11 Surface water

11.1 Introduction

The proposed modification will result in minor changes to the local catchment and has potential to affect quality of surface runoff. The surface water assessment prepared by WRM Water & Environment and JP Environmental for the Warkworth Extension Project included an assessment of potential impacts from its Year 2 mine plan, which is considered to be representative of the proposed extension area in terms of water management.

The findings of that assessment (WRM 2010) are presented in this chapter.

11.2 Existing environment

11.2.1 Surface water resources

i Catchment and surface hydrology

The Warkworth Mine and the proposed modification are within the catchments of the Hunter River and Wollombi Brook, a tributary of the Hunter River. The Hunter River has a catchment of approximately 16,400 km^2 to Singleton which is approximately 6 km downstream of Warkworth Mine. Wollombi Brook has a catchment area of approximately 1,850 km^2 to Warkworth, approximately 3 km from its confluence with the Hunter River.

Current operations at the Warkworth Mine are within a number of watersheds that direct runoff into local watercourse, or into the mine system. These watersheds include Loders Creek, Dights Creek, Longford Creek, Sandy Hollow Creek, Doctors Creek, Salt Pan Creek and several unnamed tributaries of Wollombi Brook. The catchments associated with Warkworth Mine are shown in Figure 11.1.

Water management at Warkworth Mine is integrated as part of the MTW integrated operations. Water captured at Warkworth Mine or MTO may be released via Dam 1N into Doctors Creek or Dam 9S into Loders Creek. These discharges are regulated by conditions contained in the site's EPL.

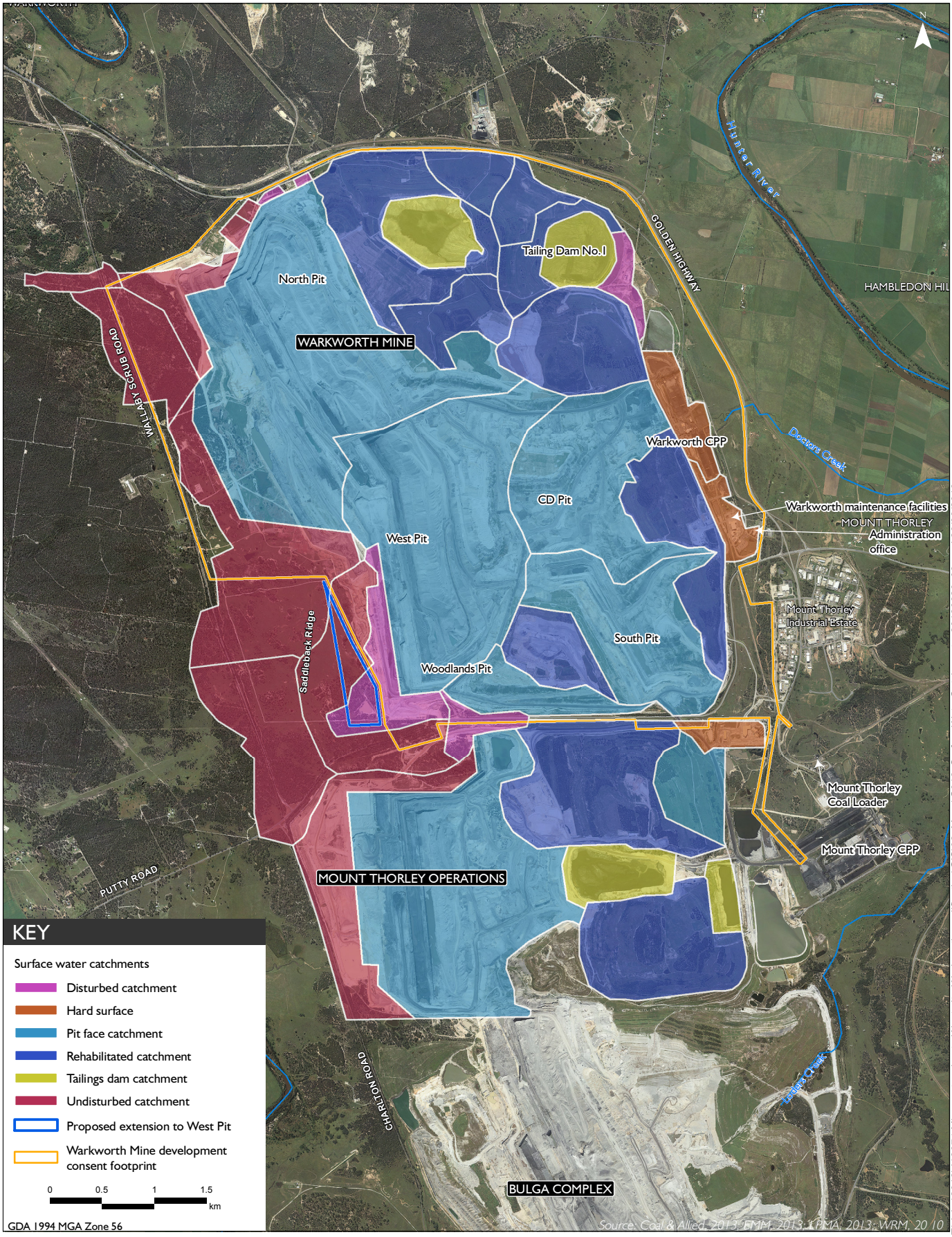
ii Rainfall and evaporation

The mean annual rainfall ranges from 650 to 700 mm, with maximum monthly rainfalls occurring during the summer months. Mean annual evaporation is about 1,600 mm. Mean evaporation is similar to mean rainfall in winter months, but exceeds rainfall for the remainder of the year.

iii Surface water quality

MTW collects data on surface water quality for waters draining the project site as well as from Wollombi Brook, and the Hunter River upstream and downstream of the confluence with Loders Creek. The monitoring is managed under WML's Environmental Management System (EMS) and reported to government agencies annually through the Annual Environmental Management Report (AEMR).

Water quality reporting indicates that discharges from Loders and Doctors creeks (in accordance with EPLs) have not had a noticeable effect on water quality in the Hunter River.



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Surface water catchments
Warkworth Modification 6
Environmental Assessment
Figure 11.1

iv Water users

The reach of Wollombi Brook adjacent to Warkworth Mine and the proposed modification is within the Lower Wollombi Brook water source within the *Water Sharing Plan for the Hunter unregulated and alluvial water sources.* The Lower Wollombi Brook water source covers an area of approximately 962 km^2, extending about 35 km upstream of Bulga.

There are 110 surface water licences for the Lower Wollombi Brook water source with a total entitlement of 6,663 ML/year (88% used for irrigation purposes and 10% used for industrial purposes). There are 38 groundwater licences for the water source with a total entitlement of 5,071 ML/year (55% used for irrigation purposes and 44% used for industrial purposes). A large number of groundwater bores are along Wollombi Brook in the vicinity of the existing mine.

11.2.2 Mine water management system

i Site operations

MTW have an integrated water management system that enables the transfer of water between the two sites. The water management system is operated under the *MTW Water Management Plan*, and is a network of infrastructure to control the movement of water around the site and prevent unscheduled water release off-site.

Water is stored on site in a number of out-of-pit dams at MTW. Prior to 2010 the total spillway volume of all water storages was 4,785 ML and the total operating volume was 4,104 ML.

Water at MTW is managed according to type which is determined by catchment source, quality and use. Three classifications are used for water managed at site: mine water, runoff water and river water.

ii Mine water

Mine water comprises pit water, CPP water supply and tailings water, and is mainly saline due to interaction with saline groundwater in coal seams and saline mine spoils. Saline water cannot be released from site except for opportunistic discharges as regulated by the HRSTS.

Pit water is pumped to out of pit storage dams or to available in-pit storages. The majority of dewatering is directed to Dam 1, Dam 6S and Dam 9S. Water is pumped between MTO and Warkworth Mine via a pipeline linking both CPP's. Water is used for CPP and dust suppression, with excess water retained in storages.

iii Runoff water

Runoff water is captured or diverted away from the mine water system dependent on water quality, climatic conditions and production requirements. There are four types of runoff varying in water quality:

- clean catchment;
- unconsolidated mine spoil;
- rehabilitated mine spoil; and
- active mining areas.

Runoff from undisturbed catchments is diverted around the mine where possible. In dry periods this water may be taken back into the mine water system as a source of water supply. Sandy Hollow Creek catchment to the west of North Pit is collected in a local catchment dam and periodically pumped to a diversion channel to the north-west of the mine. The diversion channel conveys the water into the Longford Creek Catchment and subsequently into Wollombi Brook. Runoff from Doctors Creek catchment immediately south and south-west of West Pit is contained in dam 11N, and pumped to a channel that conveys runoff to Doctors Creek and off site.

Unconsolidated mine spoil contributes the largest volume of rainfall runoff into active pits, based on area. A large proportion of incident rainfall reaches the pit as seepage due to the high porosity of the mine spoil, and accumulates salt as it flows. Runoff water from unconsolidated mine spoil will be intercepted into sediment control structures before being released off site or captured in the mine water system. Rehabilitated mine spoil is managed in the same way as disturbed clean catchment until ground cover is established.

Coal & Allied regrets that during a heavy rainfall event in early February 2012, non-mine affected water containing soil from civil works associated with the erection of a visual bund (as required under Mt Thorley's Approvals), exited MTO western boundary and flowed into land owned by Coal & Allied. This event took place within the Mount Thorley consent boundary and not the Warkworth Mine consent.

Sediment and erosion controls were in place at the time of the event but were unable to contain all the water received from the rainfall event. Since this event, Coal & Allied has undertaken further works to improve its erosion and sediment control measures at Mount Thorley with more than $500,000 invested in measures such as water channels, sediment controls barriers and enhanced monitoring.

iv River water

Singleton Council holds a high security water access licence (WAL 10543) on behalf of MTW. MTW has a maximum allocation of 1,012 ML per financial year of raw water sourced from the Hunter River. This water supply is used if site water stocks are low or not available.

v Hunter River Salinity Trading Scheme

The HRSTS was introduced by the NSW Government to reduce salinity levels in the Hunter River and allows controlled water discharges into the Hunter River. The HRSTS operates under the *Protection of the Environment Operations [Hunter River Salinity Trading Scheme] Regulation 2002*.

MTW participates in the HRSTS allowing it to discharge water from licensed discharge points at Warkworth Mine (Dam 1N) and MTO (Dam 9S) into Loders and Doctors creeks in accordance with the EPL and HRSTS.

11.2.3 Mine water balance

A water balance is a representation of all inflows, outflows and changes in storage for the water management system. MTW uses a water balance to assess and record water flux, and to forecast and plan water management needs. Site water balance is actively managed at MTW and reported annually in the AEMR. Table 11.1 shows a summary water balance for the MTW site for 2011, based on recorded and simulated values.

Table 11.1 Static model results – 2011 annual water balance (ML/a)

Water stream	Volume (ML) 2011
Inputs	
Hunter River/potable	161
Groundwater	91
Rainfall runoff	4,448
Recycled to CPP from tailings and storage (not included in total)	2,083
Imported (from Redbank Power Station)	138
Water from ROM coal	921
Total inputs	**5,759**
Outputs	
Dust suppression	1,195
Evaporation – mine water dams	745
Entrained process water	867
Discharged (HRSTS)	1,006
Water in tailings (not included in total)	1,674
Water in coarse reject (not included in total)	591
Water in product coal	835
Total outputs	**4,648**
Change in storage (increased)	1,111

Source: MTW AEMR (Coal & Allied 2012).

The main water source inputs at MTW comprise:

- rainfall runoff;
- moisture entrained in ROM coal and pit groundwater inflows; and
- river water obtained from the Hunter River.

11.3 Potential impacts

11.3.1 Surface water resources

i Catchment runoff

The proposed extension area will reduce runoff discharged to local catchments. The main catchments affected include several un-named ephemeral creeks flowing west towards Wollombi Brook. Rehabilitation of areas in the eastern part of the mine site will reinstate catchments and runoff to other drainage systems. Loss of runoff is considered unlikely to adversely impact the affected catchments which are mainly in the Wollombi Brook catchment.

ii Water quality

Land disturbance associated with mining has potential to adversely affect the quality of surface runoff through increased sediment loads. In addition, runoff from active mining areas (pits, roads, coal stockpiles, etc) and overburden emplacements may have increased salinity compared to natural runoff. These impacts are managed through the water management system implemented as part of the EMS.

Importantly, release of mine water is regulated by the HRSTS which provides for the protection of the values of receiving waters.

iii Increased fresh water usage

The proposed modification may slightly increase water demands due to increase in the length of haul road, however the existing water access licences held by MTW will be sufficient to meet these needs.

iv Flooding and stream geomorphology

A flood study was undertaken to assess potential impacts of the Warkworth Extension Project on flood flows in Wollombi Brook. A flood frequency analysis of recorded peak annual stream flows at the Bulga stream gauge was used to estimate 100 year average recurrence interval (ARI) design flood discharges in Wollombi Brook. A HEC-RAS steady flow hydraulic model was developed to estimate design flood levels. The HEC-RAS model was calibrated to recorded peak flood levels in Wollombi Brook at the Warkworth and Bulga stream gauges.

A review of the flood extents indicates that while the extent of flooding projects into the western side of the mining leases, the extension is well above these levels. Hence, the proposal will have no impact on flood flows, velocities or flood levels along Wollombi Brook for events up to and exceeding the 100 year ARI flood event. For this reason, the proposed modification does not require measures to mitigate flood impacts on Wollombi Brook.

11.3.2 Surface water management

i Water balance

An OPSIM model was used to simulate the mine water balance for the Warkworth Extension Project (WRM 2010) against 115 rainfall years for daily rainfall. The model provided static water balance results for different stages of the mine. The proposed extension area is similar to the Year 2 of the Warkworth Extension Project in terms of water management infrastructure required. The water balance for the Year 2 mine plan was not modelled, however it is considered that the proposed extension area will lie within the modelled scenarios of Year 0 (baseline) and Year 7 (identified groundwater inflow spike). These results are provided in Table 11.2.

Table 11.2 Water balance summary from Warkworth Extension Project

Component	**Average water volume (ML/year)**	
Inflows	**2010 baseline**	**Year 7 (groundwater spike)**
Catchment inflow	3,500	3,500
MTJV imported water	600	500
Groundwater	100	600
Raw coal moisture	1,400	1,400

Table 11.2 Water balance summary from Warkworth Extension Project

Component	Average water volume (ML/year)	
Total	**5,600**	**6,000**
Outflows		
Evaporation (from storage water surface)	540	470
HRSTS discharges	0	630
Sediment dam discharges	450	300
Dust suppression	1,200	1,200
Tailings moisture retention	1,300	1,300
Coarse rejects moisture	700	700
Vehicle washdown loss	60	60
CPP miscellaneous loss	100	100
Product coal moisture	1,100	1,100
Total	**5,450**	**5,860**
Change in storage	150	140

Source: WRM Water & Environment 2010.

The results indicated that under planned storage conditions, total storage in excess of 500 ML may reside in pit for more than 50% of the time for Year 0. However, this analysis was undertaken when Loders Pit which was out of service and two additional out-of-pit dams, Dam 9S and 34N (not constructed). These new dams and a dewatered Loders Pit will significantly improve the risk profile for in-pit storage.

ii Mine water management system

The existing mine water management system will be utilised to manage the proposed modification. The system is illustrated in figures 11.2 and 11.3.

With the exception of a number of small catchments in the eastern part of the site, current practice is to divert runoff from all rehabilitated areas off site, or to provide sufficiently large storages to prevent runoff entering active mining areas. These diverted areas are sufficiently regenerated to permit runoff to return to the natural watersheds with sediment control established at the watershed discharge points.

Releases will continue to occur from the water management system via the currently approved discharge locations to Doctors and Loders creeks, which report to the Hunter River. These releases will occur in accordance with the EPL and HRSTS to protect the environmental values of receiving waters. The potential for impact on the Hunter Estuary Wetland is considered unlikely due to the stringent release controls and distance of the wetland downstream from the proposed extension.

11.4 Mitigation and management

11.4.1 Surface water management and monitoring

Surface water management and monitoring will continue to be undertaken generally in accordance with the *MTW Water Management Plan* and the *MTW Water Monitoring Programme*.

The *MTW Water Management Plan* has the purpose of:

- defining accountabilities for operation of the water management system;

- describing and updating the water balance;
- describing the water management system;
- providing a process for identifying future changes to the water management system; and
- outlining a process to maintain, implement and operate the water management plan.

The objectives of the *MTW Water Management Plan* include the protection of the wider environment and especially the Hunter River and the Wollombi Brook from the impacts of mining and processing operations. A key target is the minimisation of fresh water from offsite sources along with zero unplanned releases of mine water from site as required under the EPL.

The *MTW Water Monitoring Programme* outlines the monitoring program and procedures. The monitoring program includes:

- recording imported fresh water;
- recording daily rainfall, evaporation and wind data at the mine site;
- measurement of water levels and water quality (EC, pH, TSS and other parameters within the mine water system);
- monitoring of water quality in site supply dams for use in CPPs;
- monitoring of water quality in sediment management dams that release to local drainage systems;
- water quality monitoring and reporting at the authorised discharge points to Doctors and Loders creeks, as required under the sites EPLs and HRSTS; and
- annual reporting as part of licensing, mining lease and approval conditions.

Sediment dams will be maintained or constructed as required and will be designed in accordance with relevant design standards.

11.5 Conclusion

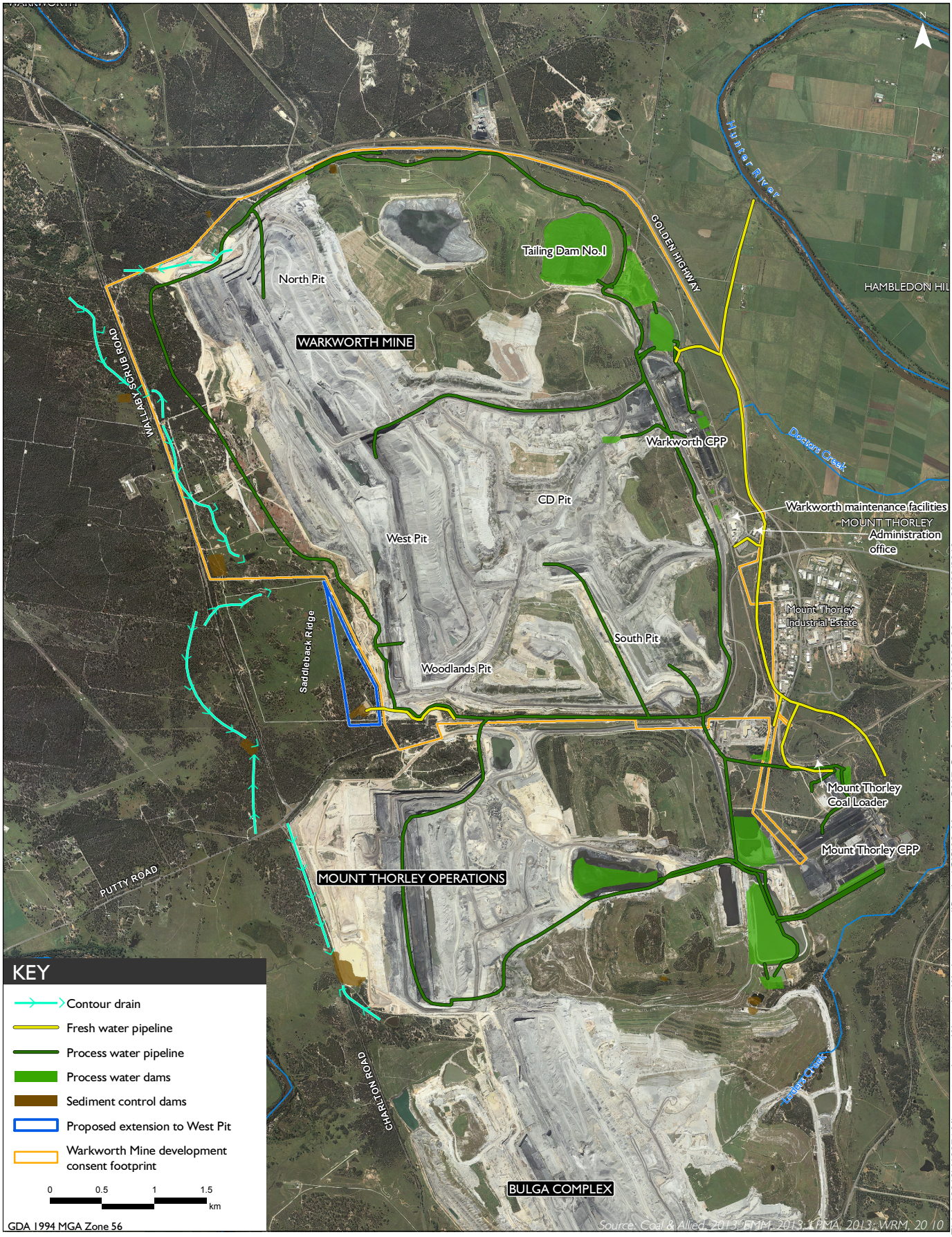
The management of potential surface water impacts for the proposed modification will be based on a continuation of the existing surface water management strategy for the integrated MTW operations. Surface water management and monitoring will continue to be undertaken generally in accordance with the *MTW Water Management Plan* and the *MTW Water Monitoring Programme* which will be modified for the proposed extension.

Clean water runoff will continue to be segregated from mine water via the maintenance of contour drains, sedimentation and mine water dams. The continuation of mining to the west will have negligible additional impact on local and regional watersheds. Parts of Sandy Hollow, Doctors, Salt Pan and Loders creek catchments previously consumed by mining will be rehabilitated and natural runoff returned to these creeks.

The results of the flood study of Wollombi Brook indicate that the proposed extension to West Pit is above the 100 year ARI design flood extent. Hence, the proposal will have no impact on flood flows,

velocities or flood levels along Wollombi Brook for events up to and including the 100 year ARI flood event.

The proposed modification is not expected to result in changes to discharge requirements. Testing of the mine water management system (for the larger Warkworth Extension Project) against 115 years of daily rainfall records indicated surpluses resulting from increased pit surface area and inflows can be managed by utilising most HRSTS discharge opportunities arising in the future. MTW currently holds sufficient HRSTS salinity credits to achieve this discharge requirement.



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Surface water management infrastructure
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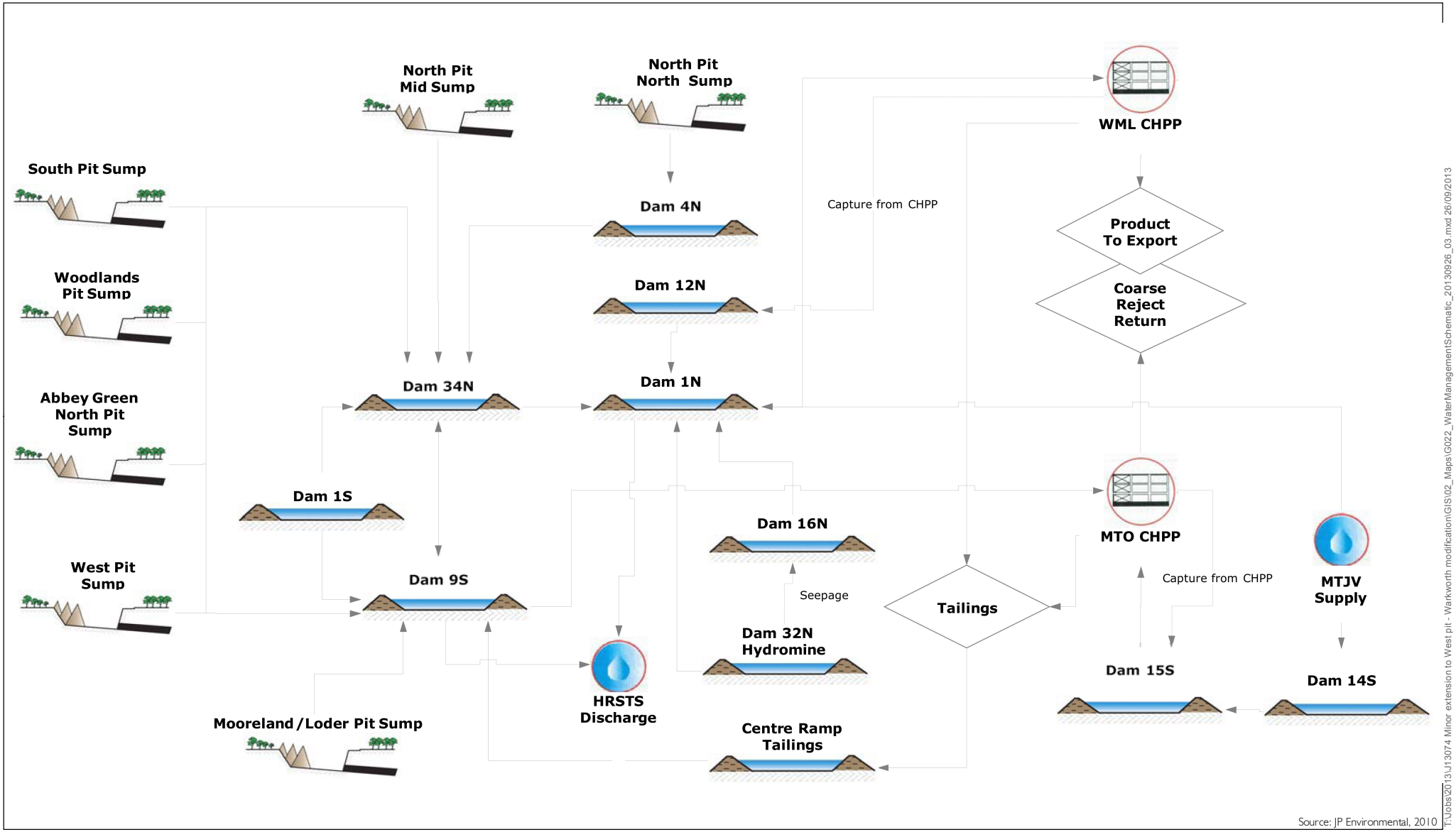

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Schematic of proposed water management system
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Figure 11.3