



WATER MANAGEMENT PLAN GROUNDWATER OPERATING STRATEGY

Mount Gibson Iron

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1. PURPOSE

The purpose of this Groundwater Operating Strategy is to provide a strategy for the operation, monitoring and reporting of all groundwater abstraction associated with operations at the Koolan Island Iron Ore Project (the Project). The document is presented as an adjunct to the Koolan Island Water Management Plan.

This Operating Strategy relates to the abstraction of water from the Projects water supply borefield. Abstraction from the water supply borefield is for the provision of water supply requirements for the mine village, crushing plant and associated administration, workshop and office areas.

2. SCOPE

The Project is operated by Koolan Iron Ore Pty Ltd as a wholly owned subsidiary of Mount Gibson Iron Ltd (MGX). Koolan Island is not a "Proclaimed Area" under the West Australian Rights in Water and Irrigation Act (RiWI Act) and as such, licenses under sections 26D and 5C of the act, to construct and alter wells, and abstract groundwater respectively, are not required. However, it is intended that the Groundwater Operating Strategy will effectively achieve the objectives of the Act that relate to environmental and water resource protection.

This Operating Strategy has been developed using the Waters and Rivers Commission (WRC) 'Use of Operating Strategies in the Water Licensing Process' (Statewide Policy No. 10-May 2004) and 'Guidelines for Hydrogeological Reports and Groundwater Monitoring Reports Associated with a Groundwater Well Licence' (Version 10ab, May 1998).

MGX commits to complying with the procedures outlined in this Operating Strategy and to minimise all potential impacts on groundwater resources associated with the operation.

3. TABLE OF ABBREVIATIONS

Term	Definition
CEO	Chief Executive Officer
C&M	Care and Maintenance
DER	Department of Environmental Regulation
DoE	Department of Environment (Federal)
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife
GM	General Manager
HSEC MS	Health, Safety, Environment and Community Management System
HSET	Health, Safety, Environment and Training
KIOP	Koolan Iron Ore Project
MGX	Mount Gibson Iron Ltd
NQMP	Northern Quoll Management Plan
OEPA	Office of the Environmental Protection Authority
OEMP	Operations Environmental Management Plan

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4. PROJECT DETAILS

4.1 Site Summary

The Koolan Iron Ore Project (KIOP) is located in Yampi Sound, off the Kimberly coast of Western Australia. The Project comprises the Main Pit, on the south side of the island, and several smaller satellite orebodies (Mullet, Acacia, Eastern and Barramundi) in the central and northern part of the island.

BHP started mining on the island in 1964 and continued until 1994. Before mining stopped, the Main Pit floor elevation was at – 80 mRL (some 85 m below mean sea level) and dewatering had become a key component of the operation. When mining ceased, BHP flooded the Main Pit by breaching the seawall on the south side of the Pit as part of the decommissioning procedure.

Aztec Resources recommenced exploration operations on Koolan Island in 2003. The project was acquired by Mt Gibson Iron Ltd in 2007 and mining operations recommenced with granting of environmental approvals from the state and federal governments. Construction of the mine site was completed in 2008 and dewatering of Main Pit commenced in 2010 following completion of the Main Pit sea wall. Mining was also undertaken in satellite pits Mullet Pit, Acacia East, Barramundi Pit and East Pit.

On 26 November 2014 the Seawall collapsed following a series of failures to the sea wall integrity during the previous month. As a result the Main Pit was inundated to sea level causing a reduction in operations to a satellite pit and subsequent transition into effective care and maintenance. In April 2016.

In June 2017 efforts commenced to rebuild the Seawall leading towards return to mining operations in 2019. Construction on the Seawall was completed in July 2018 and capital dewatering commenced to remove the resident seawater in the Main Pit. Dewatering in Mullet Pit also commenced in July 2018 to allow for in-pit disposal of waste rock.

4.2 Water Abstraction

Water abstraction is undertaken at the Project through;

- Groundwater production bores, and
- Dewatering of mining pits.

4.2.1 Production and Monitoring Bores

Water supply infrastructure has been constructed for the crushing plant and associated administration, workshop and office areas and the mining village. Groundwater is abstracted from groundwater resources on the island using three production bores; I01, V01 and K3.

Nomenclature for the production bore network generally adheres to the following naming system (Figure 1):

I – Infrastructure Bore;

V – Village Bore.

The island also has a monitoring bore network, installed to observe any potential impact on groundwater as a result of mining operations. Eight new monitoring bores (K1, K2, K4, K8, K9, K10, K11 and M3) were installed to supplement the existing BHP bores K3, K6, K7 and KL106, which were converted to monitoring bores. In addition to groundwater monitoring, the bores are also used as stygofauna monitoring bores.

The monitoring network has since changed as operations have progressed due to access and serviceability of existing monitoring bores. The location of all production and monitoring bores is illustrated in Figure 1. Bore completion summary for production and monitoring bores, including current status, are presented in Table 1 and Table 2 respectively.

Southern Syncline Bores

Production bore I01 is an existing groundwater supply bore in the original Water Bore Gully bore field, within the South Syncline aquifer. MGX previously used production bore I01 during exploration drilling programs. Production bore I02 was constructed in the Southern Syncline in June/July 2006 and is no longer serviceable.

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Existing BHP bores K6, KL106P (now decommissioned) and K7 were converted as monitoring bores in the Southern Syncline. New monitoring bores K10, K8 and K11 were drilled to supplement the existing bores to provide a comprehensive monitoring network. K8 is currently the only monitoring bore that is serviceable within the southern syncline.

Central Anticline

Production bore M2, installed in the Mullet Pit in the Central Anticline, was used for additional water supply when required, but was decommissioned by MGX. Monitoring bores M3 (now decommissioned), K1 and K2 were constructed to monitor background water quality, Mullet Pit dewatering and regional groundwater levels.

An existing BHP bore, K3, is used as an additional regional monitoring bore. However, MGX converted this to a production bore as described previously. K3 is now the main water supply bore for the village and V01 is utilized as a backup or alternate source.

Northern Syncline Bores

Two abstraction bores, V01 and back-up bore V02, were constructed as replacements of the existing bores KL104 and KL103 (in the Northern Syncline) that were destroyed during the rehabilitation of the island by BHP. V01 Bore remains as a production bore providing back-up water supply to the Village. Monitoring bores K9 and K4 were constructed as monitoring bores in the Northern Syncline. K9 is currently the only monitoring bore that is serviceable in the Northern Syncline.



Figure 1: Location of Production Bores (red) and Monitoring Bores (blue).

The Bores are also given identification labels that correspond to License to Operate (L8148/2006/4) monitoring points.

4.2.2 Pit Dewatering

The Main Pit is currently designed to be deepened to around –165 mRL. Dewatering was suspended in November 2014 with the collapse of the Seawall. Mining and dewatering operations in Mullet Pit ceased in August 2014. Dewatering and depressurization of mining pits are a critical component of mining operations at the Project.

The Main Pit is currently flooded with sea water. Capital Dewatering is expected to recommence in August 2018 to return seawater to the channel through outlets approved under EPA Part V Operating License conditions (L8148/2006/4) and the Ministerial Statement 715. The Koolan Island Marine Management Plan (v20) was approved by the OEPA and is currently in force for the duration of the Seawall rebuild and capital dewatering programs.

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Table 1: Summary of production bore construction

Bore ID	Status/(Location)	Coordinates		Elevation - Reference Level (RL) (mAHD)	Date Completed	Stick-up (magl ¹)	Main Casing			Airlift Data	
		mN	mE				Drilled (mbgl)	Blank Interval (mbgl)	Slotted Interval (mbgl)	Discharge (L/s)	Water Level (mbgl)
I01	In Service (Southern Syncline)	8216509.31	579433.03	136.50	11/01/80	0.5	200	0 – 137.0	137.0 – 200.0	7.0	112.4
K3	In Service (Northern Syncline)	8216860	580563	38.686	Pre-1990	0.05	32	Open Hole		4.2 ³	16.26
I02	Destroyed (Southern Syncline)	8216534.43	579883.34	131.75	13/07/06	0.3	240	0 – 138.0	138.0 – 238.0	0.6	112.0
V01	In Service (Northern Syncline)	8216185.11	583445.18	137.09	06/08/06	0.22	243	0 – 134.6	134.6 – 224.5	2.2 – 2.8	120.0
V02	Out of Service (standby) (Northern Syncline)	8216241.00	583249.00	136.00	26/08/06	0.25	246	0 – 126.0	126.0 – 246.0	0.8	122.0
M2	Decommissioned (Central Anticline)	8217710.00	578456.00	48.51	01/09/06	0.45	105	0 – 80.0	80.0 – 105.0	30.0	31.2

Table 2: Summary of monitoring bore construction

Bore ID	Status	Coordinates		Elevation - Reference Level (RL) (mAHD)	Date Completed	Stick-up (magl ¹)	Main Casing ²			Airlift Data	
		mN	mE				Drilled (mbgl)	Blank Interval (mbgl)	Slotted Interval (mbgl)	Discharge (L/s)	Water Level (mbgl)
K1	In Service (Central Anticline)	8217612	579148	97.57	3/06/06	0.40	160	0 – 86.0	86.0 – 156.0	0.4	83.68
K2	In Service (Central Anticline)	8217331	579676	107.453	20/05/06	0.45	163	0 – 95.5	95.5 – 161.5	0.13	88.89
K4	Out of Service (Northern Syncline)	8216368	582456	146.213	10/06/06	0.35	159	0 – 116.3	116.3 – 158.3	0.04	128.45
K6	Out of Service (Southern Syncline)	8216516	579432	136.7	28/06/06	0.80	70	0 – 27.0	27.0 – 63.0	0.00	Dry
K7	Out of Service (Southern Syncline)	8217577	577305	85.414	27/06/06	0.40	175	0 – 90.0	90.0 – 175.0	1.00	75.16
K8	In Service (Southern Syncline)	8216906	578608	136.085	15/05/06	0.50	108	0 – 70.9	70.9 – 100.9	0.10	60.75
K9	In service (Northern Syncline)	8216263	583047	145.81	14/06/06	0.40	230	0 – 109.8	109.8 – 229.8	0.40	117.48
K10	Out of Service (Southern Syncline)	8216155	580515	161.51	10/05/06	0.45	190	0 – 117.7	117.7 – 189.7	0.05	143.58
K11	Out of Service (Southern Syncline)	8216981	578373	134.898	17/06/06	0.4	233	0 – 113.5	113.5 – 232.1	0.90	93.46
KL106P	Decommissioned (Southern Syncline)	8216744	579201	132.01	No Info						105.28
M3	Decommissioned (Central Anticline)	8217733	578410	46.02	6/09/06	5.00	96	0 – 84.0	84.0 – 96.0	6.60	28.86
PB1	In Service (Southern Syncline)	8216009.763	579601.27	86.32	14/07/2008	0.88	200	No Info	No Info	No Info	64.61
PB2	In Service (Southern Syncline)	8216223.763	579376.57	118.145	14/07/2008	0.34	204	No Info	No Info	No Info	95.06
PB3	In Service (Southern Syncline)	8216455.149	579146.97	145.274	14/07/2008	0.74	204	No Info	No Info	No Info	122.94

Bore ID	Status	Coordinates		Elevation - Reference Level (RL) (mAHD)	Date Completed	Stick-up (magl ¹)	Main Casing ²			Airlift Data	
		mN	mE				Drilled (mbgl)	Blank Interval (mbgl)	Slotted Interval (mbgl)	Discharge (L/s)	Water Level (mbgl)
K12	In Service (Central Anticline) - Dry	8217216.3	578948.3	119.7	9/05/2009	1.1	136	No Info	No Info	No Info	105.16
K13	Out of Service (Central Anticline)	8217909.6	579125.9	124.86	22/06/2009	1.1	126	No Info	No Info	No Info	116.11
K14	Out of Service (Central Anticline)	8218058.96	577618.47	57.74	22/06/2009	0.8	90	No Info	No Info	No Info	48.51
K15	In Service (Central Anticline)	8217665.31	579038.76	105.48	2/11/2009	0.3	138	No Info	No Info	No Info	83.70
K16	Out of Service (Southern Syncline)	8216516	579432	136.7	15/05/2010	0.9	180	No Info	No Info	No Info	117.50

¹ magl = meters above ground level

² Casing diameter: Bore M2: Surface hole 315 mm; surface casing 300 mm steel; main hole 300 mm; main casing 155 mm PVC. All other bores: Surface hole 216 mm; surface casing 150 mm steel; main hole 147 mm, main casing 50 mm PVC

³ Recommended yield based on test pumping conducted on 21 January 2008.

5. ADMINISTRATIVE REQUIREMENTS

5.1 Duration of Operating Strategy

The administrative arrangements to ensure adherence to the Operating Strategy are as follows: This Operating Strategy will remain in effect for the duration of the operating life of the water supply borefield and dewatering system. The strategy shall be subject to review as changes in the groundwater system arise, including;

- Each year as part of the Annual Aquifer Review.
- At any other time, if a change to Operating Strategy is required to meet changing Project demand or where the current Operating Strategy cannot meet demand.

Proposals to modify the Operating Strategy will be submitted to the OEPA if and when necessary. It will be deemed necessary to resubmit the operating strategy when significant changes are considered, such as a dramatic increase or decrease in abstraction rates above that already predicted.

A revision of the Ground Water Operating Strategy shall be submitted as an adjunct to any revision of the Koolan Island Water Management in June 2018.

5.2 Water Year

The water year for reporting will be 1 January to 31 December.

5.3 Reporting Commitments

Reporting requirements include submission of an Annual Aquifer Review every year and a Triennial Aquifer Review every three years. These documents shall be submitted as part of the Annual Environment Report submitted with the Compliance Assessment Report submitted to the OEPA prior to July 31 every year.

6. OPERATING RULES

6.1 Bore Specifications and Capacities

Current production bores are to be maintained during transition from construction to mining operations to ensure provision of water needs at the Village and Mine Site. Three production bores are to be serviced and maintained (K3, IO1 and VO1). Actual pumping rate will depend on the demand for water, which will fluctuate due to seasonally variable requirements.

6.2 Main Pit Dewatering

With the suspension of mining activity in Main Pit no dewatering operations have been undertaken on Koolan Island since November 2014. Capital dewatering from the Main Pit commenced in July 2018. According to approval documents previously submitted and approved by the OEPA the dewatering characteristics and parameters shall occur for a duration of four months or more as per provisions in the s45C amendment to Ministerial Statement 715 submitted in September 2016 and the approved Koolan Island Marine Management Plan (version 20) (Table 3).

Table 3: Summary of Main Pit dewatering characteristics

Stated Element	Previous Authorized Extent	Current Authorized Extent
Dewatering of Main Pit	<ul style="list-style-type: none"> • Initial dewatering of approximately 7 million cubic meters of sea water at 300 litres per second • Maintenance rate of approximately 50 to 150 litres per second • Water abstracted from the dewatering process will be placed in a settling pond prior to discharge to sea 	<ul style="list-style-type: none"> • Dewatering to base pit level at a rate of up to approximately 1,600 litres per second • Maintenance dewatering during mine operations via a settling pond prior to discharge to sea

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6.3 Water Demand

The borefield has been designed and equipped to sustain the total Project water requirement during operations. The actual monthly demands on the water supply borefield during reconstruction and mining operations will vary from month to month as a result of variations in total water demand due to camp requirements as well as road and infrastructure maintenance.

Resident fresh rain water in East Pit and Mullet Pit may be abstracted for use in dust suppression and operational purposes if required. Annual rainfall ensures that both pits receive a large inflow of rain water during the wet season. Abstraction for either pits is not expected to impact on underlying aquifers.

6.4 Water Meter Calibration

Water meters are installed at each production bore. Any new production bores will be installed with a water meter. If a water meter requires calibration, it is to be done so in accordance with the manufacturer's specifications. The water meters currently on the production bores do not require calibration as they are mechanical. Water meter readings are taken on a monthly basis. Abstraction rates are reported in the Annual Environment Report submitted as part of the Compliance Assessment Report.

7. MONITORING

7.1 General

A groundwater monitoring program is implemented to monitor the impacts of borefield operation and pit dewatering activities on local groundwater levels and groundwater quality. The monitoring results, and the interpretation of results, shall be reported to the OEPA annually as part of the Annual Environment Report submitted as part of the Compliance Assessment Report.

The monitoring program is implemented in accordance with the Environmental Protection Act Operating Licence L8148/2006/4 issued by the Department of Water and Environmental Regulation (DWER). Monitoring is undertaken in accordance with AS/NZS 5667.11:1998 *Water Quality Sampling Part 11 Guidance on sampling of groundwater* and site safe working procedures. Water samples taken during the annual program shall be submitted to a NATA accredited Laboratory for analysis.

7.2 Monitoring Program

Table 4: Monitoring program

MONITORING BORES	SAMPLING FREQUENCY	PARAMETERS TO BE MEASURED				
K3, I01, V01	Monthly	Standing Water Level (mAHD) Cumulative abstraction (meter reading) m ³ <i>Field Measurement:</i> pH, Electrical Conductivity, Total Suspended Solids				
V01 K9 K3 K2 K1 K9 I01	Annual	<i>Submitted to Laboratory for analysis*</i> Electrical conductivity pH Total Suspended Solids Total Recoverable Hydrocarbons Hardness Total Alkalinity Total Nitrogen Total Phosphorous Bicarbonate Carbonate Nitrate Sulfate		Aluminium Arsenic Barium Boron Cadmium Calcium Chromium Copper Iron Lead Magnesium Manganese Mercury Molybdenum		
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			Nickel Potassium Selenium Sodium Zinc
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Monitoring data will be recorded in the site database and subjected to ongoing review as it is entered to ensure compliance with this Operating Strategy. The data will be presented in the annual environment reports submitted as part of the annual compliance assessment report.

8. ENVIRONMENTAL IMPACT MANAGEMENT

8.1 Water Levels

A feasibility study was undertaken by Aquaterra (Aquaterra, 2005) to assess groundwater management issues relating to mine dewatering and project water supply associated with the then proposed operation. A groundwater model was constructed to assess dewatering requirements and to predict the potential impact of dewatering on groundwater supplies at Koolan Island.

The study predicted that although dewatering activities do have an effect on the Southern Syncline water supply aquifer in the vicinity of water supply bores I01 and I02, the Island’s potable water supply will not be significantly impacted upon. Groundwater modelling predicted that groundwater levels in bore I01 could potentially be drawn down by approximately 20 m in the vicinity of this bore (-5 mRL) while bore I02 had a smaller predicted drawdown of approximately 5 m (10 mRL) due to its location away from the pit. In the Northern Syncline Aquifer bore, groundwater levels in V01 had a predicted drawdown of -40 mRL.

Groundwater level monitoring since 2011 has shown levels in all aquifers to remain unaffected by abstraction rates. Localized draw down has been recorded during high abstraction demand periods however recovery has been rapid and draw down has not exceeded 5m.

Dewatering in Main Pit when it commences shall involve the removal of resident sea water which has inundated the pit void below the sea level and does not impact on the Southern Syncline aquifer characteristics.

Regular and on-going monitoring of groundwater levels has established long-term effects of abstraction on the regional water level. To date, it does not appear that abstraction from production bores or pits has had an adverse effect on the quality of groundwater systems. Aquifers are recharged during the wet season and water demand for dust suppression is also reduced during the wet season. Dust suppression water is also predominately obtained from water collected in the settlement pond.

8.2 Drinking Water Quality

Abstraction from the water supply bores I01, V01, and previously V02 (*decommissioned in 2012*) combined with the impacts of dewatering Main Pit and Mullet Pit has the potential to induce some saline up-coning and associated deterioration in water quality. On-going monitoring of water quality parameters regularly test for changes in water quality, particularly salinity, pH and TDS.

Groundwater quality is also tested against chemical and radiological parameters listed within the *Koolan Island Drinking Water Quality Management Plan (2014)* and reported to the Department of Health.

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9. SUMMARY OF COMMITMENTS

A Summary of commitments outlined in this operating strategy is provided in Table 5.

Table 5: Summary of commitments and obligations

Relevant Section in Operating Strategy	Commitment	Timing / Duration / Frequency
Water Abstraction	Details of any new bores will be added to this operating strategy	When bores are constructed
	Abstraction for dewatering purposes will be maintained at the approved Licensed limit.	During Capital Dewatering
Administrative Requirements	The operating strategy will be reviewed every 2 years along with the Water Management Plan and at other times as may be required to meet changing project demand or declining supply capacity.	As specified
	Annual and Triennial Aquifer reviews will be submitted to the OEPA as part of the Compliance Assessment Report	Annual review – due on 31 July for reporting period of 1 January to 31 December Triennial review – due on 31 July, every 3 years, for reporting period of 1 January to 31 December.
Operating Rules	Bore table shall be amended as Bores and removed or added from service	As and when required
	Flow meters will be installed at each production bore-head and dewatering discharge outlet from Main Pit	Prior to the commissioning
	Flow meters will be calibrated as per manufacturers specifications	Main Pit Flow Meters – Annually (if in use) Production bore flow meters do not require calibration due to manufacturer's specifications and they are mechanical.
Monitoring	The proposed monitoring schedule will be implemented	Ongoing
	All data will be entered in the site monitoring database	Ongoing
	Monitoring data will be reported in the annual and triennial aquifer reviews in the compliance assessment reports.	As specified
Environmental Impact Management	Ongoing monitoring of water levels will be used to establish any long term effects of abstraction on regional water levels	As specified (Table 4)
	Ongoing water quality monitoring will be used to indicate any changes in water quality and salinity	As specified (Table 4)
	Excess water from dewatering sumps in the main pit will be discharged in accordance with Operating Licence L8148\2006\4	As required

10. REFERENCES

- Aquaterra Pty Ltd (2006), Koolan Island Feasibility Study – Groundwater. Report prepared for Aztec Resources Pty Ltd, April 2005. Report No. 524/038a
- Aquaterra Pty Ltd (2005), Koolan Island Production and Stygofauna Monitoring bores Installation and Testing and Mullet Pit Dewatering Study. Report prepared for Aztec Resources Pty Ltd, November 2006. Report No. 524/G1/201a
- Mt Gibson Iron Ltd (2014), Koolan Island Drinking Water Quality Management Plan. Plan submitted to Department of Health December 2014.
- Mt Gibson Iron Ltd (2016), Koolan Island Marine Management Plan. Plan submitted to the Office of the Environmental Protection Authority 6 September 2016.
- Mt Gibson Iron Ltd (2016), Application to amend Ministerial Statement 715 under Section 45C of the Environmental Protection Act 1985: Koolan Island Iron Ore Mine and Port Facility – Reconstruction of Sea Wall and Capital Dewatering of the Pit. Amendment submitted to the Office of the Environmental Protection Authority 6 September 2016.

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