Measures to minimise soil erosion and potential for transport of sediment to down stream waterways	Section4.3 Section 4.4 and Section 4.1
d) Describe the location, function and capacity of erosion and sediment control structures	Section 3.4
e) What measures would be implemented to monitor and maintain the structures over time.	Section 4
16. Surface Water Monitoring Plan must include:	
a) Baseline data of water quality in creeks and other water bodies that could be affected by the project;	Section 6.2
b) Surface water impact assessment criteria	Section 6.5
c) A program to monitor the impact of the project on surface water flows and quality	Section 6.3
d) Procedures for reporting the results of this monitoring	Section 6.6
17. The Raffinate Discharge control and Monitoring Plan.	Not required as there are no intended discharge of raffinate within the review period of this document. Refer to Section 5.3
18. The Groundwater monitoring program must include:	
a) Further development of the regional and local groundwater model.	Section 7.8
b) Detailed baseline data to benchmark the natural variation in groundwater levels, yield and quality;	Section 7.3

c) Groundwater impact assessment criteria;	Section 7.6
d) A program to monitor the impact of the project on groundwater levels, yield and quality;	Section 7.5
e) A program to monitor the impact of the project on the Namoi River Alluvium	Section 7.5
f) A program to monitor, detect, and quantify any leakage/leachate from the site's evaporation/storage ponds. (See condition 20)	Section 7.2 & 7.4
g) Procedures for reporting the results of this monitoring.	Section 7.7
19. The proponent shall ensure that the integrity of the low permeability layers lining the evaporation/storage ponds is maintained and achieves a permeability of less than $1x10^{-14}$ m/s whenever these ponds are in use for the storage of saline water and less than $1x10^{-9}$ m/s when being used to store raffinate or captured surface waters.	Section 7.4
20. The proponent shall ensure that the integrity of the low permeability layers lining the brine storage ponds is maintained and achieves a permeability of less than $1x10^{-14}$ m/s whenever these storage ponds are in use.	Section 7.4
21. Review of Brine Management and beneficial use of water and brine.	Not required to be addressed within this report due to review period of this report.
Schedule 6	
2.Management plans are required to include: (a) detailed baseline data; (b) a description of: • the relevant statutory requirements including relevant limits or performance measures criteria; • performance indicators; (c) a description of the measures that would be implemented. (d) Program to monitor and report on the performance of the project along with the effectiveness of any management measures. (e) Contingency plans. (f) Programs to investigate and improve the environmental performance of the project over time; (g) protocol for managing and reporting any: incidents; complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and or performance criteria; and (h) a protocol for periodic review of the plan.	This management plan addresses these requirements for each aspect of the plan within each section. The aspects of the plan are detailed in Schedule 4 of the conditions. Section 8 of this report considers items (g) and (h).

The Water Management Plan (WMP) is based on the approved Stage 2 operations (November, 2009), which includes the Statement of Commitments (referred to as 'SoC' throughout this Plan) and the revised Environmental Assessment. Any future refinements to water management or monitoring requirements will result in subsequent revisions of the WMP which will be submitted to the Director-General for endorsement.

1.3 Water Management Plan Objectives

The objectives of the Water Management Plan are [definitions of "clean", "dirty" and "contaminated" as given in the Environmental Assessment, are given in Section 2]:

- To ensure sufficient quantities of water can be obtained to meet the requirements for dust suppression across the site;
- To ensure segregation of "contaminated" and "dirty" water from "clean" water with "contaminated" water directed to sediment basins and "dirty" water directed to storage dams ("clean" water, comprising clarified water from storage dams and run-on water collected in accordance with the NCOPL's harvestable right may be directed to and/or collected in Pond D). Refer to section 2 for water definitions and water life cycle around the site;
- To maximise the use of "contaminated" and "dirty" water for dust suppression purposes;
- To minimise the volume of water discharged from the mine site, and ensure in the event of discharge that there has been sufficient settlement time such that suspended sediment levels meet concentration limits specified in the Environment Protection Licence (EPL) as issued by the Office of Environment and Heritage (OEH);
- To minimise erosion and sedimentation from all construction/operational activities;
- To eliminate or minimise the risk of off-site discharge of saline water;
- To monitor the effectiveness of surface water controls and ensure all relevant surface water quality criteria are met;
- To minimise cumulative impacts on clean water sources for the environment (water dependant ecosystems) and social values (recreation, cultural); and
- To minimise impacts on the availability of surface water to surrounding economic uses (agricultural, industrial, town water supply).

1.4 Responsibilities

During the operation phase of the development, the Narrabri Coal Mine will be managed by the General Manager who will have overall responsibility for ensuring

contractors, employees and service providers comply with all laws, regulations, licences, approvals and conditions of the project approval. **Table 1-2** outlines the responsibilities of personnel at Narrabri Coal mine under this Management plan.

Table 1-2 Roles and Responsibilities

Role	Accountability
General Manager	Responsible for providing adequate resources to undertake the activities required by this plan.
Environmental Manager	Responsible for ensuring that monitoring, periodic environmental inspections and inspections after high rainfall events are undertaken. WMP review.
Environment Officer	Implementing this WMP on a day to day basis. WMP review.

As the General Manager has the power to delegate resources and responsibility, **Table 1-3** outlines the delegated responsibility and accountability for the statement of commitments relevant to this water management plan.

Table 1-3 Statement of Commitments for Water Management and Delegate Responsibility

Delegated Responsibility	Delegated Accountability	Statement	Frequency	SoC Number
Ensure Planned location of infrastructure does not clash with ecological or heritage sites.	Environmental Officer	*Relocate or redesign the area of disturbance (if mine safety is not compromised) to avoid sites of ecological or heritage significance.*	*Initial activities of site establishment phase.*	*1.3*
Ensure Sewerage Treatment Plant and any septic systems are maintained and serviced by a competent/licensed contractor.	Environmental Officer	*Install a sewerage treatment plant irrigating effluent water which is approved by Narrabri Shire Council.*	*As required or every 6 months.*	*3.9*
		Service septic facilities by a licensed sewage collection / disposal contractor.		*3.10*

Delegated Responsibility	Delegated Accountability	Statement	Frequency	SoC Number
Testing of reject material.	Environmental Officer	*Characterise coal rejects to establish whether any deleterious products would be produced by leachate during emplacement.*	*Within initial month of production of CPP reject and annually thereafter, if relevant.*	*3.11*
Establish erosion protection within 20m wide by 80m maximum length emplacement Strip.	Environmental Officer	*Construct the Reject Emplacement Area as a series of 20m wide, elongated (north-south oriented) cells. If elevated salinity or other deleterious contaminant is identified as likely to be present within the leachate construct compacted base – see Commitment 3.11)*	*Continuous*	*3.13*
Rehabilitate completed emplacement.	Environmental Officer	*Strip and store topsoil from each cell for future re-spreading over the final landform or respread immediately following stripping.*	*Prior to the commencement of each cell. Continuous.*	*3.15*
Check erosion protection measures on emplacement area and ensure cleanout of sediment build-up.	Environmental Officer		*Weekly or after rainfall event generating runoff.*	
Install and Monitor Lysimeters the downstream slope on Reject Emplacement Area.	Environmental Officer	*install up to four lysimeters on the downslope side of the Reject Emplacement Area. (If saline leachate is generated by CPP rejects)*	*As the structure is constructed, if required Monitor Flows.*	*3.17*
Decommissioning testing of Pond areas.	Environmental Officer	*Inspect, sample and analyse ground beneath each dam or pond to confirm no leakage has occurred over the life of the pond.*	*Prior to final rehabilitation.*	*3.22*
To minimise disturbed areas and minimise erosion and sedimentation control.	Environmental Officer	*(Unless required for future access to monitor or manage subsidence related impacts), close, cross-rip and respread previously cleared vegetation over access tracks.*	*Once no longer required for site inspection purposes.*	*4.14*

Delegated Responsibility	Delegated Accountability	Statement	Frequency	SoC Number
Regular sampling of ponded water above subsided areas.	Environmental Officer	*Sample ponded water to determine if there is any increase in salinity.*	*Quarterly upon identification of subsidence induced ponding.*	*5.12*
Record and maintain records of all water movements on site.	Environmental Officer	*Record extraction volumes including weekly totals from all pumping bores, and weekly totals from the underground mine and open cut sump.*	*Weekly.*	*6.4*
		Record Volumes of water introduced to the mine for longwall operation and other requirements.	*Weekly*	*6.5*
Record and maintain records of groundwater quality.	Environmental Officer	*Record the groundwater quality (EC and pH) discharged from the underground workings and water supply bores.*	*Monthly*	*6.6*
		Sample and analyse water from all pumping bores and underground pumping stations.	*Quarterly*	*6.7*
		Record (by manual monitoring, or continuous automated monitoring) the standing water levels of piezometers P1 to P27 and WB1 to WB8 (and others as constructed).	*Monthly initially and hence quarterly when stable flow established*	*6.8*
Record and maintain records of all water movements on site.	Environmental Officer	*Monitor the flow rate and water quality of the spring discharge from "Mayfield Spring".*	*Monthly initially and hence quarterly when stable flow established.*	*6.9*
		Collect data from the vibrating wire piezometers and compare against initial groundwater and subsidence modelling predictions.	*Data collected continuously and downloaded and analysed quarterly.*	*6.11*

Delegated Responsibility	Delegated Accountability	Statement	Frequency	SoC Number
Review, audit and report on collected site data.	Environmental Officer	*Commission an experienced hydrogeologist to collate and review the monitoring data collected annually in order to assess the impacts of the project on the groundwater environment, and to compare any observed impacts with those predicted from groundwater modelling. (see also Commitment 16.11)*	*Annually.*	*6.12*
		Complete an initial audit of the groundwater model predictions against monitoring data.	*6 months after the commencement of longwall mining.*	*6.14*
		Recalibrate the ground water model based on groundwater model audit and generate confirmatory forward impact predictions made.	*6 months after the commencement of longwall mining.*	*6.15*
Design and Commission and maintain all sediment dams.	Environmental Officer	*Design and construct the sediment dams to provide sufficient water settlement and sediment storage zones to contain the 5 day 90%ile storm event.*	*Prior to commencement of long wall mining.*	*7.5*
		Dewater sediment dams within 5 days of significant rainfall event.	*With 5 days.*	*7.6*
Inspect and maintain all Pit to Drains and sediment control structures around the site directing surface water to the sediment dams.		*All sediment control structures will be regularly inspected and repaired around gas drainage or ventilation pad.*	*One a week or after rainfall event generating runoff.*	*7.16*

2 MINESITE WATER MANAGEMENT

For the purposes of water management, the water generated at the Narrabri Coal Mine is divided into four types based on water quality, as detailed below:

- **'Clean'** – surface runoff from the Mine Site areas where water quality is unaffected by mining operations. Clean water includes runoff from undisturbed areas and any fully rehabilitated areas;
- **'Dirty'** – surface runoff water from the Mine Site areas that are disturbed by mining operations. This runoff may contain silt and sediment, but does not contain contaminated material. However, this runoff must be of sufficient quality prior to discharge into natural water courses, if required;
- **'Contaminated'** – surface water from areas affected by mining operations and potentially containing chemicals of various types used in the mining operations. There are restrictions on the use and release of this water. Contaminated water areas include sumps, stockpile areas, service ponds and fuel storage areas. Rainfall and resulting runoff from these areas are also potentially contaminated and therefore must be managed to avoid discharge of potentially contaminated water into the natural water courses; and
- **'Saline'** – water pumped from the underground workings containing concentrations of total dissolved solids (TDS) above that considered fresh water by ANZECC & ARMCANZ (2000) criteria.

The locations of the potentially dirty and contaminated catchments on the Pit Top Area are shown in **Figure 2-1**.

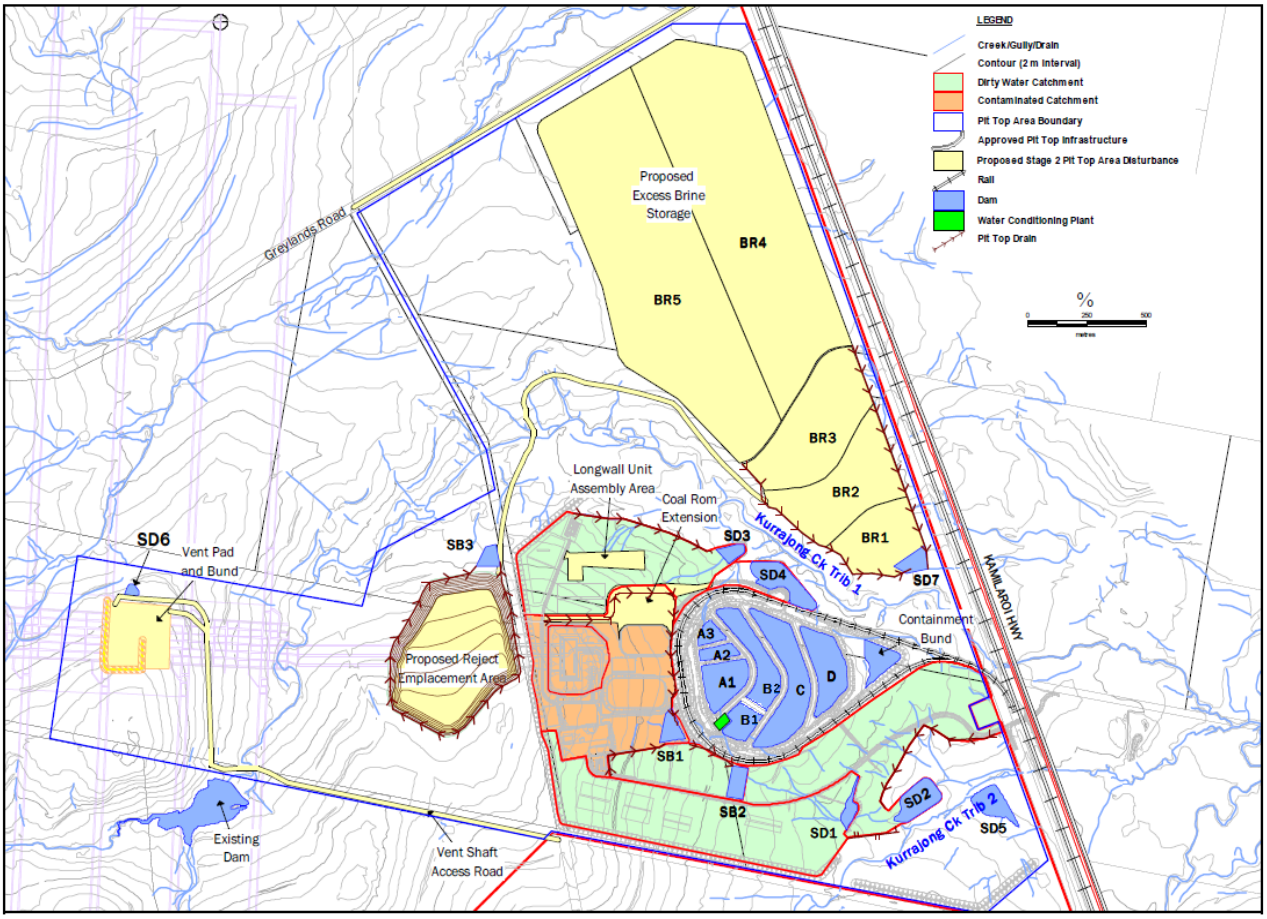

Figure 2-1 Pit Top Area Water Management Infrastructure

2.1 Water Life Cycle

As part of this review and transition of this Water Management Plan from Stage 1 to Stage 2 approvals, a water cycle diagram has been generated. This is used to define the life cycle of water on site, including; water sources; elements used for treatment; water uses; and the transport mechanisms for water leaving the site. **Figure 2-2** and **Figure 2-3** detail the water life cycles from water source to discharge. These figures outline the operational rules for the water management plan to ensure the Water Management Plan Objectives in **Section 1.3** are achieved.

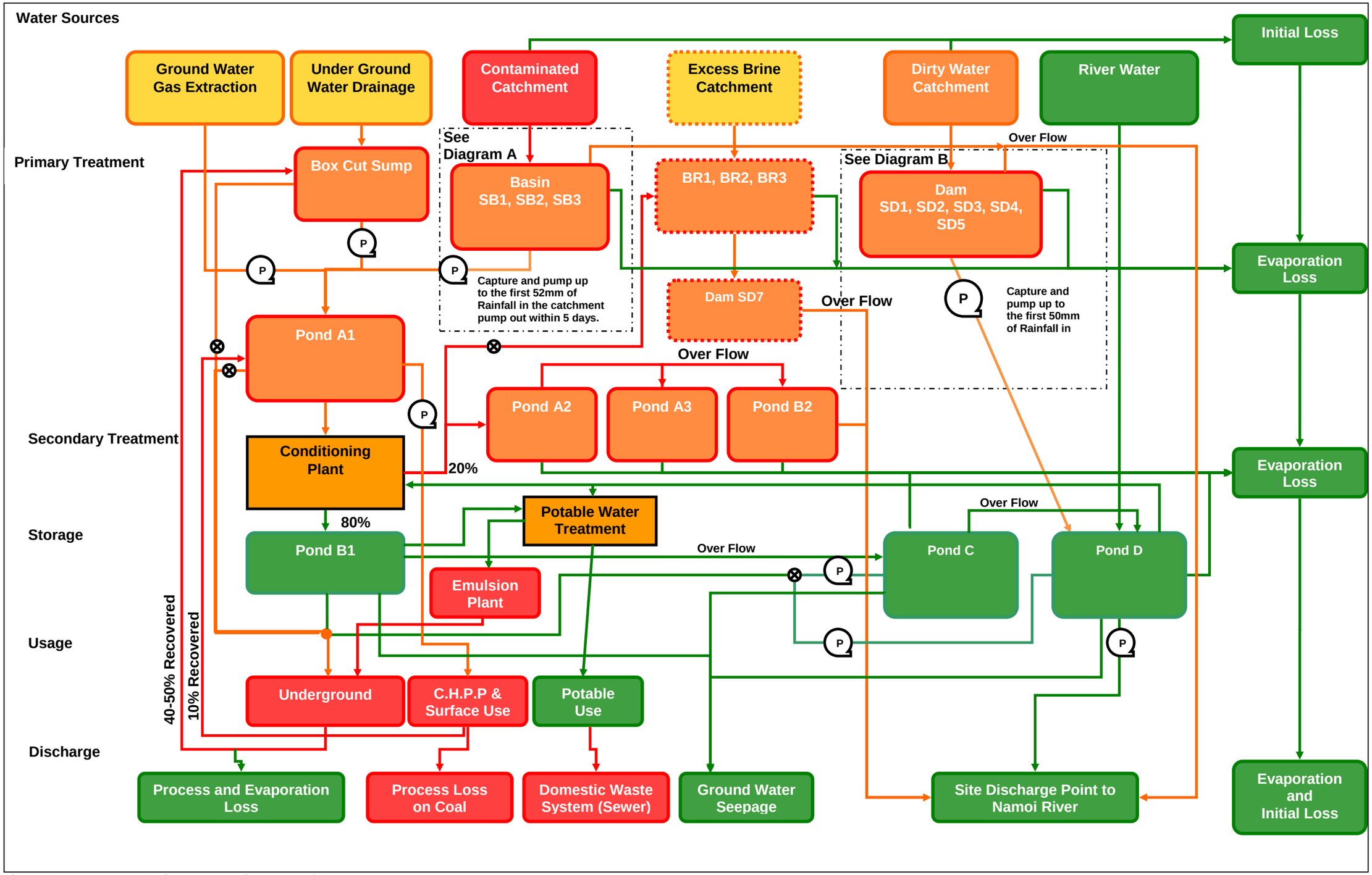

Figure 2-2 Water Cycle Process Diagram 1 of 2

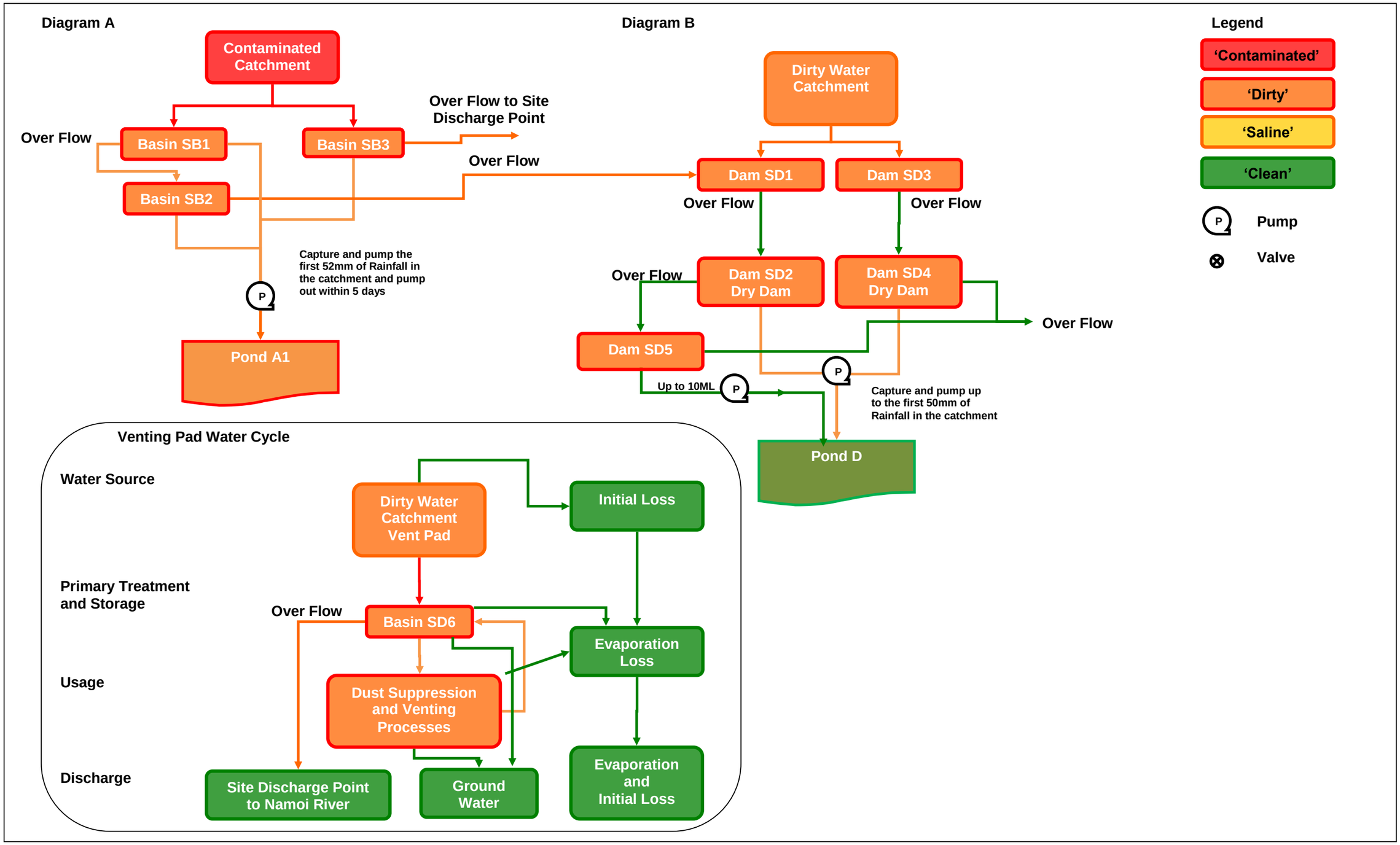

Figure 2-3 Water Cycle Process Diagram 2 of 2

2.2 Pit Top Area Surface Water Management

The main principles of the Pit Top Area Surface Water Management Strategy are to separate the "clean", "dirty", "contaminated" and "saline" water generated on the Mine Site and to provide targeted strategies to minimise the impact of each water quality type. A description of the strategies for each water type is given below.

2.2.1 Clean Water

Clean water flowing from upstream Kurrajong Creek Tributaries is separated from the pit top working areas by a buffer and flow is maintained within the natural watercourse.

The use of drains/contours to divert flows from working areas to treatment dams ensures separation of clean water from dirty or contaminated water. Clean water catchment areas above any area of disturbance that could generate dirty or contaminated water are directed around these areas and delivered to the natural water course.

The use of spreaders and energy dissipaters will ensure that erosion does not occur when delivering concentrated flows directly back into the Kurrajong Creek Tributaries.

Storage Pond B1 and Pond D are 'clean water' storages. These storages are to remain separated from the other lined ponds. In the unlikely event of cross contamination or spills into these ponds, water quality is to be taken and a remediation plan is to be formulated if water quality in these ponds has been compromised.

2.2.2 Saline Groundwater Management

A series of evaporation ponds have been constructed within the rail loop as a depository for saline water. This may be mine water pumped out from the underground operations or potentially contaminated runoff from the stockpiling and crushing/sizing area collected via SB1. During the early years of operation, when the groundwater inflows are expected to be low, the pumped out mine water would be used on site for dust suppression or will be evaporated.

As part of the approval for Stage 2 the reverse osmosis water conditioning plant must be commissioned by 26th of July 2013 to remove excess salts from the pumped out mine water so it can be used for dust suppression in the underground operations, used for longwall operational requirements, or potentially for off-site use. The trigger for construction of the plant is specified in the Stage 1 EA and SoC 6.14 as 880m^3/day of pumped out mine water. The plant may need to be commissioned earlier than the date specified if the combined groundwater from the gas extraction and box cut sump exceeds this value. The water conditioning plant is currently under construction to ensure availability of the plant as and when required.

The concentrated brine by-product of the water conditioning plant would be evaporated in storage dams on site without releasing it to the environment. Salt accumulation predictions and management will be based on the revised EA, specifically the supporting specialist consultant study; Surface Water Assessment, Section 6.3.3

2.2.3 Saline Groundwater Contingency Plan

NCOPL will monitor the volume of pumped out mine water over time and assess on a regular basis when, or if, the pumped out mine water exceeds the capacity of the evaporation dams. Options to manage the excess water (should this occur) are currently being investigated by NCOPL. These options include:

- Increasing the area of the evaporation basins;
- Treating the water to a quality sufficient to release it to the Namoi River (it is understood that salinity offsets would be required so that there is no net increase in salt loads in the Namoi River); and
- Transferring the treated water to a third party for agricultural use.

The most appropriate option will be determined when better estimates of the volume of pumped out mine water are known. This will be determined post commencement of longwall operations, and be further defined upon re-calibration of the groundwater model as prescribed under the conditions of Project Approval. Any offsite use will be subject to a detailed site specific investigation to assess the long term sustainability of reusing the water at that particular site.

2.2.4 Dirty Water Management

Figure 2-1 shows the areas likely to cause dirty water runoff on the Pit Top Area.

The storage dams (SD1-7) have a dual function: during the construction phase acting as sedimentation control dams for disturbed ground and, harvesting of surface water for use in mine operations and capture and containment of any potentially contaminated water. Operation of these dams for containment and capture is as follows.

Storage dam SD1, SD2, SD3 and SD4 collect water from around the disturbed or potentially contaminated areas. Overflow from SD1 is directed to dam SD2. Storage Dam SD3 cascades into SD4 which is operated as a dry basin. Storage Dam SD6 will be used to control sediment and potentially contaminated water from the vent pad. The predicted percentage of years of uncontrolled discharge is 31.5% and the median spill volume is 2ML per spill.

Sediment Dam SD7 will be constructed prior to the construction of the Brine Storage areas to manage water during the construction phase and after commissioning of the Brine Storage Basins. Details of basin and operating procedures will be required when detailed plans are being developed for the Brine Storage Basins.

As the operation transitions to the operational phase sediment loads are expected to be reduced due to the revegetation of previously disturbed areas. There may still be some erosion while the vegetation becomes fully established. Details of the erosion and sediment control strategy are given in **Section 4**

Refer to **Section 3.4** for further detail on the operational parameters for sediment containment dams SD1-5.

2.2.5 Contaminated Water Management

The main area of disturbance on the Pit Top Area that may generate contaminated runoff is the stockpiling, crushing and sizing area and the surface facilities area (See **Figure 2-1**), which is confined to a 32.5 ha site containing the:

- Conveyor and transport drift portals;
- ROM and product stockpiles;
- Coal Handling and Processing Plant (CHPP);
- Rail load-out bin;
- Sub-station;
- Surface facilities area; and
- Gas extraction and venting pads and bund.

Runoff from potentially contaminated catchments will be collected in sediment basin SB1. As part of the recently approved Section 75W Modification Environmental Assessment, a new sediment basin (SB2) has been constructed immediately downstream of SB1 to provide sufficient storage capacity to prevent discharge of potentially contaminated water from site in all but extreme events above 1 in 100 year events. Basin SB2 receives any weir overflow from SB1. Water collected in SB1 and SB2 will be pumped to Pond A1 for use on site, processing through the conditioning plant or evaporated.

Discharge from the reject emplacement area will collect in a third sediment basin (SB3). This will also be pumped to Pond A1 for use on site or evaporation.

The modelling for surface water management conducted for the Stage 2 EA assumes that only infrequent and extreme rainfall events will cause discharge from SB2 and SB3. Basin SB2 will function as a dry basin with no significant catchment. Routine inspections of the sediment basins, as well as appropriate maintenance of pumps, will assist with ensuring adequate capacity is maintained in SB1 and SB2. Basin SB3 is expected to handle minimal flows from the reject emplacement area and has no other catchment area. Only extreme rainfall events are expected to cause discharge from this basin.

In the unlikely case of an extreme rainfall event producing overflow from SB2 the overflow will cascade through the weirs of storage dams SD1, SD2 and SD5 prior to discharge from site. It is expected that overflow water from SB2 will have a negligible impact on site discharge waters following dilution with large quantities of

clean water runoff generated during the extreme event and the mixing effect of cascading through Dams SD1, SD2 and SD5. SB3 is able to discharge directly to a natural watercourse and leave site. The impact of this is thought to be small due to the extreme event required to cause the basin to spill and the volumes of clean water available to dilute any discharge.

Any discharges that occur from SB2 or SB3 will be sampled for water quality analysis and an estimate of the volume of water discharged will be recorded.

2.3 Subsidence Related Water Management

A separate water management plan was created for the approved Extraction Plan (Extraction Plan Water Management Plan, Whitehaven, 2012). The Extraction Plan addresses the management and monitoring of predicted subsidence impacts relating to surface waters, as outlined below:

- Ponding, which may or may not be confined to the creek channel (in-stream or over bank ponding) following mining of LW1 to LW3.
- Ponding and possible flow direction changes against contour banks.
- Increased or accelerated in-stream erosion and sedimentation generated by the altered channel gradients.
- Increased water salinity as a result of increased storage time over saline soils.
- Degradation of riparian vegetation as a consequence of inundation.

Section 8 includes elements from the Extraction Plan; however it should be referenced in conjunction with this report.

3 SURFACE WATER MANAGEMENT CONTROLS

3.1 Pit Top Surface Water Management Infrastructure

Figure 2-1 shows the locations of the existing water management infrastructure on the Pit Top Area. The water management structures are referred to in "Design Report: Evaporation and Storage Dams, Narrabri Coal Pit Top Infrastructure (URS, 2007)". The general features of the surface water management infrastructure for the Pit Top Area are as follows:

- A series of water storages (Dam A1, A2, A3, B1, B2, C and D) within the rail loop to collect, store and dispose of pumped out mine water and dirty water runoff from the Pit Top Area;
- A sediment basin (SB1) to collect dirty and contaminated runoff from the stockpiling and coal processing area;
- An additional sediment basin (SB2) immediately downstream of SB1 to collect any overflow from SB1;
- A sump in the box cut to collect runoff draining into the box cut and to temporarily store groundwater pumped from underground;
- A series of storage dams (SD1, SD2, SD3, SD4 and SD5) to collect and treat runoff from the periphery of the Pit Top Area that has been disturbed during the construction phase;
- A containment bund to collect runoff from within the rail loop; and
- A series of drains to collect runoff from the Pit Top Area and divert it to the various Pit Top Area water storages.

3.2 Rail Loop Water Storages

3.2.1 Configuration

Figure 2-1 shows the locations of the existing rail loop water storages. These were constructed within the rail loop as a depository for mine water pumped out from the underground operations and potentially dirty runoff from the Pit Top Area. The storage volumes and surface areas of the evaporation ponds at full supply level are given in **Table 3-1**.

3.2.2 Operating Procedures Prior to the Water Conditioning Plant Coming Online

The operating procedures for the rail loop water storages prior to the water conditioning plant coming on line are summarised below.

- Pond A1, A2 and A3 would receive all saline groundwater pumped from the underground workings and all potentially contaminated runoff from SB1 and SB2. These ponds are lined with HDPE with a maximum permeability of 1 x

10^{-14} m/sec. Pond B2 is also currently storing water from the gas drainage wells.;

- Sufficient freeboard will be maintained within the evaporation ponds to cater for a 1 in 100 year ARI event (SoC 7.13);
- Pumping of groundwater to the evaporation pond system will cease when the approved freeboard is reached (SoC 7.13); and
- Water in these ponds would be used for on-site dust suppression or would evaporate.

Table 3-1 Evaporation Pond Specifications

Pond	Surface Area @ Spillway (ha)	Storage Volume (ML)	Spill Location
A1	3.17	129.8	B2
A2	0.98	30.6	B2
A3	0.93	30.8	A2
B1	5.85	209.1	C
C	6.63	218.3	D
D	4.15	128.4	Containment
Containment	4.01	46.0	Nil
TOTAL	**25.72**	**793.0**	**-**

3.2.3 Operating Procedures with the Water Conditioning Plant Online

The operating procedures for the rail loop water storages when the water conditioning plant is on line are summarised below.

- Pond A1 would receive all pumped out mine water from the underground workings and would be the primary feed to the water conditioning plant;
- B1 shall be the primary storage structure for treated water from the water conditioning plant when completed. Water in Pond B1 would be used underground for motor cooling and dust suppression. Saline water may also be mixed with water in Pond B1, C or D for use in surface coal handling and site dust suppression;
- The HDPE lined Ponds A2 and A3 would be drained to Pond A1 to receive the concentrated brine product from the water conditioning plant;
- Water will be pumped from pond A3 to supply water for dust suppression.
- The clay lined Pond C and Pond D are to be the primary storage ponds for clean or potentially dirty water harvested from the storage dams on the Pit Top Area. The maximum permeability of the clay liner is 1 x 10^{-9} m/sec. These ponds would also store the excess low salinity, treated water (raffinate) from the water conditioning plant when this is brought on line;

- To prevent any of the storage dams from overflowing, each dam shall maintain a 0.5m freeboard from the spillway, which is equivalent to contain the 100 year 72 hour storm event (0.26m) and any wave run up (SoC 7.13);
- Pumping of groundwater to the evaporation pond system will cease when the approved freeboard is reached (SoC 7.13);
- The spillway for each storage is sufficient to convey the 10,000 year ARI critical duration storm event without overtopping the dam wall; and
- The dams are designed to overflow as follows:
  - A1-A2-A3;
  - A3-B2;
  - B2 & B1-C; and
  - C-D.

3.3 Contaminated Catchment

3.3.1 Contaminated Catchment Sediment Basins

Figure 2-1 shows the location of the contaminated catchment sediment basins SB1 and SB2. SB1 is located to the south of the product coal stockpile areas adjacent to the rail loop and collects and stores potentially dirty/contaminated runoff from the entire Pit Top Infrastructure Area. SB2 is located immediately downstream of SB1. **Table 3-2** provides summary details of the available storage volume of SB1 and SB2. Any water collected within SB1 will be pumped directly to Pond A1 within the rail loop via a dedicated 1ML/d pump. Water from SB2 will be pumped to Pond A1 on an as needs basis.

SB1 will be cleaned of accumulated sediment material (or extended or replaced) every 2 years or when the storage capacity of the structure is reduced by 20%.

Table 3-2 Sediment Basin Specifications

Storage Name	Catchment Area (ha)	Storage Volume (ML)
SB1	26.3	10.9 (to be extended)
SB2	0	9 (to be extended)

3.3.2 Surface Facilities Area

The surface facilities area may produce runoff that contains hydrocarbons. These areas include the:

- Wash-down area;
- Workshop;
- Fuel, oil and grease storages; and
- Refuelling bays.

These areas will be managed as follows (as per SoC 6.5 – 6.8):

- Runoff from these areas will drain to an oil separator to reduce hydrocarbons to acceptable levels before draining to SB1. The oily fraction enters a containment system for removal as necessary;
- Storage tank areas have an impermeable surface and bunding capable of containing 110% of the largest tank's capacity in accordance with EPA (2007) guidelines;
- All oil, grease, fuel and hydrocarbon products will be securely stored; and
- Refuelling, oiling and greasing will take place in designated areas only.

The following actions will be taken if a major hydrocarbon spill on an unsealed area occurs:

- The contaminated soil at the site of the spill will be collected and transported to an approved waste depot or remediated safely on the mine site;
- Pits would be constructed around the spill with sufficient hydraulic gradient to capture seepage water and contaminated material, enabling the pits to be pumped out; and
- The local groundwater will be monitored for signs of further contamination.

3.4 Storage Dams

Figure 2-1 shows the locations of seven storage dams on the Pit Top Area; SD1, SD2, SD3, SD4, SD5, SD6 and SD7. The water collected in these dams provides the final treatment of runoff (i.e. settling of sediment) from the Pit Top Area. The collected water will also be used to supplement supplies during the early years of the operational phase of the project.

Table 3-3 gives the summary details of the configurations of the storage dams as detailed in the revised Environmental Assessment. These dams have been designed to contain the 5 day 95 percentile storm event (DECC, 2008) of 52mm (intensity of 0.433mm/h) assuming a runoff coefficient of 0.74, which exceeds the minimum requirements in the Environment Protection Licence (EPL). The following points are of note:

- SD1 overflows to SD2, which overflows to SD5. Excess storage is provided in SD2 to contain the minimum storage requirements for SD1;
- SD3 overflows to SD4. Excess storage is provided in SD4 to contain the minimum storage requirements for SD3;
- SD5 partially collects runoff from Kurrajong Creek tributary 2 and was constructed (from an old farm dam) to supplement mine site supplies during the construction phase of the project. As the catchment is outside the controlled discharge area, upstream flows are out of the control of NCOPL. For this reason, the catchment area and minimum storage volume have not been specified;
- The actual storage volume for storage dams with on-site catchments (SD1 – SD4) of 100.8 ML exceeds the minimum storage sediment requirement by 60.1 ML (minimum storage = 40.7 ML);
- The spillways of all dams have been designed with sufficient capacity to pass the 100 Year ARI critical duration design flood without overtopping the dam wall. Water collected in the storage dams will be pumped to pond C to be used for mine site use when required;
- Any releases from these dams will achieve the water quality compliance criteria given in **Section 5.3**;
- The primary release points for water from the Pit Top Area will be from SD2, SD4 and SD5; and
- Additional sediment dams SD6 and SD7 are to be constructed to collect and treat water draining from the ventilation shaft area and disturbed portion of the Brine Storage Area. Water collected in the sediment dams would be harvested for on-site use during the early years of mine life. Sediment Dam SD6 at the initial ventilation shaft area spills an average of 1 year in 3. This satisfies the average annual sediment basin overflow frequency criteria given in DECC (2008).

Table 3-3 Storage Dam Specifications

Storage Name	Catchment Area (ha)	Minimum Storage Volume (ML)	Actual Storage Volume (ML)
SD1	43.2	16.6	5.9
SD2	29.6	11.4	55.2
SD3	28.6	11.0	4.7
SD4	4.5	1.7	35
SD5[1]			11.2
SD6	1.5	4	4
SD7	TBC	TBC	TBC

1 – SD5 catchment outside of controlled drainage area

The storage dams will be cleaned of accumulated sediment material (or extended or replaced) every 2 years or when the storage capacity of the structure is reduced by 20%.

4 EROSION AND SEDIMENT CONTROL

4.1 Overview

An erosion and sediment control plan was developed for the construction phase of the Narrabri Coal Mine by Coffey Geotechnics (2008). The report outlined the hydrological characteristics of the Pit Top Area and how stormwater runoff was to be managed during the construction phase of the Project. Strategic plans for the management of water together with design details of the works necessary for implementation of these plans were provided. The erosion and sediment control plan was consistent with the requirements of Landcom's Managing Urban Stormwater: Soils and Construction Manual (Landcom, 2004). All erosion and sediment control structures have been constructed in accordance with the recommendations identified in the relevant standard drawings and construction notes of Landcom (2004). This plan was submitted to the Director General and has been approved.

Stage 2 of the mining operation has the same footprint as the original proposal with the exception of generating reject from the CHPP and hence the requirement for a reject emplacement area. It is not proposed to alter the existing erosion and sediment control plan for the operational phase of the mine. A summary of the plan is given below.

4.2 Sources of Erosion and Sedimentation

Figure 4-1 contains an aerial photograph of the Pit Top Area showing the extent of the rehabilitated areas and disturbed areas taken in June 2010. The majority of the construction activities on the mine site have been completed and a significant amount of rehabilitation work has already been completed. Notwithstanding this, erosion and sedimentation could potentially result directly or indirectly from:

- Surface runoff and/or erosion from limited vegetation clearing, topsoil stripping and stockpiles;
- Surface runoff from unsealed roads and newly constructed embankments and drains;
- Erosion of stormwater drainage channels; and
- Operation of Emplacement Area.

Elevated winds may also result in erosion of finer material during clearing and soil stripping activities, and from exposed surfaces and stockpiles.

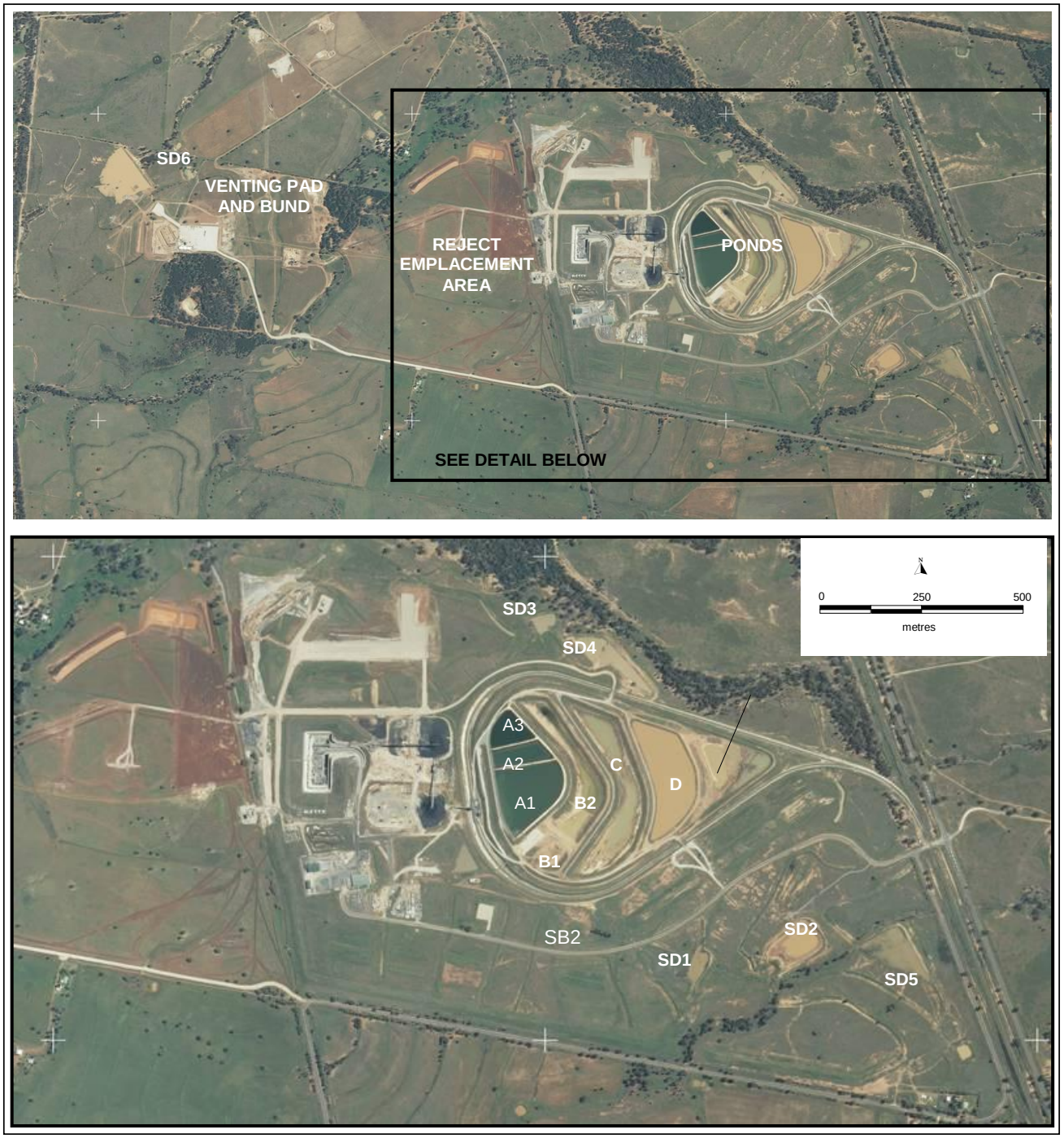

Figure 4-1 Narrabri Coal Mine Pit Top Area, June 2010

4.3 Mitigation of Erosion and Sedimentation

Erosion and sediment control within the Pit Top Area has been designed to ensure effective management of surface water and sediment suspended in runoff. Erosion and sediment mobilisation will be minimised by adopting the following practices:

- Installing erosion and sediment controls prior to disturbance of any land;
- Limiting the extent of the disturbance to the practical minimum;

- Reducing the flow rate of water across the ground particularly on exposed surfaces and in areas where water concentrates;
- Establishment of non-persistent cover crops on exposed surfaces not required for operational purposes or stockpiles retained for periods greater than 3 months;
- Revegetation of embankments and bunds;
- Progressively rehabilitating disturbed land and constructing drainage controls to improve stability of rehabilitated land;
- Ripping of rehabilitation areas to promote infiltration;
- Protecting natural drainage lines and watercourses by the construction of erosion control devices such as diversion banks, channels and sediment basins;
- Restricting access to rehabilitated areas; and
- Installing sediment basins to settle out sediment prior to off-site release.

4.4 Diversion Drains

A series of dirty water diversion drains have been constructed to divert runoff from the Pit Top Area to the sediment basins and storage dams as part of the construction stage as shown in **Figure 2-1**. The diversion drains have been designed to convey the 10 year ARI design discharge (as a minimum). These diversion drains and structures have been retained to allow for continued water management across the Pit Top Area. (SoC 7.1)

The amenity bund constructed around the perimeter of the Pit Top Area is 3 m high and effectively prevents all clean runoff from the surrounding catchment draining to the Pit Top Area. A gap exists in the southern boundary of the amenity bund to enable inflows from Kurrajong Creek. Water entering the site at this point flows in an easterly direction away from the Pit Top Area.

4.5 Reject Emplacement Area

A comprehensive drainage system will be constructed prior to the commencement of the initial cell and all subsequent cells (see **Figure 4-2**). The surface water system will include:

- diversion drains to the east and south of the Reject Emplacement Area to prevent clean runoff from entering the area;
- catchment drains at the western and northern perimeter of each cell to capture runoff from the active area of the Reject Emplacement Area; and
- a storage basin (SB3) at the northern end of each cell from where the collected water is pumped back to the main mine water management ponds for reuse and/or pumping to Pond A1.

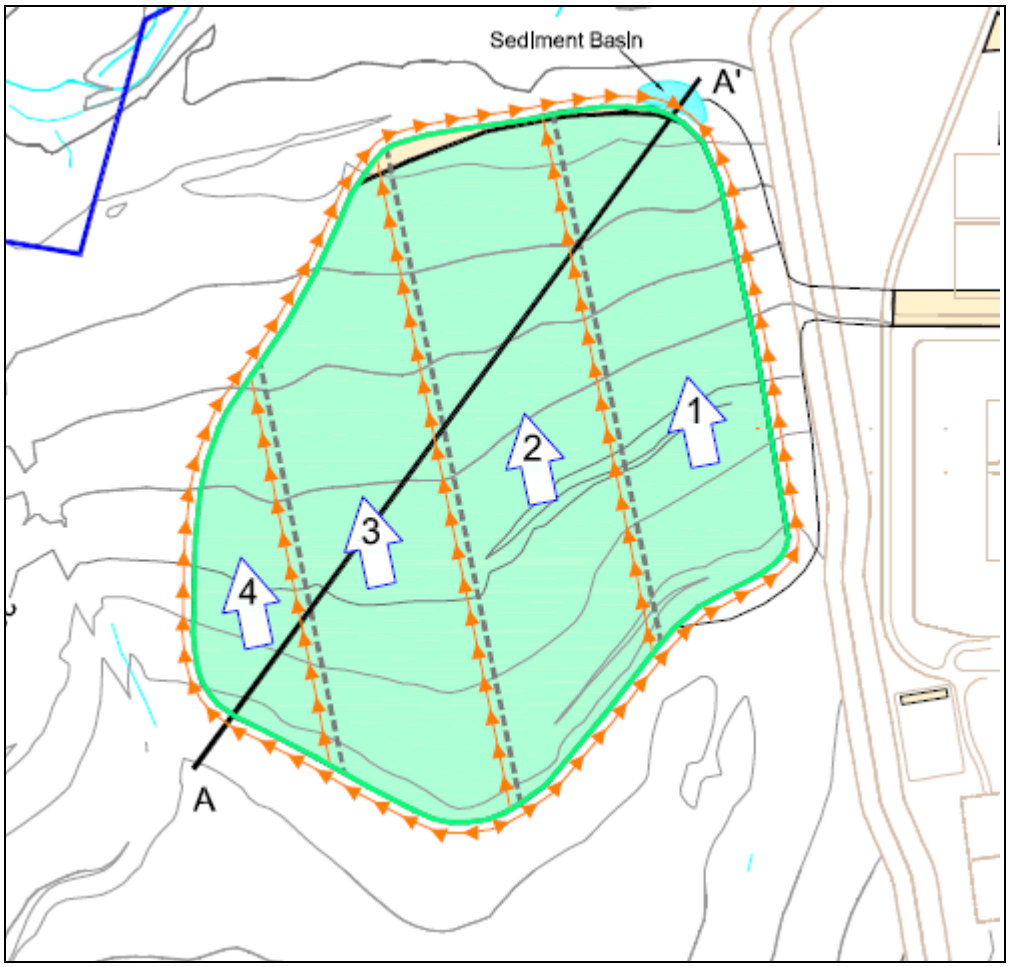

Figure 4-2 Reject Emplacement Area

To minimise sediment and potential contaminates from the Reject Emplacement Area the following erosion and sediment controls will be used in the emplacement area:

- Area of disturbance is to be minimised and cut-off earth banks are to be placed every 80m directing flow to the perimeter catch drains with a grade of between 1% and 5%.
- Stripped topsoil is to be stockpiled with maximum slopes of 1 (V) to 2 (H) and stabilised if they are to be placed for more than 10 days.
- No area of disturbance is to be left uncovered for more than 21 days.
- After placement of reject material to required height, stockpiled top soil from the disturbed areas is to be placed and rehabilitated with seeding cover crop.
- At the end of each days work a 200mm lip is to be left on the edge of each batter step within the emplacement area.
- Diversion structures are to be placed upstream of any disturbance.

- Place Sediment Fences down slope of any disturbance.

4.6 Gas Drainage or Ventilation Area

An Erosion and sediment control plan will be adopted to manage surface flows and erosion control within each gas drainage or ventilation shaft area. The ESCP will provide for the following management.

- Prior to disturbance, the area will be marked out and 'no-go' zones identified.
- If located on or adjacent to a natural drainage line, a diversion bank will be constructed up-slope of the area to be disturbed.
- the requirement for a sediment basin will be determined, using the Revised Universal Soil Loss Equation (RUSLE).
- If a sediment basin is required, ie. soil loss >200t/ha/year, the sediment basin design capacity will be calculated.
- Soil will stockpiled away from natural drainage lines.
- Sediment fencing will be installed along the down-slope boundaries of the disturbed areas.
- All sediment control structures will be regularly inspected and repaired.

5 SITE WATER BALANCE

5.1 Onsite Water Demand

Between the periods 01 April 2009 – 31 March 2010, a total of approximately 38 ML was used for mine site dust suppression purposes. Water was generally sourced from on site surface water storages. Following a prolonged dry spell in late 2009, a small quantity of raw water was trucked from offsite. Significant rainfall in late December 2009/early January 2010 subsequently filled a number of storages and removed the requirement for offsite supply. Water use comprised:

Offsite supply:

- 2 ML (raw)
- 5 ML (potable)

Surface flows to sediment basins and storage dams within the dirty/contaminated water capture system:

- 37 ML

In this same Period:

- The 2 ML of raw water from offsite was stored in Pond A1 and pumped to the water truck for dust suppression purposes;
- Potable water, from Council supplies, was stored in tanks onsite for drinking water and ablution purposes; and
- Approximately 180 ML of surface water was also collected in onsite storages during surface water flow events and utilised as required across the site for dust suppression purposes.

The above water use is indicative of dust suppression requirements during the construction phase of the Project. Additional water use will be required on commencement of production both underground and on the surface, particularly on machinery, conveyors and stockpile locations. On this basis, a true indication of water requirements as an operational mine will not be gauged until the completion of the first 12 months of production. Commencement of production will enable a more rigorous assessment of water use against predictions. If water demands are sufficient to require changes to the current licencing, NCOPL will contact the Licensing Branch of NSW Office of Water (NOW), based in the Tamworth office.

Table 5-1 shows the estimated annual mine site water requirements for the Stage 2 Narrabri Coal Mine. Mine site requirements are based on the production of 2.5 million tonnes of product coal in 2011 and 8 million tonnes per year after that upon operation of the longwall. The Mine Site water demands for Year 2 and Year 18 are taken from the stage 2 EA, Section 3 in Table 3.6. The dewatered groundwater in-flow rates for these years of operation are 0.28 ML/d and 3.83 ML/d respectively.

Table 5-1 Annual Mine Site Water Requirements

Demand (ML/year)	Construction ML	Year 2011* ML	Year 2 ML	Year 18 ML
Surface Dust Suppression	27	27	27	27
Underground Dust Suppression	142	223	337	465
Surface Coal Processing	36	44	56	100
Potable Use	20	20	20	20
Underground Recycle Water	-	-37	-89	-284
Industrial Recycle	-	-5	-5	-5
Total	220	272.5	346	323

* Water demand is based on long wall coal production from August 2011 all other figures are based on Table 4B.19 from Section 4B of the Stage 2 EA.

5.2 Sources and Security of Water Supply

5.2.1 General

Water can be supplied to the Narrabri Coal Mine from a number of sources including:

- Pumped out mine water;
- Namoi River;
- Groundwater (Namoi River Sand beds);
- Mine site runoff/direct rainfall; and
- Underground recycle.

The water management system is designed such that on-site water requirements are supplied from pumped out mine water and mine site runoff. Offsite supplies will be used to supplement on site supplies only during shortfall periods. Potable water will also be sourced from Council supplies.

5.2.2 Available Water Allocations

Table 5-2 shows the water allocation licences held by NCOPL. An aquifer interference licence was obtained to dewater the underground workings and the remaining allocations are off-site licences from either the Great Artesian Basin or the Namoi River.

Table 5-2 Narrabri Coal Mine Water Allocation Licences

Licence	Water Access Licence &/or Groundwater Works	Access Licence Category	Nominal Allocation (ML/yr)
90BL254679		Mining	818
90AL811346, 90CA811347	WAL15922, GW062433	Aquifer	248
90AL812863, 90CA802130	WAL20152	Regulated River (General Security)	600
90AL802212, 90CA802130	WAL2728	Regulated River (General Security)	10
90AL801995, 90CA802130	WAL2671	Regulated River (General Security)	48
90AL812858, 90WA812891	WAL20131, GW969667	Aquifer	150
90AL807276	WAL12833	Aquifer	67
90AL802129, 90CA802130	WAL6762	Regulated River (High Security)	20

The off-site allocations will be used to meet site demands in years where sufficient water cannot be collected on site. It is anticipated that this will only be required in the first four years of the mine life.

5.2.3 Pumped Out Mine Water

Table 5-3 shows the predicted annual groundwater inflows dewatered from the underground workings over the 29 year mine life as predicted by Aquaterra (2009). These inflows are based on the most likely (Base Case) conditions. Previous study prepared by GHD 2007 assumed the hydraulic conductivity of the Hoskisson Coal Seam to be 0.01m/d. Results obtained by Aquaterra (2009) obtain significantly higher hydraulic conductivity. Comparison of falling head test results (GHD, 2007; and RCA, 2007) and drill stem permeability test results (Sigra, 2006) is only possible at NC98. Estimated hydraulic conductivity values differ significantly, with the falling head method (GHD, 2007) giving values two orders of magnitude lower than those estimated using the drill stem method. Variation in obtained results from the two studies is due to differing test methods and periods of the testing. Refer to Section 7.3.2 for details of groundwater quality.

Total predicted mine inflows at Narrabri range from 78 ML/yr in Mine Year 1 up to a maximum of 1419 ML/yr in Mine Year 18 (i.e. 0.21 ML/d to 3.89 ML/d). It is seen that inflows peak in Years 18 - 20 (2027-2029), during the mining of LW15 - LW17. Thereafter, inflow rates steadily decline, as mining retreats further up-dip to the east and groundwater is allowed to flow back into the down-dip goaf areas.Pumped out mine water inflow rates will be monitored once mining commences to refine these

estimates. This monitoring will take place from the box cut sump and will be included in the annual reporting.

The existing licence (90BL246067) allows water excavation for mining purposes with an entitlement of 818ML/yr. As stated earlier, the estimates in Table 5-3 will be refined as mining commences; however the current expectation is that the existing entitlement will be exceeded in year 11. Once the estimates have undergone a degree of refinement, further licencing will be sought from the water markets to cover the anticipated additional requirement. The current intention is to target licences that access the Gunnedah Basin Porous Rock.

The groundwater investigations undertaken by GHD (2007) found that some of the geological formations intersected by the Stage 1 underground operations contain significant quantities of poor quality water. Therefore the use of the pumped out mine water is limited to surface dust suppression and coal processing and possibly for mixing with clean water for use underground. In the AquaTerra (2009) report significant variation in water quality around the site was observed. There is the potential for groundwater drawn from the west of the site to be of sufficient quality to be diverted directly for use in process.

Table 5-3 Predicted Groundwater Inflows (Base Case)

Year	Groundwater Inflow			Year	Groundwater Inflow		
	m3/d	ML/d	ML/year		m3/d	ML/d	ML/year
1	213	0.21	78	16	3554	3.55	1297
2	226	0.23	83	17	3328	3.33	1215
3	337	0.34	123	18	3889	3.89	1419
4	923	0.92	337	19	3773	3.77	1377
5	914	0.91	334	20	3837	3.84	1401
6	1393	1.39	508	21	3807	3.81	1390
7	1386	1.39	506	22	2623	2.62	958
8	1746	1.75	637	23	3019	3.02	1102
9	1771	1.77	646	24	1956	1.96	714
10	2099	2.1	766	25	2281	2.28	832
11	1999	2	730	26	1559	1.56	569
12	2508	2.51	915	27	1709	1.71	624
13	2381	2.38	869	28	1174	1.17	429
14	3118	3.12	1138	29	1454	0.21	531
15	2901	2.9	1059				

Tale Source: AquaTerrra (2009) Table 6.12

5.2.4 Gas Extraction Water Pump out

The gas extraction process from above the coal seam is currently underway. Groundwater from Gas extraction from above the coal seam has been recorded on the site as approximately 100ML/year. This is a component of the total groundwater inflows estimated above. Each new bore created to extract groundwater for the purposes of gas extraction will need to be licenced. These licences will also be tied to the property account 90PT982814. All volumes pumped from these bores will be recorded and included in the annual reporting.

5.2.5 Mine Site Runoff/Direct Rainfall

Water balance modelling of the mine site water management system was reported in Part 3 of the Specialist Consultant Studies Compendium of the '*Environmental Assessment for the Narrabri Coal Mine Stage 2 Longwall Project*' Report ('Surface Water Assessment' Prepared by WRM Water & Environment Pty Ltd November 2009). It predicted that the storage dams and sediment basins could harvest 71ML per year on average from the Pit Top Area. During low rainfall years, the ability to harvest water would be much lower. Although onsite water harvesting is not a reliable source of water, priority will be given to utilising mine site runoff for dust suppression and underground use rather than off site supplies.

It is noted that the runoff from the Pit Top Area is collected on environmental grounds and not as a requirement to harvest water. As such, the volume of these dams would not count towards the site's maximum harvestable rights dam capacity (MHRDC) and would not require a licence.

5.2.6 Underground Recycle

Clean water is required at the Longwall and along the conveyor belt for dust suppression and motor cooling. It is estimated that between 40 to 50% of this water used underground, given in **Table 5-1**, will be collected by the mine dewatering system and transferred back to the Pit Top Area for reuse.

5.2.7 CHPP Recycle

The CHPP will require water for the process and handling of coal. It is estimated that around 10% of water will cycle back to pond A1 for processing through the conditioning plant.

5.3 Off Site Transfers

Water balance modelling indicates that the onsite water requirements, given in **Table 5-1**, would exceed the water that could be collected on-site and dewatered from the underground during the first 5 years of mining. This assumes dry years where surface water cannot be relied upon as a water supply. During these years the excess demand will be met from the offsite supplies and therefore offsite transfers of water are not proposed at this stage.

From the water balance prepared by WRM Water and Environmental, discharge will be required after approximately 10 years of operation. The year 18 scenario (peak groundwater inflow) suggests controlled releases of the raffinate water are made from Dam D at a rate of 2.1 ML/d to prevent uncontrolled spills. This release volume would be dependent on quantity of groundwater pumped from the mine.

NCOPL will monitor the volume of pumped out mine water over time and assess on a regular basis whether sufficient storage is available in the existing evaporation basins and when, or if, off site releases would be required. Options to manage the

excess water should this occur are currently being investigated by Narrabri Coal. These options include:

- Increasing the area of the evaporation basins;
- Treating the water to a quality sufficient to release it to the Namoi River (It is understood that salinity offsets would be required so that there is no net increase in salt loads in the Namoi River); and
- Transferring the treated water to a third party for agricultural use.

The most appropriate option will be determined when better estimates of the volume of pumped out mine water are known. It is noted that NOW prefers the option to transfer water to third parties. Any offsite use will be subject to a detailed site specific investigation to assess the long term sustainability of reusing the water at that particular site.

It is also understood that any raffinate released to the Namoi River will need to meet the conditions of an EPL that specifically considers this scenario. These conditions would include an ambient water quality program both upstream and downstream of any discharge points.

5.4 Reporting Procedures

Monitoring of water volumes on site will be undertaken by collecting data on pumping rates and storage levels. Permanent pumps will be located in the following locations:

- The underground operations;
- The box cut sump;
- SB1, SB2, SD2, SD5, SD4, SB8, A1, B1 and D;
- The evaporation ponds for dust suppression requirements; and
- Gas extraction.

Mobile pumps will be used to dewater the various storage dams on the Pit Top Area.

Pumping times and flow rates will be recorded using flow meters located on pipes entering and exiting underground operations. Flow meter records will be kept at the site office and stored for later use on an active database of monitoring results.

Storage levels (and volumes) at each mine site water management dam will be monitored by installing gauge boards. For the rail loop water storages, the gauge boards will be coloured with a red zone that indicates when the stored volume is less than the 100 year 72 hour storage volume (plus wave run-up).

Levels in the rail loop water storages will be monitored on a weekly basis and following a storm event with the results recorded on the monitoring database (SoC 7.13). Storage levels in the remaining water dams will be monitored on a monthly basis and following a storm event and recorded on the monitoring database.

Following review of dam capacities, all efforts will be made to restore capacity as soon as possible in preparation for the next rain event/sequence.

Electronic monitoring will be introduced for Dams A1, B1 and D. The information collected by these sensors will be used to establish water level trends, allowing for better pond management. These systems will also incorporate a warning system that will be used in preference to the monthly monitoring system described above. The gauge board system will continue for the remaining ponds and will also be used to check the operation of the electronic system.

The total stored volume on the mine site of pumped out mine water, concentrated brine and raffinate (treated) water together with the available storage volume and an estimate of the volume of pumped out mine water over the following year is to be reported in the Annual Environment Management Report to be submitted to the various Government agencies including; NSW Office of Water (NOW), Department of Planning and Infrastructure (DoPI) and Office for Environment and Heritage (OEH).

6 SURFACE WATER MONITORING PLAN

6.1 General

Narrabri Coal Operations has a comprehensive monitoring program in place across the mine site that incorporates:

- The collection of rainfall and meteorological data; and
- The collection of water quality data in the water management dams and creeks.

It is noted that the measuring of water level is not practical in the creeks crossing the site. The channel geometry at a particular measuring site can vary considerably meaning that generation of rating curve to measure flow is difficult and inaccurate. The ephemeral nature of the creeks also means that accurate measurement of peak water level would be difficult and there would be little base for comparison with previous measurements..

6.2 Existing Catchment Water Quality

Between 2006 to 2009 water quality monitoring was undertaken during four storm events for Kurrajong Creek and Pine Creek and their tributaries across the Mine Site. Table 6-1 shows a summary of water quality data collected during the four storm events in July 2006, September 2008, December 2008 and February 2009. The locations of the water quality monitoring sites are shown in **Figure 6-1**. Data recorded at these stations have not been affected by the construction activities at the mine and are expected to be representative of baseline data.

Table 6-1 Water Quality Data for the Local Catchments in the Project Area

Parameter	No.	Mean	Median	Min	Max	10th Percentile	80th Percentile
Electrical Conductivity (TS/cm)	23	227	125	55	1300	65	301
pH	23	7.2	7.1	6.5	8.2	6.7	7.6
Total Suspended Solids (mg/L)	23	76	38	6	320	14.2	139
Oil & Grease (mg/L)	23	<2	<2	<2	<2	<2	<2

6.3 Monitoring Locations

Figure 6-1 shows the water quality sampling locations on the various creeks that cross the mine site. The locations of the various Pit Top Area water storages to be monitored are shown in **Figure 2-1**. The water quality monitoring program has been designed to provide upstream, source and downstream monitoring on the local creeks to assess whether the water quality compliance criteria have been met.

Continuing monitoring of the incoming creek flows during discharge events will help to exclude the upstream catchment as the source of any exceedance of quality limits.

6.4 Water Quality Monitoring Schedule

Table 6-2 defines the parameters to be sampled and the recommended sampling frequency for each sampling location. The proposed water quality monitoring program provides for the assessment of background data for flow events in the various creeks as well as regular grab samples from the mine water storages on-site to determine whether mine site runoff meets the adopted water quality compliance criteria. The samples will be collected fortnightly to build up a baseline data set and then monthly thereafter. The samples should be collected in a manner consistent with the Approved Method for Sampling and Analysis of Water Pollutants in NSW (DECCW, 2004).

- The event-based sampling should enable quantification of any pollutant loads from the Mine Site and their corresponding impact on the local creek water quality.
- On-site regular sampling from the water storages allows for any potential problem areas with respect to pollutant generation on-site to be identified in advance ensuring appropriate remedial action can be taken.

Monitoring is the responsibility of the Environmental Officer and should be conducted by a suitably qualified professional in accordance with the relevant Australian Standards. The frequency of monitoring and range of parameters analysed during flow and routine monitoring should be reviewed after the first two years of operations.

It should be noted that additional testing will take place within the water treatment plant. This testing will be carried out on water from ponds A1, B1 and D and will be in addition to the general testing highlighted in **Table 6-2**.

Surface water flows are not being monitored due to the small and ephemeral nature of the creeks, and the significant effort required in collecting the data. The information would also be of limited use due to the lack of base data and the resulting flood frequency assessment. This makes it impossible to identify changes in the flow pattern of the creeks.

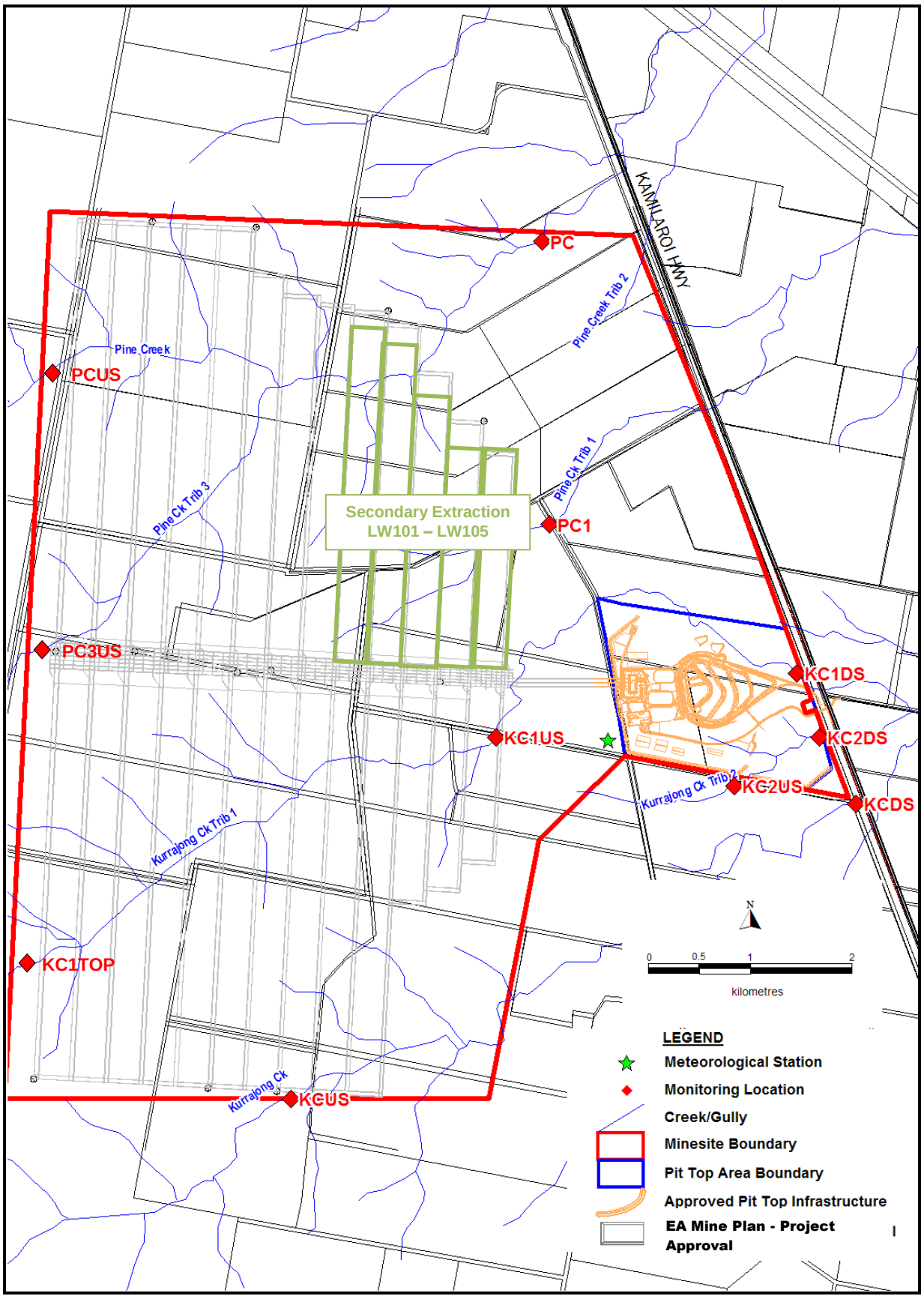

Figure 6-1 Surface Water and Meteorological Monitoring Locations

Table 6-2 Water Quality Monitoring Schedule

Location	Parameters	Frequency
Site (Meteorological Monitoring)	Rainfall Wind speed and direction Temperature Relative Humidity Solar Radiation	Recording every 15 minutes
Rail Loop Water Storages	Water level/storage volume EC pH Turbidity TDS TSS Metals Anions and cations Oil and grease Total Organic Carbon (TOC) Sodium Adsorption Ratio	Weekly (water level) Fortnightly to develop baseline conditions. Monthly thereafter (water quality)
Sediment Basins and Storage Dams	Water level EC Oil and grease pH TSS Total Organic Carbon Turbidity	Weekly (water level) Fortnightly to develop baseline conditions. Monthly thereafter (water quality – all dams) Daily during discharge events from SD2 SD3, SD4, SD5 and SD7 when constructed.
PCUS,PC, PC1,PC3US, KC1TOP, KC1US, KC1DS, KC2US, KC2DS, KCUS, KCDS	EC Oil and grease pH TSS Total Organic Carbon Turbidity	During Runoff events (as practical)

6.5 Surface Water Impact Assessment Criteria

Impact assessment criteria for surface water are only relevant to water actually discharged from the mine site. The surface water compliance criteria are as prescribed by OEH and specified as concentration limits within Environment Protection Licence (EPL) 12789. Condition L3 of EPL 12789 specifies the following concentration limits for licenced points 11 (SD4), 12 (SD5) and 13 (SD2) (**Table 6-3**):

Table 6-3 Surface Water Assessment Criteria

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	mg/L	-	-	-	10
pH	pH	-	-	-	6.5-8.5
Total Suspended Solids	mg/L	-	-	-	50

Furthermore, Condition L3.4 states:

The Total Suspended Solids concentration limits specified for Points 11, 12 and 13 may be exceeded for water discharged provided that:

(a) the discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 millimetres over any consecutive 5 day period immediately prior to the discharge occurring; and

(b) all practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store run off from a 38.4 millimetre, 5 day rainfall event.

Note: 38.4 mm equates to the 5 day 90%ile rainfall depth for Gunnedah sourced from Table 6.3a Managing Urban Stormwater: Soils and Construction Volume 1: 4th edition, March 2004.

All monitoring events will be analysed against this criteria, and any surface water discharge events reported to the DECCW as required. Narrabri Coal notes Condition L1.1 and Condition L3.3 of the EPL, as follows:

Condition L1.1

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.

Condition L3.3

To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s. (see Table 6.2 above).

6.6 Reporting Procedures

The Environmental Officer for the mine site will retain an active database of monitoring results which will be updated on a regular basis. Any discharge event off-site will result in the triggering of a sampling event. All sampling results will be made available in the Annual Review for the site, as well as on the NCOPL website. In the event of any exceedance in concentration criteria, Narrabri Coal will advise OEH and other relevant agencies within 24 hours of detecting the exceedance in

accordance with consent Condition 3 of Schedule 4. Narrabri Coal will also provide a written report within 6 days of the event to the relevant agencies which will:

- Describe the date, time and nature of the exceedance/incident;
- Identify the cause (or likely cause) of the exceedance/incident;
- Describe what action has been taken to date; and
- Describe the proposed measures to address the exceedance/incident.

The ongoing monitoring program and collation of relevant data will provide the basis for continuing improvement in surface water management across the site.

7 GROUNDWATER MONITORING PROGRAM

7.1 General

Narrabri Coal Operations has a groundwater monitoring program in place across the mine site that incorporates the collection of water quality and water level data from groundwater monitoring and local production bores. Improvements to the program have been planned in consultation with NOW and will be instigated as soon as is practical.

7.2 Monitoring Locations

The monitoring network currently consists of 27 standing piezometers, 11 vibrating wire piezometers and 11 registered production bores. These have been located strategically to allow targeted monitoring of alluvium/colluvium, overburden and coal measures. The network monitors water level and water quality across the site and beyond.

All of the vibrating wire piezometers are located around the current underground workings and the first longwall panel. The standing piezometers are more widely dispersed, coving the longwall panels, the surface workings and a small number beyond the mine lease. The locations of these monitoring bores are shown in Figure 7-1 and a description is given in Table 7-1.

An expansion of the monitoring network has been recently agreed with NOW. This includes 3 standing piezometers and 6 vibrating wire piezometers. These have been included largely to monitor the effects of the mine on the wider area, including to surrounding groundwater aquifers. Efforts are underway to negotiate access to some of the off-site locations and it is anticipated that access will be granted. The following section details these additional monitoring locations. They have also been included in Figure 7-1 and Table 7-1.

P39 will be a nested standpipe piezometer targeted at Quaternary Alluvium at approximately 20 and 35 metres and the Watermark Formation below the alluvium.

P40, P41 and P42 will be multi-channel piezometers targeted at Brigalow Sandstone, Hoskissons Coal, Benelabri Formation, Digby Formation, Garrawilla Volcanics and the Base of the Pilliga Sandstone at varying depths.

P43 will be a standpipe piezometer drilled to a depth of 40 metres and targeted at the Watermark Formation.

P44, P45 and P46 will be multi-channel piezometers targeted at Maules Creek Formation, Porcupine Formation, Watermark Formation, Pamboola Formation, Digby Formation, and Napperby Formation at varying depths.

P47 will be a standpipe piezometer targeted at the Garrawilla Volcanics at approximately 45 metres.

This expansion of the monitoring system will allow a more accurate assessment of the subsidence impact as mining progresses. NCOPL is aware of the potential impact to the Namoi Alluvial groundwater and had designed the monitoring programme accordingly.

It is likely that a number of the bore locations will become obsolete as mining progresses. As this occurs, NCOPL will assess the requirement and best location for replacement monitoring locations.

Table 7-1 Groundwater Monitoring Network

Bore ID	NOW Licenc	NOW GW Ref	Bore Owner	Issue Date	MGAE	MGAN	Peizo Type	Bore Depth (m)	Screen Interval (m bgl)	Water Level (m bgl)	Formation
P01	90BL254481	GW968435	Narrabri Coal Operations	26-Mar-08	776116	6614694	Standpipe	50	44-50	42.8	Garrawilla Volcanics
P02	90BL254482	GW968436	Narrabri Coal Operations	26-Mar-08	777282	6616355	Standpipe	50	44-50	29.9	Napperby Formation
P03	90BL254483	GW968437	Narrabri Coal Operations	26-Mar-08	780433	6620115	Standpipe	45	34-40	9.8	Pamboola Formation
P04	90BL254484	GW968438	Narrabri Coal Operations	26-Mar-08	777490	6625553	Standpipe	30	24-30	18.0	Napperby Formation
P05	90BL254485	GW968439	Narrabri Coal Operations	26-Mar-08	778180	6628195	Standpipe	30	24-30	26.6	Pamboola Formation
P06	90BL254486	GW968440	Narrabri Coal Operations	26-Mar-08	772726	6626021	Standpipe	90	78-90	89.1	Pilliga Sandstone
P07	90BL254487	GW968441	Narrabri Coal Operations	26-Mar-08	768998	6624338	Standpipe	90	78-90	62.9	Pilliga Sandstone
P08	90BL254663	GW968631	Narrabri Coal Operations		772697	6618421	Standpipe	65	57-63	50.5	Purlawaugh Formation
P09	90BL254958	GW968632	Narrabri Coal Operations	21-Jan-09	775127	6620209	Standpipe	30	24-30	19.7	Purlawaugh Formation
P10	90BL254658	GW968633	Narrabri Coal Operations		774063	6616444	Standpipe	130	118-130	20.0	Napperby Formation (no sill)
P11	90BL254959	GW968634	Narrabri Coal Operations	21-Jan-09	774066	6616447	Standpipe	50	44-50	22.9	Napperby Formation (no sill)
P12	90BL254659	GW968635	Narrabri Coal Operations	6-Mar-08	776513	6619964	Standpipe	90	84-90	36.5	Napperby Formation(above sill)

Bore ID	NOW Licenc	NOW GW Ref	Bore Owner	Issue Date	MGAE	MGAN	Peizo Type	Bore Depth (m)	Screen Interval (m bgl)	Water Level (m bgl)	Formation
P13	90BL254690	GW968636	Narrabri Coal Operations		776526	6619972	Standpipe	30	24-30	9.4	Garrawilla Volcanics/Napperby
P14	90BL254661	GW968637	Narrabri Coal Operations		775221	6622816	Standpipe	78	72-78	58.4	Napperby Formation(above sill)
P15	90BL254961	GW968638	Narrabri Coal Operations	21-Jan-09	775221	6622818	Standpipe	30	24-30	0.0	Garrawilla Volcanics
P16	90BL254660	Unknown	Narrabri Coal Operations		772233	6623740	Standpipe	146	137-146	50.5	Garrawilla Volcanics
P17	90BL254962	GW968639	Narrabri Coal Operations	21-Jan-09	772222	6623712	Standpipe	56	47-56	0.0	Purlawaugh Formation
P18	90BL254662	Unknown	Narrabri Coal Operations	6-Mar-08	776826	6621802	Standpipe	146	143-146	13.2	Hoskissons Seam
P19	90BL254963	GW968640	Narrabri Coal Operations	21-Jan-09	776827	6621543	Standpipe	187	184-187	16.2	Pamboola Formation
P20	90BL254964	GW968643	Narrabri Coal Operations	21-Jan-09	776482	6621837	Standpipe	162	159-162	13.5	Arkarula Formation
P21	90BL254965	GW969508	Narrabri Coal Operations	21-Jan-09	776851	6620363	Vibrating Wire	200	160	22.5	Hoskissons Seam
P22	90BL254966	GW969509	Narrabri Coal Operations	21-Jan-09	776745	6620406	Vibrating Wire	180	165	23.8	Hoskissons Seam
P23	90BL254967	GW969510	Narrabri Coal Operations	21-Jan-09	776226	6620693	Vibrating Wire	200	Multi-Level	0.0	Multi-Level
P24	90BL254701	GW969642	Narrabri Coal Operations	9-Apr-08	776675	6621043	Vibrating Wire	200	Multi-Level	0.0	Multi-Level
P25	90BL255167	GW969661	Narrabri Coal Operations	18-Jun-09	776703	6620326	Vibrating Wire	200	165	28.6	Hoskissons Seam

Bore ID	NOW Licenc	NOW GW Ref	Bore Owner	Issue Date	MGAE	MGAN	Peizo Type	Bore Depth (m)	Screen Interval (m bgl)	Water Level (m bgl)	Formation
P26	90BL255168	GW969973	Narrabri Coal Operations	18-Jun-09	776537	6620528	Vibrating Wire	200	176	28.6	Hoskissons Seam
P27	90BL255169	GW969974	Narrabri Coal Operations	18-Jun-09	776531	6620485	Vibrating Wire	180	176	28.3	Hoskissons Seam
P28	90BL255170	GW969662	Narrabri Coal Operations	18-Jun-09	778343	6620162	Standpipe	25	19-25	0.0	Napperby Formation(above sill)
P29	90BL255171	GW969635	Narrabri Coal Operations	18-Jun-09	778541	6619978	Standpipe	25	19-25	0.0	Napperby Formation(above sill)
P30	90BL255172	GW969963	Narrabri Coal Operations	18-Jun-09	778808	6620071	Standpipe	15	9-15	0.0	Napperby Formation(above sill)
P31	90BL255173	GW969961	Narrabri Coal Operations	18-Jun-09	778318	6620343	Standpipe	15	9-15	0.0	Napperby Formation(above sill)
P32	90BL255216	GW969959	Narrabri Coal Operations	22-Jul-09	778993	6620335	Standpipe	15	9-14	0.0	Napperby Formation(above sill)
P33	90BL255217	GW969964	Narrabri Coal Operations	22-Jul-09	778772	6620523	Standpipe	15	9-14	0.0	Napperby Formation(above sill)
P34	90BL255218	GW969684	Narrabri Coal Operations	21-Jul-09	778542	6620604	Standpipe	15	9-14	0.0	Napperby Formation(above sill)
P35	90BL255769	GW969937	Narrabri Coal Operations	19-Aug-10	776454	6620217	Vibrating Wire	0	Multi-Level	0.0	

Bore ID	NOW Licenc	NOW GW Ref	Bore Owner	Issue Date	MGAE	MGAN	Peizo Type	Bore Depth (m)	Screen Interval (m bgl)	Water Level (m bgl)	Formation
P36	90BL255770	GW969936	Narrabri Coal Operations	19-Aug-10	776339	6620441	Vibrating Wire	0	Multi-Level	0.0	
P37	90BL255771	GW969934	Narrabri Coal Operations	19-Aug-10	776474	6620492	Vibrating Wire	0	Multi-Level	0.0	
P38	90BL255772	GW969933	Narrabri Coal Operations	19-Aug-10	776386	6621639	Vibrating Wire	0	Multi-Level	0.0	
P39			Proposed		782320	6619725	Standpipe	<30 est		0.0	
P40			Proposed		772648	6620469	Vibrating Wire	450 est		0.0	
P41			Proposed		771627	6624637	Vibrating Wire	450 est		0.0	
P42			Proposed		771101	6617197	Vibrating Wire	450 est		0.0	
P43			Proposed		781147	6619935	Standpipe	<30 est		0.0	
P44			Proposed		777203	6623415	Vibrating Wire	350 est		0.0	
P45			Proposed		779476	6620063	Vibrating Wire	350 est		0.0	
P46			Proposed		777395	6617847	Vibrating Wire	400 est		0.0	
P47			Proposed		776166	6622586	Standpipe	0		0.0	
WB1	90BL028774	GW038662			777251	6622763	Production Bore	0	NK	9.0	Unknown
WB2	90BL246067	GW966836			776382	6619701	Production Bore	0	22-26	9.0	Garrawilla Volcanics
WB3a	Unknown	GW030299			779133	6631524	Production Bore	0	8.2-8.5	8.6	Alluvium

Bore ID	NOW Licenc	NOW GW Ref	Bore Owner	Issue Date	MGAE	MGAN	Peizo Type	Bore Depth (m)	Screen Interval (m bgl)	Water Level (m bgl)	Formation
WB3b	Unknown	GW030299			779133	6631524	Production Bore	0	35.1-36.3	8.5	Alluvium
WB4	Unknown	GW030230			778957	6629746	Production Bore	0	11.3-15.9	8.9	Alluvium
WB5a	Unknown	GW036004			785892	6618196	Production Bore	0	11-14.5	11.1	Alluvium
WB5b	Unknown	GW036004			785892	6618196	Production Bore	0	26.5-28	11.2	Alluvium
WB6a	Unknown	GW036005			786976	6615621	Production Bore	0	11.5-13	14.8	Alluvium
WB6b	Unknown	GW036005			786976	6615621	Production Bore	0	76.7-78	12.2	Alluvium
WB7	90BL100346	GW038200			784440	6620521	Production Bore	0	NK	4.1	Alluvium
WB8	90BL100778	GW043315			777682	6623409	Production Bore	0	27.4-29.8	0.0	Alluvium

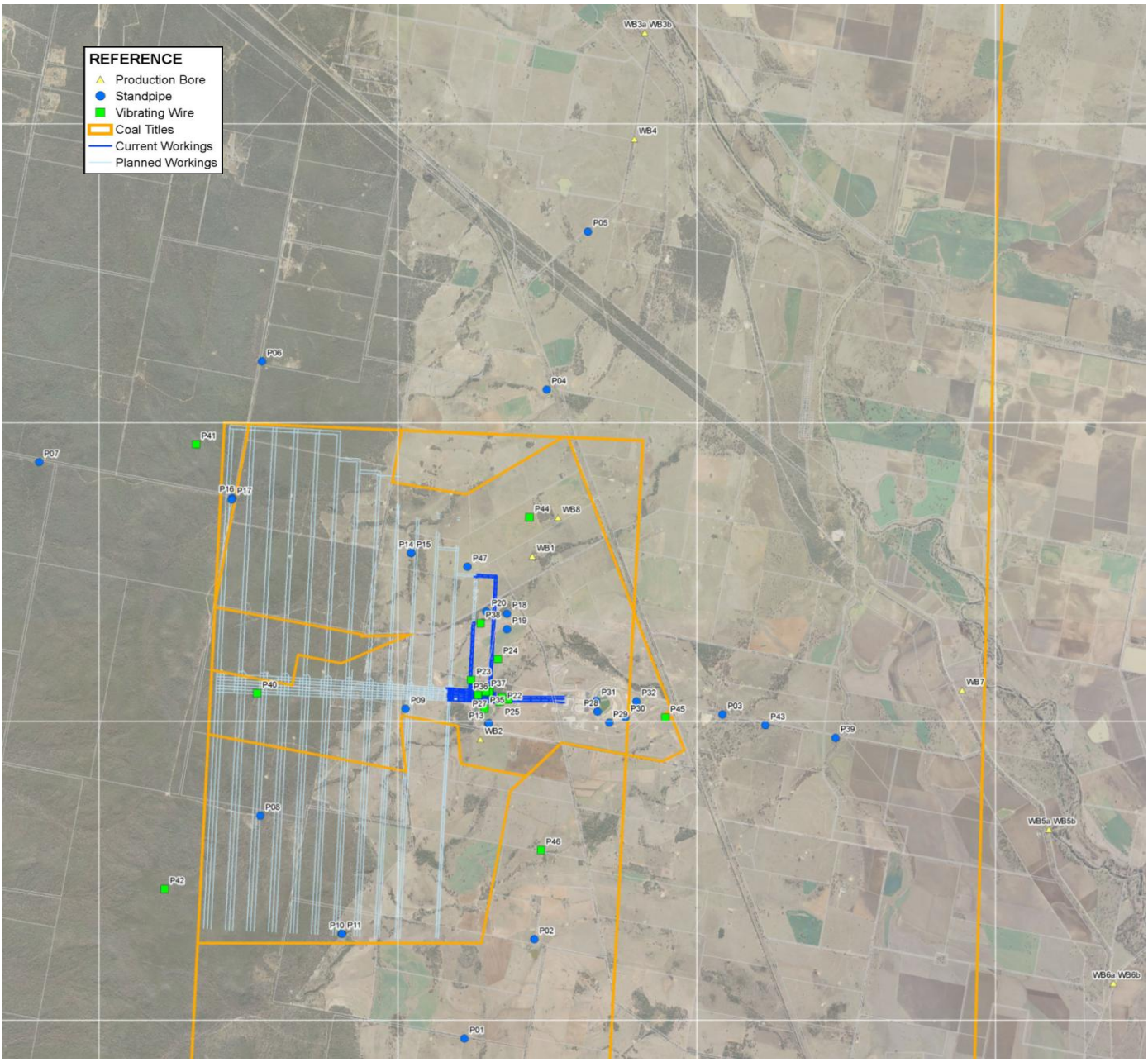

Figure 7-1 Groundwater Monitoring Network

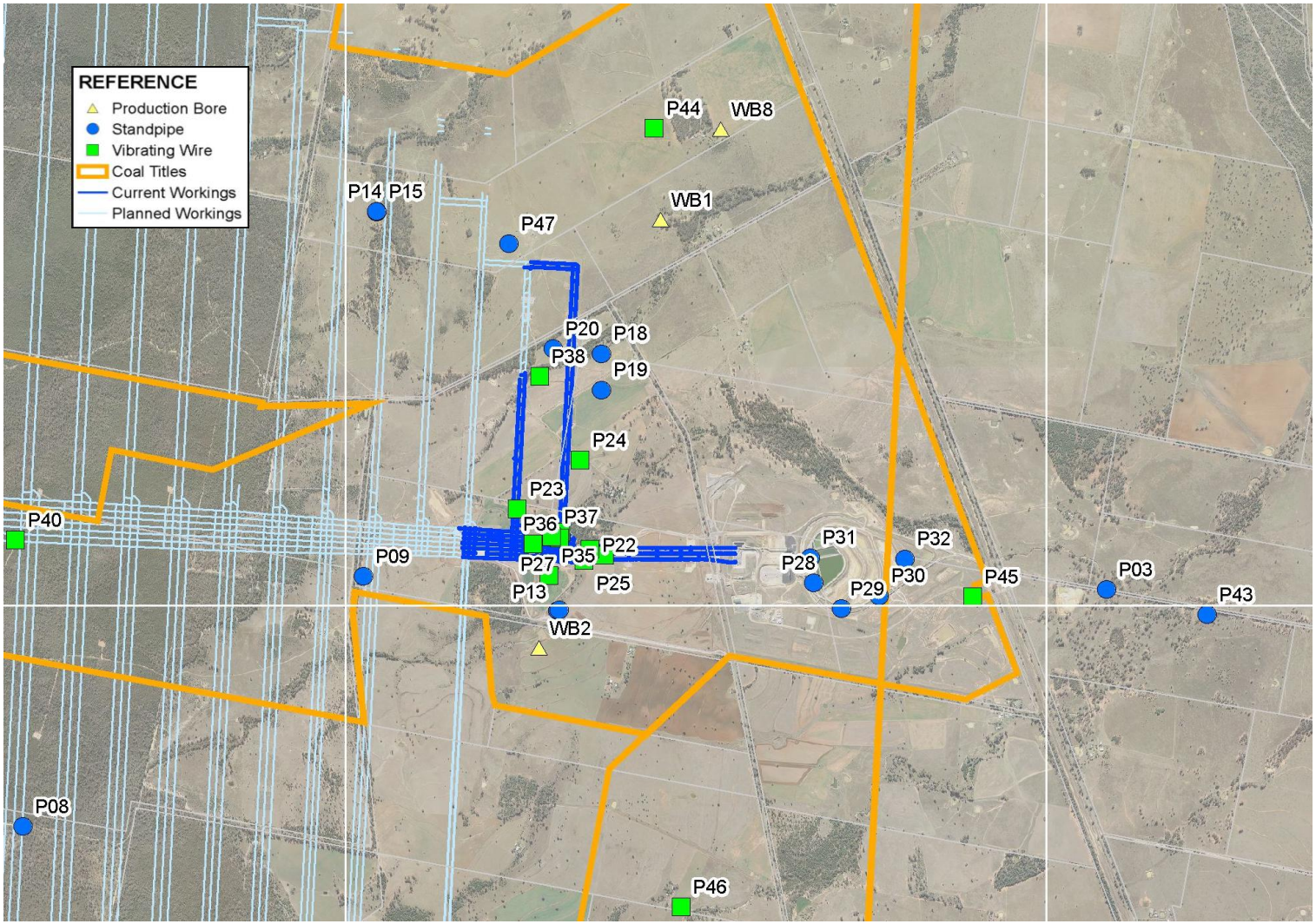

Figure 7-2 Groundwater Monitoring Network (Pit Top Area)

7.3 Baseline Data

Pre mining baseline groundwater level and quality information has been collected routinely since 2007. This is not true for all the monitoring locations, however readings are taken and maintained as soon as a bore is operational.

7.3.1 Groundwater Levels

Groundwater levels are monitored at all current and planned locations in the monitoring system. The VW piezometer bores are monitored for groundwater level/pressure only.

Three groundwater flow systems occur within the mine site area. The first is a shallow aquifer system that occurs within alluvium associated with the Namoi River, located approximately 4km east of LW101. This system forms the Upper Namoi Zone 5, Namoi Valley (Gin's Leap to Narrabri) Groundwater source. During construction of the box cut, seepage was seen in the underlying alluvium/colluvium and weathered rock (regolith) that sit above fresh rock. It is thought that this seepage came from isolated ponds that are not connected to any flow system. The remaining two systems are separate groundwater flow systems which occur predominantly in open fractures in the underlying fresh rock. The shallower of these occurs in Surat Basin Jurassic sediments that form part of the regional Great Artesian Basin and correspond to the intake beds (GWMA 601). The lower flow system is found in Gunnedah Basin sediments.Within the Project Site, groundwater levels in the shallow alluvium/colluvium/regolith aquifer are generally about 10-20m or more below ground level. Groundwater in this aquifer is localised and discontinuous and is influenced primarily by topography and local surface drainage.

The groundwater flow direction in the shallow groundwater system is therefore similar to the surface topography, ie east to northeast towards the Namoi River valley. Recharge to the shallow aquifer system is believed to occur by infiltration of rainfall through the surficial alluvium and regolith, with discharge occurring locally to the surface drainages.

Within the deeper hard rock aquifers, groundwater levels are generally in the range 25-55m below surface. The shallower of the two hard rock groundwater systems occurs within the Jurassic sediments, which subcrop beneath the Project area. The westerly dip on the strata exposes progressively younger units from east to west across the site. A deeper groundwater flow system occurs within the Permian-Triassic sediments which also dip in a westerly direction.

7.3.2 Groundwater Quality

Groundwater quality monitoring has been conducted by Narrabri Coal, with samples from all available standpipes in the monitoring network submitted for laboratory analysis of pH, electrical conductivity (EC), total dissolved solids (TDS), major anions, major cations and selected heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, V,

Mn). The main water quality characteristics (pH, TDS) in the mine area are summarised in **Table 7-2**.

The laboratory analysis results to date indicate pH to be in the neutral to slightly alkaline range of 6.7 to 8.2. Salinity ranges from fresh (<500 mg/L TDS) within the Purlawaugh formations located to the west of the Mine Site (P7 and P8), to slightly brackish (1040 mg/L TDS) in the Garrawilla Volcanics, to strongly saline (up to 16800 mg/L TDS) within the Napperby Formation. Salinity within the Hoskissons coal seam ranges from as low as 1350 mg/L measured in P18 to 9030 mg/L TDS measured in recent in seam drilling.

Low relative sulfate concentrations suggest that there is little concern for acid producing potential from groundwater inflows and therefore measurement of EC is deemed adequate for assessing water quality of groundwater discharged to surface holding ponds. Monthly analytical testing for anions, cations and metals from groundwater inflow discharge points will provide adequate monitoring of inflow groundwater quality conditions.

Table 7-2 Summary of Groundwater Salinity Data

Formation	TDS mg/L		pH	
	Minimum	Maximum	Minimum	Maximum
Pilliga Sandstone	101	101	7.95	7.95
Purlawaugh Formation	295	14820	6.25	8
Garrawilla Volcanics	109	9400	6.27	8.1
Napperby Formation (above Sill)	226	1735	6.65	7.9
Napperby Formation (below Sill)	3160	16800	7.4	8.7
Digby Formation*	N/A	N/A	N/A	N/A
Hoskissons Coal Seam**	1350	9070	6.5	8.5
Arkarula Formation	7740	9630	6.7	7.1

* No sampling has occurred from the Digby Formation and salinity is assumed to be similar to the overlying Napperby Formation

** Initial sampling from the Hoskissons coal seam was limited to a single monitoring bore (P18) which indicated that salinity within the seam was less than 2000 mg/L. Recent data from in seam gas drainage program suggests salinity concentrations are as high as 9630 mg/L.

7.4 Monitoring Schedule

Table 7-4 defines the parameters to be sampled and the recommended sampling frequency for each sampling location. The proposed groundwater quality monitoring program provides additional baseline data information initially and ongoing operational data.

Key components of 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;
- Quarterly measurement of water levels in existing registered groundwater bores within 5 km of the Mine Lease as indicated in **Table 7-1**;
- Quarterly sampling of all standpipe piezometers, for laboratory analysis of electrical conductivity (EC) and pH;
- Annual collection of water samples from all standpipe piezometers for laboratory analysis of a broader suite of parameters including:
    - Physical properties (EC, TDS, TSS and pH)
    - Major cations and anions (Ca, Mg, Na, K, Cl, SO4, HCO3 and CO3)
    - Nutrients (ammonia, nitrate, phosphorus, reactive phosphorus)
    - Dissolved metals (aluminium, arsenic, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, selenium, zinc)
    - Other (fluoride, cyanide)
- Daily measurement of the volume of mine water pumped in to and out of the underground mine;
- Quarterly and annual (full water quality) analysis of piezometers P28 – P34 to monitor, detect and quantify any leachate from the site evaporation ponds;
- Groundwater discharge quality – monthly measurements on the site of the EC and pH of samples collected from each groundwater extraction point for either dewatering or water supply purposes, including both bores and underground pumping stations;
- Weekly measurement of the volume of groundwater pumped to surface from all extraction bores, sumps within the underground workings and the box cut sump;
- Monthly sampling and analysis of water from all pumping bores and underground pumping stations for comprehensive hydro-chemical analysis (**Table 7-3**);
- Fortnightly recording of standing water levels of piezometers P1 – P27, and WB1 to WB8 (and others as constructed). When stable flow is established, this can become quarterly.
- Monthly monitoring of the flow rate and water quality of the spring discharge from “Mayfield Spring”. Once stable flow is established, this can become quarterly.
- Fortnightly manual monitoring, or continuous automated monitoring of water levels from the network of monitoring bores;

- Annual sampling of representative monitoring bores for laboratory analysis;
- Monthly monitoring of the spring discharges.

Data collected from the vibrating wire piezometers should be compared against initial groundwater and subsidence modelling predictions.

To ensure the integrity of the low permeability lining of the storage ponds, regular monitoring of the boreholes around the rail loop bordering the ponds is required. Refer to section 7.5 for monitoring procedures. This will also allow the monitoring of the structural integrity of the ponds preventing any release of the brine from the site either through groundwater movement or surface flows.

Monitoring of leachate from ponds will be conducted from the shallow piezometers installed in the monitoring points P28 – P34. If groundwater monitoring detects an excess of groundwater leachate with a significant increase in salinity, the area around the ponds should be investigated to pinpoint the source of the saline leachate.

If saline leachate is identified a plan will be required to measure the permeability of the ponds' lining around the source of the leachate and detail remedial works required to re-establish the integrity of the evaporation ponds liner.

Additional groundwater monitoring points will be installed prior to planning and construction of the additional brine storage/evaporation ponds BR1 to BR5.

Additional ground water monitoring points will also be installed around the coal reject emplacement area.

The frequency of monitoring and range of parameters analysed during flow and routine monitoring should be reviewed after the first two years of operations.

In addition to the above, which is designed to assess general impacts of drawdown, Narrabri Coal will implement a comprehensive monitoring program to investigate the subsidence impacts as they develop above longwall panels LW1 to LW3. Several multi-level vibrating wire piezometers are already in place, strategically placed within proposed chain pillars between LW1 and LW2 and just outside LW1, to enable ongoing monitoring. Additional multi-level vibrating wire piezometers and extensometers are proposed and monitoring of these would be conducted in conjunction with the subsidence monitoring recommended in the Environmental Assessment Part 5. DGS (2009), and those measures to be prescribed in the site Extraction Plan

Table 7-3 Recommended Laboratory Analysis Suite for Groundwater

Class	Parameter
Physical parameters	ED, TDS, TSS and pH
Major Cations	Calcium, Magnesium, Sodium and Potassium
Major Anions	Carbonate, bicarbonate, sulphate and chloride
Dissolved metals	Aluminium, arsenice, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, selenium, zinc
Nutrients	Ammonia, nitrate, phosphorus, reactive phosphorus

All monitoring results will be reviewed annually and summarised in each Annual Report, together with an assessment of the need to modify the parameters measured or monitoring frequency. In addition to this, the raw monitoring data is published on the mine's website within two weeks of sampling.

As Part of Annual monitoring it is the responsibility of Narrabri Coal to commission an experienced hydrogeologist to collate and review the monitoring data collected. This review will assess the impacts of the project on the groundwater environment, and to compare any observed impacts with those predicted from groundwater modelling. If significant variation is found between predicted impacts and observed operational monitoring data then notification of remediation will be required. Refer to Section 1.4 Responsibilities for details.

Table 7-4 Groundwater Monitoring Schedule

Location	Parameters	Frequency
All Standpipes P1,P2, P3, P4, P5, P6,P7,P8, P9, P10, P11,P12, P13, P14, P15, P16,P17,P18, P19, P28, P29, P30, P31, P32, P33, P34, WB1, WB2, WB3a, WB3b, WB4, WB5a, WB5b, WB6a, WB6b, WB7 and WB8	Water level EC pH See Table 7-3 for remaining criteria	Quarterly (water level, pH and EC) Annually (full water quality)
P1,P2, P3, P4, P5, P6,P7,P8, P9, P10, P11,P12, P13, P14, P15, P16,P17,P18, P19, P21, P22, P23, P24, P25, P26, P27, WB1, WB2, WB3a, WB3b, WB4, WB5a, WB5b, WB6a, WB6b, WB7 and WB8 (and others as constructed)	Water Level	First two years of mining - Weekly (manual), every 4hrs (data logger, downloaded monthly) After two years of mining – Quarterly (manual), daily (data logger downloaded monthly)
Each groundwater extraction point	EC pH	Monthly
Representative Bores	Water level EC pH TDS Metals Anions and Cations	Annually
Pumping bores and underground pumping stations	See Table 7.3	Monthly
Spring discharges (including Mayfield Spring)	Flow rate and water quality (pH, EC, TDS)	Monthly
Multi Level Vibrating Wire Piezometers P35 and P36	Water Level	Daily (Data Logger)
Mine water pumped into and out of the mine.	EC pH TDS Metals Anion and Cations Discharge Rate	Daily (flow rate) Monthly (EC pH,) Quarterly (Full water quality)

* When stable flow is established, this can become quarterly

7.5 Groundwater Sampling Procedure

The method of groundwater monitoring will be undertaken following the procedure outlined below. Note that these procedures are not exhaustive and will be complemented with 'best practice' sampling protocols.

- Depth to water table will be measured using a calibrated water level meter.
- Bores will be purged of at least three well-volumes of groundwater using a submersible pump or bailer. Purged water will be disposed of to nearby drains or adjacent land. The method of purging will be tailored for each site, dependant on the parameters being analysed to ensure the accuracy of results.
- Collection of groundwater samples will be undertaken following the purging of each bore.
- For groundwater sample, sampling devices will be dedicated and/or disposable for each sample or otherwise decontaminated between sampling locations. If rinsing is used, rinsate samples should be included in the QA/QC program as appropriate.
- Groundwater samples will be collected in laboratory supplied sampling containers that will be appropriately dosed with the preservative for the analysis required.
- The samples will be submitted for analysis to a NATA accredited laboratory within the relevant holding times with completed chain of custody documentation.
- All sampling events will have a QA/QC program and the QA/QC sample analysis will be checked to validate the integrity of the collected data.

7.5.1 Document of monitoring and reporting on monitoring results

All documentation related to groundwater will be kept on archive, and be readily accessible to facilitate ease of data analysis against regulatory criteria and monitoring trigger values. Depending on the medium for recording of field data, relevant monitoring documentation may include (but not limited to):

- Hand recorded field observations and data recording;
- Electronic data records and downloaded information;
- Calibration records for field monitoring equipment;
- Photographs of monitoring sites or potential issues of concern;
- Laboratory analytical results reports, including chain of custody records;
- Summary and records of quantities of releases of hazardous materials to the environment;
- Internal technical memorandums detailing the results of monitoring programs; and
- Monitoring reports prepared for submission to regulatory authorities.

An organised internal approach to data management and monitoring documentation will significantly enhance the intended benefits of the monitoring program. When set

up, it will facilitate the identification of potential issues of concern in a timely manner, such that appropriate contingency actions can be implemented if warranted.

7.6 Groundwater Impact Assessment Criteria

Impact assessment criteria have been adopted for:

- Mine inflow rate;
- Mine inflow water quality;
- Near surface groundwater levels, in particular groundwater levels within the Garrawilla Volcanics;
- Impacts on surficial groundwater levels and/or creek base flows; and
- Impacts on existing licensed users.

7.6.1 Mine Inflow Rates

The predicted base case mine inflow rates have been shown in **Table 5-3**. The rates gradually increase to reach a maximum of 1,409 ML per annum at Year 18. From year 19 to 23, inflow rates average 1,245 ML/annum, and decline to 76ML/annum at the end of mine life.

An observed inflow rate 100% in excess of the predicted mean monthly inflow rate at any stage during the mine life sustained for 3 consecutive months would require a response plan as detailed in **Section 8** of this report.

7.6.2 Impacts to Licenced Users

Due to the generally high groundwater salinities and low bore yields, there is very limited existing groundwater abstraction in the immediate mining area other than for coal mine dewatering.

Monitoring, that consists of vibrating wire piezometers located in the alluvium and units below, will allow assessment of groundwater levels around the site. It will then be possible to identify the impacts that may be related to mining activity which will trigger response actions, as described in Table 8-1.

Occasional small stock water supplies are drawn from near surface groundwater. Impact on surrounding registered groundwater users is treated as significant if it exceeds 15% of available drawdown. The greatest impact from Stage 2 development is predicted to occur within the Hoskissons Coal Seam, with drawdowns of 5m or more extending to 15km from the Mine Site at the end of mining. Drawdowns of 1m or more are predicted to extend to a maximum of approximately 20km from the Mine Site to the south west and 10km from the mined areas to the south. Drawdown to the east is limited by the truncation of the Hoskisson Coal Seam in sub-crop.

Registered groundwater users outside the Project Site are not predicted to have their available drawdown reduced by greater than 15%. An observed drawdown in licensed bores which exceeds predicted drawdown would require a response action as detailed in **Table 8-1**.

7.6.3 Mine Inflow Water Quality

Groundwater within the coal measures is highly variable, with measured TDS ranging from 1350 mg/L to 9070 mg/L. The salinity and pH of mine water will be monitored throughout the mine life. Significant changes in the trends of quality over a sustained period would require a response action as detailed in **Table 8-1**.

Should the water quality of the mine inflows or dewatering discharge indicate an inflow salinity of more than 20% above that predicted by Aquaterra (2009) modelling (8,000 mg/L), all relevant monitoring data will be provided to an approved experienced hydrogeologist for review and assessment of the impact on other users or the environment.

Groundwater Quality Criteria

Groundwater quality would be assessed predominantly against the NEPM livestock guidelines, given that this is the predominant use of groundwater in the vicinity of the Mine Site.

Impacts on the water quality parameters of pH, TDS, other anions and heavy metals (not considered by the NEPM criteria) would be based on comparisons to baseline monitoring of groundwater quality taken from all groundwater bores within the Mine Site.

Table 7-5 Groundwater Quality Criteria

Analyte	Agricultural Irrigation (mg/L)	Livestock (mg/L)
Arsenic (total)	0.1	0.5
Cadmium	0.01	0.01
Chromium (total)	1.0	-
Chromium (VI)	0.1	1.0
Copper	0.2	0.5
Lead	0.2	1.0
Manganese	2.0	-
Mercury (total)	0.002	0.002
Nickel	0.02	1.0
Zinc	2.0	20.0
Calcium	-	1000

- No published values

Source: Modified after NEPC (1999)

A trigger to assess the cause and effects on groundwater quality will be implemented when there is a prolonged and extended non conformance of the outlined criteria at a particular piezometer.

If a parameter is outside the designated criteria for at least 3 months in a sequence, or alternatively, exceeds its previous range of results by greater than a 10% variation for at least 3 months, then the cause will be investigated, and a remediation strategy proposed, if warranted.

7.7 Reporting Procedures

An active database of monitoring results, to be retained by the Environmental Officer, will be updated on a regular basis. Sampling results will be made available in the Annual Review, as well as on the NCOPL website. The Annual Review will present an overview of the performance of the groundwater monitoring network during the preceding 12 months and identify the proposed extraction, processing and rehabilitation activities and environmental management planned for the following 12 months.

The ongoing monitoring program and collation of relevant data will provide the basis for continuing improvement in groundwater management across the site.

7.7.1 Community Complaint Protocol

In addition to monitoring of surface and groundwater quality, Narrabri Coal records all complaints made by the community. For each complaint, the following information is recorded

- 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 by Narrabri Coal 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.

7.8 Further Development of the Groundwater Model

In accordance with Statement of Commitments within the approval conditions, the groundwater model will be recalibrated 12 months, 3 years and 5 years after the commencement of longwall extraction. Recalibration will then occur every 5 years thereafter, and at least 12 – 18 months prior to cessation of mining. Following the

first review, if necessary, the groundwater model will be recalibrated and confirmatory forward impact predictions made.

Should any review or post-audit indicate a significant variance from the model predictions with respect to either water quality or groundwater levels, then the implications of such variance will be assessed, and appropriate response actions implemented in consultation with NOW and OEH as appropriate.

If in-flows deviate significantly from predictions, regular review of the groundwater model predictions against monitoring data will be carried out. Should the recalibrated model show groundwater inflows beyond these cases described in the Environmental Assessment (EA), a separate detailed impact assessment will be conducted and mitigating measures determined.

It is proposed to calibrate this model with ongoing monitoring data from the site. Other 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.

8 SURFACE AND GROUNDWATER RESPONSE PLAN

The surface and ground water response plan will include a protocol for managing and reporting any:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and or performance criteria; and;
- a protocol for periodic review of the plan.

Records of any of these items along with the data collected as outlined in this section are to be maintained and available for review by the appropriate agency/ authorities.

8.1 Surface Water

Monitoring will involve both the sediment and chemical content of the surface water and the physical movement of the flow. If these elements are altered significantly, then remediation will be required. The monitoring will be as described in Section **Error! Reference source not found.**.

8.1.1 Contingency measures

The identification process and response protocol to adverse outcomes are provided in the trigger action response plan (TARP, Section 8.3). The responses proposed incorporate a staged assessment and development of management measures deemed appropriate for each individual event should it occur.

Specific trigger levels have been designed to alert NCOPL to observed parameter responses which are outside of normal variation and predicted responses, or where observed parameter values do not follow anticipated trends.

The triggers for instigation of response actions would occur when observed changes to monitored parameters exceed specified levels. Such changes in observed parameters or conditions include:

- Significant change in observed water quality when compared to baseline levels; and
- Changes in trends over an extended period for creeks and on site storages.

8.1.2 Response Action

If an exceedance of the monitoring criteria for wet weather discharges (listed in **Section 6**) is identified then Narrabri Coal will follow the procedure listed below:

- Exceedance in monitoring criteria identified;
- Record the timing, location, environmental conditions and any contributing factors to the exceedance;
- Advice issued to relevant agencies as soon as practicable;
- Sampling point and areas upstream inspected to ascertain cause of exceedance;
- Operational practices reviewed to determine if any current operational practice contributed to the exceedance;
- Implementation of ameliorative measures on site to minimise the potential for future exceedance, which may include clean out, redesign or alteration to structures and/or operational practice;
- Further written advice to relevant agencies identifying actions undertaken to reduce future risk of exceedance, if not included in initial communication;
- Where specific cause of exceedance cannot be identified, external advice may be sought; and
- Ongoing future monitoring to ensure ameliorative measures have been successful with concentration criteria being met.

All other surface water monitoring will be discussed in the Annual Review with reference to relevant guidelines, such as the ANZECC guidelines.

8.2 Groundwater

In the event that adverse impacts or water quality degradation on groundwater resources beyond predictions in the EA are determined, and these impacts are considered associated with the operations, NCOPL will commission an assessment of the causes, will develop a staged response program satisfactory to OEH and NOW to mitigate the adverse impacts, and will establish and implement measures to manage further impact.

8.2.1 Contingency Measures

The identification process and response protocol to adverse outcomes are provided in the trigger action response plan (TARP, Section 8.3). The responses proposed incorporate a staged assessment and development of management measures deemed appropriate for each individual event should it occur.

Specific trigger levels have been designed to alert NCOPL to observed parameter responses which are outside of normal variation and predicted responses, or where observed parameter values do not follow anticipated trends.

The triggers for instigation of response actions would occur when observed changes to monitored parameters exceed specified levels. Such changes in observed parameters or conditions include:

- Sudden inrush of groundwater into the mine in exceedance of predicted inflows;
- Significant change in observed water quality or groundwater levels between sampling rounds;
- Changes in trends over an extended period for groundwater levels and quality; and
- A significant increase or variation from predicted models.

8.2.2 Response Action

In the event of any exceedance detailed in **Section 7.6**, the following response action may be initiated:

- NCOPL assessment to determine the reason for the exceedance.
- Refer the matter to an independent hydrogeologist for review if NCOPL investigation is unable to identify reason for 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;
    - Modification to mine plans;
    - Provision of alternative water supply or other agreed compensation;
    - Introduction of engineering structures to break hydraulic coupling caused by mining; or
    - (If appropriate) no change to operations.

The above response program would be carried out in consultation with OEH, NOW and other relevant government agencies.

8.3 Trigger Action Response Plan (TARP)

The Trigger Action Response Plan (TARP) has been developed to focus upon appropriate trigger and response actions for mitigation of impacts to the natural environment as a result of mining.

The surface water and groundwater monitoring described in this document is used to develop base line conditions as well as tracking changing trends over time. The monitoring will then highlight when abnormal conditions occur that may relate to mining activities.

Each monitoring program has established trigger levels of particular impacts at which a response is needed, and to help define an appropriate response (**Table**

8-1). Management of impacts within predictions follows standard assessment review and response protocols.

It should be noted that a subsidence related TARP was developed for the approved Extraction Plan Water Management Plan (Whitehaven, 2012). The additional elements of the subsidence TARP have been included in **Table 8-1** of this document and are shaded grey.

Table 8-1 Trigger Action Response Plan (TARP)

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Surface Water					
Water quality (Pine and Kurrajong Creeks)	**Sites:** PCUS, PC1US, PC, PC1, KC1TOP, KC1US, KC1DS, KC2US, KC2DS, KCUS, KCDS (see figure 2-1). **Parameters:** EC, oil and grease, pH, TSS, TOC, Turbidity. **Analysis:** Comparison of upstream and downstream results as well as to ANZECC water quality trigger levels. Review of water quality trends over time. Current monitoring suggests baseline data is within ANZECC guidelines however there are no discernible trends at this stage. **Frequency:** During runoff events (as practical).	To provide baseline water quality data. To identify potential surface water quality impacts as a result of mining activities (e.g. via subsidence cracking, ponding, erosion).	Exceedance of baseline values (Refer to Table 6.3). Long-term upwards trend towards ANZECC quality guideline limits.	Repeat sampling to confirm results exceed trigger level. Hydrologist (or similar specialist) to review sampling and climate data and confirm likely mining impact or otherwise. If mine-related, undertake physical inspection of affected surface and creeks to identify potential source of water quality degradation. Implement appropriate management or contingency response (i.e. repair of subsidence cracking, remediation of ponding, erosion control works and rehabilitation).	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Water quality in all storages	**Sites:** All surface storages **Parameters:** Water level, EC, Oil and grease, pH, TSS, Total Organic Carbon and Turbidity In rail loop include: TDS, Metals, Anions and cations, Sodium Adsorption Ratio **Analysis:** Comparison to ANZECC trigger levels and observing trend in quality over time. Used to identify potential discharge non-conformances. **Frequency:** Water level – Weekly. Quality – Fortnightly to develop baseline conditions. Monthly thereafter. During uncontrolled discharge events – daily from SD1, SD2, SD3, SD4, SD5 and SD7 (when constructed).	To monitor quality changes over time and identify locations of potential non-conformance, should an uncontrolled discharge event occur. Water level also tracks the overview of pond use over time.	Water levels maintained above dam capacity. Long-term upwards trend towards ANZECC quality guideline limits. Uncontrolled discharge.	Plan put in place to reduce levels in the dam. May include additional dust suppression, spreading of water across other storages or other approaches. Reasons for changing trends should be identified and system changes implemented. These may include early commissioning of the desalination plant, mixing with clean water or other approaches. Uncontrolled discharge will be reported to the relevant agencies as soon as is practical. This will include the results of all quality testing during the event.	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Surface Water – Subsidence Effects					
Water quality – ponding	**Sites:** Longwall panels LW101-105. **Parameters:** Water quality sampling (EC) of surface water ponding in overbank areas. Identification of changes in topography that leads to ponding. **Analysis:** Comparison to ANZECC trigger levels and observing trend in quality over time. Identification of potential ponding areas via changes in topography. Identified via visual inspection and ALS survey. **Frequency:** Following formation of surface ponding and monthly during ponding occurrence. Monthly visual inspection and 6 monthly ALS survey.	To monitor potential salinity increases in water ponding over potential saline soils. To ensure that surface water ponding does not provide a potential source of salinity for downstream watercourses (Namoi River).	Exceedance of baseline values. Long-term upwards trend towards ANZECC quality guideline limits. Identified changes in topography either by visual inspection during an event or via survey information.	If little vegetation of significance is impacted and water quality analysis confirms no increase in salinity, the ponding would be left to “self-correct” over time. Should vegetation of significance be at risk or there is an exceedance of salinity, construct drainage (i.e. open channel / drain) works to ensure area is able to drain freely once substantial subsidence has ended. Rehabilitate and stabilise. Develop management actions through Risk Assessment for ponded water should this be shown to consistently exceed the ANZECC guidelines. Ecological benefits of ponded water should be considered before any of the above action is taken.	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Changes in watercourse morphology	**Sites:** Where Pine and Kurrajong Creeks traverse longwall panels LW101-105. **Parameters:** Water quality – use results from 'water quality' section above. Identification of changes in planform, creek grade, bank erosion and sedimentation. **Analysis:** Identified via visual inspection and subsidence monitoring survey. **Frequency:** Water quality - during runoff events (as practical). Morphology - monthly visual inspection and 6 monthly ALS survey.	To determine if subsidence due to mining is impacting on the morphology of Pine and Kurrajong Creeks. This can appear as changes in; planform, creek grade, bank erosion and sedimentation which effects water quality. This may occur in the channel and/or the wider floodplain.	Water quality triggers as described above may indicate changes in channel morphology. Identified changes in topography either by visual inspection during an event or via survey information	Identified changes in topography should be allowed to "self correct" unless there is evidence of significant erosion. (or variation from predicted model results see figure 4B.7 of the Environmental Assessment (2009)). If erosion and deposition is identified as being significant, a qualified geomorphologist will be consulted to develop action plan which may involve further monitoring or remediation. - Monitoring may involve use of 'Index of Diversion Condition' principles as per ACARP. - Remediation works will be identified; these may include erosion protection works, removal of sedimentation and realignment of the watercourse.	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Ground disturbance above longwall panels	**Sites:** Areas that traverse the long wall panels. **Parameters:** Water quality – use results from 'water quality' section above. **Analysis:** Identified via visual inspection. **Frequency:** Water quality - during runoff events (as practical).	To determine if activities above longwall panels required to enable mining is impacting on surface erosion and in turn impact on water quality.	Visual inspection revealing excessive erosion or ineffective control measures. Water quality triggers as described above may indicate increased rates of erosion.	Continued monitoring of erosion; control measures as described in the mine site erosion and sediment control plan. If implemented erosion control measures are found to be failing, review causes and replace with like or better. Continue monitoring.	Environmental Officer.
Groundwater					
Groundwater Levels – Namoi River alluvial aquifer	**Sites:** Up-gradient background reference bores. Groundwater bores in alluvium. Vibrating wire piezometers and groundwater bores in Permian between mine site and alluvium. **Parameters:** Water level. **Analysis:** Comparison to predicted	To provide baseline water level data and to identify water level impacts. To verify that impacts in base flows to Namoi River Alluvium are consistent with model predictions. To re-calibrate and validate model with additional data.	Drawdown greater than maximum predicted impact in sensitivity analysis of groundwater model.	Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section 8.2.3. Notify agencies when exceedance becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
	drawdown taking into account natural variations observed in background reference sites. Determine potential baseflow impacts during model review. **Frequency:** Manual monitoring of groundwater bores weekly and automatic groundwater level monitoring of VWPs every 4hours (downloaded monthly) during first two years of mining. Manual monitoring of groundwater bores quarterly and automatic groundwater level monitoring of VWPs every day (downloaded monthly) after first two years of mining.			hydrogeologist recommendations.	
Groundwater Levels – Permian to Jurassic hard rock aquifers	**Sites:** Vibrating wire piezometers and groundwater bores in Permian. Private landholder bores	To provide baseline water level data and to identify water level impacts. To verify that impacts on GAB aquifers are	Drawdown greater than 15% above predicted trend in VWPs, monitoring bores, and private landholder bores (not pumping affected).	Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section	Environmental Officer**.**

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
	(including identified springs to the south of the mine). **Parameters:** Water level. **Analysis:** Comparison to predicted drawdown taking into account natural variations. **Frequency:** Manual monitoring of groundwater bores weekly and automatic groundwater level monitoring of VWPs every 4hours (downloaded monthly) during first two years of mining. Manual monitoring of groundwater bores quarterly and automatic groundwater level monitoring of VWPs every day (downloaded monthly) after first two years of mining.	consistent with model predictions. To re-calibrate and validate model with additional data.		8.2.3. Notify agencies when exceedance becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Mine water inflows – volume/rate	**Sites:** Surface to in seam extraction bores, sumps/pumps, water entry to mine. **Parameters:** Volume. **Analysis:** Comparison to predicted volumes in mine water management and groundwater models. **Frequency:** Daily recording of volumes.	To verify that impacts of subsidence and groundwater drawdown are consistent with model predictions. To re-calibrate and validate model with additional data.	An observed inflow rate 100% in excess of the predicted base case mean monthly inflow rate at any stage during the mine life sustained for 3 consecutive months or inflow rate for a 3 month period 100% greater than the predicted base case total for that 3 month period.	Engage hydrogeologist and/or subsidence specialist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section 8.2.3. Notify agencies when exceedance becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	Environmental Officer.
Mine water inflows – quality	**Sites:** Underground sumps/pumps, water entry to mine. **Parameters:** Water quality – full laboratory analysis suite (See Table 7-3).	To verify that impacts of subsidence and groundwater drawdown are consistent with model predictions. To re-calibrate and validate model with additional data.	Should the TDS of the mine inflows or dewatering discharge indicate an inflow salinity of more than 20% above that predicted by modelling at any stage during the mine life sustained for 3 consecutive months (and/or the 3-month rolling average	Engage hydrogeologist and/or subsidence specialist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section 8.2.3. Notify agencies when exceedance becomes known,	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
	Analysis: Comparison to predicted water quality in mine water management and groundwater models. **Frequency:** Monthly for EC and pH. Quarterly (Full water quality).		exceeds the criteria)	and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	
Groundwater Quality	**Sites:** P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11,P12, P13, P14, P15, P16, P17, P18, P19, P28, P29, P30, P31, P32, P33, P34, WB1, WB2, WB3a, WB3b, WB4, WB5a, WB5b, WB6a, WB6b, WB7 and WB8 (and others as constructed). **Parameters:** Water quality – full laboratory analysis suite (See Table 7-3). **Analysis:** Comparison to NEPM and baseline water quality	To provide baseline water quality data and to identify water quality impacts.	Water quality exceeds NEPM guideline or exceeds baseline water quality (97.5th percentile of baseline data).	Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section 8.2.3. Notify agencies when exceedence becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
	(groundwater quality conducted up to and including the first two years of mining). **Frequency:** Quarterly for EC and pH. Annually for other water quality.				
Impact to Licenced Users	**Sites:** Neighbouring water bores, where accessible. **Parameters:** Water Level. **Analysis:** Comparison to baseline data. **Frequency:** Monthly	To ensure water supply to neighbouring water users is maintained.	Drawdown 30% greater than baseline data, sustained for 3 months.	Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section 8.2.3. Notify agencies when exceedence becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations. Water supply must be maintained to affected users.	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
Groundwater – Subsidence Effects					
Hydraulic conductivity	**Sites:** Vibrating wire piezometers P26, P27, P35 and P36 (and others as constructed at ends of panels, over panels and over chain pillars). Monitoring bores P15, P18, P19, P20 (and others as constructed at ends of panels, over panels and over chain pillars). Extenseometers to be constructed at ends of panels, over panels and over chain pillars. **Parameters:** Water level in all. In-situ hydraulic testing in monitoring bores and in all new bores or VWPs during drilling. **Analysis:** Comparison to predicted drawdown taking into account natural variations. Horizontal and vertical permeability compared to values used in groundwater	To identify changes (pre and post mining) in permeability and provide data for on-going review and recalibration of groundwater predictive models. To obtain site-specific data on fracturing behaviour and extent in overlying strata.	Drawdown greater than 15% above predicted trend in VWPs and monitoring bores, or permeability greater than upper limits used in sensitivity analysis in groundwater model, or fracturing extends above Garrawilla Volcanics.	Engage hydrogeologist and/or subsidence specialist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section **Error! Reference source not found.**. Notify agencies when exceedance becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	Environmental Officer.

	Monitoring		Response		
	Methodology	**Purpose**	**Trigger**	**Action**	**Responsibility**
	model. **Frequency:** Manual monitoring of groundwater bores weekly from commencement of adjacent longwall panel, increasing to daily from one month before longwall approach continuing until 3 months after longwall pass, otherwise as for 'Groundwater Levels – Permian to Jurassic hard rock aquifers'. Automatic groundwater level monitoring of VWPs every 4hours (downloaded monthly) from commencement of adjacent longwall continuing until 6 months of longwall pass, otherwise as for 'Groundwater Levels – Permian to Jurassic hard rock aquifers'. In-situ hydraulic testing of monitoring bores 3 months after passing of longwall. Insitu hydraulic testing during installation of new and replacement bores or VWPs.				

8.4 Management Plan Review

As specified in SoC 6.14 and 6.15, six months after the commencement of longwall mining, Narrabri Coal will complete an initial audit of the groundwater model predictions against monitoring data. Following the recalibration of the groundwater model, the Water Management Plan will be updated to include forward impact predictions.

8.5 Unforeseen Impacts Protocol

Table 8-2 outlines the procedure to be followed (in general accordance with the criteria exceedance protocols detailed in **Section 6** and **Section 7**) in the event that any unforseen surface or groundwater impacts are detected.

Table 8-2 Unforeseen Impact Procedure

Stage	Procedure
1	Review the unforeseen impact including consideration of: • Any relevant monitoring data; and • Current mine activities and land management practices in the relevant catchment
2	Commission an investigation by an appropriate specialist into the unforeseen impact, if considered appropriate by the Environmental Specialist.
3	Develop appropriate ameliorative measures based on the results of the above investigations, in consultation with the relevant authorities.
4	Implement additional monitoring where relevant to measure the effectiveness of the improvement measures.

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URS (2007) *'Report for Evaporation and Storage Dams, Narrabri Coal Pit Top Infrastructure'*, Report prepared by URS Pty Ltd for Narrabri Coal Pty Ltd.

WRM (2009) *'Narrabri Coal Mine Stage 2 Longwall Project Surface Water Assessment' Prepared by: WRM Water & Environment Pty Ltd November 2009 (Environmental Assessment (R.W. Corkery & Co. 2009) Specialist Consultant Studies Compendium Volume 1, Part 3)*

WRM (2008) *'Narrabri Coal Project Surface Water Management Plan'* prepared by WRM Water & Environment Pty Ltd for Narrabri Coal Pty Ltd

Note:

Reference has been made throughout this report to the Department of Environment and Climate Change (DECC), however the department has been recently renamed to the Office of Environment and Heritage. All reference material and guidance is still applicable to the new department.

9 Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Narrabri Coal Operations Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 01/04/2011.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 01/04/2011 and the 09/05/2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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Appendix A - IFD Table

DURATION	1 Year	2 years	5 years	10 years	20 years	50 years	100 years
5Mins	73.1	95.7	126	146	173	210	241
6Mins	68	89.1	117	136	161	196	224
10Mins	55.5	72.7	95.7	111	131	159	182
20Mins	40.7	53.3	69.9	80.8	95.4	116	132
30Mins	33	43.2	56.6	65.4	77.2	93.7	107
1Hr	21.9	28.6	37.6	43.4	51.2	62.1	71
2Hrs	13.6	17.9	23.6	27.2	32.2	39.2	44.8
3Hrs	10.2	13.3	17.6	20.4	24.2	29.5	33.8
6Hrs	6.09	8.01	10.6	12.4	14.7	18	20.7
12Hrs	3.68	4.85	6.49	7.59	9.04	11.1	12.8
24Hrs	2.27	2.99	4.03	4.72	5.64	6.95	8.01
48Hrs	1.38	1.82	2.47	2.89	3.47	4.29	4.95
72Hrs	0.988	1.31	1.78	2.09	2.51	3.11	3.6

Source: Australian Bureau of Meteorology (Latitude :-30.521039 Longitude :149.908509)

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Appendix B – Implementation of Previous Comments

Comments from OEH (29/09/11)

The following email records the response from OEH regarding the Site WMP. No action was taken.

From: Turnbull Kharl [Kharl.Turnbull@environment.nsw.gov.au]
Sent: Thursday, 29 September 2011 3:00 PM
To: Steven Farrar
Cc: OHern Robert
Subject: Narrabri Mine Stage 2 Development Consent

Hi Steven

As just discussed, thank you for forwarding the following Management Plans for our records:

- Narrabri Mine Stage 2 Energy Savings Action Plan
- Narrabri Mine Stage 2 Landscape Management Plan
- Narrabri Mine Stage 2 Noise Management Plan
- Narrabri Mine Stage 2 Aboriginal Cultural Heritage Management Plan
- Narrabri Mine Stage 2 Air Quality Monitoring Plan
- Narrabri Mine Stage 2 Water Management Plan

The Office of Environment and Heritage (OEH) encourages the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, we do not approve or endorse these documents as our role is to set environmental objectives for environmental/ conservation management, not to be directly involved in the development of strategies to achieve those objectives.

Should you have any further enquiries please do not hesitate to contact me.

Regards

Kharl Turnbull
Regional Programs Officer
Environment Protection and Regulation Group
Office of Environment and Heritage
Department of Premier and Cabinet
PO Box 494 (85 Faulkner St) l Armidale NSW 2350
Phone (02) 6773 7000 l Fax (02) 6772 2336

Version F2 Addresses Comments from NSW DoPI (2/11/11)

1. Page 26, last para - Units for permeability are m/sec rather than m/day?
   Corrected
2. Table 6-1 - I suspect the number of oil and grease samples tested was 23 rather than 2?
   Corrected
3. Page 56, last para and page 62 - Reference to an AEMR should be to an Annual Review.
   Corrected throughout the report
4. Please check references to the Department of Primary Industries throughout the document. I am not sure whether this is a reference to the NSW Office of Water within the DPI or to the Division of Resources and Energy (DRE) within DTIRIS but which used to be I&INSW within the former DPI?
   References changed to NSW Office of Water
5. Section 8.1 and also 2 references within Table 8.1 - I suspect that this protocol should indicate that all relevant agencies should be notified as soon as practicable , rather than within 7 days, especially as the seventh dot point advises that written advice is to be provide with 6 days.
   Now state to notify “as soon as practicable”. Also changed seventh dot point to offer further notice of works carried out, if not included in original communication.

Version F3 Addresses Comments from NOW (2/11/11)

1. Site Water Balance – Schedule 4 (14)

(a) Water licensing legislation and policy requirements for project site

The project site is located on Lots 151 and 152 DP816020, Lots 60 and 115 DP757124 and Lots 381 and 382 DP10228753 as indicated in s.1.1 of the Water Management Plan (WMP) (Attachment B). The land area within the mine site boundary (Attachment B) is subject to a groundwater embargo under s.113A of the Water Act 1912 (WA) (NSW Government Gazette No.159A, 22 December 2008, pg 12947). In addition, the mine site area is subject to a surface water embargo under s.22BA of WA (NSW Government Gazette No. 35, 17 March 2006, pg 1420). The project site will be under the proposed Water Sharing Plan (WSP) for the Namoi Unregulated and Alluvial water sources which is still under development. Further, the area will be subject to the proposed WSP that will cover the groundwater management area Gunnedah Basin (Porous Rock). On the western side of the mine site, the project site boundary is partly within the WSPs for the NSW Great Artesian Basin Groundwater Source 2008. The eastern mine boundary is 1.5 km from the western boundary of the Upper and Lower Namoi Groundwater Sources 2006 (Attachment B). The watercourses within the project site are tributaries of the Namoi River and the eastern boundary of the property is approximately 4 km from the Namoi River which is under the WSP for the Upper Namoi and Lower Namoi Regulated River Water Sources 2003.

Noted

The proponent must be aware of the following NSW Government water legislation, policy and licensing requirements. All works that intercept groundwater for monitoring, dewatering and test purposes are authorised under Part 5 of the Water Act 1912 (WA) until such time the NSW Government Aquifer Interference Policy has been finalised and s.91(3) of the WMA is enacted. The proponent must comply with the harvestable rights orders under Chapter 3, Part 1, div.2, s.54 of WMA with respect to the construction or use of a dam on land within the harvestable rights area constituted by the order. Any dams used solely for the purposes of capture, containment and recirculation of drainage and/or effluent, surface water erosion and sediment controls are defined as a "excluded work" under the WMA and are exempt from the requirement for an access licence under the Water Management (General) Regulation 201 1 (WMR) (Part 2, div.2, c1.18), water use approval (Part 3, sub div.2, c1.31) and a water supply work approval (Part 3, sub div.3, c1.36). In addition, activities in accordance with the harvestable right order in connection with the construction and use of the dads on land within the harvestable rights area are exempt from requirement of a control activity approval (Schedule 5, Part 2, 20, WMR). The "excluded work" must be constructed on a minor stream (i.e. < 3'* order) under Chapter 3, Part 1, s.53(l)(b) of the WMA or off-river. Notwithstanding the above, an exemption for the requirement for a water management work and use approvals under the Water Management Act 2000 (WMA) (Chapter 3, Part 3, div.2, s.92) exists for Part 3A Major Projects under s.75U of Environmental Planning and Assessment Act 1979 (EP&AA), but an access licence is still required (Chapter 3, Part 2, div.2, s.61, WMA). However, for the majority of the land area covered by the mine site boundary (Attachment B) the licensing requirements are governed by the WA until such time the proposed WSPs for surface and groundwater sources have commenced.

Noted

The proponent holds access licences and/or water supply work approvals for the take of water, which are governed by the rules of the WSPs mentioned above and may be used as an external water source for the project as shown in Attachment C. A new water supply work approval will be required only if there are changes to the authorised works (e.g. increase in the number or capacity

of pumps). It is optional to amend the existing combined approvals (i.e. water supply works and use approvals) to include an additional purpose such as mining. No water supply work approval is required for the construction of a water pipe for use solely for conveying water from one place to another (e.g. between the mine site and the Namoi River) (Part 3, sub div.3, c1.34, WMR) and water use approval (Part 3, sub div.3, c1.35, WMR). Nevertheless, it is recommended the proponent contact NOW's Licensing Branch at the Tamworth office on (02) 6701 9600 to discuss any licensing arrangements that may be required and also State Water in Dubbo on 1300 662 077 following the issue of any new or amended water supply works approvals that affect the proponent's associated water access licenses in the WSP for the Upper Namoi and Lower Namoi Regulated River Water Sources.

Noted

(b) Sources and security of water supply

Table 5-1 of the WMP summarises the annual site water requirements for the Stage 2 Narrabri Coal Mine based on the water demand for longwall coal production from August 2011 for various purposes and life stages. The proposed purpose of water use are dust suppression (surface & underground), surface coal processing, potable use and estimates on water that will be recycled industrially and underground. Section 5.2.1 of the WMP discusses the various sources of water which include: pumped out mine water, Namoi River, groundwater (Namoi River sand beds), mine site run off/direct rainfall and underground recycle. The following requirements, modifications and amendments are recommended by NOW according to NSW Government legislation (WA and WMA), embargo orders, WSPs and relevant policies.

(i)Water balance modelling

Section 5.3 of the WMP states: "water balance modelling indicates that the onsite water requirements, given in Table *5-1,* would exceed the water that could be collected on-site and dewatered from the underground during the first *10*years of mining. During these years the excess demand will be met from the offsite supplies and therefore offsite transfers of water are not proposed at this stage? This is confusing as based on the figures in Tables 5-1 (i.e. annual mine site water requirement of 346 ML in yr 2) and 5-3 and rainfall runoff estimates in Section 5.2.5 (approximately 71 MLlyr on average) there should be enough onsite water for all water requirements by year 4 (337 MLlyr predicted groundwater inflows). If this is correct then offsite transfers will commence before year 10.

Document changed to state:
"Water balance modelling indicates that the onsite water requirements, given in **Table 5-1**, would exceed the water that could be collected on-site and dewatered from the underground during the first 5 years of mining. This assumes dry years where surface water cannot be relied upon as a water supply. During these years the excess demand will be met from the offsite supplies and therefore offsite transfers of water are not proposed at this stage."
This is a conservative estimate and assumes dry years on site. It is possible that offsite transfers may be required before this time.

(ii)Water Allocations

Attachment C shows the licences that pertain to the mine site boundary (Attachment B) and other licences held by the proponent which are also mentioned in Table 5-2 of WMP. Following the review of NOW's internal and NSW Government Land and Property Information (LPI) databases it was apparent that (Attachment C):

1. WAL7411 has been cancelled and subdivided (Table 5-2). The WAL held by Narrabri Coal Operations Pty Ltd (NCOPL) is WAL20152 (Attachment C).
2. The approval 90CA807192, access licence 90AL807191 and WAL14515 are not held in the name of NCOPL. Further, the access licence is categorised as supplementary water

and as such the access rights are subject to rules relating to that category under the WSP for the Upper and Lower Namoi Groundwater Sources 2006.

3. The combined approval 90CA807277 that is attached to 90AL807276 and WAL12833 is not held in NCOPL. The proponent must attach the access licence to a water supply work approval held in their name and detach from combined approval 90CA807277.
4. As indicated in the comments column of Attachment C a number of licences must be transferred to NCOPL or decommissioned. In the cases where NCOPL are not the owner of the land proof of occupancy must be supplied (e.g. a mining lease that covers the land over the site of the bore).
5. NCOPL must submit to NOW Licensing Branch a number of Form "As as indicated in Attachment C.
6. The WAL6762 and WAL20131 (Attachment C) have been excluded from Table 5-2 of WMP.

NOW advises the proponent address the issues raised 1 to 6 above with NOW's Licensing Branch located at the Tamworth office.

Discussions have been held and the agreed list of licences is now included in the document.

As shown in Attachment C the available water from external sources amounts to 1146 ML not 1123 ML as indicated in Table 5-2 (pg 37) of WMP. Furthermore, the combined approval (90CA802130) held by the proponent is also linked to a number of access licenses and WALs. The proponent needs to clarify which water supply work approvals are proposed to be used and the associated access licences and WALs from all offsite allocations including the relevant water source and WSP.

Included the bores provided in Attachment C of comments. Not included bore 90AL807191/90CA807192 which is not held by NCOPL.

In s.5.1 of the WMP it is mentioned that a true indication of water requirements will not be apparent until the first 12 months of production, which will enable a more rigorous assessment of water use against predictions. The proponent must contact NOW's Licensing Branch at the Tamworth office if there are changes to water demands that result in the increase in water usage onsite or require more access from external sources.

Noted. Included sentence to state that NOW will be notified if there are differences.

In s.5.2.4 on pg 38 of the WMP it is stated: "gas extraction from above the coal seam is currently underway. Groundwater from Gas extraction from the above coal seam has been recorded as on site as approximately 100 ML/year. This is a component of the total groundwater inflows estimated above." Although, the 100 ML pumped is considered to be part of the licence 90BL254679, licence 90BL254679 has property account 90PT982814 associated with it. 90BL254679 is for the excavation and groundwater pumped from the excavation. Each bore that is extracting groundwater as part of the gas extraction will have to be licensed as well and tied into property account 90PT982814.

Included a note to state that each bore will require licencing, with licence tied to the property account.

(iii)Mine inflow rates and dewatering activity

The licence 90BL246067 authorises an excavation for mining purposes with an entitlement of 818 ML (Attachment C). Table 5-3 in the WMP shows a maximum predicted mine in-flow of 1419 ML/annum by year 18 of production. This exceeds the volumetric entitlement authorised on-site by 601 ML/annum. Condition 4 of the licence states "the final entitlement will be determined by modelling exercise above but it will not exceed 818 ML': Therefore, the proponent will be required to transfer groundwater entitlement to the project site to meet the estimated in-flow rates in year 18 in accordance with the trading rules of the affected proposed WSPs for the area. Further, the

existing groundwater embargo does not exempt the proponent to make application under Part 5 of WA to cater for any increases in entitlement. However, an existing groundwater entitlement must be purchased on the water market and transferred to the property. Any water trade is not guaranteed and will require an assessment by NOW prior to approval. The WMP purports that due to the poor water quality in some geological formations intersected in stage 1 of mining, the pumped out mine water will be limited to surface dust suppression and coal processing or mixed with clean water for use underground. There is mention that groundwater of better water quality may be used from west of the site. The proponent will require an access licence from the affected water source; however, it is unclear where the extraction will occur and from what water source. The proponent must indicate which water source will be accessed, as the affected water source may be covered by either the proposed WSPs for the Namoi Unregulated and Alluvial and the Gunnedah Basin (Porous Rock) or the Great Artesian Basin.
The proponent must ensure groundwater pumped out of the mine is monitored during mining operations to refine in-flow rates, water quality and quantity (connected aquifer draw down levels). The groundwater monitoring plan should be in accordance with Condition 11 "Groundwater Monitoring Plan" of the 90BL254679. In addition, it is recommended that additional monitoring bores are installed to the east of the mine site to determine the level of hydrogeological link between the Namoi Alluvium and Gunnedah Basin formations.

Additional bores have been proposed across the site, including to the east of the mine. These are specifically targeted at assessing effects on the Namoi Alluvium.

Added to Section 5.2.3: Table 5-3 are estimates and will be refined as mining commences. It is not anticipated that the current licence will be exceeded until year 11 of mining. Once the estimates have been refined, further licencing will be sought from the water markets. Looking to purchase additional licences that access the Gunnadah Basin Porus Rock.

(iv) Runoff management on Mine Site

The WMP predicts that water storage dams and sediment basins may harvest 71 ML/annum on average from the Pit Top Area and that priority will be given to utilising mine site runoff for dust suppression and underground mining use. Dams that are solely used for the capture, containment and recirculation of drainage and or effluent and used for control and prevention of soil erosion do not require a licence under the WA and a water supply work and use approval under the WMA when the relevant WSPs commence. The use of water for dust suppression and the taking of water from or by means of an "excluded work" will be exempt from the requirement for an access licence. The proponent must ensure that when exercising the exemption for "excluded works" that the water captured in the dams are draining contaminated sites or otherwise the provisions of the farm dam policy will apply with respect to the construction and use of farm dams and utilisation of the maximum harvestable rights dam capacity (MHRDC) for the property. For example, any dams that are not draining contaminated sites or are not used solely for sediment and erosion control that are within the harvestable rights area will require a licence under the WA or access licence under the WMA (i.e. mining/industrial use) if they exceed the MHRDC for the property.
The dams that are defined as an "excluded work" are not considered in the calculation which derives the total volume of existing storages within the harvestable rights area. The proponent can utilise the MHRDC for the project site from dams proposed or constructed that are not defined "excluded works" to the capacity derived from the MHRDC for the property and use such dams for any purpose without the requirement for a licence.

Stated in Section 5.2.5 that the dams are environmental and do not count to the MHRDC. They also do not require a licence.

(v) Use of off-site water allocations

It is noted that the on-site water requirements will exceed the water that can be collected on-site and dewatered from the underground during the first 10 years. It is proposed that the difference will be met from offsite water allocations as shown in Attachment C.

However, currently the proponent proposes to use 925 ML from external sources. As mentioned above the proponent is required to address the issues in Attachment C and must clarify and inform NOW all approvals, access licences and WALs proposed to be used from external sources for the project.

Section 5.5.2: Clarified that the allocations identified in Table 5-2 will be used to make up deficiencies, should they occur.

(vi) Reporting Procedures

The reporting procedures as expressed in s.5.4 of WMP are to the satisfaction of NOW,

Noted.

2. Erosion and Sediment Control -Schedule 4 (15)

It is stated in s.4 (pg 30) of WMP that the erosion and sediment control plan that was developed for the construction phase of the project is consistent with the Blue Book -Managing Urban Stormwater: Soils and Construction, Volume *l,4'h*Edition, 2004 (Landcom) ("blue book"), which was approved by the Director General. For stage 2 of the mining operation the proponent considers that the existing erosion and sediment control plan will not be altered.
Following the review of s.4 of the WMP, NOW is of the opinion that the erosion and sediment control provisions (a) to (e) in Schedule 4 (15) of the Project Approval have been addressed satisfactorily. NOW recommends any proposed or amended erosion and sediment controls structures must be consistent with the requirements of the "blue book". In addition, the construction of sediment dams must be in accordance with the Harvestable Rights policy and related sections under the WMA. NOW requires that all structural works including works for stormwater capture and treatment are to be located outside any riparian buffers; however, consideration may be given to the construction of on-line works on minor streams with adequate justification.

Noted.

Any stormwater management plan for the site must maintain environmental flows and inundation patterns in any affected watercourses so that post development flow match or better pre-development flows.

Noted.

3. Surface Water Monitoring Program -Schedule 4 (16)

NOW endorses the surface water monitoring plan but further enhancements and recommendations need to be addressed by the proponent. The proponent must develop an extensive surface water monitoring plan to the satisfaction of NOW prior to the commencement, during and for an appropriate period following the finalisation of longwall mining. The monitoring program must monitor the potential impacts of the proposal on watercourses within and adjacent (upstream and downstream) of the mine site. In particular, NOW has concerns with respect to the impacts of the mine on the hydrological regime and geomorphology of streams adjacent and within the project site. NOW insists that the monitoring plan must be adequate and implemented prior to longwall mining and address the following issues on affected watercourses: loss of baseflows, changes to stream slope or gradients, channel diversion and redirection of streamflow.
NOW recommends baseline monitoring at a frequency of fortnightly sampling within and adjacent to the development site to a standard satisfactory of the Office of Environment and Heritage (OoEH) and NOW from both affected streams and storages. NOW recommends that the water quality standards are compared against thresholds outlined in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECCIARMCANZ 2000) and that the appropriate physical and chemical parameters are measured including the measurement of streamflow. Further, the treated surface water quality is to equal or better the receiving waters and any stormwater discharges must have a neutral or beneficial impact on all affected water sources.

The proponent must ensure that discharge and monitoring is in accordance with Environment Protection Licence (EPL) 12789.

The ephemeral nature of the surface flow makes fortnightly monitoring impractical. This is also true of flow measurements that would require significant effort to record reliably but would only be of limited value. Additional surface water monitoring points included (in line with Extraction Plan WMP). Frequencies adjusted to reflect the recommendations of NOW.

The procedures for reporting and contingency measures for any exceedance of physical and chemical parameters outlined in s.6.6 of WMP are considered by NOW as satisfactory.

Noted.

4. Raffinate Discharge and Transfer Control and Monitoring Plan -Schedule 4 (17)

It is noted in Schedule 4 (13) of the Project Approval that The Raffinate Discharge and Transfer Control and Monitoring Plan does not need to be produced and approved until 3 months prior to the planned discharge or transfer of raffinate from the site. The proponent must contact NOW on completion of the draft plan and forward the document for review.

Noted.

It is mentioned that after 10 years of mining, discharge of raffinate water will be required. The management options for excess water discharged are summarised in s.5.3 of WMP (pg 39). NOW discourages the release of water via a pipeline into the Namoi River. NOW prefers other options such as the use of the water on other mine sites or transferring the treated water to primary producers for agricultural use and town water supply utilities (e.g. water supply to the township Baan Baa). Notwithstanding NOW'S preferred option, any raffinate discharged to the Namoi River must comply with the conditions of an EPL and meet water quality test standards to the satisfaction of NOW and OoEH. Furthermore, all discharge of raffinate must be authorised by an EPL under the Protection of the Environment Operations Act 1997(PoEOA). In preparation of the proposed raffinate discharge and transfer control and monitoring plan, the proponent must include provisions to implement an ambient water quality program upstream and downstream of all discharge points.

Additional comments in Section 5.3 to acknowledge NOW's preferred option and ensure that released raffinate meets the conditions of an EPL that considers its release.

5. Groundwater Monitoring Program -Schedule 4 (18)

NOW finds the groundwater model applied is adequate and that there may be possible impacts from mine development to the groundwater regime; however, there are large uncertainties associated with these predictions. It was recommended that an extensive monitoring network is implemented to ascertain any fluctuations in groundwater as mining proceeds. This will also allow an update of model calibration/verification to enable further re-runs of prediction scenarios if necessary. The modelling network should expand to include all formations at nested sites both adjacent to and within the mine site. Targeted aquifers include but not restricted to the Hoskinssons Seam, Great Artesian Basin and Namoi Alluvium. Lines of monitoring bores between the mine and the Namoi Alluvium are required to determine if any leakage from the Namoi Alluvium to the mine will result or once mining commences does occur. NOW recommends the proponent review the groundwater model after 3 years from the date mining commences utilising all groundwater monitoring data collected. This includes re-running predicted scenarios for drawdown and brine reinjection following commencement of longwall mining. The mining operations may need to be modified if the model review shows impacts greater than shown in the EA.

S7.2, New description of the monitoring network including planned expansion. New table 7-1 and new figure 7-1. S7.8, stated that the model will be recalibrated 12 months, 3 years and 5 years after mining commences. Then every 5 years.

As acknowledged by the proponent in the WMP, NOW has previously recommended the installation of additional monitoring bores to further establish the hydrogeological link between the

Namoi Alluvium and the Gunnedah Basin and any impacts on the Great Artesian Basin. Furthermore, NOW stresses the necessity for baseline monitoring at a preferred frequency of fortnightly sampling of groundwater quantity and quality for all aquifers within and adjacent to the development site, which in most cases is contrary to the monitoring schedule in s.7.4 (pg 54) of the WMP. However, NOW acknowledges and supports the proponent's plan to review after the first two years of operation, the frequency of monitoring and the range of parameters analysed.

Additional monitoring, as agreed with NOW, described in S7.2. S7.4 water level measurements changed to fortnightly (quarterly when stable flow identified), and also in table 7-4.

The WMP (s.7.2, pg 47) mentions a number of monitoring bores that are proposed to be utilised or installed. For example, s.7.3.1 of WMP mentions 25 standpipe bores, 7 vibrating wire bores and 11 registered bores are used to assess groundwater levels/pressure, while the standpipes are also used for sampling for groundwater quality. The proponent must ensure that all monitoring bores have been licensed accordingly and that access and landholder's consents have been granted if bore locations are offsite. Attachment B and C show the licensed bores on the project site. The proponent must contact the Licensing Branch at the Tamworth office of NOW if further information is required regarding licensing unauthorised bores or amendment to existing bore licenses.

S7.2, New description of the monitoring network including planned expansion. New table 7-1 and new figure 7-1.

NOW'S preferred outcome is that no induced hydraulic coupling occurs between the underlying hard rock and the Namoi River Alluvium (i.e. drainage of alluvium) as a result of underground mining operations and subsequent subsidence impacts. The WMP suggest that the proponent will incorporate a more comprehensive monitoring program to assess subsidence impacts from the longwall mining operation as they develop. In addition to the proposed multi-level vibrating wire piezometers and extensometers. NOW endorses the implementation of engineering structures (e.g. impermeable cut-off structures) designed and implemented to the applicants cost and to the satisfaction of NOW. The proponent will require a licence for any unforeseen drawdown resulting from groundwater pumping at the mine site or subsidence impacts causing the displacement of the Namoi Alluvial waters. The licensed volumetric entitlement is to be equivalent to the volume of the groundwater affected.

S7.2. Improved monitoring network in place and further improvements planned and agreed with NOW. Noted need for licencing.

No engineering structures currently employed but included as potential response in Section 8.2.3. This will only be considered should monitoring suggest this action is appropriate.

The proponent indicates in s.7.4 of the WMP that the integrity of the low permeability of lining of the storage ponds will be assessed by bores in the area around the rail loop bordering the ponds to ensure the ponds are preventing any release of brine to any ground or surface water sources that may be affected. NOW finds the program to monitor, detect and quantify any leakage/leachate from the site's evaporation/storage ponds is satisfactory. NOW advocates that the proposed additional groundwater monitoring points are implemented prior to planning and construction of the additional brine storage/evaporation ponds. Further, as part of the Statement of Conditions (SoC), the proponent must ensure a program is in place to monitor the coal reject emplacement area as specified in SoC 3.1 1 and 3.17.

Noted.

Nothing currently in place; will install monitoring around brine and emplacement area.

NOW is satisfied the proponent has addressed adequately the procedures for reporting the results of parameters measured, frequency of monitoring and groundwater modelling, including an organised internal approach to data management and monitoring documentation, which will identify potential issues and provide a path to appropriate contingency actions if required. NOW supports the commissioning of an experienced hydrogeologist to oversee and review monitoring data and groundwater modelling.

Noted.

Notwithstanding the above considerations and recommendations. NOW advises the proponent meet with hydrogeologist Martin O'Rourke from the Tamworth office and representatives from the

Major Projects and Assessment Unit of NOW to discuss the following pertinent issues and concerns with respect to the groundwater monitoring program presented in the WMP:

1. Table 7-1 was revised on the 30 June 2011 but the water levels are for September 2008. More up to date results should be presented in the plan.

   New water levels in the updated table.

2. The list of bores in Table 7-1 is the same as a list that was provided to NOW on the 28 May 2010 after discussions with NCOPL on its monitoring bore network at the time. It was advised to NCOPL in the above discussions that the monitoring bore network was inadequate in that there were no monitoring bores between the mine and the Namoi Alluvium, and bores to the full depth of the mine on the western side with screens in all aquifers. Therefore, NOW considers the WMP has not addressed the inadequacies of the monitoring bore network that was highlighted to NCOPL over 12 months ago.

   Monitoring network has been updated in discussion with NOW. New table 7-1 and new figure 7-1 show the latest state of the network.

3. Section 7.4 (pg 54) discusses a lot about what NCOPL proposes to do with respect to the monitoring schedule but fails to present the groundwater data that has already been gathered since the commencement of the project. NOW would like to discuss and peruse all parameter that have already been gathered including the reporting and peer review process.

   Report states that all monitoring is contained in the Annual Environmental Management Report. Also added that data is published on the website within two weeks

4. Section 8.2 (pg 65) mentions reporting to OoEH and DoPI, but NOW recommends they also be included in the reporting procedure.

   Replaced reference to DoPI to NOW.

5. The Trigger column shown in Table 8-1 (pg 67) mentions Alluvium/Colluvium Piezometers. NOW would like to discuss how NOCPL intend to distinguish between the impacts of mining activity and neighbouring irrigators on NOW monitoring bores.

   Included in Section 7.6.2: Vibrating wires in alluvium and units below allow effects on the groundwater levels to be assessed and identify impacts that may be related to mining activity.

Version F4 Includes relevant comments from the Extraction Plan WMP and includes these comments as an appendix

The following comments were made for the Extraction Plan WMP, but are considered applicable to this report:

There is reference to monitoring water level - monitoring of d/s catchment flow would also be useful.

It is impractical to measure water level/flow due to the ephemeral nature of the watercourse. Note added to Section 6.1 and reference removed from Table 6-2.

States that gas monitoring will be undertaken continuously - gas monitoring of what and where and purpose.

Removed reference to gas monitoring.

The description of adjacent aquifers fails to differentiate the alluvial aquifer associated with the Namoi River (Upper Namoi Zone 5, Namoi Valley (Gin's Leap to Narrabri) Groundwater Source) from the shallow alluvium/colluvium and weathered rock (regolith).

Updated the paragraph to better represent the groundwater flows in the area. Information from the Aquaterra Groundwater Report (Stage 2 EA, SCSC).

The management plan mentions monitoring of mine inflow rates. However, no mechanisms for metering of these inflows, monitoring locations and reporting requirements are included. These should be included to demonstrate Whitehaven's compliance with its obligations under S 91H of the Water Management Act 2000. This should include both mine workings, dewatering bores and gas drainage and other bores located on the site.

Section 5.2.3 – Included note on location of mine water measurement and reporting.
Section 5.2.4 – Included note on gas extraction water measurement and reporting.

The TARP has been totally re-worked to bring it in line with the template agreed for the Extraction Plan WMP.

Version F5 Includes further comments from NSW DoPI (04/03/2013)

Modify section 2.2 Subsidence related water management which refers to the extraction plan as still being developed. This should be changed to refer to the approved EP water management plan for long wall panels LW101 to LW 105.

Reference changed.

The EP WMP includes additional monitoring to be undertaken and included in the TARP tables that are not included in the main WMP (eg. ponding/change in geomorphological condition). These should either be included in the overall site water management plan OR state that these additional components are specifically addressed in the EP water management plan with a reference to the title of this document and how they are related.

Sections in Chapter 8 re-ordered for clarity. Additional elements of the subsidence related TARP now included in this document and shaded grey for distinction. A note has also been included in Section 8-3 to explain this.