



ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE ARGYLE UNDERGROUND PROJECT

WESLEY SPRINGS MANAGEMENT PLAN



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1. INTRODUCTION

1.1 PURPOSE

The aim of the Wesley Spring Management Plan is to outline measures; including monitoring, to identify any impacts on Wesley Spring and to define management actions that will be implemented should any adverse impacts be identified. The Plan will also assist in meeting compliance with the Cultural Heritage Management Plan and other Management Plans contained in the Participation Agreement.

The proposed monitoring and management actions detailed in the Management Plan will be discussed and agreed with the Traditional Owners through the Relationship Committee. Management actions to ensure these objectives are met and personnel responsible for their implementation are described in Table B17-1 Wesley Spring Management.

1.2 SCOPE

The Wesley Spring Management Plan identifies the potential impacts of the Underground Project on Wesley Spring. The Plan specifies key parameters and triggers that will be developed for identifying impacts and the additional measures that will be implemented should impacts be identified. The Wesley Spring Management Plan is supported by the management measures in the Groundwater Management Plan, Surface Water Management Plan and Flora and Vegetation Management Plan.

1.3 AREA

Wesley Spring, its surrounds and local sources

2. DEFINITIONS

Wesley Spring (Tjamindum/Nanbum Spring) A pond of water which is located on the lease area approximately 3.5 km from the proposed underground mine and 2.2 km to the west southwest of the edge of the Southern Waste Rock Dump. The Spring is of cultural significance to the Traditional Owners (TOs) and there are dreamtime stories associated with the area. Wesley Spring is a registered site with the Department of Indigenous Affairs (DIA). Argyle is also aware that the Traditional Owner for the Spring area has submitted an application to the Western Australian Government to establish a living area near Wesley Spring.

3. DETAILS

Wesley Spring is located at the confluence of a number of Wesley Spring Creek tributaries and therefore has a number of source areas. The Spring appears to be sustained through the damming of the creek flows and surface runoff behind a prominent quartz ridge situated on Wesley Flats. Potential sources for the runoff include seepage off West Ridge (via an intersecting structure), some 5km west of the existing open pit mine, and seepage from localised groundwater storage within a drainage feeding the Spring from the south west particularly after the wet season. The implied elevated storage – source zones to Wesley Spring suggests that the Spring may naturally cease to flow during extreme dry spells.

The Wesley Spring Creek catchment contains some of the Southern Waste Rock Dumps in its headwaters although the runoff from the waste rock dumps enters the Creek downstream of Wesley Spring.

Wesley Spring has not been affected to date by the dewatering operations. The Spring is located more than 1 km from the predicted dewatering drawdown area for the underground operations. However, potential areas for water source for the Spring on the West Ridge may lie within the predicted depressurisation zone. The impact of loss of pressure on these as yet unidentified recharge areas, is likely to be small since the drawdown range is typically less than 50 m in areas where the prevailing absolute groundwater levels/pressures are predicted to be in the range 300 to 400 m or 70 to 170 m above the elevation of Wesley Spring.

In the unlikely event that regional depressurisation does extend southward from the ridge areas to Wesley Spring, the estimated leakage loss from the shallow regolith to a depressurised hardrock is calculated to be less than 1 mm per annum or less than 0.2% of annual rainfall (Mackie, 2004).

Groundwater monitoring bores are located around the lease area with six bores located near Wesley Spring. It is proposed to construct additional monitoring bores in the Wesley Spring Creek area and on the West Ridge if the underground project is developed. Groundwater is monitored for both water quality and level in order to identify any changes in groundwater that may be attributed to mining operations. Groundwater monitoring will continue and be expanded throughout the underground mine operation.

Surface water is continuously monitored at three sites in the Wesley Spring Creek catchment – WGS1, 2 and 3 (see Figure B2-1). Flow rates, EC and pH are measured at all of these sites with turbidity also being monitored as the WGS1 station above the Spring. These data will enable background sediment loads to be estimated and compared with data from more disturbed catchments and monitoring points.

Monitoring results are available on a website. The results are also provided in report form at six monthly intervals to the Traditional Owners through the Relationship Committee, and to the regulatory authorities in the AER. Results, which are outside the licence parameter levels, will be investigated. The reasons for the variances and proposed remedial actions will be reported to both Traditional Owners and Government.

Wesley Spring is a known water table dependent spring and any decline in water supply to the Spring may result in a loss to phreatophytic species and some xerophytic and vadophytic species (Muir, 2002). A monitoring trial was established in the Wesley Spring area in 2003 to determine if there are any impacts of water drawdown on the vegetation at the Spring. A series of transects was established and baseline data were recorded to provide information on types and health of the vegetation in each transect (Bennett, 2003). These sites will be monitored on a triennial basis and on an as needed basis if observations indicate rapid changes. The results of the monitoring will be provided to the Traditional Owners and the regulatory authorities.

4. RESPONSIBLE PEOPLE

The following people will be responsible for the proposed actions for the management of Wesley Spring:

4.1 SUPERINTENDENT ENVIRONMENT

The Superintendent Environment will be responsible for collecting anecdotal information in relation to Wesley Spring, conducting monitoring for vegetation, groundwater and surface water. The Superintendent Environment will also be responsible for identifying impacts to water levels, water quality and vegetation that are due to mining; liaising with TOs and key stakeholders regarding management measures and implementing the agreed remedial actions, and reporting to Government via the AER.

The Superintendent Environment will also develop a procedure for access into the Restricted Access Zone with the TOs, be responsible for the demarcation of a Restricted Access Zone of 200 m from the edge of the wet season pond and for ensuring this zone is marked on site maps.

4.2 CULTURAL HERITAGE MANAGEMENT ADVISOR

The Cultural Heritage Management Advisor will develop a procedure for access into the Restricted Access Zone with the TO's and Superintendent Environment. The Cultural Heritage Management Advisor will also consult with the TOs regarding management measures to address impacts on the vegetation of Wesley Creek Spring if mining operations are identified as the cause.

5. RELATED DOCUMENTS

Management and Operational Plans

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

Procedures and Work Instructions

- Argyle (2003d) Water Monitoring Procedure
- Metago (2004b) Environmental Water Monitoring Handbook
- Argyle (2003b) Procedure for Working in and Around Rivers
- Argyle (2003c) Procedure for Working in Remote Areas
- Argyle (2003d) Water Monitoring Procedure
- Argyle (2003e) Work Instruction for Collecting Groundwater Samples
- Argyle (2003f) Work Instruction for Collecting Surface Water Samples
- Argyle (2003g) Work Instruction for Conductivity Meter Calibration
- Argyle (2003h) Work Instruction for pH Meter Calibration
- Argyle (2003i) Work Instruction for Soil and Water Sample Dispatch
- Argyle (2003j) Work Instruction for Monitoring Ground Water Levels
- Argyle (2003) Procedure for Calibration of Flow Meters

Surface water, groundwater and vegetation research references and other background documents are listed in Part C References 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**.

APPENDICES

Table B 17: Wesley Springs Management

Item	Issue	Objective	Management Action	Timing	Responsibility	Performance Target	Work Instruction Procedure
B. 17.1	Changes in surface water flow rates due to mining operations	Minimise changes to surface water flow into and out of Wesley Spring	<p>Determine baseline surface water flow rates by:</p> <ul style="list-style-type: none"> ▪ Anecdotal information from TO consultation. ▪ Stream gauging data <p>Monitor and review surface water flow into and out of Wesley Spring. Report to Relationship Committee and Regulators</p>	Within 3 months of start of underground development	Superintendent Environment	Baseline established	Nil
B. 17.2			Monitor and review surface water flow into and out of Wesley Spring. Report to Relationship Committee and Regulators	Continuous monitoring Review midway through wet and dry season and end of wet and dry season. At Relationship Committee meetings and in the AER	Superintendent Environment	Monitoring, reviewing and reporting frequency as planned.	Nil
B. 17.3	Adverse impacts on surface water flows	Minimise adverse impacts of changes to surface water flow into and out of Wesley Spring	<p>Quantify change and duration; Evaluate significance of change. Visually inspect Wesley Spring flows. Establish the cause of changes to flow by reviewing rainfall, evaporation, spring flow rates and groundwater level data etc. Report to Traditional Owners on any changes and causes of change Consult with Traditional Owners and Government on management measures for the surface water flow, such as replenishment of the surface water or recharge into the groundwater. Implement agreed management actions.</p>	Upon identification of a significant flow trend changes of either a reduced or no flow in the wet season. After cause has been established. If mining operations are identified as the cause. Following consultation with Traditional Owners and Government.	Superintendent Environment Cultural Heritage Management Advisor Superintendent Environment	Actions implemented when change is considered significant compared to agreed criteria	Nil
B. 17.4	Change in pond dimensions	Minimise changes to impounded surface water at Wesley Spring	<p>Determine baseline pond levels:</p> <ul style="list-style-type: none"> ▪ Anecdotal information from TO consultation. ▪ Stream gauging data ▪ Photographic records 	Within 3 months of start of underground development	Superintendent Environment	Baseline established	Nil



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B.17.5	Adverse impacts on pond dimensions	Minimise adverse impacts of changes to pond dimensions at Wesley Spring	<p>Photographic record of Wesley Creek Spring pond dimensions.</p> <p>Establish the cause of change by reviewing rainfall, evaporation, spring flow rates and groundwater level data etc.</p> <p>Consult with Traditional Owners on cause and significance</p> <p>Consult with Traditional Owners and Government on required management measures, to re-establish baseline pond dimensions such as replenishment of the surface water.</p> <p>Implement agreed management actions.</p>	<p>Upon identification of adverse change to the pond dimensions.</p> <p>After cause has been established.</p> <p>If mining operations are identified as the cause. Following consultation.</p>	Superintendent Environment	Actions implemented when change is considered significant compared to agreed criteria	Nil
B.17.6	Changes in groundwater elevations related to Wesley Spring due to mining activity	Minimise impacts at Wesley Spring resulting from changes in groundwater elevations	<p>Conduct groundwater level monitoring</p> <p>Establish hydrogeological model for the area including relationship between surface water and groundwater.</p> <p>Determine baseline groundwater elevations from monitoring data.</p> <p>Review groundwater monitoring programme for Wesley Spring and expand if necessary.</p>	<p>In accordance with the documented monitoring programme.</p> <p>Prior to start of underground development.</p> <p>Within 3 months of start of underground development and then every 3 years throughout the mine life</p>	Superintendent Environment	Baseline established	S5.2.2 Monitoring Procedures (Metago, 2004b)
B.17.7					Superintendent Environment	Monitoring programme provides adequate data	Nil
B.17.8	Changes in groundwater elevations related to Wesley Spring due to mining activity	Minimise impacts at Wesley Spring resulting from changes in groundwater elevations	<p>Monitoring groundwater levels and review of groundwater data including long-term trends.</p> <p>Report to Relationship Committee and Regulators</p>	<p>Continuous automatic monitoring for Wesley Spring bores. Monthly manual monitoring other relevant bores</p> <p>Six Monthly Review at Relationship Committee meetings and in the AER</p> <p>Annually (using data from end of dry and end of wet).</p>	<p>Superintendent Environment</p> <p>Cultural Heritage Management Advisor</p>	Monitoring, reviewing and reporting frequency as planned.	Nil
B.17.9			<p>Compare actual abstraction and measured groundwater elevation data with that predicted in the groundwater flow model.</p>		Superintendent Environment		Nil
B.17.10			<p>Rerun groundwater model with actual data</p> <p>Recalibrate model</p> <p>Run recalibrated groundwater model to revise groundwater drawdown contours</p>	<p>Groundwater monitoring indicates that abstraction and or drawdown are not as predicted.</p> <p>If model verification is not satisfactory.</p> <p>If recalibrated model is required.</p>	Superintendent Environment	Verified groundwater model	Nil



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Item	Issue	Objective	Management Action	Timing	Responsibility	Performance Target	Work Instruction Procedure
B.17.11	Changes in groundwater elevations related to Wesley Spring due to mining activity	Minimise impacts at Wesley Spring resulting from changes in groundwater elevations	<p>Establish magnitude of variation in change between shallow and deep groundwater elevations at each site as an indicator of groundwater level drawdown.</p> <p>Determine if any variation in change in groundwater elevations between shallow and deep aquifers at the same site using monitoring data</p> <p>Assess if groundwater elevation changes are due to mining activity and are impacting on Wesley Spring's:</p> <ul style="list-style-type: none"> ▪ Pond dimensions (7.5); ▪ Spring flow rates (7.3); or ▪ Vegetation (7.18). 	<p>Within one year of underground development</p> <p>Quarterly</p> <p>If variation in 7.11 is exceeded OR if the groundwater elevation over at least three years shows a declining trend.</p>	Superintendent Environment	Variation parameter to be determined but likely to be in the order of 0.5m	Nil
B.17.12					Superintendent Environment	Proven connection between groundwater elevations and impact	Nil
B.17.13	Adverse impact at Wesley Spring due to changes in groundwater elevations from mining activity.	Minimise adverse impacts from groundwater elevation changes.	<p>Consult with Traditional Owners on cause and significance of impacts</p> <p>Consult with Traditional Owners on required management measures, to address impacts on Wesley Spring from groundwater drawdown, such as replenishment to Wesley Spring or recharge into the groundwater aquifer.</p> <p>Implement agreed management actions.</p> <p>Conduct surface water and groundwater quality monitoring</p> <p>Determine baseline surface water and groundwater quality from monitoring data.</p> <p>Establish agreed acceptable water quality criteria.</p> <p>Review surface water and groundwater quality monitoring programmes.</p>	<p>Upon determining connection between groundwater elevations and impact.</p> <p>If mining operations are identified as the cause.</p> <p>Following consultation with Traditional Owners and Government</p> <p>In accordance with the documented monitoring programme.</p> <p>Prior to start of underground development.</p> <p>Within 1 year of commencement of underground development.</p>	Superintendent Environment	Actions implemented as agreed.	Nil
B.17.14	Water quality at Wesley Spring	Ensure the quality of surface water and groundwater in the vicinity of Wesley Spring is not impacted.	<p>Review water quality data against agreed criteria.</p> <p>Report any exceedances of the acceptable water quality criteria to the Regulatory authorities.</p> <p>Report results of water quality monitoring to the Relationship Committee</p>	<p>Upon receipt of monitoring data</p> <p>As per licence requirements and the AER.</p> <p>Six monthly</p>	Superintendent Environment	Baseline quality established and criteria agreed.	Nil
B.17.15					Superintendent Environment	Any exceedances reported.	Nil



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Item	Issue	Objective	Management Action	Timing	Responsibility	Performance Target	Work Instruction Procedure
B.17.16	Water quality at Wesley Spring	Ensure the quality of surface water and groundwater in the vicinity of Wesley Spring is not impacted.	Investigate any exceedance of water quality criteria and determine if the change is related to mining activities. Report the findings of the investigation to the Traditional Owners Consult with Traditional Owners and Government on required management measures to improve water quality to the Spring. Implement agreed management actions.	Within three months of reportable exceedances. The Relationship Committee meeting following the findings of the investigation into the exceedance If mining operations are identified as the cause. Following consultation with Traditional Owners and Government.	Superintendent Environment Superintendent Environment	Exceedances investigated Actions implemented as agreed	Nil Nil
B.17.17	Water changes impact on Wesley Spring vegetation	Ensure that mining activities do not adversely impact vegetation at Wesley Spring	Conduct vegetation survey and establish baseline vegetation transects at Wesley Spring. Obtain anecdotal information on vegetation at Wesley Spring from Traditional Owners. Develop and implement vegetation monitoring programme using on the ground monitoring of transects and investigate the use of remote sensing	Prior to start of underground development.	Superintendent Environment	Transects established and monitoring programme implemented	Nil
B.17.18	Disturbance to the Wesley Spring Site.	Ensure that mining and exploration activities do not physically impact on the Wesley Spring Site	Review monitoring programme and results. Identify any impacts on vegetation and determine the cause and if it is due to mining activity. Report the results of the survey and monitoring to the Traditional Owners and Government. Consult with Traditional Owners and Government on required management measures, to address impacts on Wesley Spring vegetation. Implement agreed management actions.	Annually	Superintendent Environment	Programme reviewed and impacts and their cause identified	Nil
B.17.19							
B.17.20							
B.17.21			Establish a 200 m restricted access zone from the Wesley Spring pond. Define the restricted access zone from the wet season pond dimensions in consultation with the Traditional Owners by: <ul style="list-style-type: none"> ▪ Determining the wet season pond area ▪ Establishing perimeter coordinates 200 m from the edge of the wet season pond 	Prior to start of underground development	Superintendent Environment	Restricted Access zone demarcated	Nil



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Item	Issue	Objective	Management Action	Timing	Responsibility	Performance Target	Work Instruction Procedure
B.17.22	Mining and Exploration personnel access to Wesley Spring Area	Ensure compliance with agreed protocols in relation to access into the Wesley Spring restricted access zone.	<ul style="list-style-type: none"> ▪ Pegging the 200m perimeter boundary ▪ Constructing boundary demarcation as agreed with the Traditional Owners. ▪ Incorporate restricted access zone into all maps, plans, inductions and procedures for current and future mining and exploration activity. ▪ Erect signage on access roads to the area. <p>Develop an agreed protocol with Traditional Owners for access into the restricted zone Use the protocol procedure for every access into the restricted zone.</p>	Prior to start of underground development Every access	Superintendent Environment	Compliance with Protocol	Nil Will be a procedure

