Surface Water Impact Assessment

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SURFACE WATER IMPACT ASSESSMENT
DRAYTON SOUTH COAL PROJECT

HANSEN BAILEY ENVIRONMENTAL CONSULTANTS
October 2012

www.wrmwater.com.au

WRM Water & Environment Pty Ltd
ABN: 96 107 404 544 ACN: 107 404 544
Level 5, Paddington Central,
107 Latrobe Terrace, PO Box 809,
Paddington Qld 4064 Australia
tel +61 7 3367 1279 fax +61 7 3367 1679
www.wrmwater.com.au

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For and on behalf of
WRM Water & Environment Pty Ltd

Greg Roads
Principal Engineer

EXECUTIVE SUMMARY

Overview

WRM Water & Environment was commissioned by Hansen Bailey Environmental Consultants on behalf of Anglo American Metallurgical Coal Pty Ltd to prepare a surface water impact assessment for the Drayton South Coal Project (the Project). The assessment is to form part of an Environmental Assessment being prepared by Hansen Bailey to support an application under Part 3A of the *Environmental Planning and Assessment Act 1979* to facilitate the continuation of the existing Drayton Mine by the development of an open cut and highwall coal mining operation and associated infrastructure within the Drayton South area.

The scope of work completed by WRM for this assessment included:

- Addressing the Director-General's Environmental Assessment Requirements relating to surface water, issued on 3 August 2011;
- Identification of surface water values;
- Identification of potential surface water impacts;
- Identification and development of surface water control measures;
- Development and analysis of a site water balance;
- Flood assessment of Saddlers Creek; and
- Development of a surface water monitoring plan.

The study area comprises an overall area of approximately 6,092 ha and includes the proposed Drayton South disturbance footprint, Drayton Mine and the transport corridor.

Existing Environment

The Project is drained by Saddlers Creek and Saltwater Creek, two minor tributaries of the Hunter River. The main drainage feature is Saddlers Creek, which commences on the existing Drayton Mine and is situated within close proximity to the north western boundary of the proposed Drayton South disturbance footprint. The creek is ephemeral and has a generally well defined channel with a thick covering of long grass across a broad base. It is generally in a poor condition with erosion evident along several sections of the stream bank which appear to be caused by the loss of vegetation and the highly dispersive soils that are characteristic of the area. Erosion resulting from stock access is also evident. Water quality in Saddlers Creek is highly saline with many background samples recording salt concentrations an order of magnitude higher than in the receiving water of the Hunter River.

Saltwater Creek commences on the Drayton Mine and drains to the east of Drayton South. The proposed Drayton South disturbance footprint is generally confined to a minor tributary, which drains into Saltwater Creek downstream of Plashett Dam located on the neighbouring Macquarie Generation site. Plashett Dam captures some 77% of the Saltwater Creek catchment and is designed to spill infrequently. That is, Saltwater Creek downstream of Plashett Dam receives runoff from only 23% of the original catchment.

The Hunter River is situated to the south of Drayton South. It has a catchment area of about 13,400km^2 and its flows are regulated by releases from Glenbawn Dam. The Hunter River water quality is also saline, although not as salty as Saddlers Creek. To manage salt concentrations and minimise the impact of industry in the catchment, the NSW government has introduced the

Hunter River Salinity Trading Scheme, which allows the scheduling of saline industrial discharges at times of high river flows and low background salinity levels.

The existing Drayton Mine is located in the upper headwaters of Ramrod Creek, Bayswater Creek, Saddlers Creek and Saltwater Creek. Drayton Mine's water management system is based on a closed system, as it does not possess a discharge licence. All mine water is stored onsite in established dams and is utilised by the mining operation primarily for coal processing and dust suppression purposes. Mining at Drayton Mine is expected to continue until 2017 at which time the final voids will be utilised for Drayton South water storage, tailings and rejects disposal, or for power station ash disposal.

Potential Surface Water Impacts

The potential surface water impacts of the Project are as follows:

- Potential to impact on surface water quality in the local and regional watercourses;
- Potential to impact on mining operations due to the build up of water in the active mining areas;
- Potential impact of flooding from the Hunter River and Saddlers Creek;
- Potential impact of reduced stream flows in Saddlers Creek and Saltwater Creek;
- Potential localised impacts on the Hunter River due to controlled releases and the proposed pump station;
- Potential impact of reduced stream flows in the Hunter River; and
- Potential to require offsite water supplies.

A discussion of the potential impacts and mitigation measures are given below.

Water Quality

Land disturbance associated with mining has the potential to adversely affect the quality of surface runoff in downstream receiving waters through increased sediment loads. In addition, runoff from active mining areas (including roads, coal stockpiles, etc.) may have increased concentrations of salts and other pollutants compared to natural runoff. A water management system has been developed to minimise or mitigate the impact of the Project on the downstream water quality. The water management system includes:

- A water management system to collect and use water that may contain high total dissolved solid (salt) concentrations. Mine water in excess of site water requirements will be released to the Hunter River under the rules governed by the Hunter River Salinity Trading Scheme;
- A tailings water management system to manage the inflows to and outflows from the Coal Handling and Preparation Plant and tailings storage facility;
- A dirty water management system to ensure runoff from disturbed areas is separated from clean area runoff and collected in sediment dams for treatment;
- A clean water management system to divert water undisturbed by mining around the Drayton South disturbance footprint; and
- A contaminated water management system for water that has come in contact with chemicals of various types used in the mining operations.

Water Management System

The main features of the water management system are as follows:

- Two new mine water dams will be constructed, the Transfer Dam and Houston Dam. Should the conveyor option be adopted for the haulage of coal from the Drayton South area to the existing Drayton Mine CHPP, an additional mine water dam (ROM Dam) will be constructed to collect runoff from the Drayton South coal stockpile area;
- Water collected in the active mining areas within Drayton South will be pumped to the Transfer Dam;
- Water stored in the Transfer Dam will be used for dust suppression;
- Mine affected water in excess of the Transfer Dam capacity will be pumped to the Houston Dam;
- Mine affected water in the Houston Dam will be pumped back to the Transfer Dam when required. The Houston Dam is also the proposed discharge point for releases under the Hunter River Salinity Trading Scheme. Raw water pumped in from the Hunter River will also be deposited in the Houston Dam, if required;
- Up to a total of 50 Hunter River Salinity Trading Scheme credits will need to be obtained by Anglo American either at the auction or traded when required to allow controlled releases from Houston Dam;
- Mine affected water in excess of the Houston Dam and Transfer Dam capacities will be pumped to the South Void at the Drayton Mine. The South Void will be the main repository for excess water within the study area;
- South Void water will be transferred to the Access Road Dam, which will be the main repository to supply water to meet operational demands at the CHPP and other operational areas at Drayton Mine. Water may also be transferred back to the Transfer Dam from the South Void if required to supply the Drayton South operational demands. An option is being considered to remove the South Void from the water management system after Year 10. If this occurred, the East void would be split into two, the East (North) Void and the East (South) Void, and the East (North) Void would replace the South Void as the main repository for excess water within the study area;
- The Rail Loop Dam, collecting mine affected runoff from the Drayton mine site facilities and coal stockpiles, will be pumped to the Access Road Dam;
- The collected runoff from the ROM Dam (where applicable) will be pumped to the Transfer Dam;
- Detailed operating rules for pumping between storages and dam freeboard threshold levels have been developed to prevent spills from the mine water storages;
- A dust suppressant will be used to minimise road watering use and prevent dust nuisance;
- Both tailings and rejects from the Coal Handling and Preparation Plant at Drayton Mine are proposed to be co-disposed in the North Void. An option is also being considered to dispose of tailings in the East (South) Void and expand the tailings disposal area to store tailings into the East (North) Void, when mining is completed;
- Runoff from overburden emplacement areas and haul roads that have not come in contact with coal or carbonaceous material will be collected in sediment dams. Water collected in the sediment dams will be released to the downstream environment after a period of settlement (if the stored water quality meets the relevant standards) or pumped into the mine water management system for reuse; and
- Runoff from undisturbed areas will be managed through the use of temporary high wall dams and drains to divert clean runoff around the disturbed area. A large clean water

storage, the Blakefield Dam, will be constructed to manage the release of the clean highwall dam water into Saddlers Creek as this catchment increases in size by 300% over the life of the Project.

Water Balance

A numerical water balance model was used to design and assess the effectiveness of the mine water management system. The model identifies water supply and discharge requirements based on the Project's expected catchment runoff (both quantity and quality) and water demands. The model was calibrated to the runoff volumes and salt concentrations measured on the Drayton Mine from 2007 to 2011. The results of the water balance model are discussed below.

- Under the proposed water management system, runoff from the site catchments and dewatered groundwater can supply all of Drayton South's water requirements over the life of the Project (unless conditions were drier than the 99th percentile conditions). Offsite water supplies would only be required when conditions drier than the 99th percentile conditions are experienced.
- There is a 50% chance that there will be a moderate accumulation of water (at least 315 ML/yr on average) in the water storages over the life of the Project. The water will mostly accumulate in the South Void, which has a storage capacity of over 14,000 ML. The accumulation of water will allow the site catchments and dewatered groundwater to supply all operational demand.
- There is sufficient out-of-pit storage available to prevent a build up of water in the mining areas except for very wet conditions. There is less than a 10% chance that a build up of water in the mining areas could potentially impact on production.
- The Project will not impact on downstream water quality due to spills from the mine water dams.
  - The main mine water storages that potentially contain elevated salinity levels, Access Road Dam, Savoy Dam, Transfer Dam, Houston Dam and the South Void, do not spill over the modelled Project Life when operated in accordance with the proposed rules.
  - There is a 10% chance that there will be one spill (over three consecutive days) from the Rail Loop Dam over the life of the Project. It is expected that this spill occurs as a result of the daily time step of the model. In reality, pumps will have been turned on throughout the day when the water level exceeded its pump out threshold to prevent the spill.
  - Minor spills occur from the ROM Dam (where applicable) over the life of the Project. The size and shape of the ROM stockpile infrastructure catchment area and the associated ROM mine water dam are indicative at this stage. This dam will be redesigned if the ROM infrastructure is required to minimise uncontrolled spills.
- Releases from Houston Dam under the Hunter River Salinity Trading Scheme will exceed 740 ML/yr on average under 50th percentile, median conditions. There is a 10% chance they will exceed 1,140 ML/yr on average. Average releases per release day will be between 25 ML and 31 ML. However on release days, the maximum release of 100 ML/d occurs frequently.
- The proposed use of a dust suppressant agent has a significant impact on the water balance. The modelling showed that using the alternative, less effective dust suppressant agent, the water management system will generally be in equilibrium with only a minor accumulation of water over the Project life under median conditions. However, under this scenario, there will be a 10% chance that at least 622 ML of offsite supplies will be required after Year 3 over the life of the Project. The majority of this

offsite demand would be required towards the start of Project Life, i.e. between Year 4 to Year 8. There will be a 1% chance that at least 1,623 ML will be required between Year 3 and Year 6 (541 ML/yr on average). There will also be a 11% to 19% reduction in average annual discharges under the Hunter River Salinity Trading Scheme when compared to the base case and no significant change in uncontrolled spills for this scenario.

- The results of the dust suppressant sensitivity analysis are indicative of the climate variability of the region. When the water balance is in equilibrium, there could potentially be both shortfalls in demand, requiring offsite supplies, or a build up of water impacting on operations depending upon whether wet or dry conditions are experienced over the Project life. Given the large storage volumes that are available at Drayton Mine, the adopted approach of minimising water use through the use of the dust suppressant agent that results in the lower watering application of 0.015 L/m^2/hr and thereby minimising, or eliminating, the requirement for offsite supplies is the preferred approach from both an operational and environmental perspective.
- A sensitivity analysis was undertaken to assess the impact of a higher decant return rate (45%) from the tailings dam back to the Coal Handling and Preparation Plant. A decant return rate of 30% is expected. Under the 45% scenario, there will be less chance that offsite supplies will be required because more water is decanted from the tailings. Slightly higher discharges will occur under the Hunter River Salinity Trading Scheme and more water will accumulate in the out-of-pit storages, potentially causing pit water to impact on mining operations during very wet conditions.
- The implementation of an alternative tailings disposal scenario, where the East Void and North Void will be utilised as a tailings and rejects disposal emplacement area, respectively was also assessed. Under this scenario:
  - Similar to the base case, there is a less than a 1% chance that offsite supplies will be required to meet operational demand over the life of the Project.
  - There are no changes to the uncontrolled spills from the site storages. Slightly higher discharges will occur under the Hunter River Salinity Trading Scheme when compared to the base case.
  - Stored volumes in-pit and out-of-pit are slightly higher for this scenario, but the general trends of when the most in-pit inundation occurs (when out-of-pit storages reach their threshold for pumped inflows) remain largely unchanged. Again, operations are likely to only be affected for the very wet, 1st percentile rainfall conditions.
- The proposed option of replacing the South Void with the East (North) Void from Year 10 would have a significant impact on the water balance given the substantial reduction in out-of-pit storage after Year 10. Under this scenario:
  - There would be a higher likelihood that mining would be affected by an accumulation of in-pit water. There is a 10% chance that water in the active mining areas will accumulate to a maximum of at least 2,290 ML and a 1% chance that water will accumulate to a maximum of at least 5,210 ML, which would impact on mining. The out-of-pit storages are too full to accept additional pit water at these times.
  - Should these conditions prevail, Anglo American would temporarily sacrifice mining in one of its active mining areas to store the additional water. There are at least three active mining areas available to store the excess water when the likelihood of a build up is greatest during the middle phases of mining. The current production schedule has the flexibility to cater for this scenario.

  - There is a 1% chance that at least 490 ML of offsite supplies would be required to supply operational demand over the life of the Project. There is a 10% chance that at least 176 ML of offsite supplies would be required to supply operational demand over the life of the Project. This offsite water supply was only required in the last stage of the Project (Year 21 to 27) and it is likely that Hunter River Salinity Trading Scheme releases from Houston Dam could be reduced or Water Access Licences obtained to supply the required short fall.
  - Under this scenario, the South Void is removed from the mine water management system in 2023. There is a 50% chance that the storage inventory in South Void would be at least 3,840 ML. There is 10% chance that the inventory would increase to at least 5,870 ML.
  - Releases from Houston Dam under the Hunter River Salinity Trading Scheme would increase from the base case scenario due to Houston Dam water levels being higher more often, and thus release opportunities utilised more effectively. There is a 50% chance that releases will exceed 990 ML/yr on average and a 10% chance they will exceed 1,440 ML/yr on average.

- Water balance modelling of the Drayton South final void, undertaken by AGE (2012) found that the predicted final void water level will be approximately 20 m lower than the pre-mining potentiometric surface surrounding the mining area and 90 m below the void spill height and is never likely to fill or spill.
- Modelling of the salinity levels in the Drayton South final void over a 122 year simulation period using historical daily rainfalls found that salt concentrations will gradually increase, with total dissolved solid concentrations of 7,000 mg/L at the end of the 122 year simulation period. It is likely that total dissolved solid concentrations would continue to increase over time as water evaporates and salt loads increase.

Flooding

The Drayton South disturbance footprint is located outside of the 100 year ARI flood extent of both the Hunter River and Saddlers Creek with the exception of the proposed pipeline to discharge water into the Hunter River about 1 km downstream of the Golden Highway Bridge (Bowmans Crossing). The proposed pumping station will be located above the 1 in 100 year level. The pipeline outlet and pumping station will be designed and constructed to minimise erosion of the Hunter River during releases and flood events, and to prevent the build up of debris carried by the Hunter River floodwater or obstruct flows. The remaining Project infrastructure is more than 40 m above the top bank of the Hunter River.

Loss of Catchment Flows

During and after the life of the Project, there is a potential impact of reduction of catchment flows to surrounding waterways, including the Hunter River, Saddlers Creek and Saltwater Creek. The following is of note:

- Over the life of the Project, the catchment draining to Saddlers Creek will change, potentially altering the geomorphic characteristics and ecological value of the Saddlers Creek waterway. Under existing conditions, the South Pit, West Void and Savoy Dam at Drayton Mine have reduced the Saddlers Creek catchment by some 301 ha (3%).

- The greatest loss of Saddlers Creek catchment will occur at about Year 10 of the Project. At this time, the catchment contributing runoff to Saddlers Creek will reduce by 1,345 ha (14%).
- The final landform will permanently reduce the Saddlers Creek catchment by 989 ha (10%).
- The existing disturbance footprint on the Mt Arthur Coal Mine currently takes up approximately 10% of the pre-mine Saddlers Creek catchment. It is understood that mining at Mt Arthur Coal Mine will extend in a south westerly direction taking up a further 8% of the catchment between Saddlers Creek and Edderton Road. The drainage and catchment characteristics on the Mt Arthur Coal Mine during the operation and mine closure phases of the Project are not known. However, it is expected that a significant proportion of Saddlers Creek catchment could be removed by Mt Arthur Coal Mine.
- The loss of Saltwater Creek catchment is generally consistent across the life of the Project with the loss of 594.1 ha (11%). The loss is mostly due to the construction of Houston Dam and the Houston mining area. At the end of Project Life, the loss of catchment will reduce to 190.8 ha (4%) when Houston Dam is removed.
- The Saltwater Creek channel is already highly impacted as a result of Macquarie Generation's Plashett Dam. The loss of additional catchment resulting from the Project is not expected to have a significant additional impact on Saltwater Creek.
- The Project will not have an significant impact on the Hunter River flows. Under mining conditions, the Project will reduce the catchment draining to the Hunter River at Liddell by a maximum of 0.14%. The proposed releases under the Hunter River Salinity Trading Scheme would reduce the loss of catchment flows offsite, effectively reducing the maximum loss of catchment due to mining operations below 0.14%. For post mining conditions the final voids will reduce the Hunter River catchment to Liddell by less than 0.1%.
- Four local gullies of Saddlers Creek will be impacted by mining. Three will be consumed by mining and the fourth will have its catchment increased from 224 ha to 678 ha.

Mitigation and Management Measures

The following measures are proposed to mitigate and manage surface water impacts of the Project.

- A dust suppressant applied to haul roads, ramps and the mine site facilities will be used to minimise water use and the need for offsite supplies. The water balance modelling found that the use of the proposed dust suppressant agent (that has an application rate of 0.015 L/m^2/hr, required to minimise dust generation) will also effectively prevent the need for importing water from offsite.
- Although the modelling suggests it is not required, it is possible that a pump station and pipeline may be constructed near the discharge pipeline to supply the mine with raw water from the Hunter River. Should offsite water be required (for instance if conditions at start up are drier than 1st percentile conditions), a pump and pipeline on the Hunter River immediately downstream of the Golden Highway will be utilised to access the 198 unit general security allocation Anglo American currently owns. The category of the Water Access Licences will be transferred as required. If more water is required, Anglo American could either purchase additional units on the open market or approach other Water Access Licence holders for a term transfer, which may require an application to change the zone. The actual siting and detailed design of the Hunter River Pumping Station will be discussed and agreed with NOW prior to construction.

- A comprehensive restoration program in conjunction with Hunter-Central Rivers Catchment Management Authority is currently being progressed for Saddlers Creek to improve its ecological integrity and geomorphic condition and to mitigate the impact of the loss of catchment flows. Although the loss of catchment flows is a residual impact, the restoration program would leave Saddlers Creek in a much better condition at the end of the Project.
- The Blakefield Gully will increase from 224 ha under existing conditions to 678 ha at the completion of mining. It is proposed to reconstruct and restore the channel to cater for the additional flows using natural channel principles generally in accordance with the relevant guidelines and the Hunter-Central Rivers Catchment Management Authority. Design plans will be submitted to the regulator for approval prior to construction.

A surface water monitoring program has been developed generally in accordance with the existing Drayton Mine Environmental Monitoring Plan. The Environmental Monitoring Plan specifies that all major dams, both mine water and clean, are monitored on a monthly basis for storage volume, pH, electrical conductivity, total dissolved solids, suspended solids, sodium, magnesium, potassium, calcium, chloride, sulphate and bicarbonates. The results will be reported in the Annual Review.

In addition to the surface water monitoring, data will be collected to update and validate the OPSIM water balance model. The updated model results will be reported as part of the annual reporting to ensure the assumptions made in this assessment are correct and appropriate. The model will be used to continually improve the water management system to both minimise the requirement for offsite releases and maximise the use of mine affected water.

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1 INTRODUCTION

WRM Water & Environment (WRM) has been engaged by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Anglo American Metallurgical Coal Pty Ltd (Anglo American) to complete a surface water impact assessment for the Drayton South Coal Project (the Project). The purpose of the assessment is to form part of an Environmental Assessment (EA) being prepared by Hansen Bailey to support an application for Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the continuation of the existing Drayton Mine by the development of an open cut and highwall coal mining operation and associated infrastructure within the Drayton South area.

In October 2011, Part 3A of the EP&A Act was repealed. However, the Project has been granted the benefit of transitional provisions and as a result, is a development to which Part 3A still applies.

The scope of work completed by WRM for this assessment included:

- Addressing the Director-General's Environmental Assessment Requirements (EARs) relating to surface water, issued on 3 August 2011;
- Identification of surface water values;
- Identification of potential surface water impacts;
- Identification and development of surface water control measures;
- Development and analysis of a site water balance;
- Flood assessment of Saddlers Creek; and
- Development of a surface water monitoring plan.

1.1 PROJECT DESCRIPTION

Drayton Mine is managed by Anglo Coal (Drayton Management) Pty Ltd which is owned by Anglo American. Drayton Mine commenced production in 1983 and currently holds Project Approval 06_0202 (dated 1 February 2008) that expires in 2017, at which time the operation will have to close.

The Project will allow for the continuation of mining at Drayton Mine by the development of open cut and highwall mining operations within the Drayton South mining area while continuing to utilise the existing infrastructure and equipment from Drayton Mine.

The Project is located approximately 10 km north west of the village of Jerrys Plains and approximately 13 km south of the township of Muswellbrook in the Upper Hunter Valley of NSW. The Project is predominately situated within the Muswellbrook Shire Local Government Area (LGA), with the south west portion falling within the Singleton LGA. Figure 1.1 illustrates the location of the Project. The Project is located adjacent to two thoroughbred horse studs, two power stations and several existing coal mines.

The Project will extend the life of Drayton Mine by a further 27 years, ensuring the continuity of employment for its workforce, the ongoing utilisation of its infrastructure and the orderly rehabilitation of Drayton Mine's completed mining areas.

Anglo American is seeking Project Approval under Part 3A of the EP&A Act to facilitate the extraction of coal by both open cut and highwall mining methods within Exploration Licence (EL) 5460 for a period of 27 years. The Project Application Boundary (Project Boundary) is shown on Figure 1.1.

The Project generally comprises:

- The continuation of operations at Drayton Mine as presently approved with minor additional mining areas within the East, North and South Pits;
- The development of an open cut and highwall mining operation extracting up to 7 Mtpa of ROM coal over a period of 27 years;
- The utilisation of the existing Drayton Mine workforce and equipment fleet (with an addition of a highwall miner and coal haulage fleet);
  - The Drayton Mine fleet consists of at least a dragline, excavators, fleet of haul trucks, dozers, graders, water carts and associated supporting equipment.
- The use of the Drayton Mine existing voids for rejects and tailings disposal and water storage to allow for the optimisation of the Drayton Mine final landform;
- The utilisation of the existing Drayton Mine infrastructure including the Coal Handling and Preparation Plant (CHPP), rail loop and associated loadout infrastructure, workshops, bath houses and administration offices;
- The construction of a transport corridor between Drayton South and Drayton Mine;
- The utilisation of the Antiene Rail Spur off the Main Northern Railway to transport product coal to the Port of Newcastle for export;
- The realignment of a section of Edderton Road; and
- The installation of water management (including a licence water discharge point and pumping station adjacent to the Hunter River) and power reticulation infrastructure at Drayton South.

The conceptual layout of the Project is shown in Figure 1.2.

1.2 STUDY AREA

The study area comprises an overall area of approximately 6,092 ha (Figure 1.2) and includes the proposed Drayton South disturbance footprint, the existing Drayton Mine and the transport corridor.

1.3 RELATED STUDIES

The studies which are to be read in conjunction with this assessment include the following:

- The EA groundwater impact assessment;
- The EA ecology impact assessment; and
- The EA agricultural impact statement.

1.4 REPORT STRUCTURE

This report includes a further six sections:

- Section 2 provides an overview of the regulatory framework;
- Section 3 describes the existing environment with respect to surface water resources and the existing water management system at Drayton Mine;
- Section 4 describes the Project and the proposed water management system;
- Section 5 presents an analysis of the site water balance;
- Section 6 describes the potential impacts of the Project on surface water resources;
- Section 7 outlines the proposed mitigation measures of the Project;
- Section 8 presents a summary of the conclusions of the surface water impact assessment; and
- Section 9 provides a list of references.

The report also includes four appendices describing the calibration of the water balance model, the storage characteristics and operating rules of the water management system within the study area.

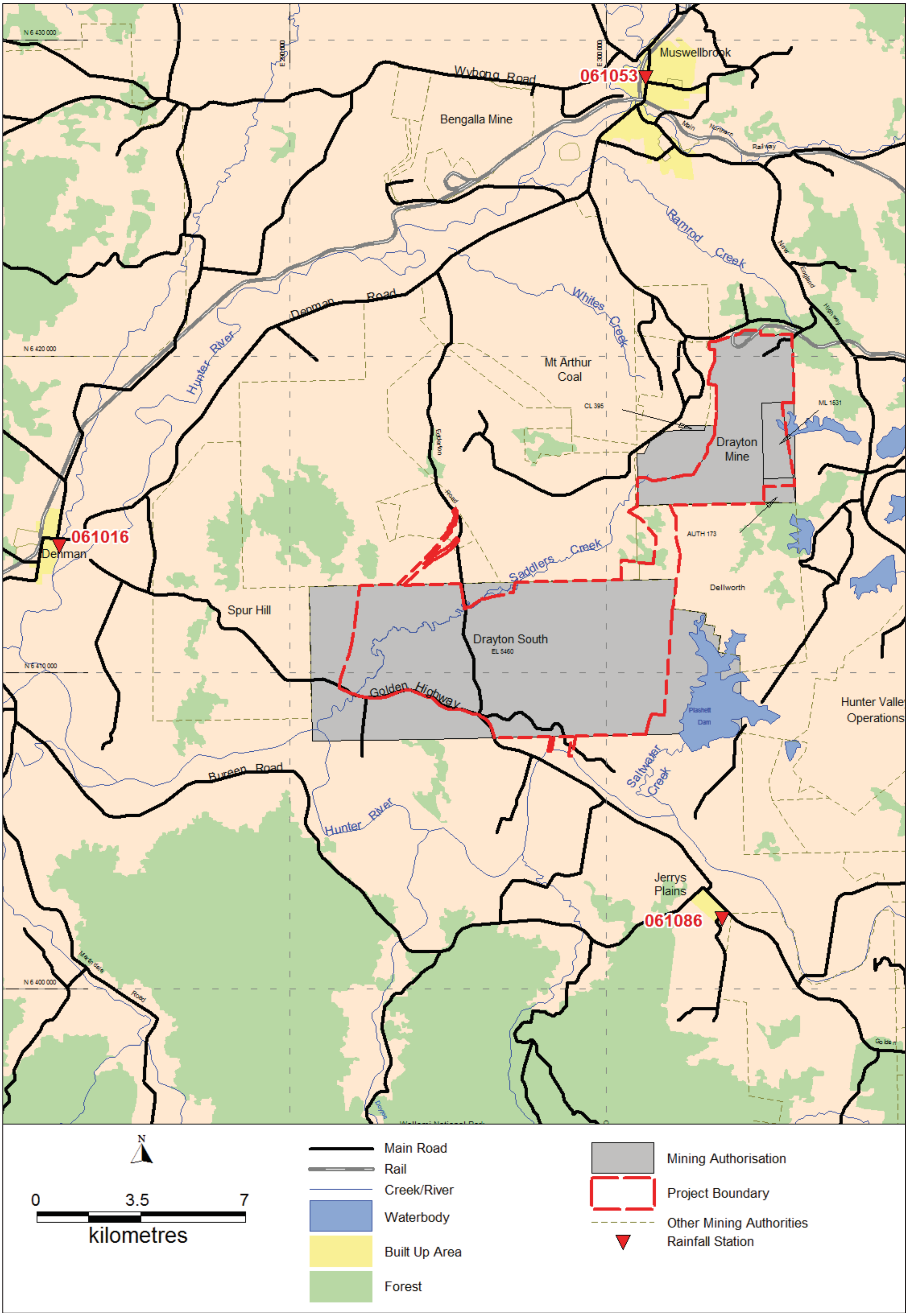

Figure 1.1 Regional Locality

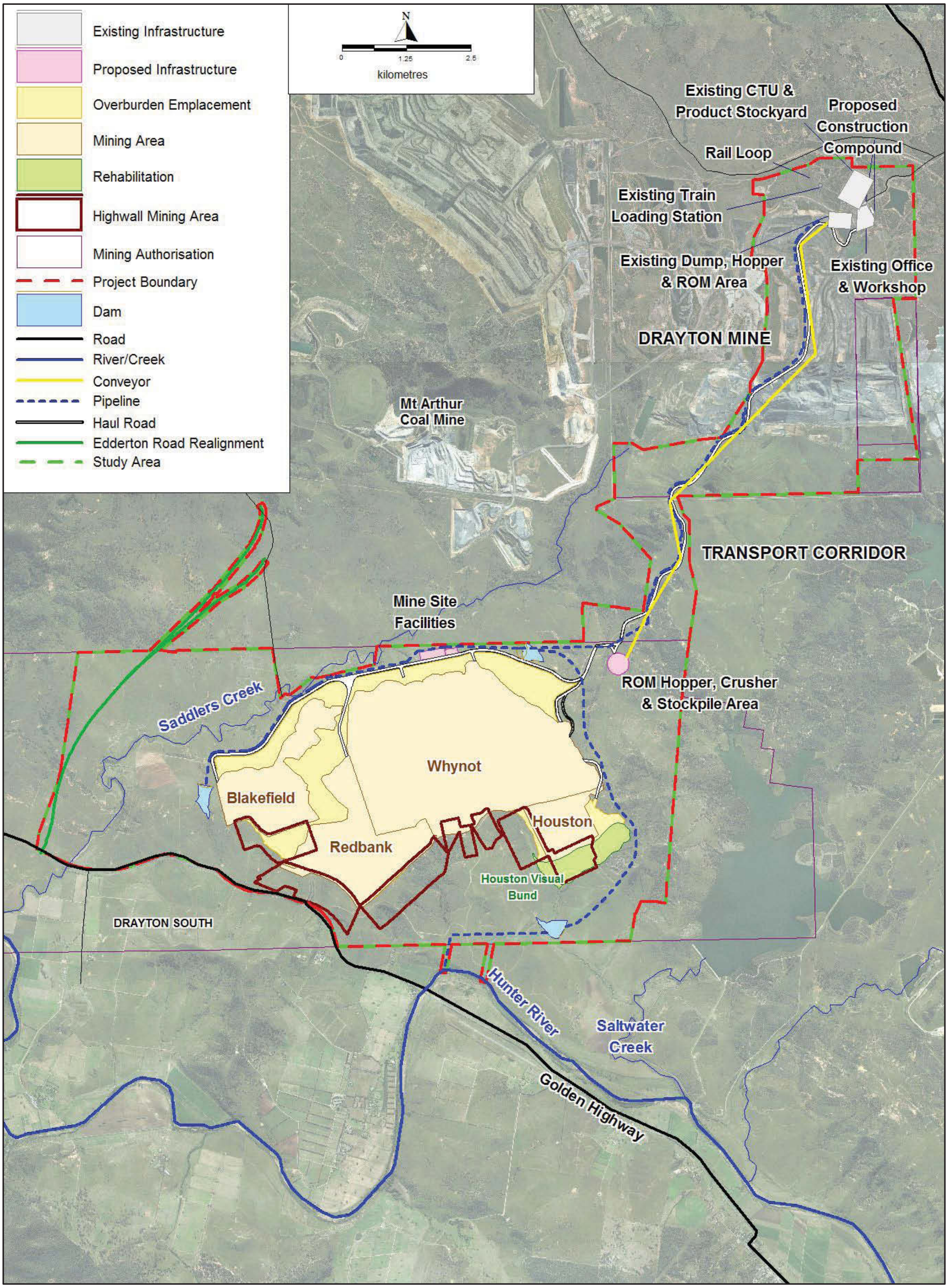

Figure 1.2 Conceptual Project Layout

2 REGULATORY FRAMEWORK

2.1 REGULATORY DOCUMENTS

The following legislation, plans, policies and regulations are relevant to the Project for surface water management:

- The *Water Management Act 2000* (WM Act), *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002, Water Sharing Plan for the Hunter Regulated River Water Source 2003* (HRRWSP) and *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (HUAWSP) with respect to:
  - the taking of waters from the Hunter River Regulated Water Source;
  - the taking of waters from the Hunter River Unregulated and Alluvial Water Source;
  - the capture of clean water runoff;
  - the use of the final voids at Drayton Mine as a water storage;
  - the construction and use of a pump station on the Hunter River; and
  - the construction and use of a discharge pipeline outlet structure on the Hunter River.
- The objectives of the State Water Management Outcomes Plan (SWMOP) and Hunter-Central Rivers Catchment Action Plan (CAP);
- The *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002* with respect to the release point for Hunter River Salinity Trading Scheme (HRSTS) discharges into the Hunter River. . These discharges will be required to be authorised as part of the Environment Protection Licence.
- *National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) and the *ANZECC Guidelines and Water Quality Objectives in NSW* (DEC, 2006) with respect to defining the environmental values of receiving waters and the definition of protection level based on ecosystem condition;
- NSW Office of Water (NOW) *Water Reporting Requirements for Mining Operations 2009*;
- *Dams Safety Act 1978* (Dams Safety Act) with respect to the design, construction, monitoring and management requirements of any prescribed dams on the site or in the surrounding area, including Plashett Dam;
- *Managing Urban Stormwater Soils and Construction – Volume 2E Mines and Quarries*, (DECC, 2008) and *Managing Urban Stormwater, Soils and Construction*, (Landcom, 2004) with respect to the design of erosion and sediment control measures; and
- *Water Act 1912* (Water Act) with respect of any water contained in fractured rock aquifers and basement rocks.

2.2 WATER LICENCES

Water Access Licences will be required for any water taken from the Hunter River and used for the Project.

Additionally, any water occurring naturally on or below the surface of the ground which is taken by the Project will be required to be the subject of a Water Access Licence unless it is subject to an exemption.

2.3 WATER SUPPLY WORKS APPROVALS

All dams, pipes, pumping stations and other water supply works which would ordinarily require water supply works approvals under the WM Act will be exempt if a project approval is granted under Part 3A of the EP&A Act (see section 75U EP&A Act). The impact and environmental issues relating to these elements are included in this assessment.

2.4 EXCLUDED WORKS

Dams solely for the capture, containment and recirculation of drainage and/or effluent, consistent with best management practice or required by a public authority (other than Landcom or the Superannuation Administration Corporation or any of their subsidiaries) to prevent the contamination of a water source, that are located on a minor stream are excluded works and accordingly are not required to be the subject of water supply works approval and there is no requirement for a Water Access Licence to take water and use water from them.

2.5 DIRECTOR-GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

All applications for Project Approval under Part 3A of the EP&A Act must be accompanied by an EA prepared in accordance with the EARs. This impact assessment, which forms part of the EA, addresses the EARs concerning surface water. Table 2.1 lists the EARs that are relevant to this assessment and the sections of this report where those EARs are addressed.

Table 2.1 Director-General's Environmental Assessment Requirements

Key Issue	Requirement	Report Section
Water	A detailed site water balance for the Drayton complex as proposed, including a description of site water demands (including access to any flows within the Hunter Regulated River source), water disposal methods, water supply infrastructure and water storage structures	Section 4 and Section 5
	Detailed modelling and assessment of the potential impacts of the project on:	
	- The quantity and quality of existing surface and ground water resources;	Section 5
	- Affected licensed water users and basic landholders rights;	
	- The riparian, ecological, geomorphological and hydrological values of watercourses both on site and downstream of the project;	Section 6.3
	- Environmental flows;	Section 6.3
	- Flooding; and	Section 6.2
	- Agriculture	EA Agricultural Impact Statement
	A detailed description of the proposed water management system for the Drayton complex as proposed (including all infrastructure and storages)	Section 5
	A detailed description of measures to mitigate surface water and groundwater impacts (including a comprehensive rehabilitation plan for Saddlers Creek)	Section 5 Section 6.3.1

This report only addresses the surface water aspects of these EARs. The groundwater aspects are addressed in the groundwater impact assessment (Appendix N of the EA).

3 EXISTING SURFACE WATER ENVIRONMENT

3.1 REGIONAL DRAINAGE NETWORK

The regional drainage network in the vicinity of the Project is shown in Figure 1.1. The Project is located north of the Hunter River approximately 10 km north west of the village of Jerrys Plains and approximately 13 km south of the township of Muswellbrook. The Hunter River has a catchment area of approximately 13,400 km^2 to Jerrys Plains, which is immediately downstream of the study area. The catchment extends some 110 km to the north and 140 km to the west and includes the major tributaries of the Pages River, Dart Brook and the Goulburn River.

The Hunter River is a regulated river supplying water from Glenbawn Dam to a range of industrial and agricultural users as well as town water supplies. Glenbawn Dam is located on the upper headwaters of the Hunter River.

Two major tributaries, Glennies Creek and Wollombi Brook, drain into the Hunter River some 10 km downstream of the Project. The total catchment area of the Hunter River to Singleton, located 30 km downstream, which includes these two tributaries, is 16,400 km^2.

3.2 LOCAL DRAINAGE NETWORK

Figure 3.1 shows the topography and the location of tributaries draining the study area.

3.2.1 Drayton Mine

Drayton Mine is located in the upper headwaters of four minor watercourses;

- Ramrod Creek;
- Bayswater Creek;
- Saltwater Creek; and
- Saddlers Creek.

The northern areas of Drayton Mine drain via four minor gullies to the Ramrod Creek catchment. Three of the gullies converge around 1.5 km downstream of Drayton Mine and the fourth converges about 6 km downstream. Ramrod Creek drains into the Hunter River 10 km to the north west of the study area immediately downstream of Muswellbrook.

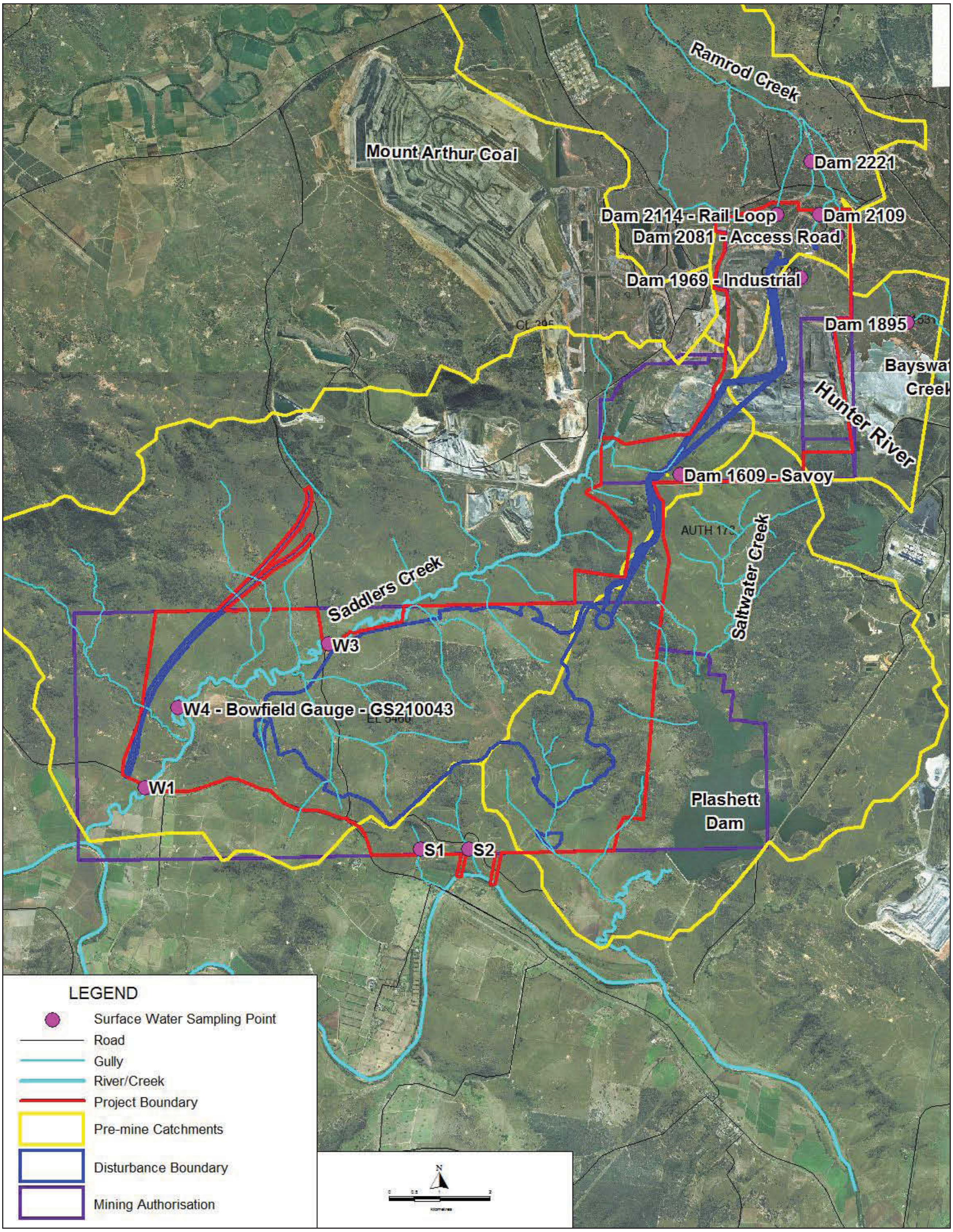

Figure 3.1 Topography and Drainage Characteristics of the Study Area

The eastern areas of the existing Drayton Mine drain to or previously drained to Bayswater Creek (prior to mining operations). Almost all of the Bayswater Creek catchment within Drayton Mine is an active mining area and does not drain offsite. Bayswater Creek drains into Lake Liddell and the headwater dams upstream of the ash dam on land owned and operated by Macquarie Generation.

The southern areas of Drayton Mine are located within the pre-mine Saltwater Creek and Saddlers Creek catchments. The Saddlers Creek and Saltwater Creek catchments at Drayton Mine are either active mining areas and no longer drain offsite or remain undisturbed. Saltwater Creek drains into Plashett Dam on land owned by Macquarie Generation. Saddlers Creek drains to the Hunter River.

3.2.2 Drayton South

The main drainage feature at Drayton South is Saddlers Creek. Saddlers Creek is a first and second order watercourse at Drayton Mine under the Strahler stream classification system (Strahler, 1957). It is a third and fourth order watercourse as it crosses Drayton South. Prior to the commencement of mining in the area, Saddlers Creek had a catchment of about 97.1 km^2. Approximately 9.5 km^2 of the catchment is currently being mined by Mt Arthur Coal Mine and a further 4.6 km^2 is being mined at Drayton Mine. That is, 15% of the original catchment is currently taken up by mining and no longer drains to the Saddlers Creek catchment. It is understood that almost all of the Saddlers Creek catchment within Mt Arthur Coal Mine's leases to the north of Saddlers Creek will be mined.

Plate 3.1 shows a photograph of Saddlers Creek at the Edderton Road crossing. The creek is ephemeral, with a generally well defined channel that has a thick covering of long grass across a broad base. There are several pools on the base that would hold water for a period following rainfall. The channel banks are well defined but have little remnant vegetation. Erosion is evident along several sections of the stream bank which appear to be caused by the loss of vegetation and the highly dispersive soils. Erosion resulting from stock access is also evident.

The channel meanders across a small floodplain with a relatively tight geometry. There are several oxbows adjacent to the main channel indicating that the channel has actively eroded in the past. A dam on the creek some 800 m upstream of Edderton Road (on the Mt Arthur Coal Mine lease) appears to overflow onto the northern floodplain, which would limit the water draining to the channel immediately below it and could potentially cause a major change in the channel alignment in time.

Several first and second order (minor) gullies and one third order gully drain into Saddlers Creek across the Drayton South area. The gullies have similar characteristics to Saddlers Creek in that they have a relatively broad base with active areas of bank erosion indicative of the dispersive soils. The gullies are generally devoid of remnant vegetation. As part of historic agricultural activities in the area contour banks have been constructed across much of land within the Drayton South area to divert overland flows to these gullies. The gullies are therefore carrying much higher catchment flows than under pre-disturbance conditions.

The eastern side of the Drayton South area drains via first and second order (minor) gullies to Plashett Dam or directly to Saltwater Creek downstream of Plashett Dam. The pre-mine and pre-power station catchment area of Saltwater Creek to its confluence with the Hunter River is 53.2 km^2. Plashett Dam is a 65,000 ML storage that captures some 40.9 km^2 (77%) of the Saltwater Creek catchment and is integral to the operations at Macquarie Generation. It receives pumped inflows from the Hunter River and is designed to spill infrequently. That is, Saltwater Creek downstream of Plashett Dam receives runoff from only 23% of the original catchment.

Two minor gullies also drain directly to the Hunter River.

Plate 3.1 Saddlers Creek at Edderton Road

Note: View looking North East.

3.2.1 Farm Dams

There are 39 existing farm dams within the Drayton South area, none of which are prescribed dams under the Dams Safety Act. These farm dams are mostly less than 1 ML in capacity located at the end of contour banks and appear to act as sediment sumps. Contour banks are evident across Drayton South, suggesting sheet erosion is prominent.

There is one significant farm dam located on Saddlers Creek, 600 m upstream from Edderton Road (on the Mt Arthur Coal Mine lease), that has a capacity of approximately 15 ML to 20 ML.

The total capacity of the existing farm dams within the Drayton South EL 5460 is expected to be less than 50 ML.

3.3 RAINFALL AND EVAPORATION

Table 3.1 shows summary details of Bureau of Meteorology (BOM) rainfall recording stations in the vicinity of the Project. The locations of the various stations are shown in Figure 1.1.

Table 3.1 BOM Rainfall Stations in the Vicinity of the Project

Station No.	Station Name	Elevation (m)	Lat. (°S)	Long. (°E)	Distance from Site (km)	Opened	Closed
061086	Jerrys Plains Post Office	90	32.497	150.909	12	1884	-
061053	Muswellbrook (Lower Hill St)	143	32.261	150.885	15	1870	-
061016	Denman (Palace Street)	105	32.388	150.689	19	1883	-

Table 3.2 shows mean monthly rainfalls for the three rainfall stations shown in Figure 1.1. Note that the mean monthly values have been calculated over varying periods, depending on the length of available record. The mean annual rainfall in the area of interest ranges from 592.9 to 644.7 mm, with maximum monthly rainfalls occurring during the summer months.

Table 3.2 also shows mean monthly evaporation (based on a Class A evaporation pan) recorded at Jerrys Plains Post Office (Station No. 061086), located some 16 km to the south of Drayton Mine. Mean annual evaporation is 1,641.3 mm, which is more than double mean annual rainfall.

Figure 3.2 shows the annual distribution of average monthly rainfall and evaporation in the local area. Mean evaporation is similar to mean rainfall in the winter months, but substantially exceeds rainfall for the remainder of the year.

Table 3.2 Mean Monthly Rainfall and Evaporation

Month	Mean Monthly Rainfall (mm)			Mean Monthly Evaporation (mm)
	Muswellbrook (Lower Hill St) (061053) [1870 -]	Jerrys Plains Post Office (061086) [1884 -]	Denman (Palace Street) (061016) [1887 -]	Jerrys Plains Post Office (061086) [10 years data]
January	69.6	77.0	72.2	220.1
February	66.9	72.4	66.4	169.5
March	52.5	58.3	53.2	155
April	43.6	44.5	40.2	120
May	41.7	40.9	36.8	89.9
June	51.4	48.1	42.2	60
July	43.9	43.5	38.7	71.3
August	38.8	36.5	35.0	80.6
September	40.7	42.0	39.2	111
October	48.6	52.1	48.6	164.3
November	56.1	61.1	55.2	195
December	67.0	67.9	65.2	204.6
Total	**620.8**	**644.7**	**592.9**	**1,641.3**

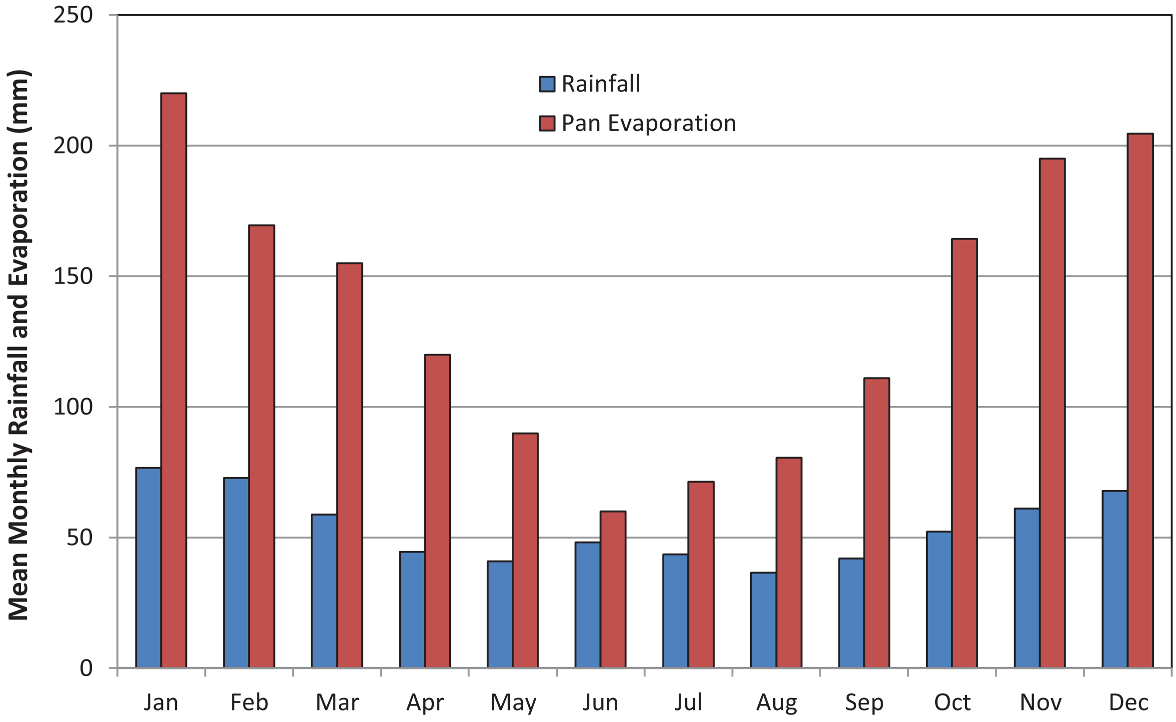

Figure 3.2 Distribution of Monthly Rainfall and Evaporation (Jerrys Plains Post Office)

3.4 STREAMFLOW

3.4.1 Hunter River

Figure 3.3 shows the flow-duration relationship for the recorded Hunter River flows, closest to Drayton South, at the Liddell gauge (GS 210083). The Liddell gauge is located approximately 9.0 km downstream of Drayton South and has an upstream catchment area of 13,400 km^2. Data has been collected at Liddell since 1969. The flow-duration relationship indicates that flow is non-zero all of the time, which is characteristic of regulated river systems. The median flow is about 270 megalitres per day (ML/d) and flows exceed 1,000ML/d some 8% of the time. The volumetric runoff coefficient (rainfall to runoff relationship) of the Hunter River flows to Liddell is approximately 4%.

3.4.2 Saddlers Creek

Figure 3.4 shows the flow-duration relationship for the recorded flows in Saddlers Creek at the Bowfield Gauge (GS210043). The location of the Bowfield Gauge is shown in Figure 3.1. Stream water level was recorded at this station between 1956 and 1981. However, very few stream gaugings greater than 10 ML/d were taken to derive an accurate relationship between water level and stream flow. As such, there is likely to be a high level of uncertainty associated with the data in Figure 3.4. Notwithstanding, the figure shows that the creek is ephemeral with flow recorded some 63% of the time and is dry 37% of the time. Extended periods of baseflow are evident indicating that the system is fed by groundwater flows. The median flow is 0.09 ML/d and the highest recorded daily flow over the period of record was 1,137 ML/d.

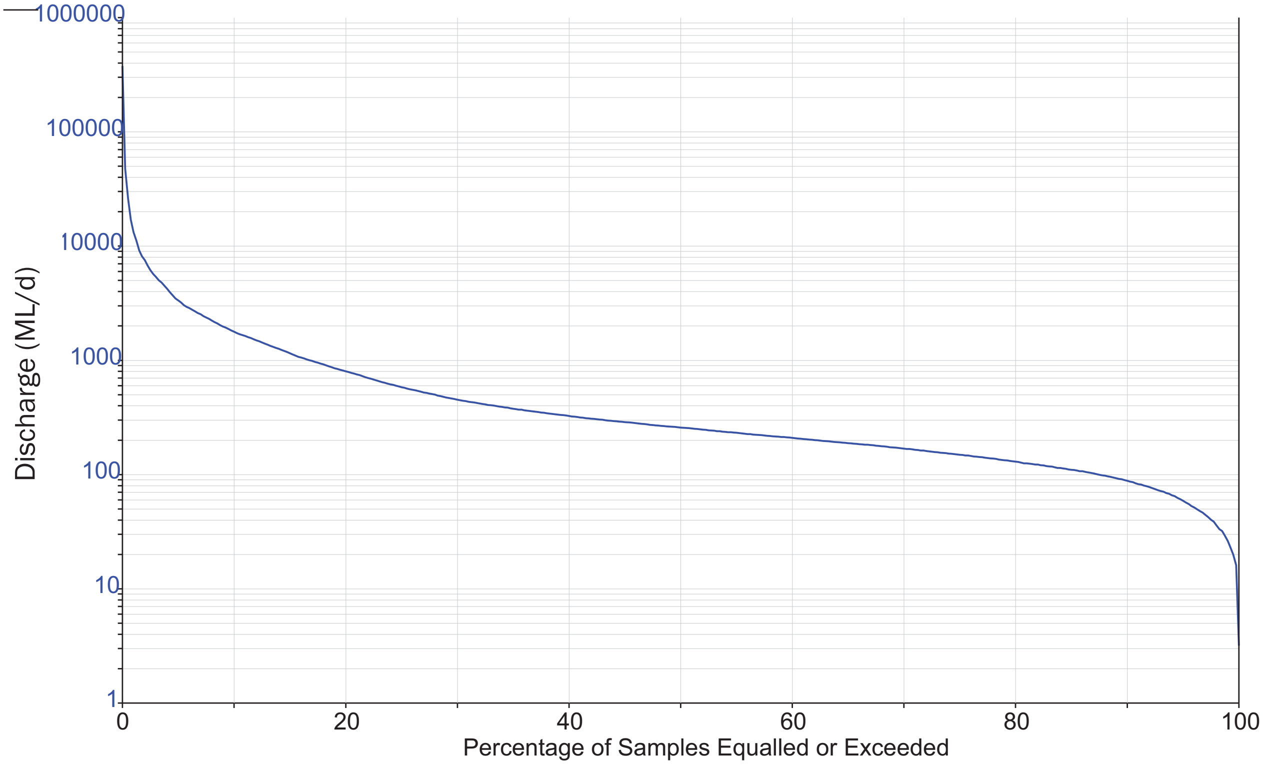

Figure 3.3 Recorded Flow-Duration Relationship for the Hunter River at Liddell (1969-2009)

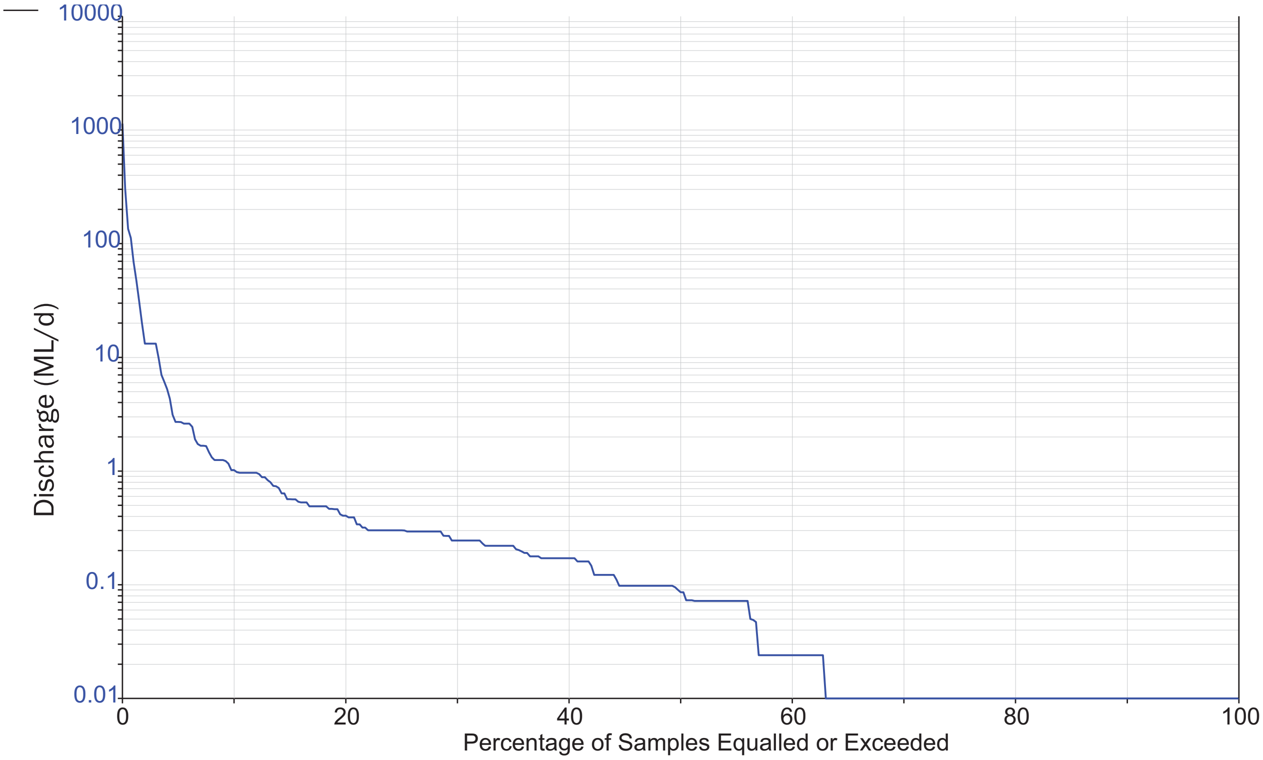

Figure 3.4 Derived Flow-Duration Relationship for Saddlers Creek at Bowfield (1956-1981)

3.5 SADDLERS CREEK FLOODING

3.5.1 Estimation of Discharges

The Rational Method was used to estimate 100 year Average Recurrence Interval (ARI) design flood discharges in Saddlers Creek along the reach flowing through Drayton South for pre-mine conditions. These conditions assume that both Drayton Mine and Mt Arthur Coal Mine were not built and the entire catchment drains to Saddlers Creek, which provides a worst case scenario (i.e. the maximum catchment contributing to runoff). Discharges were estimated at the upstream location where Saddlers Creek crosses the Project Boundary (Location A shown in Figure 3.5) and at a further two points along Saddlers Creek (Locations B and C shown in Figure 3.5).

Rational Method parameters were estimated using the recommended methodology in Australian Rainfall and Runoff (Pilgrim, 1998) for eastern NSW. Details of the Rational Method calculations are provided in Table 3.3.

Table 3.3 Estimation of Design Discharges, Saddlers Creek

Parameter	Location A	Location B	Location C
Catchment Area (km^2)	33.2	50.4	76.9
Time of Concentration (hrs)	2.88	3.37	3.96
Runoff Coefficient C_{10}	0.2	0.2	0.2
F_y	1.47	1.47	1.47
C_{100}	0.29	0.29	0.29
I_{100} (mm/hr)	25.7	23.6	21.8
Q_{100} (m^3/s)	70	97	137

3.5.2 Estimation of Flood Levels

The Hydrologic Engineering Centres River Analysis System (HEC-RAS) hydraulic model was used to estimate design flood levels along Saddlers Creek at Drayton South under pre-mining conditions. The model consists of 112 cross-sections, extracted from a digital elevation model of the area. The locations of the model cross-sections are shown in Figure 3.5. The supplied LIDAR data was taken by Atlas (Aust) Pty Ltd on behalf of Whelan Insites and has a vertical accuracy of ±150 mm.

A Manning's 'n' value (representing the hydraulic roughness of the waterway) of 0.08 was adopted for the main channel and 0.1 for the floodplain of Saddlers Creek. This is a conservatively high estimate of roughness given the existing channel vegetation.

The downstream boundary condition for the HEC-RAS model was based on a normal depth calculation, using the average longitudinal bed slope of Saddlers Creek in the area of interest of approximately 0.4%.

Estimated design flood levels along Saddlers Creek are shown in Table 3.4. Figure 3.6 shows a representative cross-section of Saddlers Creek (XS 70). Figure 3.5 shows the estimated extent of flooding for the 100 year ARI event.

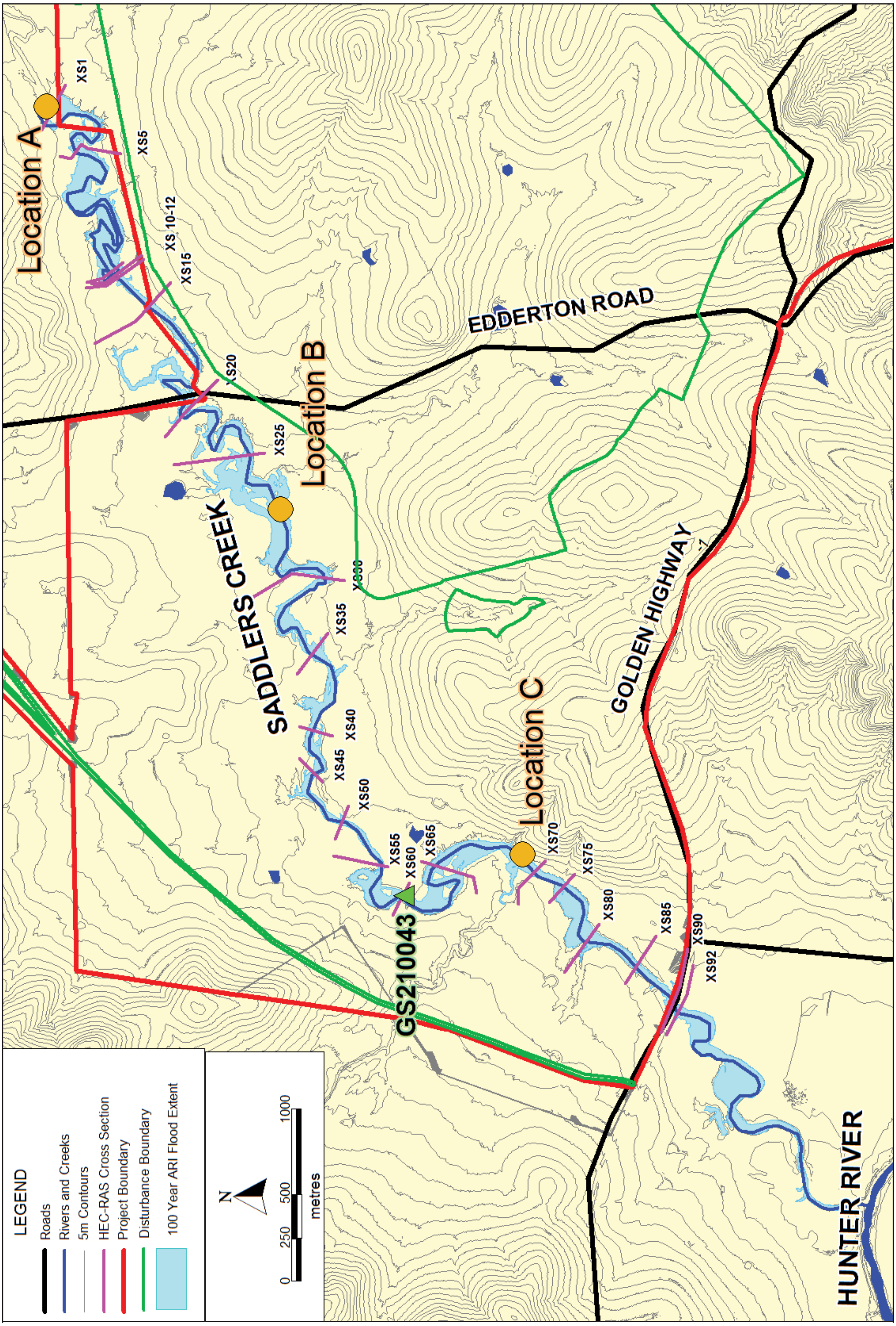

Figure 3.5 Saddlers Creek 100 Year ARI Flood Extent

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Table 3.4 Saddlers Creek 100 Year ARI Peak Flood Levels

Cross-Section	100 Year ARI Peak Flood Level (m AHD)	Flood Width (m)	Flow Velocity (m/s)
XS1	133.5	85.41	0.74
XS5	131.9	84.13	0.72
XS10	128.94	163.73	0.45
XS11	128.63	76.30	1.38
XS12	126.03	33.53	1.37
XS15	124.68	29.58	1.14
XS20	120.3	42.57	1.28
	Edderton Road		
XS25	117.27	143.09	0.95
XS30	112.24	60.53	0.9
XS35	110.58	95.82	0.47
XS40	108.57	60.04	1.04
XS45	107.24	34.24	1.16
XS50	106.22	30.75	1.15
XS55	104.92	36.56	1.42
XS60	103.37	43.38	1.1
XS65	101.16	114.01	0.84
	Bowfield Gauge		
XS70	100	70.01	0.81
XS75	99.19	111.25	0.91
XS80	98.64	96.29	0.62
XS85	97.79	35.6	1.47
XS90	96.76	152.12	0.85
	Golden Highway		
XS92	96.59	88.76	0.95

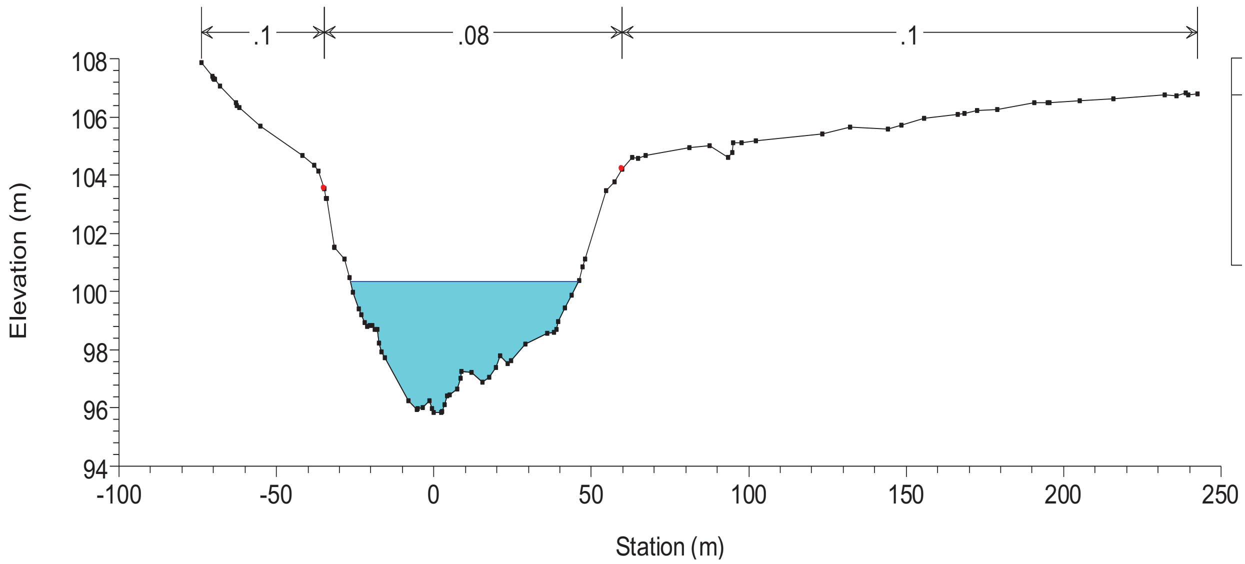

Figure 3.6 Saddlers Creek HEC-RAS Model (XS70) 100 Year ARI Flood Level

3.6 EXISTING WATER USE ENTITLEMENTS

The study area is located within Management Zone 1 of the Hunter Regulated River Water Source, defined by the WM Act. Management Zone 1 extends from Glenbawn Dam to the confluence with Glennies Creek. Management Zone 2 is located on Glennies Creek downstream of Glennies Creek dam and Management Zone 3 is located on the Hunter River downstream of the Glennies Creek confluence. Flows in the Hunter River are regulated through the HRRWSP, which was gazetted on 1 July 2004 and amended by order on 1 January 2006. The water sharing plan allows for some extraction of water from the river without a Water Access Licence to provide basic landholder rights, which include domestic and stock rights as well as native title rights.

All water extraction that is not for basic landholder rights must be authorised by a Water Access Licence. Each Water Access Licence specifies a share component. The share components of specific purpose licences, such as town water supply, stock and domestic are expressed as ML/yr. The share components of high security, general security and supplementary Water Access Licences are expressed as a number of unit shares. Table 3.5 shows the categories of access licences in the Hunter Regulated River Water Source and their total share components at the start of the HRRWSP (DIPNR, 2003). Note that the supplementary and utility water share components shown in Table 3.5 are combined Zone 1, 2 and 3 shares.

Anglo American currently owns two general security Water Access Licenses (WAL1066 and WAL491) totalling 198 units from the Hunter River.

Table 3.5 Hunter Regulated River Water Source Share Components for Different Licence Categories

Access Licence Category	Total Share Component in the Hunter		
	Zone 1	Zone 2	Zone 3
Stock & Domestic (ML/yr)	725	827	186
General Security (Unit Shares)	75,035	47,078	6,050
High Security (Unit Shares)	10,378	10,016	1,765
Supplementary Water (Unit Shares)		49,000	
Local Water Utility (ML/yr)		10,832	
Major Utility (ML/yr)		36,000	

3.7 SURFACE WATER QUALITY

3.7.1 Environmental Values of Receiving Waters

The Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) have prepared a guideline for water quality management for use throughout Australia and New Zealand based on the philosophy of ecologically sustainable development (ESD). The guideline is called the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ, 2000) and is often referred to as the 'ANZECC guideline'.

The NSW Department of Environment and Conservation (now the NSW Office of Environment and Heritage) has prepared a booklet titled *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (DEC, 2006) to assist technical practitioners with applying the ANZECC guidelines in NSW (referred to herein as the NSW guideline).

The NSW guideline defines the 'environmental values' of receiving waters as those values or uses of water that the community believes are important for a healthy ecosystem. The environmental values of the receiving waters of the Hunter River are regarded as:

- Aquatic ecosystem;
- Irrigation water supply;
- Livestock water supply;
- Primary and secondary contact recreation; and
- Visual amenity.

The ANZECC guidelines specify three levels of protection, from stringent to flexible, corresponding to whether the condition of the particular ecosystem is:

- Of high conservation value;
- Slightly to moderately disturbed; or
- Highly disturbed.

The receiving waterways adjacent to the study area are regarded as slightly to moderately disturbed.

3.7.2 Regional Water Quality

Water quality data for Electrical Conductivity (EC) is available for the Hunter River at the Glennies Creek gauging station (Station No. 210127) for the period 26 June 1993 to 1 November 2011. The data at this station is used in the calculation of HRSTS discharges, as outlined in Section 5.6 and is likely to be indicative of Hunter River EC adjacent to Drayton South. The Glennies Creek gauging station is located some 30 km downstream of the study area.

Figure 3.7 shows the relationship between daily stream flow and EC at the Glennies Creek station. The logarithmic trend line for flows above 1,000 ML/d is also shown. There is a strong relationship between flow rate and EC, with high flows (associated with floods) measuring lower EC values. There is a broad scatter of EC for low flows below 1,000 ML/d. Higher EC values tend to occur when there are limited releases from Glenbawn Dam and the majority of flow is being generated from the downstream catchments.

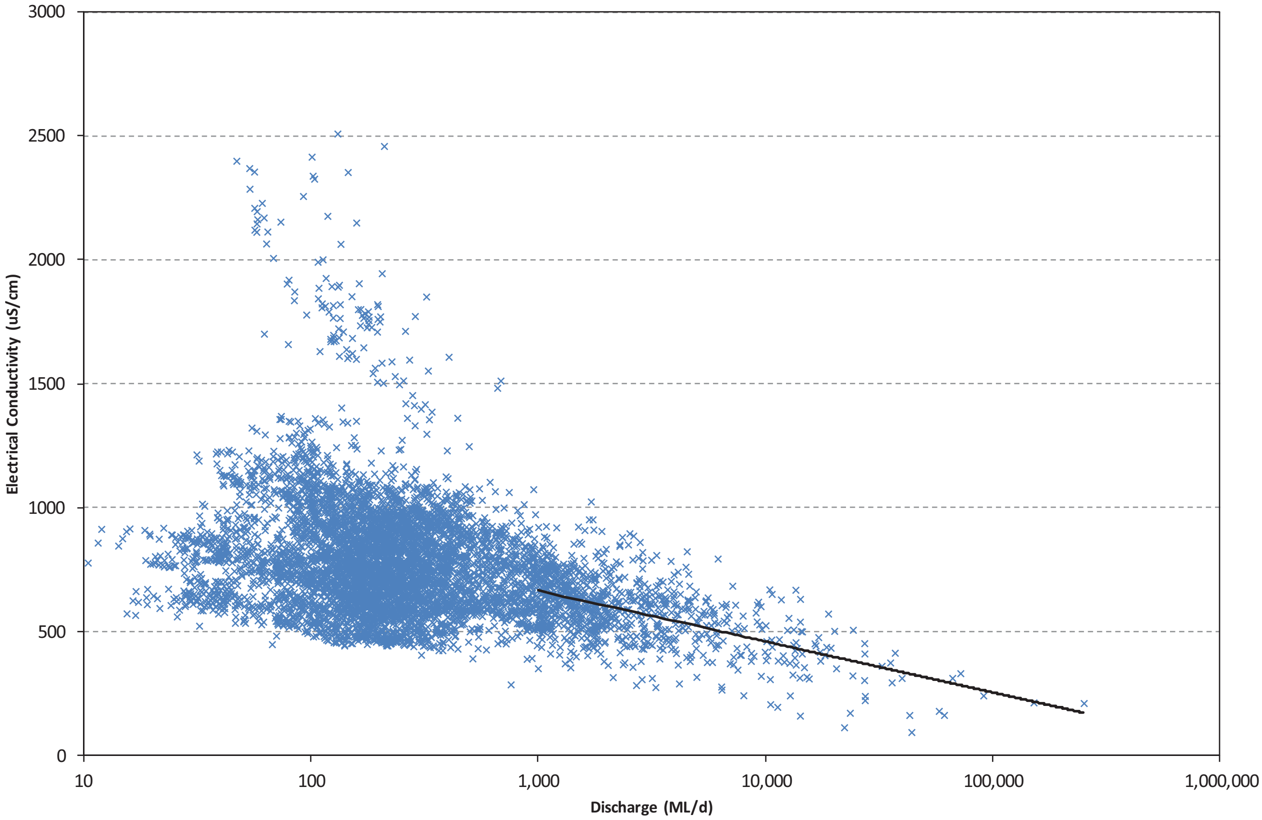

Figure 3.7 Stream Flow and Electrical Conductivity Relationship for the Hunter River at Glennies Creek

3.7.3 Drayton South Catchments

Anglo American has monitored background water quality in Saddlers Creek and some minor catchments in the study area since 1998 (420 samples). The locations of the water sampling locations are shown in Figure 3.1. A summary of water quality for Saddlers Creek and two minor catchments is given in Table 3.6. The 90th percentile value represents 90% of samples exceeding the given value, and similarly the 10th percentile value represents 10% of samples exceeding the given value. The sampling results show the following:

- Catchment runoff is slightly alkaline with pH ranging from 7.6 to 8.6 in Saddlers Creek and 6.4 to 8 in the site catchments;
- Saddlers Creek EC and total dissolved solids (TDS) concentrations are very high and substantially exceed ANZECC and ARMCANZ default trigger values. The salts are sodium dominated;
- EC values for site catchments are much lower indicating that surface runoff from vegetated areas not affected by groundwater flows may produce lower EC; and
- Recorded total suspended solids (TSS) concentrations for Saddlers Creek are low but are significantly higher in the site catchments.

3.7.4 Downstream of Drayton Mine

A summary of the water quality tested in the catchments downstream of Drayton Mine is given in Table 3.7. Drayton Mine does not discharge water to any of these catchments. Rather the catchments are mostly undisturbed with small areas of previously rehabilitated mining areas. The following is of note:

- Runoff is generally saline with EC ranging from 1,742 to 4,774 µS/cm. The EC of Bayswater Creek and Ramrod Creek is measured in dams, which would elevate recorded levels compared to streamflow;
- pH is slightly alkaline ranging from 7.5 to 9.2; and
- TSS is generally low.

Table 3.6 Drayton South Water Quality

Parameter		Drayton South		Saddlers Creek			
		S1	S2	W1	W2	W3	W4
pH	10%ile	6.44	7.01	7.6	7.8	7.8	7.9
	Median(N)	7.4	7.55	8.32	8	8	8.2
	90%ile	8	7.9	8.6	8.4	8.2	8.4
EC (µS/cm)	90%ile	83.6	137.4	1201.8	4505	4730	3974
	Median(N)	196	173	5495	7665	7480	7450
	10%ile	456.6	288	8382	9865	9380	9090
TDS (mg/L)	90%ile	77.4	100	770	2273.2	2785	2405
	Median(N)	146	120	3375	4940	4920	4750
	10%ile	342	235	5435	6276	5892	5872
TSS (mg/L)	90%ile	40	10.4	3	2	4	2
	Median(N)	182	50.5	8	7	16	5
	10%ile	401.2	324.5	78.6	34.4	60	10
Fe Diss (mg/L)	90%ile	-	-	0.05	0.05	0.05	0.05
	Median(N)	-	-	0.05	0.05	0.05	0.05
	10%ile	-	-	0.278	0.208	0.265	0.312
Fe Absorb. (mg/L)	90%ile	-	-	0.084	0.05	0.094	0.074
	Median(N)	-	-	0.54	0.2	0.44	0.18
	10%ile	-	-	3.084	2.02	3.742	0.88
SO4 (mg/L)	90%ile	-	-	91.8	229.2	254	138.8
	Median(N)	-	-	200	520	527.5	237
	10%ile	-	-	370	672.2	660	306.6
Magnesium (mg/L)	90%ile	-	-	46	131	163	93.4
	Median(N)	-	-	160	305	320	177
	10%ile	-	-	230	385.6	382.5	265.2
Sodium (mg/L)	90%ile	-	-	206	448	335	538.6
	Median(N)	-	-	910	1090	1070	1000
	10%ile	-	-	1566	1515.8	1315	1542
Potassium (mg/L)	90%ile	-	-	7.52	6.4	5.95	8
	Median(N)	-	-	9	8.3	8	9
	10%ile	-	-	11.8	25.4	11.65	11.4

Table 3.7 Downstream Drayton Mine Water Quality

Parameter		Bayswater Dam (1895)	Ramrod Creek (2221)
pH	10%ile	9.20	8.48
	Median	8.80	7.9
	90%ile	8.21	7.52
EC (µS/cm)	10%ile	4774	3296
	Median	3310	2220
	90%ile	2045	1742
TSS (mg/l)	10%ile	20	60.4
	Median	6	19
	90%ile	1	4

3.7.5 Drayton Mine

Anglo American monitors water quality in all water storages at Drayton Mine. A summary of the water quality tested in the various water storages at Drayton Mine is given in Table 3.8. The summary is based on monthly samples collected between January 2008 and July 2011. The results indicate that runoff draining Drayton Mine catchments has similar water quality characteristics to the natural catchments with runoff that is saline and slightly alkaline.

Table 3.8 Drayton Mine Water Quality

Parameter		Savoy Dam	Industrial Dam	Access Road Dam	Rail Loop Dam	West Void
pH	10%ile	8.28	8.60	8.60	8.30	8.00
	Median	8.00	8.20	8.20	8.10	7.85
	90%ile	7.70	7.90	7.64	7.70	7.60
EC (µS/cm)	10%ile	6440	5710	5404	5864	8335
	Median	5240	4720	4780	4990	7805
	90%ile	4580	4010	4354	2990	6865
TSS (mg/l)	10%ile	14.8	47.6	85.4	57.8	15.0
	Median	6.0	16.0	12.0	12.0	7.0
	90%ile	2.2	6.0	4.0	4.4	3.5

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3.8 HUNTER RIVER SALINITY TRADING SCHEME

The HRSTS was implemented by the NSW Government to reduce salinity levels in the Hunter River and allows controlled water discharges into the Hunter River during periods of high flow. The HRSTS operates under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.

Under the HRSTS, credit holders are permitted to discharge saline water to the Hunter River on a managed basis. The aim is to maintain river salinity levels below 600 µS/cm at Denman and 900 µS/cm at Singleton. This is achieved through:

- Discharge scheduling that allows discharge only at times when the river flow and salinity levels are such that salt can be discharged without breaching the salinity targets; and
- Sharing the allowable discharge according to licensed holdings of tradeable salinity credits.

The discharge schedule prohibits discharges during low flow periods. Discharges are regulated in proportion to credit holdings during high flow periods and unlimited discharges are permitted during flood flow periods, subject to tributary protection limits and the overarching requirement to achieve the upper limit salinity levels at Denman and Singleton.

A total of 1,000 credits are available for allocation through the scheme. Consequently, a holding of one credit entitles the owner to discharge 0.1 percent of the total allowable discharge for the period. The classification of low, high and flood flow periods is presented in Table 3.9.

Table 3.9 Flow Discharge Categories for Each Sector of the Hunter River

Sector	Low flow range	High flow range	Flood flow range
Upper	Less than 1,000 ML per day	1,000 ML per day to 4,000 ML per day (inclusive)	Exceeds 4,000 ML per day
Middle	Less than 1,800 ML per day	1,800 ML per day to 6,000 ML per day (inclusive)	Exceeds 6,000 ML per day
Lower	Less than 2,000 ML per day	2,000 ML per day to 10,000 ML per day (inclusive)	Exceeds 10,000 ML per day

Reference: Protection of The Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002

3.9 EXISTING WATER MANAGEMENT SYSTEM

3.9.1 Overview

The existing Drayton Mine water management system is operated in accordance with the Drayton Water Management Plan (WMP) (Anglo American, 2009) and the Anglo Environment Water Management System Standard.

Figure 3.8 shows a schematic of Drayton Mine's water management system and the various connection and flow paths between the water storages. Figure 3.9 shows the locations of the major water storages and the three active mining areas; East Pit, North Pit and South Pit at Drayton Mine.

Drayton Mine's water management system is based on a closed system, as it does not possess a discharge licence. All mine water is stored onsite in established dams and is utilised by the mining operation primarily for coal processing and dust suppression purposes.

3.9.2 Water Storages

Table 3.10 shows details of the main water management storages at Drayton Mine. The catchment areas and land use draining to the various dams are given in Appendix A. The dams are connected by a pipe network, which enables a transfer of water according to mine operational requirements. The West Void, currently subleased to Mt Arthur Coal Mine, is used as a repository for excess water on the mine for later reuse. The agreement between Drayton Mine and Mt Arthur Coal Mine allows Drayton Mine to store water within the West Void until January 2017, upon which time any stored water has to be pumped back to the Drayton Mine. The agreement also allows 600 ML per annum to be transferred to Mt Arthur Coal Mine when required.

The Access Road dam is a prescribed dam listed under Schedule 1 of the Dams Safety Act, which requires the proponent monitor and manage the dam to ensure it is safe to the downstream community.

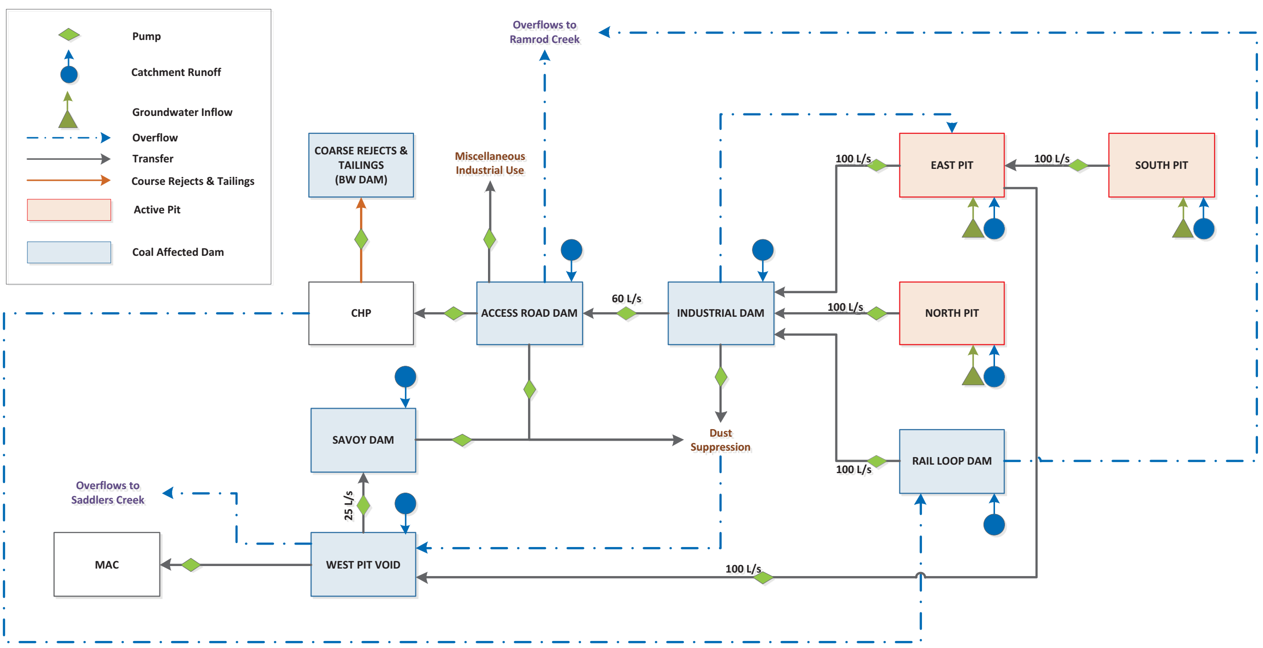

Figure 3.8 Drayton Mine Water Management System Schematic

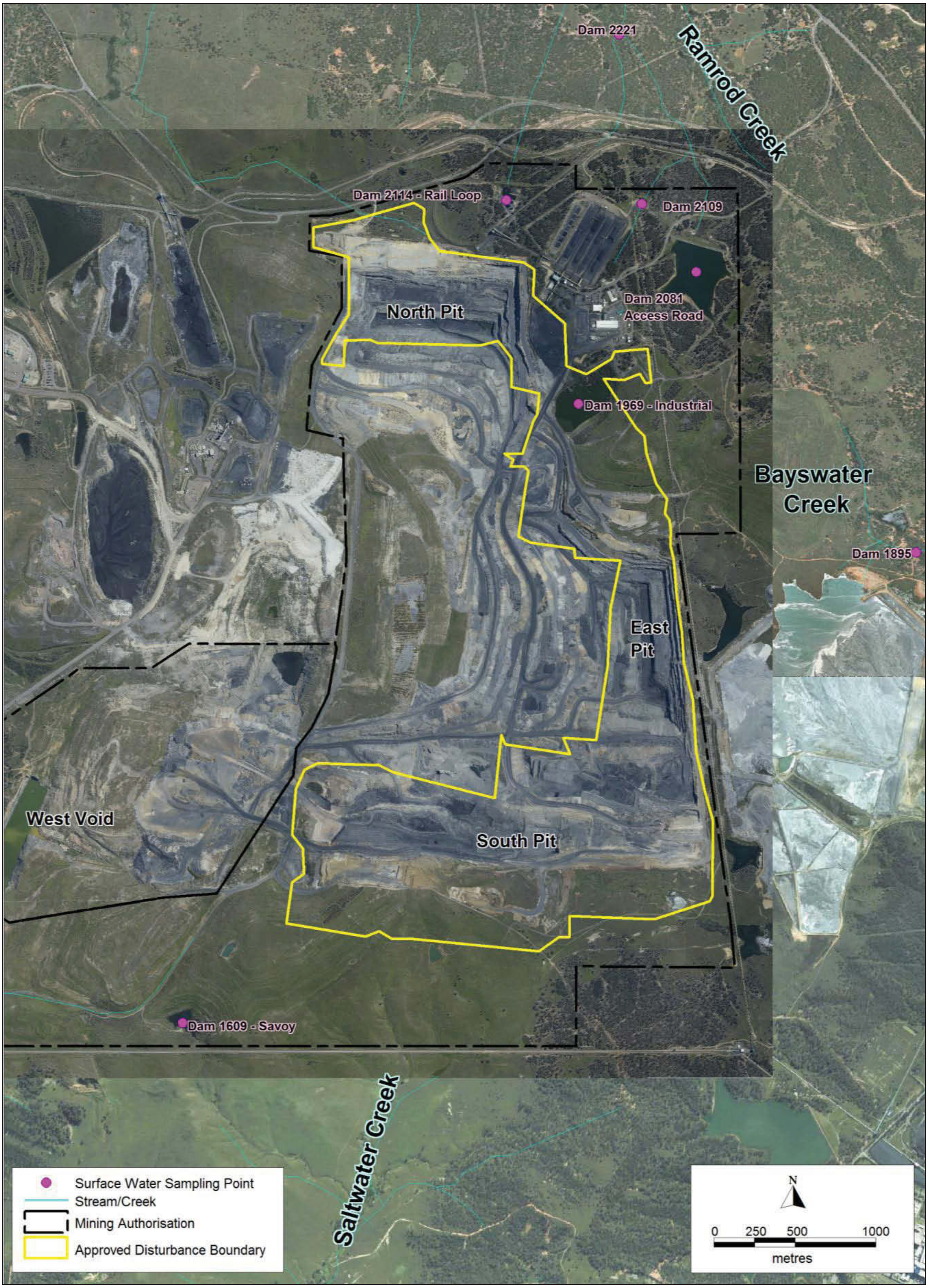

Figure 3.9 Drayton Mine Water Management Dams

Table 3.10 Capacities of Drayton Mine Water Storages

MINE WATER STORAGE	Storage Capacity (ML)	Supply Source	Water Use
Access Road Dam (2081)	750	o Pumped transfers from Industrial Dam o Mine site and rehabilitated catchment runoff	o CHPP Use o Industrial Use o Stockpile and haul road dust suppression
Industrial Dam (1969)	750	o Pumped transfers from active mining areas and Rail Loop Dam o Mine site and rehabilitated catchment runoff	o Pumped transfers to Access Road Dam o Haul Road dust suppression o Industrial washdown
Rail Loop Dam (2114)	18	o Industrial and mine site catchment runoff	o Pumped transfers to Industrial Dam o Stockpile and haul road dust suppression
Savoy Dam (1609)	140	o Mine site, and rehabilitated catchment runoff	o Pumped transfers to Industrial Dam o Haul road dust suppression
West Void (SW13)	4043	o Rehabilitated and spoil catchment runoff o Pumped transfers of excess water from active mining areas	o Pumped transfers to Industrial Dam o Pumped to Mt Arthur Coal

3.9.3 Tailings Disposal System

Anglo American has approval to place raw tailings within the East Void. The East Void will be separated into the East (South) Void, which will store tailings, and the East (North) Void, in which mining will continue.

Approximately 3 million cubic meters (Mm^3) of dewatered tailings is proposed to be placed in the East (South) Void to 2017. Tailings emplacement and capping will be up to 106m AHD. Subsequently, 1,500 ML of water will be stored to increase the in-pit level to 114m AHD behind an in situ pillar to enable mining to the north.

Following the tailings emplacement, Macquarie Generation has the opportunity to then complete filling the void to the currently approved design level with fly ash material. Alternatively, the void will be capped in accordance with standards developed by the Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy (DTIRIS – DRE).

4 MINE PLAN AND WATER MANAGEMENT SYSTEM

4.1 OVERVIEW

The conceptual mine plan layout and water management system for year 3, year 5, year 10, year 15, year 20 and year 27 is given in Figure 4.1 to Figure 4.6.

Mining operations are proposed to commence in the Whynot, Redbank and Blakefield mining areas generally progressing in a north to south sequence. In Year 3A (beginning of Year 3), construction of the Houston visual bund will commence. The purpose of the visual bund is to shield views into the Houston and Whynot mining areas. During this period, mining activities will continue in the Whynot, Redbank and Blakefield mining areas. By Year 3B (end of Year 3), mining will have commenced in the Houston mining area.

From Year 10, highwall mining operations commence in the Houston mining area followed by the Redbank and Blakefield mining areas in Year 15 and the Whynot mining area in Year 27. Open cut mining and progressive rehabilitation continues throughout the life of the operation. The majority of the Redbank and Blakefield mining areas will be rehabilitated by Year 20 with the remainder progressively completed to final landform following Year 27 (final year of mining).

During the construction phase of Drayton South, the transport corridor, mine site facilities and required water management and power reticulation infrastructure will be established, along with the realignment of Edderton Road. Following the completion of construction, there will be a period where mining ramps down at Drayton Mine and commences at Drayton South. During this period personnel and equipment will be progressively transferred from Drayton Mine to Drayton South up until the stage when mining is completed at Drayton Mine and all mining operations will be undertaken at Drayton South.

Three proposed mine layouts of Drayton Mine after 2017, which corresponds to the three possible tailings disposal scenarios from Year 3 to Year 27, are shown in Figure 4.7, Figure 4.8 and Figure 4.9. These scenarios are described in Section 4.3.2.

4.2 SURFACE WATER MANAGEMENT PRINCIPLES

Land disturbance associated with mining has the potential to adversely affect the quality of surface runoff in downstream receiving waters through increased sediment loads. In addition, runoff from active mining areas (including roads, coal stockpiles, etc.) may have increased concentrations of salts and other pollutants compared to natural runoff. The surface water generated within the study area is categorised into five types, based on water quality:

- 'Mine affected' – surface water that has generally come in contact with coal such as in the open cut mining area or from the ROM coal stockpile. This water may contain high TDS, above values that represent fresh water as defined by ANZECC & ARMCANZ (2000);

- ‘Dirty’ – surface runoff water from areas that are disturbed by mining operations (including out-of-pit overburden and haul roads). This runoff does not come into contact with coal or other carbonaceous material and may contain high sediment loads, but does not contain contaminated material or high salt concentrations. This runoff must be managed to ensure that downstream water quality is within the adopted water quality compliance criteria;
- ‘Clean’ – surface runoff from areas where water quality is unaffected by mining operations. Clean water includes runoff from undisturbed areas and any fully rehabilitated areas;
- ‘Tailings’ – water that has been used to wash coal in the CHPP. Tailings water potentially has a higher concentration of contaminants than ‘Mine affected’ water and therefore requires a higher level of protection to prevent discharge into the natural watercourses; and
- ‘Contaminated’ – surface water from areas potentially containing chemicals of various types used in the mining operations. There are restrictions on the use and release of this water. Contaminated water areas include sumps, service bays and fuel storage areas. Rainfall and resulting runoff from these areas is also potentially contaminated and therefore must be managed to avoid discharge of potentially contaminated water into the natural watercourses. This type of surface water runoff is typically treated prior to being reused in the water management system or pumped out by licensed contractors.

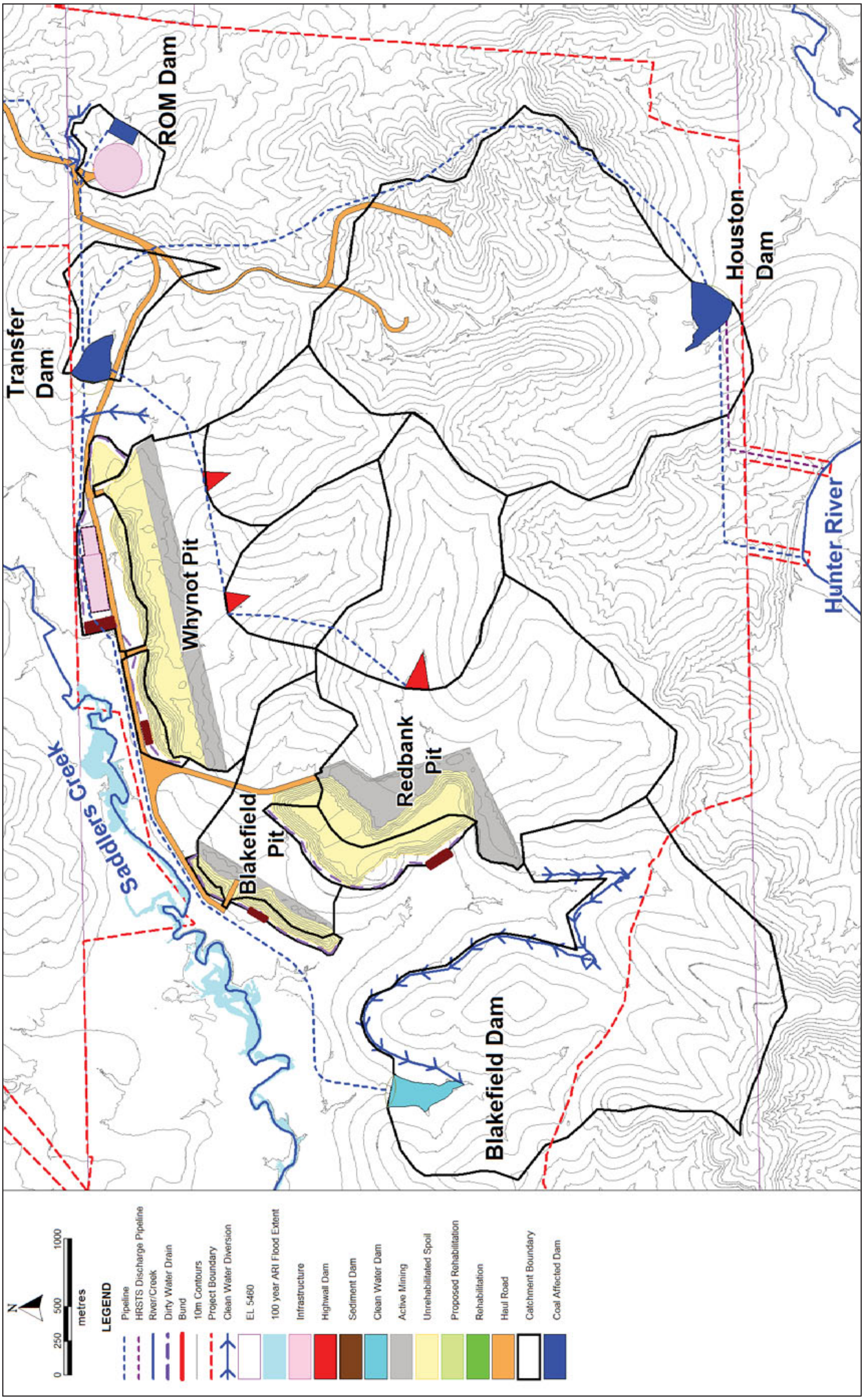

Figure 4.1 Drayton South Conceptual Mine Plan and Water Management System, Year 3

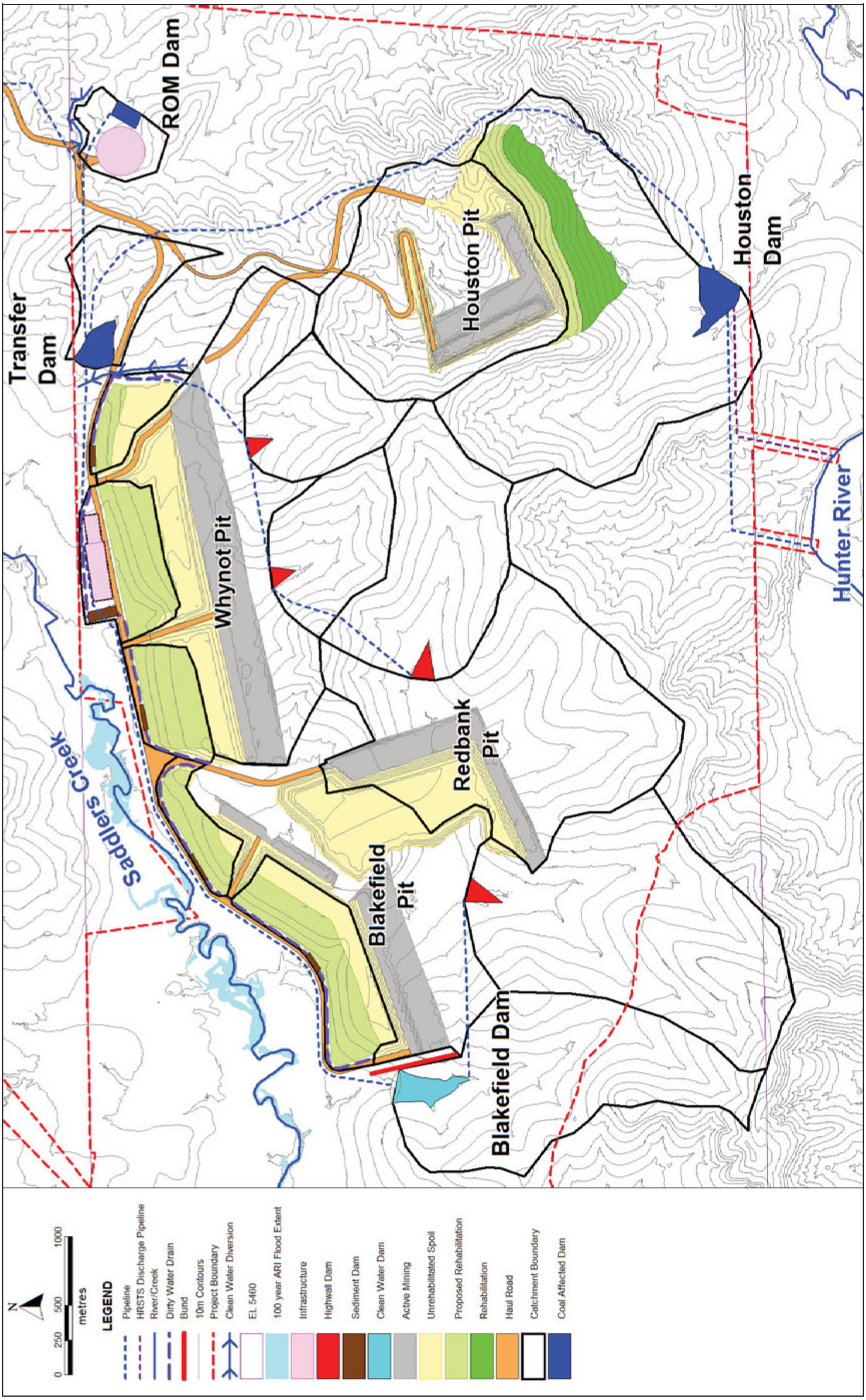

Figure 4.2 Drayton South Conceptual Mine Plan and Water Management System, Year 5

wrm water + environment

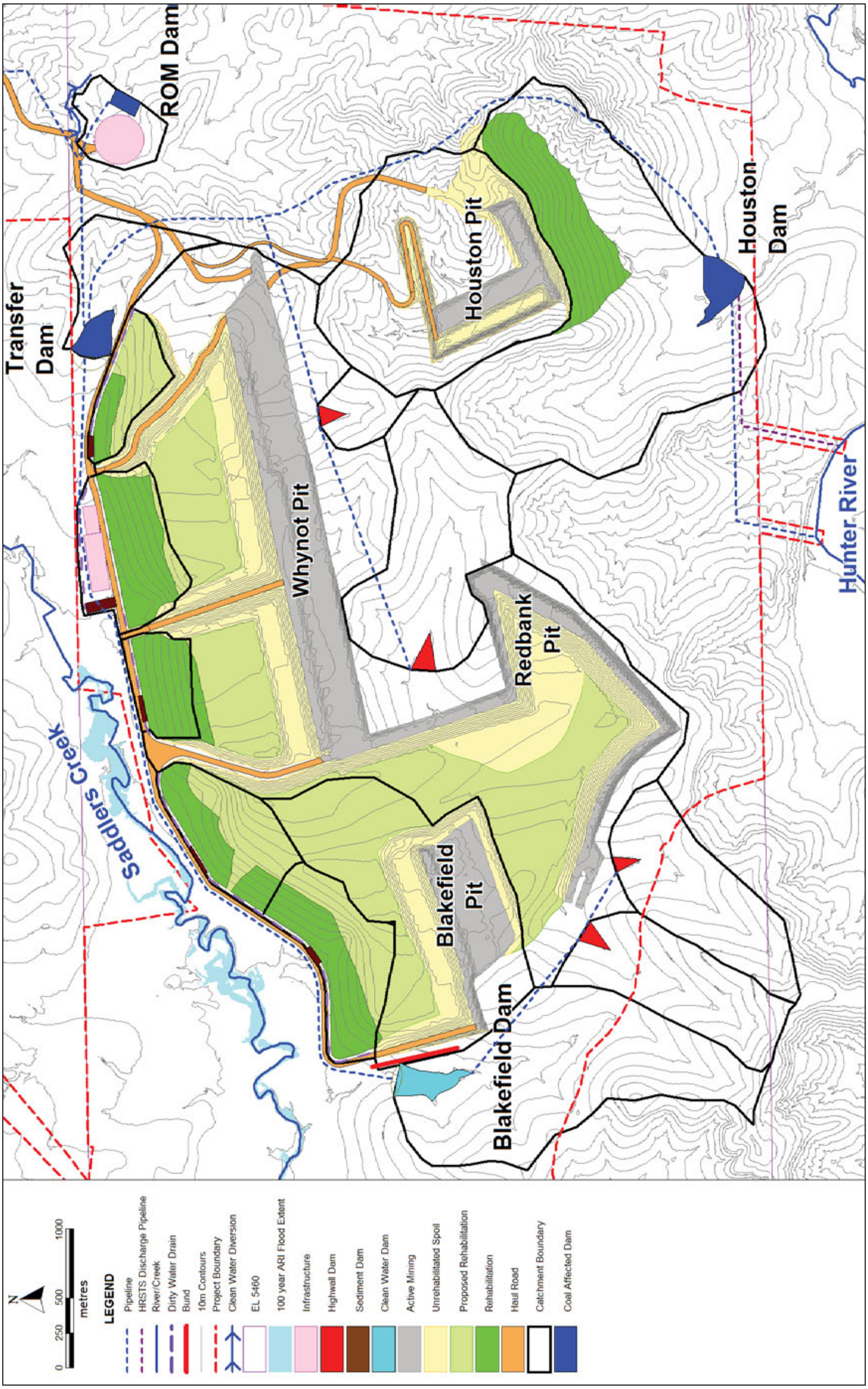

Figure 4.3 Drayton South Conceptual Mine Plan and Water Management System, Year 10

wrm water + environment

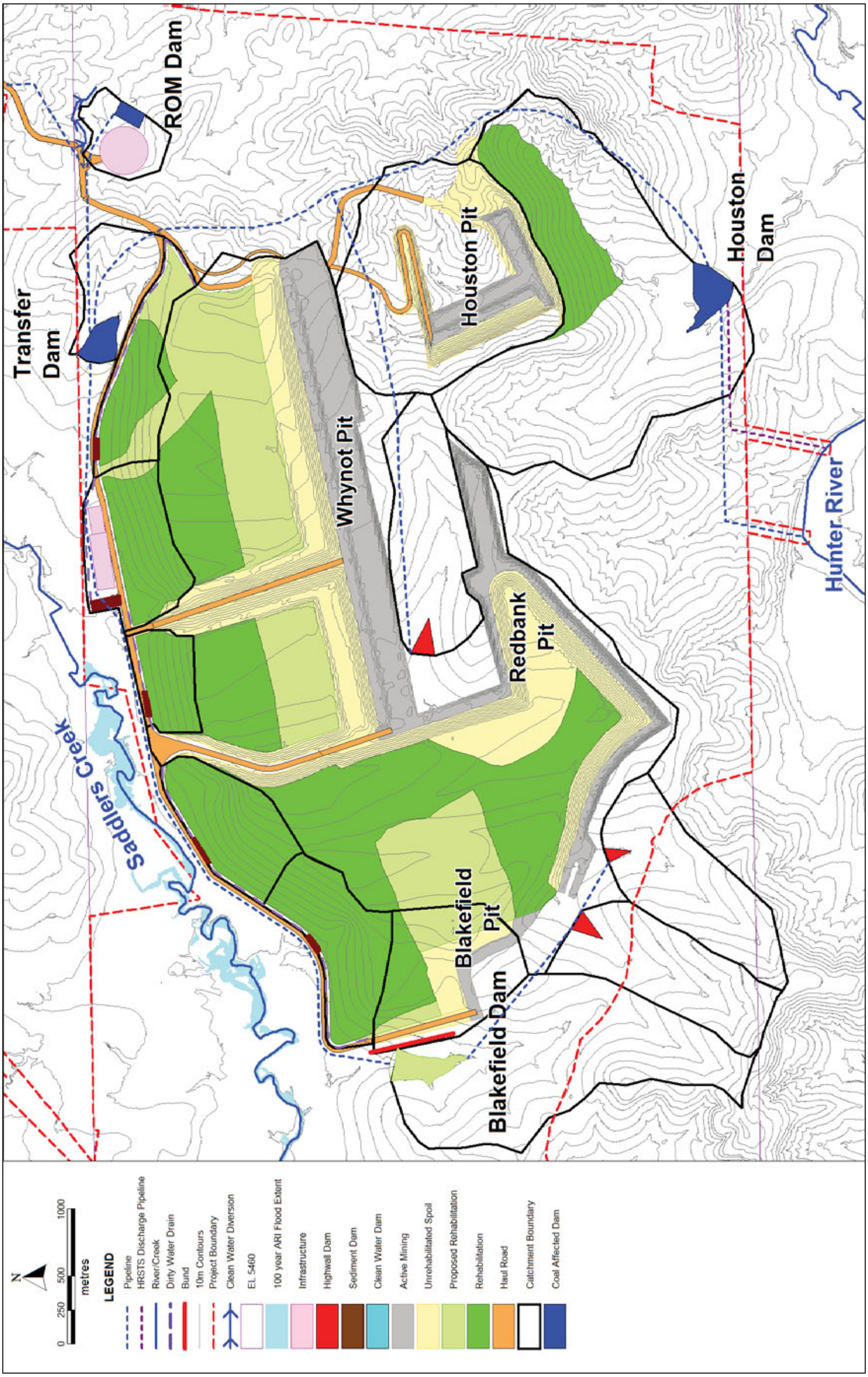

Figure 4.4 Drayton South Conceptual Mine Plan and Water Management System, Year 15

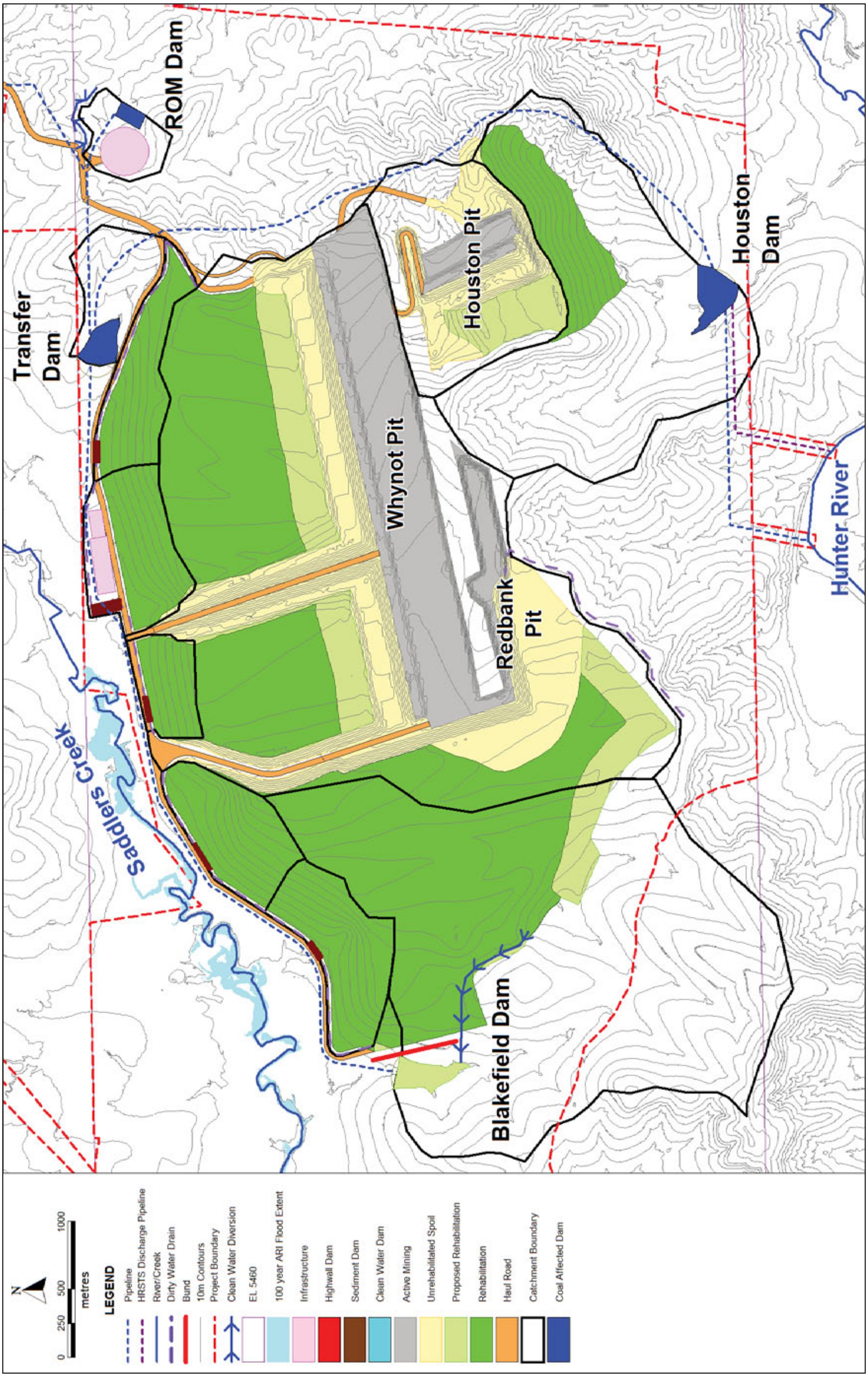

Figure 4.5 Drayton South Conceptual Mine Plan and Water Management System, Year 20

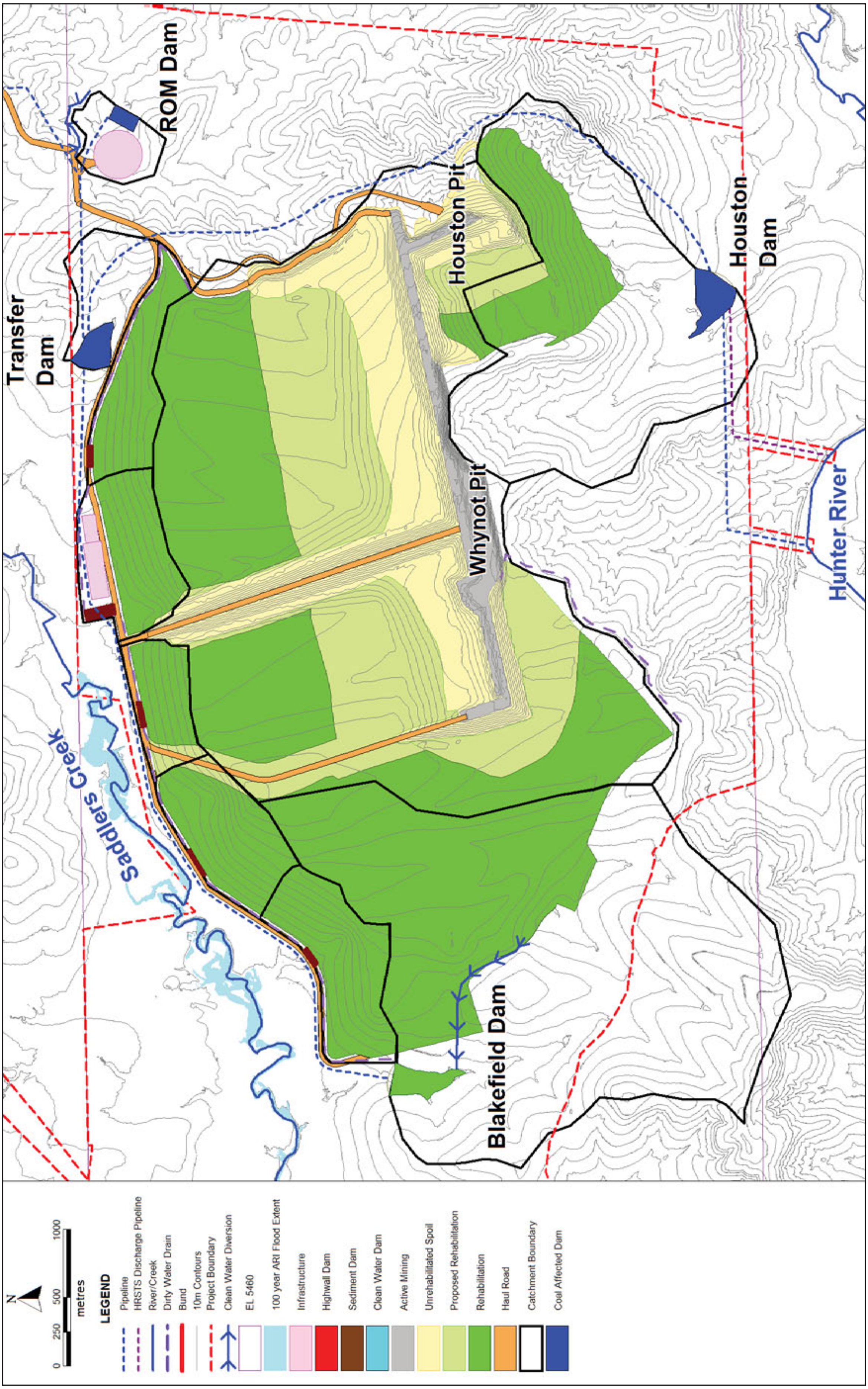

Figure 4.6 Drayton South Conceptual Mine Plan and Water Management System, Year 27

wrm water + environment

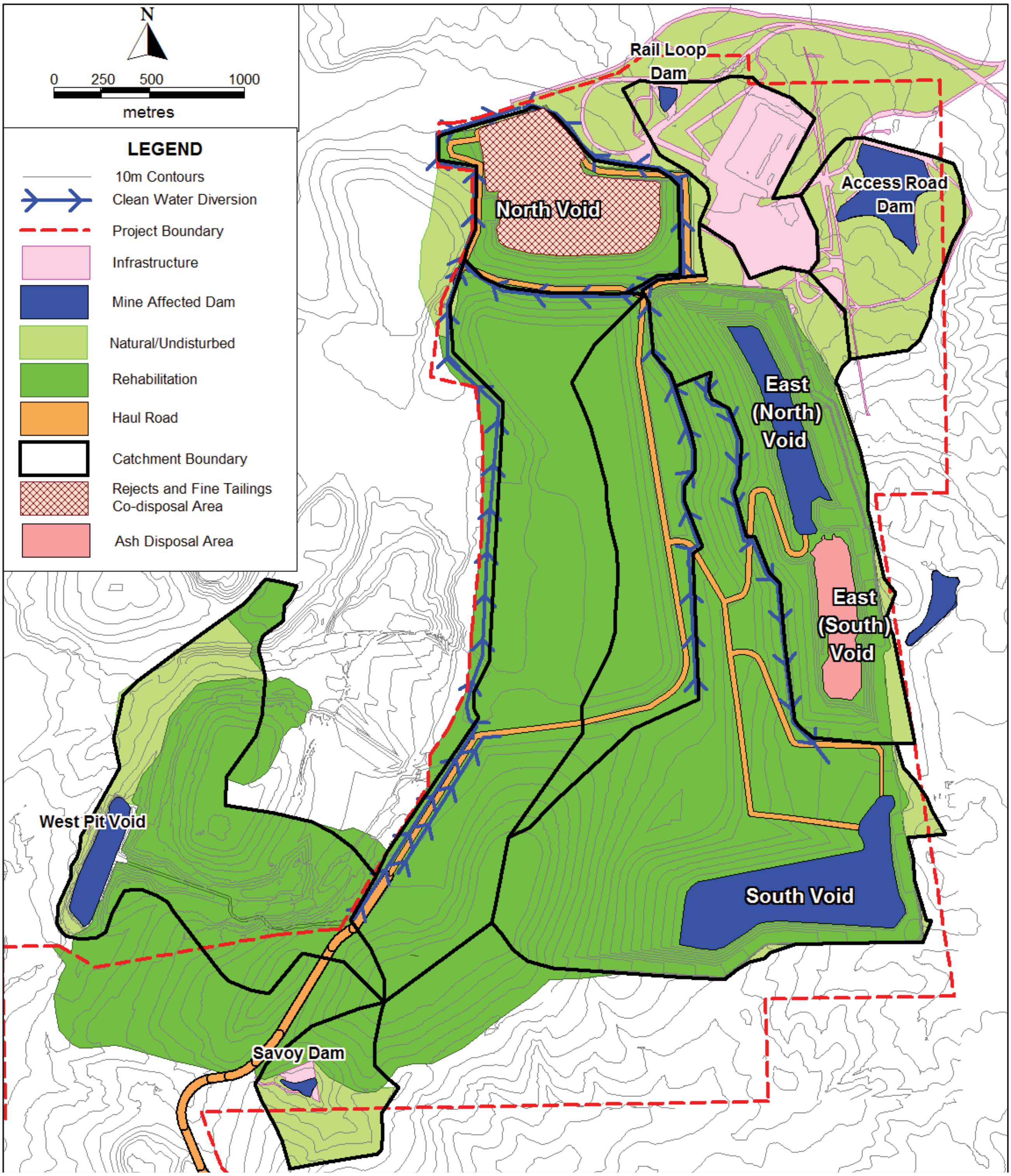

Figure 4.7 Drayton Mine Conceptual Landform Year 3-27 (Scenario 1)

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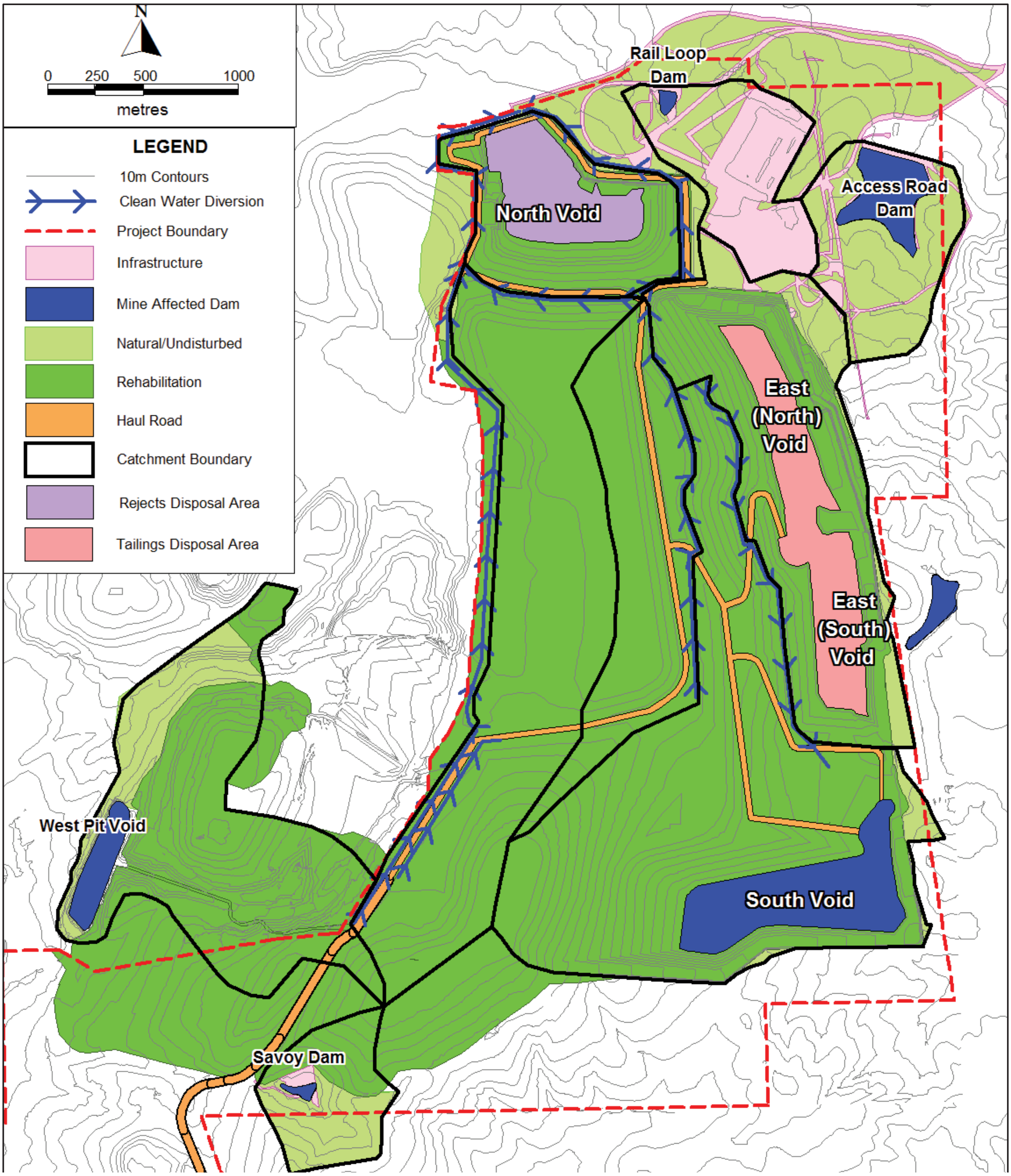

Figure 4.8 Drayton Mine Conceptual Landform Year 3-27 (Scenario 2)

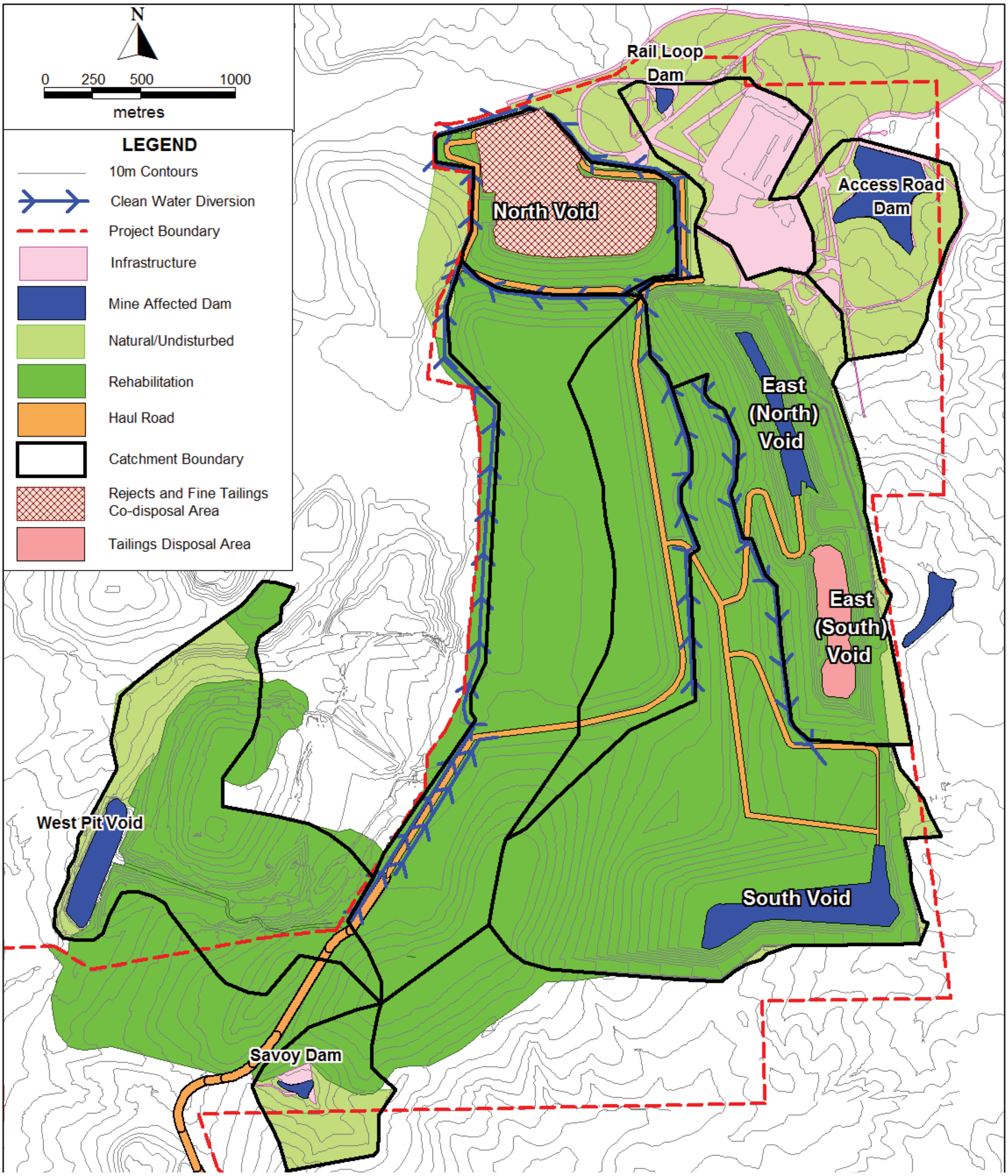

Figure 4.9 Drayton Mine Conceptual Landform Year 3-27 (Scenario 3)

4.3 WATER MANAGEMENT

4.3.1 Mine Water Management System

A summary of the proposed water management system within the study area is given below:

- Water collected in the active mining areas within Drayton South will be pumped to the Transfer Dam.
- Water stored in the Transfer Dam will be used for dust suppression.
- Mine affected water in excess of the Transfer Dam capacity will be pumped to the Houston Dam.
- Mine affected water in the Houston Dam will be pumped back to the Transfer Dam when required. The Houston Dam is also the proposed discharge point for releases under the HRSTS. Raw water pumped in from the Hunter River will also be deposited in the Houston Dam, if required.
- Mine affected water in excess of the Houston Dam and Transfer Dam capacities will be pumped to the South Void at the Drayton Mine. The South Void will be the main repository for excess water within the study area.
- South Void water will be transferred to the Access Road Dam, which will be the main repository to supply water to the CHPP. Water may also be transferred back to the Transfer Dam from the South Void if required to supply the Drayton South operational demands.
- The Rail Loop Dam, collecting mine affected runoff from the Drayton mine site facilities and coal stockpiles, will be pumped to the Access Road Dam.
- Should the conveyor option be adopted for the haulage of coal from the Drayton South area to the existing Drayton Mine CHPP, an additional mine water dam (ROM Dam) will be constructed to collect runoff from the Drayton South coal stockpile area. The collected water will be pumped to the Transfer Dam.

An option is being considered where the South Void is replaced by the northern section of the East Void (East (North) Void) as the main repository for excess water within the study area from Year 10 (2023) of mine site operations. This potential option is considered as part of a sensitivity analysis in this assessment.

A numerical water balance model was used to design the operating rules and assess the effectiveness of the mine water management system. The model identifies water supply and discharge requirements based on the Project's expected catchment runoff and water demands. The water balance model is discussed in detail in Section 5.

4.3.2 Tailings Water Management System

At the completion of coal mining operations within the presently operated Drayton Mine area, three voids will remain including the North, East and South Voids (see Figure 4.7). It is proposed that rejects and tailings generated at the CHPP from the Drayton South operation will be deposited in two of these voids and the third will be used for water storage.

Rejects will be trucked from the CHPP whilst tailings will be pumped via a pipeline and deposited within an allocated void. Decant water recovered in this process will be recycled within the site water management system.

Contingent upon a commercial agreement with Macquarie Generation, there are three possible scenarios for rejects and tailings disposal for which approval is being sought. These scenarios are outlined below. For this report, scenario one has been assessed as the base case with scenarios two and three considered as part of a sensitivity analysis. . For each scenario, Drayton Mine will dispose of tailings in the East (South) Void as currently approved to a level of 104m AHD, which is forecast to occur in 2017. This area will then be capped and rehabilitated by Drayton Mine at 106 m AHD as per the Deed of Agreement with Macquarie Generation.

Under all scenarios the water collected in the tailings disposal area will be given priority to supply the CHPP.

Scenario 1

In Scenario One, occupation and utilisation of the East (South) Void will be transferred to Macquarie Generation following capping and rehabilitation by Drayton Mine in 2017 as per the current Deed Agreement between the two parties. The void, which is situated on land owned by Macquarie Generation, will then be used at their discretion, potentially for the deposition of power station ash. Macquarie Generation will be responsible for the rehabilitation of East (South void) under Scenario 1.

The North Void will be allocated as a co-disposal emplacement area for rejects and tailings generated from the processing of Drayton South coal. The North Void will be separated into two cells for emplacement of each coal waste stream then filled, graded to be free draining, capped and rehabilitated at 202 m AHD. Some rejects will also be trucked to the southern side of the North Void and blended with the final landform to assist with infill of existing ramps and roads in this area.

The South Void will be utilised as a water storage area for the life of the Project. This void is situated on land owned by Macquarie Generation. Currently Drayton Mine has a legal agreement with Macquarie Generation to utilise the South Void until 1 January 2023. As such Anglo American will consult further with Macquarie Generation regarding the utilisation of the South Void, and enter into a commercial arrangement which satisfies the needs of both parties prior to 2023.

The utilisation of the voids at Drayton Mine under Scenario 1 is illustrated in Figure 4.7.

Scenario 2

This scenario assumes that Macquarie Generation is granted planning approval to raise their current ash dam wall to increase its storage capacity or make other arrangements and confirm that they will no longer require the East (South) Void for ash disposal.

As such the East Void will be utilised for tailings disposal during the life of the Project and capped and rehabilitated at 140 m AHD.

Given that East (South) Void is located on land owned by Macquarie Generation, Anglo American will enter into a new commercial arrangement for the Project to occupy this void until closure of operations. Anglo American will be responsible for the rehabilitation of East (South void) under Scenario 2.

Under Scenario Two, the North Void will be utilised as a rejects emplacement area and capped and rehabilitated at 181 m AHD.

The South Void will be utilised as a water storage area for the life of the Project. This void is situated on land owned by Macquarie Generation. Currently Drayton Mine has a legal agreement with Macquarie Generation to utilise the South Void until 1 January 2023. As such Anglo American will consult further with Macquarie Generation regarding the utilisation of the South Void, and enter into a commercial arrangement which satisfies the needs of both parties prior to 2023.

The utilisation of the voids at Drayton Mine under Scenario 2 is illustrated in Figure 4.8.

Scenario 3

This scenario assumes that Macquarie Generation decide to utilise both the East (South) and South Voids which are located on their land. As such water will be stored in the South Void until 1 January 2023 when the current commercial agreement with Macquarie Generation expires. Occupation and utilisation of the East (South) and South Voids would then be transferred back to Macquarie Generation. The voids, which are situated on land owned by Macquarie Generation, will then be used at their discretion, potentially for the deposition of power station ash or storage of water.

From 2023 water for the Drayton Complex will be stored in East (North) Void to 100 m AHD and within the Drayton South area.

The North Void will be allocated as a co-disposal emplacement area for rejects and tailings generated from the Drayton South mining areas. The North Void will be separated into two cells for emplacement of each coal waste material and then filled, graded to be free draining, capped and rehabilitated at 202 m AHD. Some rejects will also be trucked to the southern side of the North Void and blended with the final landform to assist with infill of existing ramps and roads in this area.

The utilisation of the voids at Drayton Mine under Scenario 3 is illustrated in Figure 4.9.

4.3.3 Dirty Water Management System

The design of sediment control measures for the Project will be based on the principle of ensuring that runoff from disturbed areas is separated from clean area runoff and collected in sediment dams for treatment. Design of proposed erosion and sediment control measures will be based on the recommended design standards in the following guidelines:

- Managing Urban Stormwater, Soils and Construction, (Landcom, 2004);
- Managing Urban Stormwater, Soils and Construction, Volume 2E Mines and Quarries (DECC, 2008).
- Managing Urban Stormwater, Soils and Construction, Volume 2C Unsealed Roads (DECC, 2008a).

Figure 4.1 to Figure 4.6 show the locations of the proposed sediment control dams on the Drayton South site. It is expected that up to six sediment dams may be required between Saddlers Creek and the northern boundary of the active mining areas to collect runoff from the overburden emplacement areas.

Sediment dam sizes and locations will be confirmed during detailed design. However, the dam sizes will be based on the following design standards and methodology:

- “Type F” sediment basins consistent with SD 6-4 (page 6-19, Landcom 2004);

- Sediment basin spillway capacity of 50 year ARI peak discharge (to provide a high level of immunity to protect against structural damage);
- Total sediment basin volume = settling zone volume + sediment storage volume. The sediment storage volume is the portion of the basin storage volume that progressively fills with sediment until the basin is de-silted. The settling zone volume is the minimum required free storage capacity that must restored within 5 days after a runoff event;
- Sediment basin settling zone volume based on 90^{th} percentile 5-day duration rainfall (35.9 mm) with an adopted volumetric event runoff coefficient for disturbed catchments of 0.35; and
- Sediment storage volume = 50% of settling zone volume.

The location and layout of the haul road between Drayton South and the existing Drayton Mine will be determined during detailed design. An erosion and sediment control plan will be developed in accordance with DECC (2008a) as part of the detailed design. The general management principles of the plan are as follows:

- The haul road will be sited along the ridgeline wherever possible to minimise the requirement for cross drainage structures and steep gradients;
- Where cross drainage structures are required, the upslope catchment will be diverted to prevent it from crossing the road.
- Any cross drainage structures will be designed to convey the 5 year ARI event without being overtopped.
- Dissipating structures will be constructed downstream of any cross drainage to ensure concentrated flows are below erosive flows.
- Table drains will be constructed at a gradient to minimise erosion or erosion protection measures will be installed where necessary. Mitre drains will be used to minimise the catchment area draining to the table drains.
- The mitre drains will discharge to well vegetated areas or sediment control structures and not directly to a drainage line.
- A dust-a-side will be used to minimise dust by coagulating the finer particles together and thus minimising turbid runoff.

Runoff from the haul road is not expected to be mine water affected. Spillage from coal haul trucks is expected to be minimal given the maximum gradient of the haul road will be less than the access ramps from the mining areas. The haul road will be monitored visually for any potentially contaminated material. If the conveyor option is selected, then the haul road will carry mostly light vehicles.

4.3.4 Clean Water Management System

A series of temporary highwall dams and drains will be constructed to divert clean water around the Drayton South disturbance footprint as shown in Figure 4.1 to Figure 4.6. The highwall dams will have a capacity to store runoff from a 10 year ARI 24 hour duration rainfall event from their contributing catchments and a spillway capable of passing the 100 year ARI event without overtopping the dam wall. Given the size of these dams and the temporary nature, none of the highwall dams are expected to be prescribed dams under the Dams Safety Act.

Water collected in the highwall dams will be pumped to the Blakefield Dam to the west of the existing Edderton Road. The primary purpose of Blakefield Dam is to manage the release of clean highwall dam water into Saddlers Creek as this catchment increases in size by 300% over the life of the Project. It is not proposed to pump 'mine affected' water into the Blakefield Dam although minor areas of dirty water runoff from the active working areas may drain to the Blakefield Dam.

Water collected in the Blakefield Dam will be released to the downstream environment in a similar manner to a sediment dam if it meets the water quality compliance requirements or pumped to the Transfer Dam for use onsite. It is expected that the Blakefield Dam and the highwall dams will be decommissioned at about year 10 to year 15 of the Project when the channel downstream of Blakefield Dam has been rehabilitated (See Section 7.3).

4.3.5 Contaminated Water Management System

The approved Drayton mine site facilities and the proposed mine site facilities at Drayton South may produce runoff that contains hydrocarbons. These areas include:

- The vehicle and equipment wash-down area;
- Workshop;
- Fuel, oil and grease storages; and
- Refuelling bays.

Runoff from these areas on the mine site facilities will be managed as follows:

- Runoff will drain to a triple interceptor (or similar) to reduce hydrocarbons to acceptable levels before draining to the downstream dams. The oily fraction would enter a containment system for removal as necessary.
- Storage tank areas would have an impermeable surface and bunding capable of containing 110% of the largest tank's capacity.
- All oil, grease, fuel and hydrocarbon products would be securely stored.
- Refuelling, oiling and greasing would take place in designated areas only.

In event of a spill, the contaminated soil at the site of the spill would be collected and transported to a licensed waste disposal facility or remediated safely onsite.

4.3.6 Potable Water

Potable Water on the Drayton Mine is supplied via a pipeline from Muswellbrook Shire Council. The current supply arrangement is proposed for the Project. Potable water requirements at the Drayton South facilities will be sourced from the existing Drayton potable water supply, and transported by truck to the Drayton South facilities, within potable water standard requirements. As the existing Drayton Mine workforce will continue to be utilised there will be no increase in potable water required for the Project.

4.4 WATER MANAGEMENT STORAGES

Table 4.1 shows details of the main water management storages within the study area including the sources of water pumped to and from each storage. The catchment areas and land use draining to the various dams are given in Appendix B. The stage-storage-surface area of each dam is given in Appendix C. The dams are connected by a pipe network, which enables the transfer of water according to mine operational requirements. The operational rules of the various storages are given in Appendix D.

Table 4.1 Water Storages within the Study Area

MINE WATER STORAGE	Storage Capacity (ML)	Supply Source	Water Use
Access Road Dam (2081)	750	o Pumped transfers from Rail Loop Dam and South Void o Mine site and rehabilitated catchment runoff	o Pumped transfers to Access Road Dam o Haul Road dust suppression o Industrial washdown
Rail Loop Dam (2114)	43	o Industrial and mine site areas catchment runoff	o Pumped transfers to Access Road Dam o Stockpile and haul road dust suppression
Savoy Dam (1609)	140	o Mine site and rehabilitated catchment runoff	o Pumped transfers to Access Road Dam o Haul road dust suppression
North Void	18900	o Mine site, rehabilitated and spoil catchment runoff o Receive rejects from CHPP o Potential receive co-disposal tailings	o Final Void o Return water to CHPP if used to store tailings
East Void	40756	o Mine site, rehabilitated and spoil catchment runoff o Receive tailings	o Return water to CHPP
South Void	14788	o Mine site, rehabilitated and spoil catchment runoff o Pumped Transfers from Transfer Dam	o Pumped transfers to Access Road Dam o Haul road dust suppression
Transfer Dam	640	o Pumped transfers from active pits, sediment dams, highwall dams and Houston Dam. o Mine site Catchment Runoff	o Pumped transfers to South Void o Pumped transfers to Houston Dam o Haul road dust suppression
Houston Dam	1,810	o Pumped transfers from active mining areas in excess of transfer dam capacity o Pumped inflows from Hunter River (Raw water)	o Pumped transfers to Transfer Dam o HRSTS release point
Blakefield Dam	225	o Mine site, rehabilitated and spoil catchment runoff	o Pumped transfers to Transfer Dam
Drayton South ROM Dam	75	o Industrial (ROM) catchment runoff	o Pumped transfers to Transfer Dam

The three new dams, the Transfer Dam, Houston Dam and Blakefield Dam, will be designed and constructed by a suitably qualified and experienced person in accordance with the requirements of the Dams Safety Act. Should the conveyor option be adopted for the haulage of coal from the Drayton South area to the existing Drayton Mine CHPP, an additional dam (ROM Dam) will be constructed to collect runoff from the Drayton South coal stockpile area. A preliminary assessment of the dams would suggest that the dams would be in the low or very low flood consequence category. The Transfer Dam and Blakefield Dam are located in first and second order watercourses that drain to Saddlers Creek respectively. There is no population at risk along Saddlers Creek or the minor watercourses. Houston Dam discharges into a second order watercourse that drains to Saltwater Creek downstream of Plashett Dam on the Macquarie Generation site. There is no population at risk along these watercourses. A detailed assessment of the flood consequence of these dams will be undertaken during detailed design.

It is proposed to increase the capacity of the Rail Loop Dam at the Drayton Mine to 43 ML as part of the Project or divert some of this catchment into the existing mine dirty water management system. The Rail Loop Dam is currently fitted with an automatic pump back system to the Industrial Dam that minimises the probability of spill. Whilst the current automatic pump back system has been working, the increased capacity will reduce the likelihood of an uncontrolled spill, should the pump back system fail.

Modelling described in Section 5 shows that the Project may require HRSTS permits to discharge water during extended wet periods. It is proposed to discharge water via a pump/pipeline directly to the Hunter River. It is not proposed to discharge mine affected water to the Saltwater Creek catchment.

The Industrial Dam is a 750 ML storage currently used as a pit water repository to supply water for haul road dust suppression, industrial wash down and as a back up to the Access Road Dam to supply water to the CHP. The industrial dam will be removed as mining progresses in the East Pit. It is proposed to shift the current functions from the Industrial Dam to the Access Road Dam. That is:

- pit water will be pumped directly to the Access Road Dam;
- pit water will be transferred to the West Pit void if the Access Road Dam is full;
- haul road dust suppression will be taken from the Access Road Dam, with back up from the Savoy Dam;
- industrial wash down water will be taken from the Access Road Dam; and
- the Rail Loop dam will be pumped to the Access Road Dam.

Any water remaining in the Industrial Dam at the time of decommissioning will be pumped to other storages on Drayton Mine.

4.5 FINAL LANDFORM

Figure 4.10 shows the configuration and drainage catchments of the final landform at Drayton South. The following drainage characteristics are proposed for the final landform at Drayton South.

- The Blakefield Dam, Houston Dam, ROM Dam (where applicable) and Transfer Dam will be removed and rehabilitated;
- The Houston mining area will be rehabilitated to drain back to the final void left by the Whynot mining area;
- The rehabilitated northern face of the overburden emplacement area will drain directly to Saddlers Creek;
- The Blakefield mining area and western sections of the Redbank mining area will be rehabilitated such that it drains to the Blakefield Dam catchment. A drain will be constructed to divert some isolated first order gully catchments around the disturbance footprint to the Blakefield Dam catchment. The drain will be designed with a bed slope and characteristics similar to the adjoining first order watercourses; and
- The top of the overburden emplacement area will drain into the final void of the Whynot mining area. The catchment area of the final void is 11.4 km^2.

The final landform for Drayton Mine will be similar to that shown in Figure 4.7, Figure 4.8 and Figure 4.9 and will ensure the rehabilitation of all major infrastructure and the final capping and rehabilitation of fine tailings and coarse rejects disposal areas.

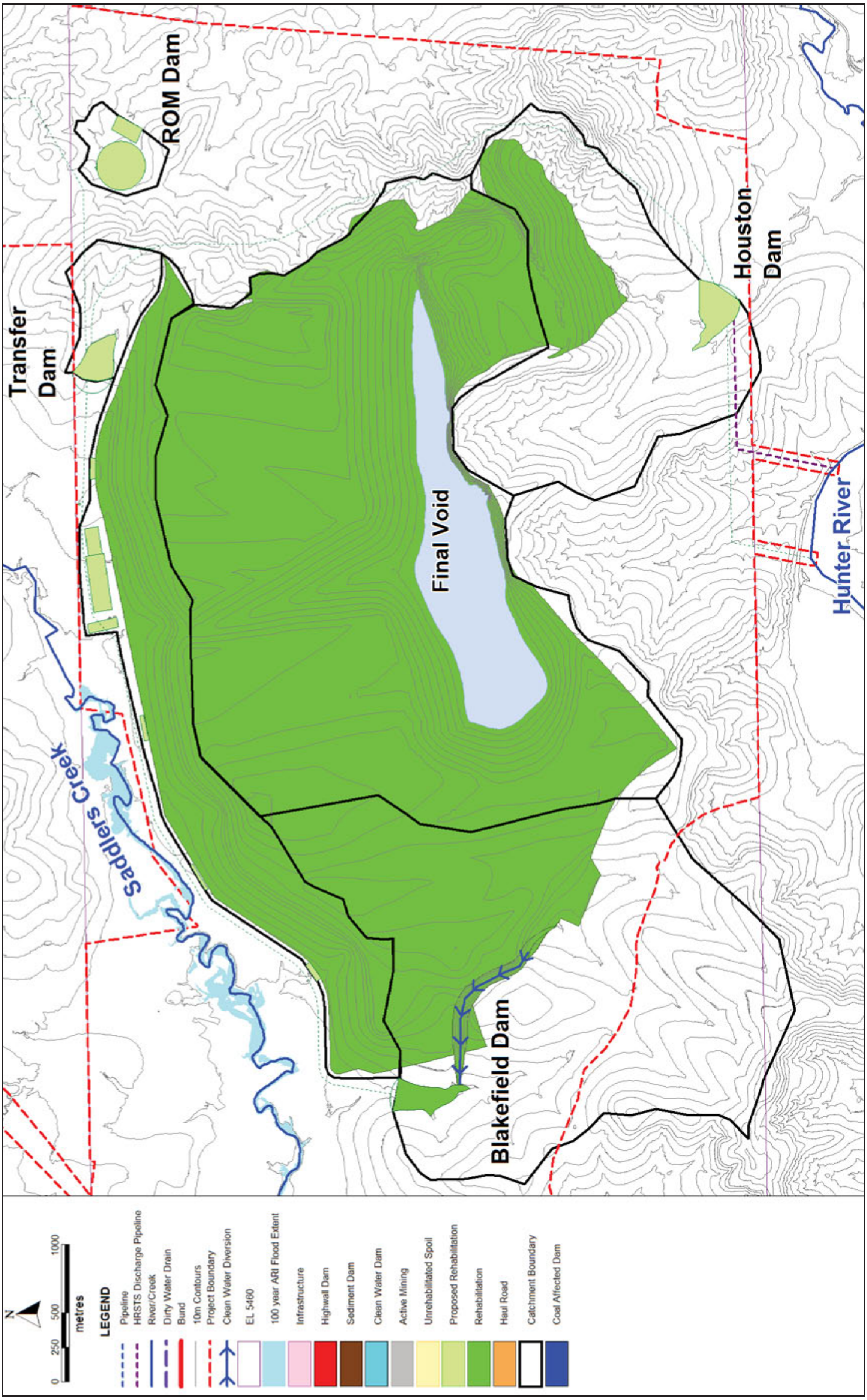

Figure 4.10 Drayton South Conceptual Final Landform

5 WATER BALANCE

5.1 OVERVIEW

A computer-based simulation model (OPSIM) was used to assess the dynamics of the water balance under conditions of varying rainfall and catchment conditions within the study area. The OPSIM model works to dynamically simulate the operation of the water management system and in doing so keeps complete account of all site water volumes and representative water quality on a daily time step.

The model has been configured to simulate the operations of all major components of the water management system. The simulated inflows and outflows included in the model are given in Table 5.1.

Table 5.1 Simulated Inflows and Outflows to Mine Water Management System

Inflows	Outflows
Direct rainfall on water surface of storages	Evaporation from water surface of storages
Catchment runoff	CHPP demand
Groundwater inflows	Dust suppression demand
Raw water supply from Hunter River	Vehicle wash down
	Offsite spills from storages
	Controlled Releases under the HRSTS

5.2 METHODOLOGY

The OPSIM water balance model of the Drayton Mine water management system, previously developed to assess the impact of the proposed changes to the tailings disposal system (Water Solutions, 2011), was used as the basis for the assessment. For this study, the runoff parameters in the OPSIM model were recalibrated to match the recorded and predicted storage volumes over the period 2007 to 2011. Details of the OPSIM model configuration and calibration is given in Appendix A. A description of the existing Drayton Mine water management system is given in Section 3.9.

The calibrated model was updated to include Drayton South and then run as a dynamic forecast simulation model. The 27 year Project Life of Drayton South was modelled, i.e. 2014 – 2040, using historical climatic data from the SILO Data Drill service (Jeffrey et al. 2001). The dynamic configuration allows the simulation to change over the modelled Project Life, reflecting changes in the water management system over time. Six different stages of the Project Life were linked in the model to reflect variations over time such as catchments, ROM coal production and groundwater seepage. The changes in the physical layout are represented in the mine stage plans given in Figure 4.1 to Figure 4.6. Descriptions of the water management system over the life of the Project are given in Section 4. The operational rules and physical layout for each representative stage of mine progression were applied to a range of years given in Table 5.2. The operational rules at each modelled stage are provided in Appendix D.

Table 5.2 Application of Representative Mine Stages to Full Project Life

Representative Mine Stage	Applied Range of Project Life
Year 3	Year 1 (2014) – Year 3 (2016)
Year 5	Year 4 (2017) – Year 5 (2018)
Year 10	Year 6 (2019) – Year 10 (2023)
Year 15	Year 11 (2024) – Year 15 (2028)
Year 20	Year 16 (2029) – Year 20 (2033)
Year 27	Year 21 (2034) – Year 27 (2040)

Although the catchment areas are expected to continuously change as Drayton South is continually rehabilitated, the simplification is expected to reasonably represent conditions over the 27 year period. The changes in catchment areas draining to each mine water storage are given in Appendix B.

To assess the effects of varying climatic conditions, the model was run for multiple cycles with each cycle corresponding to the 27 year Project Life. A different rainfall input sequence was applied to each cycle. Of the 114 years of historical climatic and Hunter River flow data available from January 1893 to December 2006, there are 88 "blocks" of data, each 27 years in length. The first "block" of data, from January 1893 to December 1919, is applied to the first cycle of the model. The second "block" of data, offset by one year, is then applied from January 1894 to December 1920 to the second cycle. Each subsequent cycle of the model has the rainfall data offset by one year, until the mine water system has been tested for 88 cycles against 114 years of rainfall data. A statistical analysis of the 88 cycles can then be undertaken to assess the behaviour of the various storages over extended dry and wet periods.

The adopted rainfall sequence for the simulations was based on a synthetic rainfall data set interpolated from point observations by the Bureau of Meteorology (SILO Data Drill, Jeffrey et al., 2001). A comparison of SILO data against recorded data is given in Appendix A. Hunter River stream flows were obtained from the NSW Office of Water IQQM model.

The OPSIM model also undertakes a mass balance of salt loads in all of the major storages within the study area to enable an assessment of the long term build up of salts and to determine the release volumes under the HRSTS.

5.3 CATCHMENTS AND LAND USE

5.3.1 Drayton Mine

Table 5.3 shows the predicted catchment areas that drain to the various water management dams at Drayton Mine based on the final landform given in Figure 4.7. This final landform, and the associated catchment areas and land use types, have been applied over Drayton South's full 27 year life and are assumed to not change. Any water stored in the Industrial dam or West void is assumed to be pumped to the South Void at the time they are decommissioned. A description of the land use types and the associated runoff characteristics is given in Appendix A.

Table 5.3 Drayton Mine Final Landform Catchment Areas

Storage Name	Catchment Area (ha)						
	Mine Site	Cleared	Mining Area	Hardstand	Rehab.	Spoil	Total
North Void	1	0	45	8	30	0	**85**
South Void	8	0	62	13	224	0	**306**
East Void	23	0	100	7	43	0	**173**
Access Rd Dam	49	0	0	19	0	0	**68**
Rail Loop Dam	17	0	0	44	0	0	**61**
Savoy Dam	23	0	0	2	16	0	**42**
West Void	31	0	10	2	127	0	**171**

5.3.2 Drayton South

The catchment areas reporting to the Drayton South surface water storages will change as the site evolves. The breakup of catchment types for the main storages in Year 3 of Drayton South's Project Life (applied over Year 1 to Year 3) are summarised in Table 5.4. Details of the catchment areas for all modelled Drayton South storages for later stages are provided in Appendix B.

Table 5.4 Drayton South Catchment Areas, Year 3

Storage Name	Catchment Areas (ha)						
	Mine Site	Cleared	Mining Area	Hardstand	Rehab.	Spoil	Total
Transfer Dam	51.1	0.0	0.0	4.7	0.0	0.0	**55.8**
Houston Dam	561.7	0.0	0.0	5.0	0.0	0.0	**566.7**
Blakefield Dam	499.5	0.0	0.0	0.0	0.0	0.0	**499.5**
ROM Dam	18.3	0.0	0.0	10.6	0.0	0.0	**28.9**
Whynot Mining Area	97.9	0.0	34.9	0.9	0.0	52.7	**186.4**
Redbank Mining Area	245.0	0.0	38.3	0.0	0.0	29.8	**313.1**
Blakefield Mining Area	85.6	0.0	9.0	3.2	0.0	14.7	**112.5**

5.4 WATER REQUIREMENTS

5.4.1 Coal Handling and Preparation Plant

Table 5.5 shows the expected daily water balance at the CHPP averaged over the applied range of years for each mine stage given in Table 5.2. Water is required at the CHPP for coal processing, washdown and other associated uses. The volume of water required at the CHPP was provided by Aurecon Hatch (2011) and is directly related to the annual forecast coal production tonnages. The following operational characteristics were used to estimate CHPP water requirements:

- Raw feed coal total moisture content: 8% w/w;
- Product coal total moisture content: 10% w/w;
- Rejects total moisture content: 15% w/w;

- Tailings total moisture content: 65 % w/w;
- Tailings split: 48.59% (ratio of fine rejects/total rejects using dry weights); and
- Plant efficiency: the projected ratio of product coal/raw feed (by dry weights) ranges from 64.5% to 83.8% over the 27 year Project Life.

It was assumed that 30% of the tailings moisture will be decanted from the tailings dams and returned to the CHPP. The remaining 70% would evaporate or become entrained with the tailings. The decant return was given priority to supply the CHPP above all other sources. Moisture within the rejects was assumed to be lost to the system.

An assessment of the sensitivity of the 30% return rate on the water balance using a 45% return rate is given in Section 5.10.2.

Table 5.5 Projected Coal Handling and Preparation Plant Water Balance

	Stage					
	Yr 3	Yr 5	Yr 10	Yr 15	Yr 20	Yr 27
Ave. ROM Coal Washed (kTpa)	2,144	4,809	5,600	5,600	4,880	2,724
Ave. CHPP Product (kTpa)	1,607	3,386	4,210	4,189	3,726	2,122
Ave. Plant Efficiency (dry weight)	0.733	0.689	0.735	0.732	0.747	0.762
Ave. Raw Feed Moisture (kL/d)	470	1053	1227	1227	1069	597
Ave. Coal Product Moisture (kL/d)	440	927	1153	1147	1020	581
Ave. Rejects Moisture (kL/d)	131	342	339	343	282	148
Ave. Tailings Moisture (kL/d)	1300	3403	3368	3413	2806	1474
Ave. CHPP Makeup (kL/d)	1401	3619	3632	3677	3040	1606

5.4.2 Industrial Use

The industrial demands for the study area were provided by Aurecon Hatch and are as follows:

- Drayton mine site facilities - 1,120 kL/d; and
- Drayton South mine site facilities - 112 kL/d (assumed to be half the requirement of Drayton Mine and 80% recovery).

Industrial water use was assumed to be constant throughout the life of the Project.

5.4.3 Dust Suppression

Table 5.6 shows the predicted dust suppression water requirements for each mine stage. The rate of coal stockpile dust suppression is considered constant over the Project Life. The adopted haul road dust suppression demand at each stage is dependent on the length of the haul roads and ramps. The length of the haul road at Drayton Mine and the Drayton South mine site facilities are assumed not to change. Only the length of haul roads, ramps and internal routes at Drayton South change over the Project Life. The following is of note with regards to haul road dust suppression rates:

- Dust suppression occurs at a constant rate throughout the year for each mine stage scenario. No adjustments for summer and winter watering requirements were made;

- A dust suppressant agent will be applied to haul roads, ramps and mine site facilities to minimise water use. Based on information provided by Anglo American, water requirements for dust suppression will be applied at an application rate of 0.015 L/m^2/hr when used in conjunction with the dust suppressant agent;
- Haul road and ramp lengths were calculated from the Drayton South staged mine plans (Hansen Bailey, November 2011) and the Drayton Mine final landform (Hansen Bailey, January 2012). Industrial areas were adopted from the Drayton South Expansion Water Management Design Criteria (Anglo American, August 2011);
- The adopted road watering application rate, for internal routes and mine working areas is 0.2 L/m^2/hr (Anglo American, August 2011). Dust suppressant agents are not proposed for the mine working areas; and
- Drayton Mine haul roads were assumed to be 14 m wide, Drayton South haul roads and ramps assumed to be 26 m wide and trucks were assumed to operate 23 hrs/day, (Anglo American, August 2011).

Dust suppression demands at Drayton South are sourced from the Transfer Dam, while demands at the existing Drayton Mine are sourced from the Access Road Dam.

Table 5.6 Projected Haul Road Dust Suppression Demand

Demand (kL/d)	Stage					
	Yr 3	Yr 5	Yr 10	Yr 15	Yr 20	Yr 27
Drayton Mine Haul Road	96.1	96.1	96.1	96.1	96.1	96.1
Coal Stockpile Dust Suppression	31.9	31.9	31.9	31.9	31.9	31.9
Drayton Mine Site Facilities	3.2	3.2	3.2	3.2	3.2	3.2
Drayton South Haul Road	103.6	153.3	171.1	156.6	142.0	150.0
Drayton South Mine Face/Route	804.3	1469.2	1352.0	1237.2	926.3	926.3
Drayton South Mine Site Facilities	3.2	3.2	3.2	3.2	3.2	3.2
Total (kL/d)	1042	1757	1658	1528	1203	1211

5.5 GROUNDWATER INFLOWS

Table 5.7 shows the estimated groundwater inflow to the three mining areas at Drayton Mine and the proposed mining areas at Drayton South over the life of the Project (AGE, 2006; 2012). The following is of note with regards to the adopted groundwater inflow rates:

- The adopted volumes are the estimated pumpable volumes after evaporation from the coal face is taken into account;
- Groundwater inflows to the Whynot and Redbank mining areas are assumed to be combined from Year 10 onwards;
- For the Houston mining area from Year 10 and for the Redbank mining area in Year 27, the theoretical evaporation from the coal face exceeded the modelled drain output, indicating very low or zero groundwater available to dewater;

- Blakefield mining area is decommissioned from Year 20 onwards, contributing no groundwater;
- For Scenario 1 (base case option) tailings and rejects are co-disposed in the North Void, no groundwater is dewatered from the East Void over the life of the Project and the groundwater inflows to the North Void are reduced by 10% to account for tailings deposition (Anglo American, 2011); and
- Similarly, for Scenario 2 with the disposing of tailings in the East Void, no groundwater was dewatered from the North Void as it only contains rejects and the groundwater inflows to the East Void were reduced by 10% to account for tailings deposition.

Table 5.7 Drayton South Project Pumpable Groundwater Inflows

Mining Area	Stage (kL/d)					
	Yr 3	Yr 5	Yr 10	Yr 15	Yr 20	Yr 27
North	1070*					
South	350					
East	1270*					
Whynot	352	1,063	1,521	1,842	1,705	684
Redbank	54	218	2,049	1,431	0	10
Houston	0	85	0	29	0	0
Blakefield	80	780	708	41	0	0
Total	3,175	4,836	6,967	6,033	4,395	3,384

*Values reduced by 10% depending on tailings disposal scenario.

5.6 HUNTER RIVER SALINITY TRADING SCHEME

The OPSIM model has been configured to include the simulation of controlled discharges of stored mine water into the Hunter River via the Houston Dam in accordance with the requirements of the HRSTS. The Total Allowable Discharge was calculated assuming that all 1000 credits were used by the various credit owners to increase the Hunter River EC to 900 µS/cm at Singleton for every discharge event. Discharge opportunities and release volumes were estimated assuming the following:

- Hunter River stream flows, derived using the Hunter River IQQM model, provided by NOW, over the period 1893 to 2006 inclusive;
- Hunter River EC derived from a logarithmic relationship between recorded stream flows and EC at the Glennies Creek gauge (located at the end of the Middle Sector) over the period of recorded data (1991-2009). Only data that fell within the relevant HRSTS release window of 1800-6000 ML/day was used to derive the relationship. The adopted relationship is shown in Figure 3.7;
- An average concentration of all releases by credit holders under the HRSTS would be 5,000 µS/cm;
- A maximum pump/discharge rate of 100 ML/d during flood flows;

- An total of 50 HRSTS credits would be purchased by Anglo American either at the auction or traded when required; and
- Houston Dam storage volume must be above 312 ML before a release is made. This minimum volume was derived during the modelling process to minimise unnecessary releases of small quantities of water.

Figure 5.1 shows a sample of the behaviour of the HRSTS discharges using the OPSIM model. The top graph shows the Hunter River flow sequence and the HRSTS releases from the Houston Dam. The bottom graph shows the simulated Hunter EC and Houston Dam storage volumes. Releases of 100ML/d are made when the river is in the 'flood' zone and lower releases are made when river levels are in the 'high' zone. No releases are made when the Houston storage volume is below the storage volume of 312 ML. Hunter River salinity levels are generally low when releases are made and are well below the target threshold of 900 µS/cm to allow other credit holders to discharge in the same flow window. The results in Figure 5.1 indicate that the model is accurately representing the assumed HRSTS discharge opportunities.

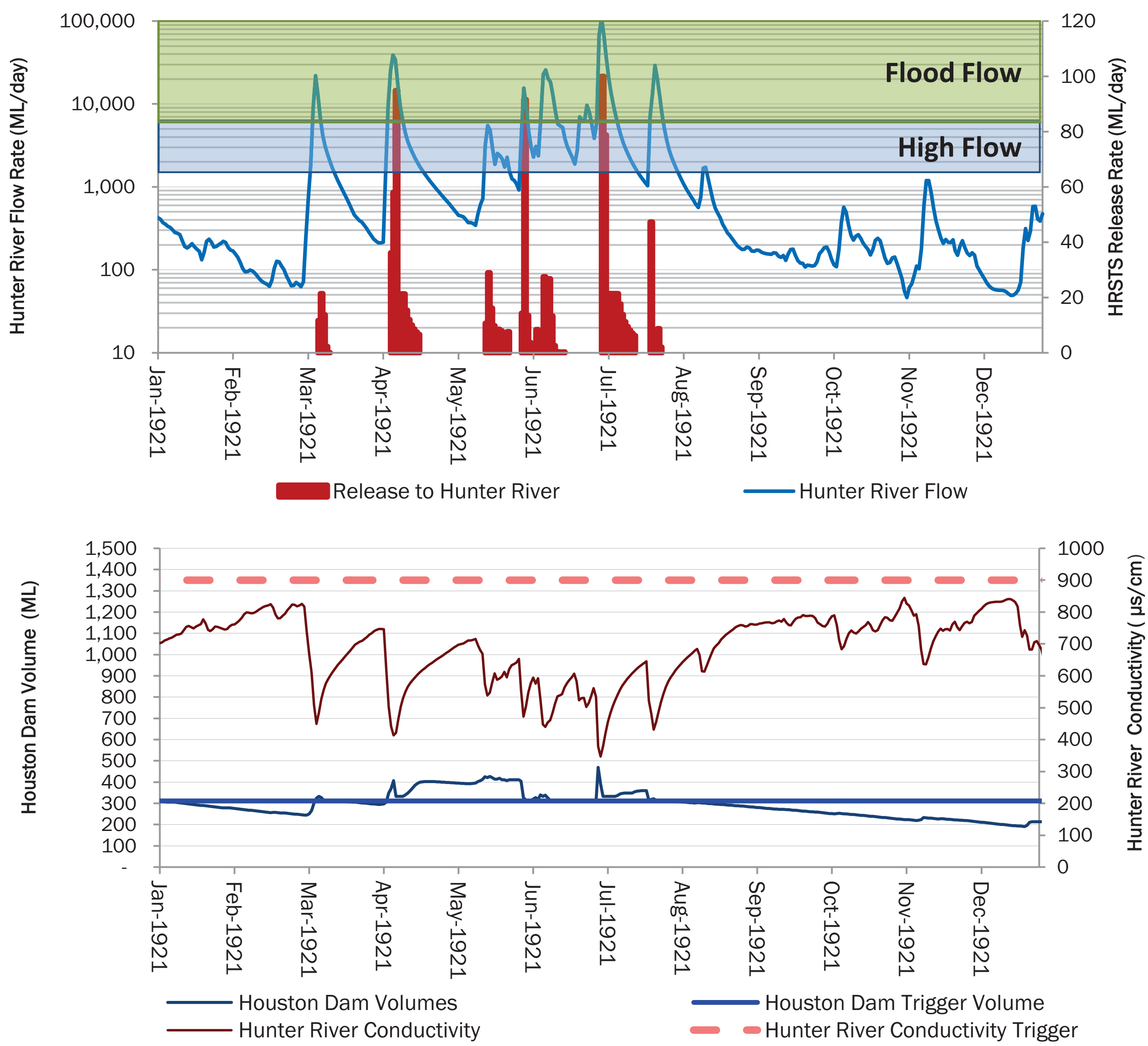

Figure 5.1 Sample of Simulated HRSTS Discharges from Houston Dam

5.7 PUMP OPERATING RULES

Table 5.8 shows the adopted pump operating rules used to switch pumps on and off from the storages throughout the study area. The operating rules have been developed to either maintain a storage volume to enable supplies to be met or to prevent uncontrolled spills from occurring. The limits are generally based on the receiving storages ordering water to meet demand or to prevent an uncontrolled spill. Supplying storage thresholds are applied to the Transfer Dam to ensure there is sufficient water to meet road watering demand and also to the Houston Dam to prevent mine discharges to the Hunter River. Pumping from Blakefield Dam is given the lowest priority to maximise the release of clean water from the site.

Table 5.8 Adopted Pump Operating Rules

Supply Storage	Receiving Storage	Pump Capacity (L/s)	Suppling Storage's Release Threshold (ML)	Receiving Storage's Order Threshold (ML)	Receiving Storage's Supply Cessation Threshold (ML)
Savoy Dam	South Void	60	-	-	12392
Transfer Dam	South Void	200	39	78	12392
Transfer Dam	Houston Dam	250	39	-	1520
South Void	Access Rd Dam	100		341	-
East Void	Access Rd Dam	100	-	-	477
North Void	Access Rd Dam	100	-	-	477
Rail Loop Dam	Access Rd Dam	150	-	-	-
Houston Dam	Hunter River	100	312	-	-
Houston Dam	Transfer Dam	200	-	39	-
South Void	Transfer Dam	200	-	39	-
Hunter River	Transfer Dam	200	-	39	-
Whynot	Transfer Dam	100	-	-	365
Redbank	Transfer Dam	100	-	-	365
Houston	Transfer Dam	100	-	-	365
Blakefield	Transfer Dam	100	-	-	365
Blakefield Dam	Transfer Dam	100	-	-	370
High Wall Dams	Transfer Dam	25	-	-	365
ROM Dam	Transfer Dam	25	-	-	365
Sediment Dams	Transfer Dam	25	-	-	365

5.8 RAW WATER

For the purposes of current investigations, the term ‘raw water’ represents the amount of raw water imported from the Hunter River that is required to sustain the nominated design production rate and associated operational demands for the Project. Any shortfall in mine water is made up from imported raw water – that is, during dry periods, imported raw water is used to ensure that all operational demands are met. It is assumed that water collected on site is used before water is imported from the Hunter River. Hunter River water, if required, will be pumped either into the Houston or Transfer Dams.

5.9 WATER BALANCE MODEL RESULTS

5.9.1 Overview

The OPSIM model was used to assess the performance of the proposed water management system (base case) against the following:

- Mine complex storage inventory;
- Offsite raw water requirements;
- Uncontrolled spills from the mine water storages;
- Controlled releases under the HRSTS; and
- The overall water balance within the study area.

The model was also used to assess the behaviour of the final voids at the end of the Project life.

Four sensitivity analyses have also been undertaken to assess the impact of the following:

- Using an alternative, less effective dust suppressant agent, which will require a higher haul road watering application rate;
- Using the East Void to store tailings, rather than the North Void (described in Section 4.3.2 as Scenario 2);
- Replacing the South Void water storage repository with the East (North) void after Year 10 of mine site operations (described in Section 4.3.2 as Scenario 3); and
- Using a decant return rate of 45% from the North Void co-disposal tailings dam rather than 30%.

In interpreting the results, the 50th percentile probability represents the 'most likely' scenario as it is the median result of all forecast simulations. The 10th and 90th percentile results represent reasonable wet and dry conditions over the simulation period. There is an 80% chance that the result will fall within this range. The 1st and 99th percentile results represent the likely upper and lower bounds of the estimate (i.e. 98% of all results will fall within this range).

It is important to note that investigation outcomes are dependent on the validity of the information on which the investigations were based. Although considerable care and attention has been paid to ensuring that base information is the best available, there is inherent variability with respect to some key site characteristics (e.g. catchment yield/rainfall runoff, mining area groundwater inflows, tailings return rates). Nevertheless, investigation outcomes are considered to be fair and reasonable, given the current status of base information.

5.9.2 Mine Site Storage Inventory

Figure 5.2 and Figure 5.3 show the predicted probability of in-pit and out-of-pit storage volume on site over the 27 year life of the Project. The active pits include the Whynot, Blakefield, Houston and Redbank mining areas. A build-up of water in the active mining areas generally occurs when the out-of-pit storages are too full to accept additional water from the mining areas. The out-of-pit storages include the South Void, Houston Dam, Transfer Dam, Blakefield Dam, North Void, Savoy Dam, Rail Loop Dam, ROM Dam (where applicable) and the Access Road Dam. The out-of-pit storages (excluding the North Void) have a combined capacity of approximately 18,300 ML. The storages are kept below approximately 14,750 ML to prevent uncontrolled spills. In effect, the available out-of-pit storage capacity is about 14,750 ML. The North Void, used for the co-disposal of tailings and rejects, has a capacity of 18,900 ML.

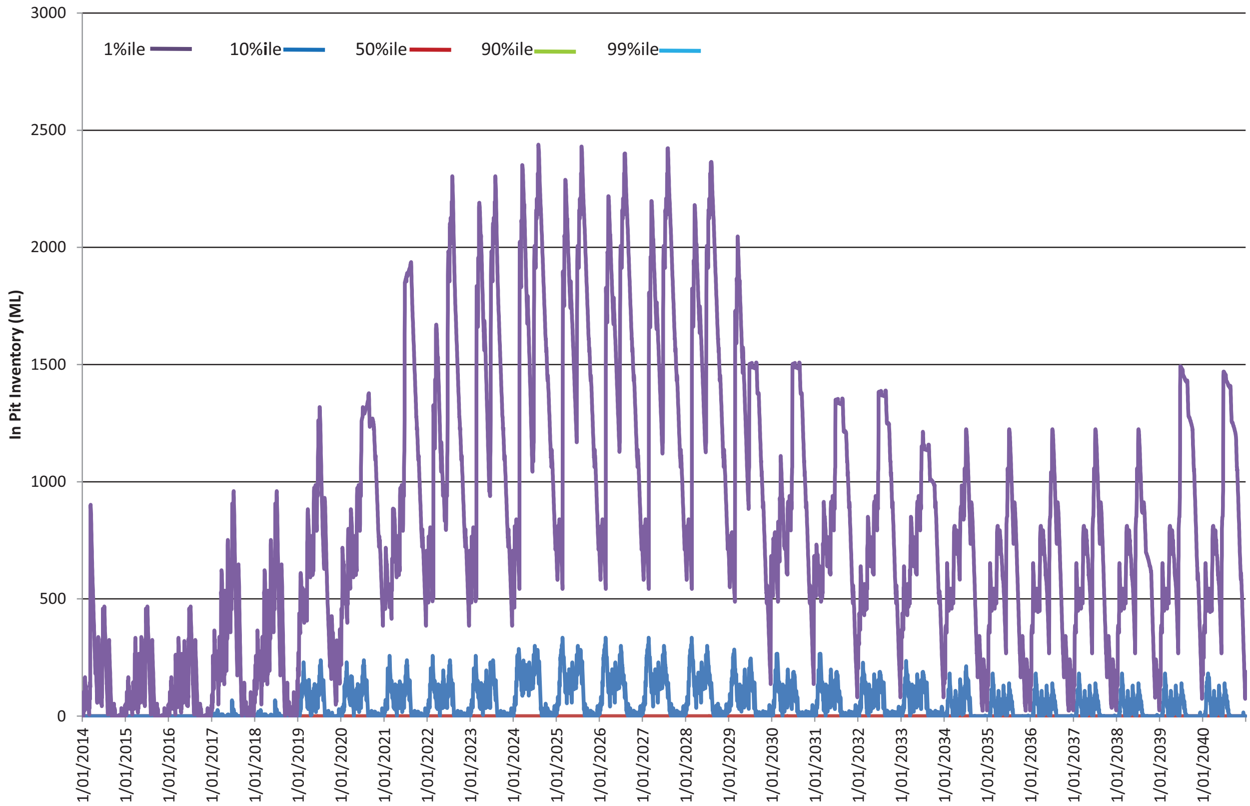

Figure 5.2 Forecast In-pit Storage Inventory, 99th (very dry), 90th (dry), 50th (median), 10th (wet) and 1 (very wet) Percentile Conditions, 2014 to 2040.

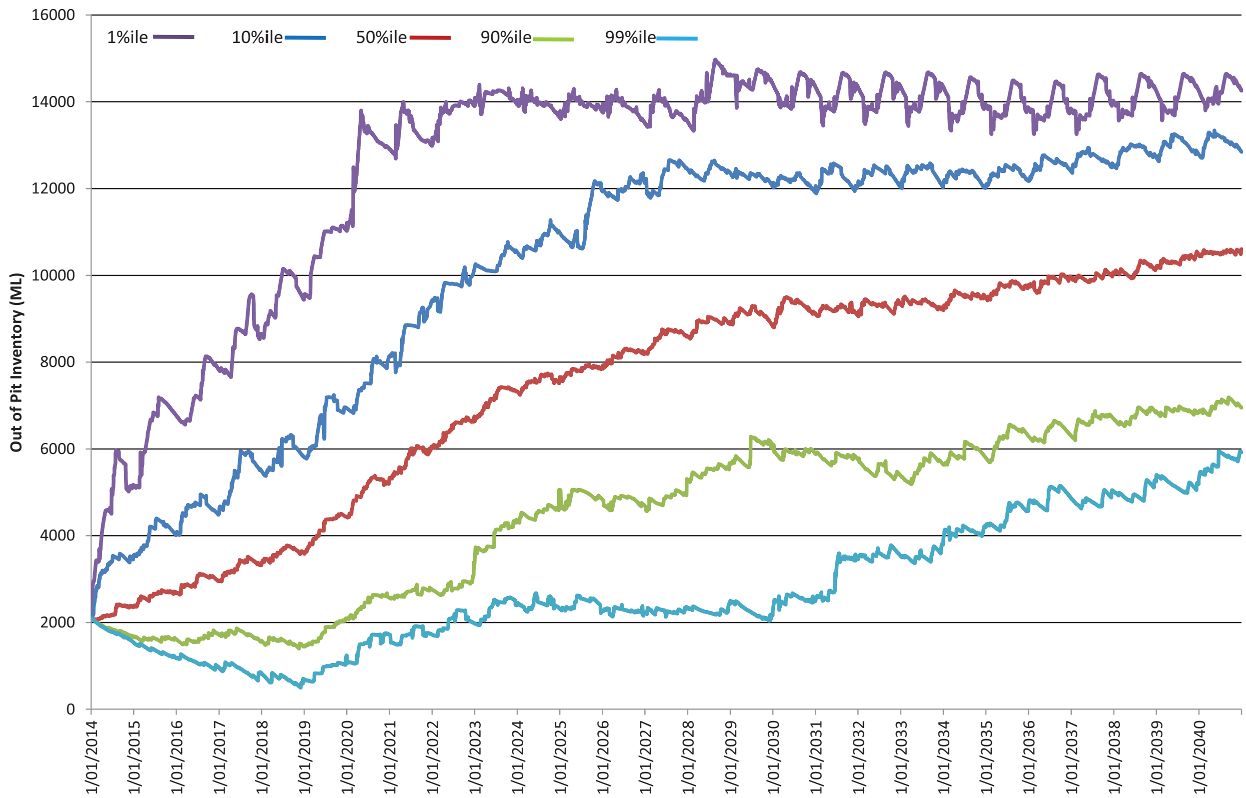

Figure 5.3 Forecast Out-of-pit Storage Inventory, 99th (very dry), 90th (dry), 50th (median), 10th (wet) and 1st (very wet) Percentile Conditions, 2014 to 2040.

The site water balance would generally be in equilibrium over the life of the Project when water in the out-of-pit storages under median (50%) conditions does not exceed 14,750 ML, to allow water to be pumped in from the active mining areas at all times. If the out-of-pit storage capacity exceeds 14,750 ML, mining could be affected. The following is of note:

- There is a 50% chance that there will be no build up of water in the active mining areas and a minor accumulation of water in the out-of-pit storages with total inventory rising from approximately 2,100 ML to 10,600 ML over the Project life (315 ML/yr on average);
- There is a 10% chance that at least 10,750 ML will accumulate in the out-of-pit storages over the life of the Project. Similarly there is a 10% chance that inundation in the combined mining areas would reach a maximum of 335 ML during the Project life, when the out-of-pit storages are too full to accept additional inflows. It is likely that this amount could be redistributed around the site or pumped directly to Houston Dam for release to the Hunter River under the HRSTS and not significantly impact on mining operations;
- There is a 1% chance that the out-of-pit storages will reach the threshold at which water cannot be pumped in after Year 7 of operations and would remain at that threshold for the entire Project Life. Under these 1st percentile (very wet) conditions, mining area inundation would begin to accumulate from about Year 7 onwards and the water in the active pits would accumulate to a maximum of at least 2,440 ML, which is expected to significantly impact mining operations,
- The results show that should 1st percentile, very wet conditions occur, the Drayton Mine and Drayton South site storages are likely to be too full to accept pumped inflows from the mining areas in the central stages of the Project's life, particularly from about 2021 to 2031. Production will potentially be impacted during these periods and an active mining area may need to be temporarily sacrificed for water storage. Alternatively, dust suppression watering rates could be increased;
- There is a 10% chance (90th percentile (dry) conditions) that there will be a build-up of water of at most 4,860 ML in the out-of-pit storages over the life of the Project; and
- There is a 1% chance (99th percentile (very dry) conditions) that there will be a build-up of water of at most 3,830 ML in the out-of-pit storages over the life of the project. Even under these very dry conditions, the water management system is not in equilibrium from about 2030 and is accumulating water. This indicates that inflows to the water management system (including groundwater and surface runoff) are exceeding the combined outflows (including evaporation, controlled releases under the HRSTS, dust suppression, industrial use and CHPP demands).

5.9.3 Offsite Water Requirements

The model predicts that there is less than a 1% chance that offsite supplies will be required for the Project. That is, runoff from Drayton Mine catchments and dewatered groundwater can supply all of the Drayton South water requirements over the life of the Project (unless conditions were drier than the 99th percentile conditions). This is consistent with the existing operations at Drayton Mine, which has not needed to source offsite water over the life of the mine. Note that the proposed use of a dust suppressant agent that minimises water use on the haul roads (with a haul road watering application rate of 0.015 L/m^2/hr) has played a significant role in minimising the chance of requiring offsite supplies. The comparative results for the water balance modelling that includes a less effective dust suppressant agent (i.e. higher water usage) is provided in Section 5.10.1.

5.9.4 Uncontrolled Spills from Mine Water Storages

Table 5.9 shows the predicted spills from the mine affected water storages over the 27 year period for the median conditions as well as the 90th and 10th percentile confidence limits of the estimate. The results show the following:

- The main mine water storages, Access Road Dam, Savoy Dam, Transfer Dam, Houston Dam and the South Void do not spill over the Project Life;
- There is a 10% chance that there will be one spill (over three consecutive days) from the Rail Loop Dam over the life of the Project. It is expected that this spill occurs as a result of the daily time step of the model. In reality, pumps would have been turned on throughout the day when the water level exceeded its pump out threshold to prevent the spill; and
- There is a 10% chance that minor spills will occur from the ROM Dam (where applicable) over the life of the Project. The size and shape of the ROM stockpile infrastructure catchment area and the associated ROM mine water dam are indicative at this stage. This dam will be redesigned once the ROM infrastructure design has been finalised to minimise uncontrolled spills. If required, a pump back system would be installed to prevent spills ensuring no impacts on the downstream catchment.

Table 5.9 Predicted Spills from Mine Affected Water Storages over 27 Years

Dam	Probability	No. Days of Spill	Ave. Spill Volume per Spill Day (ML)
Rail Loop Dam	10%ile	3	15.7
	50%ile	0	0
	90%ile	0	0
Access Road Dam	10%ile	0	0
	50%ile	0	0
	90%ile	0	0
Savoy Dam	10%ile	0	0
	50%ile	0	0
	90%ile	0	0
Transfer Dam	10%ile	0	0
	50%ile	0	0
	90%ile	0	0
Houston Dam	10%ile	0	0
	50%ile	0	0
	90%ile	0	0
South Void	10%ile	0	0
	50%ile	0	0
	90%ile	0	0
ROM Dam	10%ile	17	3.7
	50%ile	0	0
	90%ile	0	0

5.9.5 Hunter River Salinity Trading Scheme Releases

Table 5.10 shows the predicted releases from the Houston Dam using the HRSTS release rules given in Section 5.6. The releases are highly dependent upon the availability of water in Houston Dam at the time of a release window and are limited to 100 ML/day (the adopted release capacity). The operating rules have been developed to maximise the chances of releases being made by keeping water in the Houston Dam. However, further optimisation of the operating rules could increase or decrease the release opportunities depending upon whether there is a water deficit or an excess at the mine. The following is of note:

- There is a 50% chance that releases will exceed 740 ML/yr on average and a 10% chance they will exceed 1,140 ML/yr on average;
- Average releases per release day are between 25 ML and 31 ML. However releases of 100 ML/d day have the potential to occur frequently; and
- There is a 50% chance that the average number of release days per year will exceed 30.

Table 5.10 Hunter River Salinity Trading Scheme Releases, Houston Dam

Probability (%ile)	Cumulative No. of Days of Release	Cumulative Release Volume (ML)	Average No. of Days of Release per Year	Average Release Volume per Release Day (ML/day)	Average Release Volume per Year (ML/yr)
1 (very wet)	1300	33530	49	26	1240
10 (wet)	1217	30860	46	25	1140
50 (Median)	799	19850	30	25	740
90 (dry)	559	16860	21	30	620
99 (very dry)	493	15140	19	31	560

5.10 SENSITIVITY ANALYSES

5.10.1 Haul Road Dust Suppressant Agent

The OPSIM water balance model was used to assess the impact on the water balance of using an alternative, less effective chemical dust suppressant agent that results in a higher haul road watering rate of application. The modelling has shown that there are periods over the Project life where excess water will accumulate in the out-of-pit storages, partly as a result of using the dust suppressant agent with the lower haul road watering application rate. Haul road watering application rates of 0.015 l/m^2/hr are expected when the dust suppressant agent is used (base case). Watering rates of 0.08 l/m^2/hr are expected with the alternative, less effective dust suppressant agent. As a result, haul road and mine site facilities dust suppression rates will increase by 5.33 times above those given in Table 5.6. The cumulative requirements for offsite water supplies are shown in Figure 5.4. The forecast results for in-pit and out-of-pit water storage inventories for the alternative dust suppressant scenario are provided in Figure 5.5 and Figure 5.6, respectively. The following is of note:

- There will be at least a 50% chance that no offsite water will be required under this scenario.
- There is a 10% chance that at least 622 ML will be required over the life of the Project. The majority of this offsite demand would be required towards the start of Project Life, i.e. between Year 4 to Year 8. The Water Access Licences currently owned by Anglo American are likely to satisfy this supply shortfall under this scenario. The category of the

Water Access Licences will be transferred as required. If more water is required, Anglo American could either purchase additional units on the open market or approach other Water Access Licence holders for a term transfer, which may require an application to change the zone.

- There is a 1% chance that at least 1,623 ML will be required between Year 3 and Year 6 (541 ML/yr on average).
- The water management system will accumulate at least 3,980 ML under median (50th percentile) conditions and will generally be in equilibrium over the life of the Project under dry (90th percentile) conditions. There is no major draw down or build up of water as shown by the 90th percentile forecast out-of-pit storage inventory curve on Figure 5.6. Notwithstanding, there remains a 1% chance that the out-of-pit storage will be too full to accept mining area inflows at some stage over the life of the Project.
- The forecast in-pit storage inventory, shown in Figure 5.5, indicates that there will be at least a 1% chance that in-pit storage volumes could impact on production, although in-pit storage volumes will be much lower than for the base case.
- There will be an 11% to 19% reduction in average annual discharge volumes under the HRSTS when compared to the base case and no change in uncontrolled spills for this scenario.

The results of the sensitivity analysis are indicative of the climate variability of the region. When the water balance is in equilibrium, there could potentially be both shortfalls in demand, requiring offsite supplies, or a build up of water impacting on operations depending upon whether wet or dry conditions are experienced over the Project life. Given the large storage volumes that are available at Drayton Mine, the adopted approach of minimising water use through the use of the dust suppressant agent that results in the lower watering application of 0.015 l/m²/hr and thereby minimising, or eliminating, the requirement for offsite supplies is the preferred approach from both an operational and environmental perspective.

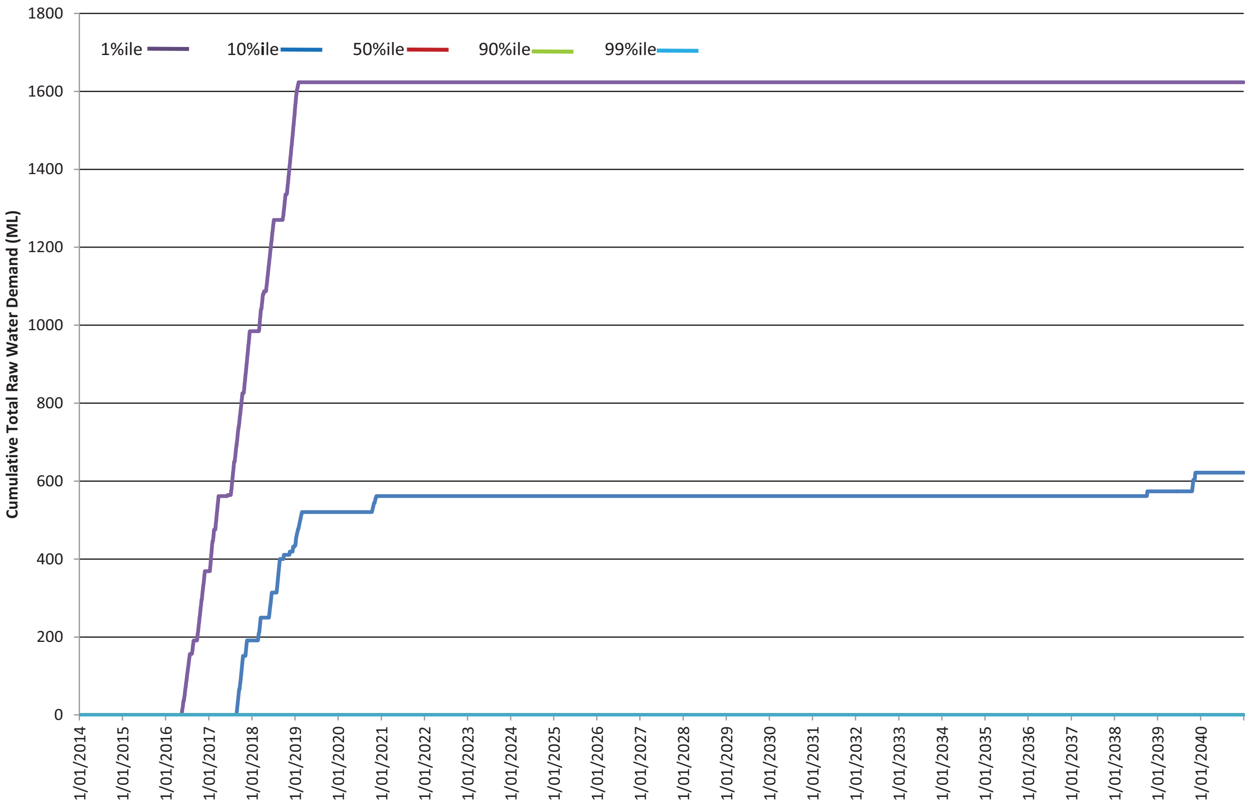

Figure 5.4 Cumulative Offsite Water Requirements, Alternative Dust Suppressant Agent

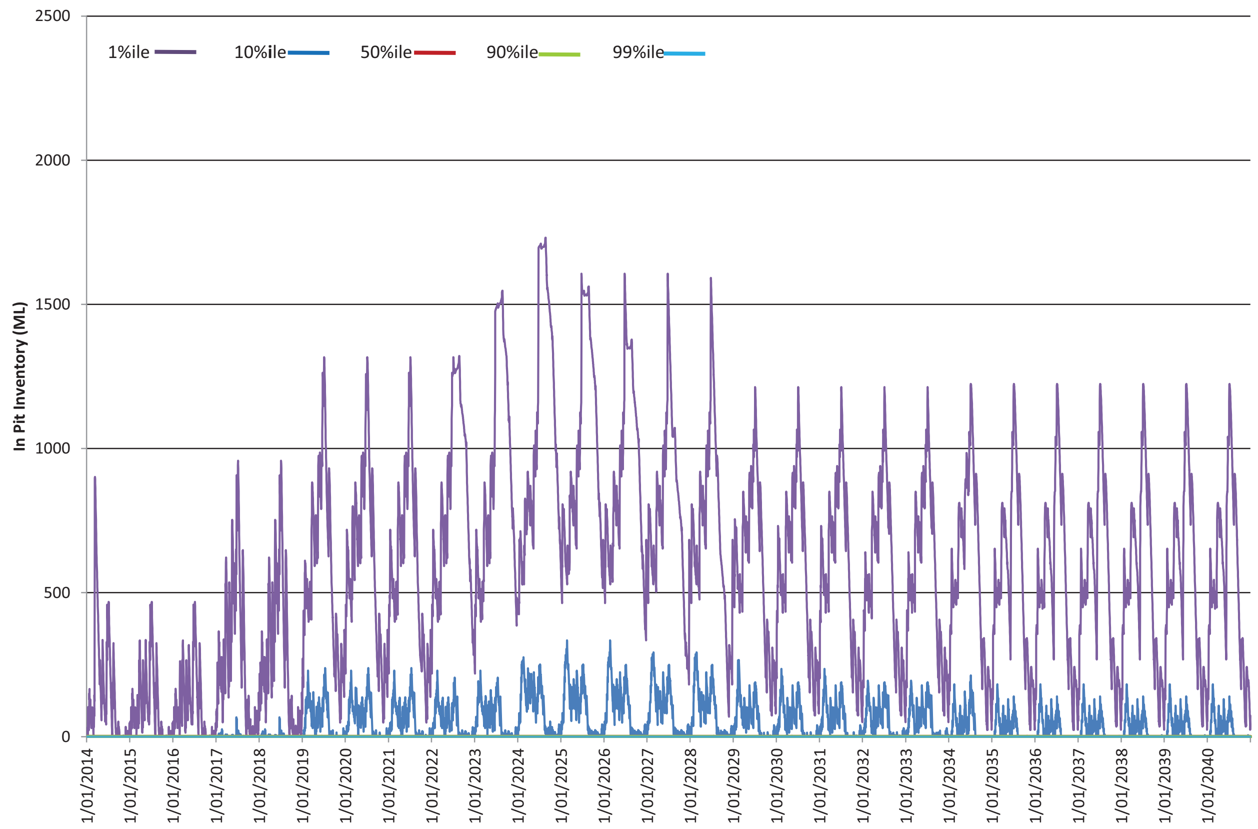

Figure 5.5 Forecast In-pit Storage Inventory, Alternative Dust Suppressant Agent

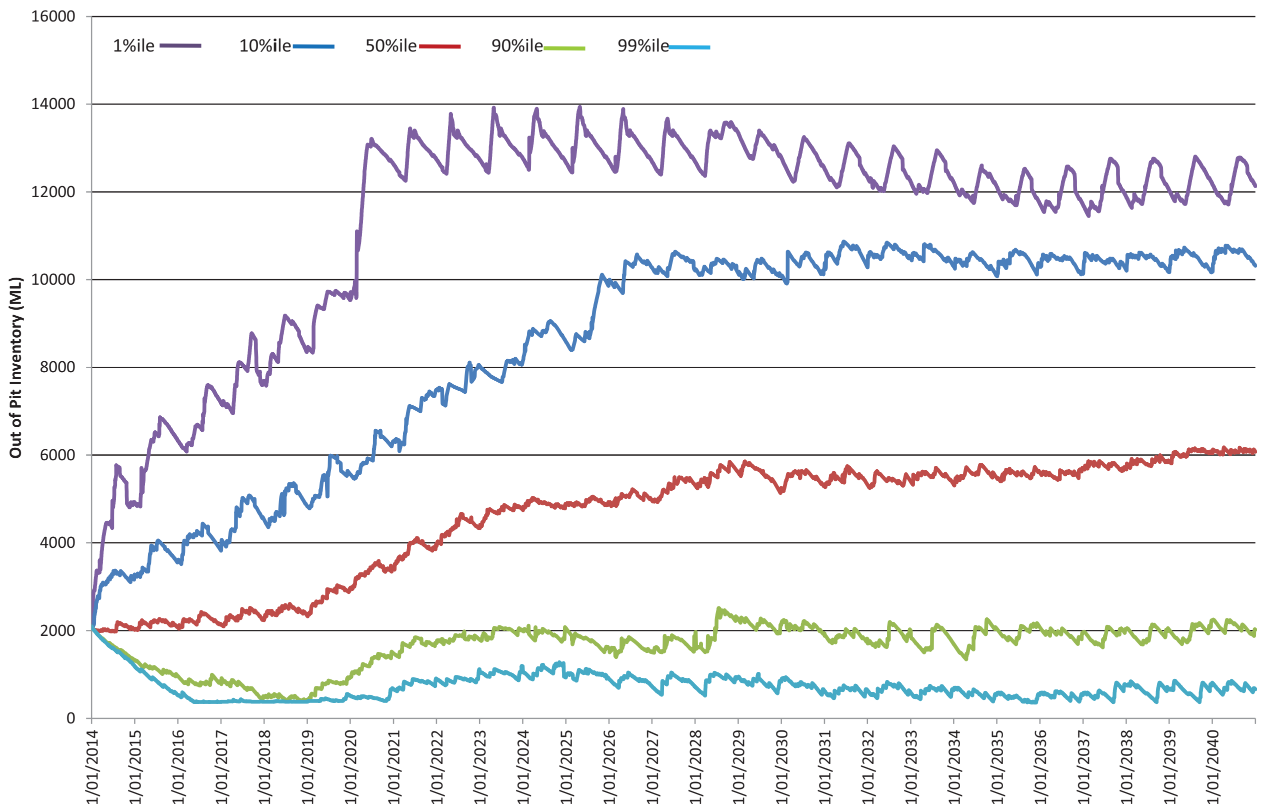

Figure 5.6 Forecast Out-of-pit Storage Inventory, Alternative Dust Suppressant Agent

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5.10.2 Tailings Dam Decant Return Rate

The OPSIM water balance model was used to assess the impact on the water balance of a higher proportion of water, pumped to the tailings dam with the tailings, being decanted and returned to the CHPP. The expected rate of return, used in the base case, is 30% with the remainder evaporating or being entrained with the tailings. An assessment assuming that 45% can be returned has been undertaken. Under this scenario, less water is required from the onsite catchments (or offsite) to supply operational demand. The forecast results for in-pit and out-of-pit water storage inventories for the 45% decant return rate scenario are provided in Figure 5.7 and Figure 5.8, respectively. The following is of note:

- Similar to the base case, there will be less than a 1% chance that offsite supplies will be required to meet operational demand over the life of the Project.
- The uncontrolled spills from the various storages within the study area do not significantly change from that given in Table 5.9.
- Releases under the HRSTS from Houston Dam do not significantly change. The average annual discharge volumes under the HRSTS are slightly higher when compared to the base case, increasing by 0% to 10%. There is a 50% chance that average releases will exceed 750 ML/yr on average and a 10% chance of exceeding 1,250 ML/yr on average.
- Stored volumes in-pit and out-of-pit are higher for this scenario, but the general trends of when the most in-pit inundation occurs and when out-of-pit storages reach their threshold for pumped inflows remain largely unchanged.
- There remains a 50% chance that there will be no build up of water in the active mining areas. Under these median conditions there is an accumulation of water in the out-of-pit storages with total study area inventory rising from approximately 2,100 ML to 12,600 ML over the Project life (390 ML/yr on average, compared to 315 ML/yr on average for the base case scenario).
- There is a 10% chance that at least 11,350 ML will accumulate in the out-of-pit storages over the life of the Project, which compares to 10,750 ML under base case conditions. Similarly there is a 10% chance that inundation in the combined mining areas would reach a maximum of 483 ML during the Project life, when the out-of-pit storages are too full to accept additional inflows, which compares to 335 ML under base case conditions. Again, the minor build up is not expected to impact on mining operations.
- There will be a 1% chance that the out-of-pit storages will reach the threshold at which water cannot be pumped in after about Year 7 of operations, remaining at that threshold for the entire Project life. There is a 1% chance that inundation in the active mining areas would reach a maximum of at least 2,688 ML in 2024. Similar to the base case, mining operations could be significantly affected should very wet conditions prevail and an active pit may need to be temporarily sacrificed for water storage.

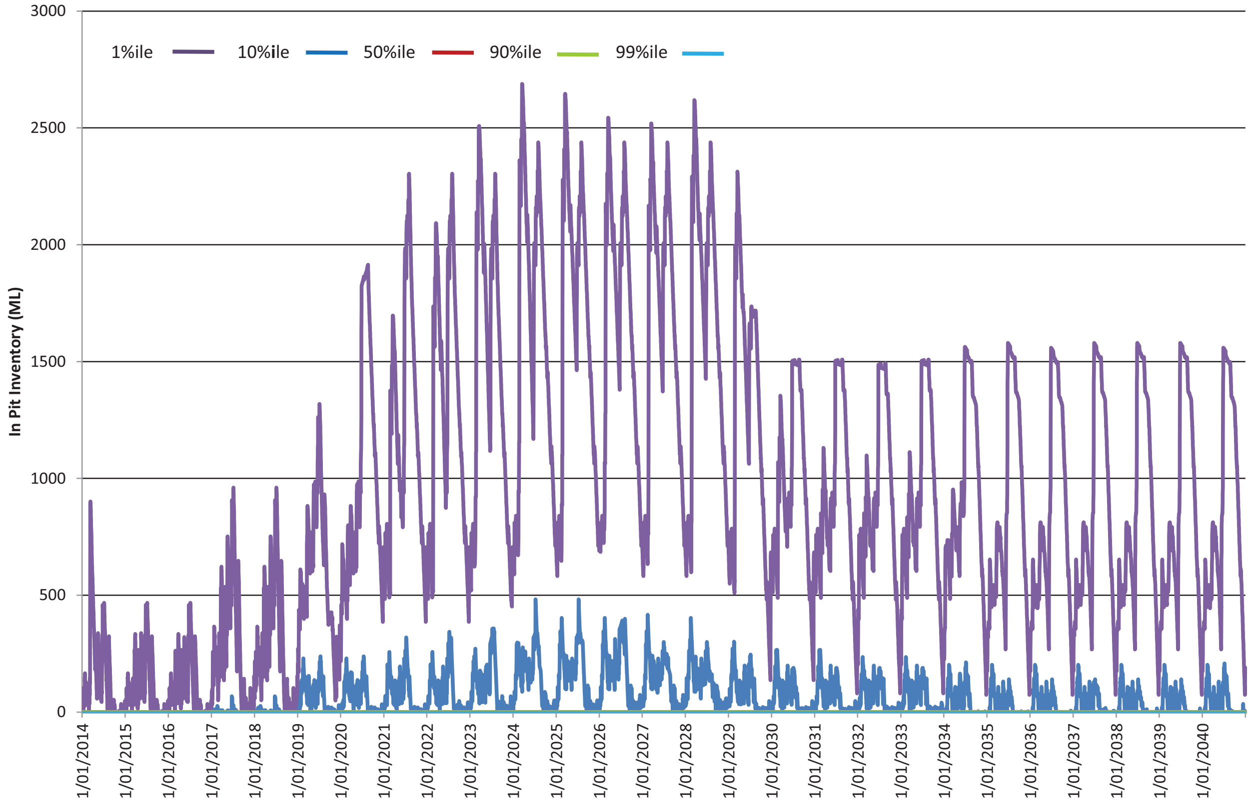

Figure 5.7 Forecast In-pit Storage Inventory, 45% Decant Return Rate

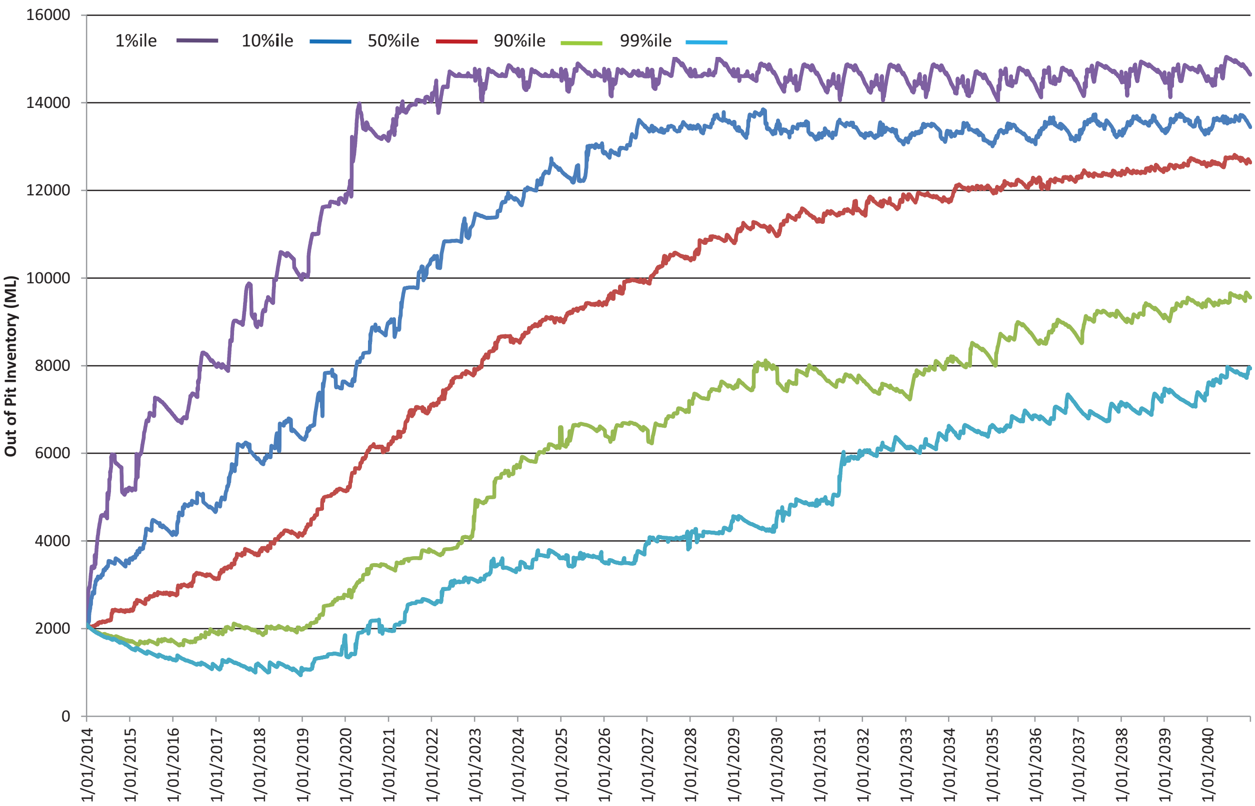

Figure 5.8 Forecast Out-of-pit Storage Inventory, 45% Decant Return Rate

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5.10.3 Rejects and Tailings Storage

The OPSIM model was used to assess the impact on the water balance of two alternative rejects and tailings disposal scenarios (Scenario 2 and 3) as described in Section 4.3.2. The results of the sensitivity analysis are provided below.

Scenario 2

Scenario 2 involves utilising the East Void and North Void as a tailings and rejects disposal emplacement areas, respectively. The North Void will be filled with rejects and capped at 181 m AHD. The East Void will be occupied by tailings and capped at 140 m AHD. The final level for the East Void accounts for the tailings volume deposited to 2017 as previously approved.

For both the base case and the sensitivity analysis on Scenario 2, it was assumed that no water will be returned to the CHPP from the rejects and 30% of the water entrained with the tailings will be returned to the CHPP. Under this scenario, the changes to the water balance occur as a result of the different stage-storage-surface area, catchment area and groundwater inflows between the North and East Void. The East Void catchment is some 88 ha larger than the North Void and groundwater inflow differences are marginally higher. As such, it is expected that marginally more water will be available for dewatering from the East Void for operational use. The forecast results for in-pit and out-of-pit water storage inventories for the East Void tailings emplacement scenario are provided in Figure 5.9 and Figure 5.10, respectively. The following is of note:

- Similar to the base case, there is a less than 1% chance that offsite supplies will be required to meet operational demand over the life of the Project;
- The uncontrolled spills from the various storages within the study area do not significantly change from those in the base case scenario, provided in Table 5.9;
- Releases under the HRSTS from Houston Dam do not significantly change. The average annual discharge volumes under the HRSTS are slightly higher for the 1st and 10th percentile wet conditions when compared to the base case, increasing by 4% to 10%. For the 50th, 90th and 99th percentile median and dry conditions, there is no change to the amount released under the HRSTS. There is a 50% chance that average releases will exceed 740 ML/yr on average and a 10% chance of exceeding 1,250 ML/yr on average;
- Stored volumes in-pit and out-of-pit are slightly higher for this scenario, but the general trends of when the most in-pit inundation occurs and when out-of-pit storages reach their threshold for pumped inflows remain largely unchanged;
- There remains a 50% chance that there will be no build up of water in the active mining areas. Under these median conditions there is an accumulation of water in the out-of-pit storages with total study area inventory rising from approximately 2,800 ML to 12,550 ML over the Project life (360 ML/yr on average, compared to 315 ML/yr on average for the base case scenario);
- There is a 10% chance that at least 10,550 ML will accumulate in the out-of-pit storages over the life of the Project, which compares to 10,750 ML under base case conditions. Similarly there is a 10% chance that inundation in the combined mining areas would reach a maximum of at least 483 ML during the Project life, when the out-of-pit storages are too full to accept additional inflows, which compares to 335 ML under base case conditions. Again, the minor build up is not expected to impact on mining operations;
- There is a 1% chance that the out-of-pit storages will reach the threshold at which water cannot be pumped in after about Year 7 of operations, remaining at that threshold for the entire Project Life. There is a 1% chance that inundation in the active mining areas would reach a maximum of at least 2,814 ML in 2024. Similar to the base case, mining operations could be significantly affected should very wet conditions prevail and an active pit may need to be temporarily sacrificed for water storage.

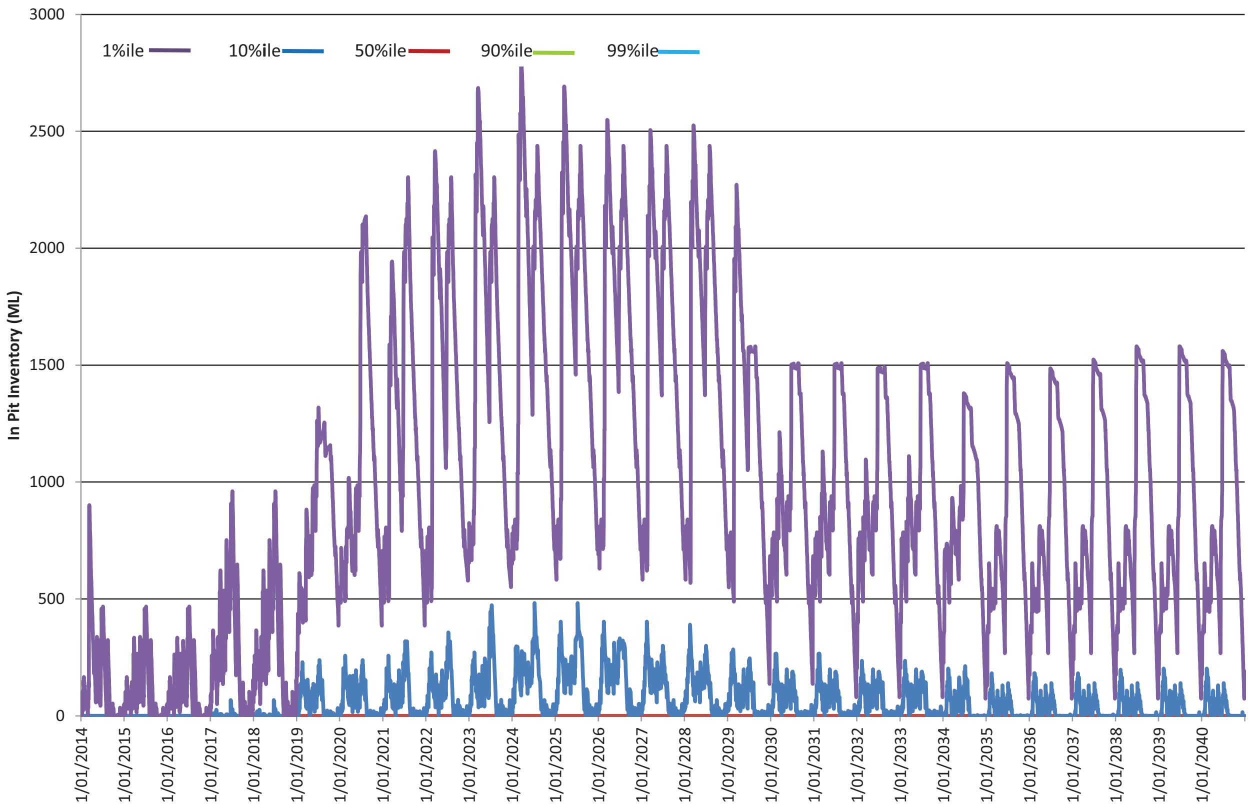

Figure 5.9 Forecast In-pit Storage Inventory, East Void Tailings Emplacement Scenario

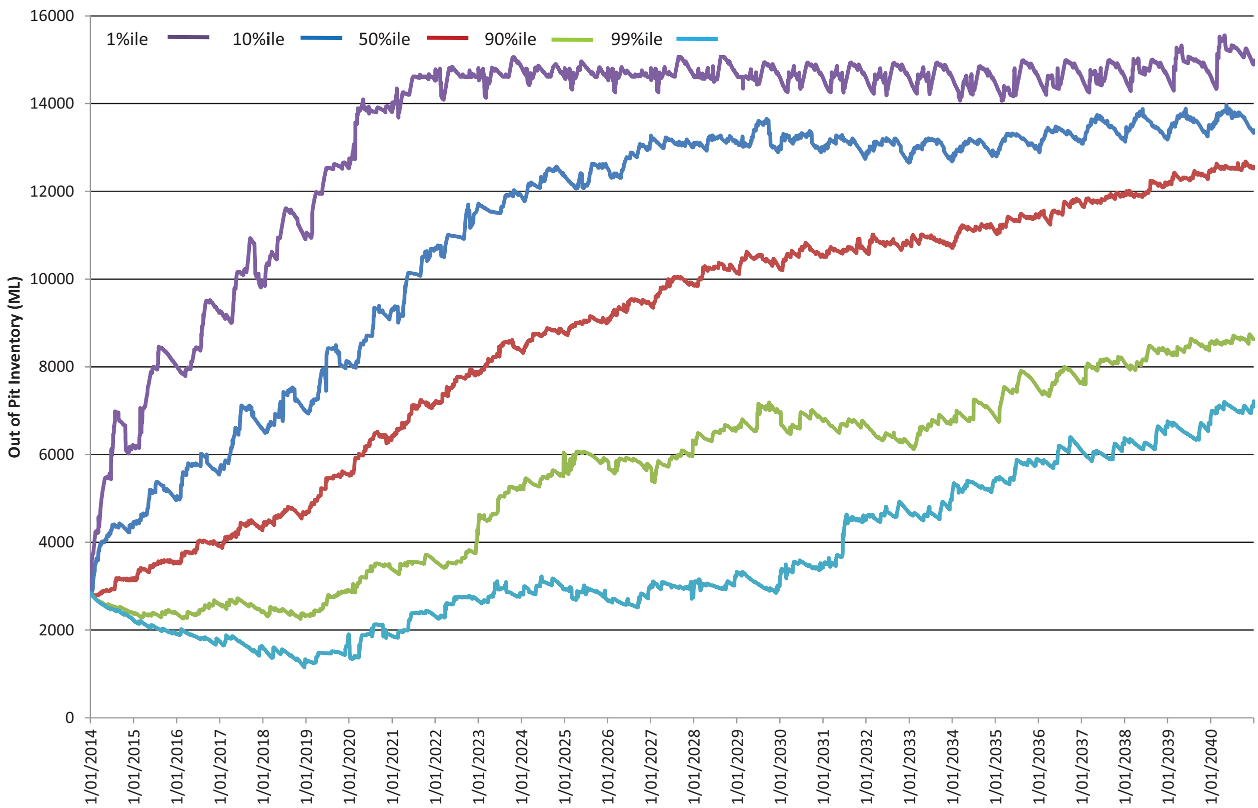

Figure 5.10 Forecast Out-of-pit Storage Inventory, East Void Tailings Emplacement Scenario

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Scenario 3

The OPSIM water balance model was also used to assess the impact on the water balance of replacing the South Void with the East (North) void as the main repository for excess mine water from Year 10 (2023). The maximum capacity of the East (North) Void is 910 ML, much smaller than the South Void. The reduction in out-of-pit storage is expected to impact on mining operations after this time. To compensate for the reduction in out-of-pit storage volume, several modifications were made to the water management system from Year 10 onwards as follows:

- The runoff captured in the East (South) Void and the South Void would be managed by Macquarie Generation under this scenario and will no longer form part of the Project's water management system. Excess water will be transferred to the East (North) Void, which will then be transferred to the Access Road dam for use in the CHPP;
- The out-of-pit storages (excluding the North Void) have a combined capacity of approximately 4,400 ML. The storages are kept below approximately 2,500 ML to prevent uncontrolled spills. In effect, the available out-of-pit storage capacity is 2,500 ML;
- East (North) Void is given preference over Houston Dam for makeup water supplies to Transfer Dam in the last stage (Year 21 to 27) in order to reduce build up of water in East (North) Void and to maximise the ability to release from Houston Dam under the HRSTS; and
- East (North) Void was assumed to have half the groundwater inflow of the predicted total East Void inflow of 1,270 kL/day.

The North Void will continue to be used for the co-disposal of both rejects and tailings under Scenario 3 as per the base case scenario (Scenario 1).

The forecast results for in-pit and out-of-pit water storage inventories for this scenario are provided in Figure 5.11 and Figure 5.12, respectively. For comparison purposes, the South Void storage volume (available up to Year 10) has not been included in the out-of-pit storage volume results shown in Figure 5.12. The following is of note:

- There is a 50% chance that the water in the out-of-pit storages would reach their capacity of approximately 2,500 ML during the Project life. The greatest chance occurs during the middle phases of mining when groundwater inflows are predicted to be the highest;
- There is a 10% chance that water in the active mining areas will accumulate to a maximum of at least 2,290 ML and a 1% chance that water will accumulate to a maximum of at least 5,210 ML, which would impact on mining. The out-of-pit storages are too full to accept additional water from mining areas at these times.
- Should these conditions prevail, Anglo American will temporarily sacrifice an active mining area to store the additional water. There are at least three active mining areas available to store the excess water when the likelihood of a build up is greatest during the middle phases of mining. The current production schedule has the flexibility to cater for this scenario.
- The modelling indicates that there is a 1% chance that at least 490 ML of offsite supplies would be required to supply operational demand over the life of the Project. There is a 10% chance that at least 176 ML of offsite supplies would be required to supply operational demand over the life of the Project. This offsite water supply was primarily required in the last stage of the Project (Year 21 to 27) and it is likely that HRSTS releases from Houston Dam could be reduced or water access licences obtained to supply the required short fall. The Water Access Licences currently owned by Anglo American are likely to satisfy this supply shortfall under this scenario. The category of the Water Access Licences will be transferred as required. If more water is required,

Anglo American could either purchase additional units on the open market or approach other Water Access Licence holders for a term transfer, which may require an application to change the zone.

- There is no change in the likelihood of uncontrolled spills from the mine water dams under this scenario.
- At the time the South Void is removed from the mine water management system in 2023, there is a 50% chance that the storage inventory in South Void would be at least 3,840 ML. There is 10% chance that the inventory would increase to at least 5,870 ML.
- Releases from Houston Dam under the HRSTS would increase from the base case scenario due to Houston Dam water levels being higher more often, and thus release opportunities utilised more effectively. There is a 50% chance that releases will exceed 990 ML/yr on average and a 10% chance they will exceed 1,440 ML/yr on average.
- Average releases per release day are between 30 ML and 37 ML. However releases of 100 ML/d have the potential to occur frequently.

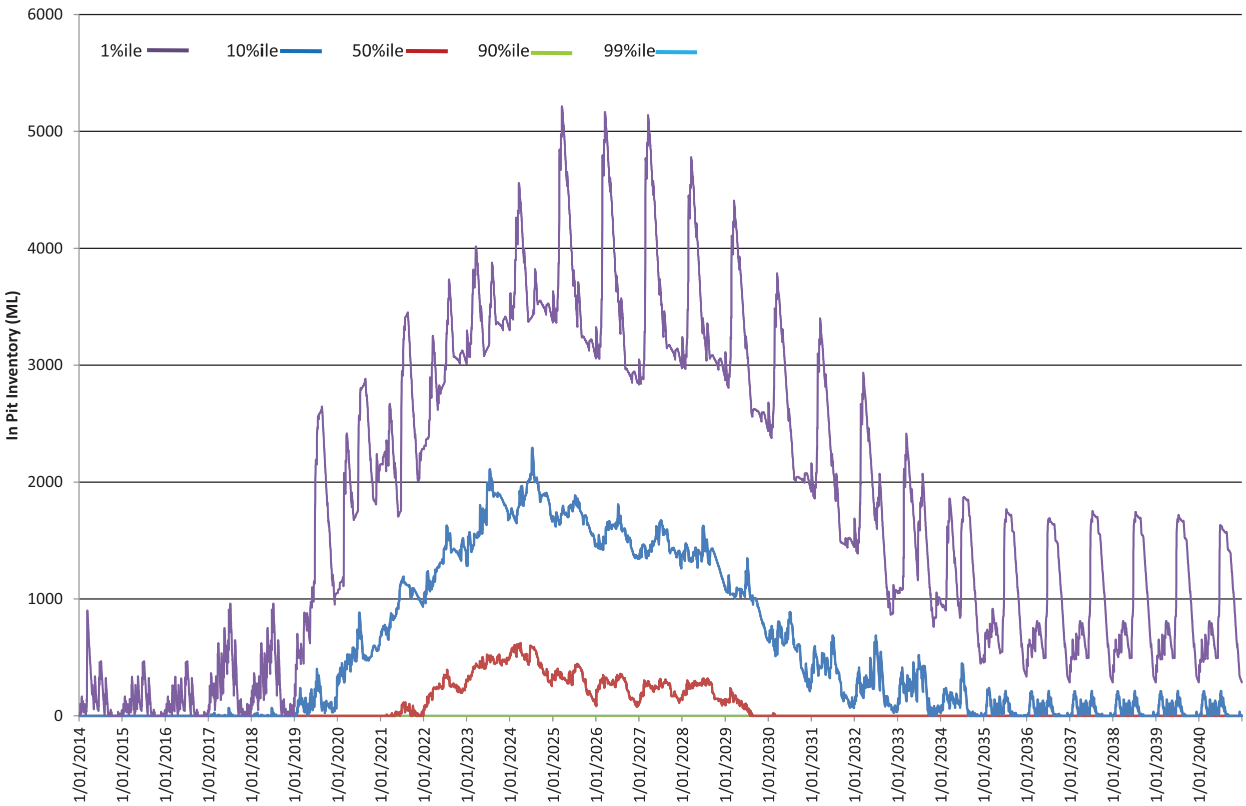

Figure 5.11 Forecast In-Pit Storage Inventory, East (North) Void Replacing South Void Scenario

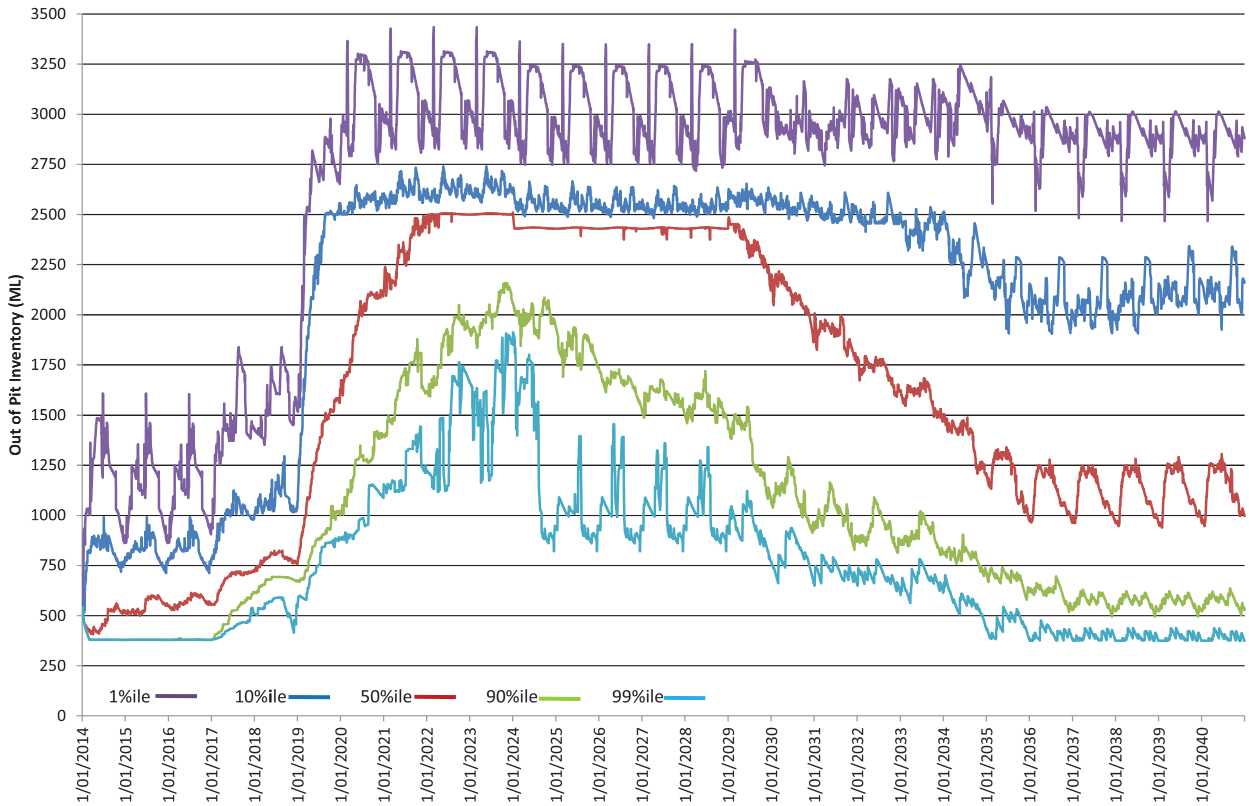

Figure 5.12 Forecast Out-of Pit Storage Inventory, East (North) Void replacing South Void Scenario

5.11 FINAL VOID STORAGE BEHAVIOUR

The Drayton South final void water levels have been modelled as part of the Drayton South groundwater assessment (AGE, 2012). A summary of the AGE findings is provided below:

- Water levels in the final void are predicted to reach 100m AHD, which is 85% of their final stable water level (post mining equilibrium), within 147 years after cessation of mining;
- Water levels within the final void attain their post-mining equilibrium level of approximately 117m AHD after approximately 950 years. Effectively, at this level the amount of water entering the void via runoff and inflow is equivalent to the evaporation that can be expected given the area of the void lake surface;
- The freeboard between the water level surface and the void spill height is approximately 90m. Hence, the final void is never likely to fill (nor spill), as a rainfall event causing enough catchment runoff to fill the void is unlikely; and
- The final void water level recovery model results suggest that the post-mining equilibrium void water level is approximately 20m lower than the pre-mining potentiometric surface surrounding the mining area. The predicted final void water balance suggests that the depression of the potentiometric surface around the void will act as a “sink”, not permitting water within the final void to flow outwards into the regional system, for about 700 years after mining.

The OPSIM water balance model was reconfigured to replicate the final void behaviour estimated by AGE (2012) to assess the long term build up of salts in the Drayton South final void. The OPSIM model was run as a static simulation using the historical rainfall data sequence from 1889 to 2010. The Year 27 groundwater inflows of 0.694 ML/d were assumed over the entire simulation. The predicted water level and salt concentration represented as TDS is shown in Figure 5.13.

The OPSIM model results indicate that the final void reaches a level of about 115 m AHD after about 68 years and remains within about 2 m of this level for the remaining 54 years of the simulation. It is likely that the water level peaks more quickly in the OPSIM model when compared to the groundwater model because the OPSIM model includes the above average wet period during the 1950s. The groundwater model uses average rainfalls.

The results show salt concentrations gradually increasing, with TDS concentrations peaking at 7,000 mg/L towards the end of the simulation period (122 years). It is likely that TDS concentrations will continue to increase over time as water evaporates and salt loads increase.

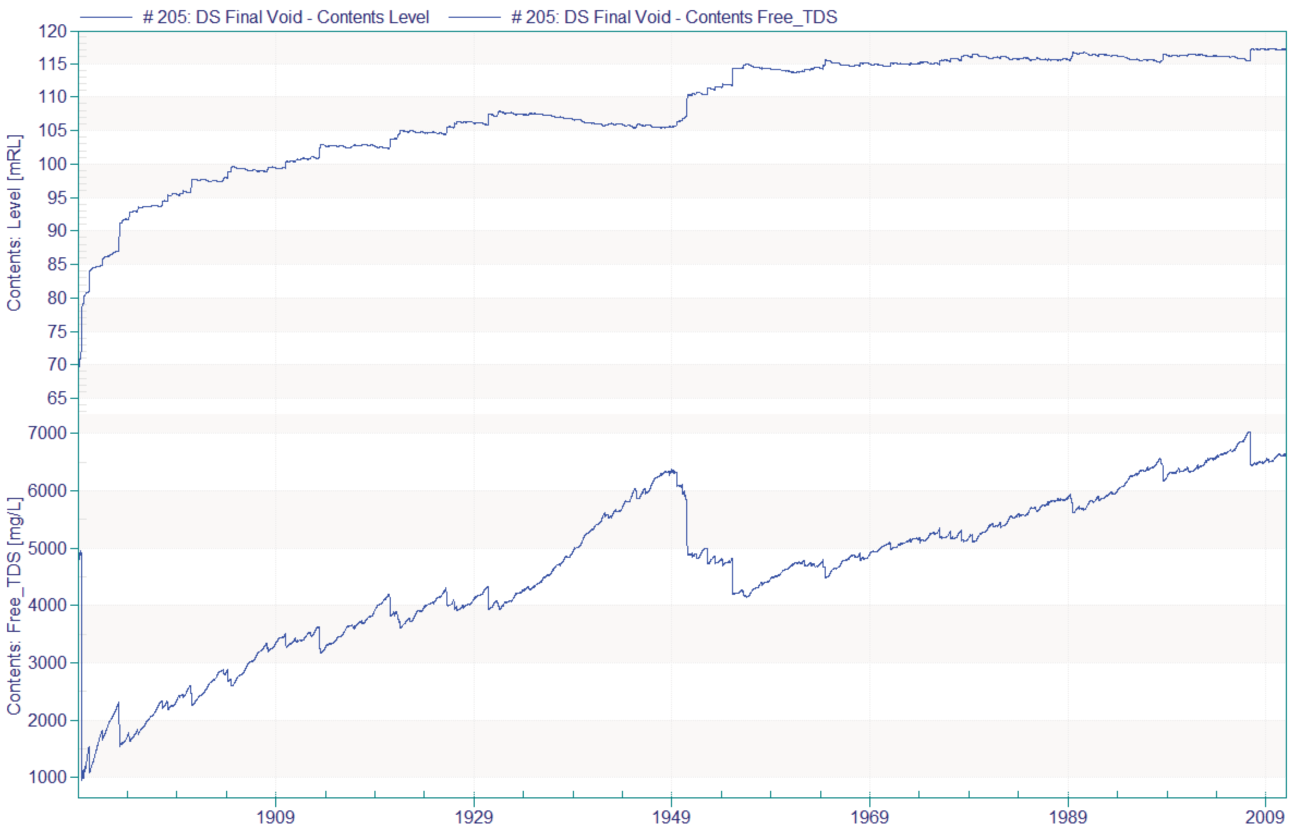

Figure 5.13 Final Void Storage Level and Total Dissolved Solids Concentration

6 IMPACT ASSESSMENT

6.1 POTENTIAL IMPACTS

The potential impacts of the Project are as follows:

- Potential to impact on mining operations due to the build up of water in the active mining areas;
- Potential to require offsite water supplies;
- Potential to increase Hunter River and Saddlers Creek flood levels and flood extent;
- Potential to reduce Hunter River, Saddlers Creek and Saltwater Creek catchment flows; and
- Potential to impact on regional and local surface water quality.

An analysis of the potential impact on mining operations and potential requirements for offsite water supplies is discussed in Section 5. An assessment of the other potential impacts is given below.

6.2 FLOODING

6.2.1 Hunter River

The Hunter River crosses the south western corner of EL 5460 and flows within 500m of the Project Boundary downstream of the Golden Highway Bridge (Bowman's Crossing). On the southwest corner, the Project Boundary has been set away from the Hunter River so that no part of the study area or disturbance footprint will be impacted by Hunter River flooding. The closest infrastructure to the Hunter River in this area is at least 20 m higher than the top bank of the Hunter River. The remaining infrastructure in this area is more than 40m above the top of bank of the Hunter River and is therefore not prone to Hunter River flooding.

It is proposed to construct a pipeline to discharge water into the Hunter River about 1 km downstream of the Golden Highway Bridge (Bowman's Crossing). The pipeline outlet will be designed in accordance with set standards, average discharge rates and following consultation with NOW. Although it is not required at this stage, a pump station and pipeline may be constructed near the discharge pipeline to supply the mine with raw water from the Hunter River. If required, the pump station will be located on the high bank of the Hunter River and the inlet will be designed in accordance with set standards and in consultation with NOW.

6.2.2 Saddlers Creek

The Drayton South disturbance footprint is located outside of the 100 year ARI flood extent of Saddlers Creek for pre mine conditions, as shown in Figure 4.1 to Figure 4.7. At its closest point, which is the haul road corridor, the disturbance footprint is located some 80m from the edge of the pre-mine 100 year ARI flood extent and some 3m higher in elevation, which suggests that the flood immunity of the project is much higher than 100 years ARI. The methodology used to estimate the flood extent is given in Section 3.5. The Project and the adjoining Mt Arthur Coal Mine will reduce the contributing catchment of Saddlers Creek and hence the post mine flood discharges and flood extent will be reduced from that given in Section 3.5. That is, no infrastructure within the proposed disturbance footprint for the Project will be impacted by Saddlers Creek flooding.

6.3 LOSS OF CATCHMENT FLOWS

6.3.1 Saddlers Creek

Table 6.1 shows the changes in the catchment area draining to Saddlers Creek, measured at the Hunter River confluence, over the life of the Project. The catchments draining to the sediment dams, the Blakefield Dam and associated highwall dams will mainly drain to the downstream catchment during mining and will not lead to a significant loss of catchment flow. The catchments draining to the Transfer Dam, Savoy Dam, the mining areas and associated highwall dams will not drain offsite during the life of the Project. At the completion of the Project, the proposed Blakefield, Houston and Transfer Dams will be removed and the final void catchments minimised.

Table 6.1 Changes in Saddlers Creek Catchment Area

Mine Stage	Catchment Area (ha)								
	Open Cut	High Wall Dam (to Transfer Dam)	Transfer Dam	Savoy Dam	Blakefield Dam	High Wall Dam (to Blakefield Dam)	Sediment Dams	Undisturbed	Total
Pre-mine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9718.0	9718
Existing	260.4	0.0	0.0	40.6	0.0	0.0	0.0	9417.0	9718
Yr 3	611.9	363.9	46.6	40.6	499.5	0.0	66.2	8089.3	9718
Yr 5	815.6	315.5	46.6	40.6	207.9	279.0	221.0	7791.8	9718
Yr 10	1088.7	170.0	46.6	40.6	196.9	183.8	289.8	7701.6	9718
Yr 15	1067.0	95.1	46.6	40.6	0.0	0.0	289.8	8178.9	9718
Yr 20	948.1	0.0	46.6	40.6	0.0	0.0	309.3	8373.4	9718
Yr 27	948.1	0.0	46.6	40.6	0.0	0.0	309.3	8373.4	9718
Final	948.1*	0.0	0.0	41.0	0.0	0.0	0.0	8728.9	9718

* Mine site Saddlers Creek catchment component of final void

The following is of note with respect to the loss of catchment area:

- The pre-mining catchment, shown in Figure 3.1, is based on the 1:25,000 topographic maps prior to the commencement of mining on both Drayton Mine and Mt Arthur Coal Mine and works on the adjoining Macquarie Generation site;

- Under existing conditions, the South Pit, West Void and Savoy Dam at Drayton Mine reduce the Saddlers Creek catchment by some 301 ha (3%);
- The greatest loss of Saddlers Creek catchment occurs about Year 10 of the Project. At this time, the catchment contributing runoff to Saddlers Creek would reduce by 1,345 ha (14%); and
- The final void will permanently reduce the Saddlers Creek catchment by 989 ha (10%).

Mt Arthur Coal Mine is also located in the Saddlers Creek catchment. The existing disturbance footprint on Mt Arthur Coal Mine (currently 975 ha) takes up some 10% of the pre-mine Saddlers Creek catchment. It is understood that mining at Mt Arthur Coal Mine will extend in a south westerly direction taking up a further 8% of the catchment between Saddlers Creek and Edderton Road. The drainage and catchment characteristics on the Mt Arthur Coal Mine during the operation and mine closure phases of the Project are not known. Assuming the existing disturbance footprint does not drain to Saddlers Creek and is not returned to the creek at the completion of mining, a total of 24% of the catchment could be removed as a result of both the Project and Mt Arthur Coal Mine. The catchment will reduce by at total of 20% at the completion of the Project.

There are no licensed water users on Saddlers Creek that could be impacted by the reduction in catchment flows. However, the reduction in catchment flows could potentially alter the geomorphic characteristics and ecological value of the Saddlers Creek waterway. Cumberland Ecology (2012) determined that the ecological integrity of the existing Saddlers Creek channel was generally severely or extremely impaired due to existing land use practices. The ecological integrity was sound at one location, which was at the location of greatest disturbance at the existing farm dam 800m upstream of Edderton Road. The habitat value was found to be low with little or no in-stream vegetation or rocks and snags for aquatic fauna. The existing stream morphology is directly related to the ecological integrity and is highly degraded. Measures to improve the ecological value and geomorphic integrity of the waterway and mitigate the impact of the loss of catchment flows are given in Section 7.3.

6.3.2 Saltwater Creek

Table 6.2 shows the changes in catchment area draining to Saltwater Creek, measured at the Hunter River confluence, over the life of the Project. The catchments draining to the mining areas and the two mine water dams will not drain offsite during the life of the Project. At the completion of the Project, the proposed Houston Dam and ROM Dam (where applicable) will be removed, leaving the loss of catchment associated with the final void only. The loss of Saltwater Creek catchment is generally consistent across the life of the Project with the loss of 594.1 ha (11%). The loss is mostly due to the construction of Houston Dam and the Houston mining area. At the end of Project Life, the loss of catchment will reduce to 190.8 ha (4%) when Houston Dam is removed.

Plashett Dam on the Macquarie Generation site has a significant impact on Saltwater Creek catchment flows. About 77% of the total Saltwater Creek catchment drains to the Dam and any releases from the Dam are made to a low flow channel and not directly to the Saltwater Creek channel. As a result, the only flows draining to Saltwater Creek under existing conditions is the catchment downstream of Plashett Dam. If it is assumed that Plashett Dam does not overflow, the combined loss of catchment flows downstream of Plashett Dam when Houston Dam is in operation will be some 88%. This will reduce to 81% at the completion of mining when Houston Dam is rehabilitated. Given the existing impact of Plashett Dam, the impact of the Project on Saltwater Creek is not expected to be significant.

Table 6.2 Changes in Saltwater Creek Catchment Area

Mine Stage	Catchment Area (ha)				
	Open Cut	Houston Dam	ROM Dam	Undisturbed	Total
Pre-mine	0	0	0	5321.0	5321
Existing	0	0	0	5321.0	5321
Yr 3	0	565.2	28.9	4726.9	5321
Yr 5	220.7	344.5	28.9	4726.9	5321
Yr 10	220.7	344.5	28.9	4726.9	5321
Yr 15	220.7	344.5	28.9	4726.9	5321
Yr 20	220.7	344.5	28.9	4726.9	5321
Yr 27	190.8	374.4	28.9	4726.9	5321
Final	190.8	0	0	5130.2	5321

The Project will reduce the catchment draining to Plashett Dam by at most 78ha, which is 1.9% of the total Plashett Dam catchment of 4,078 ha. The loss in catchment is due to open cut mining areas (49.1 ha) and the ROM Dam (28.9 ha) (where applicable) catchment. At the end of Project Life, the loss of catchment will reduce to 49.1 ha (1.2%) when the ROM pad is rehabilitated and the ROM Dam (where applicable) is removed. Given the minor loss of catchment, the impact on flows draining to Plashett Dam is not expected to be significant.

6.3.3 Hunter River

During the life of the Project, the catchment draining to the Hunter River at Liddell will reduce by a maximum of 1,940 ha or 0.14% as a result of the Drayton South mining operations. The proposed releases under the HRSTS will reduce the loss of catchment flows offsite, effectively reducing the maximum loss of catchment due to mining operations to below 0.14%. For post mining conditions the final voids will reduce the Hunter River catchment to Liddell by less than 0.1%. In addition to the loss of catchment, a pump station will be installed, if required, on the Hunter River to access the units currently held by Anglo American's in accordance with the existing Water Access Licences (WAL1066 and WAL491). The category of the Water Access Licences will be transferred as required. These licences make up approximately 0.15% of the general security allocation on the Hunter River or 0.08% of the total allocation. On this basis, the impact of the Project on the Hunter River will be insignificant.

6.3.4 Local Mine Site Gullies

There are four gullies of Saddlers Creek that will be impacted by mining. Blakefield Dam is located on the western most gully (Blakefield Gully). At the completion of mining, the catchment draining to Blakefield Gully will increase from 224 ha to 678 ha at the location of the rehabilitated Blakefield Dam. The gully upstream of Blakefield Dam will not be impacted by mining. The increased catchment flows will potentially cause erosion of the channel as it drains into Saddlers Creek. Measures to mitigate the impact of the additional catchment flows on the Blakefield Gully are given in Section 7. The remaining gullies will be consumed by mining.

6.4 SURFACE WATER QUALITY

Land disturbance associated with mining has the potential to adversely affect the quality of surface runoff in downstream receiving waters through increased sediment loads. In addition, runoff from active mining areas (including roads, coal stockpiles, etc.) may have increased concentrations of salts and other pollutants compared to natural runoff. By implementing an effective system of mine water management, the Project will ensure no adverse impact on receiving waters or on the adjoining Plashett Dam. Key elements of the proposed water management system include:

- Diversion of runoff from undisturbed catchments away from disturbed areas, wherever possible, using surface drains;
- Treatment of runoff from overburden emplacements using sedimentation dams prior to discharge from the site;
- Runoff from mining areas (including coal stockpiles) will be collected within mine water dams for recycling on site; and
- Water in excess of site use will be released directly to the Hunter River under the HRSTS.

Details of the proposed mine water management system are provided in Section 5. Water balance modelling has been undertaken to demonstrate that the operation of the mine water management system will ensure that no uncontrolled releases occur from the mine water dams and controlled releases are made in accordance with the rules governed by the HRSTS. Hence, the Project will not adversely affect surface water quality in downstream receiving waters. The methodology and results of the water balance modelling for the Project are provided in Section 5.

6.5 WATER ALLOCATIONS

The water management system for the Project has been designed to minimise the capture of clean runoff wherever possible. Highwall dams are proposed to capture clean water runoff that would have drained into the open cut mining areas. Water collected in these dams will be pumped to the Blakefield Dam, a clean water dam, for release into Saddlers Creek. The remaining dams are solely for the capture, containment and recirculation of mine affected water consistent with best management practice to prevent the contamination of a water source. These types of dams are “excluded works” and are exempt from the requirement for water supply works approvals and Water Access Licences. Therefore the water captured in these dams is not subject to licencing.

OPSIM modelling of the highwall dams indicate that the frequency and volume of overflows from the highwall dams is very low. Therefore, these dams are effective at diverting clean water around the mine. On this basis, a Water Access Licence may only be required for the residual catchment between the highwall of the mining areas and the proposed highwall dams. It has been assumed that the clean catchment draining to the Houston Dam (which generally stores mine affected water) may also be outside the exclusion.

Table 6.3 shows the estimated average volume of water captured within the water management system over the life of the project. Runoff volumes have been separated into mine affected catchments draining to sediment/mine water dams, clean water runoff draining to highwall dams and clean water runoff draining to mine water dams. The location of the highwall dams may change during detailed design, which will impact on these estimates.

The intercepted average annual runoff has been estimated using average annual rainfall at Jerrys Plains of 645.7mm and a volumetric runoff coefficient of 0.048 (See Table A 13 in Appendix A). The total surface water entitlement for the unregulated river water source is 80,652 units (ML/yr). The Jerrys Water Source, to which the Project applies, is a component of the unregulated river water source and is limited by an entitlement of 2,573 units (ML/yr). The predicted average annual impact on the total share component for the Jerrys Water Source under the HUAWSP is negligible.

Table 6.3 Surface Water Allocations

Water Sharing Plan	Water Source	Water Impacted	Predicted Average Annual Catch (ML)	Predicted Average Annual Impact on Water Source (%)	Current Licences	Licences/ Allocations Required
HUAWSP	Hunter Unregulated and Alluvial Water Source (Jerrys Management Zone)	Water captured off mining areas and collected within sediment/mine water dams	402	15.6	Nil	No licence required due to Clause 18 (i) of the WM Regulation
		Water captured in highwall dams and diverted around the site back into natural catchment	206	8.0	Nil	No licence required due to Clause 18 (i) of the WM Regulation
		Water falling within natural catchment and runoff into mining areas	168	6.5	Nil	168

7 MITIGATION AND MANAGEMENT MEASURES

7.1 MINIMISATION OF OFFSITE WATER USE

It is proposed that a dust suppressant be applied to haul roads, ramps and mine site facilities to reduce dust, minimise water use and the need for offsite supplies. Based on information supplied by Anglo American, road watering requirements when used in conjunction with the proposed dust suppressant agent will be applied at an application rate of 0.015 L/m²/hr. Watering rates of 0.08 L/m²/hr are expected with an alternative dust suppressant agent and much higher rates when no dust suppressant is used.

The water balance modelling found that the use of the proposed dust suppressant agent will effectively prevent the need for importing water from offsite.

Should offsite water be required (for instance if conditions at start up are drier than 1%ile conditions), Anglo American will establish a pump and pipeline on the Hunter River immediately downstream of the Golden Highway (Bowman's Crossing) to access the 198 unit general security allocation it currently owns. The category of the Water Access Licences will be transferred as required. If additional water is required, Anglo American could either purchase additional units on the open market or approach other Water Access Licence holders for a term transfer, which may require an application to change the zone.

7.2 HUNTER RIVER DISCHARGE PIPELINE AND PUMP SITE

It is proposed to construct a discharge pipeline to the Hunter River about 1km downstream of the Golden Highway Bridge (Bowman's Crossing). The outlet structure will be a controlled activity under the Water Management Act. However, the Project will receive the benefit of section 75U of the EP&A Act if it is approved. This section states that a project approved under Part 3A of the EP&A Act will be exempt from the requirement to obtain a Controlled Activity Approval under section 91 of the Water Management Act.

The discharge pipeline will be designed by a suitably qualified and experienced person in accordance with the "Guidelines for Outlet Structures" and "Guidelines for Riparian Corridors" produced by NOW. The pipeline outlet will be designed and constructed to minimise erosion of the Hunter River during releases and to prevent the build up of debris carried by the Hunter River floodwater. Where possible, the design and construction footprint and extent of disturbance within the riparian corridor will be minimised.

Although it is not expected to be required, a pump station and pipeline may be constructed near the discharge pipeline to supply the mine with raw water from the Hunter River. If required, the pump station will be located on the high bank of the Hunter River and the inlet will be designed in accordance with set standards and in consultation with NOW.

7.3 RESTORATION OF SADDLERS CREEK

In conjunction with advice from the Hunter-Central Rivers Catchment Management Authority, a comprehensive restoration program for Saddlers Creek will be undertaken to improve its ecological integrity and geomorphic condition, and to mitigate the impact of the loss of catchment flows. This program is currently being progressed in a partnership arrangement between Anglo American and Hunter-Central Rivers Catchment Management Authority. A summary of the restoration program is as follows:

- The retention and improvement of 24 ha of existing vegetation that is situated within the immediate vicinity of Saddlers Creek;
- The regeneration of a wide, dense riparian zone comprised of local provenance species along the length of Saddlers Creek to provide habitat for native fauna and flora;
- The stabilisation of channel banks and flats with rapid growing native groundcover and link with existing communities to form broader habitat corridors;
- The exclusion of stock from the entire length of channel by fencing to prevent direct soil disturbance from their hooves;
- Densely vegetating the in-stream with Phragmites and other aquatic vegetation to trap sediment and prevent erosion;
- The creation of pools and sediment bars by creating weirs through the reinstatement of snags and woody debris; and
- Soil conservation earthworks to minimise sediment from overbank areas.

Although the loss of catchment flows is a residual impact of the Project, the proposed restoration program will leave Saddlers Creek in a much better condition both during and at the completion of the Project. Ongoing monitoring and rehabilitation criteria will confirm the success of the restoration program.

7.4 RECONSTRUCTION AND RESTORATION OF BLAKEFIELD GULLY

The Blakefield Gully will increase from 224 ha under existing conditions to 678 ha at the completion of mining. The catchment draining to the Blakefield Gully at the completion of mining is shown in Figure 4.10. The impacted gully is about 1km long and has a longitudinal slope of some 2%. The configuration of the Blakefield Gully under existing conditions is shown in Figure 7.1. It is a second order watercourse under the Strahler ordering system but will likely convert to a third order watercourse post mining. It is proposed to reconstruct the channel to cater for the additional flows using natural channel principles generally in accordance with the guideline *Management of Stream/Aquifer Systems in Coal Mining Developments Hunter Region* (DIPNR, 2005).

The channel will be designed by a suitably qualified person using the following principles:

- The channel will be designed using the neighbouring gully to the east (adjacent to Edderton Road) as the template. This gully has an existing catchment area of 890 ha and bed slope of 0.7%;
- To achieve a similar bed slope in Blakefield Gully, the channel will be constructed with a meander geometry similar to the template channel. Drop structures may also be required;
- The channel confluence with Saddlers Creek will not change. However, works will be undertaken to ensure the gully flows are not directed onto the adjoining bank; and

- The rehabilitation program planned for Saddlers Creek, described in Section 7.3, will be extended up this gully. The rehabilitation will be installed and established prior to Blakefield Dam being removed.

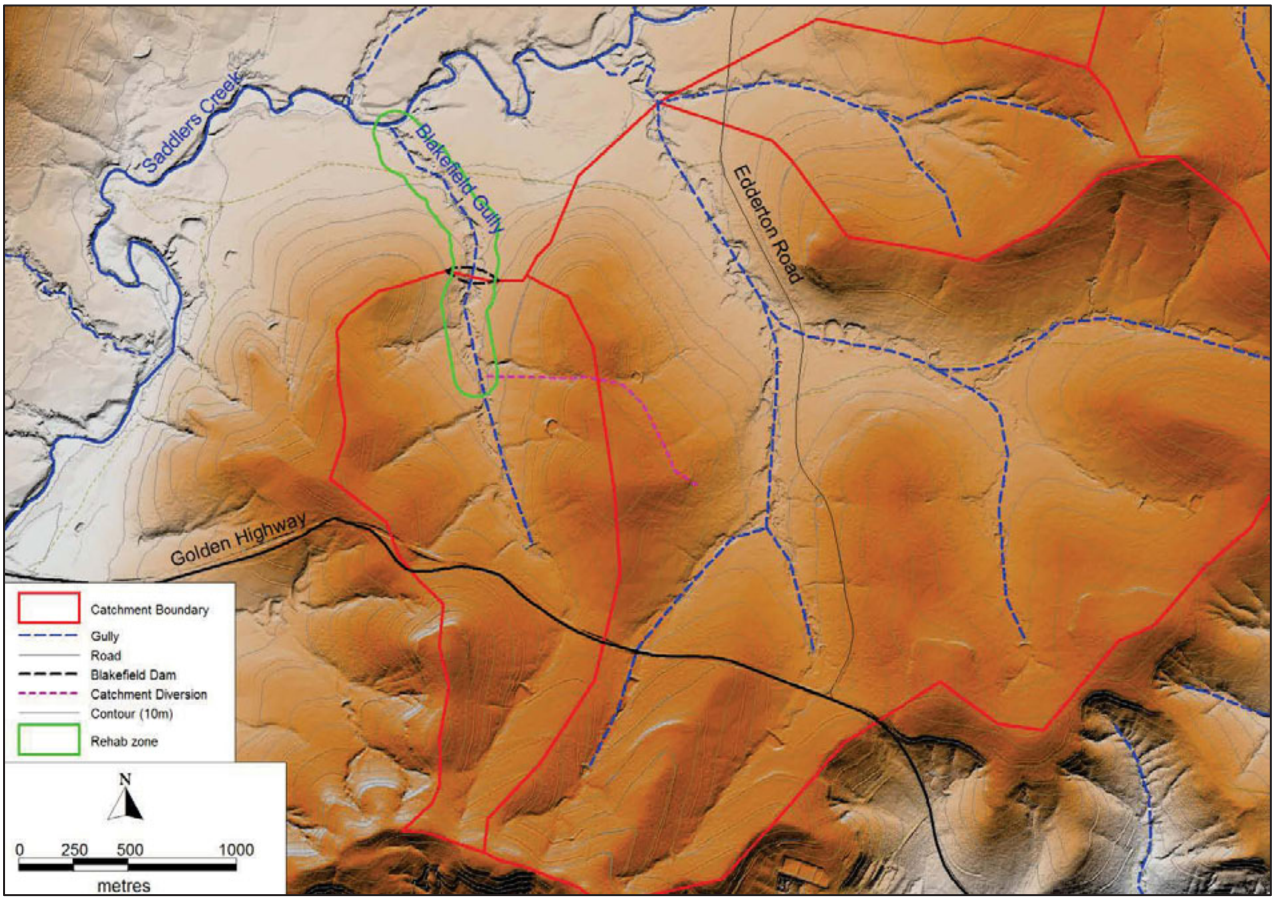

Figure 7.1 Blakefield Gully Rehabilitation Zone

7.5 SURFACE WATER MANAGEMENT AND MONITORING

The proposed water management system, described in Section 4 and Section 5, will ensure no adverse impact on receiving waters through the release of mine affected water. With respect to runoff from overburden emplacement areas, the following is of note:

- All sediment dams and water management systems will be designed in accordance with relevant standards (DECC 2008). The water quality of runoff will be regularly tested to ensure that it meets relevant standards prior to release from the site. If the quality of runoff from disturbed areas is not suitable for release, this water will be pumped into the mine water management system;
- The proposed sediment dams will be dewatered within five days after a runoff event to provide free storage capacity of at least the settling zone volume. Where TSS concentration in sediment dams after a runoff event is less than the selected water quality objective, sediment dams may be dewatered to receiving waters. Where TSS exceeds the water quality objective, water in basins must be either:
  - Flocculated to reduce TSS to less than the water quality objective;
  - Pumped to another water storage with available capacity; or

- Pumped into the mine water management system.

- All surface water diversion drains, outlets, contour drains, catch drains and other waterways will be designed to convey peak runoff discharge rates for a 20 year ARI storm event (DECC, 2008). All drains are typically trapezoidal in section with 3H:1V channel batters and are designed to convey runoff at non erosive velocities of less than 1.5 m/s;
- Runoff from mining areas (including coal stockpiles) will be collected within the various mine water dams, detailed in Table 7.1, for recycling on site; and
- Water in excess of operational use will be released directly to the Hunter River. It is proposed to obtain up to 50 HRSTS credits to manage the release of mine water in accordance with the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.

Surface water monitoring will continue to be undertaken generally in accordance with the Drayton Mine Environmental Monitoring Plan (EMP). The EMP specifies that all major dams, both mine water and clean, are monitored on a monthly basis for storage volume, pH, EC, TDS, TSS, sodium, magnesium, potassium, calcium, chloride, sulphate and bicarbonates. The results will be reported in the Annual Environment Management Report.

The EMP will be extended to include the additional water storages and regional catchments impacted by the Project. The existing and proposed monitoring locations are shown in Figure 7.2. A description of the monitoring sites is given in Table 7.1.

In addition to the surface water monitoring, data will be collected to update and validate the OPSIM water balance model. The updated model results will be reported as part of the annual reporting to ensure the assumptions made in this assessment are correct and appropriate. The model will be used to continually improve the water management system to both minimise the requirement for offsite releases and maximise the use of mine affected water. Additional information that will be collected to update the OPSIM model and improve the water management system is as follows:

- A gauge plate will be installed in water storages and at the Saddlers Creek monitoring stations to allow water levels to be recorded at the time a water quality sample is taken;
- Pump rates and key storage levels will be systematically monitored to ensure ongoing validation of the computerised water balance model predictions. All data will be recorded and reviewed regularly as part of compliance procedures and alert protocols;
- A meteorological monitoring station will be maintained at Drayton South recording hourly rainfall, evaporation and wind data at the site;
- Sediment management dams will be monitored to assess compliance with Environment Protection Licence conditions; and
- Releases from Houston Dam under the HRSTS will be monitored when releases occur as required under HRSTS.

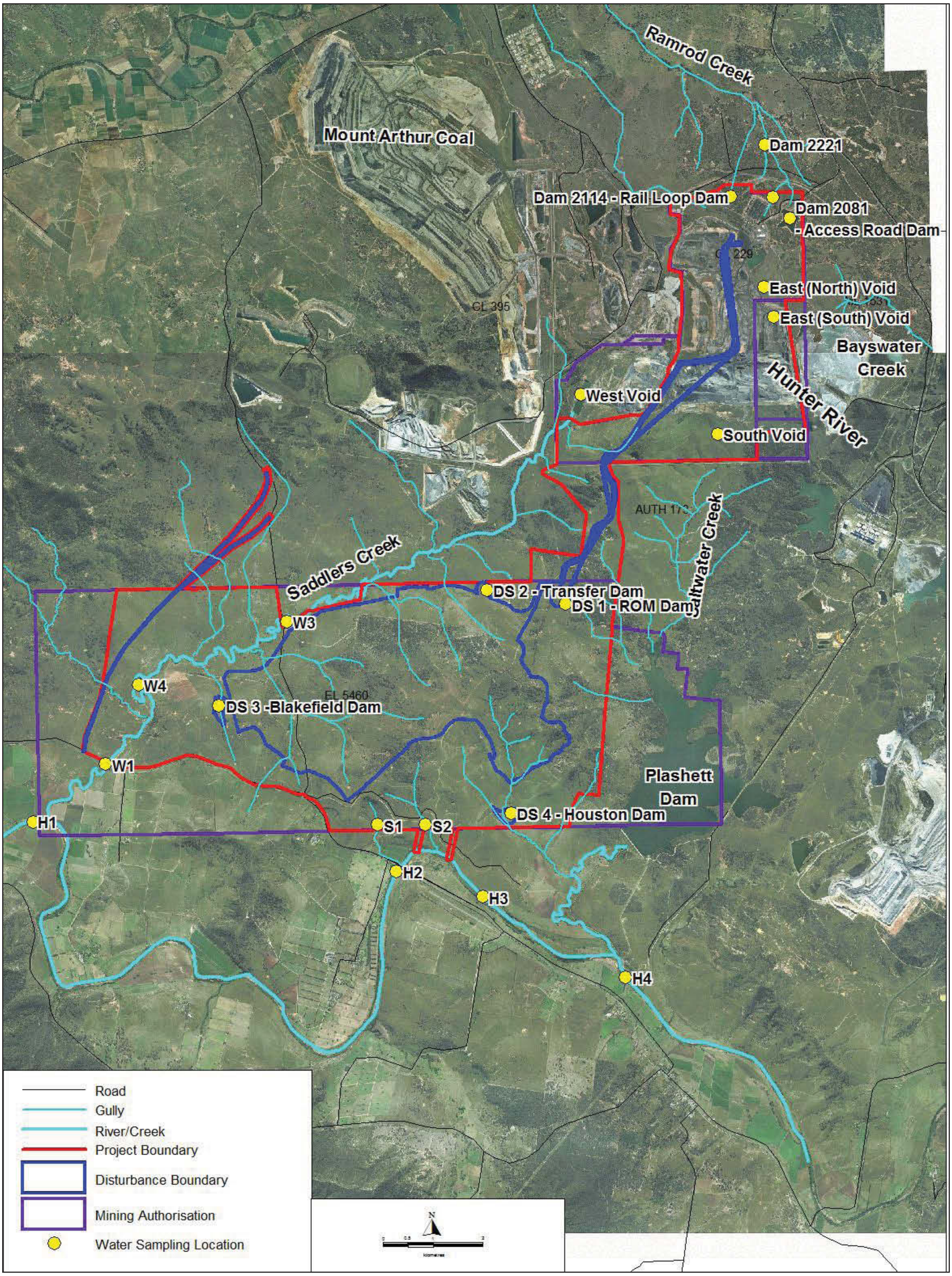

Figure 7.2 Surface Water Monitoring Plan

Table 7.1 Monitoring Locations

ID	Description
Mine Water Dam	
2081	Access Road Dam
2114	Rail Loop Dam
SW13 Void	West Void#
2109	Stockpile Dam
	South Void
DS1	ROM Dam
DS2	Transfer Dam
DS3	Blakefield Dam
DS4	Houston Dam
Tailings Dam	
	East Void/North Void
Stream Monitoring	
2221	Ramrod Creek
W1	Saddlers Creek - Golden Highway
W3	Saddlers Creek - Old Edderton Rd
W4	Saddlers Creek – Bowfield Gauge
H1	Hunter River U/S Saddlers Creek
H2	Hunter River at Golden Highway (Bowman's Crossing)
H3	Hunter River 900m D/S discharge Point
H4	Hunter River 500m D/S of Saltwater Creek

No longer required after 2017 when transferred to Mt Arthur Coal

8 CONCLUSIONS

The Project is a planned continuation of the existing Drayton Mine by the development of a 27 year open cut and highwall mining operation within the Drayton South area. The Project is located between Saddlers Creek and Saltwater Creek, two minor tributaries, to the north of the Hunter River. A water management system has been developed for the Project that includes:

- A mine water management system (water that has come in contact with coal) to collect and use water that may contain high TDS (salt) concentrations. Mine water in excess of site water requirements will be released to the Hunter River under the rules governed by the HRSTS;
- A tailings water management system to manage the inflows to and outflows from the CHPP and tailings storage facility;
- A dirty water management system to ensure runoff from disturbed areas is separated from clean area runoff and collected in sediment dams for treatment;
- A clean water management system to divert water undisturbed by mining around the Drayton South disturbance footprint; and
- A contaminated water management system for water that has come in contact with chemicals of various types used in the mining operations.

Water balance modelling was undertaken to assess the performance of the proposed water management system. The results of the water balance modelling are as follows:

- Under the proposed water management system, runoff from the Drayton Mine catchments and dewatered groundwater can supply all of the water requirements at Drayton South over the life of the Project (unless conditions were drier than the 99%ile conditions). Offsite water supplies are not required, unless conditions are drier than the 99^{th} percentile conditions;
- There is a 50% chance of a moderate accumulation of water in the South Void over the life of the Project. The accumulation of water will allow the site catchments and dewatered groundwater to supply all operational demands. However, the build up of water does not significantly impact on the ability to dewater the active mining area;
- The Project will not impact on downstream water quality due to spillages from the mine water dams;
  - The main mine water storages, Access Road Dam, Savoy Dam, Transfer Dam, Houston Dam and the South Void do not spill over the Project Life;
  - There is a 10% chance that there will be one spill (over three consecutive days) from the Rail Loop Dam over the life of the Project. It is expected that this spill occurs as a result of the daily time step of the model. In reality, pumps would have been turned on throughout the day when the water level exceeded its pump out threshold to prevent the spill;
  - Minor spills occur from the ROM Dam (where applicable) over the life of the Project. The size and shape of the ROM stockpile infrastructure catchment area and the associated ROM Dam are indicative at this stage. This dam will be redesigned, if the ROM infrastructure is required, to minimise uncontrolled spills. If necessary, a

pump back system will be installed to prevent uncontrolled spills to ensure no impact on the downstream environment (including Plashett Dam);

- It is proposed to obtain 50 credits under the HRSTS to allow controlled discharge of mine affected water. The modelling suggests that there is a 50% chance that releases will exceed 740 ML/yr on average and a 10% chance they will exceed 1,140 ML/yr on average. Average releases per release day will be between 25 ML and 31 ML;
- The proposed use of a dust suppressant agent has a significant impact on the water balance. Sensitivity analysis found that with the alternative, less effective dust suppressant agent, the water management system will generally be in equilibrium with only a minor accumulation of water over the Project life under median conditions. However, under this scenario, there will be a 10% chance that at least 622 ML of offsite supplies will be required over the life of the Project. The majority of this offsite demand would be required towards the start of Project Life, i.e. between Year 4 to Year 8. The Water Access Licences currently owned by Anglo American are likely to satisfy this supply shortfall under this scenario. The category of the Water Access Licences will be transferred as required. If more water is required, Anglo American could either purchase additional units on the open market or approach other Water Access Licence holders for a term transfer, which may require an application to change the zone. There will be a 1% chance that at least 1,623 ML will be required between Year 3 and Year 6 (541 ML/yr on average). There will also be a 11% to 19% reduction in average annual discharges under the HRSTS when compared to the base case and no significant change in uncontrolled spills for this scenario;
- The results of the dust suppressant sensitivity analysis are indicative of the climate variability of the region. When the water balance is in equilibrium, there could potentially be both shortfalls in demand, requiring offsite supplies, or a build up of water impacting on operations depending upon whether wet or dry conditions are experienced over the Project life. Given the large storage volumes that are available at Drayton Mine, the adopted approach of minimising water use through the use of the dust suppressant agent that results in the lower watering application of 0.015 $L/m^2/hr$ and thereby minimising, or eliminating, the requirement for offsite supplies is the preferred approach from both an operational and environmental perspective;
- A sensitivity analysis was undertaken to assess the impact of a higher decant return rate (45%) from the tailings dam back to the CHPP. A decant return rate of 30% is expected. Under the 45% scenario, there will be less chance that offsite supplies will be required because more water is decanted from the tailings. Slightly higher discharges will occur under the HRSTS and more water will accumulate in the out-of-pit storages, potentially causing pit water to impact on mining operations during very wet conditions; and
- The proposed option to use the East Void to store tailings will not have a significant impact on the water balance.
- The proposed option of replacing the South Void with the East (North) Void from Year 10 would have a significant impact on the water balance given the substantial reduction in out-of-pit storage after Year 10. Under this scenario:
  - There would be a higher likelihood that mining would be affected by an accumulation of in-pit water. There is a 10% chance that water in the active mining areas will accumulate to a maximum of at least 2,290 ML and a 1% chance that water will accumulate to a maximum of at least 5,210 ML, which would impact on mining. The out-of-pit storages are too full to accept additional pit water at these times.
  - Should these conditions prevail, Anglo American would temporarily sacrifice an active mining area to store the additional water. There are at least three active pits available to store the excess water when the likelihood of a build up is greatest

during the middle phases of mining. The current production schedule has the flexibility to cater for this scenario.

- There is a 1% chance that at least 490 ML of offsite supplies would be required to supply operational demand over the life of the Project. There is a 10% chance that at least 176 ML of offsite supplies would be required to supply operational demand over the life of the Project. This offsite water supply was only required in the last stage of the Project (Year 21 to 27) and it is likely that HRSTS releases from Houston Dam could be reduced or Water Access Licences obtained to supply the required short fall. The Water Access Licences currently owned by Anglo American are likely to satisfy this supply shortfall under this scenario. The category of the Water Access Licences will be transferred as required. If more water is required, Anglo American could either purchase additional units on the open market or approach other Water Access Licence holders for a term transfer, which may require an application to change the zone.
- At the time the South Void is removed from the mine water management system in 2023, there is a 50% chance that the storage inventory in South Void would be at least 3,840 ML. There is 10% chance that the inventory would increase to at least 5,870 ML.
- Releases from Houston Dam under the HRSTS would increase from the base case scenario due to Houston Dam water levels being higher more often, and thus release opportunities utilised more effectively. There is a 50% chance that releases will exceed 990 ML/yr on average and a 10% chance they will exceed 1,440 ML/yr on average.

In addition to the water balance, the other potential impacts of the Project and mitigation measures are as follows:

- The Drayton South disturbance footprint is located outside of the 100 year ARI flood extent of both the Hunter River and Saddlers Creek. A pipeline to discharge water into the Hunter River about 1 km downstream of the Golden Highway will be constructed. The pipeline outlet will be designed and constructed to minimise erosion of the Hunter River during releases and to prevent the build up of debris carried by the Hunter River floodwater or obstruct flows;
- The Project will reduce the Saddlers Creek catchment by a maximum of 14% and the Saltwater Creek catchment will reduce by 11% over the life of the Project. At the completion of the mining, the proposed Blakefield, Houston and Transfer Dams will be removed and the final void catchments will be minimised, resulting in a total 10% and 4% loss of catchment area of Saddlers Creek and Saltwater Creek, respectively;
- To mitigate the impact of the loss of catchment flows, a comprehensive rehabilitation program is proposed for Saddlers Creek including an extensive restoration program and in-channel works of reinstating woody debris and snags to encourage pools and sediment bars to form;
- The Saltwater Creek channel is already highly modified as a result of Macquarie Generation's Plashett Dam. The loss of additional catchment resulting from the construction of Houston Dam is not expected to have a significant impact on Saltwater Creek;
- The Project will have an insignificant impact on the Hunter River flows. Under mining conditions, the Project will reduce the catchment draining to the Hunter River at Liddell by a maximum of 0.14%; and
- Four local gullies of Saddlers Creek will be impacted by mining. Three will be consumed by mining and the fourth (Blakefield Gully) will have its catchment increased from 224 ha to 678 ha. The restoration program planned for Saddlers Creek will be extended up this

gully to ensure it is stable. Restoration works will be established prior to Blakefield Dam being removed.

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APPENDIX A

WATER BALANCE MODEL DEVELOPMENT AND CALIBRATION

A.1 METHODOLOGY

An OPSIM water balance model of the Drayton Mine water management system, previously developed to assess the impact of the proposed changes to tailings disposal system (Water Solutions, 2011), was used for the assessment. The model was updated by recalibrating the runoff parameters to match the storage volumes over the period 2007 to 2011 using available meteorological data for the mine. The model was also updated to include a salt balance. The model was then modified to include the final landform on the Drayton Mine.

The updated model of the Drayton Mine water management system was used to determine:

- The frequency and volume of potential spills from various dams;
- The reliability of the storages to supply operationalwater requirements; and
- The ability to dewater the mining area.

A.2 THE OPSIM MODEL

The OPSIM model estimates runoff and evaporation at each of the site water storages on a daily basis using historical climate data. It also simulates the transfer of water between storages, the harvesting of water and the controlled discharge of water if required.

Table A 1 provides a summary of the inflows and outflows included in the OPSIM model. Details of the model configuration, input data and results are provided in the following sections.

Table A 1 Simulated Inflows and Outflows to Mine Water Management System

Inflows	Outflows
Direct rainfall on water surface of storages	Evaporation from water surface of storages
Catchment runoff	CHPP demand
Groundwater inflows	Dust suppression demand
Raw water supply	Vehicle washdown
	Offsite spills from storages
	Controlled releases

A.3 METEOROLOGY

A.3.1. Rainfall

A representative long-term rainfall sequence for Drayton Mine was obtained from the Bureau of Meteorology's SILO Data Drill. These synthetic data are derived by interpolation of recorded rainfall data between stations as described by Jeffreys et al (2001). Rainfall data from the SILO Data Drill is available from the late 1800s and is corrected for missing data and accumulated totals. Hence, this data is more reliable and easier to use for computer modelling than raw recorded rainfall data.

Figure A 1 shows a comparison of mean monthly rainfall recorded at the Jerrys Plains Post Office rainfall station (#061086), Denman Palace St Gauge (#061016) and the Muswellbrook Lower Hill St gauge (#061053) with the SILO Data Drill rainfalls over the study area from 1889 to 2010. The comparison indicates that the SILO data provides a good representation of recorded rainfall data at Drayton Mine.

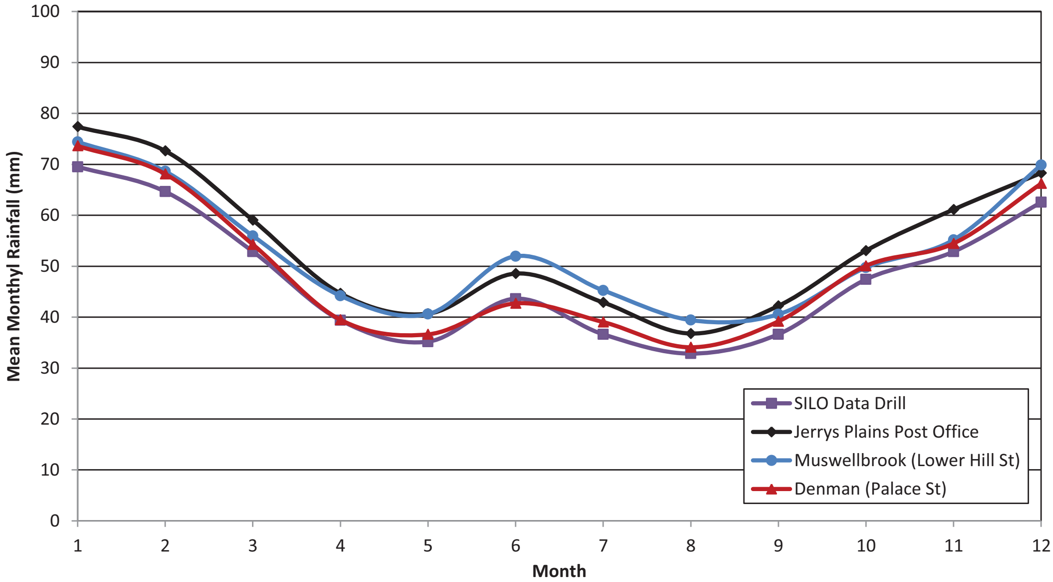

Figure A 1 Comparison of Mean Monthly Rainfalls of Surrounding Rainfall Stations with SILO Data Drill, 1889 to 2010

A.3.2. Evaporation

The pan evaporation data for the area was obtained from the SILO Data Drill database (Jeffrey et al., 2001). Pan factors were applied to the pan evaporation data to match Morton's lake evaporation (Morton, 1983). Morton's method is regarded as suitable for the estimation of lake evaporation in non-arid areas (Mulder, 1997). Table A 2 shows the adopted pan evaporation and pan factors used to estimate evaporation from the onsite storages.

Table A 2 Adopted Monthly Lake Evaporation Factors

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Average	211	167	148	106	71	53	62	87	117	156	182	215
Monthly Lake Pan Factors	0.9	0.92	0.93	0.87	0.83	0.77	0.78	0.84	0.88	0.92	0.92	0.89

For the mining areas, the values shown in Table A 2 were factored by 0.7 to reflect the likely reduction in evaporation due to the depth of the open cut below surface level. For AWBM soil moisture evapotranspiration, the values shown in Table A 2 were factored by 0.99 to convert to areal evapotranspiration.

A.4 DRAYTON MINE WATER BALANCE MODEL CALIBRATION

A.4.1. Methodology

The calibration model was run over the period January 2007 to mid-2011, for which stored water volumes onsite were available. It was assumed that catchment areas draining to the active mining areas do not change over the calibration period. The change in catchment area over this period is only minor when compared to the total study area catchment so the impact on the water balance of this assumption is not expected to be significant.

A.4.2. Water Management System

Figure A 2 shows a schematic of the Drayton Mine water management system over the calibration period. The locations of the various storages and active mining areas are shown in Figure A 3. A summary of the main features of the water management system is as follows:

- Active mining areas are dewatered to the Industrial Dam at a nominal pump rate of 100 L/s;
- CHPP make-up demand is sourced from the Access Road Dam;
- The Rail Loop Dam receives runoff from the CHPP and industrial areas;
- Coal stockpile dust suppression is sourced from the Access Road Dam, which is topped up by water in the Industrial Dam;
- The Industrial Dam supplies the East Pit fill point for haul road dust suppression;
- The Savoy Dam supplies the West Void fill point for haul road dust suppression (via the Turkeys Nest Dam which is not explicitly modelled);
- West Void receives inflows from the active mining areas should additional dewatering be required.

Full details of the operational rules adopted over the calibration period are given in Table A 3.

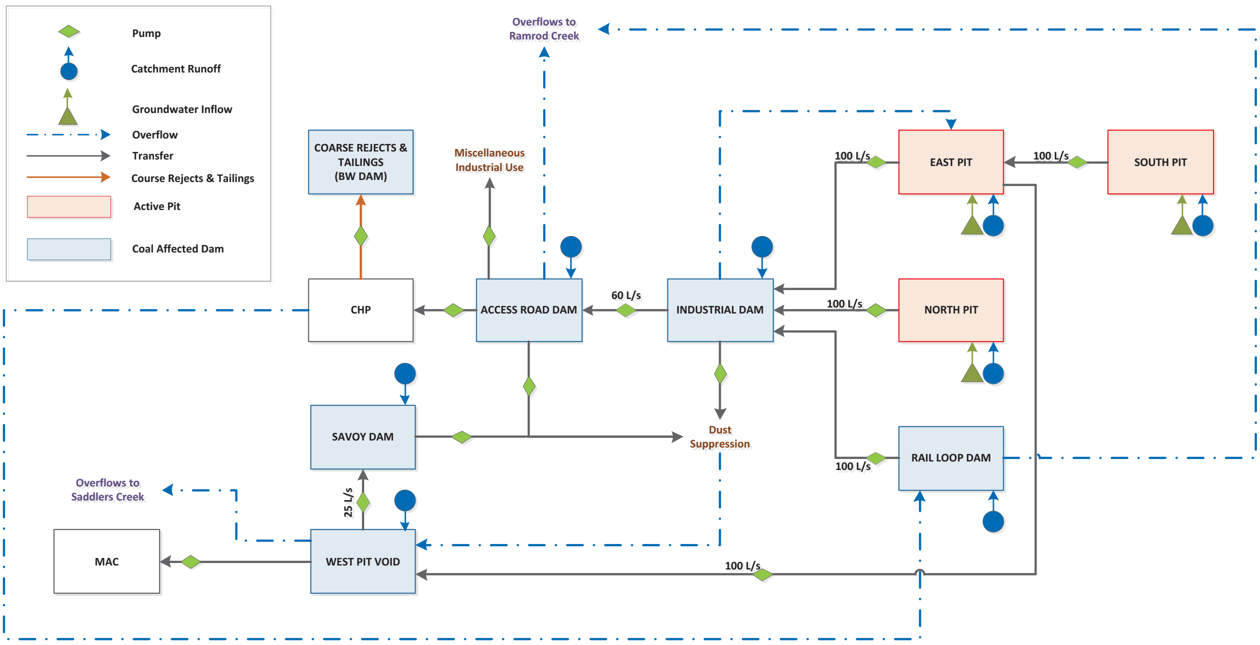

Figure A 2 OPSIM Model Schematic of Drayton Mine Water Management System for the Calibration Period, January 2007 to May 2011

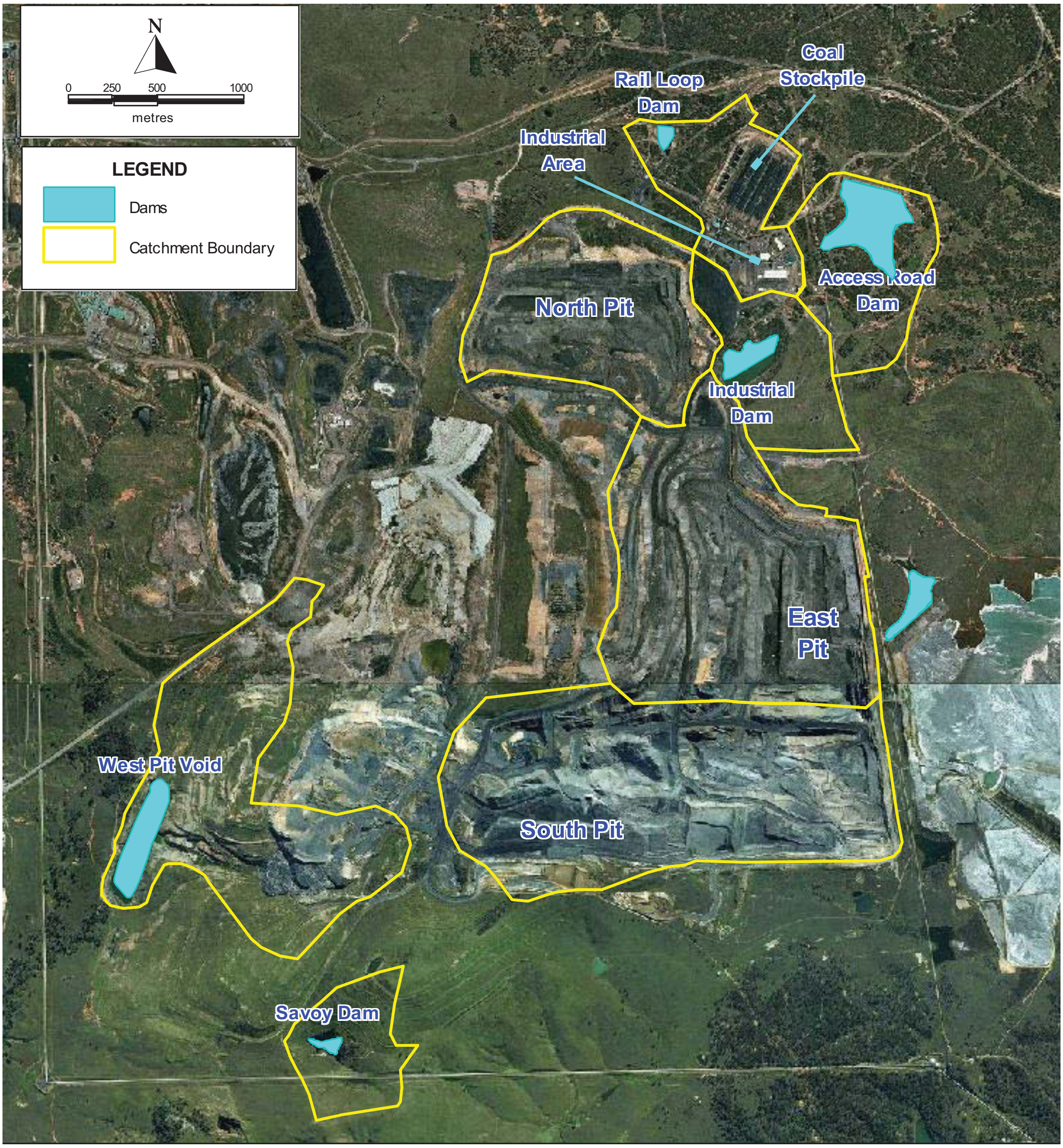

Figure A 3 Existing Drayton Mine Catchment and Operational Areas

Table A 3 Adopted Drayton Mine Operational Guidelines for Calibration Period 2007-2010

	Operational Description	Operating Rules
1	**Supply to Demands**	
1.1	CHPP Make Up	Supplied from the Access Rd dam at a rate of 237kL/d 100% loss assumed.
1.2	Miscellaneous Industrial use	Sourced from the Access Road Dam at a rate of 650kL/d. 100% loss assumed.
1.3	Haul Road Dust Suppression	2 Haul Road Fill locations: • West Void Fill Point: 15% of haul road dust suppression demand is sourced from Savoy Dam at a rate of 292kL/d. • East Pit Fill Point: 85% of haul road dust suppression is sourced from the Industrial Dam at a rate of 1,660kL/d. • 100% loss assumed.
1.4	Stockpile Dust Suppression	• Supplied from the Access Rd dam at a rate of 42kL/d. • 100% loss assumed.
2	**Transfer of Mine Waters**	
2.1	North Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Industrial Dam. • Received groundwater inflows at a rate of 550kL/d (200ML/yr).
2.2	South Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to East Pit. • Received groundwater inflows at a rate of 450kL/d (164ML/yr).
2.3	East Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Industrial Dam. • Received groundwater inflows at a rate of 1,100kL/d (400ML/yr). • If pit water increases above 310 ML then additional direct transfer to West Void at 100L/s
3	**Operation of Key Storages**	

3.1	Access Road Dam	• Primary mine water storage for CHPP and industrial use.
		• Receives inflows from the following locations:
		  o Pumped transfers from Industrial Dam at 60L/s when required.
		• Supplies to the following locations:
		  o Drayton CHPP
		  o Industrial Area
		  o Stockpile Dust Suppression
		• Storage overflows to Ramrod Creek

3.2	Industrial Dam	• Receives inflows from the following locations:
		  o Pumped transfers from East Pit
		  o Pumped transfers from North Pit
		  o Pumped transfers from Rail Loop Dam
		• Supplies to the following locations:
		  o East Pit Fill Point for haul road dust suppression.
		  o Pumped transfers to the Access Road Dam at 60L/s when required.
		• Storage overflows to East Pit.

3.3	Rail Loop Dam	• Mine water collection and transfer storage. • Receives catchment runoff inflows from the CHPP and industrial areas. • Supplies to the Industrial Dam at 100L/s. • Maintained at empty to prevent uncontrolled spills. • Storage overflows to Ramrod Creek.
3.4	Savoy Dam	• Mine water collection and transfer storage. • Supplies to West Void Fill Point for haul road dust suppression. • Receives pumped transfers from West Void at 25 L/s (when required to ensure supply of water for dust suppression).
3.5	West Void	• Receives pumped inflows from East Pit when stored water exceeds 90m AHD. • Supples to Savoy Dam when required. • Storage overflows to Saddlers Creek. • No other transfers to or from West Void over calibration period.
4	**General**	All storages and pits receive local catchment runoff and lose water through evaporation.

A.4.3. Storages and Mining Areas

The adopted capacities of water storages included in the OPSIM calibration model are shown in Table A 4. The full supply volume is the nominal volume available below the spillway crest. The operating volume is the target maximum storage volume to minimise uncontrolled spills. The initial free volume is the observed volume recorded in each storage, applied at the start of the modelling period, i.e. January 2007.

Table A 4 Capacities of Water Storages

WATER STORAGE	Full Supply Volume (ML)	Operating Volume (ML)	Initial Free Volume (ML)
Access Road Dam (2081)	750	600	310
Industrial Dam (1969)	750	596	555
Rail Loop Dam (2114)	18	0	11
Savoy Dam (1609)	140	50	140
West Void (SW13)	4043	4043	412

Note that Delpah Dam and A Transfer Dam were included in the previous water balance modelling of the Drayton Mine (Water Solutions, 2011). Advice from personnel on site suggests that these dams do not play a role in the water balance and as such were excluded from the model.

The operating volume of the Rail Loop Dam was set to zero in an attempt to match the number of modelled spills with the actual spills over the calibration period.

The adopted capacities of the active mining areas are shown in Table A 5. The full supply volume is the nominal volume available, above which uncontrolled spills will occur.

Table A 5 Capacities of Mining Areas

MINING AREA STORAGE	Full Supply Volume (ML)	Initial Free Volume (ML)
North Pit	17905	0
East Pit	17138	0
South Pit	993	0

The locations of these storages and mining areas are shown in Figure A 3.

A.4.4. Catchment Areas and Land Use Classifications

The adopted catchment areas reporting to each of the existing Drayton Mine storages are presented in Figure A 4 and detailed in Table A 6.

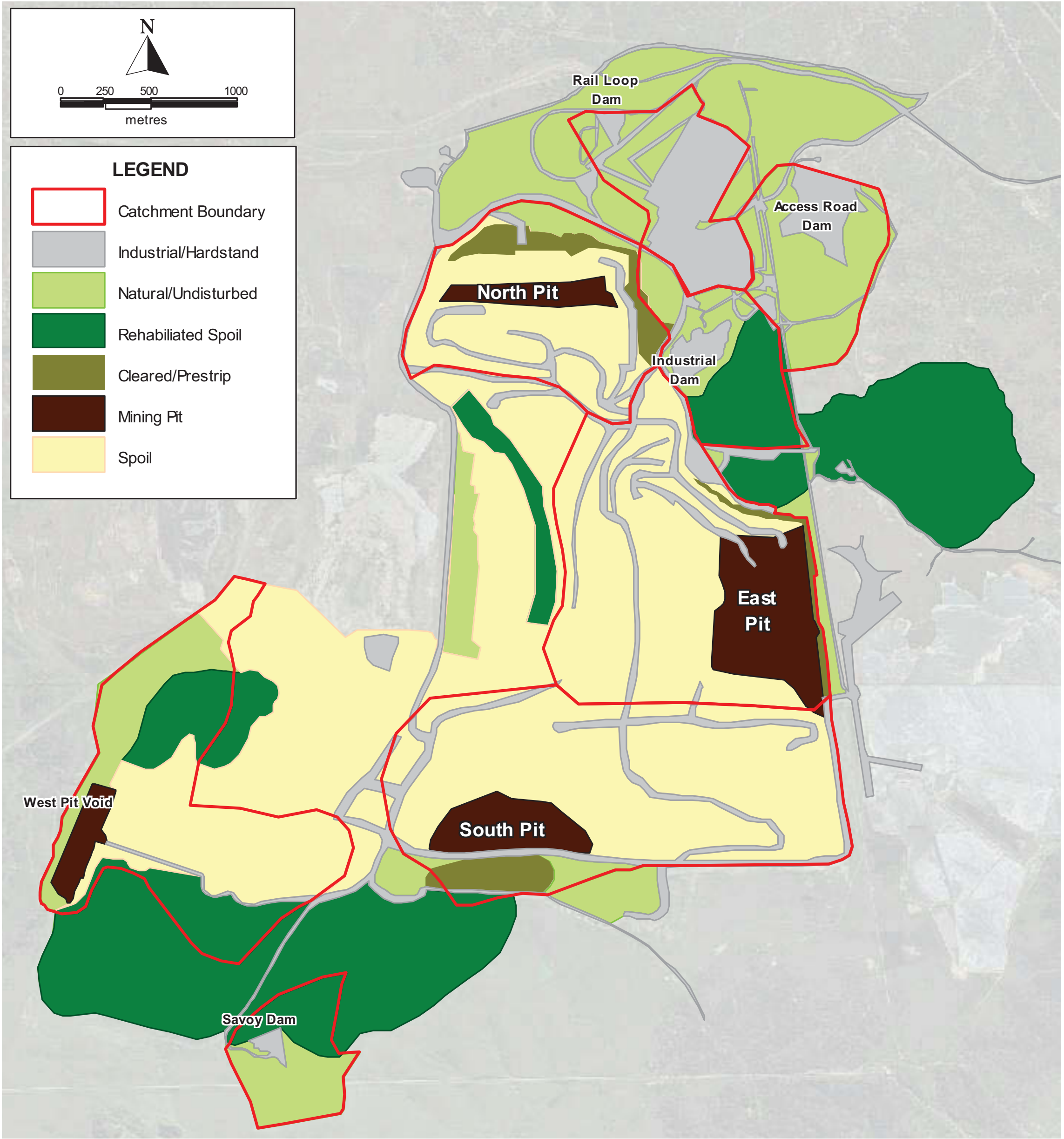

Figure A 4 Existing Drayton Mine Catchments and Land Use Classifications

Table A 6 Existing Drayton Mine Catchment Areas

Storage Name	Catchment Area (ha)						
	Mine Site	Cleared	Mining Area	Hardstand	Rehab.	Spoil	Total
North Pit	7.6	14.7	10.9	15.0	0.0	84.5	**132.7**
South Pit	6.3	11.4	22.2	31.6	0.0	71.4	**143.0**
East Pit	0.0	5.9	44.4	24.9	0.0	139.1	**214.3**
Access Rd Dam	48.1	0.0	0.0	19.3	0.6	0.0	**68.0**
Rail Loop Dam	18.5	0.0	0.0	44.7	0.0	0.0	**63.2**
Savoy Dam	23.2	0.0	0.0	2.3	15.1	0.0	**40.6**
Industrial Dam	17.3	0.0	0.0	10.4	29.9	0.0	**57.6**
West Void	31.4	0.0	9.7	2.2	45.2	76.6	**165.2**

wrm water + environment

A.4.5. Demands

The adopted total demand over the calibration period is 2,720 kL/d, consisting of the CHPP makeup demand, industrial usage and dust suppression of haul roads and coal stockpiles. Each of these demands is detailed below.

Annual values of the CHPP makeup requirements for 2007 to 2009 were obtained from previous calibration modelling of the Drayton Mine site (Water Solutions, 2011), listed in Table A 7.

The volume of water required for CHPP makeup is generally related to the annual coal production tonnages. Insufficient production data was available to conduct a net water balance over the CHPP to assess the net water requirements, so it was assumed that the CHPP makeup requirement would provide an accurate representation.

Table A 7 Drayton Mine CHPP Makeup Requirements

Year	ML/yr	kL/d	Source
2007	63	170	Drayton Mine Extension (Water Solutions, 2011)
2008	166	450	Drayton Mine Extension (Water Solutions, 2011)
2009	25*	91	Drayton Mine Extension (Water Solutions, 2011)
Average		**237**	

*January 2009 to September 2009

Annual values of industrial usage for 2007 to 2010 are provided in Table A 8. The average industrial demand of 650 kL/d was adopted over the calibration period. The industrial usage demand is sourced from the Access Road Dam and is assumed to be 100% lost.

Table A 8 Drayton Mine Industrial Usage

Year	ML/yr	kL/d	Source
2007	130	356	Drayton Mine Extension (Water Solutions, 2011)
2008	272	745	Annual Environment Management Report 2008 (Anglo Coal)
2009	360	986	Annual Environment Management Report 2009 (Anglo Coal)
2010	188	515	Annual Environment Management Report 2010 (Anglo Coal)
Average	**238**	**650**	

Annual rates of coal stockpile dust suppression for 2007 to 2010 are provided in Table A 9. The average coal stockpile dust suppression demand of 50 kL/d was adopted over the calibration period, sourced from the Access Road Dam and assumed to be 100% lost.

Table A 9 Drayton Mine Coal Stockpile Dust Suppression Usage

Year	ML/yr	kL/d	Source
2007	27	74	Drayton Mine Extension (Water Solutions, 2011)
2008	2	5	Annual Environment Management Report 2008 (Anglo Coal)
2009	6	16	Annual Environment Management Report 2009 (Anglo Coal)
2010	38	104	Annual Environment Management Report 2010 (Anglo Coal)
Average	**18**	**50**	

Annual rates haul road dust suppression for 2007 to 2010 are provided in Table A 10. The average haul road dust suppression demand of 1786 kL/d was adopted over the calibration period. Based on advice from onsite personnel, 85% is sourced from East Pit Fill Point (Industrial Dam) and 15% from the West Void Fill Point (Savoy Dam).

Table A 10 Drayton Mine Haul Road Dust Suppression Usage

Year	ML/yr	kL/d	Source
2007	470	1288	Drayton Mine Extension (Water Solutions, 2011)
2008	603	1652	Annual Environment Management Report 2008 (Anglo Coal)
2009	814	2230	Annual Environment Management Report 2009 (Anglo Coal)
2010	720	1973	Annual Environment Management Report 2010 (Anglo Coal)
Average	**652**	**1786**	

A.4.6. Groundwater Inflows

The rates of groundwater inflow into the active mining areas were adopted from the previous calibration modelling (Water Solutions, 2011), detailed in Table A 11.

Table A 11 Drayton Mine Groundwater Inflows

Mining Area	ML/yr	kL/d
North Pit	200	550
South Pit	165	450
East Pit	400	1100

A.4.7. AWBM Calibration

The OPSIM model uses the AWBM model to estimate runoff volumes from onsite catchments, based on available rainfall and evaporation data. The AWBM (Boughton & Chiew, 2003) is a saturated overland flow model which allows for variable source areas of surface runoff. The model uses daily rainfalls and estimates of catchment evapotranspiration to calculate daily values of runoff using a daily water balance of soil moisture. The model has a baseflow component which simulates the recharge and discharge of a shallow groundwater store. Runoff depth calculated by the AWBM model is converted into runoff volume by multiplying the depth and the contributing catchment area. The various parameters of the AWBM model are shown in Table A 12.

Table A 12 Summary of AWBM Model Parameters

Parameter Specification	Description
Partial Area Fractions	Parameters A1, A2 & A3. Fraction of catchment area represented by surface storages No. 1, 2 & 3.
Soil Store Capacities	Parameter C1, C2 & C3. Soil moisture storage capacities for smallest store (No. 1), middle store (No. 2) and largest store (No. 3).
Base Flow Index	Parameter BFI. Proportion of runoff directed to baseflow store.
Daily Baseflow Recession Constant	Parameter K. Rate at which water discharges from baseflow store.
Lake to Evapotranspiration Factor	Factor to convert open water evaporation to evapotranspiration.

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To estimate catchment runoff inflows to the OPSIM model, separate AWBM model parameters were developed for the following catchment types:

- Mine site/undisturbed;
- Industrial/hardstand/roads;
- Spoil, unrehabilitated;
- Spoil, rehabilitated;
- Mining area;
- Cleared/prestrip.

In the absence of recorded runoff data for the different catchment types, reasonable parameter values were selected based on experience in similar previous studies and expected values of volumetric runoff coefficients. Adopted AWBM model parameter values are shown Table A 13. The overall representation of catchment runoff was validated by matching the stored volume in all storages on the site over the calibration period.

Table A 13 Adopted AWBM Model Parameters for Various Catchment Types

AWBM Model Parameter		Mine Site	Industrial/ Hardstand	Unrehabilitated Spoil	Rehab. Spoil	Mining Area	Cleared/ Prestrip
Surface Store Depth (mm)	C1	40	4.08	13	7.7	3	2.4
	C2	85	12.96	48	77	11.75	10.8
	C3	145	0	0	0	0	9.96
	Avg.	100	12.07	41	70.7	10	0.1
Partial Areas	A1	0.2	0.1	0.2	0.1	0.2	0.1
	A2	0.4	0.9	0.8	0.9	0.8	0.9
	A3	0.4	0	0	0	0	0
Base flow index	BFI	0	0	0.85	0.15	0	0
Base flow recession constant	K	1	1	0.7	0.98	1	1
Lake to Evapotranspiration Factor		0.99	0.99	0.99	0.99	0.99	0.99
Long Term Runoff Coefficient	RC	0.048	0.312	0.138	0.085	0.348	0.344

A.4.8. Water Quality Parameters

Water quality was modelled in OPSIM as TDS in mg/L. The adopted salinity concentrations of the various catchment types included in the calibration model are provided in Table A 14. These values are based on the assessment of water quality information currently collected for a number of storages (with non-homogeneous catchments) across Drayton Mine. The results of the calibration of the catchment runoff salinities are provided in Section A.4.10. The equivalent EC values assuming a typical conversion of 0.75 are also given.

Table A 14 Catchment Inflow Salinity Concentrations

Catchment Type	TDS (mg/L)	EC (µS/cm)
Cleared/Prestrip	2000	2667
Mining Area	4000	5333
Mine site/Undisturbed Catchment	200	267
Industrial/Hardstand	2000	2667
Spoil	2000	2667
Rehabilitated Spoil	1000	1333
Groundwater	4720	6300

A.4.9. Storage Volume Calibration Results

The modelled AWBM parameters were calibrated using known site performance and operations from January 2007 to May 2011 at the existing Drayton Mine. The modelled total inventory for the Industrial Dam, Savoy Dam, Access Road Dam, Rail Loop Dam and the North, South and East Pits and West Void were compared to the recorded total inventory. The results of the calibration are shown in Figure A 5.

SILO Data Drill rainfall was selected for this calibration as it was found that the provided Drayton Mine data showed consistently higher daily values than surrounding BOM stations, potentially indicating an incorrectly calibrated onsite gauge.

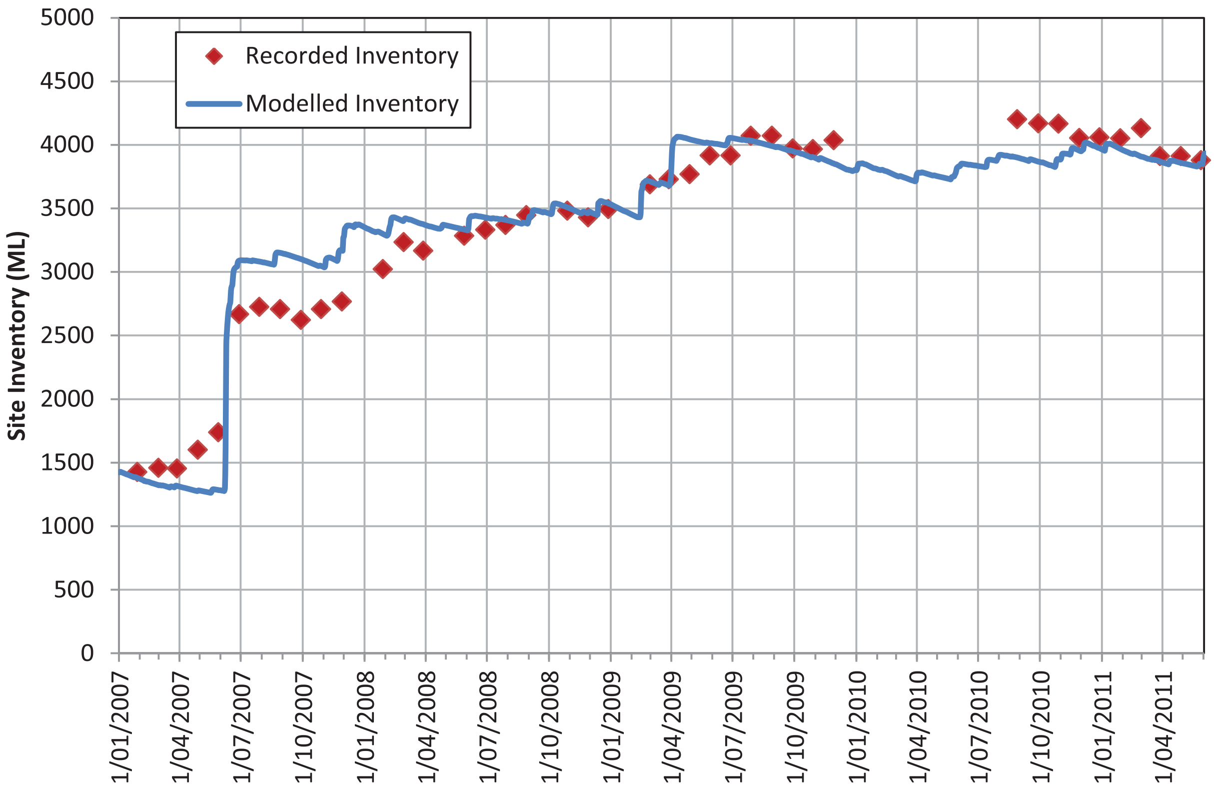

Figure A 5 Modelled and Recorded Total Inventory (Stored Volume)

The following is of note with the calibration of the AWBM parameters for the OPSIM model:

- The behaviour of the modelled site inventory over January 2007 to May 2011 is in good agreement with the recorded inventory;
- In September 2009, 2000ML stored in the West Void was transferred to the ownership of Mt Arthur Coal Mine. This 2000ML has not been removed from the recorded total site inventory to allow direct comparison with the modelled results;
- All demands are met 100% of the time over the calibration period;
- No controlled discharges occurred over the calibration period; and
- The modelled results showed one spill from the Rail Loop Dam in conjunction with the June 2007 rainfall event.

The calibration results are marginally different to the calibration given in Water Solutions (2011) due to the use of more up to date storage volume information. The current calibration parameters generate more runoff than what was proposed by Water Solutions (2011).

A.4.10. Water Quality Calibration Results

The concentration of salts assigned to the various catchment types was calibrated using recorded salinities in onsite storages with non-homogenous catchments from January 2007 to May 2011. Initial salinities were estimated from a linear interpolation of the recorded site data. The modelled water quality for the Industrial Dam, Savoy Dam and Access Road Dam were each compared to the recorded storage salinities. Recorded storage salinities were converted from EC (µS/cm) to TDS (mg/L) assuming a typical conversion of 0.75. The results of the calibration are shown in Figure A 6, Figure A 7 and Figure A 8.

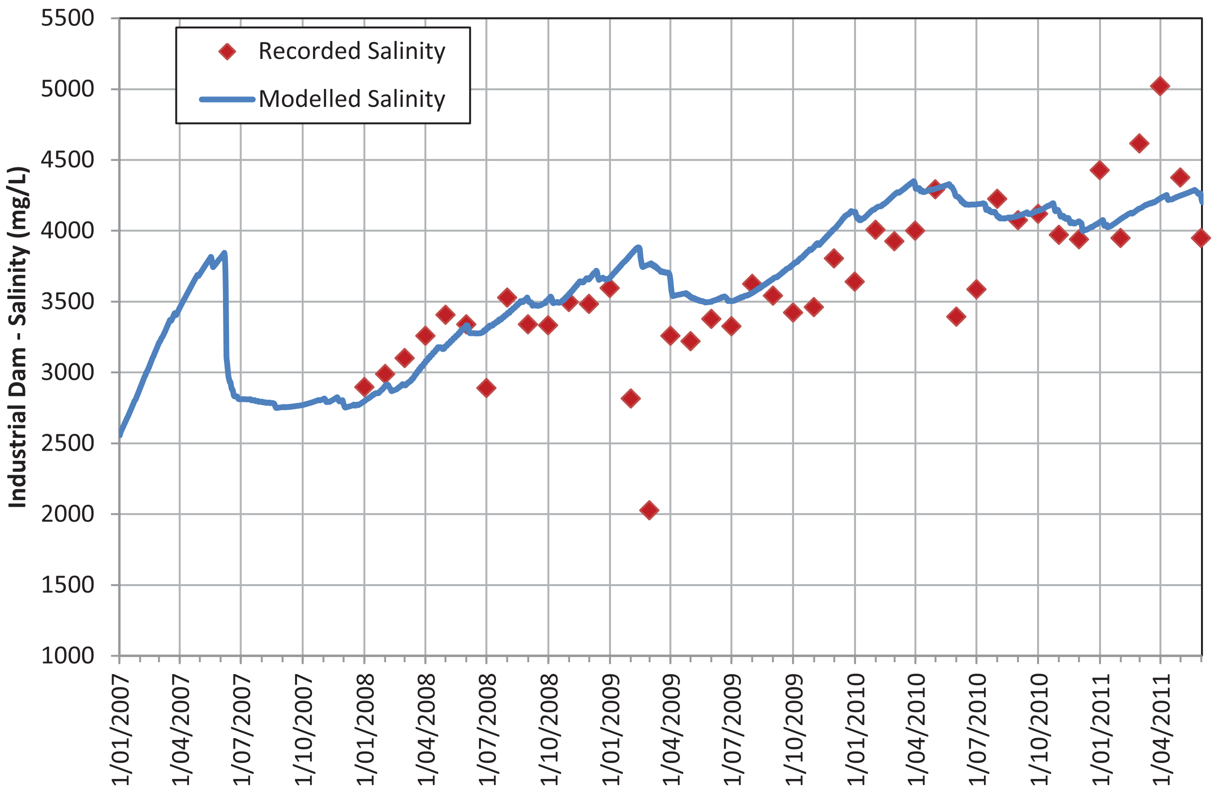

Figure A 6 Modelled and Recorded Industrial Dam Total Dissolved Solids, Jan 2007 to May 2011

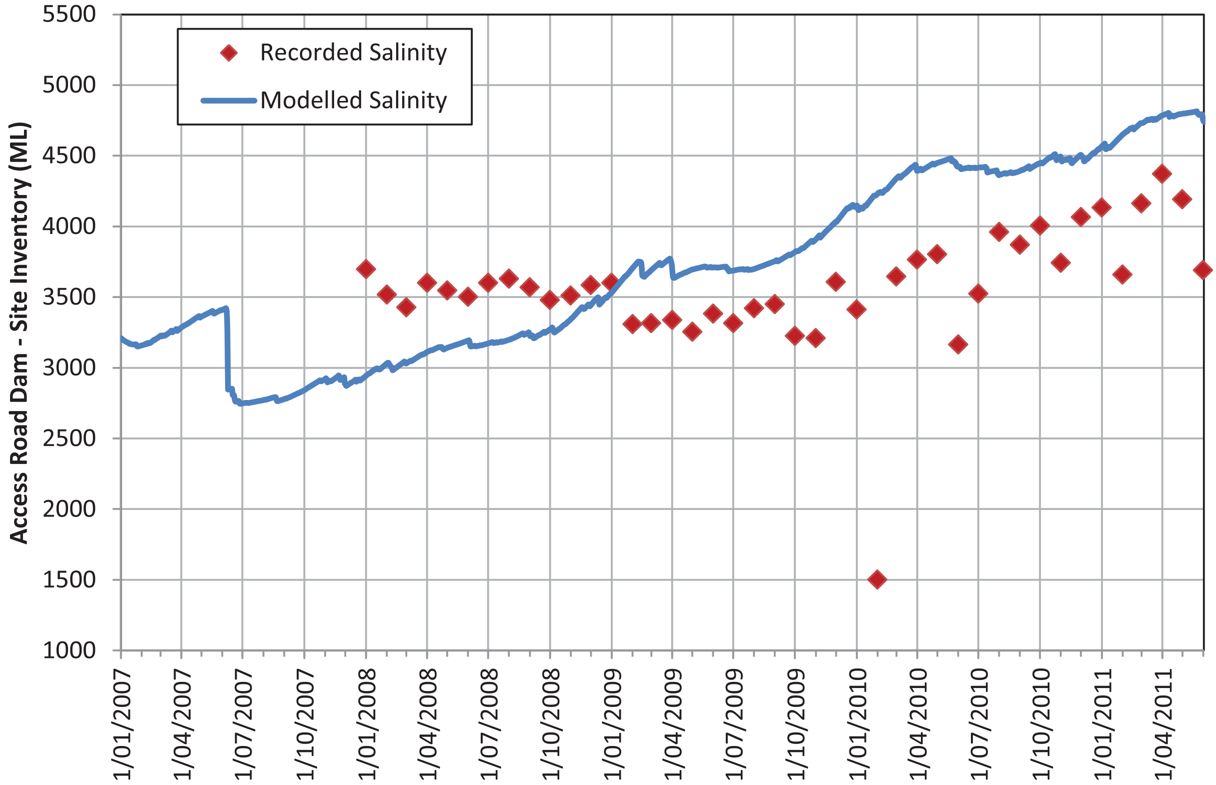

Figure A 7 Modelled and Recorded Access Road Dam Total Dissolved Solids, Jan 2007 to May 2011

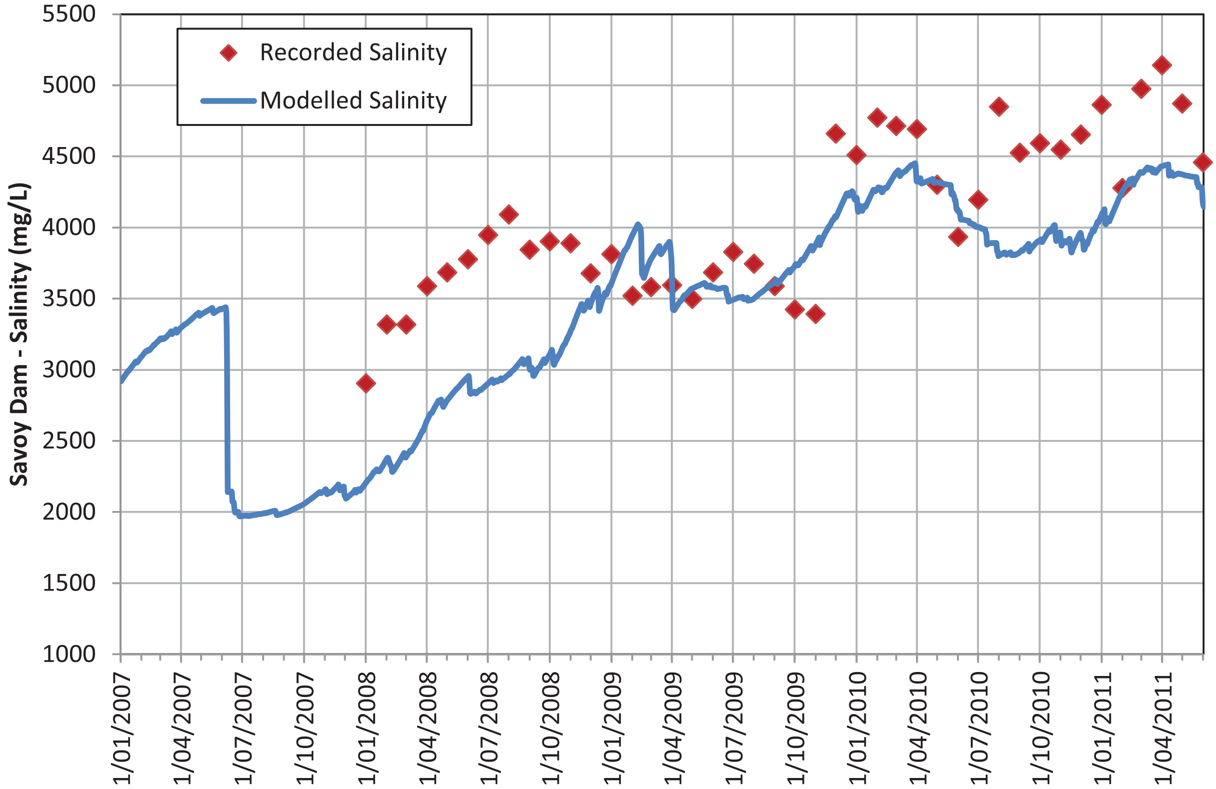

Figure A 8 Modelled and Recorded Savoy Dam Total Dissolved Solids, Jan 2007 to May 2011

The following is of note with the calibration of the catchment runoff salinities for the OPSIM model:

- The overall TDS calibration in the three storages appears reasonable;
- It is expected that TDS concentrations in the Industrial Dam and Access Road Dam would reflect the mining area and spoil runoff TDS as well as groundwater TDS as they mostly contain pumped inflows from the open cut mining areas; and
- Runoff from natural catchments vary greatly with high TDS concentrations measured to the south and lower concentrations in the north.

A.5 LIMITATIONS OF THE WATER BALANCE MODEL CALIBRATION

The results of the OPSIM modelling need to be interpreted with caution. Key limitations of the OPSIM model and known discrepancies between the model and water management practice are outlined below:

- The AWBM parameters adopted for the model appear reasonable based on past experience and the available calibration data for Drayton Mine;
- TDS concentrations applied to study area catchments are based on past experience and the limited water quality data available to date. More water quality information is required to accurately calibrate the water balance model to observed site data; and
- TDS is not necessarily the critical contaminant that will control the operation of the water management system and will need to evolve and be operated to recognise the results of future water quality and quantity monitoring programs.

APPENDIX B

DRAYTON SOUTH CATCHMENT AREAS

Table B 1 Drayton South Catchment Areas

Storage	Year	Catchment Areas (ha)					
		Mine Site	Mining Area	Hardstand	Rehab.	Spoil	Total
Houston Dam	3	561.7	0.0	5.0	0.0	0.0	**566.7**
	5	285.8	0.0	0.0	36.1	23.4	**345.3**
	10	285.8	0.0	0.0	58.9	0.0	**344.7**
	15	286.0	0.0	0.0	58.9	0.0	**344.9**
	20	285.9	0.0	0.0	58.9	0.0	**344.8**
	27	273.2	0.0	0.0	80.8	8.8	**362.8**
Transfer Dam	3	51.1	0.0	4.7	0.0	0.0	**55.8**
	5	50.9	0.0	4.7	0.0	0.0	**55.6**
	10	49.8	0.0	4.0	0.0	0.0	**53.8**
	15	43.9	0.0	2.8	0.0	0.0	**46.6**
	20	43.9	0.0	2.8	0.0	0.0	**46.6**
	27	43.9	0.0	2.8	0.0	0.0	**46.6**
Blakefield Dam	3	499.5	0.0	0.0	0.0	0.0	**499.5**
	5	207.9	0.0	0.0	0.0	0.0	**207.9**
	10	196.9	0.0	0.0	0.0	0.0	**196.9**
	15	196.9	0.0	0.0	0.0	0.0	**196.9**
	20	430.6	0.0	0.0	227.9	21.4	**679.9**
	27	432.2	0.0	0.0	247.8	0.0	**680.0**
Houston Mining Area	5	138.7	31.8	7.8	0.0	43.3	**221.5**
	10	138.0	24.8	7.8	0.0	50.3	**220.8**
	15	128.6	27.9	7.6	0.0	47.3	**211.4**
	20	55.5	21.3	5.0	0.0	87.0	**168.7**
Whynot Mining Area	3	97.9	34.9	0.9	0.0	52.7	**186.4**
	5	115.3	80.4	8.8	0.0	68.4	**272.9**
Redbank Mining Area	3	245.0	38.3	0.0	0.0	29.8	**313.1**
	5	216.5	36.4	0.0	0.0	42.6	**295.5**
Whynot/Redbank Mining area	10	224.0	181.2	23.2	5.1	442.2	**875.6**
	15	110.2	185.0	19.4	274.8	477.5	**1066.9**
	20	76.8	216.7	21.5	324.6	367.7	**1007.3**
	27	61.0	54.9	26.7	363.5	626.4	**1132.5**
Blakefield Mining area	3	85.6	9.0	3.2	0.0	14.7	**112.5**
	5	119.2	46.2	6.4	0.0	75.4	**247.2**
	10	21.2	45.0	3.0	0.0	143.8	**213.0**
	15	19.4	7.7	3.1	19.3	39.1	**88.7**
High Wall 1-Blakefield	5	279.0	0.0	0.0	0.0	0.0	**279.0**
High Wall 1-Redbank	3	155.1	0.0	0.0	0.0	0.0	**155.1**
	5	156.6	0.0	0.0	0.0	0.0	**156.6**
	10	146.0	0.0	0.0	0.0	0.0	**146.0**
	15	95.1	0.0	0.0	0.0	0.0	**95.1**

Storage	Year	Catchment Areas (ha)					
		Mine Site	Mining Area	Hardstand	Rehab.	Spoil	Total
High Wall 1-Whynot	3	105.6	0.0	0.0	0.0	0.0	**105.6**
	5	76.7	0.0	0.0	0.0	0.0	**76.7**
	10	24.4	0.0	0.0	0.0	0.0	**24.4**
High Wall 2-Redbank	10	88.9	0.0	0.0	0.0	0.0	**88.9**
	15	88.9	0.0	0.0	0.0	0.0	**88.9**
High Wall 2-Whynot	3	103.2	0.0	0.0	0.0	0.0	**103.2**
	5	82.8	0.0	0.0	0.0	0.0	**82.8**
High Wall 3-Redbank	10	94.9	0.0	0.0	0.0	0.0	**94.9**
	15	94.9	0.0	0.0	0.0	0.0	**94.9**
Sediment Dam - Coal Stockpile	3	49.5	0.0	9.8	0.0	0.0	**59.3**
	5	49.5	0.0	9.8	0.0	0.0	**59.3**
	10	49.5	0.0	9.8	0.0	0.0	**59.3**
	15	49.5	0.0	9.8	0.0	0.0	**59.3**
	20	49.5	0.0	9.8	0.0	0.0	**59.3**
	27	49.5	0.0	9.8	0.0	0.0	**59.3**
Sediment Dam 1-Blakefield	3	3.5	0.0	0.0	0.0	7.2	**10.8**
	5	0.0	0.0	6.8	0.0	65.1	**72.0**
	10	0.0	0.0	0.0	69.7	0.0	**69.7**
	15	0.0	0.0	0.0	69.7	0.0	**69.7**
	20	0.0	0.0	0.0	70.1	0.0	**70.1**
	27	0.0	0.0	0.0	75.8	0.0	**75.8**
Sediment Dam 1-Redbank	3	12.7	0.0	0.0	0.0	30.7	**43.3**
Sediment Dam 1-Whynot	3	5.9	0.0	2.7	0.0	5.8	**14.4**
	5	0.0	0.0	3.0	0.0	36.1	**39.1**
	10	0.0	0.0	4.9	26.8	0.0	**31.7**
	15	0.0	0.0	4.3	26.6	0.7	**31.7**
	20	0.0	0.0	4.3	26.6	0.7	**31.7**
	27	0.0	0.0	5.0	27.1	7.3	**39.4**
Sediment Dam 2-Blakefield	5	0.0	0.0	5.7	0.0	21.6	**27.2**
	10	0.0	0.0	0.0	61.2	0.0	**61.2**
	15	0.0	0.0	0.0	61.2	0.0	**61.2**
	20	0.0	0.0	0.0	61.2	0.0	**61.2**
	27	0.0	0.0	0.0	60.2	6.2	**66.4**
Sediment Dam 2-Whynot	5	5.8	0.0	1.1	0.0	20.6	**27.5**
	10	0.0	0.0	4.5	7.9	21.7	**34.1**
	15	0.0	0.0	7.6	28.0	20.6	**56.1**
	20	0.0	0.0	7.6	48.6	0.0	**56.1**
	27	0.0	0.0	7.6	48.6	0.0	**56.1**
Mine Site Facilities Catch Dam	3	0.0	0.0	7.5	0.0	0.0	**7.5**
	5	0.0	0.0	7.5	0.0	0.0	**7.5**
	10	0.0	0.0	7.5	0.0	0.0	**7.5**

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Storage	Year	Catchment Areas (ha)					
		Mine Site	Mining Area	Hardstand	Rehab.	Spoil	Total
	15	0.0	0.0	7.5	0.0	0.0	**7.5**
	20	0.0	0.0	7.5	0.0	0.0	**7.5**
	27	0.0	0.0	7.5	0.0	0.0	**7.5**
MIA Sediment Dam	3	23.9	0.0	5.5	0.0	11.6	**41.1**
	5	11.3	0.0	4.5	0.0	39.4	**55.2**
	10	11.3	0.0	4.6	37.8	8.2	**61.9**
	15	12.6	0.0	4.6	43.4	3.6	**64.2**
	20	12.6	0.0	4.6	47.0	0.0	**64.2**
	27	12.6	0.0	4.6	47.0	0.0	**64.2**

APPENDIX C

DAM STAGE-STORAGE-SURFACE AREA CURVES

Table C 1 Industrial Dam

Level (mAHD)	Area (ha)	Volume (ML)
218	6.3	0
222	6.4	254
223	6.5	318.5
224	6.8	385
225	7	454
227	7.2	596
229	7.6	750

Table C 2 Access Road Dam

Level (18mAHD)	Area (ha)	Volume (ML)
228	8	0
228.5	8.25	40.6
229	8.5	82.5
229.5	8.75	125.6
230	9	181
230.5	9.25	214
231	9.5	252
231.5	9.75	294
232	10	341
232.5	10.5	392
233	11	448
233.5	11.5	509
234	12	574
234.5	12.75	644
235	13.25	718
235.5	14	750

Table C 3 Savoy Dam

Level (mAHD)	Area (ha)	Volume (ML)
252.2	3.85	0
253	3.9	31
254	3.95	70.3
254.5	4	101
255	4.1	116
255.2	4.2	122
255.4	4.3	127
255.5	4.4	129
255.6	4.5	131
256	5.5	140

Table C 4 Rail Loop Dam

Level (mAHD)	Area (ha)	Volume (ML)
220	1.48	0
221	2.52	18

Table C 5 West Void

Level (mAHD)	Area (ha)	Volume (ML)
155	4.8	0
160	5.8	265
165	6.6	575
170	7.7	933
175	8.9	1,349
180	9.9	1,819
185	11.3	2,348
190	11.3	2,913
195	11.3	3,478
200	11.3	4,043

Table C 6 Existing East Pit

Level (mAHD)	Area (ha)	Volume (ML)
80	0.8	0
85	2.2	75
90	7.1	308
95	10.1	738
100	12	1,291
105	13.8	1,934
110	17.4	2,713
115	21	3,674
120	25.6	4,839
125	32.1	6,282
130	38.5	8,046
135	55.6	10,398
140	69	13,512
145	76.1	17,138

Table C 7 Final Landform East Void

Level (mAHD)	Area (ha)	Volume (ML)
70	0.00	0.0
75	0.30	8.9
80	2.86	102.5
85	6.01	333.2

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90	8.89	705.4
95	11.94	1,223.9
100	16.22	1,935.3
105	20.15	2,851.5
110	23.39	3,938.0
115	27.06	5,197.6
120	31.86	6,669.5
125	36.76	8,389.9
130	40.99	10,336.0
135	44.77	12,480.4
140	48.43	14,810.6
145	52.43	17,330.6
150	59.54	20,171.8
155	68.18	23,414.4
160	78.15	27,088.9
165	86.83	31,233.5
170	95.21	35,795.1
175	103.21	40,756.1

Table C 8 Existing North Pit

Level (mAHD)	Area (ha)	Volume (ML)
140	0.5	0
145	1.5	52
150	2.5	154
155	4.5	329
160	6.4	602
165	8.4	972
170	12.4	1,492
175	15	2,177
180	21.4	3,087
185	24.7	4,238
190	30.4	5,616
195	42.7	7,443
200	47	9,685
205	52.6	12,174
210	56	14,889
215	64.7	17,905

Table C 9 Final Landform North Void

Level (mAHD)	Area (ha)	Volume (ML)
65	0.00	0.0
70	0.11	2.8
75	0.40	15.0

80	0.76	43.7
85	1.24	92.9
90	1.89	170.2
95	3.01	298.0
100	3.78	468.1
105	4.49	674.7
110	5.24	917.6
115	6.08	1200.1
120	7.05	1527.5
125	8.10	1906.1
130	9.20	2338.5
135	10.33	2826.7
140	11.50	3372.3
145	12.69	3976.8
150	14.64	4657.2
155	16.36	5432.3
160	17.86	6288.1
165	21.37	7269.2
170	24.01	8404.8
175	27.73	9701.1
180	30.69	11161.9
185	35.48	12827.1
190	38.40	14674.9
195	41.92	16681.8
200	46.82	18900.0

Table C 10 Existing South Pit

Level (mAHD)	Area (ha)	Volume (ML)
140	0.5	0
145	0.9	35
150	1.9	105
155	2.8	222
160	4	391
165	5.1	618
170	9.9	993

Table C 11 Final Landform South Void

Level (mAHD)	Area (ha)	Volume (ML)
85	0.00	0.0
90	0.28	7.0
95	0.70	30.7
100	1.29	79.7
105	2.04	162.1
110	3.74	316.4

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115	5.30	542.4
120	7.02	850.6
125	8.77	1245.3
130	10.56	1728.5
135	12.63	2308.5
140	14.52	2986.3
145	16.52	3761.6
150	18.63	4639.3
155	21.22	5630.5
160	39.69	7136.9
165	46.36	9283.2
170	54.18	11793.0
175	64.60	14788.4

Table C 12 Transfer Dam

Level (mAHD)	Area (ha)	Volume (ML)
178.5	0.00	0.0
179	0.05	0.1
179.5	0.13	0.5
180	0.26	1.5
180.5	0.37	3.0
181	0.51	5.2
181.5	0.68	8.2
182	0.87	12.0
182.5	1.09	16.9
183	1.34	23.0
183.5	1.61	30.4
184	1.90	39.1
184.5	2.23	49.4
185	2.57	61.4
185.5	2.94	75.2
186	3.31	90.8
186.5	3.71	108.4
187	4.11	127.9
187.5	4.54	149.6
188	4.98	173.3
188.5	5.43	199.3
189	5.90	227.7
189.5	6.38	258.4
190	6.88	291.5
190.5	7.31	327.0
191	7.75	364.7
191.5	8.21	404.5
192	8.67	446.7

192.5	9.15	491.3
193	9.63	538.2
193.5	10.13	587.6
194	10.64	639.6

Table C 13 Blakefield Dam

Level (mAHD)	Area (ha)	Volume (ML)
127.5	0.02	0.0
128	0.03	0.2
128.5	0.05	0.4
129	0.10	0.7
129.5	0.18	1.4
130	0.34	2.6
130.5	0.57	5.0
131	0.71	8.2
131.5	0.84	12.0
132	0.98	16.6
132.5	1.13	21.8
133	1.31	27.9
133.5	1.53	35.0
134	1.80	43.3
134.5	2.08	53.0
135	2.42	64.2
135.5	2.80	77.2
136	3.18	92.2
136.5	3.64	109.2
137	4.18	128.7
137.5	4.79	151.1
137.8	5.18	166.0
138	5.46	176.7
138.5	6.11	205.6
139.8	6.49	224.5

Table C 14 Houston Dam

Level (mAHD)	Area (ha)	Volume (ML)
116	0.00	0.0
116.5	0.06	0.1
117	0.21	0.7
117.5	0.46	2.4
118	0.80	5.5
118.5	1.21	10.5
119	1.70	17.7
119.5	2.27	27.6
120	2.91	40.5

120.5	5.75	67.6
121	6.46	98.1
121.5	7.23	132.3
122	8.04	170.4
122.5	8.91	212.8
123	9.82	259.6
123.5	10.78	311.1
124	11.80	367.5
124.5	12.86	429.1
125	13.97	496.2
125.5	15.13	568.9
126	16.35	647.6
126.5	17.61	732.4
127	18.92	823.7
127.5	20.28	921.7
128	21.69	1026.6
128.5	23.15	1138.6
129	24.66	1258.1
129.5	26.21	1385.3
130	27.82	1520.4
130.5	28.77	1662.0
131	29.68	1808.1
131.5	30.64	1958.9
132	31.63	2114.5

APPENDIX D

OPERATIONAL RULES

Table D 1 Operational Rules, Yr3 - Yr10

	Operational Description	Operating Rules Yr 3	Operating Rules Yr 5	Operating Rules Yr 10
1	Supply to Demands			
1.1	CHPP Mine Water	• Supplied from the Access Rd dam at a rate of 1400kL/d (Average of 2.14Mtpa ROM feed). • Codisposal to the North Void (Option 1). • Tailings disposal into the East Void, rejects disposal to the North Void (Option 2).	• Supplied from the Access Rd dam at a rate of 3620kL/d (Average of 4.8 Mtpa ROM feed). • Codisposal to the North Void (Option 1). • Tailings disposal into the East Void, rejects disposal to the North Void (Option 2).	• Supplied from the Access Rd dam at a rate of 3630kL/d (Average of 5.6Mtpa ROM feed) • Codisposal to the North Void (Option 1). • Tailings disposal into the East Void, rejects disposal to the North Void (Option 2).
1.2	Miscellaneous Industrial use	• Sourced from the Access Road Dam at a rate of 1120kL/d (410ML/yr). • 100% loss assumed.	• Sourced from the Access Road Dam at a rate of 1120kL/d (410ML/yr). • 100% loss assumed.	• Sourced from the Access Road Dam at a rate of 1120kL/d (410ML/yr). • 100% loss assumed.
1.3	Haul Road Dust Suppression	• Supplied from the Access Rd dam • Demand of 96kL/d at a rate of 0.015 L/m2/hr. • Demand of 513kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 96kL/d at a rate of 0.015 L/m2/hr. • Demand of 513kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 96kL/d at a rate of 0.015 L/m2/hr. • Demand of 513kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.4	Stockpile Dust Suppression	• Supplied from the Access Rd dam at a rate of 32kL/d. • 100% loss assumed.	• Supplied from the Access Rd dam at a rate of 32kL/d. • 100% loss assumed.	• Supplied from the Access Rd dam at a rate of 32kL/d. • 100% loss assumed.
1.5	Mine Site Facilities Dust Suppression	• Supplied from the Access Rd dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.6	Drayton South Mine Face and Route Dust Suppression	• Supplied from the Transfer Dam • Demand of 804kL/d • Rate of 0.2 L/m2/hr • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 1469kL/d • Rate of 0.2 L/m2/hr • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 1352kL/d • Rate of 0.2 L/m2/hr • 100% loss assumed.
1.7	Drayton South Haul Road Dust Suppression	• Supplied from the Transfer Dam • Demand of 104kL/d at a rate of 0.015 L/m2/hr. • Demand of 553kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 153kL/d at a rate of 0.015 L/m2/hr. • Demand of 818kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 171kL/d at a rate of 0.015 L/m2/hr. • Demand of 912kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.8	Drayton South MIA Dust Suppression	• Supplied from the Transfer Dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.9	Drayton South Mine Site Facilities Industrial Demand	• Supplied from the MIA Catch Dam and supplemented by Transfer Dam • Demand of 560kL/d, 80% recovery assumed, resulting in net demand of 112 kL/d.	• Supplied from the Mine Site Facilities Catch Dam and supplemented by Transfer Dam • Demand of 560kL/d, 80% recovery assumed, resulting in net demand of 112 kL/d.	• Supplied from the Mine Site Facilities Catch Dam and supplemented by Transfer Dam • Demand of 560kL/d, 80% recovery assumed, resulting in net demand of 112 kL/d.
2	Transfer of Mine Waters			
2.1	North Void	• Codisposal of rejects from CHPP (Option 1) or rejects disposal from CHPP (Option 2) • For Option 2: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Pit dewatering directed to Access Rd Dam for Option 2, no pit dewatering directed to Access Rd Dam for Option 1. • Receives groundwater inflows at a rate of 1070kL/d . • Groundwater inflows reduced by 10% for Option 2 due to tailings deposition.	• Codisposal of rejects from CHPP (Option 1) or rejects disposal from CHPP (Option 2) • For Option 2: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Pit dewatering directed to Access Rd Dam for Option 2, no pit dewatering directed to Access Rd Dam for Option 1. • Receives groundwater inflows at a rate of 1070kL/d . . • Groundwater inflows reduced by 10% for Option 2 due to tailings deposition.	• Codisposal of rejects from CHPP (Option 1) or rejects disposal from CHPP (Option 2) • For Option 2: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Pit dewatering directed to Access Rd Dam for Option 2, no pit dewatering directed to Access Rd Dam for Option 1. • Receives groundwater inflows at a rate of 1070kL/d . . • Groundwater inflows reduced by 10% for Option 2 due to tailings deposition.
2.2	South pit	• Bidirectional transfers to/from the Transfer Dam at a maximum rate of 200L/s. • Supplies Access Rd Dam as required. • Receives transfers from Savoy Dam.	• Bidirectional transfers to/from the Transfer Dam at a maximum rate of 200L/s. • Supplies Access Rd Dam as required. • Receives transfers from Savoy Dam.	• Bidirectional transfers to/from the Transfer Dam at a maximum rate of 200L/s. • Supplies Access Rd Dam as required. • Receives transfers from Savoy Dam.

	Operational Description	Operating Rules Yr 3	Operating Rules Yr 5	Operating Rules Yr 10
		• Receives groundwater inflows at a rate of 350kL/d.	• Receives groundwater inflows at a rate of 350kL/d.	• Receives groundwater inflows at a rate of 350kL/d.
2.3	East Void	• Tailings disposal from CHPP (Option 2). • For Option 1: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. . • No pit dewatering occurs when tailings are co-disposed (Option 2). • Received groundwater inflows at a rate of 1270kL/d . • Groundwater inflows reduced by 10% for Option 1 due to tailings deposition.	• Tailings disposal from CHPP (Option 2). • For Option 1: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. . • No pit dewatering occurs when tailings are co-disposed (Option 2). • Received groundwater inflows at a rate of 1270kL/d . • Groundwater inflows reduced by 10% for Option 1 due to tailings deposition.	• Tailings disposal from CHPP (Option 2). • For Option 1: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. . • No pit dewatering occurs when tailings are co-disposed (Option 2). • Received groundwater inflows at a rate of 1270kL/d . • Groundwater inflows reduced by 10% for Option 1 due to tailings deposition.
2.4	Whynot Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 264kL/d. • Receives spills from highwall dams.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 761kL/d. • Receives spills from highwall dams.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 200L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 2573kL/d. • Receives spills from highwall dams.
2.5	Redbank Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 75kL/d. • Receives spills from highwall dams.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 156kL/d. • Receives spills from highwall dams.	
2.6	Blakefield Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 79 kL/d.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 706kL/d. • Receives spills from highwall dams.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 609kL/d. •
2.7	Houston Pit		• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 87kL/d. •	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Receives no groundwater inflows.
3	Operation of Key Storages			

3.1	Access Road Dam	• Primary mine water storage for CHPP and industrial use.
		• Receives inflows from the following locations:
		  o Pumped transfers from South Void (as required)
		  o Pumped transfers from East Void (tailings decant return-Option 1)
		  o Pumped transfers from North Void (co-disposal decant return-Option 2)
		  o Pumped transfers from all existing Drayton storages.
		• Supplies to the following locations:
		  o Drayton CHPP
		  o Industrial Area
		  o Stockpile Dust Suppression
		  o Drayton Haul Road Dust Suppression
		• Storage overflows to Ramrod Creek
			• Primary mine water storage for CHPP and industrial use.
			• Receives inflows from the following locations:
			  o Pumped transfers from South Pit Void (as required)
			  o Pumped transfers from East Void (tailings decant return-Option 1)
			  o Pumped transfers from North Void (co-disposal decant return-Option 2)
			  o Pumped transfers from all existing Drayton storages.
			• Supplies to the following locations:
			  o Drayton CHPP
			  o Industrial Area
			  o Stockpile Dust Suppression
			  o Drayton Haul Road Dust Suppression
			• Storage overflows to Ramrod Creek
				• Primary mine water storage for CHPP and industrial use.
				• Receives inflows from the following locations:
				  o Pumped transfers from South Void (as required)
				  o Pumped transfers from East Void (tailings decant return-Option 1)
				  o Pumped transfers from North Void (co-disposal decant return-Option 2)
				  o Pumped transfers from all existing Drayton storages.
				• Supplies to the following locations:
				  o Drayton CHPP
				  o Industrial Area
				  o Stockpile Dust Suppression
				  o Drayton Haul Road Dust Suppression
				• Storage overflows to Ramrod Creek

3.2	Rail Loop Dam	• Receives catchment runoff inflows from the CHPP and industrial areas. • Pumped transfers to the Access Rd Dam at 150L/s. • Storage maintained empty. • Storage overflows to Ramrod Creek.	• Receives catchment runoff inflows from the CHPP and industrial areas. • Pumped transfers to the Access Rd Dam at 150L/s. • Storage maintained empty. • Storage overflows to Ramrod Creek.	• Receives catchment runoff inflows from the CHPP and industrial areas. • Pumped transfers to the Access Rd Dam. • Storage maintained empty. • Storage overflows to Ramrod Creek.
3.3	Savoy Dam	• Collects local catchment runoff • Pumped transfer to the South Void as required at 60 L/s. • Maintained at empty. • Storage overflows to Saddlers Creek.	• Collects local catchment runoff • Pumped transfer to the South Void as required. • Maintained at empty. • Storage overflows to Saddlers Creek.	• Collects local catchment runoff • Pumped transfer to the South Void as required. • Maintained at empty. • Storage overflows to Saddlers Creek.

3.4	Transfer Dam	• Receives pit dewatering from all Drayton South pits and storages.
		• Receives transfers from highwall dams.
		• Supplies to the following locations:
		  o Drayton South Haul Road and Mine ramps dust suppression
		  o Drayton South mine face and route dust suppression
		  o Drayton South mine site facilities dust suppression
			• Receives pit dewatering from all Drayton South pits and storages.
			• Receives transfers from highwall dams.
			• Supplies to the following locations:
			  o Drayton South Haul Road and Mine ramps dust suppression
			  o Drayton South mine face and route dust suppression
			  o Drayton South mine site facilities dust suppression
				• Receives pit dewatering from all Drayton South pits and storages.
				• Receives transfers from highwall dams.
				• Supplies to the following locations:
				  o Drayton South Haul Road and Mine ramps dust suppression
				  o Drayton South mine face and route dust suppression
				  o Drayton South mine site facilities dust suppression

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	Operational Description	Operating Rules Yr 3	Operating Rules Yr 5	Operating Rules Yr 10
		○ Drayton South Mine Site Facilities Industrial demand(as required) ○ Bidirectional transfer to Houston Dam at a rate of 250L/s • Bidirectional transfer to/from South Void as required at a rate of approximately 200L/s. • Storage overflows to Saddlers Creek	○ Drayton South Mine Site Facilities Industrial demand(as required) ○ Bidirectional transfer to Houston Dam at a rate of 250L/s • Bidirectional transfer to/from South Void as required at a rate of approximately 200L/s. • Storage overflows to Saddlers Creek	○ Drayton South Mine Site Facilities Industrial demand(as required) ○ Bidirectional transfer to Houston Dam at a rate of 250L/s • Bidirectional transfer to/from South Void as required at a rate of approximately 200L/s. • Storage overflows to Saddlers Creek
3.5	**Houston Dam**	• Bidirectional transfer to Transfer Dam at a rate of 250L/s • Strategic discharge to Hunter River under HRSTS (if applicable). • Receives water extracted from Hunter River (if applicable)	• Bidirectional transfer to Transfer Dam at a rate of 250L/s • Strategic discharge to Hunter River under HRSTS (if applicable). • Receives water extracted from Hunter River (if applicable)	• Bidirectional transfer to Transfer Dam at a rate of 250L/s • Strategic discharge to Hunter River under HRSTS (if applicable). • Receives water extracted from Hunter River (if applicable)
3.6	**Blakefield Dam**	• Collects local catchment runoff • Receives transfers from highwall dams. • Pumped discharge to Transfer Dam as required at 100 L/s • Overflows to Saddlers Creek.	• Collects local catchment runoff • Receives transfers from highwall dams. • Pumped discharge to Transfer Dam as required at 100 L/s • Overflows to Saddlers Creek.	• Collects local catchment runoff • Receives transfers from highwall dams. • Pumped discharge to Transfer Dam as required at 100 L/s • Overflows to Saddlers Creek.
3.7	**Drayton South Mine Site Facilities Catch Dam**	• Dirty water catch dam servicing Drayton South mine site facilities • Pumped discharge to Transfer Dam as required • Overflows to Drayton South Mine Site Facilities Sediment Dam • Supplies the Drayton South Mine Site Facilities Industrial demand.	• Dirty water catch dam servicing Drayton South mine site facilities • Pumped discharge to Transfer Dam as required • Overflows to Drayton South Mine Site Facilities Sediment Dam • Supplies the Drayton South Mine Site Facilities Industrial demand.	• Dirty water catch dam servicing Drayton South mine site facilities • Pumped discharge to Transfer Dam as required • Overflows to Drayton South Mine Site Facilities Sediment Dam • Supplies the Drayton South Mine Site Facilities Industrial demand.
3.8	**Drayton South Mine Site Facilities Sediment Dam**	• Receives overflows from the Drayton South Mine Site Facilities Catch Dam and Whynot spoil area • Pumped transfers to the Transfer Dam as required • Overflows to Saddlers Creek	• Receives overflows from the Drayton South Mine Site Facilities Catch Dam and Whynot spoil area • Pumped transfers to the Transfer Dam as required • Overflows to Saddlers Creek	• Receives overflows from the Drayton South Mine Site Facilities Catch Dam and Whynot spoil area • Pumped transfers to the Transfer Dam as required • Overflows to Saddlers Creek
3.9	**Spoil Runoff Dams**	• Receives overflows from the various spoil areas • Pumped transfers to the Transfer Dam • Overflow to Saddlers Creek	• Receives overflows from the various spoil areas • Pumped transfers to the Transfer Dam • Overflow to Saddlers Creek	• Receives overflows from the various spoil areas • Pumped transfers to the Transfer Dam • Overflow to Saddlers Creek
3.10	**Highwall Dams**	• Receive clean catchment runoff upstream of the mining pits. • Pumped transfers to the Transfer Dam or Blakefield Dam • Overflows to the various mining pits that they are located above.	• Receive clean catchment runoff upstream of the mining pits. • Pumped transfers to the Transfer Dam or Blakefield Dam • Overflows to the various mining pits that they are located above.	• Receive clean catchment runoff upstream of the mining pits. • Pumped transfers to the Transfer Dam or Blakefield Dam • Overflows to the various mining pits that they are located above.
4	General	All storages and pits receive local catchment runoff and lose water through evaporation.	All storages and pits receive local catchment runoff and lose water through evaporation.	All storages and pits receive local catchment runoff and lose water through evaporation.

Table D 2 Operational Rules, Yr15-Yr 27

	Operational Description	Operating Rules Yr 15	Operating Rules Yr 20	Operating Rules Yr 27
1	**Supply to Demands**			
1.1	CHPP Mine Water	• Supplied from the Access Rd dam at a rate of 3680kL/d (Average of 5.6Mtpa ROM feed). • Codisposal to the North Void (Option 1). • Tailings disposal into the East Void, rejects disposal to the North Void (Option 2).	• Supplied from the Access Rd dam at a rate of 3040kL/d (Average of 4.88 Mtpa ROM feed). • Codisposal to the North Void (Option 1). • Tailings disposal into the East Void, rejects disposal to the North Void (Option 2).	• Supplied from the Access Rd dam at a rate of 1610kL/d (Average of 2.72 Mtpa ROM feed). • Codisposal to the North Void (Option 1). • Tailings disposal into the East Void, rejects disposal to the North Void (Option 2).
1.2	Miscellaneous Industrial use	• Sourced from the Access Road Dam at a rate of 1120kL/d (410ML/yr). • 100% loss assumed.	• Sourced from the Access Road Dam at a rate of 1120kL/d (410ML/yr). • 100% loss assumed.	• Sourced from the Access Road Dam at a rate of 1120kL/d (410ML/yr). • 100% loss assumed.
1.3	Haul Road Dust Suppression	• Supplied from the Access Rd dam • Demand of 96kL/d at a rate of 0.015 L/m2/hr. • Demand of 513kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 96kL/d at a rate of 0.015 L/m2/hr. • Demand of 513kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 96kL/d at a rate of 0.015 L/m2/hr. • Demand of 513kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.4	Stockpile Dust Suppression	• Supplied from the Access Rd dam at a rate of 32kL/d. • 100% loss assumed.	• Supplied from the Access Rd dam at a rate of 32kL/d. • 100% loss assumed.	• Supplied from the Access Rd dam at a rate of 32kL/d. • 100% loss assumed.
1.5	Mine Site Facilities Dust Suppression	• Supplied from the Access Rd dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Access Rd dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.6	Drayton South Mine Face and Route Dust Suppression	• Supplied from the Transfer Dam • Demand of 1237kL/d • Rate of 0.2 L/m2/hr • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 926 kL/d • Rate of 0.2 L/m2/hr • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 926kL/d • Rate of 0.2 L/m2/hr • 100% loss assumed.
1.7	Drayton South Haul Road Dust Suppression	• Supplied from the Transfer Dam • Demand of 157kL/d at a rate of 0.015 L/m2/hr. • Demand of 835kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 142kL/d at a rate of 0.015 L/m2/hr. • Demand of 757kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 150kL/d at a rate of 0.015 L/m2/hr. • Demand of 800kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.8	Drayton South Mine Site Facilities Dust Suppression	• Supplied from the Transfer Dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.	• Supplied from the Transfer Dam • Demand of 3.2kL/d at a rate of 0.015 L/m2/hr. • Demand of 17kL/d at a rate of 0.08 L/m2/hr. • 100% loss assumed.
1.9	Drayton South Mine Site Facilities Industrial Demand	• Supplied from the Mine Site Facilities Catch Dam and supplemented by Transfer Dam • Demand of 560kL/d, 80% recovery assumed, resulting in net demand of 112 kL/d.	• Supplied from the Mine Site Facilities Catch Dam and supplemented by Transfer Dam • Demand of 560kL/d, 80% recovery assumed, resulting in net demand of 112 kL/d.	• Supplied from the Mine Site Facilities Catch Dam and supplemented by Transfer Dam • Demand of 560kL/d, 80% recovery assumed, resulting in net demand of 112 kL/d.
2	**Transfer of Mine Waters**			
2.1	North Void	• Codisposal of rejects from CHPP (Option 1) or rejects disposal from CHPP (Option 2) • For Option 2: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Pit dewatering directed to Access Rd Dam for Option 2, no pit dewatering directed to Access Rd Dam for Option 1. • Receives groundwater inflows at a rate of 1070kL/d . . • Groundwater inflows reduced by 10% for Option 2 due to tailings deposition.	• Codisposal of rejects from CHPP (Option 1) or rejects disposal from CHPP (Option 2) • For Option 2: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Pit dewatering directed to Access Rd Dam for Option 2, no pit dewatering directed to Access Rd Dam for Option 1. • Receives groundwater inflows at a rate of 1070kL/d . . • Groundwater inflows reduced by 10% for Option 2 due to tailings deposition.	• Codisposal of rejects from CHPP (Option 1) or rejects disposal from CHPP (Option 2) • For Option 2: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Pit dewatering directed to Access Rd Dam for Option 2, no pit dewatering directed to Access Rd Dam for Option 1. • Receives groundwater inflows at a rate of 1070kL/d . . • Groundwater inflows reduced by 10% for Option 2 due to tailings deposition.
2.2	South pit	• Bidirectional transfers to/from the Transfer Dam at a maximum rate of 200L/s. • Supplies Access Rd Dam as required. • Receives transfers from Savoy Dam. • Receives groundwater inflows at a rate of 350kL/d.	• Bidirectional transfers to/from the Transfer Dam at a maximum rate of 200L/s. • Supplies Access Rd Dam as required. • Receives transfers from Savoy Dam. • Receives groundwater inflows at a rate of 350kL/d.	• Bidirectional transfers to/from the Transfer Dam at a maximum rate of 200L/s. • Supplies Access Rd Dam as required. • Receives transfers from Savoy Dam. • Receives groundwater inflows at a rate of 350kL/d.

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	Operational Description	Operating Rules Yr 15	Operating Rules Yr 20	Operating Rules Yr 27
2.3	East Void	• Tailings disposal from CHPP (Option 2). • For Option 1: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. . • No pit dewatering occurs when tailings are co-disposed (Option 2). • Received groundwater inflows at a rate of 1270kL/d . • Groundwater inflows reduced by 10% for Option 1 due to tailings deposition.	• Tailings disposal from CHPP (Option 2). • For Option 1: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. . • No pit dewatering occurs when tailings are co-disposed (Option 2). • Received groundwater inflows at a rate of 1270kL/d . • Groundwater inflows reduced by 10% for Option 1 due to tailings deposition.	• Tailings disposal from CHPP (Option 2). • For Option 1: Decant return discharges to Access Rd Dam for two scenarios: 30% and 45%. • Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. . • No pit dewatering occurs when tailings are co-disposed (Option 2). • Received groundwater inflows at a rate of 1270kL/d . • Groundwater inflows reduced by 10% for Option 1 due to tailings deposition.
2.4	Whynot Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 200L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 2328kL/d. • Receives spills from highwall dams.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 200L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 1358 kL/d. • Receives spills from highwall dams.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 200L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 354kL/d. • Receives spills from highwall dams.
2.5	Redbank Pit			
2.6	Blakefield Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Received groundwater inflows at an average rate of 45 kL/d. •	• No active mining occurring in-pit. • Recontoured as a diversion to Blakefield Dam.	• No active mining occurring. • Recontoured as a diversion to Blakefield Dam.
2.7	Houston Pit	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Receives no groundwater inflows.	• Continuous pumping from pit dewatering pumps (when required) at a nominal maximum rate of 100L/s. • Pit dewatering directed to Transfer Dam. • Receives no groundwater inflows.	• No active mining occurring. • Recontoured, catchment draining to Houston Dam.
3	Operation of Key Storages			

3.1	Access Road Dam	• Primary mine water storage for CHPP and industrial use.
		• Receives inflows from the following locations:
		  o Pumped transfers from South Void (as required)
		  o Pumped transfers from East Void (tailings decant return-Option 1)
		  o Pumped transfers from North Void (co-disposal decant return-Option 2)
		  o Pumped transfers from all existing Drayton storages.
		• Supplies to the following locations:
		  o Drayton CHPP
		  o Industrial Area
		  o Stockpile Dust Suppression
		  o Drayton Haul Road Dust Suppression
		• Storage overflows to Ramrod Creek
			• Primary mine water storage for CHPP and industrial use.
			• Receives inflows from the following locations:
			  o Pumped transfers from South Void (as required)
			  o Pumped transfers from East Void (tailings decant return-Option 1)
			  o Pumped transfers from North Void (co-disposal decant return-Option 2)
			  o Pumped transfers from all existing Drayton storages.
			• Supplies to the following locations:
			  o Drayton CHPP
			  o Industrial Area
			  o Stockpile Dust Suppression
			  o Drayton Haul Road Dust Suppression
			• Storage overflows to Ramrod Creek
				• Primary mine water storage for CHPP and industrial use.
				• Receives inflows from the following locations:
				  o Pumped transfers from South Void (as required)
				  o Pumped transfers from East Void (tailings decant return-Option 1)
				  o Pumped transfers from North Void (co-disposal decant return-Option 2)
				  o Pumped transfers from all existing Drayton storages.
				• Supplies to the following locations:
				  o Drayton CHPP
				  o Industrial Area
				  o Stockpile Dust Suppression
				  o Drayton Haul Road Dust Suppression
				• Storage overflows to Ramrod Creek

3.2	Rail Loop Dam	• Receives catchment runoff inflows from the CHPP and industrial areas. • Pumped transfers to the Access Rd Dam. • Storage maintained empty. • Storage overflows to Ramrod Creek.	• Receives catchment runoff inflows from the CHPP and industrial areas. • Pumped transfers to the Access Rd Dam. • Storage maintained empty. • Storage overflows to Ramrod Creek.	• Receives catchment runoff inflows from the CHPP and industrial areas. • Pumped transfers to the Access Rd Dam. • Storage maintained empty. • Storage overflows to Ramrod Creek.
3.3	Savoy Dam	• Collects local catchment runoff • Pumped transfer to the South Void as required. • Maintained at empty. • Storage overflows to Saddlers Creek.	• Collects local catchment runoff • No pumped transfer to the SouthVoid. • Storage overflows to Saddlers Creek.	• Collects local catchment runoff • No pumped transfer to the South Void. • Storage overflows to Saddlers Creek.

3.4	Transfer Dam	• Receives pit dewatering from all Drayton South pits and storages.
		• Receives transfers from highwall dams.
		• Supplies to the following locations:
		  o Drayton South Haul Road and Mine ramps dust suppression
		  o Drayton South mine face and route dust suppression
		  o Drayton South mine site facilities dust suppression
		  o Drayton South Mine Site Facilities Industrial demand(as required)
		  o Bidirectional transfer to Houston Dam at a rate of 250L/s
		• Bidirectional transfer to/from South Void as required at a rate of approximately 200L/s.
		• Storage overflows to Saddlers Creek
			• Receives pit dewatering from all Drayton South pits and storages.
			• Receives transfers from highwall dams.
			• Supplies to the following locations:
			  o Drayton South Haul Road and Mine ramps dust suppression
			  o Drayton South mine face and route dust suppression
			  o Drayton South mine site facilities dust suppression
			  o Drayton South Mine Site Facilities Industrial demand(as required)
			  o Bidirectional transfer to Houston Dam at a rate of 250L/s
			• Bidirectional transfer to/from South Void as required at a rate of approximately 200L/s.
			• Storage overflows to Saddlers Creek
				• Receives pit dewatering from all Drayton South pits and storages.
				• Receives transfers from highwall dams.
				• Supplies to the following locations:
				  o Drayton South Haul Road and Mine ramps dust suppression
				  o Drayton South mine face and route dust suppression
				  o Drayton South mine site facilities dust suppression
				  o Drayton South Mine Site Facilities Industrial demand(as required)
				  o Bidirectional transfer to Houston Dam at a rate of 250L/s
				• Bidirectional transfer to/from South Void as required at a rate of approximately 200L/s.
				• Storage overflows to Saddlers Creek

3.5	Houston Dam	• Bidirectional transfer to Transfer Dam at a rate of 250L/s • Strategic discharge to Hunter River under HRSTS (if applicable). • Receives water extracted from Hunter River (if applicable)	• Bidirectional transfer to Transfer Dam at a rate of 250L/s • Strategic discharge to Hunter River under HRSTS (if applicable). • Receives water extracted from Hunter River (if applicable)	• Bidirectional transfer to Transfer Dam at a rate of 250L/s • Strategic discharge to Hunter River under HRSTS (if applicable). • Receives water extracted from Hunter River (if applicable)

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	Operational Description	Operating Rules Yr 15	Operating Rules Yr 20	Operating Rules Yr 27
3.6	Blakefield Dam	• Decommissioned. • Overflows to Saddlers Creek.	• Decommissioned. • Receives transfers from highwall dams. • No pumped discharge to Transfer Dam. • Overflows to Saddlers Creek.	• Decommissioned. • Receives transfers from highwall dams. • No pumped discharge to Transfer Dam. • Overflows to Saddlers Creek.
3.7	Drayton South Mine Site Facilities Catch Dam	• Dirty water catch dam servicing Drayton South mine site facilities • Pumped discharge to Transfer Dam as required • Overflows to Drayton South Mine Site Facilities Sediment Dam • Supplies the Drayton South Mine Site Facilities Industrial demand.	• Dirty water catch dam servicing Drayton South mine site facilities • Pumped discharge to Transfer Dam as required • Overflows to Drayton South Mine Site Facilities Sediment Dam • Supplies the Drayton South Mine Site Facilities Industrial demand.	• Dirty water catch dam servicing Drayton South mine site facilities • Pumped discharge to Transfer Dam as required • Overflows to Drayton South Mine Site Facilities Sediment Dam • Supplies the Drayton South Mine Site Facilities Industrial demand.
3.8	Drayton South Mine Site Facilities Sediment Dam	• Receives overflows from the Drayton South Mine Site Facilities Catch Dam and Whynot spoil area • Pumped transfers to the Transfer Dam as required • Overflows to Saddlers Creek	• Receives overflows from the Drayton South Mine Site Facilities Catch Dam and Whynot spoil area • Pumped transfers to the Transfer Dam as required • Overflows to Saddlers Creek	• Receives overflows from the Drayton South Mine Site Facilities Catch Dam and Whynot spoil area • Pumped transfers to the Transfer Dam as required • Overflows to Saddlers Creek
3.9	Spoil Runoff Dams	• Receives overflows from the various spoil areas • Pumped transfers to the Transfer Dam • Overflow to Saddlers Creek	• Receives overflows from the various spoil areas • Pumped transfers to the Transfer Dam • Overflow to Saddlers Creek	• Receives overflows from the various spoil areas • Pumped transfers to the Transfer Dam • Overflow to Saddlers Creek
3.10	Highwall Dams	• Receive clean catchment runoff upstream of the mining pits. • Pumped transfers to the Transfer Dam or Blakefield Dam • Overflows to the various mining pits that they are located above.	• Receive clean catchment runoff upstream of the mining pits. • Pumped transfers to the Transfer Dam or Blakefield Dam • Overflows to the various mining pits that they are located above.	• Receive clean catchment runoff upstream of the mining pits. • Pumped transfers to the Transfer Dam or Blakefield Dam • Overflows to the various mining pits that they are located above.
4	General	All storages and pits receive local catchment runoff and lose water through evaporation.	All storages and pits receive local catchment runoff and lose water through evaporation.	All storages and pits receive local catchment runoff and lose water through evaporation.