ARGYLE

DIAMONDS

ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE ARGYLE UNDERGROUND PROJECT

SURFACE WATER MANAGEMENT PLAN

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1. INTRODUCTION

1.1 PURPOSE

The primary aim of this Management Plan is to comply with Argyle's Standard for Water Use and Quality Control (2004a). This is to ensure the efficient, safe and sustainable use and protection of water resources and ecosystems in and around Argyle's operations and to understand water resources, their spatial and temporal interrelationships, their ownership in the region and the needs of key catchment stakeholders.

The management actions in this plan are derived to ensure compliance with the following legal obligations:

1. Surface Water Licence commitments for M80/45 – Lake Argyle (SWL151367 [2]), AM70/259 Limestone Creek (WRRD) (SWL 99703[2]) and AM70/259 – Smoke Creek (Gap Dam) (SWL99702 [5]) (DoE, 2004a):

    - The mine's raw water requirements will, where possible, be met from dewatering and Gap Dam water sources prior to drawing on Lake Argyle;
    - Fresh water use from Gap Dam and Lake Argyle will be reduced as much as practically possible though the recycling of process water, and the recovery and reuse of waste waters; and
    - Maximum use will be made of dewatering discharge for mining and processing operations.

2. Licence to Operate - 4459/9 conditions (DoE, 2004b):

    - **W1** The licensee shall ensure that waste management facilities shall be operated so as to minimise the discharge of silt that may affect local water resources or enter tributaries of the Ord River;
    - **W6 (a)-(e)** Licensee shall test water quality at AK1 TSF1 underdrains 1-4 and LIA underdrain outfalls quarterly and report in tabular form in the AER;
    - **W7** The licensee shall manage all sewage wastewater treatment ponds such that uncontaminated stormwater runoff does not enter the ponds or cause erosion of the outer pond embankments, uncontrolled discharges are prevented, there is no discernable seepage loss and vegetation growth is minimised and controlled in the pond wastewaters and on the inner pond embankments;
    - **W8** All treated wastewater from the premises excluding stormwater shall only be discharged through the discharge pipe from the final effluent pond to the effluent disposal channel (Village);
    - **W9**. Manage the effluent channel to minimise soil erosion, surface ponding and repeated localised discharges (Village lagoon);
    - **S3 (b)** Maintain a distance of at least 100 metres from the waste disposal site to any surface water body; and

- **S4** Divert stormwater away from any filled areas (landfill) by drains or other means to dedicated stormwater drains.

- Surface water will be managed to minimise adverse impacts on the environment. Management actions, which will ensure these objectives are met and the personnel who are responsible for their implementation are described in Table B2-2 Surface Water Management.

1.2 SCOPE

This Management Plan identifies surface water management issues, risks and appropriate management actions to minimise impacts to the environment during underground mining operations and closure. Surface water bodies such as creeks, springs, permanent pools, dams, TSFs and drainage are reviewed within the area potentially impacted by underground mining. Issues relating specifically to managing the TSFs are outlined in more detail in B12 Tailings Management Plan and B1 Groundwater Management Plan.

1.3 AREA

Argyle mining lease and miscellaneous licences

2. DEFINITIONS

Surface water

Water in lakes, rivers, streams, springs and offsite dams. On site water in the pit, tailings dams and ponds, described as "impounded water" in the Argyle Standard for Water Use and Quality Control (2004a), is included with surface water for this Management Plan.

Acid Rock Drainage (ARD)

Low pH drainage derived from materials with insufficient capacity to neutralise the acidic products of sulphide and elemental sulphur oxidation and the dissolution products of acidic minerals and amorphous materials. Rocks that contain reactive sulphide minerals and do not have sufficient acid neutralising capacity (ANC) are referred to as Potentially Acid Forming (PAF). Other materials are considered non-acid forming (NAF) or barren. Secondary by-products of ARD, such as magnesium, calcium and sulphate ions can leach out.

3. DETAILS

Mining operations may impact on environmental values that are dependent on surface waters directly through abstraction, exposure to contaminants or less directly, as a consequence of changed drainage patterns or abstraction of ground water for dewatering. These activities may alter erosion patterns and result in inundation or reduction in "environmental" water to landforms and vegetation. Disturbed land and particularly man-made landforms such as the TSFs and WRD are particularly vulnerable to drainage changes and thus erosion.

The primary aim of this Management Plan is to minimise the use and contamination of surface waters and to manage water that may be contaminated as a consequence of mining operations. Wherever possible engineering controls such as bunds, drains and culverts will be used to prevent surface waters causing contamination.

The mine is located at the southeastern end of the Matsu Range, which contains the headwaters of the following four watercourses flowing through the Lease Area. These ultimately drain northeast into Lake Argyle:

- Flying Fox Creek, a tributary of Smoke Creek, which flows east from Glen Hill station and drains the northern part;
- Smoke Creek, a tributary of the Ord River, which flows north east and drains the central and northern parts;
- Limestone Creek, a tributary of the Bow River, which flows east-north-east and drains the south central and eastern portion; and
- Wesley Spring Creek, a tributary of the Bow River, which flows south- southeast and drains the south-western portion.

Maintenance of surface water flow and quality are particularly important as Lake Argyle was listed as a Ramsar Wetland of International Importance on the 7th June 1990 (www.ramsar.org). Lake Argyle provides a dry season refuge for water birds and is reported to hold some of the largest numbers of water birds to be found at a site in Northern Australia.

Flows within the Creeks to Lake Argyle are highly variable, reflecting the extreme range of rainfalls that can be experienced in the area. The Limestone Creek, Smoke Creek and Wesley Spring Creek catchments associated with these watercourses have been impacted by open cut mining operations. The environmental impacts on these surface water catchments and monitoring associated with the open cut mining operation and future underground mining is discussed in the following sections. Hydrocarbons and ARD seepage have been recorded in the alluvial treatment plant sub-catchment, which is part of the Limestone Creek Catchment, however the Project will not affect this area and thus it is not included in this Management Plan.

There are no natural permanently inundated areas on the Lease Area and the creek lines are seasonally waterlogged. Harvesting of surface water from the Lake Argyle catchments may reduce the "environmental" water allocation available particularly to the riparian systems and ephemeral pools. Spasmodic low intensity rainfall events may have been particularly beneficial to these pools pre-mining, providing a 'top-up' and sustaining them during extended dry periods.

Some areas on the Argyle leases and miscellaneous licence areas have been inundated, possibly as a result of surface water drainage changes. These areas will be mapped and evaluated to determine whether they are indicative of changed groundwater or surface water regimes and if they will likely return to their original state once mining ceases.

If the change is likely to be permanent as a result of modified surface drainage patterns then a decision will be made whether any engineering works are required to reinstate drainage. Groundwater levels are

expected to rise once mining ceases, however they will remain below the original pre-mining levels and no engineering solutions to this exist to reinstate original levels.

Groundwater abstraction has probably affected drainage lines on the ridges within 500 metres of the open cut pit. Increased vertical seepage is likely to have increased rates of recharge to the regolith and reduced the base flow following the wet season. The vegetation in these upland creek lines is unlikely to be directly dependent on permanent water, however, downstream ephemeral pools may be affected by reductions in downstream allocations, especially during relatively dry seasons.

Sediments, hydrocarbons, acids, heavy metals, dissolved ions, detergents, nutrients and bacteria may contaminate surface water moving through the mining and processing areas. Much of this surface water is currently treated as wastewater. Water from the hydrocarbon bioremediation site goes into the AK1 TSF1. Surface runoff from lay down areas, landfills and car parks currently is not intercepted but will largely be recovered by RCP3, when constructed.

Sediment loads exceeding background levels generally occur from runoff over areas where land is disturbed or the surface water drainage has been modified. The DoE Licence to Operate, Condition W1 specifies that discharges of silt to the environment be minimised. The TSF, WRD, dams, stockpiles, lay down areas and unpaved roads are all likely to release more sediment than undisturbed land, particularly under the influence of modified surface drainage. Sediment traps are located along Gap Creek and within the Designated Area. A sediment trap will also be incorporated into the drainage design for the temporary stockpile for underground material.

The principle source of water for mining and domestic use at the site is Gap Dam, from which 5.41 Mm3 was drawn during 2003-2004 (Argyle, 2004b). The sources of water utilised on site and quantities used in 2003-2004 are outlined in Table B2-1.

Table B 3-1: Raw Water Consumption 2003-2004

SOURCE	VOLUME DIVERTED OR ABSTRACTED (Mm3)	LICENCE NO.	LICENCED ALLOCATION (Mm3)
Lake Argyle (harvested from the catchment)	1.19	SWL 151367	6
Gap Dam (catchment runoff)	1.64	SWL 99702	4.4
Limestone Creek WRD Seepage Retention Dam (calculated from pump performance specifications)	0.47	SWL 99703	1
In-pit Dewatering	3.77	GWL 74139	4.4

Once RCP3 be constructed, most of the surface water runoff, including diffuse seepages with relatively high solute concentrations from the Limestone Creek Catchment would be captured and recycled through the processing circuit, reducing demands for water from other sources, including Lake Argyle. This includes surface water discharges from TSF underdrains 1, 2, 3 and 4 and the Light Industrial Area (LIA) underdrain, both currently monitored as part of the DoE Licence to Operate conditions. A contingency to discharge water to Gap Creek in flood conditions (1:100 year rainfall events) would be required. However the spilled water would rapidly mix with other surface waters during these events. A concrete and rock lined spillway is proposed to minimise erosion into the creeks.

Surface water monitoring is undertaken at the locations shown on FigureB2-1. Sampling is taken in accordance with Government of WA (2000) guidelines. The results of the water-sampling programme are compared with the Australian and New Zealand Environment and Conservation Council (ANZECC/ARMCANZ, 2000) Guidelines for Protection of Aquatic Ecosystems in Fresh Waters and water quality values from the background monitoring sites. Background water quality levels generally fall within the ANZECC/ARMCANZ guideline values. Monitoring to date indicates that the metal ions concentrations in the seepage water and other surface waters monitored are similar to the background, however monitoring will continue and if measurements consistently above guideline values are recorded, the cause and remedial actions will be investigated.

3.1 LIMESTONE CREEK CATCHMENT

The Limestone Creek Catchment has two sub-catchments within the Lease area - Gap Creek and Upper Limestone Creek. This catchment contains processing facilities, bulk fuel and chemicals, ore stockpiles, landfills, a bioremediation site, LIA, lay down areas and car parks; Jacko's Dam, the AK1 TSF1 and some of the WRD.

The Limestone Creek Catchment also contains the preferred site for the proposed TSF2, which is located downstream and south of the existing TSF1; bisected by Gap Creek and two other minor creek lines. TSF2 will be water retaining and contain undersurface drains from a central decant, starter embankments and later, drainage in the final embankment structures. Surface water drainage at the Process Plant areas and at the LIA is by means of a comprehensive drainage network of open drains and subsurface pipes. A cut off trench located along the foot of the hills to the north drains to the east and then southeast into Gap Creek. All other stormwater drains flow into Gap Creek upstream of the Gap Creek silt trap.

The Gap Creek sub-catchment is about 1420 ha, representing less than 5% of the total Limestone Creek catchment into which it flows. The total annual flow is in the order of 4.5 to 6 GL depending on seasonal rainfall and the maximum-recorded flow recorded is just over 1 Mm3 over four days. Base flow volumes at the end of the dry season are about 3,000 m3/day, which provides perennial surface water to the creek from excess pit dewatering discharge. It is estimated that at least 70% of this flows from the Wandarrie Road sediment dams and the remainder from the AK1 TSF1 under drains. During the wet season base flow may be greater than 6,000 m3/day and total flows up to 0.5 Mm3/day.

Seepage from the Southern WRD is captured in Jacko's Dam. This dam has a capacity of around 0.21 Mm3 prior to water spilling into the upper Limestone Creek (Metago, 2004d). Water from Jacko's Dam is usually pumped to the process plant and thus ultimately is recovered as decant or becomes seepage from the AK1 TSF1 underdrains. The storage capacity is considered inadequate and Metago (2004d) has determined that a 1.75 Mm3 retention dam is required with upgraded pumps to improve the efficiency of seepage collection from the toe drain. The status of this dam is being reviewed with regard to improving water recycling and efficiency.

Magnesium, calcium and sulphate ions have been recorded in the catchment, primarily emanating from the WRD and the TSF under drains; otherwise surface water quality is generally good. An estimated 700 tonnes per year of MgSO4 are flushed down Limestone Creek with the continuous pit dewatering flows and AK1 WRD and TSF seepages that drain into Gap Creek (Ecowise, 2004). Although within the 1996 Australian Drinking Water Guidelines, the concentrations of SO4 are well above the levels found in the Wesley Creek and Smoke Creek Catchments (Ecowise, 2004). Concentrations of MgSO4 are slightly higher than background values (490 to 730 mg/L SO4). Research projects are underway to investigate the impacts of MgSO4 on aquatic biota and this is discussed in more detail in B3 ARD Management and B8 Fauna Management.

An integrated water management system for impounded and surface run-off water, utilising the RCP3 when constructed, the proposed TSF2 and possibly including a new WRD seepage dam or upgraded Jacko's Dam; will be implemented for the Project. If constructed, almost the entire Gap Creek catchment will be intercepted by the RCP3 facility and this water will be recycled to the processing circuit. Demand for surface water from Lake Argyle is estimated to decrease from an average of 2000 ML during the previous five years to between 0 ML (RL147 spillway) and 144 ML (RL146 spillway). This will also substantially reduce the demand for energy to pump this water – which currently requires an estimated 1.8 GWh per year (SKM, 2004).

Construction of the proposed RCP3 and proposed TSF2 during the life of the Project will also reduce demand for storage in Gap Dam, resulting in fewer spill events into Smoke Creek during high rainfall periods. Water quality is also anticipated to improve with the dilution of diffuse sources of contaminants such as MgSO4. Concentrations of MgSO4 are predicted to fall to between 130 to 285 mg/L with a reduction in solute loads of greater than 85% (Metago, 2005b). The pH of dewatering discharge from the Project will be tested to ensure that ARD seepage is not adversely affecting water quality in the RCP3 and Jacko's Dam.

The average daily process plant water intake is around 20 ML/day therefore most of the expected dewatering base flow and a once per year storm flow event could be incorporated into the process (Metago, 2004d). Where the volume of dewatering discharge from the underground exceeds the capacity of the thickeners, it will be discharged to Jacko's Dam or RCP3 for temporary storage prior to transfer to the process water circuit. Should water abstraction requirements exceed the capacity of the ponds and

dams, the emergency contingency (eg: in excess of 1:100 rainfall event) is to directly release water to the environment. When RCP3 is constructed, a spill is predicted to occur on average once every years via a 10-14 m long five concrete lined and a 200 m rock lined spillway (Metago, 2005a) designed to minimise erosion. It is predicted that excess dewatering is unlikely to occur for more than 10 days in the wettest of years (Metago, 2004d). Any dewater discharged during these events is likely to be rapidly diluted as part of the generalised flooding across the site.

Management of the AK1 TSF1, WRDs and the LIA to minimise contamination of surface water will continue according to the relevant operating manuals and Site Environmental Inspection checklists and is described in more detail in the 1 Waste Rock Management and 2 Tailings Management.

Surface water drainage infrastructure has been established around the Project area to divert surface runoff away from the existing exploratory decline entrance. Probable Maximum Flood (PMF) events have been applied in determining appropriate surface drainage (Minenco, 1996 and Proteus, 2003). A drain has been installed on the up-gradient side of the exploratory decline, which will divert stormwater runoff from the Project area into the Gap Creek drainage line. There are a number of sedimentation dams along the Gap Creek drainage line.

3.2 WESLEY SPRING CREEK CATCHMENT

The Wesley Spring Creek Catchment contains Wesley Spring at the confluence of a number of tributaries and some of the AK1 WRD in its headwaters. The tributary adjacent to the WRD is downstream of Wesley Spring (see Figure B2-1) and thus any seepage from the WRD is unlikely to affect the Spring, which appears to be sustained through the damming of creek flows behind a prominent quartz ridge situated on Wesley Flats.

Dewatering for the open cut mining operations does not seem to have affected Wesley Spring and modelling of the dewatering required for the Project indicates that there the spring will not be impacted. Surface and groundwater monitoring will continue to confirm modelling predictions. Surface water is continuously monitored at three sites in the Wesley Creek Catchment – WGS1, 2 and 3. Flow rates, EC and pH are measured. Turbidity monitoring may also be added to the WGS1 station, above the Wesley Spring. These data will enable background sediment loads to be estimated for comparison with the loads in the more disturbed catchments. Actions to minimise environmental impacts to the Spring are discussed in detail in the B17 Wesley Spring Management Plan.

Magnesium sulphate has been recorded in East Wesley Creek at the Designated Area fence monitoring station, just below the WRD. An estimated 33 tonnes seeped out of the WRD during 2002-2003 and 219 tonnes in 2003-4 (Ecowise, 2005). Should any PAF material be encountered in the Project, engineering controls will be implemented to encapsulate this material on the WRD and thus minimise further seepage of MgSO4. Consideration is also being given to replacing the Upper Limestone Creek Waste Rock Dump Seepage Retention Dam (Jacko's Dam) to improve the efficiency of seepage capture from the Southern WRD as discussed above. This water will then be utilised in the processing circuit or treated to lower the solute concentrations to acceptable levels.

3.3 SMOKE CREEK CATCHMENT

The Smoke Creek Catchment contains most of the open cut mine, northern WRD, Gap Dam, alluvial mining areas and Devil Devil Spring. Dewatering for the open cut mine has depressurised the rock strata near Devil Devil Spring and it therefore ceases to flow early in the dry season. The groundwater levels previously sustaining the more permanent flow of this spring have dropped and are unlikely to return to pre-mining levels.

About 10 GL of runoff water from the Smoke Creek Catchment is captured in the Gap Dam each year. Water quality is generally good, however SO4 concentrations are still significantly higher (260 mg/L SO4) than base values recorded in the upper catchment (around 5 mg/L SO4 in the Matsu Valley) (Ecowise, 2004). Total export of MgSO4 has been estimated to be 1500 tonnes per year during high rainfall periods when the Gap Dam overflows (Ecowise, 2004). This overflow is rapidly diluted with surface runoff during these events and the A continuous flow monitor gauging station will be installed at the dam spillway to measure flow rates, EC and pH.

Alluvial mining ceased in this catchment in 2000 and although mostly rehabilitated, sediment discharge is five times that of the Gap and Limestone Creek catchments. Areas of the WRD previously unavailable for rehabilitation may become available after commencement of the Project and thus provide opportunities to further reduce sediment and MgSO4 losses with appropriate engineering controls for surface drainage and by construction of cover systems using NAF waste rock. Successful rehabilitation will help stabilise the WRD surfaces and thus reduce erosion.

Implementation of integrated water management for the Project through construction of RCP3, a new WRD seepage dam or an upgraded Jacko's Dam will effectively increase the storage capacity of Gap Dam and thus reduce the frequently of overflows with similar reductions in MgSO4 and sediment losses.

3.4 SEWAGE TREATMENT PONDS

The sewage treatment ponds and facilities are located adjacent to the accommodation villages. The DoE Licence to Operate provides a series of conditions for managing the sewage ponds as per Section 2.1.2. Management actions to comply with the licence conditions; minimise erosion and loss of contaminants from the sewage treatment ponds is covered in 3 Non Mineral Waste Management.

4. RESPONSIBLE PEOPLE

The following people are responsible for actions to manage surface water at Argyle:

4.1 SUPERINTENDENT ENVIRONMENT

The Superintendent Environment is responsible for monitoring and for reporting surface water quality in creeks, springs, containment facilities and underdrains from the TSFs and WRDs, operational water data and surface water incidents in the AER. The Superintendent Environment is also responsible for notifying the DoE and DoIR of significant Licence to Operate or SWL non-compliances and for arranging inspections of surface water facilities by Government regulators.

4.2 CULTURAL HERITAGE MANAGEMENT OFFICER

The Cultural Heritage Management Officer will consult with Traditional Owners, document their concerns and provide feedback on surface water quality and issues as they arise.

4.3 TAILINGS AND WATER ENGINEER

The Tailings and Water Engineer (TWE) will develop water reuse targets and Key Performance Indicators, which will be reported annually to regulators in the AER. The TWE will monitor surface water volumes diverted to Gap and Jacko's Dam's, and from Lake Argyle, to maintain allocation within licensed limits. The TWE is also responsible for ensuring that RCP3 is utilised to maximise capture of surface water runoff within the upper Limestone Creek Catchment and that this water is recycled as process water prior to drawing on Lake Argyle or Gap Dam surface water resources. The TWE will review and revise the Mine Water Management Plan as required.

5. RELATED DOCUMENTS

Management and Operational Plans

- Metago (2004c) Argyle Water Management Plan
- Metago (2004a) Argyle Water Operating Strategy for Water and Rivers Commission

Procedures and Work Instructions

- Argyle (2003d) Water Monitoring Procedure
- Metago (2004b) Environmental Water Monitoring Handbook

Surface water research references and other background documents are listed in the Reference list on Part C of the Environmental Protection Statement (EPS).

6. RECORDS MANAGEMENT

As subsequent revisions of this document are carried out, previous versions are retained within DM5 for records management purposes in accordance with the **Management of Controlled Documents Procedure #AD-226750**.

7. APPENDICES

7.1 TABLE B 2: SURFACE WATER MANAGEMENT

Action	Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction Procedure
B.2.1	Surface water is managed in accordance with the Water Licence Operating Strategy	To ensure compliance with the Water Licence Operating Strategy	Review and revise the Water Licence Operating Strategy and Mine Water Management Plan to incorporate changes to allocation, water management and/or monitoring and reporting requirements. Discuss with regulatory authorities as required.	Triennial or when significant change occurs.	TWE Superintendent Environment	Water Operating Strategy and Mine Water Management Plan are reviewed.	S3 Administrative Requirements and S4 Operating Regime (Metago, 2004b)
B.2.2			Develop water reuse targets and Key Performance Indicators (KPI) for annual reporting to regulators. Document and report key new water reuse/recycling initiatives.	Within 6 months of commencement of the Project.	TWE	Review AER KPIs annually. Review status of implementation of new initiatives.	S3 Administrative Requirements (Metago, 2004b)
B.2.3			Review and update the site water and solute balance to ensure all inputs, uses, outputs and losses are included. Monitor surface water volumes diverted from Gap Dam, Lake Argyle and Jacko's Dam to ensure they can be maintained within the annual licensed allocation limit.	Annually Quarterly	Manager Production Processing TWE	Internal audit, Report in AER.	S7.2 (Metago, 2004a) S2.3 Water Use; S5.3.1.1 Water Supply; S7.2 Water Balance Model (Metago, 2004b)

Action	Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction Procedure
B.2.4	Surface water is managed in accordance with the Water Licence Operating Strategy	To ensure compliance with the Water Licence Operating Strategy	Provide operational water data to Environment Section. Include operational water data in AER	Annually Annually	TWE Superintendent Environment	Annual review of operational water data.	S5.2.3 Monitoring Data Management and Reporting (Metago, 2004b) S2.3 Water Use; S5.3.1.1 Water Supply; S7.2 Water Balance Model (Metago, 2004b)
B.2.5			Lodge incident reports for surface water incidents and non-compliances. Report all surface water incidents to Government in the AER. Notify DoE and DoIR of any significant Licence to Operate & Surface Water Licence non-compliances.	As required Annually As required	All staff TWE/Superintendent Environment Superintendent Environment	All surface water incidents and non-compliances are reported and Government is notified as appropriate.	Procedure for Reporting and Investigating Non-conformance (Argyle, 2001a) S2.3 Water Use (Metago, 2004b)
B.2.6	Surface water is managed in accordance with the Water Licence Operating Strategy	To ensure compliance with the Water Licence Operating Strategy	Continue consultation with Traditional Owners (through the Relationship Committee) and other stakeholders to give them feedback on surface water use, levels and quality; vegetation and fauna, and potential impacts on Aboriginal heritage sites. Document stakeholder concerns and implement management actions where deemed appropriate. Where adverse impacts occur evaluate ameliorative actions with stakeholders and implement where feasible.	Quarterly Quarterly As required	Cultural Heritage Management Officer Cultural Heritage Management Officer Cultural Heritage Management Officer /Environmental Superintendent	Stakeholder meetings are held and documented. Stakeholder opinions are incorporated into reviews of Operating Strategy and Management Plans.	S6 Water Use (Metago, 2004b) Schedule 2 Participation Agreement and Management Plan 8 – Devil Devil Springs S5 Argyle Participation Agreement (Freehills, 2004)

Action	Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction Procedure
B.2.7		Ensure regulators are familiar with surface water operations and no non-compliances occur.	Arrange an inspection of surface water facilities by Department of Environment (Licensing) personnel in conjunction with other Government regulators.	Annually	Superintendent Environment	No non-compliances. Documented feedback from regulators	S9 (Metago, 2004b)
B.2.8	Impact of changed water regimes on environment	To identify modified water regimes and reinstate where feasible.	Identify areas that may have been affected by changes in surface water drainage and reinstate where possible (ie: by environmental water releases or engineering to reinstate drainage).	Ongoing	Superintendent Environment	Compliance with Condition 1 GWL74139 (4) (DoE, 2004b)	S2.3 Water Use (Metago, 2004b)
B.2.9	Impact of drawing raw water from Lake Argyle and Gap Dam	Maximise water recycling and reuse and minimise demand for water from Lake Argyle.	Optimise retention of catchment water for recycling in the process circuit. Construct new Reclaim Pond. Preferentially draw on RCP3 and Jacko's Dam water prior to abstraction from Gap Dam and Lake Argyle	As required Ongoing	TWE TWE	RCP3 is constructed. Conditions 2 & 3 SWL99702 (5); SWL99703(2) and SWL151367(2) (DoE, 2004b)	Stage 2 Design of RCP3 S4.6 (Metago, 2004b) Environmental Water Monitoring Handbook (Metago, 2004b)
B.2.10			Evaluate options to improve the effectiveness of Jacko's Dam to intercept seepage water from the AK1 WRDs for subsequent use in the process water circuit.	Ongoing	TWE	Increase volumes of seepage water returned to process circuit.	ARD (site) Management Plan (Metago, 2004e) Environmental Water Monitoring Handbook (Metago, 2004b)
B.2.11	Contamination of surface water	Ensure contamination of surface water is minimised.	Ensure new landfills are located at least 100 m from surface water bodies. Divert stormwater away from landfill sites. Map landfill locations on contaminated sites register.	As required As required. Following construction	Environmental Advisor Superintendent CAMS	Landfills are managed appropriately. Landfill maps are updated following construction.	Conditions S3 (b) and S2 Licence to Operate 4459/9 (DoE, 2004a)
B.2.12	Contamination of surface water.	Ensure water quantities and qualities are monitored in	Continue monitoring water quality (BMI, N & HM) and flow in the Limestone Creek Catchment stations:	Ongoing as per Monitoring Procedures	Superintendent Environment	Monitoring completed and reported.	S3 Administrative Requirements; S5.3 & Appendix C Monitoring Programme; S7.2 Water

Action	Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction Procedure
		accordance with the monitoring programme	AK1 TSF1: AK1TDQ2, AK1TEQ, East Dam, OFTD, NE Dam, SE Toe, UD1-6; AK1 WRD seepage – WRDGSQ; Bent Way near Camp Nick – BWCNQ; Final storage water quality prior to decant to Reclaim Pond - AK1 TSF1 (AK1TDQ); Intersection of N tributary of upper Limestone Creek and Wandarrie Road - LCWR LCGSQ, GAPSQ; LIA – LIAQ1, POFQ, LOFQ LLIMQ1, LLIMQ2 (also TPH), Pit Range Surface Runoff at Lissadell Road Crossing – PRSRQ; Process Water Pond spillway (PWPQ); and TSF Underdrains - AK1TEQ, AK1TWQ Waste Rock Runoff Dam (Jacko's) – LCDAMQ.				Balance Model; S9 Commitments (Metago, 2004b) Argyle Standard on Water Use and Quality Control S3.3.2 (Argyle, 2004a) S5.2.2 Monitoring Procedures (Metago, 2004b)
B.2.13	Contamination of surface water.	Ensure water quantities and qualities are monitored in accordance with the monitoring programme	Continue monitoring water quality (MBI, N, HM) and flow in the Smoke Creek Catchment stations: ▪ Gap Dam East & West- GAPDE, GAPDW; ▪ Gap Dam @ base of spillway – GAPDLQ; ▪ PQ; ▪ Post Gap Dam – FBCQ; and	Ongoing as per Monitoring Procedures	Superintendent Environment	Monitoring completed and reported.	S3 Administrative Requirements; S5.3 & Appendix C Monitoring Programme; S7.2 Water Balance Model; S9 Commitments (Metago, 2004b) S5.2.2 Monitoring Procedures (Metago, 2004b)

Action	Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction Procedure
			▪ At Lease Area boundary – AGSQ (also TPH). Investigate option to install automatic water quality and flow samplers on: ▪ Gap Dam spillway; and ▪ Fat Bullock Creek (plus sediment). Continue monitoring water quality (BMI & N) at: ▪ AK1 Mine Pit (AK1MPQ); & ▪ Devil Devil Springs – DDSQ;				
B.2.14	Contamination of surface water.	Ensure water quantities and qualities are monitored in accordance with the monitoring programme	Continue monitoring water quality (BMI, N, HM, Micro) monitoring and flow in the Wesley Spring Creek Catchment stations: ▪ Wesley Spring – WSSDQ; WSCQ, WSQ1, WS12; WGS 1-3; and ▪ WRD South – WRDSCQ.	Ongoing as per monitoring procedures	Superintendent Environment	Monitoring completed and reported.	S5.2.2 Monitoring Procedures (Metago, 2004b)

Action	Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction Procedure
B.2.15			Continue monitoring water quality (BMI, N, HM, Micro) at: ▪ Village sewage treatment plant sampling points – VSTPQ1 & 2 ▪ Village effluent – VSLGSQ ▪ Wandarrie Sewage treatment plant sampling points – WSTPQ1, 2 & 3	6 monthly	Superintendent Environment	Monitoring completed and reported.	S3 Administrative Requirements; S5.3 & Appendix C Monitoring Programme; S7.2 Water Balance Model; S9 Commitments (Metago, 2004b) Argyle Standard on Water Use and Quality Control S3.3.2 (2004a) S5.2.2 Monitoring Procedures (Metago, S3 2004b)
B.2.16	Contamination of surface water.	Ensure baseline data are obtained to assess impacts of mining operations.	Continue monitoring water quality (BMI) at regional stations: PRSRQ, BWCNQ	Annual	Superintendent Environment	Monitoring completed and reported.	S3 Administrative Requirements; S5.3 & Appendix C Monitoring Programme; S7.2 Water Balance Model; S9 Commitments (Metago, 2004b) Argyle Standard on Water Use and Quality Control S3.3.2 (Argyle, 2004a) S5.2.2 Monitoring Procedures (Metago, S3 2004b)
B.2.17			Report surface water quality and flow data to the regulatory authorities in the AER; include comparisons against previous years and baseline data.	Annually by 30 September	Superintendent Environment	Review of AER; Review of regulator comments on AER.	WLOS Commitments for S5.2.3 Monitoring Data Management and Reporting; S9 Commitments (Metago, 2004b)

BMI = Basic and Major Ions: EC, TDS, pH, Harndess, Na, K, Ca, Mg, Cl, Alk (CaCO3), SO4, CO3, HCO3, Si, F, Fe, Mn, A
N = Nutrients: NO2, NO3, NH4(free), Total N, PO4, Total P, Chlorophyll, BOD

HM = Heavy Metals: Zn, Cu, Ni, Pb, Cd, Cr, As, Hg
TPH = Hydrocarbons: TOG, TPH, C6-9, C10-14, C15-28, C29-36
Micro = Microbiological: Faecal coliform, Hetrotrophic Plate count 21C/37C, Total Coliforms, Faecal Steptococci