Australian Ilmenite Resources

Water Management Plan

Australian Ilmenite Resources Pty Ltd

SILL80 Project, Mining Lease Application 27422

DW090024

January 2012

CONSULTING SCIENTISTS AND ENGINEERS

Offices:

Western Australia
Queensland
Northern Territory
New South Wales
Victoria
Hanoi, Vietnam

Document Control Record

Prepared by:	Casey Hawkey
Position:	Environmental Scientist
Signed:	
Date:	04/04/2011

Approved by:	Ray Hall
Position:	Principal
Signed:	
Date:	13/01/2012

REVISION STATUS

Revision No.	Description of Revision	Date	Approved
1	First Issue	04/04/2011	Casey Hawkey
2	Internal Review	18/11/11	Jeff Richardson
3	Internal Review	06/01/2012	Ray Hall

Recipients are responsible for eliminating all superseded documents in their possession.

VDM Consulting (NT) Pty Ltd
trading as EcOz Environmental Services
ACN: 143 989 039

Winlow House, 3rd Floor
75 Woods Street
DARWIN NT 0800
PO Box 381, Darwin NT 0800

Telephone: +61 8 8981 1100
Facsimile: +61 8 8981 1102
Email: ecoz@ecoz.com.au
Internet: www.ecoz.com.au

Executive Summary

Australian Ilmenite Resources Pty Ltd (AIR) SILL80 Project is a proposed open cut mine and processing facility to be constructed in the Roper River region of the Northern Territory. AIR intends to produce 200,000 tonnes of refined ilmenite at the mine per annum, with an expected mine life exceeding 20 years.

The Public Environmental Report (PER) is a formal assessment under the *NT Environmental Assessment Act 1982* at the request of the Northern Territory Minister for Natural Resources, Environment and Heritage (the Minister). The Water Management Plan (WMP) is one of many complimentary reports required to support the PER for the SILL80 Ilmenite Project.

The principal intent of the WMP is to address key risks identified in the Guidelines; the major risks identified concerning extraction of water for this project are:

- Average cease to flow occurrences in the Roper River may increase with significant amounts of extraction; and
- Impacts may be caused downstream from the extraction point to water quality and supply for other users and wildlife.

There is very little extant information that can inform development of targets to achieve this objective. The NT Water Allocation Planning Framework nominates that at least 80% of flow at any one time in any part of a river is allocated as water for environmental and other public beneficial water provision. It also nominates that extraction for consumptive uses will not exceed the threshold level of 20% of instantaneous flow at any time in any part of the river. For this development it is assumed that extracting less than 20% of instantaneous flow will achieve this plan's objectives.

This WMP details the processes and procedures to remain below the target. These include monitoring flow input and extraction rates from the extraction pool. In-stream flow monitoring uses a combination of automated and manual gauging. Flow and extraction data are assessed daily and if extraction rates reach the 20% threshold, pumping will cease.

AIR will appoint an independent auditor who will be responsible for performing audits of the gauging, data collection and analysis, reporting and compliance with the processes and procedures detailed in this WMP.

Contents

Tables

Figures

Appendices

1 Introduction

1.1 Purpose of this Water Management Plan

As part of the environmental approvals process Australian Ilmenite Resources (AIR) has submitted a Notice of Intent (NOI) to the Northern Territory government (NTG). The NTG provided in response the *Guidelines for the Preparation of a Public Environmental Report* (Guidelines), which specified that a Public Environmental Report (PER) process is required and also identified the NTG's concerns about the development. One of the concerns the NTG expressed was in relation to water extraction from the Roper River and consequently, the proponent is required to develop a Water Management Plan (WMP) to address these concerns.

This WMP is designed as a stand-alone document which gives the legislative and hydrological environment in which this plan was developed and uses these to inform the development of measurable objectives and targets for the management of water for this development. It also presents schedules, auditing and data procedures, to ensure effective implementation of the WMP.

Further detail about water availability, current surface and ground water extractions, river hydrology and strategies to mitigate risks can be found in the Risks section of the PER.

1.2 WMP Intent

The principal intent of the WMP is to address key risks identified in the Guidelines; the major risks identified concerning extraction of water for this project are:

- Cease to flow occurrences in the Roper River may increase with significant amounts of extraction; and
- Impacts may be caused downstream from the extraction point to water quality and supply for other users and wildlife.

This WMP aims to address these risks by:

- Developing water extraction practices to mitigate any potential negative impacts for downstream communities and wildlife; and
- Providing a framework for reporting and auditing water extraction by AIR to the Northern Territory Government.

1.3 Relevant Legislation

1.3.1 Northern Territory Water Act, 1992

Under the NT Water Act (1992), mining operations are exempt from licensing for consumptive use. In lieu of a surface water license, this WMP for the AIR's SILL80 Project will provide the necessary information and framework to ensure AIR's operations cause minimal disruption to the environment and other users.

1.3.2 Northern Territory Mining Management Act, 2011

Under the NT Mining Management Act (2011), the operator of a mine site is required to submit a Mining Management Plan (MMP), detailing how any potential environmental impacts of the operation will be managed. Accordingly, it is anticipated that the Department of Resources (DoR) will require details of water management for the site and therefore this document will be updated as required to fulfil DoR's MMP requirements.

1.3.3 Proposed Mataranka Ground Water Allocation Plan

Currently, the Mataranka Groundwater Allocation Plan (MGAP) is being developed by the Northern Territory Government. The MGAP will detail extraction limits for groundwater systems that contribute to the Roper River. It is envisaged that details in the MGAP will have some bearing on the availability of surface water within the Roper River due to interaction between the Tindall Limestone Aquifer and the Roper River up-stream of AIR's water extraction point. Increased groundwater extraction will potentially impact surface water resources within the Roper River catchment and therefore affect availability to surface water users.

1.4 Limitations and Assumptions

This WMP has been developed specifically for the AIR SILL80 Project using project operation details as found in AIR's Public Environmental Report. Extraction rates and response thresholds assume a maximum pumping rate of $0.02m^3/s$ (20 L/s).

The NT Water Allocation Planning Framework nominates that at least 80% of flow at any one time in any part of a river is allocated as water for environmental and other public beneficial water provision. It also nominates that extraction for consumptive uses will not exceed the threshold level of 20% of instantaneous flow at any time in any part of the river (NT Government 2006). It is assumed that using this 20% threshold will achieve the ecological and human use outcomes prescribed in the Guidelines.

This report has been developed using available public information. Additional mining developments are currently investigating water resources within the Roper River catchment. However, at the time of writing, only preliminary investigations were occurring. Therefore, this report only details the AIR development and any additional projects are beyond the scope of this report.

2 The Roper River Region

2.1 The Region

The Roper River catchment covers an area of approximately 82,000 km^2 of the wet/dry tropics of the Northern Territory (Faulks 2001). The Roper River catchment contains ten rivers and three major creeks. These are the Roper, Strangways, Phelp, Hodgson, Arnold, Wilton, Mainoru, Jalboi, Chambers and Waterhouse Rivers as well as Flying Fox, Maiwok and Elsey Creeks (*note the Roper River headwaters are known as the Roper Creek).

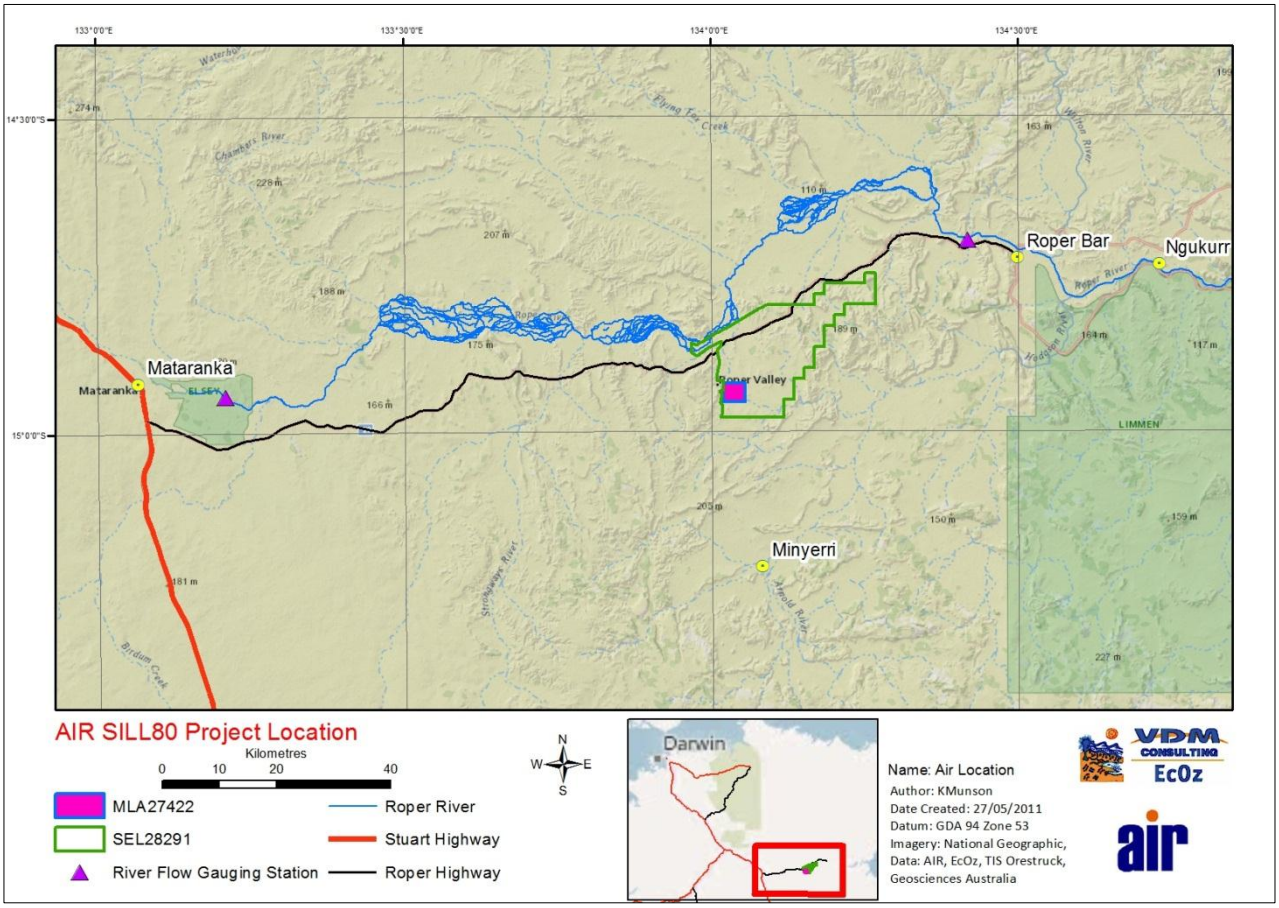

Figure 2-1: Map of Roper catchment and SILL80 Project location

2.2 Climate

The nearest weather station to AIR's SILL80 Project is located at Roper Bar store, approximately 60km to the North-East of the project area. In this region, the wet season (October through April) months are warmer (Figure 2-2), wetter (Figure 2-3) and more humid (Figure 2-4) than the dry season (Bureau of Meteorology, 2011).

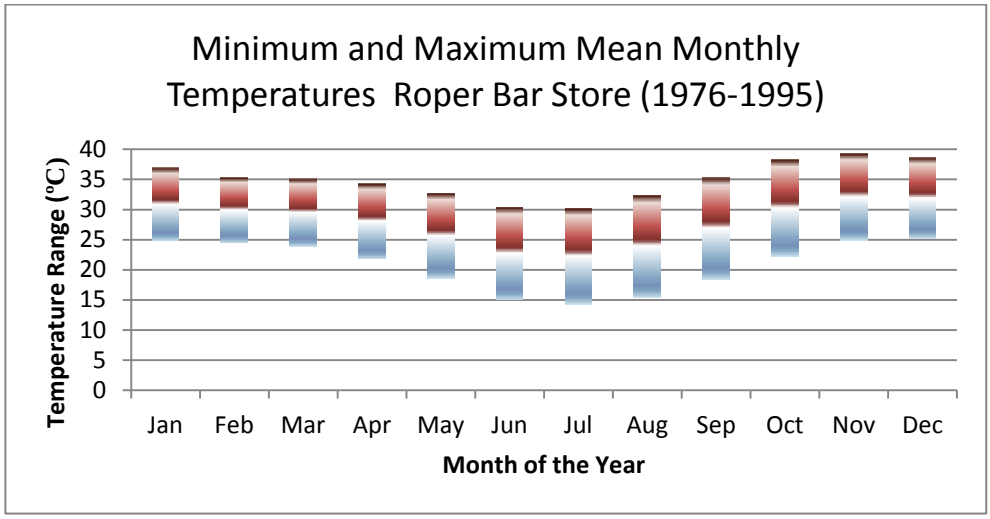

Figure 2-2: Mean Monthly Temperatures (°C) at Roper Bar Store (1976-1995)

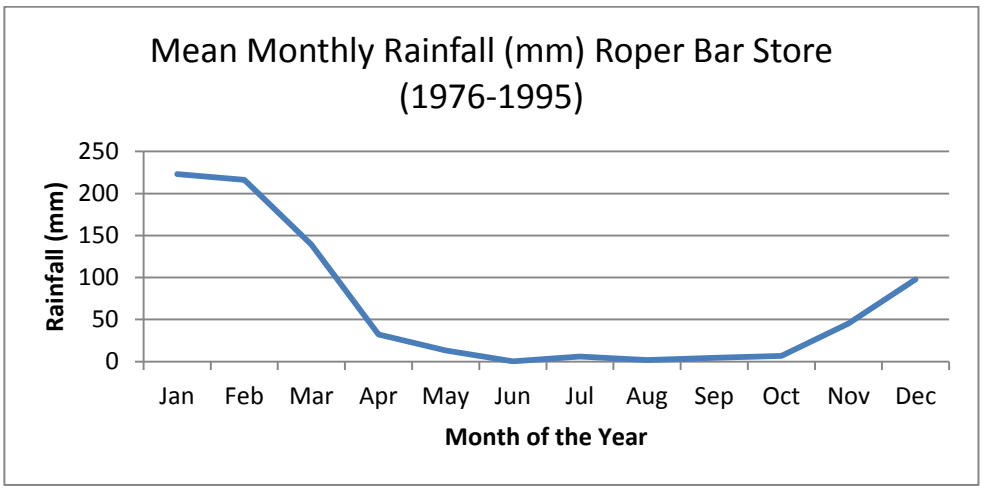

Figure 2-3: Mean Monthly Rainfall (mm) at Roper Bar Store (1976-1995)

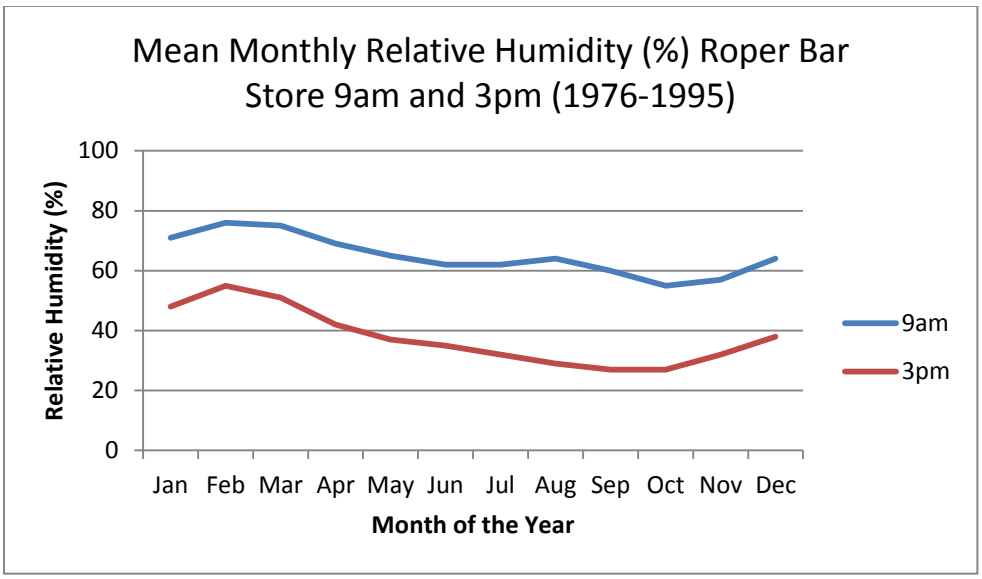

Figure 2-4: Mean Monthly Relative Humidity (%) at Roper Bar Store (1976-1995)

3 Water Resources

The Roper River catchment's surface and groundwater resources are discussed in the recently completed Gulf Water Study (Zaar 2009), co-funded by the Australian Government and NRETAS, available through the NRETAS website (http://www.nt.gov.au/nreta/water/gws/index.html). This study, and the associated integrated surface water/groundwater computer model (Knapton 2009) were used in determining appropriate Roper River water extraction limits for the Project.

The Roper River's tributary network provides large wet season surface water flows to the Roper, with the highest mean monthly discharge occurring in March ranging from 83 m^3/s near Mataranka, to 509 m^3/s at Red Rock. However, most of these tributaries cease to flow in the dry season. Importantly, during the dry season, baseflows in the Roper are maintained mainly by the Tindall Limestone aquifer, located in the river's headwaters near Mataranka, and the Dook Creek dolomitic aquifer supplies flows via the Wilton and Flying Fox Creeks, and other smaller carbonate aquifers (Zaar 2009). These aquifers are responsible for maintaining river flows over the dry season and their water dependant ecosystems. The lowest mean monthly discharge occurs in September and October; ranging from 1.5 m^3/s near Mataranka, to 1 m^3/s at Red Rock.

AIR's SILL80 Project is situated near the central section of the Roper River downstream of groundwater discharge from the Tindall Limestone Aquifer. The river in these middle reaches is highly braided, resulting in substantial evaporation losses and therefore makes the river a "losing stream" along this section. The limit of tidal influence of the Roper River extends to Roper Bar, which is approximately 65km downstream of the project area and 145 kilometres from the river mouth that flows into the Gulf of Carpentaria. However, the actual saltwater/freshwater interface in the river varies considerably depending on river flows. Knapton (2009) noted that the "hydrodynamic nature of the pool section of the Roper River downstream of Roper Bar and its response to allocated flows warrants further study. The long term quality of water within this pool is highly dependent on the upstream flows that are maintained to it" (Knapton 2009).

3.1 The Roper River

The Roper River is one of the largest rivers in the Northern Territory, extending for over 500km. The river originates near Mataranka as Roper Creek (Little Roper River), where it flows eastward to join the Waterhouse River and become the Roper River. The Roper River flows generally eastward, before discharging into the Gulf of Carpentaria. The tidal limit of the river is Roper Bar, a natural rock bar extending across the river, approximately 200km east of Mataranka.

The Roper River is a losing system, with flows decreasing with distance downstream, except for areas of groundwater interaction (Knapton 2009). As such, only the upper reaches of the Roper River maintain flows greater than 0.1 m^3/s (100 l/s) by the end of the dry season, due to groundwater input. The middle and lower reaches of the river usually have flows less than 0.1 m^3/s by the end of the Dry season, and flow records show that cease to flow conditions can often occur at Roper Bar. In some very dry periods, such as the 1950s and 1960s, cease to flow events occurred up to 65 km upstream at Judy Crossing, close to AIR's proposed water extraction point.

3.1.1 Flow Regime

Two NRETAS flow gauging stations currently operate on the Roper River (Figure 3-1), including:

- G9030176 (Mataranka Homestead gauge) located near Mataranka Homestead, approximately 80 km upstream of AIR's proposed water extraction point, with flow records from 1961 – present (Figure 3-2); and
- G9030250 (Red Rock gauge) located at Red Rock (8 km upstream of Roper Bar), about 60 km downstream of AIR's proposed water extraction point, with flow records from 1967 – present (Figure 3-3).

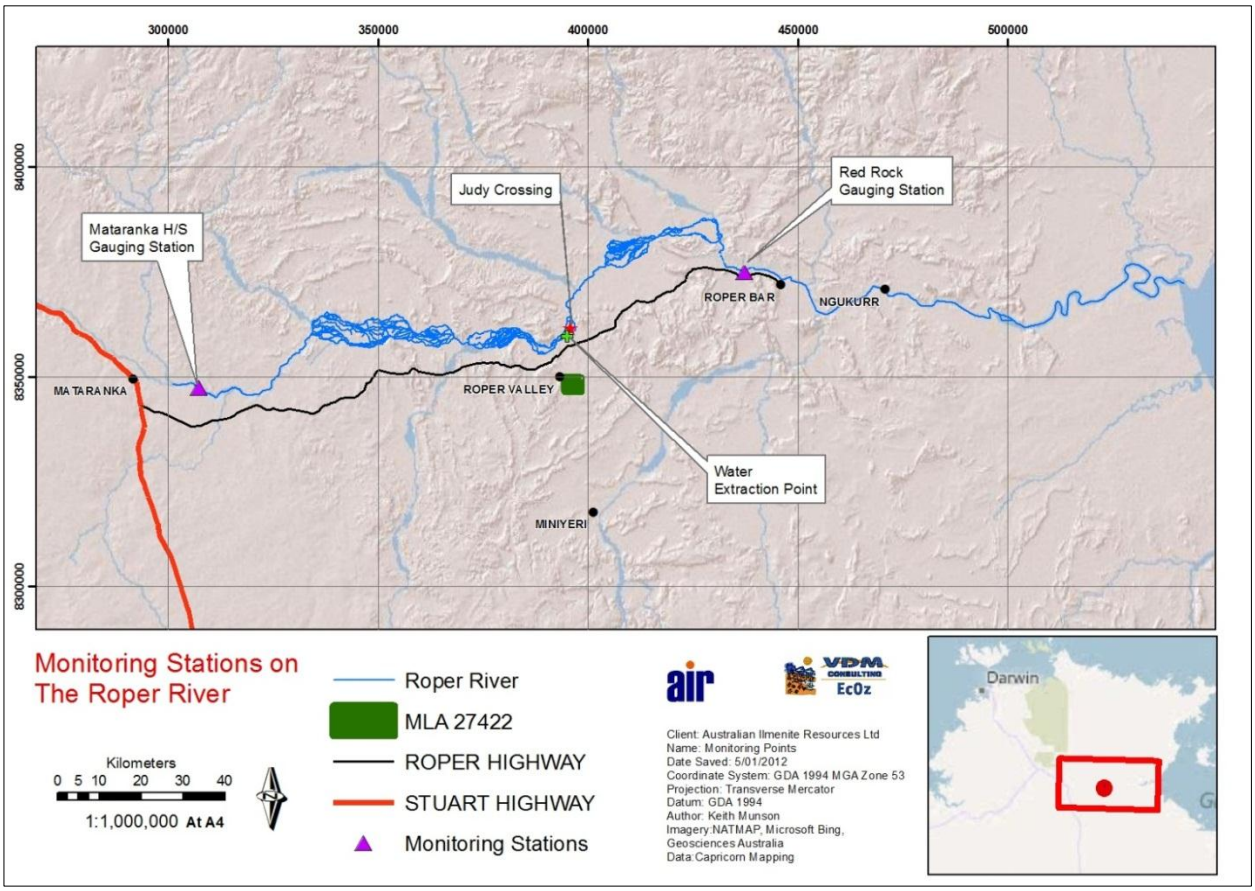

Figure 3-1 – Flow monitoring locations on the Roper River

A summary of the flows observed since development of these two gauging stations until present are available in Table 1.

Table 1. Summarised flow observations for Mataranka homestead and Red Rock Gauging Stations

FLOW STATION	LOWEST RECORDED FLOW (m^3/s)	HIGHEST RECORDED FLOW (m^3/s)	MEAN DAILY FLOW (m^3/s)	MEDIAN DAILY FLOW (m^3/s)	MEAN DAILY FLOW RATE $<1m^3/s$	MEAN DAILY FLOW RATE $<0.02m^3/s$
Mataranka homestead gauge G9030176	0.72	4117.37	21.61	2.37	24.6 days/year	0 days/year
Red Rock gauge G9030250	0.00002	4291.56	99.78	5.12968	71.2 days/year	2.87 days/year

3.1.2 Cease to Flow Events

Flow gauge records indicate that during extended dry periods, such as those observed in the 1950's and 1960's, the Roper River can cease to flow at the end of the dry season at Roper Bar and up to 65 km kilometres upstream, near AIR's proposed water extraction point. In contrast, the last decade has been a relatively wet period with high rainfall, and flows at Roper Bar have hardly dropped below 1 m^3/s.

Modelling of integrated surface and groundwater flows and their response to rainfall (Knapton 2009) show that cease to flow (CTF) conditions at Red Rock are relatively common, occurring in 48 of 107 years since 1900. The model also showed that no flow occurred for approximately 5% of the time, equating to 18 days of no flow in an average year. CTF events at Roper Bar were predicted to occur when flows at Red Rock fall below 0.02 m^3/s.

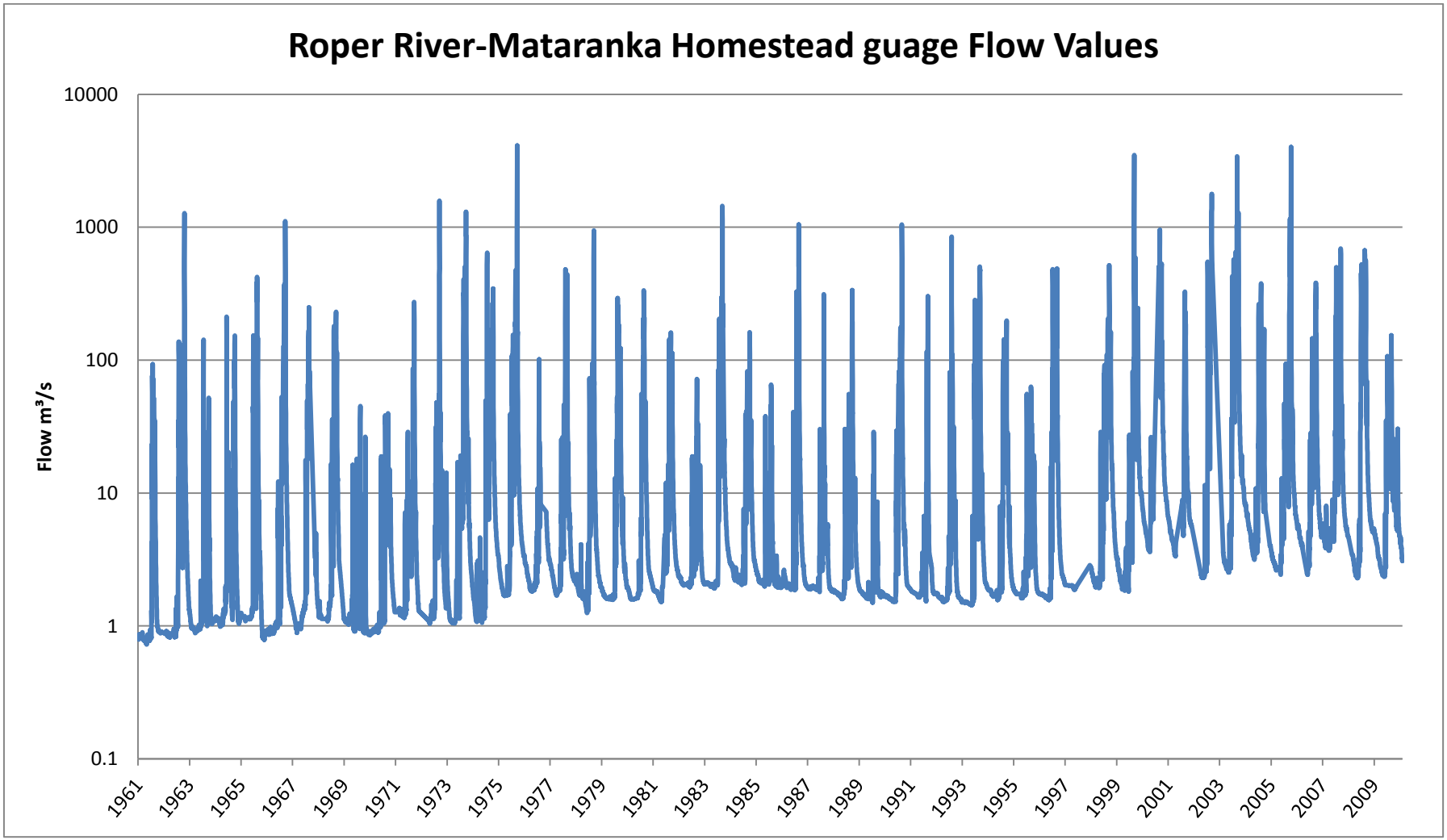

Figure 3-2. Flow values for Roper River at Mataranka Homestead gauge.

Data supplied by Dept. Natural Resources, Environment, The Arts and Sport. © Northern Territory of Australia

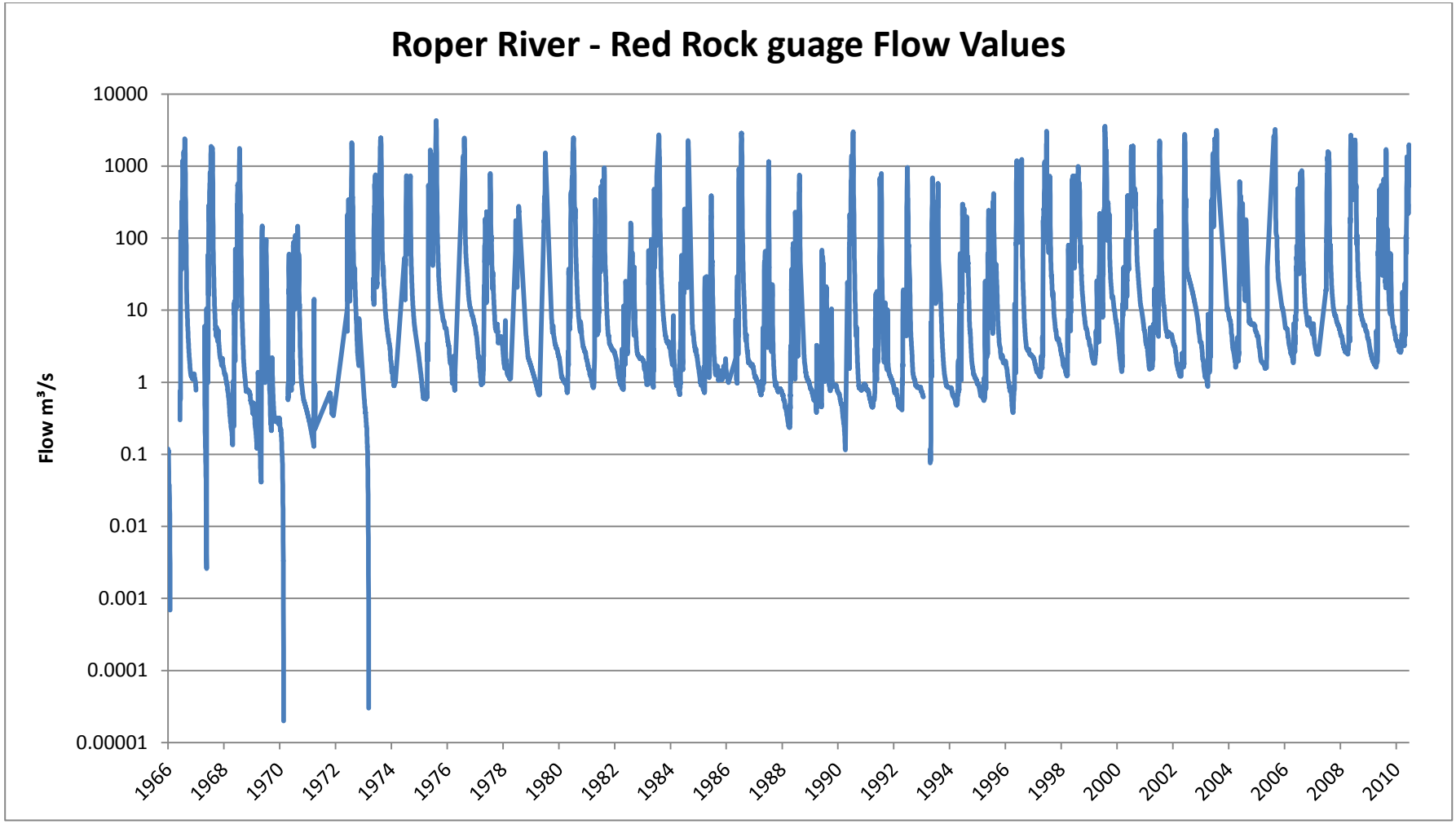

Figure 3-3. Flow values for Roper River at Red Rock gauge.

Data supplied by Dept. Natural Resources, Environment, The Arts and Sport. © Northern Territory of Australia

3.2 Water Control District & Groundwater Allocation Plan

The Daly Roper Water Control District (DRWCD) was declared by the Minister for Natural Resources, Environment and Heritage on 8 December 2008. Water Control Districts are a statutory instrument under the NT *Water Act 1992* that allow a greater level of water management to be implemented. Within a WCD:

- All groundwater and surface water extraction, excluding for stock and domestic purposes must be licensed;
- Bore construction permits are required, with minimum construction standards designed to prevent contamination of groundwater resources; and
- Water Allocation Plans can be declared.

Currently, a Groundwater Allocation Plan is being developed for the Tindall Limestone Aquifer in the area immediately surrounding Mataranka. The Mataranka Groundwater Allocation Plan (MGAP) seeks to plan and manage the groundwater resource for sustainable future demand. The MGAP will relate only to groundwater extraction, although consideration will be given to the connection between the Tindall aquifer and the Roper River surface flows. Prior to a Water Control District being declared, groundwater extraction licenses were only required if extraction exceeded 0.015m^3/s (15 L/s). Since declaration of the WCD, all new groundwater applications have been classified as pending, so that full availability of the resource can be assessed prior to additional licenses being issued.

The MGAP will only cover the Tindall Limestone Groundwater Aquifer in the Mataranka area but it is anticipated that the plan will also affect the level of surface water extraction permitted.

3.2.1 Commercial, Community, Domestic and Stock Water Supply

Current information pertaining to surface water and groundwater license entitlements from the Roper River Region were sourced through the NRETAS Water Licensing Register. As of 3rd June 2011 there are:

- Three surface water licenses on the Roper River with a combined water entitlement of 88.2 ML/annum; and
- 15 groundwater licenses exist within this aquifer with a combined water entitlement of 4937ML/annum.

Communities and cattle stations adjacent to the Roper River utilise the stream for reliable water supply. Cattle stations nearby to the proposed development have reported dams drying up late in the dry season, due to extended periods of minimal to no rain and high evaporation rates. Historically, Numul Numul and Flying Fox stations have drawn water from permanent water holes in the Roper River to supplement dam and groundwater infrastructure during dry periods.

Groundwater is generally the preferred source of domestic water. The major population centres near AIR's SILL80 project (Minyerri, Urapunga, and Ngukurr) all rely on groundwater supplies, although Ngukurr supplements its groundwater with Roper River water. The Kewulyi (Roper Valley) Community, located 4 km north-west of the proposed development at the old Roper Valley Homestead, sources water from a nearby spring. Nearby cattle stations also utilise groundwater resources for stock watering purposes, dependent on availability and reliability. Outstations utilise bores, springs, river water and lagoons for domestic water supply dependent on resource reliability and proximity.

4 Water Management

4.1 Water Management Objectives and Targets

The principal objective of the WMP is to ensure that a sustainable off-take of water is defined, specifically that:

- The proposed development will not lead to any increase in the number of cease-to-flow events; and
- Any extraction does not impact negatively on water quality and other downstream users, including wildlife.

There is very little extant information that can inform development of targets to achieve this objective. The NT Water Allocation Planning Framework nominates that at least 80% of flow at any one time in any part of a river is allocated as water for environmental and other public beneficial water provision. It also nominates that extraction for consumptive uses will not exceed the threshold level of 20% of instantaneous flow at any time in any part of the river (NT Government 2006). For this development, it is assumed that extracting less than 20% of instantaneous flow will achieve this plan's objectives.

4.2 Water Extraction Limit

AIR proposes installing a pump with a maximum extraction rate of 0.02 m^3/s. For this to represent a sustainable off-take (i.e. 20% instantaneous flow) means that pumping must cease when flow gets to less than or equal to 0.1 m^3/s at the extraction point.

4.3 Flow and Extraction Monitoring

There is no gauging station at the proposed extraction point on Roper River. Flow monitoring will use a combination of Red Rock gauge, as well as manually gauging Judy Crossing downstream from the extraction point.

The Roper River is a losing river downstream of Elsey Station, thus it is assumed that any flow at Red Rock must be less than at the extraction point.; The Red Rock gauge station flow data will therefore be used as a proxy for flows at the extraction point. AIR will remotely monitor daily flow rates obtained from the Red Rock gauge station. This station is operated by NRETAS and daily flow rate information is available via their website. However, the Red Rock gauging station becomes unreliable in low flows (Cruickshank S, 2011 pers. comm., 2 September), therefore AIR will utilise data from this gauge station until flow reaches $3m^3/s$. Once flow drops below $3m^3/s$ at the Red Rock gauging station, AIR will manually monitor flow at Judy Crossing to ensure that extraction is below the 20% instantaneous flow threshold (Figure 4-1). Further details of the flow monitoring are provided in the following section.

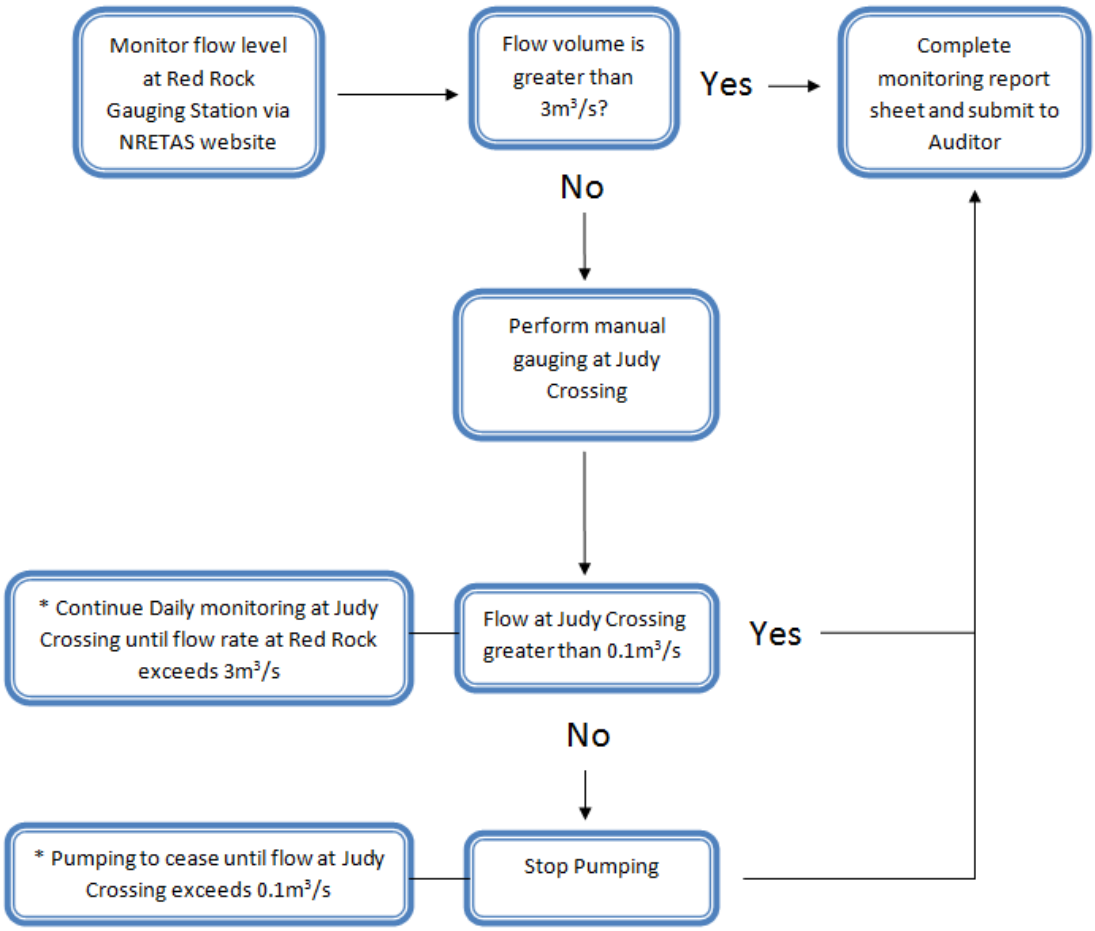

Figure 4-1 AIR monitoring and reporting requirements

4.3.1 Pump and Pump Metering

Calculations for when to cease pumping to fulfil the requirements of the WMP, have assumed a pump with a capacity of no greater than 0.02 m^3/s is used to extract water for this project.

AIR will install a pump flow meter in accordance with the *National Framework for Non-Urban Water Metering*. The pump meter will be read by AIR staff on a daily basis. The meter will be located at the delivery end of the pipe (close to AIR's processing operations).

4.3.2 Installing gauges at Judy Crossing

There is currently no gauge at the proposed water extraction location on the Roper River. AIR proposes to select a suitable location for installation of gauge boards at Judy Crossing, ~1 km downstream of proposed water extraction point. This is considered to be a conservative approach, given that the flow rate at Judy Crossing is assumed to be lower than at the extraction location (i.e. the river is a losing system in this section of its catchment). During periods of water extraction, flow rates measured at this location will be added to the flow rates from the pump flow meter to determine the instantaneous flow rate at the extraction location.

Manual flow monitoring will involve reading river heights from a gauge board, for which a height-flow (i.e. ratings table) will be developed. AIR will engage a suitably qualified hydrologist to select a suitable gauging location and develop a ratings table for the Judy Crossing monitoring location, which will involve the river gaugings at various heights.

5 Water Management Procedures

Water management procedures are initiated by the operation of the Roper River extraction pump, which starts the process of data collection, interpretation, reporting and actioning.

During periods of water extraction, the relationship between water taken from the extraction pool and river flow will be assessed on a daily basis.

Each pumping day, a datasheet is required to be filled out (Appendix G1). This datasheet will be reviewed as part of the auditing process.

5.1 Reporting, Auditing and Compliance

5.1.1 Appointing an Auditor

AIR will appoint an independent auditor to fulfil the auditing obligations in this section, including negotiating with NRETAS (or other specified government body) on any required reporting and information exchange.

5.1.2 Compliance Auditing

Compliance audits will ensure that the processes outlined in the WMP are being followed. It will check:

- Data has been collected, regularly entered and appropriately reported;
- Any cease-to pump events have been recorded and complied to;
- Inflows since last reporting period; and
- Extraction since last reporting period.

There are two types of compliance audits:

- Monthly data audits; and
- On-site audits.

5.1.2.1 Monthly Audits

Data audits will occur following the end of each calendar month. They are intended to ensure:

- Compliance with data collection and processing procedures; and
- Compliance with any cease to pump events.

These audits will review each calendar month's data and will occur at the beginning of the subsequent month.

AIR will enter daily flow data in a spreadsheet and submit the previous month's data to the auditor within the first week of the calendar month. The auditor will report back to AIR and other required parties within one week of receipt of the data.

5.1.2.2 On-site audits

On-site audits of equipment, procedures and processes will occur three times per year:

- Recommencement Audit: at the recommencement of pumping (approx. May);
- Mid-season Audit: two months after recommencement (approx. July); and
- Late-season Audit: in late dry season when inflows are at their lowest (approx. October).

The Recommencement Audit criteria are:

(i) No change in water management principles and legislation from relevant government bodies that would influence procedures and processes for the WMP;

(ii) Reporting and audit schedule agreed on;

(iii) A copy of this WMP is available;

(iv) Water flow gauge complies with appropriate guidelines (such as the *National Framework for Non-Urban Water Metering*) connected;

(v) Water flow monitoring, reporting and management flowchart is displayed;

(vi) Data sheets are available;

(vii) Manual gauging of Judy Crossing equipment available;

(viii) Staff are properly trained in WMP, monitoring and reporting requirements including being aware of NRETAS flow monitoring website in particular the Red Rock gauging data; and

(ix) Staff responsibilities for monitoring, datasheet entry and water management defined.

Mid-Season Audit will ensure:

- Prior to field visit auditor checks ensures that data submission procedures have been followed;
- Review monitoring, recording and metering to date;
- Ensure that Judy Crossing monitoring procedures are understood by relevant staff; and
- Steps (iii) to (ix) above.

Late-season Audit will:

- Repeat the mid-season audit with higher scrutiny of Judy Crossing monitoring.

5.2 Data Collation, Processing and Submitting Procedures

The datasheet (Appendix G1) is to be completed daily. This sheet will record:

- Pump meter reading (volume) and conversion to an average volume/second (i.e. m^3/s);
- If flow rate at Red Rock Gauging Station exceeds $3m^3/s$; and
- Flow rate at Judy Crossing (if flow at Red Rock < $3m^3/s$).

5.2.1 Non-Compliance or Variations in Procedure

If AIR recognises any incidents of non-compliance with the WMP commitments, they will immediately inform the independent auditor who is responsible for notifying NRETAS (or other government body as required).

5.2.1.1 Procedural Review

These procedures will be reviewed if:

- Auditing identifies any shortcomings of existing procedures; and
- At the end of the first pumping season (i.e. after three 1 year of operation).

5.2.1.2 Responsibilities

Table 2 lists the roles and responsibilities of personnel involved in executing the Water Management Plan.

Table 2. Roles and Responsibilities

POSITION	RESPONSIBILITY
General Manager (Production)	• Ensure that this Water Management Plan is implemented • Ensure data is collected, stored and submitted as per the WMP • Ensure regular reports and incidence of non-compliance reported to NRETAS (and/or other Departments, as required) • Ensure all personnel are aware of and adhere to these procedures
Field Manager	• Implement non-pumping periods when water extraction rates are likely to exceed maximum threshold (i.e. 20% of instantaneous flow at extraction point).
Environmental Officer	• Perform daily water use and flow monitoring • Ensure regular reports and incidence of non-compliance reported to General Manager (Production)
Independent Auditor	• Ensure monitoring and reporting is maintained • Ensure data is received and processed • Perform compliance auditing • Report audit outcomes to AIR and NRETAS (and/or other Departments, as required)
Regulators	• Act on non-compliance • Maintain Red Rock gauging station, telemetry and web reporting on flow rates • Provide updates on legislation changes

6 Glossary

AIR:	Australian Ilmenite Resources Proprietary Limited
CTF:	Cease to Flow
ML:	Mega Litres
MLA:	Mining Lease Application
NOI:	Notice of Intent
NRETAS:	The Department of Natural Resources, Environment the Arts and Sport
WMP:	Water Management Plan
WCD:	Water Control District

7 References

Bureau of Meteorology 2011, *Climate Statistics for Australian Locations*, Monthly Climate Statistics, Australian Government, Bureau of Meteorology, viewed 4th April 2011, < http://www.bom.gov.au/climate/averages/tables/cw_014633.shtml>.

Faulks, JJ 2001, *An Assessment of the Physical and Ecological Condition of the Roper River and its Major tributaries,* Technical Report No.36/2001, Natural Resources Division, Department of Lands, Planning and Environment.

Knapton, A 2009, *Gulf Water Study Integrated Surface Groundwater Model of the Roper River Catchment Part A: Coupled Surface – Groundwater Model,* NT Department of Natural Resources, Environment, The Arts and Sport, Darwin.

NT Government 2006, *Northern Territory Water Allocation Planning Framework,* NT Department of Natural Resources, Environment, the Arts and Sport, Darwin.

Zaar, U 2009, *Water Resources Of The Roper River Region,* Technical Report No.16/2009D, NT Department of Natural Resources, Environment, the Arts and Sport, Darwin.

Appendix G1 – Monitoring Data Sheet

Day	Date	Pump Meter Reading	Calculated average extraction rate for last 24 hours (m^3/s)*	Red Rock flow > 3 m^3/s	Flow @ Judy Crossing	Pumping shut down?
Monday				YES	No further action required	
				NO		
Tuesday				YES	No further action required	
				NO		
Wednesday				YES	No further action required	
				NO		
Thursday				YES	No further action required	
				NO		
Friday				YES	No further action required	
				NO		
Saturday				YES	No further action required	
				NO		
Sunday				YES	No further action required	
				NO		

*The calculated average extraction rate for last 24 hours turns flow volume into a rate (m^3/s). This is determined by dividing the volume of water taken over the last 24 hours and dividing by the number of seconds in a day (86400).

Note: When flow at Red Rock Gauging Station is equal to or less than 3 m^3/s, manual gauging at Judy Crossing is required; when flow less than 0.1 m^3/s at Judy Crossing requires pump shutdown.