Illawarra Coal

Dendrobium

DSC Notification Area

Avon and Cordeaux Reservoirs DSC Notification Area Management Plan

Review History

Revision	Description of Changes	Date
Monitoring Plan DENMP003		
Revision 7	Final Plan for Area 1	01/06/05
Revision 8	Plan updated to include Area 2	30/03/07
Revision 9	Final Plan incorporating Area 2	20/10/07
Revision 10	Rewrite and updated to include Area 3A Incorporate DSC and Water NSW comments Incorporate additional DSC and Water NSW comments Revised Mine Plan Area 3A and DSC Comments	27/11/09 15/01/10 10/03/10 06/04/10
Contingency Plan DENMP0049		
Revision 1	Final revision for Area 1	20/07/05
Revision 2	Draft Revision to Accompany Area 2 Application	30/03/07
Revision 3	Final Revision to incorporate Area 2	20/10/07
Revision 4	Rewritten and updated to incorporate Area 3A Incorporate DSC and Water NSW comments Incorporate additional DSC and Water NSW comments Revised Mine Plan Area 3A and DSC Comments	27/11/09 14/01/10 10/03/10 06/04/10
Revision 5	Revised to incorporate contingency for Dendrobium Dyke	22/02/11
Closure Plan DENMP0030		
Revision 1	Final for Area 1	01/06/05
Revision 2	Draft incorporating Area 2	30/03/07
Revision 3	Final incorporating Area 2	20/10/07
Revision 4	Rewritten and updated to incorporate Area 3A Incorporate DSC and Water NSW Comments Incorporate additional DSC and Water NSW Comments Revised Mine Plan Area 3A and DSC Comments	27/11/09 14/01/10 10/03/10 06/04/10
Management Plans DENMP0078		
Revision 0 Draft 2	Monitoring, Contingency and Closure Plans were updated after review and consolidated into one document	26/9/11
Revision 0 Draft 3	Revised to incorporate Annual Review, revised TARP, updated responsibilities and to include Area 3B	5/10/12
Revision 0	Final Endorsed by DSC	12/12/12
Revision 1 Draft 1	Revised to incorporate results of Annual Review	22/05/14
Revision 1	Revised to incorporate DSC correspondence 15/07/14	25/11/14
Revision 2	Revised following review of Management Plan	17/08/15
Revision 3	Rewrite and Update following review	09/10/15

Revision 4	Review and Update requested by DPE 25/10/17	14/11/17

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2 INTRODUCTION

South32 Illawarra Coal is mining the Wongawilli Seam in Area 3B, workings include development of roadways and longwall extraction. Extraction of Longwalls 9, 10, 11 and 12 are complete in Area 3B

and Longwall 13 commenced extraction in March 2017. Dendrobium has previously extracted Longwalls 1 and 2 in Area 1, Longwalls 3 to 5 in Area 2 and Longwalls 6 to 8 in Area 3A. Area 3B is located to the east of Lake Avon, between the Native Dog Creek arm of the Lake and Wongawilli Creek, and is partially located within the Dams Safety Committee (DSC) Notification Area for Avon Reservoir (DSC Notification Area). Dendrobium has DSC approval for the extraction of Longwall 14 and Department of Planning and Environment (DPE) Subsidence Management Plan (SMP) Approval for the extraction of Longwalls 14 and 15.

As was the case for Areas 1, 2 and 3A, none of the current or proposed Area 3B mine workings underlie any dam wall and no longwall extraction is undertaken below stored waters of Avon or Cordeaux Reservoirs. Longwalls 9 and 10 are outside the Avon DSC Notification Areas and Longwall 11 is just inside the Area (refer to Plan 1). Longwalls 14 to 18 are set back from the Avon Reservoir Full Storage Level (FSL) by a minimum of 300m. The development headings known as Nebo Mains between Areas 1 and 2 and North West Mains between Areas 2 and 3A pass directly below the stored waters of the Cordeaux Reservoir.

To gain and maintain approval for mining within the DSC Cordeaux Notification Area, Illawarra Coal is required to implement the Avon and Cordeaux Reservoir DSC Notification Area Management Plans (Plan).

The Plan describes the monitoring, contingency and closure requirements for the Avon and Cordeaux Reservoirs Notification Areas and has been developed in accordance with the relevant provisions of the Dams Safety Act 1978, to minimise the loss of reservoir water because of mining within the Notification Areas.

This Plan will be applied in conjunction with the Mine Health and Safety Management System and may be influenced by or have influence on other Management Plans and procedures, including:

- DSC4C – Mining Near Prescribed Dams Management and Monitoring Matters
- DSC4D – Mining Near Prescribed Dams Contingency Plans
- DSC Annexure ‘D’ and ‘D1’ conditions and Annexure E for the relevant Avon and Cordeaux Reservoir DSC Notification Areas
- Inundation or Inrush of any Substance Principal Hazard Management Plan (DENMP0005) Strata Failure Management Plan (SFMP)
- SMP

Figure 1 describes the interrelationship between the Management Plans.

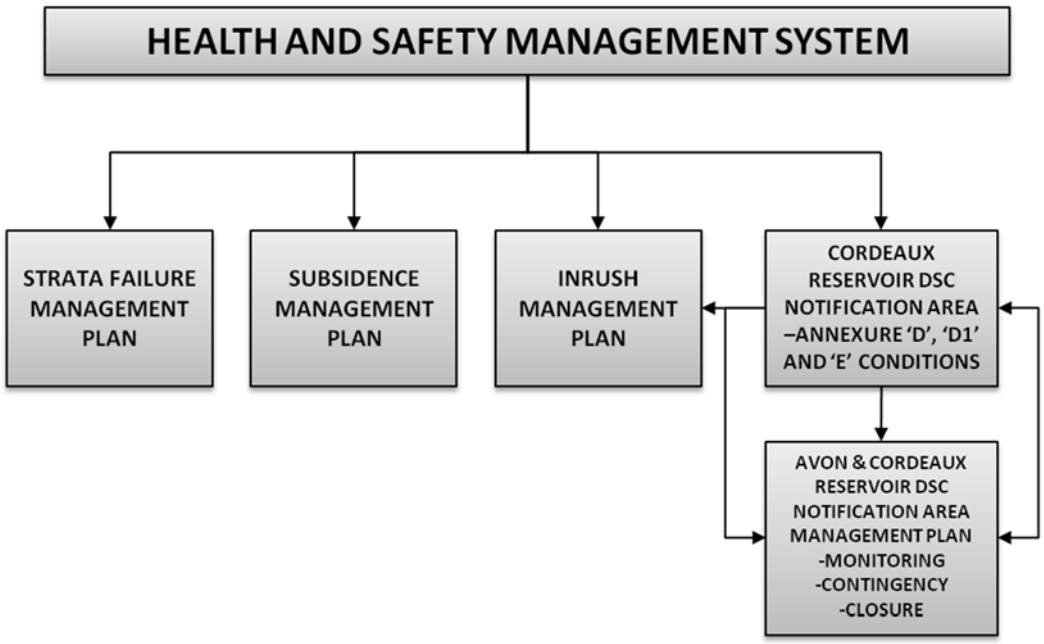


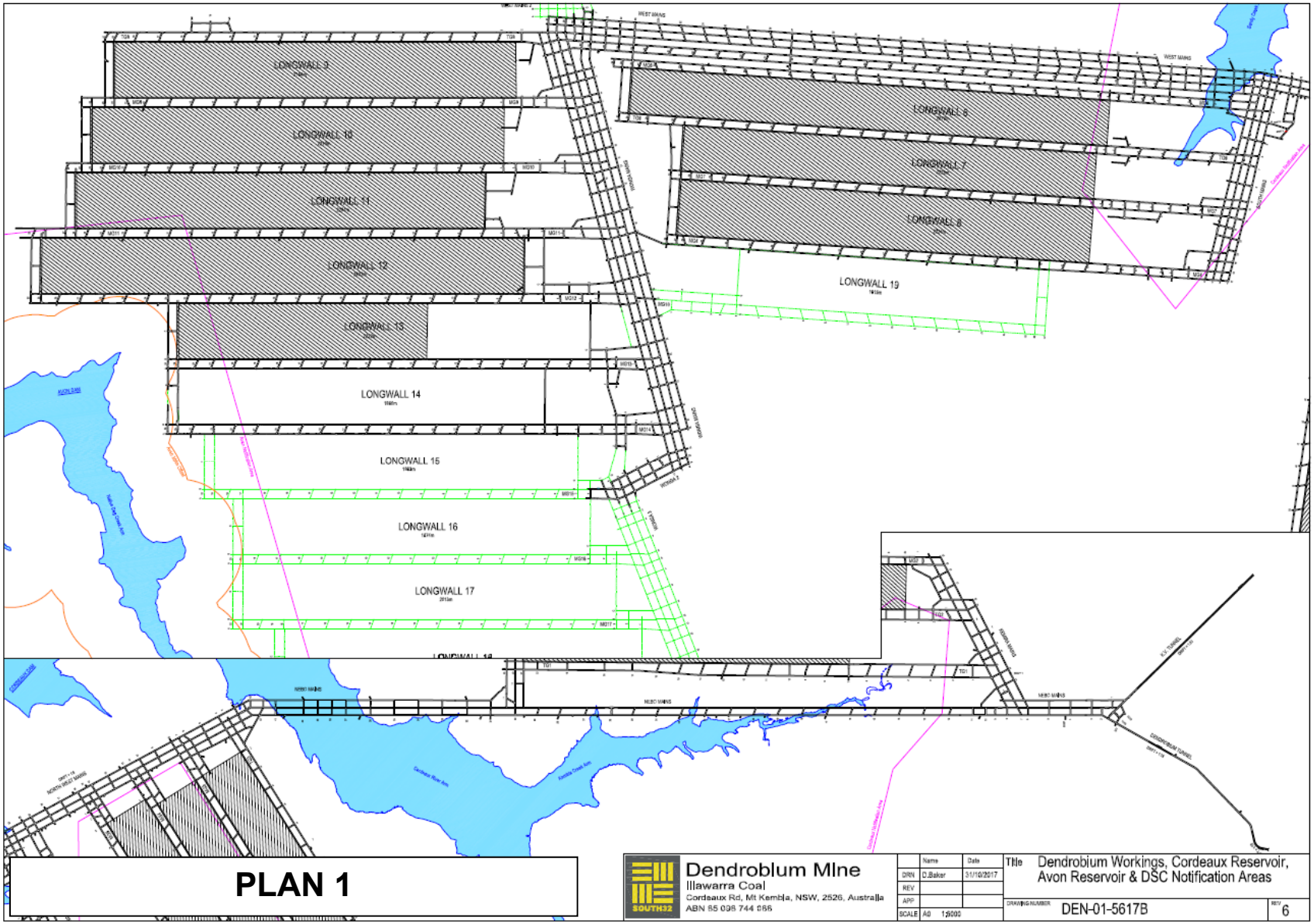
Figure 1 – Dendrobium Coal Health and Safety Management Structure

3 PURPOSE

The purpose of the Avon and Cordeaux Reservoirs DSC Notification Area Management Plan is to define the standards, procedures and responsibilities required to:

- Clearly describe the monitoring requirements to detect potential impacts on the Cordeaux and Avon Reservoirs,
- Maintain a system for effectively managing the risk of inflow of stored water into the Mine, and
- To protect the long-term security of the dams and stored waters from any deterioration that may be caused directly or indirectly by operations associated with Dendrobium Mine.

The Cordeaux and Avon Reservoirs, DSC Notification Areas and mine workings are shown in Plan 1.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LONGWALL 8
PLAN 1
Dendroblum Mlne
Illawarra Coal
Cordeaux Rd, Mt Kembla, NSW, 2526, Australia
ABN 65 098 744 055
Title
Dendrobium Workings, Cordeaux Reservoir, Avon Reservoir & DSC Notification Areas
DEN-01-5617B
6

4 SCOPE

This Plan applies to all development and longwall extraction – i.e. first and second workings within the DSC Avon and Cordeaux Reservoirs Notification Areas and other underground areas and operations at Dendrobium Mine (existing and proposed Dendrobium Mine workings - Plan 1).

5 DEFINITIONS

Abnormal Inflow – a confirmed or suspected flow of water into the Mine workings from any source that is in excess of that normally attributable to the water 'make' from the seam, surrounding strata, rainfall events and mining operations, during the drivage of roadways or longwall operations. In particular, any flow of water from a geological structure encountered during mining or a flow that commenced in outbye workings for no apparent reason.

ATM – Authority to Mine

CI – Chief Inspector

Cross Measure Hole – a hole drilled from one seam to intersect another seam to determine interburden thickness or to drain water

DCI – District Check Inspector

DPE – Department of Planning and Environment (including Resources and Geoscience - previously DTI)

DSC – Dams Safety Committee

DSC ICZ – Inrush Control Zone – an area of workings delineated by the DSC that require further investigation prior to gaining approval to develop or extract in that area. This exists only within the DSC notification area.

In-seam drilling – drilling conducted from and within the working seam, in advance of mining, to detect or confirm geological features and/or anomalies, determine in-situ gas make, and to identify and quantify water bearing strata.

FSL – Full Storage Level

Geological Structure – a geological discontinuity which may be capable of providing a conduit for water or gas into the mine workings, e.g. fault, dyke, diatreme.

Hydraulic Seals – the permanent seals erected for the sealing of the mine either at the cessation of mining or should contingency measures fail to control stored water inflows.

IMP – Inrush Management Plan

IM – Inspector of Mines

Inflow – Ingress of water that is of operational nuisance value and may be high velocity, low volume, or high potential volume but of low delivery rate. Inflows in relation to water emanating from Avon or Cordeaux Reservoir, whilst insignificant from an inrush perspective, are critical in relation to DSC requirements and are addressed in the Contingency Plan.

Inrush – "unplanned or uncontrolled flood of liquid, gas or material that has a potential to create a hazard" as defined by the Coal Mines Health and Safety Regulations 2006.

Inrush Control Zone (ICZ) – a 50 metre zone of solid strata around a potential source of inrush.

Inrush Hazard – involves the existence of a significant quantity of water or other fluid material, any material that flows when wet or flammable or noxious gases, all possibly under pressure that can swiftly flow or release into or within an underground coal mine.

Long-term Limit (Cordeaux) - the DSC-imposed limit of daily water losses from Cordeaux Reservoir into Dendrobium Mine directly or indirectly resulting from Dendrobium mining operations for the life of the Reservoir following closure of the mine.

Long-term Limit (Avon) - the DSC-imposed limit of daily water losses from Avon Reservoir into Dendrobium Mine directly or indirectly resulting from Dendrobium mining operations for the life of the Reservoir following closure of the mine.

Man Made Feature – shafts, wells, pipelines, tunnels, quarries, repositories, dam or other earthworks.

Notification Area – is an area determined by the DSC which surrounds a Prescribed Dam and its storage. It is defined by straight lines joining a series of co-ordinates as set out in an order published in the NSW State Government Gazette. The Notification Area is drawn to include the structure (any dam walls and spillways), the stored water, and an area around these within which mining may have an effect on the Prescribed Dam or on the security of its stored water.

Prescribed Dam – means any dam or proposed dam specified in Schedule 1 of the Dams Safety Act, 1978.

Principal Monitoring Controls – The primary means of defining and initiating a response to abnormal water inflows.

Water NSW – Previously Sydney Catchment Authority

SCADA – Supervisory Control and Data Acquisition, the computerised system through which real-time data is monitored throughout the mining process.

Sealing of the Mine – using designed permanent Hydraulic Seals or bulkheads as final seals.

Secondary Monitoring Controls – Monitoring resulting in triggers that alert Mine Management to the potential for an abnormal inflow and that initiate low level alarms within the Principal Monitoring TARP.

Short-term Limit – the DSC-imposed limit of daily water losses from the Reservoirs into Dendrobium Mine during the operation of the mine.

SFMP – Strata Failure Management Plan

Stored Water – Water within the Reservoirs.

Surface Borehole - is a hole drilled from the surface that may or may not intersect the seam being mined.

Surface Feature – creeks, rivers, ponds, reservoirs etc.

TARP – Trigger Action Response Plan

Temporary Seals – the seals erected to control water as part of remediation activities under the Contingency Plan. The seals may be installed to manage water flow while other contingency activities are undertaken e.g. grouting.

Ventilation Seals – the seals erected during the normal course of operation to isolate a worked out area of the mine. These structures may contain water sampling and monitoring facilities but are not designed to withstand any significant head of water.

6 HAZARD IDENTIFICATION

The potential for water inflow to the mine from Cordeaux Reservoir has been the subject of considerable investigation and analysis to assess and mitigate the risk of inflow whilst mining in Areas 1, 2 and 3. The following risk assessments, reviews and gap analysis have been conducted:

- The Dendrobium Project Critical Risk Management Assessment 2001, Australian Coal Mining Consultants that identified the major inrush risks to the mine.
- GHD LongMac report June 2004 “Hydrogeological Interaction of Underground Coal Mining” that reviewed Area 1 potential inflow risks with mining.
- Hawcroft Miller Swan Consultants Risk Review undertaken in January 2005 that reviewed all data associated with Area 1.
- Hawcroft Miller Swan Consultants Risk Review undertaken in July 2005 to review data and assess the risks associated with the development of Area 2.

- Hawcroft Miller Swan Consultants Risk Review undertaken in October and December 2005 to review all data associated with Area 2 and update previous findings from Area 1 operations and identify risks associated with operating longwalls in Area 2.
- AXYS Consulting May 2008 Risk Assessment to review all data associated with Area 3A.
- HMS Consultants Australia, July 2009 Cordeaux Reservoir DSC Closure, Contingency and Monitoring Management Plan Audit.
- HMS Consultants Australia, October 2009 Cordeaux Reservoir DSC Closure, Contingency and Monitoring Management Plan Gap Analysis to review all data associated with Area 3A.
- AXYS Consulting Pty Ltd - Loss of Stored Water from Avon Reservoir, Risk Assessment Report (AR1664), Revision 3, 08 September 2016.

Notwithstanding previous assessments of Areas 1, 2 and 3 and to assist the Mine identify and control hazards associated with the loss of water and damage to the Reservoirs, the following hazards have been identified as potential causes for loss of water into Dendrobium Mine:

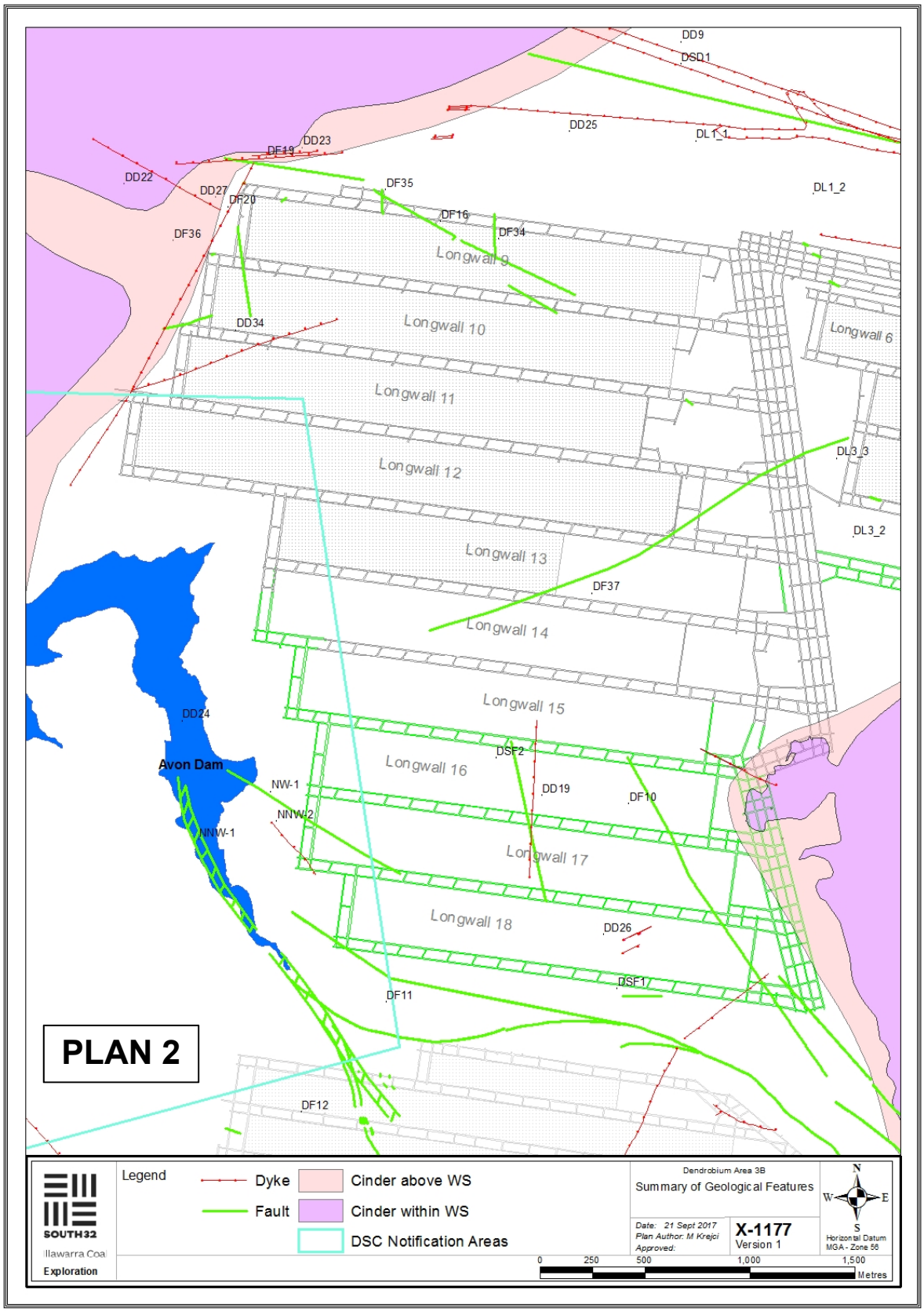
- Inflow from sub-vertical, through-going geological structure connected to the Reservoirs (such as diatreme, fault, dyke, fault associated with dyke, joint or joint swarm). A specific plan has been prepared for the potential inflow along the Dendrobium Dyke into Area 3A at the request of the DSC;
- Inflow from low angle through-going geological structure connected to the Reservoirs (faults, sills, bedding, bedding plane shears) resulting from intersection during extraction of longwall panels and goaf formation;
- Inflow through the longwall caved zone due to:
    - Intersection with high permeability strata or zones that connect with the Reservoirs, or
    - Inflow from fractures associated with valley closure and upsidence with high permeability zones, or
    - ‘Through going’ structure;
- Inflow through fractured rockmass associated with igneous intrusions, causing hydrogeological connection with Reservoirs;
- Inflow via abandoned exploration borehole(s);
- Underground mining in a regional context impacting on Reservoir walls;
- Seal bypass or failure as a result of increased head of water against seal or strata failure or leakage around seal resulting in outflow of stored water from the mine portals;
- Inflow through fractured rock mass associated with igneous intrusions, causing hydrogeological connection with the Reservoirs (e.g. Cordeaux Crinanite);

- Inflow through horizontal shear planes that exist naturally and others that are likely to form as a result of downslope movements associated with mining subsidence; and
- Failure of the IMP and/or the Contingency Plan to reduce flows to acceptable levels.

Prior to the installation of permanent hydraulic seals the Review Team will evaluate all closure options and recommend actions to be authorised by the DSC.

The potential for loss of Stored Water from the Avon Reservoir whilst mining Area 3B was considered in a risk assessment held in September 2016 which was conducted by AXYS Consulting. The objective of the assessment was to assist Illawarra Coal control identified risks associated with mining of Longwalls 12 to 18 which may cause the loss of stored water. The following hazards were identified as potential causes for such losses (Plan 2):

- Water inflow from the Avon Reservoir into the Dendrobium Mine workings (Approved Plan). Loss of stored water through porous flow outside the influence of mining or fracture flow within the mining induced fracture zone.
- Water inflow from the Avon Reservoir into the Dendrobium Mine workings. Loss of stored water through porous flow outside the influence of mining or fracture flow within the mining induced fracture zone.
- Water inflow from the Avon Reservoir into Wongawilli Creek or Dendrobium Mine workings. Basal shear creates high conductivity zone between Avon Reservoir and the extent of goaf fracturing. The potential for flow from Avon Reservoir into Wongawilli Creek along basal shear planes was also considered but is regarded as not credible based on the results of piezometer monitoring (SCT Report DEN4574).
- DF11 Elouera Fault Zone (DF11) acts as a conduit between the Avon Reservoir and the mine workings (development or longwall) resulting in loss of stored water.
- Aeromag Fault (NW-1) acts as a conduit between the Avon Reservoir and the mine workings (development or longwall) resulting in loss of stored water. Aeromag Dyke (NNW-2) acts as a conduit between the Avon Reservoir and the mine workings (development or longwall) resulting in loss of stored water. Underground Mapped Dyke (DD34) acts as a conduit between the Avon Reservoir and the mine workings (development or longwall) resulting in loss of stored water.
- Surface Mapped Dykes and Fault (DD20, DD21, DSF3) acts as a conduit between the Avon Reservoir and the mine workings (development or longwall) resulting in loss of stored water.
- Unsealed borehole within the DSC Notification area acts as a conduit between Avon Reservoir and the mine workings (development or longwall). Assumes that borehole intersects high conductivity Basal Shear zone.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DD34
Longwall 10
Longwall 6
Longwall 11
DL3_3
Longwall 12
DL3_2
Longwall 13
DF37
Longwall 14
Longwall 15
DD24
DSF2
Avon Dam
Longwall 16
NW-1
DD19
DF10
NNW-2
NNW-1
Longwall 17
Longwall 18
DD26
DSF1
DF11
PLAN 2
DF12
Legend
Dyke
Fault
Cinder above WS
Cinder within WS
DSC Notification Areas
SOUTH32
Illawarra Coal
Exploration
Dendrobium Area 3B
Summary of Geological Features
Date: 21 Sept 2017
Plan Author: M Krejci
Approved:
X-1177
Version 1
N
W
E
S
Horizontal Datum
MGA - Zone 56
0
250
500
1,000
1,500
Metres

- Unknown geological structure within the DSC Notification area acts as a conduit between the Avon Reservoir and the mine workings (development or longwall) resulting in loss of stored water.
- Seismic event changes hydraulic conductivity of geological structures between Avon Reservoir and the mine workings (development or longwall). Loss of stored water.

7 MONITORING AND MANAGEMENT PLAN

In compliance with the Dams Safety Act 1978, Guidance Sheet DSC4C – Typical Monitoring Programme Requirements for Mining near Prescribed Dams, and DSC Annexure 'D' Section 17 Monitoring and Management Plans, a Monitoring and Management Plan encompassing monitoring programs required by the DSC must be prepared and submitted for approval prior to the commencement of mining.

The Avon and Cordeaux Reservoir DSC Notification Area Monitoring Plan provided the monitoring framework for Areas 1, 2, 3A and 3B. Dendrobium is currently mining Longwall 13, which is the third extraction within the Avon Notification Area.

The DSC wrote to Illawarra Coal 15 July 2014 and 29 June 2015 to indicate their requirements for mining within the Avon Notification Area. The following requirements have been addressed in submissions to the DSC and are detailed below:

- Water chemistry data has been reviewed by an independent expert.
- Surface to seam boreholes have been established between the mine workings and the Avon Reservoir. The purpose of these boreholes is to monitor the pressure heads in strata and to sample formation waters. These boreholes were established to provide baseline data before Longwall 12 extraction.
- Water sampling and analytical programme as well as interpretation will continue while mining progresses in Area 3B.
- A comprehensive review/analysis of water chemistry and piezometer data for Areas 2, 3A and 3B has been completed. The review includes a discussion of the deficits in the current sampling regime and actions to remove these deficits.
- Data indicating a low level of risk to the storages from mining through geological structure.
- Flow along basal shear planes is likely to exist, however previous mining at Dendrobium Mine has not indicated unacceptably high inflows from Cordeaux Reservoir through the barriers provided and the barriers for Avon Reservoir would therefore appear to be of more than adequate size.

- It is considered there is no credible potential for flow from Avon Reservoir to Wongawilli Creek to be a source of loss from Avon Reservoir.

7.1 SCOPE

This Plan details the monitoring and reporting protocols for the identification of unexpected conditions and potential failure mechanisms, which could indicate adverse effects on the Avon or Cordeaux Reservoirs. Key components include:

- Identification of geological structures or features that could be of concern.
- Identification of extraneous inflow of water from various sources.
- Monitoring of subsidence behaviour.
- Analysis of data and reporting.
- Definition of responsibilities and accountabilities to undertake specified actions.

To facilitate mining within the Avon Reservoir Notification Area, baseline monitoring has commenced and will continue. Monitoring and reporting requirements of the DSC shall continue as specified until the DSC considers that it is no longer required, pursuant to Condition 12.1 of the Standard Conditions.

7.2 CONTROL PROCEDURES

Monitoring control procedures are aimed at detecting the ingress of water, identifying when surface water is a component of an inflow, and the presence or behaviour of the potential water conduits outlined previously, that may influence the potential for water to be lost from the storage area as a consequence of mining. These procedures may be categorised as either principal or secondary monitoring controls.

Principal Monitoring Controls are the primary means of defining and initiating a response to abnormal water inflows. These controls are a combination of underground water balance determinations from Dendrobium Mining Areas, coupled with regular sampling and analysis for determination of the source of the water. This data can be used to establish trigger levels within the Contingency Plan TARPS.

Secondary Monitoring Controls are monitoring activities resulting in triggers that alert mine management to the potential for an abnormal inflow and that initiate low level alarms within the Principal Monitoring TARP. They are the Monitoring components used to provide early warning of a potential abnormal water inflow to the workings and that may activate a Level 1 Principal

Monitoring Alarm or significant components of the response to this. Secondary Monitoring Controls include:

- Inseam drilling results;
- Groundwater monitoring;
- Surface water monitoring (including rainfall monitoring);
- Underground site water balance;
- Stress monitoring;
- Water quality monitoring; and
- Visual inspections of underground workings.

Monitoring and reporting controls are outlined in the following section with actions, responsibilities and specific DSC requirements. Appendix A lists the DSC Approval Conditions and the actions required to comply with the plan.

7.3 PRINCIPAL MONITORING CONTROLS

7.3.1 Underground Water Sampling and Analysis

The *DSC - Dendrobium Water Management Procedure* (DENP0048) outlines the routine periodic sampling of panel water sources with fingerprinting analysis against known reference sources and reported monthly to the DSC. Isotope analysis (Tritium) requires a longer (several months) period to determine. Samples are collected from as close as practical to the source. Details on the sample sites can be found in the *DSC - Dendrobium Water Management Procedure* (DENP0048). Information on the underground pumping is detailed in Plan 9.

The characteristics of the underground waters are compared to reference samples from the surface (Cordeaux Reservoir, Sandy Creek, Kembla Creek and the Upper Cordeaux No.2 Reservoir and rainwater) and aquifers in the overburden strata (Scarborough, Bulgo and Hawkesbury Sandstones) to determine the origin of water entering the mine. 'Fingerprinting' allows for better quantification by identifying discrete water sources.

The DSC Condition for sampling and analysis can be found below.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
The Company shall submit a proposal for a groundwater sampling and assessment program as part of the Monitoring Management Plan required under Annexure D Condition 17, for approval by the Committee. The company shall comply fully with the approved Monitoring Management Plan. The company shall sample and assess the properties of water entering the longwall mining area, water in adjacent workings, groundwater in the overlying strata (including groundwater in the facility required under Condition 3.1) and surface water in area 3B.	Annexure D1, Section III, Condition 3.2	▪ *DSC – Dendrobium Water Management Procedure (DENP0048)* for routine periodic sampling of panel water sources (existing and new) with "fingerprinting" analysis against known reference sources. ▪ Monthly report of results to DSC	Planning Manager/Water Balance Officer

7.3.2 Underground Water Balance

The mine water balance is used to quantify total flows of water in defined mining areas. The procedure is described in *DSC - Dendrobium Water Management Procedure* (DENP0048). The water balance monitoring process includes continuous monitoring of:

- Water inflow via the mine water main (equipment cooling, dust suppression, fire-fighting, drilling, etc.);
- Water pumped from the mine;
- Water entering or leaving via mine ventilation; and
- Moisture content of coal leaving the mine.

From this monitoring, Dendrobium calculates a daily water balance (outflow minus inflow). In addition to the total mine balance calculation; a daily water balance is prepared for Areas 1, 2, 3A and 3B. The water balance for the total mine is used to initiate triggers within the Principal TARP of the Contingency Plan. Any significant change as outlined in the 'Emergency Water' Requirements of Section 8 of Annexure D shall be reported to the DSC immediately. The DSC condition for underground water balance can be found below.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
a). The company shall carry out daily measurements of all water entering and leaving the section of the mine that includes the approval area	Annexure D, Section VII	▪ Daily Water Balance for mine and each mining area, *DSC - Dendrobium Water Management Procedure*	Planning Manager/Water Balance Officer

b) Reports of the measurements shall be forwarded to the DSC monthly or at intervals determined by the Committee from time to time.		*(DENP0048)* ▪ Monthly report of results to DSC	
"Significant" in relation to groundwater flows into the workings is defined as meeting any of the following criteria: • The volume or rate of flow, or change in the volume or rate of flow, or the location causes surprise among persons familiar with the workings; or • The volume or rate of flow doubles over a few days; or • The volume or rate of flow is more than 3 standard deviations above the mean value (i.e. larger than about 99% of recent readings).	Annexure D, Section VIII	▪ DSC to be immediately notified in the case of - Total outflow significantly greater than total inflow - Significant groundwater flow into any approval area or within 300m - Significantly increasing water flows at any time during the development of workings - Any visible flow is discoloured by the presence of sand, clay or silt	Planning Manager/Water Balance Officer

7.4 SECONDARY MONITORING CONTROLS

7.4.1 In – Seam Drilling

In-seam drilling undertaken between all planned workings and the Avon reservoir within the DSC Notification Area will:

- Determine the in-seam location of inferred geological features from surface exploration and confirm potential geological features projected from existing workings, as outlined in Section 6 " Hazard Identification; and
- Test all structures within the Notification Areas for water flow and hydrostatic head as a means to determine features likely to affect the mining footprint.

Drilling completion reports will be submitted to the DSC outlining water and gas make, and any geological features encountered. Appendix B-2 is provided as an example of the reporting template.

7.4.2 Underground Geological Mapping

Regular mapping of seam level geological features is undertaken in accordance with the mine's SFMP. This mapping refers to the definitions and descriptions of faults and dykes set out in DSC Annexure 'B'. In addition, any water inflow is reported as per Section V of DSC Annexure 'D', Standard Mining Conditions. Results of this mapping are included in the Monthly DSC Report.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Seam level geological mapping	Annexure D, Section V	▪ Monthly geological mapping ▪ Prepare geological plans (1:4000) in the Notification Area and within 300m including plans showing: - faults, dykes, slickensided joints and areas of cinder - angle of dip to the horizontal and other properties as listed in Annexure B - positions, dates, turbidity and flow rates of all water inflows ▪ On a monthly basis provide extracts of the updated plans with a report describing any new geological feature to DSC ▪ On completion of work in an Area provide a transparency and/or two (2) copies of the plans to the DSC	Geotechnical Engineer or Surveyor

7.4.3 Surface Geological Mapping

Mapping of Areas 1, 2, 3A and 3B has been undertaken in accordance with DSC Annexure 'B' and Section VI of DSC Annexure 'D' (Conditions 6.1, 6.2 and 6.3).

7.4.4 Environmental Monitoring at the Mining Face

Under the requirements of the *Work Health and Safety (Mines) Act 2013 (NSW)* and associated Regulations, Mine Statutory Personnel conduct regular inspections of all areas of the mine. These inspections include reporting of roadway conditions with respect to the stability of mine roadways.

Section IV of Annexure 'D' requires information from these inspections to be provided to the DSC as detailed in the table below. This information relates to conditions which could influence the magnitude of surface subsidence, performance of pillars, or permeability of the strata. Specific inspections and responses are also required under the Inrush Management Plan (IMP) and the TARP included in the IMP.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Inspection of Workings	Annexure D, Section IV	▪ Weekly visual inspections of the workings whenever mining in the Notification Area (or within 6 months of cessation of mining) ▪ Monthly geotechnical report of results to DSC including : - Pillar performance (spalling, deterioration) - Roof conditions (guttering, falls, pillar punching, degree of caving etc) - Floor conditions (floor heave or pillar punching) - Water inflows - Plan showing extraction/development for the period (coloured)	Geotechnical Engineer and Underground Mining Officials

7.4.5 Groundwater Monitoring

Groundwater monitoring is a Secondary Monitoring Control undertaken to determine and assess hydrogeological conditions within the rock mass between the Reservoirs and the Wongawilli Seam in Areas 1, 2, 3A and 3B.

This monitoring aims to detect the impacts of mining on groundwater, assess groundwater flow from stored water and provide verification of the results of hydrological modelling.

The monitoring consists of measuring and recording pressures from piezometers to allow for estimation of a flow direction and quantity through the rock mass (i.e. from the stored water in the reservoir to the longwall extraction). These determinations are one of the inputs used for the analysis of the source of groundwater reporting to the mine workings.

Groundwater monitoring at Dendrobium consists of both 'shallow' and 'deep' monitoring. The 'shallow' groundwater monitoring is primarily used to assess impacts on surface flows, swamps and ecology, the 'deep' groundwater monitoring is used to understand inflows into the mine. In Areas 1 and 2 'deep' groundwater monitoring was heavily focused on the area between the extraction and the Reservoir. The monitoring in Area 3 has been designed to provide regional groundwater data in addition to increased monitoring near the reservoir where access is available. Groundwater Monitoring details are shown in Plans 3 – 5.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Monitoring of groundwater pressures	Annexure D1, Section II	▪ Monitoring as per the Monitoring Plan ▪ Monthly report to DSC with analysis and interpretation of the monitoring results: - Piezometric data from each hole in terms of pressure and equivalent height in metres above AHD - Graphs to demonstrate piezometric trends over time - Indication of longwall or other mining activities	Planning Manager/Water Balance Officer

7.4.6 Subsidence Monitoring

Due to terrain, vegetation and access restrictions, the primary method of monitoring subsidence movements over Dendrobium Areas 1, 2, 3A and 3B is via Airborne Laser Scanning (ALS). This technique generates a complete topographic model of the subsidence.

The initial base survey for Area 3B was captured in 2005 and was captured again in January 2013 immediately prior to the commencement of longwall operations in Area 3B. ALS surveys are

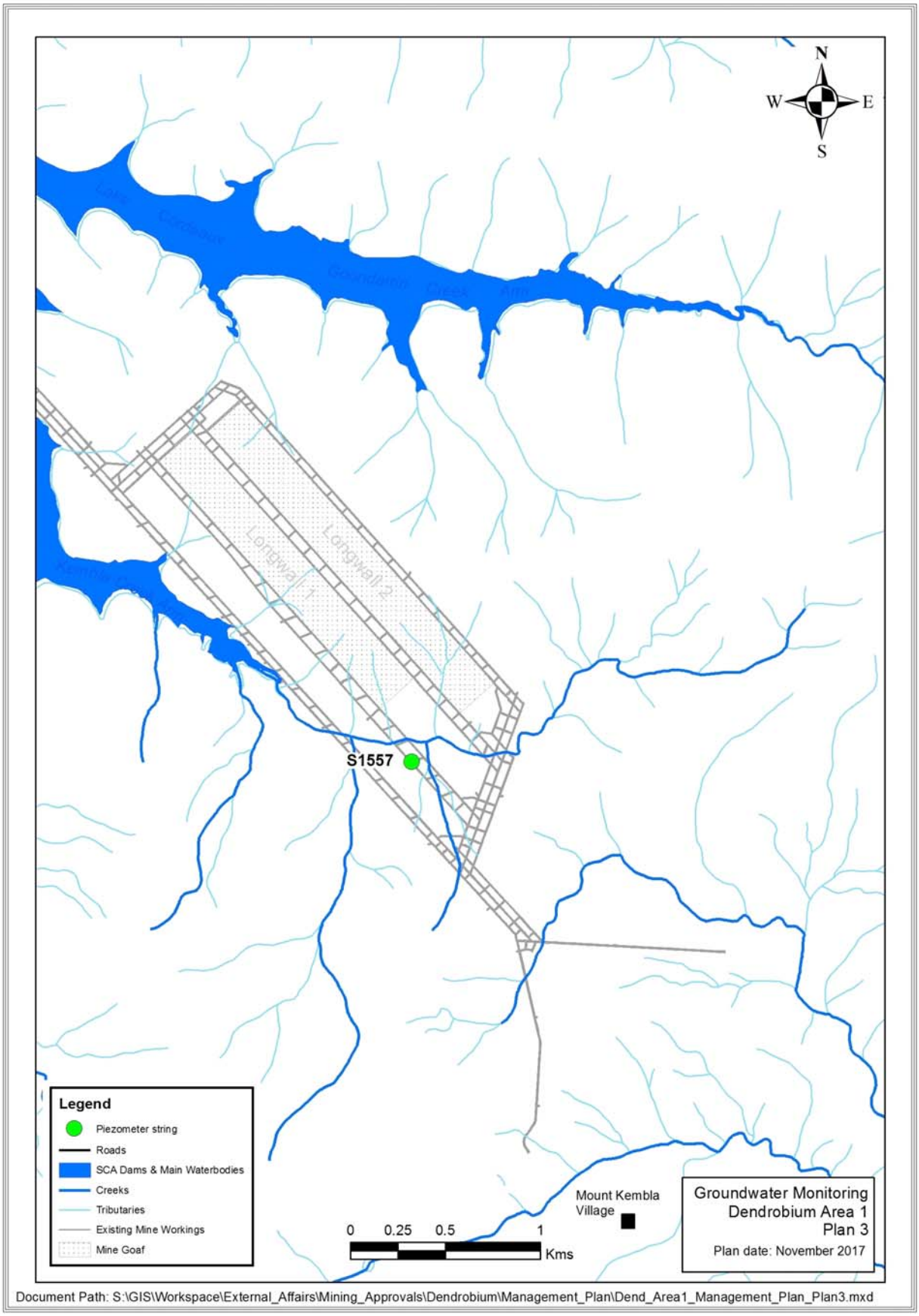
conducted prior to any mining, after the completion of each longwall and 12 months after the completion of longwall extraction in each mining area. Contours of subsidence from each longwall will be provided to the DSC.

Subsidence monitoring for Area 3B is shown in Plan 7 (SDS2021). Selected 3D survey marks are established and monitored to augment the ALS data. The points are established in accessible areas as control reference points for the ALS and to provide information on horizontal ground movements.

The 3D survey points are distributed throughout Area 3B, however the locations are subject to site constraints i.e. at locations with good sky windows suitable for high resolution GPS surveying. The survey frequency of these points will coincide with ALS data capture. Additional subsidence monitoring sites have been installed and monitored for closure across the Native Dog Creek arm of Lake Avon.

The DSC agreed to the cessation of monitoring of Areas 1 and 2 3D points. Visual monitoring (for cracking) is undertaken and reported with each set of subsidence data. Visual inspection of the active subsidence area is undertaken in accordance with the SMP.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Subsidence and Strain Monitoring	Annexure D, Section IX (only applicable to Area 3A. Condition doesn't apply to LW11 approval)	▪ Remote scanning of Digital Terrain Model by ALS after mining each longwall block and 12 months after completion of mining in Area 3A ▪ 3D subsidence monitoring stations as a control for the DTM after mining each longwall block and 12 months after completion of mining in Area 3A ▪ Survey results to DSC within 1 week of survey (except ALS 2 months after analysis) ▪ Pursuant to Annexure D, Section XII monitoring is to continue until the DSC considers that is longer required.	Survey Team Lead


N
W
E
S
Longwall 1
Longwall 2
S1557
Legend
Piezometer string
Roads
SCA Dams & Main Waterbodies
Creeks
Tributaries
Existing Mine Workings
Mine Goaf
Mount Kembla Village
0 0.25 0.5 1
Kms
Groundwater Monitoring
Dendrobium Area 1
Plan 3
Plan date: November 2017
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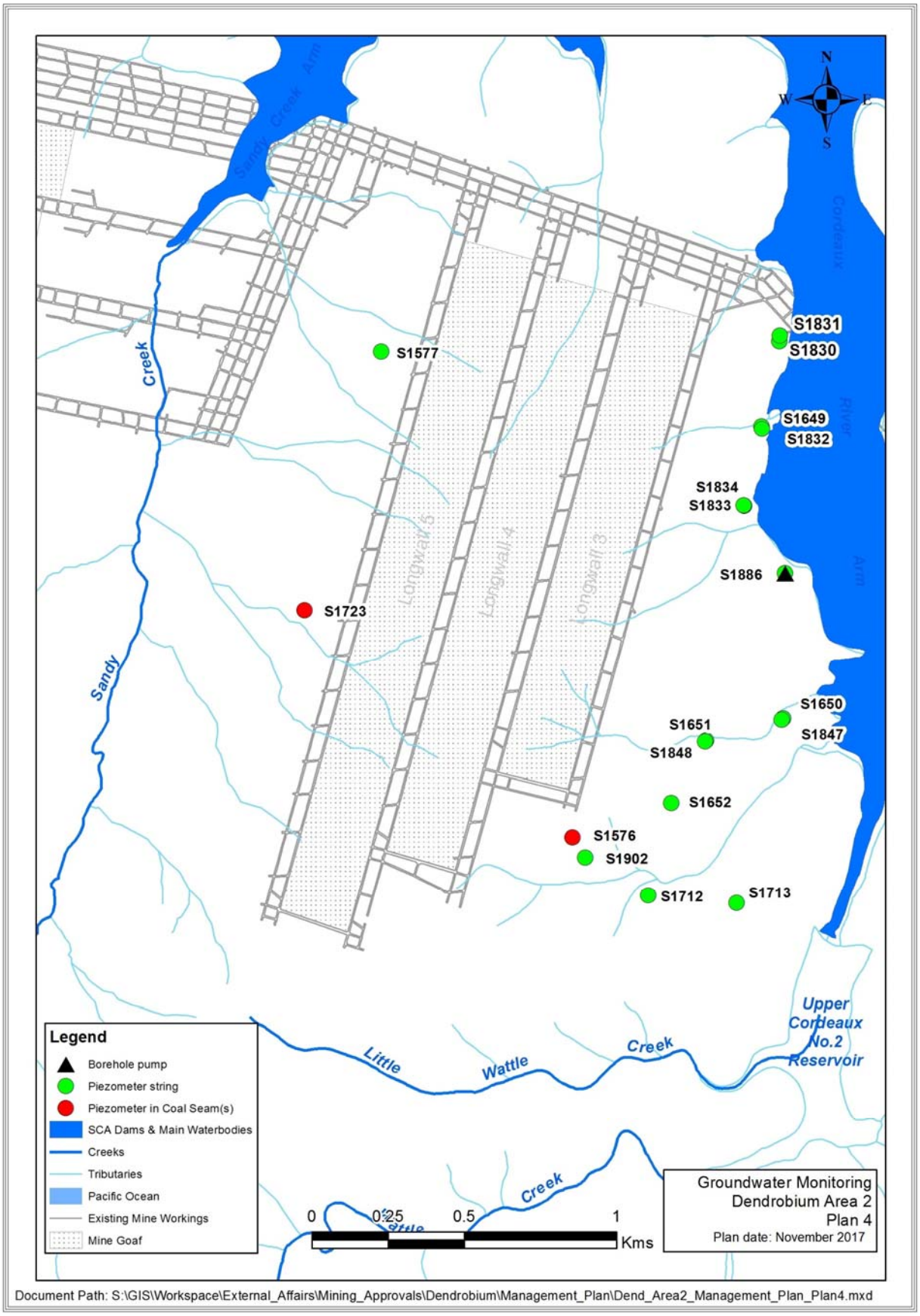
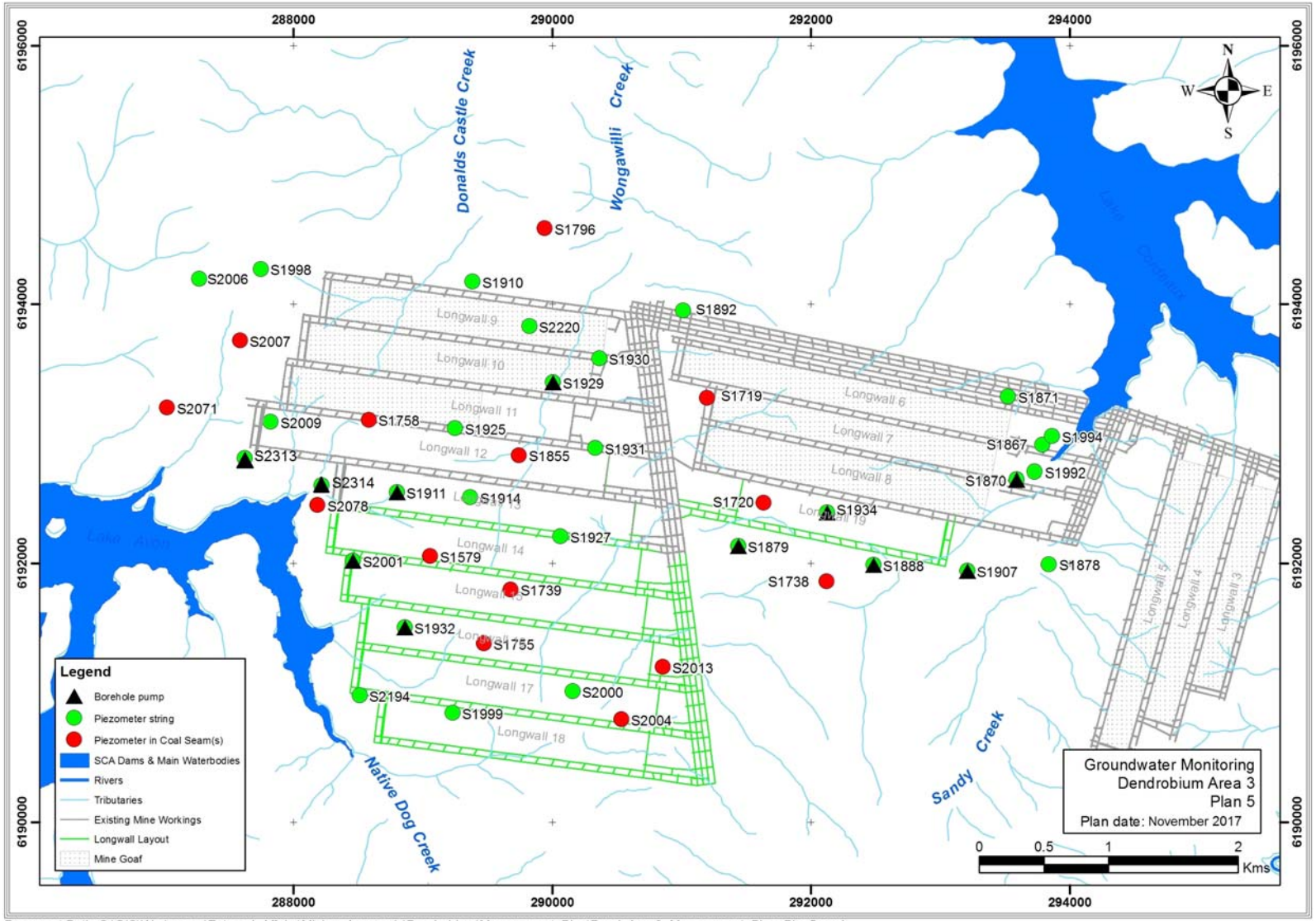

N
W
E
S
Sandy Creek Arm
Cordeaux River Arm
Sandy Creek
Longwall 5
Longwall 4
Longwall 3
S1831
S1830
S1577
S1649
S1832
S1834
S1833
S1886
S1723
S1650
S1651
S1847
S1848
S1652
S1576
S1902
S1712
S1713
Little Wattle Creek
Upper Cordeaux No.2 Reservoir
Legend
Borehole pump
Piezometer string
Piezometer in Coal Seam(s)
SCA Dams & Main Waterbodies
Creeks
Tributaries
Pacific Ocean
Existing Mine Workings
Mine Goaf
0 0.25 0.5 1
Kms
Groundwater Monitoring
Dendrobium Area 2
Plan 4
Plan date: November 2017
Document Path: S:\GIS\Workspace\External_Affairs\Mining_Approvals\Dendrobium\Management_Plan\Dend_Area2_Management_Plan_Plan4.mxd



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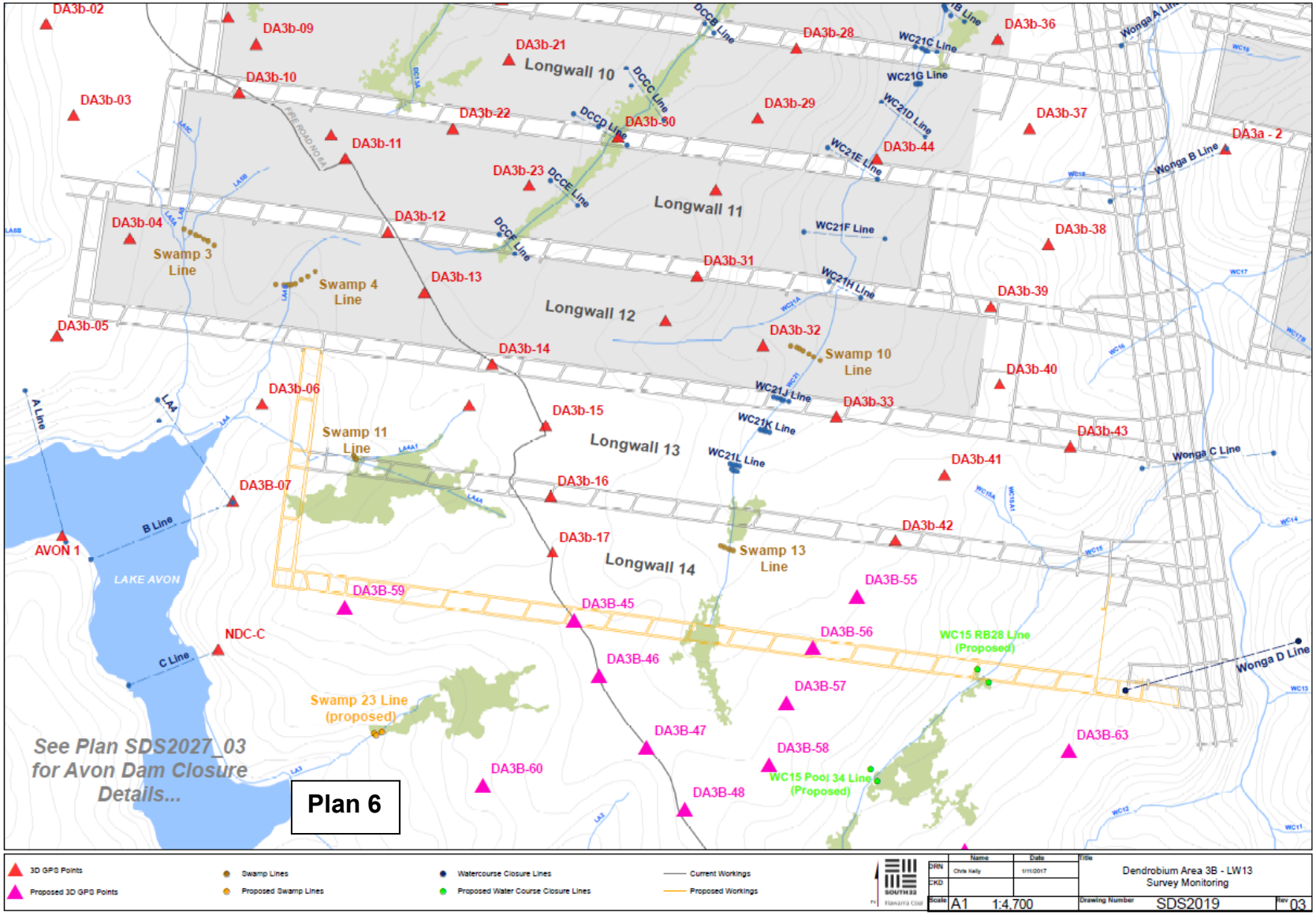
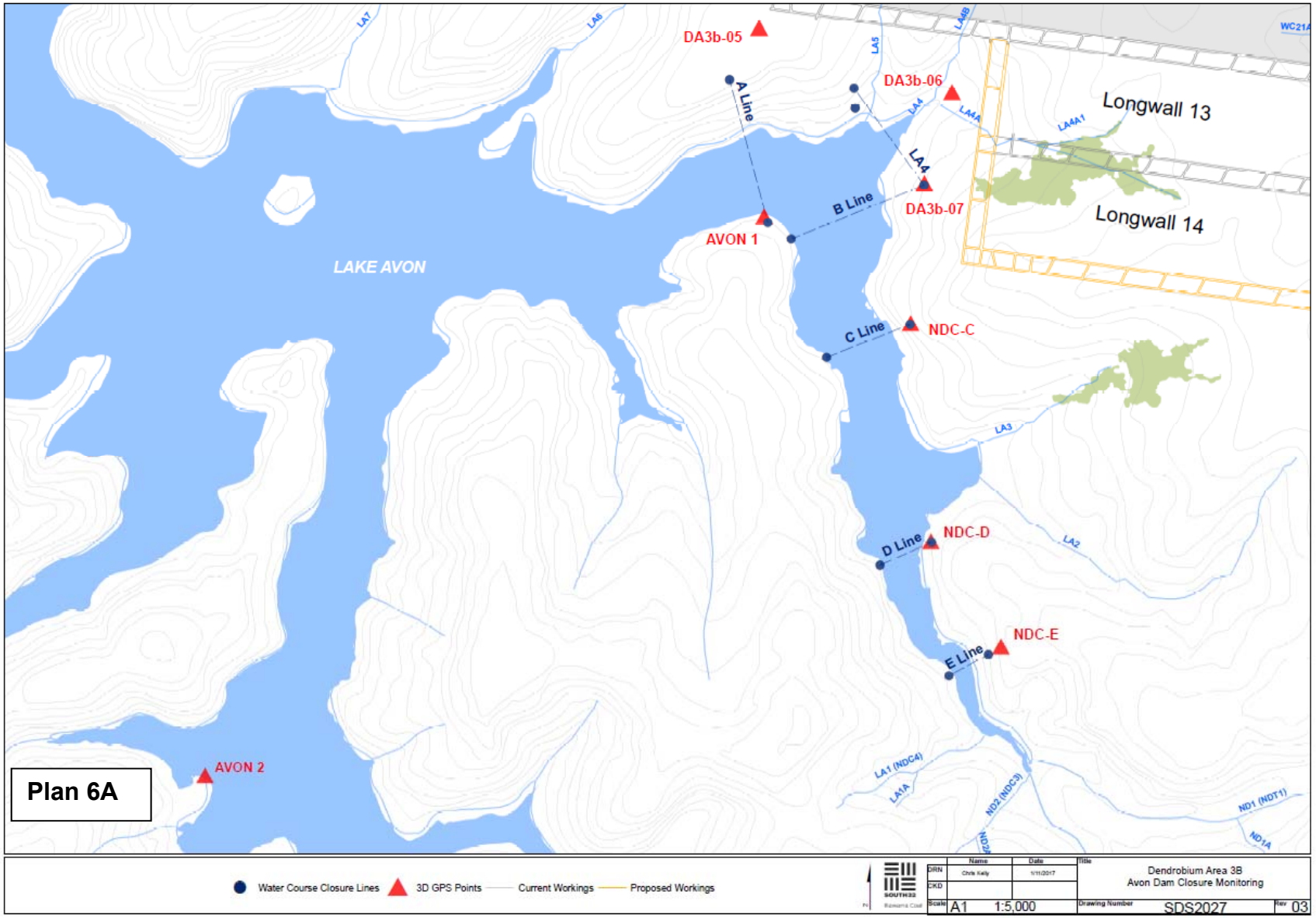

DA3b-02
DA3b-09
DA3b-21
DA3b-28
DA3b-36
DA3b-10
DA3b-03
DA3b-22
DA3b-29
DA3b-37
DA3a - 2
DA3b-11
DA3b-30
DA3b-44
DA3b-23
DA3b-12
DA3b-04
DA3b-38
DA3b-31
DA3b-39
DA3b-13
DA3b-05
DA3b-32
DA3b-14
DA3b-40
DA3b-06
DA3b-15
DA3b-33
DA3b-43
DA3b-41
DA3B-07
DA3b-16
DA3b-42
AVON 1
DA3b-17
DA3B-59
DA3B-55
DA3B-45
NDC-C
DA3B-56
DA3B-46
DA3B-57
DA3B-47
DA3B-63
DA3B-58
DA3B-60
DA3B-48
Longwall 10
Longwall 11
Longwall 12
Longwall 13
Longwall 14
Swamp 3 Line
Swamp 4 Line
Swamp 10 Line
Swamp 11 Line
Swamp 13 Line
Swamp 23 Line (proposed)
WC15 RB28 Line (Proposed)
WC15 Pool 34 Line (Proposed)
LAKE AVON
A Line
B Line
C Line
Wonga A Line
Wonga B Line
Wonga C Line
Wonga D Line
See Plan SDS2027_03 for Avon Dam Closure Details...
Plan 6
3D GPS Points
Proposed 3D GPS Points
Swamp Lines
Proposed Swamp Lines
Watercourse Closure Lines
Proposed Water Course Closure Lines
Current Workings
Proposed Workings
Dendrobium Area 3B - LW13
Survey Monitoring
A1
1:4,700
SDS2019
03


DA3b-05
DA3b-06
DA3b-07
AVON 1
AVON 2
NDC-C
NDC-D
NDC-E
A Line
B Line
C Line
D Line
E Line
LA4
LAKE AVON
Longwall 13
Longwall 14
LA7
LA6
LA5
LA4B
LA4
LA4A
LA4A1
WC21A
LA3
LA2
LA1 (NDC4)
LA1A
ND2 (NDC3)
ND2
ND1 (NDT1)
ND1A
Water Course Closure Lines
3D GPS Points
Current Workings
Proposed Workings
Dendrobium Area 3B
Avon Dam Closure Monitoring
A1
1:5,000
SDS2027
03

Plan 6A

7.4.7 Statistical Reports

The amount of coal extracted and any other statistics related to the approval are reported to the DSC at intervals as specified in Annexure D.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Total tonnage extracted and other statistics related to the approval	Annexure D, Section XIX	▪ Written report of total tonnage extracted and other statistics related to the approval on an annual basis for each year ending June 30th – to be supplied by July 31st each year ▪ Progressively reported in the monthly report	Planning Manager

7.4.8 Compliance Reports

Dendrobium monitors and reports compliance with approval conditions in a statement of compliance at intervals as specified in Annexure D.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Statement of compliance with all monitoring conditions	Annexure D, Section XX	▪ Monthly written statement of compliance with all monitoring conditions in the Monthly Report	Planning Manager/Water Balance Officer

7.4.9 Monitoring, Reporting and Extraction Schedule

An updated Monitoring, Reporting and Extraction Schedule is submitted at intervals as specified in Annexure D. The schedule will track future mine workings, status of reports required by the DSC, and requirements for implementing certain monitoring and other conditions (e.g. required dates for installing equipment).

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Regularly updated schedule which tracks future mine workings, reports to be submitted to the DSC and requirements for implementing certain monitoring or other conditions	Annexure D, Section XXI	▪ Monthly Monitoring, Reporting and Extraction Schedule to be submitted to DSC including target dates for starting and finishing each block, or other mining area as determined by the DSC included in the Monthly Report	Planning Manager

7.4.10 Liaison Officer

Dendrobium has appointed the Manager Approvals as a suitably qualified and experienced person, acceptable to the Committee, as a liaison officer for the period where there is active mining in any Notification Area and for an additional period afterwards as determined by the Committee.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Appointment of Liaison Officer	Annexure D, Section XXII	▪ Dendrobium employee appointed to act as Liaison Officer to ensure effective coordination and management of the monitoring programs	Planning Manager

7.4.11 Face Location

A plan is provided to the DSC showing the location of any active faces, to the satisfaction of the Committee, at intervals as specified in Annexure D.

DSC Condition	Reference	Actions to Demonstrate Compliance	Responsibility
Plan showing location of any active faces	Annexure D, Section XXIII	▪ Plan e-mailed to the DSC each week showing the location of active faces	Mine Surveyor

7.4.12 Dendrobium Dyke Monitoring

In September 2013 DSC approved the monitoring regime for West Mains 4 cut-through to return to “normal” levels of monitoring.

8 CONTINGENCY PLAN

This Plan describes the contingency requirements for the Cordeaux and Avon Reservoirs DSC Notification Areas, which has been developed in accordance with the relevant provisions of the Dams Safety Act 1978, to minimise the loss of stored water from the reservoir as a result of mining within the Notification Areas.

8.1 SCOPE

This Plan applies to all development and longwall extraction i.e. first and second workings within the DSC Cordeaux and Avon Dams Notification Areas and other areas and operations at Dendrobium Mine (existing and proposed Dendrobium Mine - Plan 1).

This Plan identifies potential risk of extraneous inflow of water sources from the Reservoirs and potential failure mechanisms, which may lead to an unexpected condition. In accordance with **Annexure ‘D’ Condition 16.1**, the Plan describes the “*emergency plan of action designed to contend with an inrush of stored water” ” to minimise water loss from the storage”.*

This Plan:

- References the monitoring activities to identify loss of stored water from the Reservoirs to the mine workings;
- Details the trigger levels related to each form of monitoring (where appropriate) and defines the actions to be taken as a trigger level is reached, including reporting requirements; and
- Details the personnel responsible for each action (including notifications) and the resources that are available for each response.

Specifically listed DSC 4D Contingency Requirements covered by the Plan are:

- Capacity of the pumping system;
- Capacity of the underground storage facilities;
- Design of the bulkheads;
- The name, position and role of key personnel;
- A contact telephone list; and
- Grouting procedures and the applicability of these procedures to likely inflow mechanisms.

In addition, the Plan:

- Outlines the processes to monitor and identify any extraneous inflow of water;
- Provides for the assessment of the causes of any such flows; and
- Clearly defines the necessary trigger levels and response actions.

8.2 CONTROL PROCEDURES

This Plan provides a framework to encompass the emergency procedures and reporting requirements recommended by the DSC as per DSC 4D (formally DSC 35). In the case of Areas 1, 2, 3A and 3B, this refers to DSC Section XVI 'Contingency Plans' Annexure D Condition 16.1. This includes the following requirements:

Monitoring – those Principal and Secondary Monitoring Controls that monitor the surface and underground environment to detect any abnormal inflow.

Pumping - that provides time for assessment to be conducted and/or the appropriate response to be initiated without adverse effect on mining operations.

Remedial - those designed to correct an unacceptable inflow from any source but most specifically from the Reservoirs.

8.2.1 Principal Monitoring Controls

The primary elements of the Principal Monitoring Control are used to quantify total inflows and outflows in relation to defined mining areas and the total water imbalance. This includes the following requirements:

- Underground Water Sampling and Analysis – refer Section 7.3.1. Underground water analysis sampling locations and zones are detailed on plan DEN-01-3833 (Plan 7).
- Underground Water Balance – refer Section 7.3.2.

8.2.2 Secondary Monitoring Controls

Secondary Monitoring Controls result in triggers that alert mine management to the potential for an abnormal inflow and that initiate low level alarms within the Principal Monitoring TARP.

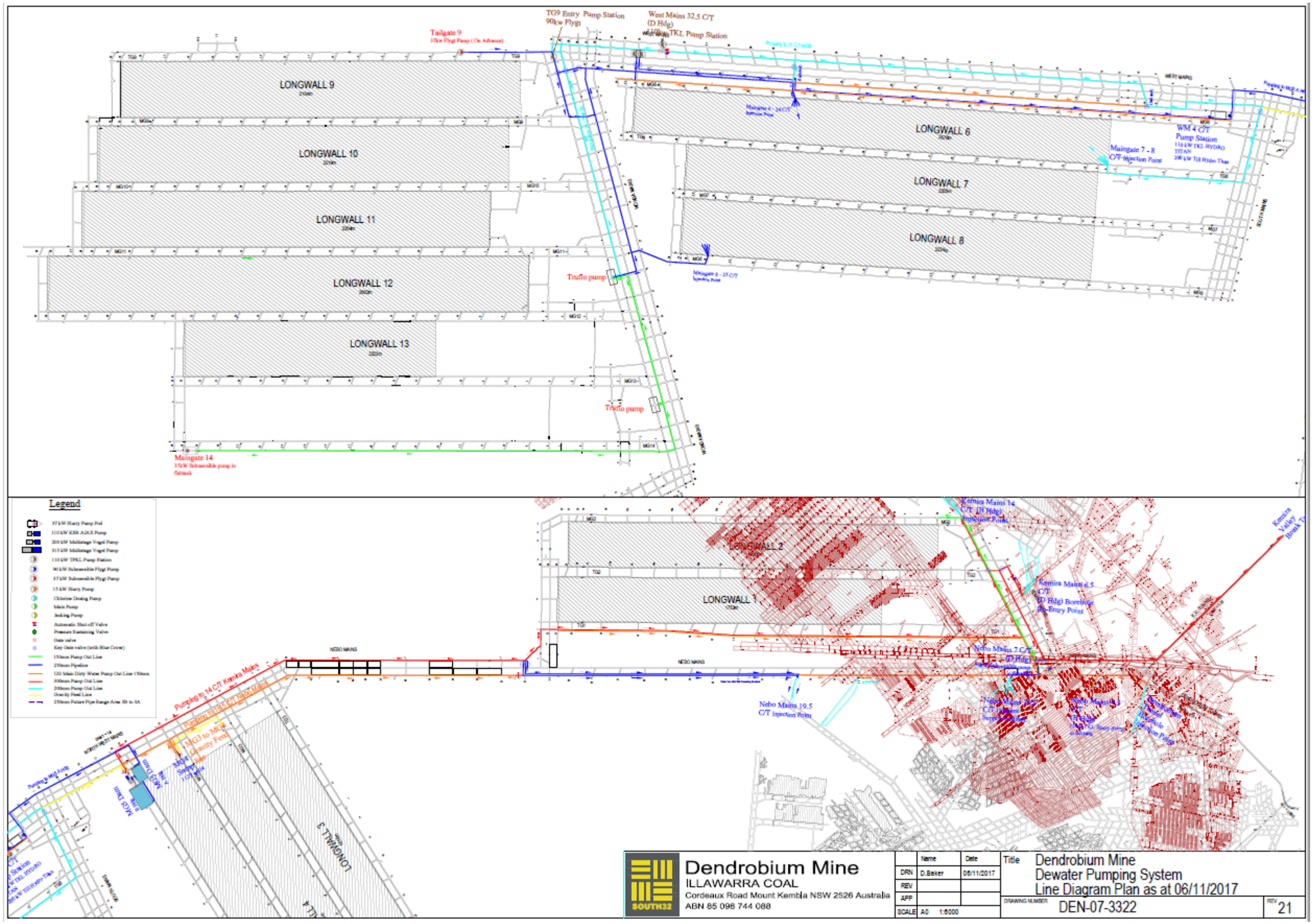
- In Seam Drilling **–** refer Section 7.4.1.
- Monitoring of Workings – refer Section 7.4.4.
- Ground Water Monitoring – refer Section 7.4.5.
- Subsidence Monitoring – refer Section 7.4.6.

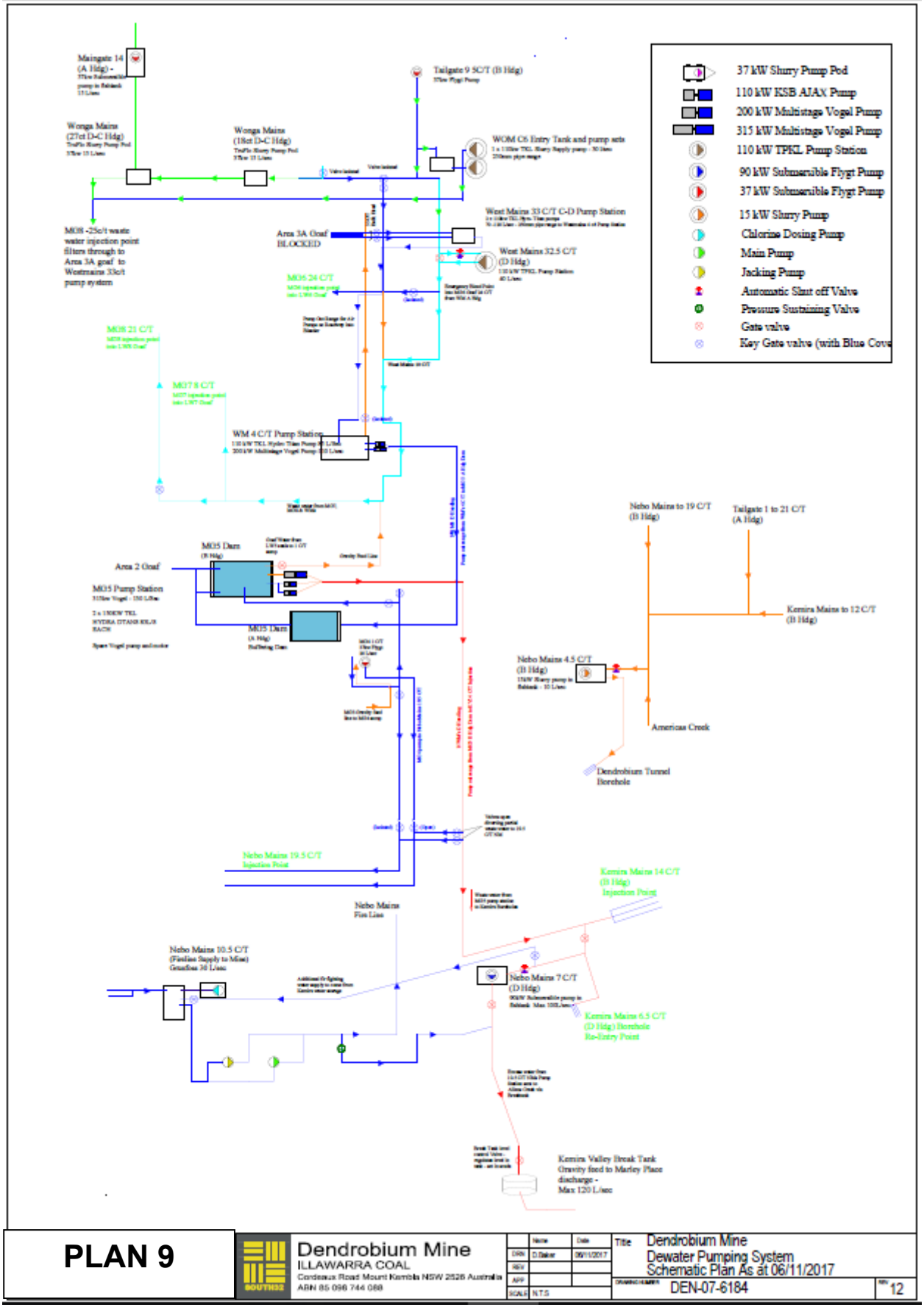
8.3 PUMPING

Pumping is a fundamental control procedure relating to the management of water and is treated within the IMP. The Mine operates a comprehensive pumping system to provide for regular dewatering of the underground workings. Mine water management is detailed in drawing DEN-07-3322 and Schematic drawing DEN-07-6184 (Plan 8 and 9). Total designed pump out capacity is 155 litres per second.

Large and unexpected flows of water into the mine workings will be dealt with in the first instance by air operated pumps installed in the vicinity of the working panels and lowest points in the perimeter roads around goaf areas. Should inflows exceed the capacity of installed pumps, additional pumps will be sourced and this will represent a 'trigger' initiating action within the Principal Monitoring TARP. The Mine Water Balance Procedure is the standard for monitoring the water flow in and out of the mine.

The water balance is a means of quantifying abnormal inflows to various parts of the mine. Monitoring of inflow and outflow to Areas 1, 2, 3A and 3B occurs through the daily water balance.


LONGWALL 9
LONGWALL 10
LONGWALL 11
LONGWALL 12
LONGWALL 13
LONGWALL 6
LONGWALL 7
LONGWALL 8
LONGWALL 2
LONGWALL 1
LONGWALL 3
Tailgate 9
TG9 Entry Pump Station
90kw Flygt
West Mains 32.5 C/T
(D Hdg)
TKL Pump Station
Maingate 7 - 8
C/T Injection Point
WM 4 C/T
Pump Station
Trudlo pump
Trudlo pump
Maingate 14
Legend
Kemira Mains 14
C/T
Kemira Mains 6.5
C/T
Nebo Mains 19.5
C/T Injection Point
Dendrobium Mine
ILLAWARRA COAL
Cordeaux Road Mount Kembla NSW 2526 Australia
ABN 85 098 744 088
Title
Dendrobium Mine
Dewater Pumping System
Line Diagram Plan as at 06/11/2017
DRAWING NUMBER
DEN-07-3322
REV
21


37 kW Slurry Pump Pod
110 kW KSB AJAX Pump
200 kW Multistage Vogel Pump
315 kW Multistage Vogel Pump
110 kW TPKL Pump Station
90 kW Submersible Flygt Pump
37 kW Submersible Flygt Pump
15 kW Slurry Pump
Chlorine Dosing Pump
Main Pump
Jacking Pump
Automatic Shut off Valve
Pressure Sustaining Valve
Gate valve
Key Gate valve (with Blue Cove
Maingate 14 (A Hdg) -
Tailgate 9 SC/T (B Hdg)
Wonga Mains (27ct D-C Hdg)
Wonga Mains (18ct D-C Hdg)
WOM C6 Entry Tank and pump sets
West Mains 33 C/T C-D Pump Station
MG8 -25c/t waste water injection point filters through to Area 3A goaf to Westmains 33c/t pump system
Area 3A Goaf BLOCKED
West Mains 32.5 C/T (D Hdg)
MG6 24 C/T
MG8 21 C/T
MG7 8 C/T
WM 4 C/T Pump Station
MG5 Dam
Area 2 Goaf
MG5 Pump Station
MG5 Dam
Nebo Mains to 19 C/T (B Hdg)
Tailgate 1 to 21 C/T (A Hdg)
Kemira Mains to 12 C/T (B Hdg)
Nebo Mains 4.5 C/T (B Hdg)
Americas Creek
Dendrobium Tunnel Borehole
Nebo Mains 19.5 C/T Injection Point
Kemira Mains 14 C/T (B Hdg) Injection Point
Nebo Mains Fire Line
Nebo Mains 10.5 C/T (Firelines Supply to Mine) Gravflow 30 L/sec
Nebo Mains 7 C/T (D Hdg)
Kemira Mains 6.5 C/T (D Hdg) Borehole Re-Entry Point
Kemira Valley Break Tank Gravity feed to Marley Place discharge - Max 120 L/sec
PLAN 9
Dendrobium Mine
ILLAWARRA COAL
Cordeaux Road Mount Kembla NSW 2526 Australia
ABN 85 096 744 088
SOUTH32
Title
Dendrobium Mine
Dewater Pumping System
Schematic Plan As at 06/11/2017
DEN-07-6184
12

8.4 CONTINGENCY ACTIONS

8.4.1 Grouting, PUR Injection and Similar Activities

The fundamental remedial strategy for addressing abnormal water inflows from conduits such as fissures through the strata, associated with disturbances such as faults or dykes, or from diffuse sources such as porous ground or horizontal shear, regardless of source, may take the form of one of a number of established engineered solutions for stopping or controlling water flows through strata.

The application of a particular consolidation technique to any circumstance of abnormal water inflow to the mine from (or potentially from) the Cordeaux or Avon Reservoirs will be determined at the time by the decision of all stakeholders (Illawarra Coal, DSC and Water NSW) based on the advice of ground consolidation experts.

The Review Team will take appropriate early remedial action to avoid the need to elevate the defined response to a Principal Monitoring trigger. Types of remedial actions available for gaining control of water inflows to the mine and their applications are summarised below.

Description of Flow Mechanism	Remedial Action	Injection Location
Disturbed or fractured ground	Concrete blinding	Surface/ underground
Regional water flows through porous/ fractured strata	Installation of grout curtains (cement based or chemical compounds)	Surface/ underground
Localised sealing of open fractures and joints	Polyurethane resin (PUR) injection or cement based grouts	Surface/ underground

8.4.2 Sealing

The installation of ventilation seals to isolate the Area 1 goaf was undertaken as Longwalls 1 and 2 were extracted. Each cut-through in Tailgate 1 and Maingate 2 was sealed for mine ventilation purposes. Subsequently Area 1 was sealed from the mine ventilation system leaving only one heading in Tailgate 1 open as an intake roadway. Several of these ventilation seals contain monitoring, sampling facilities. Ventilation seals have progressively been installed as longwalls are extracted.

The final sealing of the mine requires hydraulic seals to be installed that ensure any stored water from the reservoir reporting to the mine is controlled. The overall sealing strategy for mine water is contained in the Closure Plan (Section 9).

In the event stored water inflows approach DSC permissible limits, triggers will initiate a number of actions. The decision to abandon contingent techniques designed to maintain control of these inflows and commence the installation of hydraulic seals either to isolate particular areas or to seal the mine are defined in Trigger Action Response Plans. Otherwise the sealing strategy for the Mine is described in the Closure Plan.

A specific hydraulic seal has been designed for the mine. It consists of a two stage concrete sleeve/plug and associated grouting. The SMEC design is documented in the report Dendrobium Water Inflow Solution – Concrete Sleeve/Plug Design Report, December 2010.

8.5 TRIGGER ACTION RESPONSE PLANS

The Principal Monitoring TARP relates to identifying, assessing and responding to abnormal water inflows into the mine. The Principal TARP represents actions to be taken as each trigger level is reached. On the basis of water balance and analyses the following will occur:

- Should stored water be identified in water ingress to the mine, the rate of stored water inflow would be used to estimate the quantity of stored water inflows for the complete longwall, based on the data available at that time.
- The Review Team will take appropriate remedial action whenever the projected total stored water inflow reaches a trigger level.
- Known water inputs to Areas 1, 2, 3A, 3B and the total discharge from these areas are continuously tracked on the Mine's SCADA.
- The trigger levels, to initiate remedial action, are based on the total Areas 1, 2, 3A and 3B balance and analysis. The trigger levels specifically exclude Area 2 rainfall related inflows.
- Normal water inflow conditions will be defined as being < 0.5ML/day of stored water inflow to the mine from each of the stored waters (Cordeaux and Avon) averaged over a seven day period.
- All stored water inflow levels referenced within TARPs are based on this same standard of being averaged over seven days.

The Principal Response Flowcharts (Figure 2) describes the process of decision making to be applied with respect to taking corrective actions in this Plan.

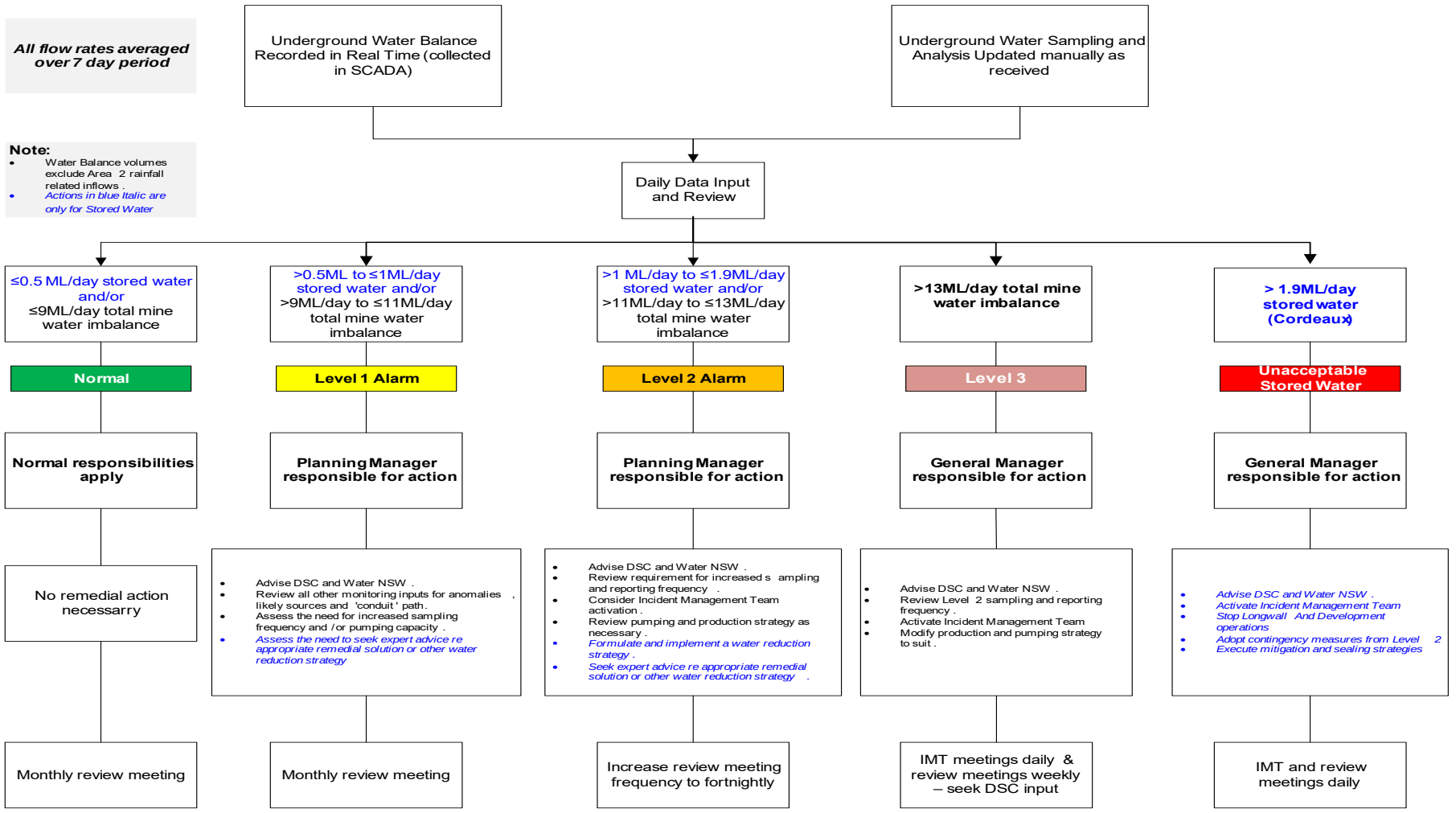
Separate TARPs are provided for Cordeaux (Figure 2a) and Avon (Figure 2b) storages. The following changes are proposed to the Principal and Secondary TARPs:

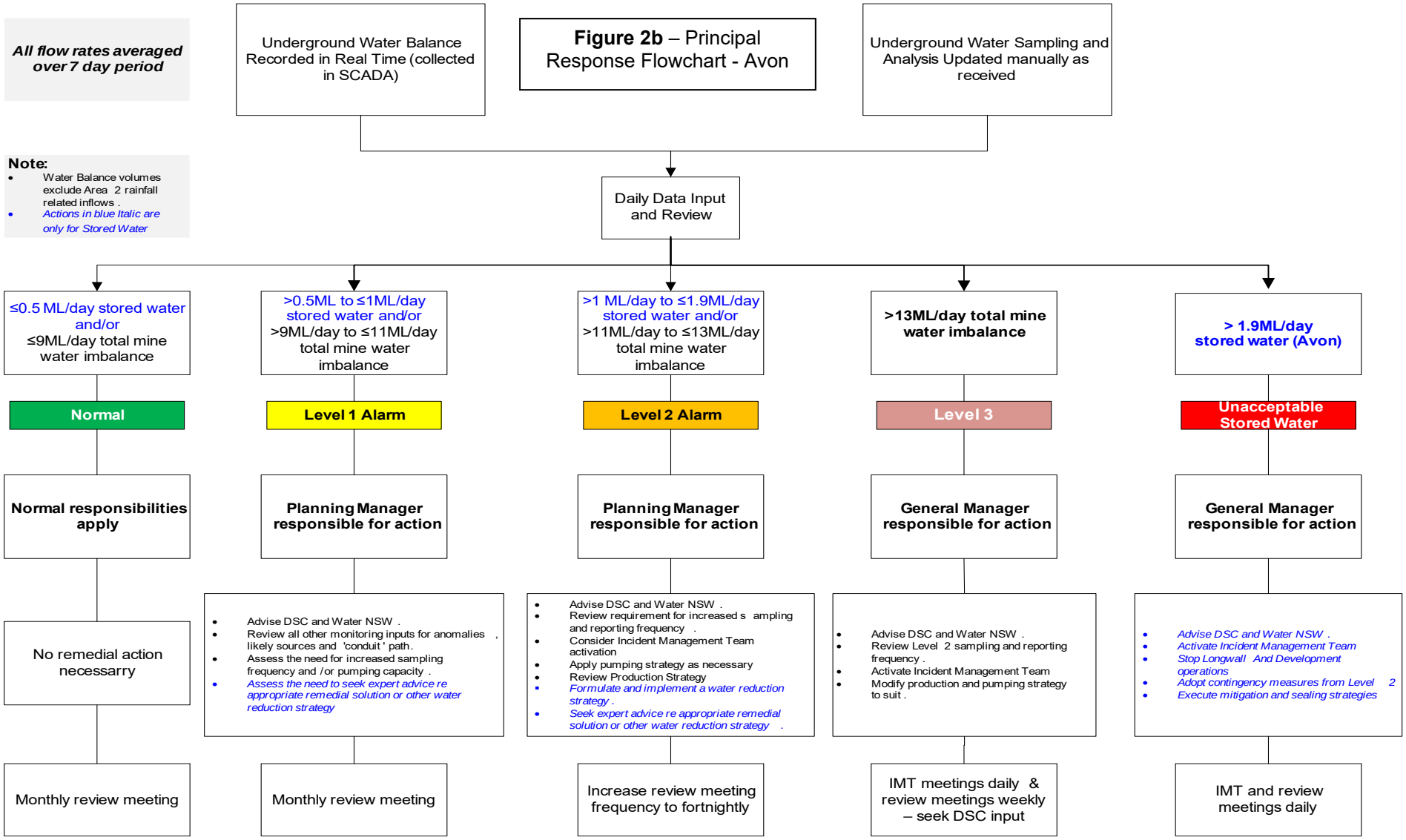
- It is critical that Dendrobium Mine is able to detect early presence of stored water and deal with the source and treatment deliberately in the TARPs. A second TARP has been incorporated into the Plan to cater for stored water from Lake Avon (Figure 2b).

- The groundwater models predict increased water make as new domains are extracted, the overall water in-balance is expected to increase (Figure 11, Hydrosimulations March 2014). It is proposed that the trigger levels based on total mine water imbalance (not stored water) should be increased to reflect the increased water make into the mine as additional mining areas are developed. The DSC is yet to agree to this principle. As this is a total mine water balance it is applied to both the Cordeaux and Avon TARPs.

8.6 PRINCIPAL TARP FLOW CHART

Figure 2a – Principal Response Flowchart - Cordeaux




All flow rates averaged over 7 day period
Underground Water Balance Recorded in Real Time (collected in SCADA)
Figure 2b – Principal Response Flowchart - Avon
Underground Water Sampling and Analysis Updated manually as received
Note:
Water Balance volumes exclude Area 2 rainfall related inflows .
Actions in blue Italic are only for Stored Water
Daily Data Input and Review
≤0.5 ML/day stored water and/or ≤9ML/day total mine water imbalance
>0.5ML to ≤1ML/day stored water and/or >9ML/day to ≤11ML/day total mine water imbalance
>1 ML/day to ≤1.9ML/day stored water and/or >11ML/day to ≤13ML/day total mine water imbalance
>13ML/day total mine water imbalance
> 1.9ML/day stored water (Avon)
Normal
Level 1 Alarm
Level 2 Alarm
Level 3
Unacceptable Stored Water
Normal responsibilities apply
Planning Manager responsible for action
Planning Manager responsible for action
General Manager responsible for action
General Manager responsible for action
No remedial action necessarry
Advise DSC and Water NSW .
Review all other monitoring inputs for anomalies , likely sources and 'conduit ' path.
Assess the need for increased sampling frequency and /or pumping capacity .
Assess the need to seek expert advice re appropriate remedial solution or other water reduction strategy
Advise DSC and Water NSW .
Review requirement for increased s ampling and reporting frequency .
Consider Incident Management Team activation
Apply pumping strategy as necessary
Review Production Strategy
Formulate and implement a water reduction strategy .
Seek expert advice re appropriate remedial solution or other water reduction strategy .
Advise DSC and Water NSW .
Review Level 2 sampling and reporting frequency .
Activate Incident Management Team
Modify production and pumping strategy to suit .
Advise DSC and Water NSW .
Activate Incident Management Team
Stop Longwall And Development operations
Adopt contingency measures from Level 2
Execute mitigation and sealing strategies
Monthly review meeting
Monthly review meeting
Increase review meeting frequency to fortnightly
IMT meetings daily & review meetings weekly – seek DSC input
IMT and review meetings daily

8.7 PRINCIPAL TARP

At 1ML/day of stored water from Cordeaux or Avon – the General Manager will stop Longwall and Development operations following confirmation of this level. When remedial measures bring stored water inflows back below this level, Longwall and/or Development operations may resume. If unable to stem flows using other remedial measures, the General Manager will implement recovery of the Longwall and Development district and sealing of the areas according to the Mine Closure

Total Underground Water Balance Coupled with Sampling and Analysis

Flow rates averaged over 7 day period	CHARACTERISTICS OF LEVEL	POSSIBLE REASONS	ACTIONS	ACTION BY	NOTIFICATION
NORMAL	≤ 0.5 ML/day stored water and ≤9ML/day total water imbalance	N/A	▪ No remedial action necessary ▪ Monthly review meeting	**No Special Action Required**	None necessary
Level 1	> 0.5 to ≤1.0 ML/day stored water or >9 to ≤11ML total water imbalance and/or Unacceptable secondary monitoring alarm	▪ Intersection of 'conduit' to stored water source ▪ Increased groundwater make ▪ Normal No.3 seam water 'make'	▪ Advise DSC and Water NSW. ▪ Review all other monitoring inputs for anomalies, likely sources and 'conduit' path. ▪ Assess the need for increased sampling frequency and/or pumping capacity. ▪ *Assess the need to seek expert advice re appropriate remedial solution or other water reduction strategy*	**Planning Manager**	▪ Water Balance Review Team ▪ DSC and Water NSW (notification within 24 hours of confirmation)
Level 2	>1.0 to ≤1.9ML stored water or >11 to ≤13 ML/day total water imbalance	▪ Intersection of 'conduit' to stored water source ▪ Increased groundwater make	▪ Advise DSC and Water NSW. ▪ Review requirement for increased sampling and reporting frequency. ▪ Consider Incident Management Team activation. ▪ Review pumping and production strategy as necessary. ▪ *Formulate and implement a water reduction strategy.* ▪ *Seek expert advice re appropriate remedial solution or other water reduction strategy.*	**Planning Manager**	▪ Water Balance Review Team ▪ DSC and Water NSW (immediately on confirmation)
Level 3	>13ML/day total water imbalance	▪ Increased groundwater make	▪ Advise DSC and Water NSW. ▪ Review Level 2 sampling and reporting frequency. ▪ Activate Incident Management Team ▪ Modify production and pumping strategy to suit.	**General Manager**	▪ Water Balance Review Team ▪ IMT ▪ DSC and Water NSW (immediately on confirmation)
Unacceptable Stored Water	>1.9ML/day stored water	▪ Intersection of 'conduit' to stored water source	▪ *Advise DSC and Water NSW.* ▪ *Activate IMT* ▪ *Stop Longwall and Development production* ▪ *Adopt contingency measures from Level 2* ▪ *Mobilise mitigation and sealing strategies* ▪ *IMT and review team meetings daily – seek DSC input*	**General Manager**	▪ Water Balance Review Team ▪ IMT ▪ DSC and Water NSW (immediately on confirmation)

▪ Note: Water Balance Volumes exclude Area 2 Rainfall related events

▪ *Actions in Blue Italic are only for Stored Water*

8.8 SECONDARY TARP

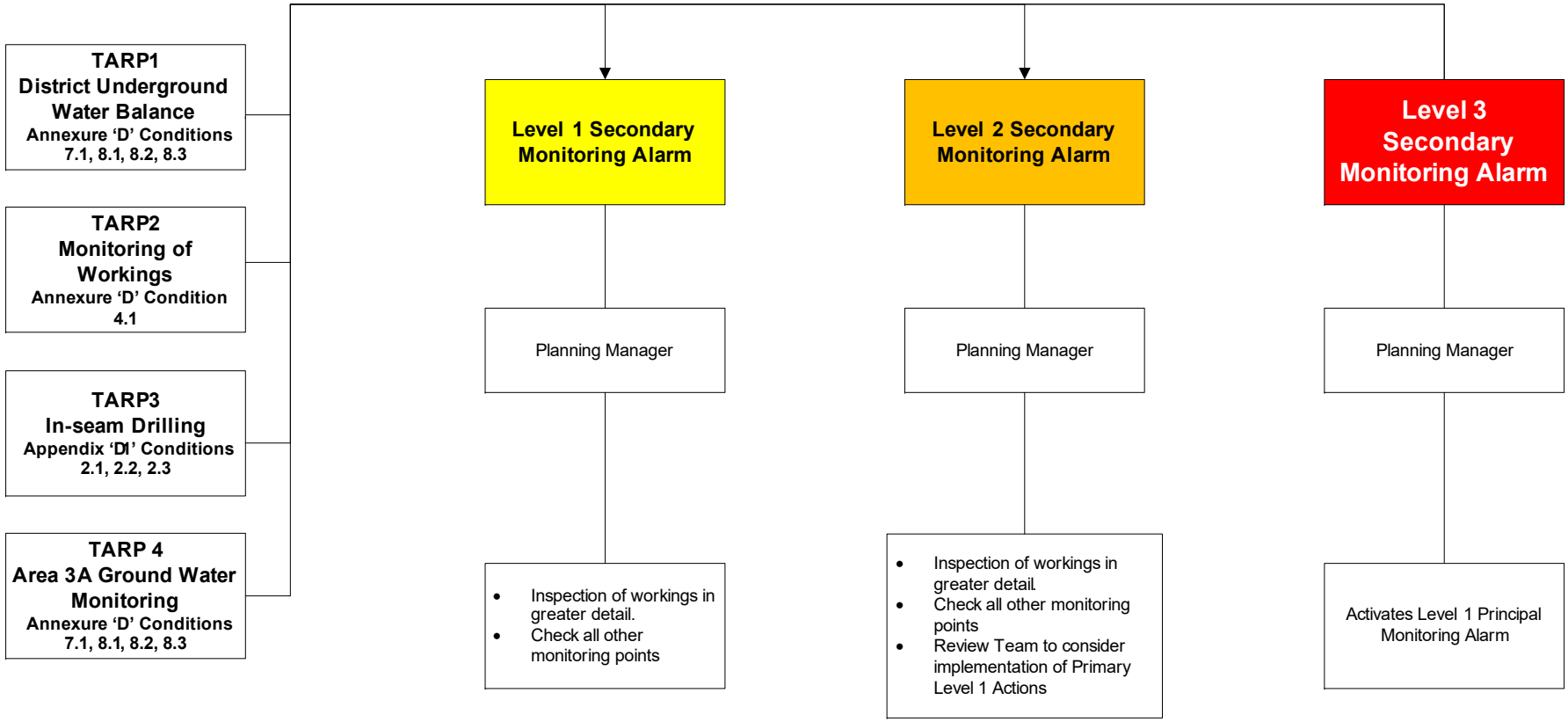


Figure 3 - Represents the relationship between the Secondary Monitoring TARPs and the Principal Monitoring TARP

Secondary TARP 1 - District Underground Water Balances Coupled with Sampling and Analysis					
	CHARACTERISTICS OF LEVEL	**POSSIBLE REASONS**	**ACTIONS**	**ACTION BY**	**NOTIFICATION**
NORMAL	Proportion of stored water < 20% of district discharge	N/A	▪ None necessary. ▪ Continue normal district monitoring, sampling and analyses: In Longwall - Weekly in active zone and monthly in non-active zones	**No Special Action Required**	None necessary
Level 1	Proportion of stored water as a proportion of development panel district discharge >20% (potentially only small quantities)	Intersection of 'conduit' to stored water source	▪ Inspection of all possible inflow zones in district ▪ Review all other monitoring inputs for anomalies ▪ Activate additional pumping capacity as necessary ▪ Initiate site remedial actions as necessary	**Planning Manager**	Review Team
Level 2	Proportion of stored water >20% to ≤50% of district discharge in Longwall Panel (potentially larger quantities involved)	▪ Intersection of 'conduit' to stored water source ▪ Intersection of goaf breaks with aquifer etc	▪ Increase frequency of all district sampling and analysis to weekly. ▪ Check SCADA data and assess need to activate any alarm levels ▪ Initiate site remedial actions as necessary ▪ Activate additional pumping capacity as required	**Planning Manager**	Review Team
Level 3	Proportion of stored water >50% of district discharge	▪ Intersection of 'conduit' to stored water source ▪ Intersection of goaf breaks with aquifer etc	Activate level 1 Principal Monitoring Alarm	**Planning Manager**	Review Team DSC and Water NSW

Secondary TARP 2 – Monitoring of Workings					
	CHARACTERISTICS OF LEVEL	**POSSIBLE REASONS**	**ACTIONS & CONSIDERATIONS**	**ACTION BY**	**NOTIFICATION**
Normal	▪ Some water make from roof, floor and sides. ▪ Minor water flow from drill holes. ▪ Minor geological structures exist with little or no water. ▪ Generally good roof and sides	N/A	▪ None necessary. ▪ Continue normal district inspections and observations	**No Special Action Required**	None necessary
Level 1	▪ Water make from roof, floor and sides increases. ▪ Increase in water surrounding mining equipment (set up of face pumps). ▪ Regular flow of water from drill holes. ▪ Increase in water around any geological structure. ▪ Roof and ribs degenerating as a result of water make.	▪ Intersection of 'conduit' to stored water source ▪ Increased groundwater make due to rainfall, intersection of goaf breaks with aquifer etc ▪ Normal No.3 Seam water 'make'.	▪ Inspection of all possible inflow zones in district ▪ Review all other monitoring inputs for anomalies ▪ Activate additional pumping capacity as required	**Planning Manager**	Review Team
Level 2	▪ Abnormal water flow from strata, particularly if causing failing strata conditions (operations affected). ▪ Continual flow of water from drill holes. ▪ Intersection of a significant structure e.g. Fault with throw >1m or large quantity of water flowing from any structure, major roof failure that does not reduce over time	▪ Intersection of 'conduit' to stored water source ▪ Increased groundwater make due to rainfall, intersection of goaf breaks with aquifer etc	▪ Increase district sampling and analysis frequency to weekly. ▪ Check SCADA data and assess need to activate any alarm levels.	**Planning Manager**	Review Team
Level 3	▪ Continuation of abnormal water flows causing strata deterioration. ▪ Inflow of water from stored waters. ▪ Intersection of a major structure e.g. Fault with throw >2m.	▪ Intersection of 'conduit' to stored water source ▪ Increased groundwater make due to rainfall, intersection of goaf breaks with aquifer etc	Activate Level 1 Principal Monitoring Alarm	**Planning Manager**	Review Team, DSC and Water NSW

Secondary TARP 3 – In-Seam Drilling					
	CHARACTERISTICS OF LEVEL	**POSSIBLE REASONS**	**ACTIONS & CONSIDERATIONS**	**ACTION BY**	**NOTIFICATION**
Normal	▪ Drilling confirms known/projected structures ahead of development. ▪ No water flow from intersected structures	N/A	Drilling maintained between workings and reservoirs	**No Special Action Required**	None necessary
Level 1	▪ Unpredicted structure of minor magnitude e.g. fault with throw 0 to 1m with signs of dampness ▪ Structure of significant magnitude e.g. fault with throw >1m but with no associated dampness means <300L/hr water flow from hole	▪ Structure of limited extent or emergence of previously unknown structure	▪ Execute provisions of the Strata Failure Management Plan ▪ Inspect structure when exposed, map and assess its potential to act as a water conduit in future workings	**Planning Manager**	Review Team
Level 2	▪ Unpredicted structure of minor magnitude e.g. fault with throw >1m and ≤ 2m with signs of dampness ▪ Structure of significant magnitude e.g. fault with throw >2m but with no associated dampness.	▪ Structure of limited extent or emergence of previously unknown structure. ▪ Structure connected to stored water, to inseam water accumulation or to another conduit to stored water or in seam water accumulation	▪ Execute provisions of the Strata Failure Management Plan ▪ Inspect and assess potential for water inflow problems during Longwall or Development mining. ▪ Include in description of geological structure in monthly report	**Planning Manager**	Review Team
Level 3	▪ Unpredicted structure of major magnitude e.g. fault with throw < 2m with signs of moderate water flow (Moderate water flow >300 and <1500L/hr) ▪ Any structure generating significant water flow from the hole (significant water flow > 1500L/hr)	▪ Structure of limited extent or emergence of previously unknown structure. ▪ Structure connected to stored water, to inseam water accumulation or to another conduit to stored water or in seam water accumulation	Activate level 1 principal monitoring alarm	**Planning Manager**	Review Team, DSC and Water NSW

Secondary TARP 4 – Area 3A Ground Water Monitoring (Bores S1867, 1870, 1992 & 1994)					
	CHARACTERISTICS OF LEVEL	**POSSIBLE REASONS**	**ACTIONS**	**ACTION BY**	**NOTIFICATION**
Normal	Depressurisation of Scarborough Sandstone to Wongawilli Seam strata Partial depressurisation of Hawkesbury & Bulgo Sandstones	▪ Predicted impact of Longwall on Groundwater	▪ Download Area 3 piezometers monthly ▪ Review data at normal review team meetings	**Planning Manager**	None necessary
Level 1	Piezometric Head in the Bulgo Sandstone approaches SWL	▪ Water movement commencing towards goaf	▪ Review Team to consider data and review water balance and other monitoring data and determine appropriate actions	**Planning Manager**	Review Team
Level 2	Piezometric Head measured in one Bulgo Piezometer (within a borehole) drops below Cordeaux Dam SWL	▪ Water movement commencing towards goaf	▪ Review Team as per Level 1 ▪ Increase download frequency of remaining piezometers to weekly	**Planning Manager**	Review Team
Level 3	Piezometric Head measured in all Bulgo Piezometers (within a borehole) drops below Cordeaux Dam SWL	▪ Water movement towards goaf	▪ Actions in Level 2 ▪ Activate Level 1 Principal Monitoring Alarm	**Planning Manager**	Review Team, DSC and Water NSW

9 CLOSURE PLAN

The Plan is a requirement of DSC Standard Condition Annexure D, Section XVIII 'Closure Plans' of existing approvals. There are no Avon Reservoir Notification Area approvals that specify closure requirements.

The Plan describes the appropriate sealing protocols for the mine:

- At the completion of operations, or
- An inrush of stored water from the Reservoirs, being a failure of the IMP provisions, or
- Failure to control inflows from a Reservoir within DSC acceptable limits, being a failure of the Plan contingency provisions.

9.1 SCOPE

This Plan applies to:

- The closure of Dendrobium Mine at the completion of the operations or as required to effectively control adverse water inflow.
- Sealing methods for the underground areas of the mine and the mine entries to fulfil the obligations imposed by the DSC Notification Area Approvals, consistent with the requirements of the NSW Coal Mining Health and Safety Act 2002 and NSW Coal Mining Health and Safety Regulations 2006 and Dendrobium Lease Conditions.

9.2 ASSUMPTIONS

The assumptions upon which this Plan is based are:

- Total stored water inflows from Cordeaux Reservoir into Dendrobium are limited to a maximum of 1 ML/day during the life of the mine, while the short-term mine limit of 2 ML/day can be achieved without the use of remedial measures.
- A sustained loss of no more than 1ML per day be applied to future mining operations within the Avon Notification Area;
- Permanent hydraulic seals can control long-term stored water inflows to Areas 2 and 3 to zero so that residual inflows into Area 1 represent the long term losses from Cordeaux Reservoir and are maintained below 1 ML/day.
- The final seals erected to seal Area 1 and the Mine portals limit any flow of stored water from the mine entering via the Wongawilli Seam workings to less than 1 ML/day regardless of the failure of the inbye seals. The final seals to Area 1 do not address potential leakage from the reservoir via the Mt Kembla Mine Bulli Seam workings to the Area 1 goaf. Any stored water

inflow to the Area 1 goaf via the Mt Kembla workings would be dealt with by the Contingency Plan (Section 8) prior to implementing the Closure Plan. The final design of the permanent hydraulic seals with regard to 'leaky' versus 'non-leaky' will be assessed as part of mine closure. Hydraulic seals erected must have 100+ years life.

9.3 CONTROL PROCEDURES

The process that will govern the installation of permanent hydraulic seals (in consultation with the DSC, Water NSW and DPE) is:

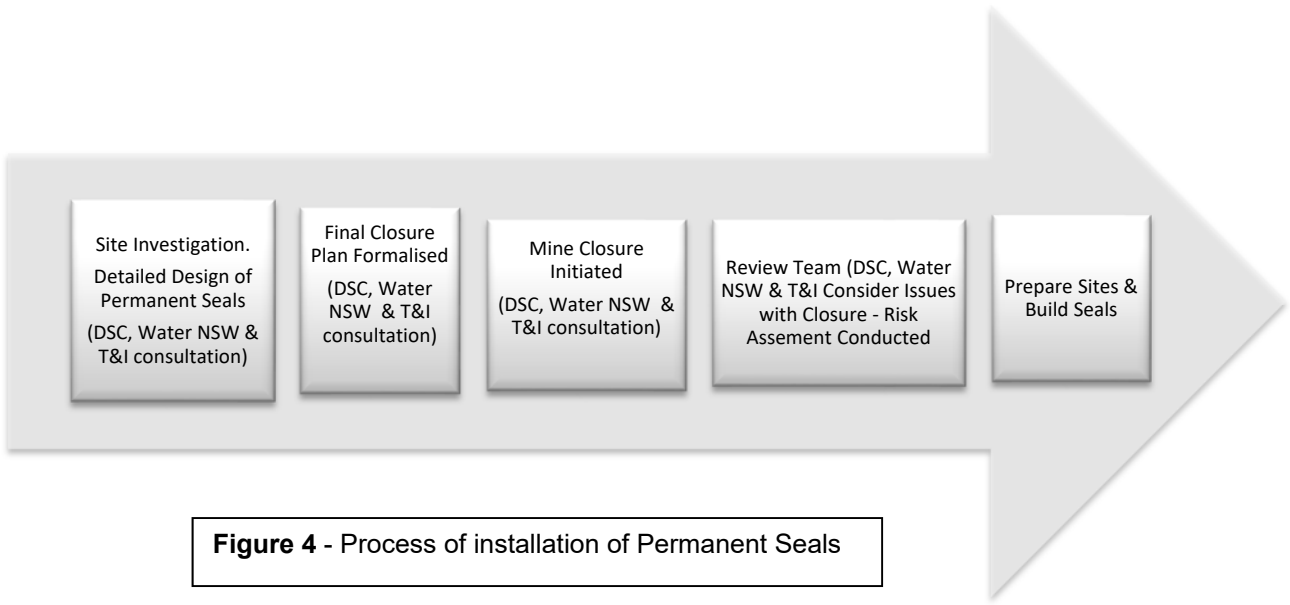


Figure 4 - Process of installation of Permanent Seals

9.3.1 Water Inflow Scenario Analysis

A scenario analysis has been undertaken as the basis for developing/reviewing the mine closure sealing strategy. Table 1 summarises water inflow scenarios, potential leakage paths expected, flow/flooding sequences and experiences to date.

Potential Leakage Paths	Scenario Analysis
Wongawilli Seam	Any water accumulation in the workings would be subjected to the normal hydrological regime that draws water down dip to the northwest. Area 3 is down dip of Area 2 which is down dip of Area 1.
Dendrobium Portals	Any significant flow of water would result in ponding in the workings. Depending on the source, if the Contingency Plans or the IMP were not successful, the flow would result in flooding of the workings. The highest point in the mine is Nebo Mains 1 cut-through, adjacent to Dendrobium and Kemira Valley Tunnels. Ultimately the water level would rise and over flow would occur to the Kemira Valley portal, due to the level in Dendrobium Tunnel.
Connections to Adjacent Wongawilli Seam Workings	

Potential Leakage Paths	Scenario Analysis
Connecting Headings	There are no planned connections to the adjacent Kemira or Nebo Workings and the IMP requires a system of protective boreholes to ensure that workings do not inadvertently mine into an unmarked roadway. There are no adjacent workings within 500m of the proposed Area 2 or 3 workings.
In-seam Boreholes	These have been used to prove the location of adjacent workings and manage water accumulations. Currently there are live boreholes being used to emplace and drain the water from Kemira Colliery. In addition there are boreholes to Nebo Colliery (now part of the adjacent Wollongong Coal's Wongawilli Colliery) to emplace mine water and draw off clean water. The holes are nominally 100mm diameter. All holes have been surveyed and are included in the Dendrobium Mine Plan.
Seepage	▪ Dendrobium has already worked down dip of accumulated water in the adjacent Kemira and Nebo Workings. ▪ Nebo Mains at the closest point is 45 metres from Nebo Workings where the head is approximately 15 metres above Nebo Mains. Kemira Mains, at the closest point, is 127 metres from Kemira Mine Workings, which have 27metres head of water at that location. ▪ Dendrobium workings do not have a noticeable water make from these adjacent flooded workings. ▪ There is no measurable seepage from neighbouring Wongawilli Seam workings but any water that does result from long term seepage from adjacent workings can be clearly and scientifically differentiated from water entering the mine from Cordeaux Reservoir.
Connections to Overlying Bulli Seam Mount Kembla Workings	
Shafts	Dendrobium No 1 Shaft was sunk through the overlying Bulli Seam Workings to the Wongawilli Seam. There are no identified shafts or drifts from the Mt Kembla Workings to the Wongawilli Seam workings.
Exploration Boreholes	All exploration borehole locations are known and proper abandonment protocols will continue to be carried out.
Vertical and Inclined Boreholes	▪ Currently there are no significant flows from the Mount Kembla Workings. The holes are drilled to ensure that all overlying water is drained prior to development and extraction beneath the 'potentially flooded workings'. The holes are nominally 100mm diameter. All holes have been surveyed and are included on the Dendrobium Mine Plan. ▪ Standpipes and gate valves control any flows from these holes during their operating life. Each borehole not destroyed as a result of the formation of a longwall goaf will be backfilled with cement at the end of its operating life.
Connection through Goaf Fracturing	▪ The comprehensive drilling programme to drain the overlying Mt Kembla Workings in the Bulli Seam prior to longwall extraction in Area 1 has not identified significant standing water. ▪ Uphole drilling and the subsequent extraction of Longwalls 1 and 2 has effectively drained the overlying Mt Kembla workings. The water make from the Area 1 goaf is currently less than 0.5 ML/day; water testing indicated that none of this is sourced from the Cordeaux Reservoir. ▪ The sealing of the Dendrobium workings inbye of the overlying Mt Kembla workings would ensure that, in the long term, water did not find its way into the Longwall 1 and 2 goafs and potentially to the Mount Kembla Portals from Areas 2 and 3. Bulkheads are planned to be established at Site 1 in Nebo Mains between 30 and 31 cut-throughs to stop water from entering Area 1. The review of the sealing strategy in October 2009 (see section 4.3) confirmed this strategy. ▪ The potential connection between the reservoir and the Area 1 goaf (and the overlying Bulli

Potential Leakage Paths	Scenario Analysis
	Seam Workings) is proposed to be managed as part of the Contingency Plan in the short term and as part of the Closure Plan in the long term. A grout curtain erected from Nebo Mains or Tailgate 1 is expected to be effective in controlling the flow into the Longwall 1 goaf. ▪ Any leakage from the reservoir into the Mt Kembla Bulli Seam Workings (directly or through the Area 1 goaf) not successfully managed by the installation of an underground grout curtain during the life of the mine, or after the mine was closed, then the installation of a grout curtain from the surface or a clay liner to a section of the Kembla Creek Arm of the dam would be considered. Sealing strategies close to the source of the water are preferred to strategies at the outflow. The sites of the Mt Kembla portals, which are the potential outflow points, has been reviewed and it is expected that sealing multiple sites along the escarpment to withstand the hydraulic head would be extremely difficult given the issue of limited overburden and ground stability. ▪ A flow into the Bulli Seam workings would report to the 'low point' over Longwall 1 and 2 and accumulate behind the goaf seals. Monitoring of the water level and composition is planned through-out the life of the mine. It is highly unlikely that such a flow would not be identified during mine life. Post closure the installation of a grout curtain and clay liners are proven technologies and early indications of the effectiveness could be gauged by the installation and monitoring of piezometers.

Table 1 – Water Inflow Scenarios

9.4 Hydraulic Seal Design

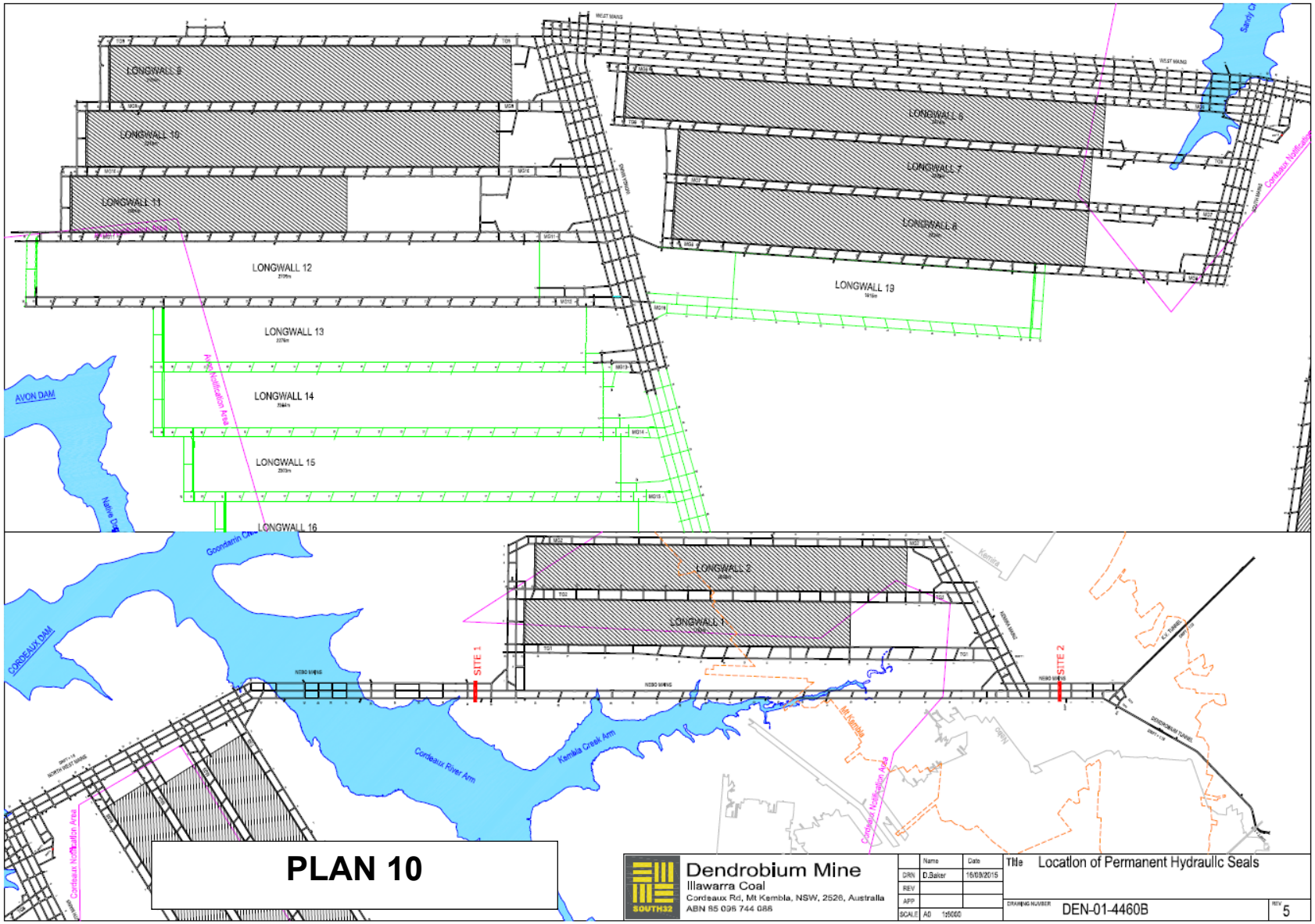
GHD (February 2005) have provided a conceptual permanent bulkhead design that can satisfy the recommendation of the Forbes Rigby, now Cardno, Consequence Study (2005), which determined the conceptual design of permanent water retention bulkheads as final seals in the event of uncontrollable inrush, stored water inflow or as a part of the normal mine closure protocol.

Two sites are identified for final seal location according to the strategy defined in Section 9.5 and Plan 10 shows the location of the permanent seal sites. The seals relevant to the Closure Plan are the hydraulic seals or permanent water retention bulkheads. Detailed seal designs for each site will be developed in consultation with the DSC and Water NSW.

9.5 Sealing Strategy

Given the likely flow paths for water into the mine and the likely outflow connections to the surface, the following points are noted to ensure that sealing solutions provided by Dendrobium Mine meet both the short and long term limits on stored water outflow from the Mine.

- Inflows to the mine will be monitored during the extraction of longwalls. The Contingency Plan details the actions that will be taken if monitoring indicates projected stored water inflows will exceed DSC limits.


LONGWALL 8
LONGWALL 10
LONGWALL 11
LONGWALL 12
LONGWALL 13
LONGWALL 14
LONGWALL 15
LONGWALL 16
LONGWALL 9
LONGWALL 7
LONGWALL 6
LONGWALL 19
LONGWALL 2
LONGWALL 1
AVON DAM
CORDEAUX DAM
SITE 1
SITE 2
Cordeaux River Arm
Kembla Creek Arm
Mt Kembla
Cordeaux Notification Area
PLAN 10
Dendrobium Mine
Illawarra Coal
Cordeaux Rd, Mt Kembla, NSW, 2526, Australia
ABN 85 096 744 088
Title Location of Permanent Hydraulic Seals
DRN D.Baker 15/09/2015
DEN-01-4460B
REV 5

- Ventilation seals were erected in each cut through of Tailgate 1 and Maingate 2 during the Longwall 1 and 2 extraction process.
- It was known that there was no stored water reporting to the mine at the completion of the extraction of Longwall 5 in Area 2. At the time of writing, this continues to be the case.
- Once the remaining roadways in Area 1 were no longer required and Longwall 2 was completed, ventilation seals with water level, drainage and sampling capability were erected across the Kemira Mains and bleeder headings. Key ventilation seals were identified for monitoring the ongoing water 'make' and the proportion of stored water during the extraction of Area 3. The erection of ventilation seals in these locations allows the Tailgate 1 roadway to be used as a parallel intake airway for the life of the mine.
- If, during the life of Areas 2 and 3, Area 1 experiences stored water inflows then Contingency Plan Principal TARP Level 1 Alarm will be activated.
- The design of permanent seals requires the site be prepared and constructed at the one time; therefore preparation of permanent seal sites beforehand is not appropriate.
- At the completion of mine operations it is assumed that the Contingency Plan provisions have been able to maintain stored water inflows below the DSC long-term limit of 1ML/day for both Cordeaux and Avon Reservoirs and below the DSC short-term limit of 2ML/day for Cordeaux Reservoir.
- Seal 1 is to be erected to seal Areas 2 and 3 from Area 1 resulting in long-term leakage from these areas being effectively zero.
- Originally Area 1 was to be sealed from Nebo Mains by installing the seals at two additional sites as Areas 2 and 3 were extracted. This strategy has been reviewed based on the lack of stored water reporting to Area 1 and ongoing operation requirements for ventilation roadways. As a result of the revised strategy the requirement for permanent seals within Area 1 is no longer valid.
- The Review Team will also consider the need for a Permanent Seal at Site 2 to isolate the Mine from any outflows from the portals, specifically water sourced from Area 1.
- In the event that inflows to the Bulli Seam were not recognised and mitigated during mine life then the installation of a grout curtain from the surface or the installation of an impermeable liner (e.g. clay) in the Kembla Creek Arm of the reservoir are considered to be the best mitigation strategies post closure.
- The current workings provide 376 days of storage at the highest recorded inflow rate for the Southern Coalfield (Wongawilli Blue Panel) of 2.5ML/day. The storage capacity within the workings is additional to the 13.4ML/day mine pump capacity. The erection time for seals varies between 2 days for ventilation seals to a month for permanent seals with an additional

month required to achieve full strength. The ventilation or temporary seals could also be used to slow the inflow rate and provide additional time to erect permanent seals.

9.6 PERMANENT HYDRAULIC SEAL DESIGN

Permanent hydraulic seal design is addressed in Dendrobium Area 1 Bulkhead Report (GHD, February, 2005). Site investigations have been undertaken and are reported in DEN2964A, Site investigation for Underground Seals at Dendrobium Mine (SCT 2007).

9.7 PERMANENT AND VENTILATION SEAL SITES

Permanent and ventilation seal sites are to be considered by the Review Team at Mine Closure.

9.7.1 Permanent Seal Site 1

To prevent stored water from entering (or leaving) Area 1 from (or to) Area 2 and 3 workings, seals will be installed at Site 1 across Nebo Mains between 30 and 31 cut-throughs i.e. at the point before the Nebo Mains development passes beneath the Cordeaux River arm of the reservoir. The depth of cover at Hydraulic Seal Site 1 is 160 to 190 metres.

9.7.2 Permanent Seal Site 2

The preferred site to isolate the portals from leakage from Area 1 is between 4 and 5 cut-through in Nebo Mains for the following reasons:

- Underground the location is geotechnically stable ground;
- Located >150m from the top of the escarpment and 600m from the major gradients of the escarpment, the potential for pre-existing surface cracking parallel to the escarpment is minimised;
- Located under a ridge, with surface elevation of 376m;
- Seam level of 171 metres;
- Depth of cover is maximised (205 metres); and
- The potential for deep talus slopes is minimised.

9.7.3 Ventilation Seal Sites

Ventilation seals were erected in each cut-through of Longwall 1 Tailgate and Longwall 2 Maingate as they were extracted. The erection of ventilation seals in these locations allows the Tailgate 1 and Maingate 2 roadways to be used as parallel intake airways. Seals have been installed in Areas 2 and 3 as the longwalls are extracted and will continue to be installed to manage ventilation.

9.8 MONITORING AND REPORTING

During the life of the mine the Areas 1, 2 and 3 key ventilation seals will have provision to measure water pressure and quality. Additional standpipes and valving will also be installed to manage water levels. Water levels behind each seal will be measured on a monthly basis and visual checks of seal integrity performed.

The data obtained from the monitoring of Areas 1, 2 and 3 seals during the life of the Mine will provide information:

- On future risk to the stored waters;
- For modifications to the design, location and necessity of hydraulic seals; and
- As input data to the ongoing considerations of the Review Team.

Reports will be provided to the DSC and Water NSW on a monthly basis. This report will include the status of the ventilation and permanent seal preparation and construction according to these provisions and monitoring results from Areas 1, 2 and 3 seals in addition to the data to be provided as a result of the IMP, Contingency Plan and any other conditions of approval.

9.9 TRIGGERS AND RESPONSES

Sealing of the Mine may only be initiated by the General Manager following consultation with the Review Team, IMT, DSC, Water NSW and DPE and with recognition that further remedial measures would be ongoing following sealing.

It is anticipated that the requirement for early sealing will never eventuate as remedial action defined within the Contingency Plan is triggered at a level well below DSC imposed limits.

Final sealing of the Mine will be undertaken in the normal course of events and according to the strategy defined in Section 9.5.

10 RESPONSIBILITY AND AUTHORITY

10.1 Review Team

The Review Team consists of the following regular members:

- Planning Manager or Mine Manager;
- Water Balance Officer;
- Principal Approvals;
- Geotechnical Engineer (when required);
- Water Quality Consultant (when required);

- Mining Consultant/Geologist (when required);
- Mine Surveyor (when required); and
- Hydrogeology Consultant (when required).

The team can request the attendance of additional personnel, stakeholders (e.g. DSC and Water NSW) and technical specialists as it deems necessary.

The Review Team shall:

- Review all monitoring data generated as a result of the provisions of this Plan;
- Determine the need for any additional monitoring, inspections, tests, expert opinion or advice or otherwise to improve their knowledge and understanding of the situation at any time regarding any water inflows or potential stored water inflows and the appropriate response;
- Participate in review of the Plan;
- Cause the implementation of an appropriate remedial response should any Principal Monitoring Trigger level be projected to occur during the life of each longwall;
- Cause the immediate implementation of the responses specified within the relevant TARP and any other action that the team considers necessary should any trigger level be attained;
- Provide assistance to the IMT in the event it is established;
- Ensure that all actions required as a result of this Plan are clearly communicated in writing to those responsible for their implementation; and
- Maintain detailed minutes of each Review Team meeting and in the event of an inflow from Avon or Cordeaux Reservoir, the minutes will be forwarded to the DSC and Water NSW.

10.2 Incident Management Team

The IMT will operate in accordance with the Emergency Response Control Plan DENMP0088. For TARP related activities the IMT as a minimum will consist of the following four members with others as required:

- Mine Manager
- Production Manager
- Planning Manager
- Engineering Manager

The IMT shall:

- Be initiated when Level 3 or Unacceptable Level of the TARP has been reached;
- Meet daily and assess what is occurring, determine the need for any additional monitoring, inspections, tests, expert opinion or advice or otherwise to improve their knowledge and understanding of the situation and what actions are required;

- In the case of stored water flows, implement an appropriate sealing response should any situation warrant the implementation of these control measures following discussion with the DSC and agreement that no other safe course of action is available;
- In the case of stored water flows, seal preparation and construction are undertaken according to the provisions of this Plan and that suitable monitoring facilities are incorporated;
- Ensure all actions required as a result of this Plan are clearly communicated in writing to those responsible for their implementation; and
- Maintain minutes of each IMT meeting and in the event of an inflow from Avon or Cordeaux Reservoir, the minutes will be forwarded to the DSC and Water NSW.

10.3 Mine Manager

The Mine Manager shall:

- Ensure that the resources required by this Plan are provided as required by the Review Team and/or any other Official with defined duties;
- Act as a member of the IMT;
- Act as a member of the Review Team when required; and
- Take specific actions defined within the Principal TARP related to the implementation of remedial measures and where required the cessation of longwall operations and implementation of a sealing solution.

10.4 Planning Manager

The Planning Manager shall:

- Act as a member of the Review Team;
- Act as a member of the IMT;
- Ensure that monitoring data related to, and triggers generated by, the IMP are made available for assessment by the Review Team at its meetings;
- Implement the specific actions defined within the Principal TARP and Secondary TARPs as trigger levels are reached;
- Ensure that all personnel with responsibilities under the plan are trained to the required standard;
- Ensure standards and frequencies related to the monitoring controls are adhered to; and
- Ensure the quality elements related to the ongoing effectiveness of this Plan are conducted and reported as required by the provisions of this Plan.

10.5 Maintenance Superintendent

The Maintenance Superintendent shall:

- Ensure the resources required by this Plan are provided as required by the Review Team and/or any other Official with defined duties relating to emergency procedures, preventative and remedial pumping systems; and
- Act as a member of the IMT.

10.6 Mining Engineering Manager

The Mining Engineering Manager shall:

- Ensure elements of the IMP regarding 'Monitoring of Workings' are completed according to Annexure D, Section IV.

10.7 Water Balance Officer

The Water Balance Officer shall:

- Review the water balance data and alarms;
- Review statutory reports to identify unusual mine inflows;
- Undertake underground water sampling;
- Lead the preparation of reports to the DSC (weekly, monthly, borehole completion);
- Liaise with Manager Approvals;
- Co-ordinate the Review Team meeting;
- Act as a member of the Review Team; and
- Assist the IMT as required.

10.8 Mining Consultant/Geologist

The Mining Consultant or Geologist shall:

- Act as a member of the Review Team when required.

10.9 Mine Surveyor

The Mine Surveyor shall:

- Generate and update plans and other data as required by this Plan or as directed by the Review Team or Incident Management Team.

10.10 Control Officer

The Control Officer shall:

- Remain aware of the provisions within the TARPs associated with this Plan;
- Respond immediately to any SCADA alarm or any other monitoring alarm related to this Plan that he becomes aware of, as defined within the relevant TARP; and
- Co-ordinate response activities as directed by the Planning Manager to the full extent of his training, experience and authority.

10.11 Water Quality Consultant

The Water Quality Consultant shall:

- Assess the information related to water quality received from the NATA Testing Authority;
- Act as a member of the Review Team as required;
- Immediately bring to the attention of the Planning Manager any anomaly identified as a result of the assessment of results;
- Ensure that the NATA Testing Authority immediately advises the Water Quality Consultant of any anomaly identified as a result of their analysis; and
- Assist in the training of “best practice “methodology for obtaining, labelling and transporting water samples for analysis.

10.12 Geotechnical Engineer

The Geotechnical Engineer shall:

- Act as a member of the Review Team as required;
- Perform underground inspections of workings according to the SFMP;
- Promptly inspect, as appropriate, any reported abnormal underground water inflow;
- Assess and interpret drillers logs; and

10.13 Underground Mining Officials

Underground Mining Officials shall:

- Conduct underground inspections for signs of abnormal water inflows from strata, from goaf areas or any abnormal water accumulations within the mine and immediately report all observations to the Senior Mining Official and record in detail in their daily statutory report; and
- Ensure activity conducted in relation to this Plan,, is conducted according to Dendrobium IMP.

10.14 Training Coordinator

The Training Coordinator shall ensure:

- That the Quality provisions related to training are developed, conducted and reported as required by the provisions of ‘Training and Competency’; and
- Co-ordinate any training required by the Plan.

10.15 Principal Approvals

The Principal Approvals will:

- Act as a member of the Review Team; and
- Ensure that the resources required by this Plan are provided as required by the Review Team and/or any other Official with defined duties.

10.16 Hydrogeological Consultant

The Hydrogeological Consultant will:

- Act as a member of the Review Team when required; and
- Immediately bring to the attention of the Planning Manager any anomaly identified as a result of the assessment of results.

11 TRAINING AND COMPETENCY

The Training Co-ordinator is responsible, on the basis of information obtained from the Planning Manager for detailing the minimum general training requirements relating to DSC Monitoring, Contingency and Closure Plans for underground employees and the more specific training requirements applicable to personnel who carry out designated development and other related tasks. The Training Co-ordinator shall develop training modules that include competency-based assessment.

11.1 DSC Contingency Awareness

The content of this module shall include an introduction and basic explanation of the structure of the DSC Management Plans and how it is designed to predict and prevent inrush, escape and first response principles and the outcomes of relevant risk assessments.

It shall be applied to all personnel who may, at any time, be required to pass through or work in a mining panel, development or longwall, or adjacent to an Inrush Control Zone (ICZ).

Module	Topics	When
Inflow identification assessment and reporting (All employees)	▪ General awareness and the critical nature of water inflow and accumulation observations. ▪ The need to formalise these and the means to do that – statutory reports ▪ The need to ensure that this information is forwarded to the technical specialists who will assess and act on it	▪ At start of employment ▪ Regular toolbox talks and re-assessment of understanding
Underground Water Sampling (To be provided by Water Quality Consultant)	▪ Methodology of Sample Collection, Labelling and Transport to Testing Authority ▪ Criticality of strict adherence to established procedure	▪ At start of employment. ▪ At any time audit reveals any deficiency in protocols being used
Alarm Response (Control Officers)	▪ Provisions contained within TARPs	▪ At start of employment as Control Officers. ▪ Re-assessment after 12 months
Supporting activities for contract drillers	▪ As defined by contract drillers and contractors employed to perform	▪ At start of employment ▪ Re-assessment after 12 months

Module	Topics	When
and PUR injection personnel (Selected employees)	PUR/Grouting activities	
Drilling (Drillers and drilling contractors)	▪ Purpose of in-seam drilling within the notification area. ▪ Drilling procedures ▪ Hole logging – especially related to the identification of structures, water flow, hydrostatic head, and gas flows. ▪ Hole surveying	▪ At start of employment ▪ Regular toolbox talks and re-assessment of understanding

11.2 Duties and Responsibilities

The content of this module shall be an explanation of the contingency related duties and responsibilities of Officials who have roles defined by the Plan. It shall be applied to any new Official in the first instance and re-assessment made of each incumbent following review of the Plan.

12 DOCUMENT CONTROL

The Plan shall be controlled as part of the Illawarra Coal Document Control System.

Modifications to the Plan or the standards and procedures that are referenced by the Plan may occur as a result of the auditing and review process, the assessment and implementation of a corrective action or as a result of system improvements or modifications. The Planning Manager shall approve all modifications and amendments to the Plan or associated documentation.

The Planning Manager shall delegate, to an appropriately qualified person, the responsibility to document any changes to the Plan, decide the personnel who are to receive controlled copies of the Plan and its associated standards and procedures.

13 REVIEW

The Plan shall be reviewed on a regular basis and the results of the review will be used to initiate a revision of the Plan as required.

14 RECORD KEEPING AND CONTROL

Data derived from monitoring will be archived and stored for a period of at least seven years. Statutory reports containing information relating to inspections and observations, the geological database, weekly planning sheets, relevant correspondence, notification and approvals, training records, records of communication, particularly with statutory authorities, audit reports and review recommendations shall be maintained for a period of at least seven years.

Reports relating to the actions taken, including any subsequent assessment/investigation, in response to any trigger shall be kept by the Planning Manager for a period of at least seven years.

15 COMMUNICATION AND CONSULTATION

Dendrobium Mine maintains a comprehensive system of forums for communication that will be used to regularly inform employees of current issues and changes to the Plan.

These may include:

- Shift meetings, where safety and operational issues for the upcoming shift are discussed. This is the most direct forum for providing information to the crews relevant to upcoming conditions;
- Tool box talks are held as a regular form of communication between management and the workforce on each shift;
- Shift changeover meetings by Officials and Control Officers being relieved are undertaken to update the Official relieving them as to the current status or any problems encountered during the previous shift;
- Daily operational meeting;
- Monthly meeting of the Health Safety Environment and Community Committee; and
- Crew and department safety meetings.

For further details refer to the procedure Communication at Dendrobium Coal Mine DENP0107.

16 ASSOCIATED DOCUMENTATION AND REFERENCES

The following documents listed below support this Plan.

Dendrobium Procedures and other Documents
DSC – Dendrobium Water Management Procedure– DENP0048
Inrush Management Plan – DENMP0005
Cordeaux Reservoir Notification Area Monitoring Management Plan –DENMP0003
Cordeaux Reservoir DSC Notification Area Contingency Plan – DENMP0049
Cordeaux Reservoir DSC Notification Area Closure Plan – DENMP0030
Strata Failure Management Plan – DENMP0015
Development Roof Control Trigger Action Response Plan – DENTARP0007
Asset Protection Plan – Area 1, 2, 3A & 3B – DENMP0040
Procedure for Major Geological Structures – DENP0257
Rib Control Trigger Action Response Plan – DENTARP0008
Communication at Dendrobium Mine – DENP0107
Dendrobium Dyke Stress Change Monitoring – March 2010
Dendrobium Incident Management Manual – DENMP0076
DSC Area 3A Mine Design Management Plan – DENMP0072
Dendrobium Incident Management Manual Avon and Cordeaux Reservoir Notification Area Management Plans – DENMP0078 Revision 0
Associated Documentation and References
DSC/SCA Documentation and Information Sheets: ▪ DSC4B Mining Near Prescribed Dams Management Mining Applications ▪ DSC4C Mining Near Prescribed Dams Management and Monitoring Matters ▪ DSC4D Mining Near Prescribed Dams Contingency Plans
NSW DSC Annexure “D” Standard Mining Conditions: ▪ DPI 080708 – West Mains to LW6 Development ▪ DPI 130308 – West Mains to 4 C/T ▪ DPI 241208 – Area 3A Development ▪ I&I 290110 – E Heading ▪ I&I 290110 – Longwalls 6-9 Extraction ▪ I&I 171210 – Longwall 6-8 within Cordeaux Notification Area ▪ DSC 091111 – DSC Approval to reduce monitoring of 4cct ▪ T&I 150113 – Longwall 11 Extraction in the Avon Notification Zone ▪ DSC 180913 – Approval to reduce monitoring of West Mains 4c/t to normal. ▪ DSC – 080114 – Approval to reduce Area 1 and part of Area 2 Monitoring. ▪ DSC – 020415 – Endorsement of LW12 and 13 Gate Roads. ▪ DSC – 131017 – Endorsement of LW15 Gate Roads

- DSC – 201017 – LW14 Endorsement

Dendrobium Plans
Plan 1 - Dendrobium Workings, Lake Cordeaux and the DSC Notification Area – DEN-01-5617
Plan 2 – Faults and Dykes Dendrobium Area 3B
Plan 3 - Groundwater Monitoring Dendrobium Area 1
Plan 4 - Groundwater Monitoring Dendrobium Area 2
Plan 5 - Groundwater Monitoring Dendrobium Area 3
Plan 6 – Dendrobium Area 3B Subsidence Monitoring
Plan 7 – Dendrobium Water Sampling Sites – DEN-01-3833
Plan 8 – Dewater Pumping System – DEN-07-3322
Plan 9 – Dendrobium Pump Line Diagram – DEN-07-6184
Plan 10 – Location of Permanent Hydraulic Seals – DEN-01-4460

External Publications

- The Dendrobium Project Critical Risk Management Assessment 2001, Australian Coal Mining Consultants that identified the major inrush risks to the mine,
- Review of Environmental Factors for Selection and Development of Monitoring Sites for Area 1 of the Dendrobium Underground Coal Mine (Project S3733, August 2003).
- Assessment of Long Term Stability of Nebo Mains and Area 1 Chain Pillars Within the DSC Notification Area at Dendrobium Mine – SCT Operations P/L.
- Hydrogeological Interaction of Underground Coal Mining – GHD LongMac June 2004
- Dendrobium Area 1- Hydrogeological Monitoring During Longwall Extraction and Collection of Additional Incidental Hydrogeological Data of Relevance to Area 1 - GHD LongMac
- Dendrobium Mine - BHP-Billiton Response Plan - Water Inrush – Ground Consolidation P/L
- Risk Assessment on the Potential Impacts of Mining Area 1 on Cordeaux Reservoir – HMS Consultants.
- Design of Permanent Water Retention Bulkheads – Dendrobium Mine – Intercon P/L
- Dendrobium Area 1 Bulkhead Report, dated February, 2005 by GHD.
- Scenario Consequence Report on Potential Discharge from Dendrobium Mine Portals – Forbes and Rigby Pty Ltd.
- Hawcroft Miller Swan Consultants Risk Review undertaken in January 2005 that reviewed all data associated with Area 1.
- Hawcroft Miller Swan Consultants Risk Review undertaken in July 2005 to review data and assess the risks associated with the development of Area 2.
- Hawcroft Miller Swan Consultants Risk Review undertaken in October and December 2005 to review all data associated with Area 2 and update previous findings from Area 1 operations and identify risks associated with operating longwalls in Area 2.
- Risk Assessment Area 2 Extraction Impacts on Cordeaux Reservoir and Upper Cordeaux No.2 Dam and Reservoir. Hawcroft Miller Swan Consultants, Foster, P. & Allanson, C., January 2006
- AXYS Consulting May 2008 Risk Assessment to review all data associated with Area 3A
- HMS Consultants Australia, July 2009 Cordeaux Reservoir DSC Closure, Contingency and Monitoring Management Plan Audit.
- HMS Consultants Australia, October 2009 Cordeaux Reservoir DSC Closure, Contingency and Monitoring Management Plan Gap Analysis to review all data associated with Area 3A
- SMEC Australia, December 2010 Dendrobium Water Inflow Solution – Concrete Sleeve/Plug Design Report,
- AXYS Consulting February 2014 Qualitative Risk Assessment – Loss of Stored Water from Avon Reservoir from the Mining of Longwalls 12 to 18.

- AXYS Consulting Pty Ltd - Loss of Stored Water from Avon Reservoir, Risk Assessment Report (AR1664), Revision 3, 08 September 2016.

17 PLANS

A3 or higher versions (297x420mm) of the Plans included in the text are electronically provided to facilitate being reproduced in larger format if required.

Plan 1 DEN-01-5617

Plan 2 X-1050

Plan 3 Groundwater Monitoring Area 1

Plan 4 Groundwater Monitoring Area 2

Plan 5 Groundwater Monitoring Area 3

Plan 6 Subsidence Monitoring

Plan 7 DEN-01-3833

Plan 8 DEN-01-3322

Plan 9 DEN-07-6184

Plan 10 DEN-01-4460

18 APPENDIX A

Appendix A lists the DSC Approval Conditions for Area 3A and 3B:

- Area 3A Development 24/12/2008
- West Mains E Heading 22/12/2009
- Longwall 6-9 Extraction 22/12/2009
- Longwall 6-8 Extraction 17/12/2010
- DSC approval to reduce monitoring of 4 c/t 9/11/2011
- Longwall 11 Extraction 18/12/2012
- DSC approval to reduce monitoring of 4 c/t to “normal” 18/9/2013
- Longwall 12 Extraction 23/11/2015
- Longwall 13 Extraction 15/11/2017
- Longwall 14 Extraction 12/10/2017

The table on the following pages lists the DSC requirements and Dendrobium actions.

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/3	Notice of commencement of mining within NA	Within seven days of commencement	One off	Within seven days of commencement
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016)	Annexure D/4	Inspection of Workings *LW 11 - Not applicable*		Weekly	Monthly

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
• Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)					
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/5	Plans of Seam Level Geology *LW 11 - Not applicable*			Monthly
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads	Annexure D/5	Plans of Seam Level Geology *LW 11 - Not applicable*			On completion of mining Area

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
(16/10/2017)					
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/7	Mine Water Monitoring		Daily	Monthly
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16)	Annexure D/8	Notification if “significant” water inflow occurs *LW 11 - Not applicable*		As required	Immediately

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
• Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)					
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/9	Plan for programme of Subsidence Monitoring *LW 11 - Not applicable*	Before Mining	One off	Before Mining in Monitoring Management Plan
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016)	Annexure D/9	Subsidence Monitoring Results • ALS • 3D Control • Valley Closure • Visual Crack Conditions don't specify type of survey *LW 11 - Not applicable*	ALS within 2 months of survey, Other surveys within 1 week of survey. Conditions specify within one month of survey	Prior to commencement of Panel. After completion of each longwall	ALS within 2 months of survey, Other surveys within 1 week of survey. Conditions specify within one month of survey

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
• Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)					
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/17	Monitoring Management Plan to the satisfaction of the Committee *LW 11 - Not applicable*	Before Mining	One off	Before Mining
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12)	Annexure D/17	Review of Monitoring Management Plan *LW 11 - Not applicable*		Annually	Annually

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
• Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)					
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/19	Statistical Report *LW 11 - Not applicable*	By 31 July	Annually	By 31 July
Dendrobium-4 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9	Annexure D/20	Compliance Report		Monthly Every 6 months or as required by Committee	Monthly Every 6 months or as required by

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
(22/12/2009) • Extraction LWs 6-8 (17/12/10)					Committee
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/21	Monitoring, Reporting and Extraction Schedule *LW 11 - Not applicable*		Monthly	Monthly
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015)	Annexure D/22	Liaison officer appointed		One off	Before Mining

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
• Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)					
Dendrobium-4, 5 & 6 • Area 3A Development (24/12/2008) • E Heading (22/12/2009) • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D/23	Location of the Face		Weekly	Weekly
Dendrobium-4 • Area 3A Development (24/12/2008) • E Heading (22/12/2009)	Annexure D1/2	Completion Report for In-seam Drilling	Within 1 month of completion of borehole	Fore each borehole	Within 1 month of completion of borehole
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Area 3A Development	Annexure D1/3	Water fingerprinting program	Before Mining	One off	Before Mining in Monitoring

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
(24/12/2008) • E Heading (22/12/2009) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)					Management Plan
Dendrobium-4 • E Heading (22/12/2009)	Annexure D1/4	Monitoring Plan 4 c/t Area	Before Mining	One off	Before Mining in Monitoring Management Plan
Dendrobium-4 • E Heading (22/12/2009) • DSC letter (9/11/11) • DSC letter (18/9/13)	Annexure D1/4	Monitoring 4 c/t Area Monitoring Results		Weekly - normal	Monthly
Dendrobium-4 • E Heading (22/12/2009) • DSC letter (18/9/13)	Annexure D1/4	Review of 4 c/t Monitoring Plan		Annually if seepage at dyke intersection increases go to weekly or daily	Annually within Monitoring Management Plan
Dendrobium-4 • Extraction Longwalls 6-9 (22/12/2009)	Annexure D1/2	Groundwater Monitoring Programme	Approved before mining within 300m of	One off	Before mining within 300m of the NA

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
• Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12)			the NA		
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D1/2	Groundwater Monitoring		Hourly	
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D1/2	Groundwater Monitoring Interpretation			Monthly

Approval	Condition	Deliverable Description	Due Date	Frequency of Monitoring	Frequency or Timing of Reporting
Dendrobium-4, 5, 6, 7, 8, 9,10, and 11 • Extraction Longwalls 6-9 (22/12/2009) • Extraction LWs 6-8 (17/12/10) • Extraction LW 11 (18/12/12) • Extraction LW12 and 13 gate roads (02/04/2015) • Extraction LW13 (15/11/16) • Extraction LW14 gateroads (10/11/2016) • Extraction LW14 (12/10/2017) • Extraction LW15 gateroads (16/10/2017)	Annexure D1/3	Water Fingerprinting Programme	Approved before mining within 300m of the NA	One off	Before mining within 300m of the NA

19 APPENDIX B1 AND B2 (ONLY IF REQUIRED)

B1

Weekly Inspection – Outbye deputy - West Mains D4 Stub

This inspection is a requirement of the NSW Dams Safety Committee Approval for West Mains E Heading at Dendrobium Mine.

Date/time: _____ **Statutory Official:** _____

Flow Monitoring

– Flow is to be monitored before passing the dam so as not to disturb flow rate before measurement.

V notch weir reading (mm water above bottom of V): _____

OR

Time taken to fill 1 L measuring cylinder located at the V notch weir (sec): _____

If there is **NO FLOW** through the V notch please circle one of the following:

Dam dry/Ponded water.

Perform a visual inspection of workings at dyke intersection in the last 15m inbye end of stub (tick appropriate boxes).

		Minor drip	Trickle	Flow	Water Clarity (eg Clear, Muddy)
Seepage from dyke					
Seepage from 4m cable bolts inbye dyke	Cable 1				
	Cable 2				
Seepage from coal jointing at dyke margins					
Any new flows?					

Deterioration/fretting of dyke material? Yes/No

Page 1 of 2

General comments/changes observed

Ventilation Conditions

Note any damage or defect in Brattice screens or other ventilation components

Geotechnical Conditions

Note any change in
Spalling or deterioration of the ribs?

Guttering or Roof Falls?

Floor Heave or Indications of Pillar Punching?

Page 2 of 2

B2

DSC Notification Area - Drilling Completion Report

Borehole ID:	Mine Plan Location:
Start Date:	Collar Coordinates:
Finish Date:	Drilling Company:
Trunk Length:	Diameter:
Branch A Length:	Branch C Length:
Branch B Length:	Branch D Length:

Drilling Conditions (comment on any changes AND identify branch and distance of change):

Water Make:

Gas make:

Geology:

Any specific analysis requested from Geologist? YES or NO (circle)
Expected Geological Features Encountered? YES or NO (circle)

Comments:

Other:

Drill Log Reviewed by:
Review Date:

Chip/Core Analysis Summary:

Geologist: Analysis Date:

Dominant Geology:

Any Anomalies (ie. Intrusions, faults)? YES or NO (circle)

Branch and Distance of Anomalies:

Comments:

Water Balance Officer Comments: