MOC

WATER MANAGEMENT PLAN

NOVEMBER 2011

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EXECUTIVE SUMMARY

The Mount Owen Complex (MOC) is owned and managed by Xstrata Mt Owen (XMO) and is located in the Hunter Valley of NSW. The MOC consists of three adjacent DA approved open cut coal mines; Mt Owen, Ravensworth East (West Pit) and Glendell Mines. Mt Owen Mine is contract mined, currently by Thiess Pty Ltd (Thiess). The Glendell mine is owned and operated by XMO and comprises the Barrett Pit and West Pit (formerly known as Ravensworth East Mine).

The current Mt Owen Mine development consent enables the integration of the Ravensworth East and Glendell mining operations into the MOC through the shared use of coal transportation and coal processing infrastructure, and tailings management systems. Following the acquisition of Glendell Mine in 2003, Xstrata has developed synergies between the three adjacent mining operations: Mt Owen; Ravensworth East; and Glendell. Approval was granted in 2004 for the extension to open cut mining operations at Mt Owen and integration of the proposed Glendell Mine into the MOC (DA 14-1-2004). Development consent for the Ravensworth East Mine (DA 52-03-99) was granted in 2000 and was modified in August 2005 to align with the Mt Owen Consent and provided for the integration of the mining operations' management into the MOC. A modification, approved in 2008, to the Glendell Mine development consent (DA 80/952), enabled the implementation of a revised mining plan while maintaining the synergies with the approved MOC. Mt Owen consent was also modified in November 2010 to accommodate rail refuelling facility on the Mt Owen rail spur.

XMO will manage the adjacent mining operations as a single unit. One of the issues central to this process is the development of an integrated Water Management Plan for the MOC. This Water Management Plan (WMP) has been developed to satisfy the relevant consent conditions of MOC.

The mining operations have the potential to impact surface and groundwaters due to the existing and future increase in the mining footprint, construction of new infrastructure and access roads, changes to mining operations and diversions of creeks around the MOC.

This WMP describes the potential impacts of the modifications on the water management system and water balance for the site, as well as outlining the erosion and sediment controls, surface and groundwater monitoring programs and response plan to manage these impacts. This WMP has been designed to mitigate the impact of the development on the surrounding environment. The implementation of the controls outlined in the *Erosion and Sediment Control Plan* will facilitate the management and mitigation of the impacts of the development on site water quality and surrounding waterways. Surface and groundwater will be monitored in accordance with the *Surface Water and Groundwater Monitoring Programs* and any results outside the relevant impact assessment criteria will be addressed by the implementation of the *Surface Water and Groundwater Response Plan*. The implementation of the programs, procedures and controls outlined in this WMP will ensure that the impacts of the MOC are minimised.

1. COMMITMENT AND POLICY

1.1 Purpose

1.11 Overview of the MOC

MOC is owned and managed by Xstrata Mt Owen (XMO) and is located in the Hunter Valley of NSW. The MOC consists of three adjacent DA approved open cut coal mines; Mt Owen, Ravensworth East (West Pit) and Glendell Mines. Mt Owen Mine is contract mined, currently by Thiess Pty Ltd (Thiess). The Glendell mine is owned and operated by XMO and comprises the Barrett Pit and West Pit (formerly known as Ravensworth East Mine).

The current Mt Owen Mine development consent enables the integration of the Ravensworth East and Glendell mining operations into the MOC through the shared use of coal transportation and coal processing infrastructure, and tailings management systems. Following the acquisition of Glendell Mine in 2003, Xstrata has developed synergies between the three adjacent mining operations: Mt Owen; Ravensworth East; and Glendell. Approval was granted in 2004 for the extension to open cut mining operations at Mt Owen and integration of the Glendell Mine into the MOC (DA 14-1-2004). Development consent for the Ravensworth East Mine (DA 52-03-99) was granted in 2000 and was modified in August 2005 to align with the Mt Owen Consent and provided for the integration of the mining operations' management into the MOC. A modification, approved in 2008, to the Glendell Mine development consent (DA 80/952), enabled the implementation of a revised mining plan while maintaining the synergies with the approved MOC. Mt Owen consent was also modified in November 2010 to accommodate a rail refuelling facility on the Mt Owen rail spur.

The MOC (MOC) comprises land within the catchments of Swamp Creek, Yorks Creek, Bowmans Creek, Main Creek and Bettys Creek. Both Swamp Creek and Bettys Creek flow in a southerly direction into Bowmans Creek which discharges into the Hunter River. The upper reaches of Swamp Creek have been diverted into Yorks Creek to the west of the MOC as part of the mine development. The upper reaches of Bettys Creek will be diverted into Main Creek to the east of the MOC under existing licences from the Department of Water and Energy (DWE). Sections of these diversions have been completed while others are currently under construction.

XMO will manage the adjacent mining operations as a single unit. One of the issues central to this process is the development of an integrated Water Management Plan for the MOC. In addition to this, the MOC will be an integral part of the Greater Ravensworth Mine Water Sharing System (GRMWSS) with the Cumnock, Ravensworth Operations, Narama, Ravensworth Underground and Liddell mining operations. The GRMWSS will allow greater flexibility in mine water management by the MOC.

Glendell Mine approvals include a diversion of Swamp Creek around the north-east of the mining area and the diversion of Bettys Creek around the south-east and southern approved mining areas. As part of the current approvals for Glendell Mine, a 200 ML Mine Water Staging Dam may be built to the north of the approved mining area to network with the existing MOC water management system, however this has not yet been constructed. Two smaller dams will be built to supply recycled water to the infrastructure areas and control sediment run-off.

The primary sources of water supply for the MOC are:

- water from the nearby Liddell Colliery (Xstrata owned) underground workings, pumped to Mt Owen from the Liddell borehole;
- mine water from other Xstrata owned operations;
- an allocation of up to 1020 ML/yr from Glennies Creek
- catchment runoff from disturbed areas; and
- groundwater inflows to the open cut pits.

Water retained on site is used in the Coal Handling and Preparation Plant (CHPP) and for dust suppression.

It is anticipated that during periods of water surplus, excess water from MOC will be disposed of off-site. When appropriate, water will be pumped to the GRMWSS via the Southern Dam or to the Liddell Colliery underground workings.

The MOC is licensed to discharge water under the rules of the Hunter River Salinity Trading Scheme (HRSTS) and currently holds adequate salt credits to allow discharging. The Environmental Protection Licence (EPL) (No. 4460) permits controlled discharges from Mt Owen to Swamp Creek at a maximum rate of 66 ML/day.

In order to reduce the potential for impacts on surface water and groundwater resources the MOC has implemented a range of on-site controls and comprehensive water monitoring programs for surface water and groundwater.

1.2 Scope

1.21 Overview of the Water Management Plan

This WMP provides a framework for the management of water on-site at the MOC. This WMP is a revision of the *MOC Water Management Plan* (Xstrata, 2008). The WMP provides details on:

- the site water management strategy;
- site water balance;

The WMP should also be read in conjunction with the following plans with each section discussed in this plan.

- Erosion and sediment Management Plan;
- Surface Water Monitoring Program;
- Groundwater Monitoring Program;
- Surface Water and Groundwater Response Plan;
- Swamp Creek Diversion Detailed Design;
- Bettys Creek diversion Stage 2 Monitoring and Maintenance;

2. PLANNING

2.1 Approvals

2.11 Development Consents

The preparation of a WMP is required by the consent conditions for Mt Owen (DA 14-1-2004), Ravensworth East (DA 52-03-99), and Glendell Mines (DA 80/952).

2.12 Environmental Protection Licence

EPLs are administered by the NSW Office of Environment and Heritage (OEH). The licences include criteria for discharges of water (refer to **Section 3.24**) and requirements for water monitoring and reporting.

XMO holds EPL No. 12840 for Glendell Mine, EPL N0. 4460 for Mt Owen and EPL No. 10860 for Ravensworth East Mines.

2.13 Water Licences

XMO currently holds groundwater licences under the *Water Act 1912* for the operation of extraction and monitoring bores. The details of these licences are presented in the Groundwater Monitoring Program.

XMO holds licences under the *Water Act 1912* for the diversions of Bettys and Swamp Creeks, as well as licences under *Water Management Act 2000* for the operation of a pumping plant located at Glennies Creek and a water access licence for Glennies Creek. The details of these licences are presented in the Surface Water and Groundwater Monitoring Programs.

A summary of the details licences currently held by XMO are presented in **Table 1**.

Table 1 - Water Licences held by XMO for the MOC

Water Licence Number	Licensed Activity
20AL200722 (high security)	Licence to pump 1000 units of high security water from Glennies Creek
20WA200723	Pumping Plant on Glennies Creek
20AL200890 (general security)	Licence to pump 20 units of general security water from Glennies Creek
20WA200891	Pumping Plant on Glennies Creek
20BL169332 to 20BL169336	Monitoring bore
20BL169337	Bore
20BL168209	Saline water extraction bore

Water Licence Number	Licensed Activity
20BL169544	Saline water extraction bore
20BL168116	Saline water extraction bore
20SL052139	Diversion of Swamp Creek – Mt Owen Mine
20SL061065	Diversion of Swamp Creek – Ravensworth East Mine
20SL061386	Diversion of Bettys Creek

As part of the Environmental Assessment (EA) for Modification of Glendell Mine (Umwelt, 2007) it was recognised that Glendell Mine will require Part 2 licences under *Water Act 1912* for the diversion of Swamp Creek and Bettys Creek and a Part 5 licence for groundwater extraction from the open cut pit. A copy of the Swamp Creek Diversion Detailed Design Report (Parsons Brinckerhoff, 2008) that was prepared in support of the Part 2 licence is incorporated into the WMP. Applications are currently being prepared for the Part 2 licence for the diversion of Bettys Creek around the southern edge of the Glendell Mine and Part 5 licence for groundwater extraction from the Glendell open cut pit and will be incorporated into the WMP when completed.

2.2 Statutory Requirements

In addition to the relevant approvals, the MOC WMP has been prepared with reference to:

- Protection of the Environment Operations Act 1997 (POEO Act) administered by the OEH;
- *Water Act 1912*, administered by NSW Office of Water (NOW);
- Water Management Act 2000, administered by NOW;
- *Environmental Planning and Assessment Act 1979* (EP&A Act) administered by the Department of Planning and Infrastructure (DoPI);

3. IMPLEMENTATION

3.1 Overview of the MOC Mine Water Management System

The key components of the MOC water management system, shown in relation to surrounding catchments, are presented in **Figure 1**.

3.11 Water Management System Objectives

The MOC has an extensive water management system, which includes mine dewatering systems, creek diversions, water storages, sediment dams, tailings ponds, drains and earth bunding around stockpiles, hardstand areas and fuelling areas. The key functions of these controls are to:

- prevent the contamination of clean water by mining activities;
- segregate clean waters away from active mining areas to reduce the volume of mine affected water requiring subsequent storage and treatment;
- minimise the discharge of pollutants from mining affected areas into the environment;
- manage approved water discharges to meet licence conditions; and
- minimise adverse effects of mining activities on the surrounding areas.

The objectives of the mine water management system are as follows:

- quantify the water used, stored and imported/exported;
- minimise the demand for high quality water in mining operations (including water sourced from Glennies Creek);
- minimise inflow into the pit void from the alluvium of Swamp and Bettys Creeks;
- maximise recycling and water sharing opportunities; and
- minimise discharges under HRSTS.

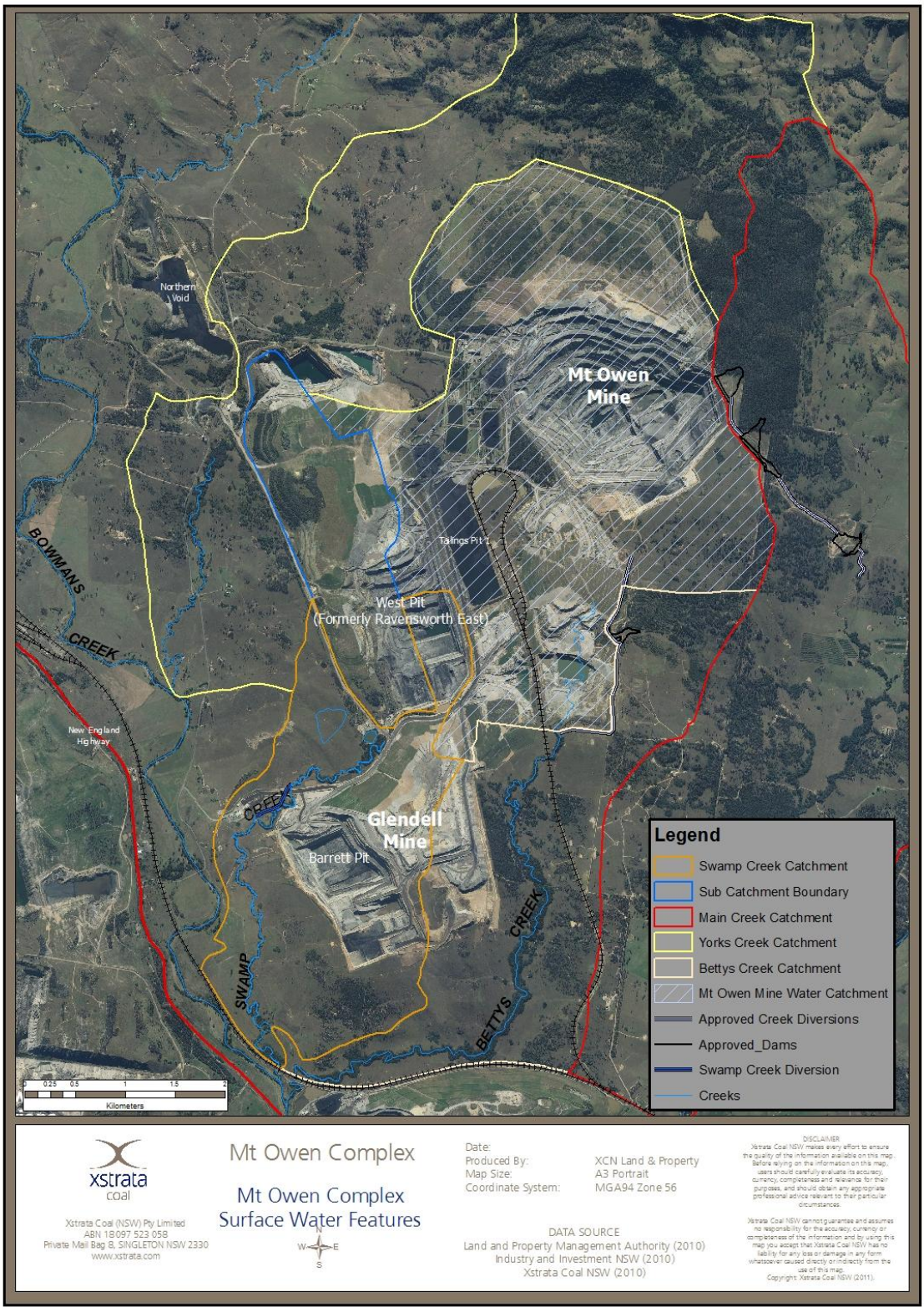

Figure 1 Mt Owen Surface Water Features

3.12 Mine Water Management System Components

The ongoing development of the water management systems for the MOC mining operations including dams, storage tanks, pipelines and pumping infrastructure will be integrated as part of the existing MOC water management system. The existing water management system is supported by the Citect continuous monitoring and management system and a schedule of regular inspections and maintenance works is in place.

3.2 Site Water Balance

The development consent conditions for Mt Owen, Ravensworth East and Glendell Mines each specify requirements for the preparation of a site water balance.

The future site water balance for the Mt Owen and Ravensworth East mining operations was assessed as part of the *Environmental Impact Statement Mt Owen Operations* (Umwelt, 2003) and *Ravensworth East Mine Environmental Impact Statement* (EIS) (ERM, 1999). The future site water balance for Glendell Mine was assessed as part of the *Glendell Environmental Assessment* (EA) (Umwelt, 2007).

The current reporting and predictive site water balances for each mine and for the combined MOC builds on information contained in the environmental assessments listed above and additional data gathered since their preparation. A schematic showing the interactions of the key mine water management system components is presented in **Figure 1**.

3.21 Water Sources

The sources of water supply to the MOC are summarised as:

- water imported from Liddell and Narama Mines;
- external water supply from Glennies Creek;
- runoff captured from the footprint of the mining disturbance area by the water management system; and
- groundwater inflows to the open cut mining pits.

3.211 Runoff from Land Surface

A network of diversions has been established to minimise the inflow of clean water into active mining areas. Water that accumulates within mining pits is pumped to surface storages for re-use in the mining operations and CHPP. Table 2 summarises the predicted mine water management system catchment areas for the MOC.

Table 2 - Future Predicted Mine Water Management System Catchment Areas (ha)

Year	Ravensworth East Mine	Mt Owen Mine	Glendell Mine	MOC Total
2013	470	893	311	1674
2018	470	848	314	1633
2023	0 [1]	821	301	1122

Note 1: End of current development consent for Ravensworth East Mine – will not report to the MOC water management system

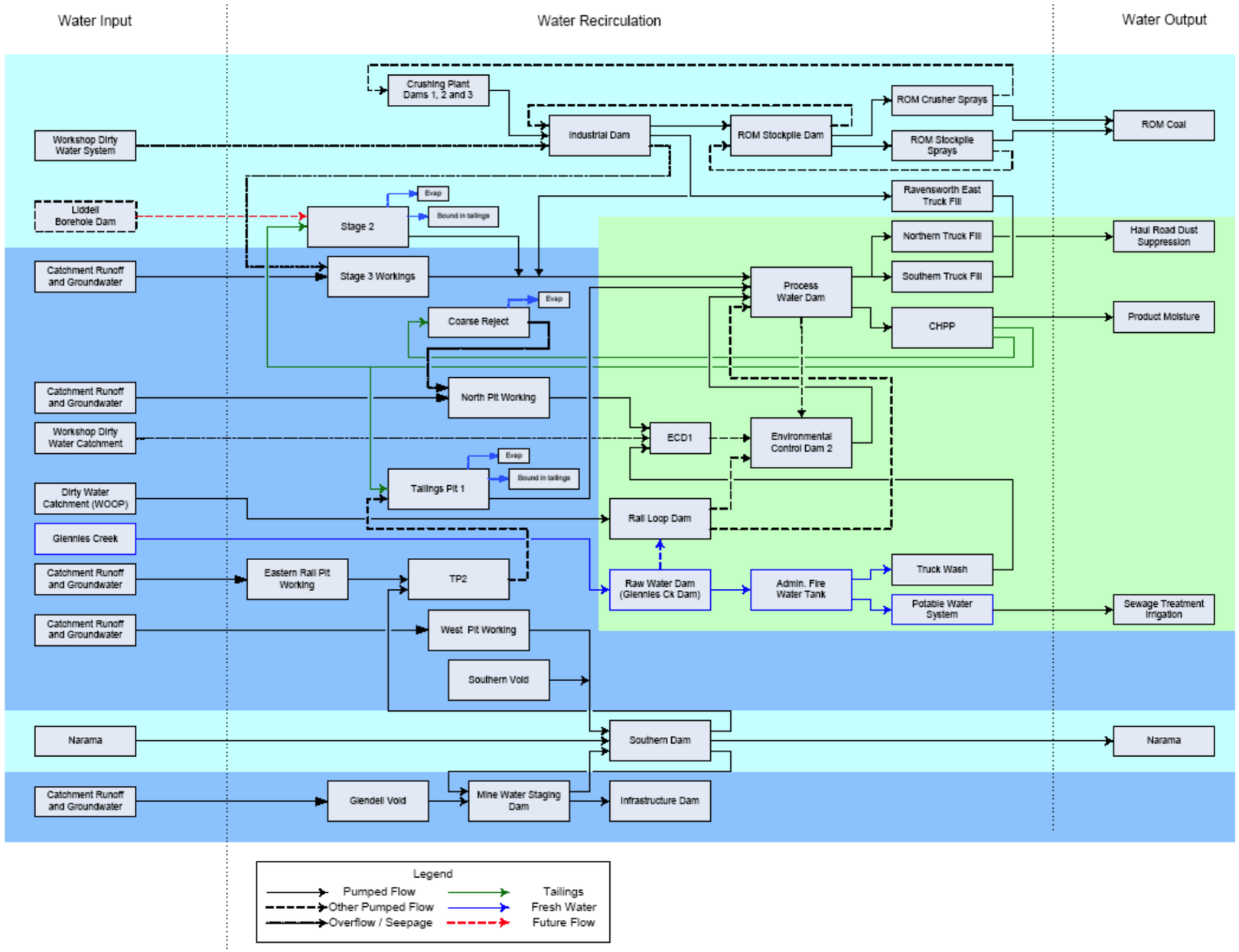

Figure 2 XMO Water Balance Model

The catchment areas (refer to **Table 3.1**) are sourced from the relevant Ravensworth EIS (ERM, 1999), Mt Owen EIS (Umwelt, 2003) and Glendell EA (Umwelt, 2008) and include the following assumptions:

- Ravensworth East Mine:
  - all catchment areas fully rehabilitated by 2020;
  - no catchment area contributing to the MOC water balance after 2020 (end of current approval);
  - Tailings Pit 1 and TP2 which are included in the catchment areas listed in the Ravensworth EIS (ERM, 1999) form part of the catchment area of Mt Owen Mine water management system. These catchments are included in the Mt Owen EIS (Umwelt, 2003) and form part of the Mt Owen Mine operations;

- Mt Owen Mine:
  - North Pit catchment area is rehabilitated and runoff from established rehabilitation areas diverted off-site in accordance with Mt Owen EIS proposed staging (Umwelt, 2003);
  - West Dump and associated Rail Loop Dam catchment areas are fully rehabilitated by 2013 and do not contribute to the MOC water management system catchment area after 2013 (in accordance with Mt Owen EIS (Umwelt, 2003));
  - Stages 1 & 2 catchment areas are fully rehabilitated by 2013, however continue to contribute to the MOC water management system catchment area;
  - Eastern Rail Pit catchment area fully rehabilitated by 2013 and does not contribute to the MOC water management system catchment area after 2013 (in accordance with Mt Owen EIS(Umwelt, 2003));

- Glendell Mine:
  - catchment areas in accordance with the Glendell EA (Umwelt, 2008).

3.212 Import from Other Mines

Where practical, the MOC seeks to use surplus mine water from other mines in preference to fresh water from Glennies Creek and clean catchment runoff. Currently, infrastructure is in place to import mine water from the neighbouring Liddell and Narama Mines. XMO is continually seeking new opportunities to introduce mine water sharing schemes with other mines to minimise the consumption of fresh water from Glennies Creek.

3.213 Pumping from Glennies Creek

The MOC holds a water access licence to extract up to 1000 units of high security water and 20 units of general security water from Glennies Creek (refer to **Section 2.32**). Water from Glennies Creek is used for potable water for the administration offices, workshop, bath houses, for industrial water in the workshop and as the water supply for the fire fighting systems. Where possible, use of water from Glennies Creek is kept to a minimum.

3.214 Groundwater Inflows

Open cut mining within the MOC intercepts saline groundwater aquifers. Groundwater that accumulates within mining pits is pumped to surface storages for re-use in mining operations. **Table 3** summarises the predicted groundwater inflows for the MOC.

Table 3 - Future Predicted Groundwater Inflows (ML/year)

Year	Ravensworth East Mine	Mt Owen Mine	Glendell Mine	MOC Total
2012	697	205	316	1218
2013	709	206	365	1280
2014	720	208	389	1317
2015	732	209	414	1355
2016	744	211	438	1392
2017	755	212	438	1405
2018	767	214	438	1419
2019	767	215	438	1420
2020	767	215	438	1420
2021	0[1]	215	438	1420
2022	0[1]	215	438	1420
2023	0[1]	215	438	1420

Sources: ERM (1999), Umwelt (2003), Umwelt (2007)

Note 1: End of current development consent for Ravensworth East Mine – will not report to the MOC water management system

3.22 Water Storages

Water at the MOC is stored in surface dams, open cut pits, mining voids, tailings dams and sediment dams. The existing major on-site dam storage capacities and surface areas are presented in **Table 4.**

Table 4 – Existing Major Storage Capacities at the MOC

Mine	Storage	Volume (ML)	Surface Area (ha)
Mt Owen	Process Water Dam	130	2.6
	Environmental Control Dam 1	1[1]	0.5
	Environmental Control Dam 2	310	4.2
	Raw Water Dam (Glennies Creek Dam)	7	4.1
	Rail Loop Dam	60	2.2
	Tailings Pit 1	4900[2]	25.9
	TP2	366	3.1
Ravensworth East	Industrial Dam	10	0.2
	Southern Dam	40	1.0
Glendell	Mine Water Staging Dam	200	6.6
	Infrastructure Sediment Dam (pollution control dam)	3	0.25
	Infrastructure Dam	4	0.25

Note 1: Estimated volume

Note 2: Estimated available volume

Water can also be stored in the Mt Owen open cut pits (including North Pit, Eastern Rail Pit and Stages 1 & 2), Ravensworth East open cut pits (including West Pit, Southern Void and Stage 3 Workings) and the future Glendell open cut pit. As operational open cut mining areas the volume of water stored in these areas will depend on the operational requirements at the time.

3.23 Water Demands

The water demands on site include:

- gross water requirements for the CHPP , which includes water lost to product, coarse rejects and tailings, washdown water and water for stockpile dust suppression;
- the net water used by the CHPP includes water lost with the product and water trapped in tailings;

- haul road dust suppression (refer to **Section 3.232**); and
- potable water.

3.231 CHPP

The Mt Owen Mine CHPP is the major water user at the MOC. Water from the coal handling and preparation process is either lost with the product or coarse reject material or pumped as tailing slurry to tailings emplacement areas. Most of the water is recycled from the tailings emplacement areas. However, some water remains bound in with the tailings and is not recoverable. The gross water requirement of the CHPP is approximately 250 L/tonne run of mine (ROM) coal. However, the net water loss, once recycling from the tailings is accounted for is approximately 175 L/tonne ROM coal

XMO was granted approval under the Mt Owen and Glendell Mine development consents to upgrade the CHPP to handle the production requirements of the Mt Owen, Ravensworth East and Glendell Mines, which has increased the water demand of the CHPP. **Table 5** summarises the predicted future tonnages for the MOC.

Table 5 - Future Predicted ROM (Mtpa)

Year	Ravensworth East Mine	Mt Owen Mine	Glendell Mine	MOC Total
2012	1.5	7.9	3.7	13.1
2013	1.5	7.9	3.6	13.0
2014		7.9	4.2	12.1
2015		7.9	4.4	12.3
2016		8.0	4.4	12.4
2017		8.0	4.5	12.5
2018		8.0	3.9	11.9
2019		8.0	3.3	11.3
2020		8.0	3.9	11.9
2021		8.0	3.2	11.2
2022		8.0	2.9	10.9
2023		8.0	2.9	10.9

Sources: Umwelt (2003), Umwelt (2007)

3.232 Water Trapped in Tailings

Depending on the design of the tailing emplacement area the tailing matrix can retain between 25% and 50% (by weight) water. That is, a portion of the water pumped with the tailing, approximately 60% by weight when pumped, stays bound with the tailings in the emplacement area. The balance of the water is decanting from the tailing. At XMO

the design of the tailings emplacement area results in a 'beach' forming at one end of the emplacement area and a pond where the water is recovered forming at the other. It is estimated that the tailings retain at least 45% by weight water because of the design of the tailing emplacement area.

3.233 Dust Suppression

The volume of water required for dust suppression will vary according to prevailing climatic conditions, the extent of haul road development and the usage of the haul roads. It is considered that on days where the daily rainfall exceeds evaporation it is unlikely that dust suppression will be required. As such the yearly rate for haul road watering has been calculated using the effective evaporation for the site (i.e. total evaporation on days where the daily evaporation exceeds the daily rainfall) multiplied by the area of haul road to be watered (assuming a width of 30 metres is to be watered) and then multiplied by a factor of 1.4 to allow for increased evaporation due to vehicle movements on the haul road. This rate may be able to be reduced by use of chemical stabilisers, however for the site water demand use of stabilisers has not been considered due to their application specific effectiveness. **Table 6** summarises the predicted haulage routes requiring dust suppression for the MOC.

Table 6 - Future Predicted Dust Suppression Lengths (km)

Year	Ravensworth East Mine	Mt Owen Mine	Glendell Mine	MOC Total
2012	3.5	10.7	2.1	16.3
2013	3.6	11.2	2.4	17.3
2014	3.7	11.7	3.0	18.4
2015	3.9	12.2	3.5	19.6
2016	4.0	12.8	4.0	20.8
2017	4.1	13.3	4.2	21.5
2018	4.2	13.8	4.3	22.3
2019	4.2	14.3	4.4	22.9
2020	4.2	14.3	4.4	22.9
2021	0.0	14.3	4.4	18.7
2022	0.0	14.3	4.4	18.7
2023	0.0	14.3	4.4	18.7

Sources: ERM (1999), Umwelt (2003), Umwelt (2007)

3.234 Potable Water Demands

The MOC holds a water access licence to extract water from Glennies Creek a portion of which is used as potable water in the administration offices, workshop and bath house. Potable water is produced on demand by the Mt Owen Mine potable water treatment

plant using coagulants, soda ash and UV pathogen treatment. It is estimated that approximately 42 ML/year of potable water is used on site.

3.235 External Water Demands

At present there are no external demands for the use of water generated or held by the MOC.

3.24 Water Disposal

3.241 Wastewater Effluent Disposal

Wastewater from the administration offices, workshop and bath houses is collected and treated on site in a number of aerated wastewater treatment plants around the site, which is licensed by Singleton Council. At the Mt Owen Mine administration offices and workshop complex the effluent is then used to irrigate a three hectare tree-lot. At the Ravensworth East Mine workshop the effluent is used to irrigate a one hectare tree-lot. At the Glendell infrastructure area the effluent is reused within the mine water system.

3.242 Discharges to the Hunter River Salinity Trading Scheme

Mt Owen Mine is licensed under the POEO Act to discharge saline water in accordance with HRSTS Regulation. The aim of the scheme is to manage saline water discharges in order to minimise impacts on other water users and the aquatic ecosystems of the Hunter River and its tributaries. The HRSTS provides for controlled discharges based on volume and electrical conductivity during high or flood flows in the Hunter River. The volume of saline water that can be discharged is controlled by flows in the river, the salt load of discharge waters and available salt credits. XMO is the holder of 12 salt credits and EPL No. 4460 permits controlled discharges to the Hunter River via Swamp Creek (refer to **Section 2.31**).

EPL No. 4460 permits a maximum discharge of 66 ML/day from Environmental Control Dam 2 (ECD2) under the HRSTS Regulations. The water discharged from ECD2 must be within the concentration limits specified for that pollutant in **Table 7**.

Table 7- Surface Water Impact Assessment Criteria for Discharge Water

Pollutant	Concentration Limit
pH	6.5 ≤ pH ≤ 9.5
Non-filterable residue	≤ 120 mg/L

3.25 Water Transfers

Water can be transferred to and from the MOC water management system to several other Xstrata operations. The maximum export rates and typical annual transfer volumes are presented in **Table 8.**

Table 8- Water Transfer Rates from the MOC

External Operation	Maximum Water Transfer Rates	Typical Annual Water Transfer Rates
Liddell Colliery	5 ML/day	300 ML
Narama	5 ML/day	1000 ML

The Mt Owen, Ravensworth East and Glendell Mine water systems are integrated into the MOC water management system. The transfer of water between the MOC water management system and the Liddell and Narama operations is via the Process Water Dam and Southern Dam respectively (refer to **Figures 2.1** and**3.1**).

3.26 Existing Mt Owen and Ravensworth East Water Balance

The water balance for the MOC was calculated by comparing the known components of water into, water out of and changes to storage volumes for various localised water systems located within the main water management system. The localised site balances included the following circuits:

- Ravensworth East Mine
  - Southern Dam;
  - Southern Void
  - Crusher;
  - Industrial Dam;
  - Stage 3 Workings; and
  - West Pit Working;
- Mt Owen Mine
  - Process Water Dam;
  - ECD1 and ECD2;
  - Rail Loop Dam;
  - Glennies Creek Raw Water Dam;
  - CHPP;
  - Stages 1 & 2;
  - Tailings Pit 1;
  - TP2;

- North Pit Working; and
- Eastern Rail Pit Working.

For each of these circuits the water balance was analysed on a monthly basis. The localised water balances were then combined to create an overall MOC water balance for 2007.

The overall MOC water balance is summarised in **Table 3.9** and indicates that during the period of analysis (i.e. January 2007 to December 2007) the site made approximately 2830 ML of water (i.e. approximately 7.7 ML/day).

Approximately 740 millimetres of rainfall fell at Mt Owen during 2007. This equates to approximately an 80th percentile rainfall year. During 2007 there were three major storm events that caused significant runoff at the MOC. These occurred in June 2007, August 2007 and November 2007. As such 2007 was a very high runoff year with an estimated rainwater yield for the MOC water management system of approximately 4800 ML (estimated to be approximately a 95th percentile runoff year).

The **Table 3.9** contains a summary of the key inflows and outflows to the MOC water management system for the twelve month period from January 2007 to December 2007 (inclusive). This will be updated in the next review of this plan.

Aspects of the mine water balance that reduce the accuracy of the water balance and therefore require further investigation include:

- runoff rates from disturbed catchment areas;
- volume changes in major dams and open cut pits;
- the estimate of how much water stays bound in the tailings matrix after the excess water is decanted from the tailings;
- seepage from Stages 1 & 2 to Bowmans Creek; and
- the accuracy of the flow meter and manual observations.

Table 3.9 - 2007 MOC Water Balance

Variable	Volume	Unit
Water Sources		
- Rainfall on Dams and Ponds	507	ML
- Runoff from Catchments	4800	ML
- Groundwater Seepage	833	ML
- Glennies Creek	392	ML
- Liddell	0	ML
- Narama	0	ML
TOTAL INPUTS	6532	ML
Water Losses		
- Evaporation from Dams and Ponds	-1161	ML
- Haul Road Dust Suppression	-757	ML
- Stockpile Dust Suppression	-180	ML
- Lost with Crusher Coal	-21	ML
- Lost with Product Coal	-450	ML
- Lost with Course Rejects	-106	ML
- Bound with Fines in Tailings	-662	ML
- Admin - Potable Water System	-42	ML
- Seepage to Bowmans Creek from Stages 1 & 2	-223	ML
- Discharged from ECD2	0	ML
- Discharged off-site to Narama	-103	ML
TOTAL OUTPUTS	-3705	ML
Net Water Balance	2827	ML
	7.7	ML/day

3.27 Predicted Future MOC Water Balance

To explore the water balance for MOC, a detailed daily water balance model has been developed to model the proposed mining and coal handling characteristics, as detailed in **Sections 3.21** to **3.25**. This model is based on the 2007 MOC water balance structure (refer to **Section 3.26**) and has been setup to be able to model all future mining operations and associated water balances.

The predictive model uses daily meteorological data for rainfall and evaporation sourced from the Scone Bureau of Meteorology Rainfall Station for the 35 year period from 1973 to 2007. The model has been set up to allow detailed analysis and calibration of the MOC water balance and individual mine site water balances and considers:

- direct rainfall onto dam/water storage surfaces;
- evaporation from dam/water storage surfaces;
- runoff from natural, rehabilitated and disturbed catchment areas;
- groundwater inflow to open cut pits;
- water lost to product coal through the CHPP and ROM coal through the crusher;
- water used for on-site dust suppression (haul roads and stockpiles);
- transfers to and from other sites in the GRMWSS;
- extraction from Glennies Creek; and
- discharges under Hunter River Salinity Trading Scheme (HRSTS).

The water balance model uses statistical distribution functions to determine the possible outcomes based on the variability of the local rainfall, water demands for dust suppression, production rates and production yield rates.

The results are presented as a 'most likely' average, 10th percentile and 90th percentile statistical distributions to show the variability of the future water balance.

The predicted water balances for the MOC and each of the contributing mines are shown on **Figure 3.2**.

Figure 3.2 show some differences between the predictions published in the previous EISs and EA. These differences are primarily due to the current water balance modelling being more detailed and exploring the interactions within each mine site than those previously undertaken. This results in more surplus water being predicted at Ravensworth East Mine, a reduced surplus at Mt Owen Mine (this is also a result of changes to the Glendell Mine production schedule since the Mt Owen EIS (Umwelt, 2003) and use of recent data to determine the CHPP water requirements) and increases in the predicted water surplus at Glendell Mine.

It is proposed that additional on-site monitoring and modelling of the existing site water balance be used to further calibrate the existing site water balance. This additional calibration work will then assist in further refining the future MOC and mine site water balances (refer to **Section 3.28**).

3.28 Decommissioning

Based on current approval periods for the Mt Owen, Ravensworth East and Glendell Mines, mining is scheduled to cease at the MOC in 2025. All sediment dams will remain in use as farm dams after decommissioning, although the capacity of the dams may be reduced. The water supply dams will be rehabilitated into the final landform as free draining areas. Catch drains will remain as part of the final landform. Any future development application for continued mining operations beyond the proposed cessation of the MOC operations 21 years will include a revision of the existing water management system.

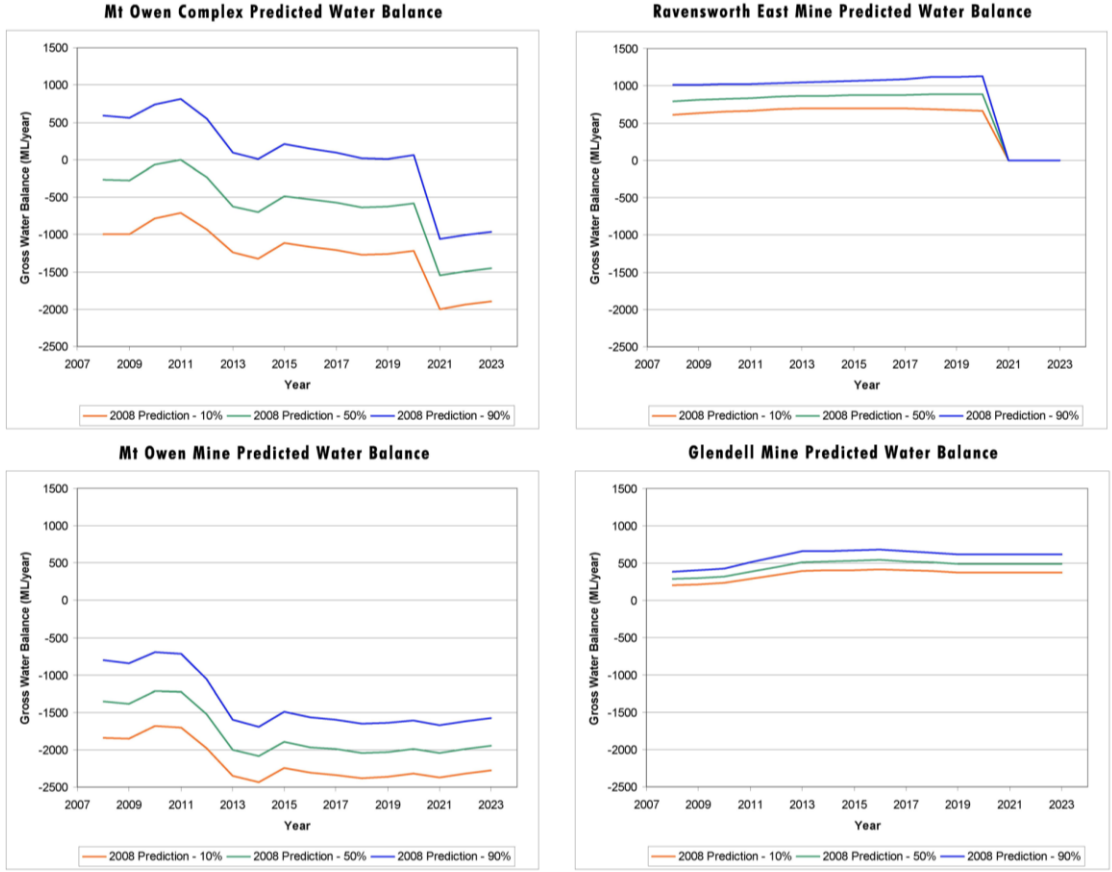

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Figure 3.2 Predicted Water Balance

4. MEASUREMENT AND EVALUATION

4.1 5.0 Monitoring and Maintenance Requirements

4.11 Water Balance

As part of the water management system XMO will monitor rainfall on site, water usage on site, fresh water imported to site, mine water transferred to or from site, water discharged off the site, the transfers of water around site and the volume of water stored in the dams around the site.

The monitoring data will be used to update the site water balance. The results from the site water balance will be reported in the AEMR.

4.12 Construction, Operational and Rehabilitation Phase Works

During the construction, operational and rehabilitation phases at the MOC, monitoring of the erosion and sediment control measures will be undertaken on a monthly basis and after major storm events, for works that may be affected by such an event. Monitoring of the Bettys Creek diversion will be undertaken in accordance with the approved plan. Water quality monitoring will also be undertaken as part of the project.

Where identified through site risk assessments, high risk dams and water storages will be reviewed at least every two years for their structural integrity or more frequently if required under specific approvals.

5. REVIEW AND IMPROVEMENT

5.1 Reporting and Review

The WMP will be reviewed every three years and updated where necessary. The MOC Environment and Community Manager will be responsible for reporting any significant findings regarding the implementation of this plan in the AEMR, including:

- the results of monitoring;
- the effectiveness of the erosion and sediment controls;
- any identified issues or results outside the impact assessment criteria; and
- details of measures undertaken or proposed to address any identified issues.

A copy of the AEMR will be provided to DWE, DECC and DoPI.

6. DEFINITIONS

Term	Definition
Alluvium	Sediment deposited by a flowing stream, e.g., clay, silt, sand, etc.
AEMR	Annual Environmental Management Report
Aquifer	A water-bearing rock formation.
CHPP	Coal handling and preparation plant
DA	Development Application
DECC	Department of Environment and Climate Change
DoP	Department of Planning
DWE	Department of Water and Environment
EA	Environmental Assessment
EIS	Environmental Impact Statement
Environmental Planning and Assessment Act 1979	NSW Government Act to provide for the orderly development of land in NSW.
EPL	Environmental Protection Licence
Groundwater	Sub-surface water that is within the saturated zone and can supply wells and springs. The upper surface of this saturated zone is called the water table.
Ha	Hectares, equivalent to 10,000 m^2
HSEC	Health, Safety, Environment and Community
HRSTS	Hunter River Salinity Trading Scheme
kL	kilolitres or thousands of litres, e.g. 3 kL is the same as 3,000 litres
Km	Kilometres
mAHD	Metres Australian Height Datum
µS/cm	microsiemens per centimetre is the standard measure of conductivity.
ML	megalitres or millions of litres, e.g. 5 ML is the same as 5 million litres
Mtpa	million tonnes per annum
Protection of the Environment Operations Act 1997	NSW legislation administered by DECC that regulates discharges to land, air and water.
Run of mine (ROM)	Bulk material extracted from a mine, before it is processed in any way
GRMWSS	Greater Ravensworth Mine Water Sharing System

Term	Definition
Surface infrastructure	Any man made object, facility or structure on the surface of the land
Tailings	Fine residual waste material separated in the coal preparation process.
WMP	Water Management Plan
XMO	Xstrata Mt Owen

7. ACCOUNTABILITIES

The responsibilities of the relevant personnel at the MOC are summarised in Table 9**.**

Table 9 - Accountabilities

Role	Accountabilities for this document
E&C Manager	Responsible for ensuring that monitoring, periodic environmental inspections and inspections after high rainfall events are undertaken.
Operations Manager	Responsible for providing adequate resources to undertake the activities required by this plan

8. REFERENCES

8.1 Xstrata Coal NSW

- Standard 10 - Environment, Biodiversity and Landscape Functions

8.2 Xstrata Mt Owen

- Xstrata Mt Owen Pty Limited (2008) MOC Water Management Plan.

8.3 Other

- ERM, 1999. Ravensworth East Mine Environmental Impact Statement.
- Landcom, 2004. Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition.
- Umwelt (Australia) Pty Limited, 2003. *Environmental Impact Statement Mt Owen Operations*. Prepared for Xstrata Mt Owen Pty Limited.
- Umwelt (Australia) Pty Limited 2007. *Environmental Assessment for Modification of Glendell Mine*. Prepared for Xstrata Mt Owen Pty Limited.

9. APPENDICES

Nil

10. CONTROL AND REVISION HISTORY

10.1 Document information

Property	Value
Approved by	<<Type name of document approver>>
Document Owner	<<Type name of document owner>>
Effective Date	N/A
Keywords	<<Type list of keywords>>

For a complete list of document properties, select **View Properties** from the document's context menu on the intranet.

10.2 Revisions

Version	Date reviewed	Review team (consultation)	Nature of the amendment
1			
2	Nov 2011	MOC E&C Manager, E&C Coordinator	Update with current practices and applicable standards
3			