POLARIS
METALS NL

CARINA IRON ORE PROJECT:
CONCEPTUAL MINE CLOSURE PLAN

FEBRUARY 2010

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1. INTRODUCTION

1.1 CARINA PROJECT

Polaris Metals NL (Polaris) proposes to develop the Carina iron ore deposit, located approximately 60 km northeast of Koolyanobbing and 100 kilometres northeast of Southern Cross. Further details of the project are included in assessment documents, specifically the Public Environmental Review and Mining Proposal.

Development and operation of the Carina deposit is scheduled to commence from the end of 2010. The project involves the following components;

- open cut mining from a single pit,
- ore haulage approximately 50 kilometres to a siding on the existing trans Australian railway and
- dry crushing and screening,
- train loading at the siding.

A mining rate of 4 Million tonnes per annum (Mtpa) is anticipated. The Carina deposit contains an estimated 21.4 million tonnes of iron ore, with an expected mine life of 5 years. A summary of key characteristics of the Carina project are summarised in Table 1.

Table 1: Key project characteristics

Project description	
Components	Open pit, mine waste landform and ancillary mine infrastructure.
Mineral resource	Direct shipping ore (DSO) – hematite / goethite.
Processing type	Dry crushing and screening.
Date of commencement	2010 (fourth quarter).
Life of pit	5 years.
Date of completion	2015
Mine	
Tenements	Exploration tenement granted E77/1115 Mining lease granted M77/1244. Miscellaneous license application L15/305A submitted for the haul road. General purpose lease application G15/21 submitted for the rail siding. L15/303A submitted for the accommodation village L15/306A submitted for village access road.
Resource	21.4 Mt at an average grade of 59% Fe.
Mine waste volume	22.8 million bank cubic metres (bcm). This equates to 30.8 million loose cubic metres (lcm)
Mining rate	4. Mtpa.
Stripping ratio (t:t)	1:2.88
Mining method	Conventional open pit, drill and blast, hydraulic excavation, load and haul.
Estimated project footprint	500 ha

PAF mine waste	The majority will be non acid forming (NAF). Approximately 1 to 2% by volume will be potential acid forming (PAF). This is to be encapsulated in the waste landform.
Infrastructure requirements	• Crushing and screening plant. • Administration facilities, accommodation. • Workshop and equipment park-up area. • Reverse osmosis water treatment plant. • Power generation. • Wastewater treatment plant. • Access and haul roads. • Railway siding.
Stockpile requirements	• Vegetation stockpile. • Topsoil stockpile. • Waste landform. • ROM ore stockpile. • Product stockpiles
Water use	Mine and immediate surrounds: 1,210 KL/d (442 ML/yr) Haul road and rail siding: 650KL/d (236ML/yr)
Potable water	Groundwater will be treated via a reverse osmosis plant for potable use.
Power source and requirements	Stand alone diesel powered generation facilities are proposed. 4-5 MW is required.
Hours of operation	24 hours a day, 7 days a week.
Ore haulage	
45-50 km dedicated unsealed haul road	200 tonne payload road trains operating 24/7
Rail siding	
Siding	Crushing, screening and ore product stockpiles.
Train loading	FEL operation loading train consists of 90 cars (7,000 tonnes per train). 10 trains per week

1.2 PURPOSE AND SCOPE

The purpose of the conceptual closure plan is to describe the rehabilitation and closure strategies, necessary to adequately address environmental issues at the completion of operations, to the satisfaction of Polaris and regulatory authorities. The strategies are designed to ensure maintenance free or “walk away” closure over the long term.

Polaris will implement the final mine closure plan until agreed closure criteria are met and the site is safe and stable.

The overall objective of this document is to ensure planning for mine closure commences in the early stages of the project and is integrated with mine development processes. This is consistent with the Australian and New Zealand Minerals and Energy Council / Minerals Council of Australia (ANZMEC/MCA) (2000) *Strategic Framework for Mine Closure*. To that end, this document sets out a conceptual closure strategy for the project.

At the end of mine life, the five basic steps involved in closure planning are:

- The removal and disposal of all infrastructure not required for other uses.
- The remediation of any soil or water contamination.

- Rehabilitation of remaining disturbances.
- Post-closure maintenance and monitoring.
- Tenement relinquishment and bond retirement.

1.3 RELEVANCE TO OTHER PLANS

The conceptual closure plan is included in the Carina mining proposal as a component of the proponent's environmental management activities associated with the project approval process.

The conceptual closure plan will be revised every two years during site operations to ensure it remains accurate and relevant. It is anticipated that subsequent revisions will contain more detailed information concerning actual infrastructure, rehabilitation and closure strategies, as well as estimated closure costs, as the project moves through its operational life.

2. BACKGROUND

2.1 PROJECT DESCRIPTION

Figure 1 shows the overall site layout. The main components of the Carina project are:

- Open cut mining operations to a maximum depth of 170 metres.
- Run-of-Mine (ROM) pad and product stockpiles.
- Mine waste landforms.
- Crushing and screening plant.
- Infrastructure area containing equipment workshops, bulk fuel storage, power generators, water dam, supply letdown area.
- Haul roads and other access roads.
- Accommodation camp and supporting infrastructure.

Detailed descriptions of infrastructure and operating processes are contained in the Carina Mining Proposal.

2.2 RATIONALE FOR SITE INFRASTRUCTURE

The crushing plant and main mine support infrastructure has been sited close to the rail siding. The plant location and design has also addressed environmental requirements using the principles of:

- Minimising infrastructure in the proposed conservation park.
- Minimise overall disturbance by concentrating infrastructure in one area.

The accommodation village has been located close to the rail siding to minimise commute distance to the main work centre.

6210,000 mE
215,000 mE
220,000 mE
225,000 mE
230,000 mE
235,000 mE
240,000 mE
6,630,000 mN
6,625,000 mN
6,620,000 mN
6,615,000 mN
6,610,000 mN
6,605,000 mN
6,600,000 mN
6,595,000 mN
6,590,000 mN

See Insert A
M77/1244-I
YENDILBERIN HILLS
rocky outcrops
MT WALTON
523
450
510
500
467
405
3
2
old dry lakes
454
Mt Walton Road
WATT HILL
490
FIN9
GNOLADGIN HILL
450
NM F 399
511
L15/305A
FIN11
Seventy One Mile Rock
MT FINNERTY
496
BM 432
Finnerty Dam
QM
QL
BM 426
400
Wallangie Soak
Norton Dam
FIN10
420
Breakaway Mine (abandoned)
465
Yankee Doodle Dam
Johnnies Dam
numerous small rocky outcrops
Sardine Dam
370
445
Baker Mine (abandoned)
Creek
Jaurdi
Shed Dam
Esdaile
PERTH
Jaurdi Airstrip
KALGOORLIE
Perth-Kalgoorlie Railway
aerial
Wallangering Rock
462
9
4

INSERT A
M77/1244-I
Carina Mining Lease
Infrastructure 2
Pit
Waste Dump
Infrastructure 1
L15/305A
Haul Road

INSERT B
L15/306A
Access Road
L15/303A
Mine Camp
Mt Walton Road
L15/305A
Haul Road
G15/21A
Rail Siding
Perth-Kalgoorlie Railway

See Insert B
L15/306A
L15/303A
G15/21A

Polaris Metals NL

Yilgarn Iron Ore Project
Carina Project

Date: 8/2/2010
Author: DCK
Office: Perth
Figure 1
Scale: 1:125000
Projection: MGA Zone 51 (GDA 94)

0 1.25 2.5 5
kilometres

3. STATUTORY REQUIREMENTS AND INDUSTRY GUIDELINES

3.1 POLARIS ENVIRONMENTAL POLICY

The closure plan is consistent with the Company environmental policy (Appendix 1).

3.2 ENVIRONMENTAL PROTECTION ACT 1986

The conceptual closure plan is consistent with the Public Environmental Review (PER) for the Carina iron ore mine, assessed under the Environmental Protection Act 1986. Closure related commitments in the PER principally relate to:

- Undertake progressive rehabilitation and research on optimum techniques and timing during the life of mine.
- Timely closure consultation with stakeholders.
- Develop a final closure plan concurrently with mine operations.

3.3 MINING ACT 1978

The conceptual closure plan is consistent with the Carina mining proposal assessed under the Mining Act 1978.

3.4 AGREEMENTS

3.4.1 Aboriginal heritage

Polaris has undertaken ongoing consultation with Aboriginal parties and implemented heritage surveys over project areas as they are developed. These negotiations have resulted in support of the project by the Aboriginal parties.

3.4.2 DTF

Polaris has negotiated a road agreement with the Department of Treasury and Finance (DTF), for use of a section of their access road to the Mt Walton Intractable Waste Storage Facility for mine support traffic. That is supply of goods and services and also workforce commute traffic. It does not include ore haulage traffic. Ore haulage traffic is confined to a dedicated haul road from the mine to the rail siding, constructed and maintained by Polaris.

3.5 OTHER RELEVANT LEGISLATION

Other relevant legislation relevant to mine closure includes:

- Agriculture and Related Resources Protection Act 1976.
- Bushfires Act 1954.

- Contaminated Sites Act 2003.
- Dangerous Goods (Transport) Act 1998.
- Explosives and Dangerous Goods Act 1961.
- Land Administration Act 1997.
- Rights in Water and Irrigation Act 1914.

DMP and DEC are the two agencies with primary responsibility for overseeing the closure of the Carina iron ore mine.

3.6 GUIDELINES

This Conceptual Closure Plan document conforms to details described in Section 2.3 of the ANZMEC/MCA's (2000) *Strategic Framework for Mine Closure*.

The operational closure plan, also described in the framework, will be developed within 2 years of commencement of operations. Polaris will periodically review the operational closure plan during the life of mine, incorporating results of rehabilitation research during the project life and ongoing industry best practice, as they are presented through such forums as:

- Chamber of Minerals and Energy (CME).
- Other mining operations in the region.
- DoIR Golden Gecko Awards.

Key government and industry guidelines relevant to mine closure in Western Australia are listed in Table 2.

Table 2: Closure guidance documents

Guideline	Purpose
Australian Minerals Industry (AMI) Code for Environmental Management (MCA, 2000).	Framework including consultation, progressive rehabilitation and reporting.
Strategic Framework for Mine Closure (ANZMEC/MCA, 2000) (a joint government and industry guideline).	Framework including upfront planning for closure, consultation, progressive rehabilitation and reporting.
Guideline Safety Bund Walls Around Abandoned Open Pit Mines. Department of Minerals and Energy of Western Australia (1997).	Design of abandonment bunds around open pits to prevent vehicular access.
Mine Closure Guideline for Mineral Operations in Western Australia (Chamber of Minerals and Energy WA Inc. 2000).	Framework including consultation, progressive rehabilitation and reporting.
Mine Closure Policy (MCA, 1999).	Policy on mine closure.
Mine Rehabilitation Handbook (MCA, 1998).	Stakeholder consultation and financial provisioning.
Assessment Levels for Soil, Sediment and Water (DoE, V3 Nov 2003).	Threshold levels for contaminated soils.
ANZECC/ARMCANZ: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.	Establishing water quality criteria using previous monitoring data and site specific factors, to establish standards to be achieved at closure.
The Commonwealth Environmental Protection Agency series ‘Best Practice Environmental Management in Mining’.	Industry examples of mining practices.
Guidance for the Assessment of Environmental Factors: Rehabilitation of Terrestrial Ecosystems. Draft No. 6 (EPA 2006)	Closure strategy and description of objectives, targets and review during mine operation.

4. STAKEHOLDER CONSULTATION

Stakeholders are defined as government agencies, individuals, community groups or others who have the potential to be affected by the project. Stakeholder consultation is a key component of the closure planning process, as interests held by stakeholders often precede a mining operation and remain long after its closure.

The Carina stakeholders identified to date are listed below.

State Government

- Department of Mines and Petroleum
- Department of Environment and Conservation
- Fremantle Port Authority
- Department of Treasury and Finance
- Department of Indigenous Affairs
- Department of Water
- Department of Transport
- Department of Agriculture and Food

Non-Government Organisations

- Westnet Infrastructure Group
- Australian Rail Group (AGR)

Local Government

- Shire of Yilgarn
- Shire of Coolgardie
- Town of Kwinana

Indigenous groups

- The Central West Goldfields People.
- The Gubrun People.
- The Kelamaia Kabu(d)n People
- Goldfields Land and Sea Council

Special Interest Groups

- Conservation Council
- Wilderness Society

4.1 RECORD OF CONSULTATION

No specific consultation concerning mine closure has been undertaken to date. Consultation with identified stakeholders has occurred on project implementation. The record of this consultation is included in respective environmental and mining approval documents.

Record of future stakeholder consultation concerning mine closure will be included in this section of future revisions of this document.

4.2 CONSULTATION PROCESS

Consultation with stakeholders concerning closure of the project will be undertaken according to the ANZMEC/MCA, principles outlined in the *Strategic Framework for Mine Closure*. This includes:

- Consultation will occur throughout the life of mine.
- A targeted strategy will be implemented to reflect the needs of key stakeholder groups.
- Adequate resources will be allocated to ensure consultation is effective.
- Local communities will be included in the consultation process.

The consultation programme will be designed to:

- Inform stakeholders about mine developments.
- Record issues raised.
- Provide feedback on mine design and management that address issues raised.
- Establish regular dialogue.

5. REHABILITATION

5.1 COMPLETION CRITERIA

Polaris has prepared a Rehabilitation Plan, as an appendix to the Project Environmental Management Plan (PEMP). Like the PEMP, the Rehabilitation Plan is an adaptive document, changing through the life of mine to incorporate monitoring results and other information.

Completion criteria are agreed standards to be achieved on particular aspects of the project. Progressive assessment against these criteria demonstrates the relative success of closure actions in achieving final closure outcomes.

DoIR (2006) states that for each site a specific set of completion criteria needs to be developed, to determine whether the rehabilitation end point has been reached. Where possible, completion criteria should be developed from actual rehabilitation trials and site experience rather than arbitrary baseline studies conducted on analogue (local pristine) sites, which may have little edaphic or physical / chemical similarity to mine soils.

This is an extremely important principle in the development of the final mine closure plan. The significant earthworks and disturbance associated with most open cut mining projects often results in final landforms, with soil structure and properties significantly different to the pre-mining state. These differences may mean that return of pre-mining ecosystems is not readily achievable. It is crucial that closure planning is based on results of field evaluations and trials to ensure that rehabilitation methods are effective, durable and achievable. In most cases, appropriate methodologies may take years to develop and may be markedly different to initial concepts.

This view is also supported in ANZMEC/MCA (2000), which states that completion criteria are specific to the mine being closed, and should reflect its unique set of environmental, social and economic circumstances. Completion criteria should be flexible enough to adapt to changing circumstances without compromising the agreed end objective. There should be an agreed process for periodic review and modification of completion criteria in light of improved knowledge or changed circumstance.

While the overall objective of the closure plan is to establish safe, stable final landforms, with a preference for self-sustaining vegetation, similar to that in the surrounding landscape, specific completion criteria will be developed to address aspects of the site including:

- Public safety.
- Geotechnical stability.
- Water quality
- Chemical stability.
- Revegetation.

Completion criteria will be developed in consultation with stakeholders, to define measurable goals for rehabilitation and closure. Agreed criteria and detailed actions necessary to satisfy the criteria will be described in subsequent versions of this document.

Agreed criteria will include progressive targets, to provide milestones on whether final criteria are likely to be achieved. Assessments over time plot development of rehabilitated areas against reference (analogue) sites and also the defined target score. Targets will be

periodically reviewed in liaison with regulatory authorities, usually through the annual reporting mechanisms required in EPA and DMP approvals.

DoE (2006) requires that completion criteria must be sufficiently stringent to ensure that the overall objectives of rehabilitation have been met. These criteria must also be designed to allow effective reporting and auditing to define an endpoint for rehabilitation activities, to enable sites to be relinquished. Guidelines published by ANZMEC (2000) for completion criteria state they should be:

1. Specific enough to reflect the unique set of environmental, social and economic circumstances at the site.
2. Flexible enough to adapt to changing circumstances without compromising overall objectives.
3. Include indicators suitable for demonstrating that rehabilitation trends are heading in the right direction.
4. Undergo periodic review resulting in modification if required due to changed circumstances or improved knowledge.
5. Based on targeted research which results in more informed decisions.

5.2 ECOSYSTEM FUNCTION ANALYSIS

Various analytical tools exist to assess rehabilitation success. One tool is the Ecosystem Function Analysis (EFA). EFA was originally developed for monitoring rangelands for the purpose of sustainable development and maintenance of biodiversity. More recently, the method was adapted for use in other disturbed landscapes, such as mine sites. More detail on EFA is available on the CSIRO website http://www.csiro.au/services/EcosystemFunctionAnalysis.html

EFA is a monitoring procedure that establishes how well an ecosystem works as a biophysical system. The conceptual framework was published in Ludwig et al (1997). It uses simple, visual, rapidly assessed indicators that focus on soil surface processes. As such it differs from conventional monitoring that typically records the presence and/or abundance of selected biota. It is made up of three modules:

- landscape function analysis (LFA)
- vegetation composition and dynamics
- habitat complexity.

EFA is designed for repeated use so that the development, or degradation, of a site can be assessed over time. It includes an analytical process to examine the trajectory of the ecosystem being monitored and to use this information to decide if the site is converging on a target functional state, or needs further work to ensure ultimate success.

Polaris proposes to use the EFA methodology in assessing rehabilitation success. Initial completion criteria, objectives and interim targets are proposed in Table 3. Further consultation with stakeholders will refine these targets through the life of mine. The interim targets will be reviewed against progressive rehabilitation results, to establish final closure targets in the final mine closure plan.

Table 3: Initial completion criteria and interim targets

Criteria	Objective	Interim Targets
Safety, stability, and sustainability	The overall health and safety of humans, stability of soils and landforms, long-term sustainability for agreed land uses.	Safety and abandonment structures all in place.
Soils	Soil profiles and structures must ensure landform stability.	Rehabilitated waste landforms achieving defined scores/indices. Interim targets to be defined in subsequent reviews of the document.
Off-site impacts	Significant adverse off-site impacts must be avoided.	No off site impacts recorded
Pollution	Pollutants due to chemical spillage, excavation of substrates or changes to hydrology (e.g. acid drainage) avoided or managed within rehabilitated areas as required.	Monitoring showing that pollution levels are within parameters set by Regulatory agencies.
Hydrology	If there are major changes to hydrology as a result of mining operations, establish criteria that measure flows and availability of surface and groundwater to receiving environments.	Photographic record showing flow in all creek systems. Temporary creek diversions rehabilitated and original pathway restored.
Resilient and self-sustaining vegetation	This is a frequently used completion criteria that is linked to other criteria listed below:	
• Species diversity	Specified targets based on site data or analogue plots. Setting appropriate targets requires knowledge of the proportion of plant species that are unlikely to recruit or can be propagated from seed in the short term.	Rehabilitated waste landforms achieving defined scores/indices. Interim targets to be defined in subsequent reviews of the document.
• Abundance and cover	Sustainable rehabilitation requires vegetation cover to be sufficient to stabilise landforms and exclude weeds. In most cases, completion criteria are based on relative cover (% of area) occupied by native plants, in permanent plots or transects. Permanent photographic-monitoring points should also be established.	Rehabilitated waste landforms achieving defined scores/indices. Interim targets to be defined in subsequent reviews of the document. Permanent photographic monitoring points installed.
• Weed management	Effective weed management requires demonstration that: (a) the relative cover of minor weeds is low (b) major weeds capable of becoming dominant at the expense of native plants are absent.	Monitoring and photographic records showing weed species on site limited to minor infestations.
Pest species	Control of introduced animal species that can have a major impact on native plants and animals. Animal grazing also requires effective management in rehabilitated areas.	Declared pest species controlled over rehabilitated areas. Installation of fencing around waste landforms.

6. CLOSURE PROCESSES

The aim of the closure plan is to establish safe, stable final landforms, with self-sustaining vegetation, similar to that in the surrounding landscape.

For purposes of this plan, the assumption has been made that all site facilities and infrastructure will be dismantled and the area rehabilitated at mine closure. However, during the mine's life, Polaris will consult with key stakeholders to ensure infrastructure that could be used after completion of operations is identified.

The development of mines in remote locations in Western Australia often necessitates construction of significant infrastructure, with a number of possible options for sequential use. Mine infrastructure usually includes:

- An independent power supply, often with many kilometres of transmission line.
- Haul road and access network
- Borefield and pipeline network.
- Potable water treatment plant.
- Communication link.
- Airstrip.
- Accommodation and messing facility.

Sequential land use planning with stakeholders often has conflicting principles for the mining industry. Desire from some stakeholders to provide for sequential activities such as tourism and eco-tourism mean that requests for mining companies to retain some infrastructure for sequential uses continues to gain momentum.

Often, safety and public liability considerations conflict with stakeholder desire of having the public in close proximity to disused mines. Other issues include ongoing ownership and maintenance of retained infrastructure. Continued consultation is required to resolve these issues.

Carina is located in a former pastoral lease (Jaurdi Station), purchased by CALM in 1989. The former pastoral lease is proposed to be reclassified as the Jaurdi Conservation Park (EPA, 2007, DEC 2007 & 2008).

The area of the former Jaurdi Station is approximately 289,776 hectares. In comparison, the mine footprint area within the former station is approximately 450 hectares.

6.1 MONITORING AND MAINTENANCE

Once rehabilitation and closure work has been completed, a post-closure monitoring programme will commence, with the aim of confirming that rehabilitation has been effective and closure criteria satisfied.

In general terms, post-closure monitoring will include:

- **Public safety**: Confirm that access to the pit void and other excavations has been effectively prevented and will not allow access to vehicles.

- **Geotechnical stability**: Confirm that earthworks have been completed as per design, and there is no significant subsidence, slumping or slippage in the structure.
- **Physical stability**: Confirm that no significant erosion is occurring and no undermining of material by wind or water.
- **Chemical stability**: Sampling of surface runoff, ground water and soils for levels of contaminants that exceed guidelines adopted for closure.
- **Revegetation**: Confirm that rehabilitated areas are likely to become comparable with that on similar areas that have not been disturbed by mining.

It is expected that on ground mine closure works are likely to span a period of approximately 12 months. This will be followed by a period of post-closure monitoring and maintenance, which is envisaged as nominally 4 years, as shown in Table 4, but may extend longer depending on monitoring results against closure criteria. The frequency of monitoring will decrease as closure progresses and will cease when closure objectives and criteria have been achieved.

At specified intervals a monitoring team will visit the site to take scheduled samples and make assessments regarding the progress of revegetation and the effectiveness of closure measures put in place. If remedial work is required, a maintenance team will carry out repairs and maintenance. Remedial work may include:

- Replanting /reseeding areas that have not regenerated.
- Repairing major erosion problems.
- Weed control.

6.2 RECORDS AND REPORTING

Records of all rehabilitation and closure works will be maintained and will include:

- Data on rehabilitation research and analogue sites (to provide benchmark data against which rehabilitation can be compared).
- Information on topsoil removal and storage techniques utilised.
- Details on the rehabilitation prescription, including:
    - The scope of earthworks.
    - Seed bed preparation.
    - Species used in the seeding programme.
    - Seed pre-treatment and seeding methods.
- Results of rehabilitation monitoring.
- The scope of any remedial work (such as re-ripping, re-seeding and weed control).

Annual reporting of rehabilitation results to the DMP and the DEC will occur through the normal annual report process.

Table 4: Proposed closure monitoring

Time	Issue	Monitoring	Standard
At closure	Rehabilitation works	Confirm that specifications of works have been completed, e.g. abandonment bund in place, stability of slopes, drainage system in place.	Final closure plan. Guideline Safety Bund Walls Around Abandoned Open Pit Mines. Department of Minerals and Energy of Western Australia (1997). Strategic Framework for Mine Closure (ANZMEC/MCA, 2000) Mine Closure Guideline for Mineral Operations in Western Australia. Chamber of Minerals and Energy WA (2000).
6 months	Water	Groundwater and surface water.	Groundwater: Parameters (e.g. SWL, TDS, pH) meet criteria. Surface: Parameters (e.g. TSS, pH) meet criteria.
12 months	Rehabilitation works	Monitor rehabilitated areas. Implement remedial works if required. e.g. replanting, reseeding, erosion.	Final closure plan.
	Water	Groundwater and surface water.	Groundwater: Parameters (e.g. SWL, TDS, pH) meet criteria. Surface: Parameters (e.g. TSS, pH) meet criteria.
18 months	Water	Groundwater and surface water.	Groundwater: Parameters (e.g. SWL, TDS, pH) meet criteria. Surface: Parameters (e.g. TSS, pH) meet criteria.
24 months	Flora and Fauna	Monitor rehabilitated areas. Implement remedial works if required. e.g. replanting, reseeding, erosion.	Final closure plan.
	Water	Groundwater and surface water.	Groundwater: Parameters (e.g. SWL, TDS, pH) meet criteria. Surface: Parameters (e.g. TSS, pH) meet criteria.
4 years	Flora and Fauna	Monitor rehabilitated areas.	Meets closure criteria against natural analogue sites.
	Water	Groundwater and surface water.	Groundwater: Parameters (e.g. SWL, TDS, pH) meet criteria. Surface: Parameters (e.g. TSS, pH) meet criteria.

6.3 RESOURCE ALLOCATION AND FINANCIAL PROVISIONING

Table 5 identifies staff employed by Polaris to manage environmental issues, undertake rehabilitation and closure planning and supervise rehabilitation and closure activities.

This version of the closure plan does not include cost estimates of closure strategies.

During the project approval process, rehabilitation bonds will be established by regulatory agencies. These bonds generally cover landform rehabilitation provisions for closure. However, total closure costs also need to consider other factors such as infrastructure demolition and possible income from sale or salvage of plant. Subsequent versions will:

- Confirm that a financial provision is in place that reflects the total cost of closure.
- Confirm that accepted accounting standards were used as the basis for financial provisioning.
- Confirm that adequate securities are in place to protect the community from closure liabilities.

Table 5: Management responsibility

Time	Responsibility	Description
Pre Closure	Operations Manager	Ensure closure plan is prepared
	Company Accountant	Ensure provision for closure plan is in place
	Environmental Officer	Preparation of progressive closure plan's and final closure plan
Post Closure	Environmental Officer	Implementing final closure plan

6.4 SUSPENSION OF OPERATIONS

Circumstances may eventuate that require a temporary suspension of mine operations, and enter into a "Care and Maintenance" period. Provisions in the Mines Safety and Inspection Regulations 1995 govern care and maintenance periods. The provisions in the regulations (in part below) would form the basis of a suspension plan to be implemented in such a situation.

Details to be included in notification of suspension

Notification of the suspension of mining operations at a mine must, in addition to the details set out in regulation 3.12, include the following details —

a) the reason for the suspension and the planned duration of the suspension;
b) whether the closure is total or whether access to underground and/or open pit workings is to be maintained;
c) if underground and/or open pit access is to be maintained, details of the arrangements that have been made for the provision of regular services and emergency services to ensure the safety of employees engaged in maintaining the mine;
d) the measures that have been taken to prevent unauthorised access or entry to the mine;
e) the precautions that have been taken to protect underground equipment and service installations; and
f) any plans required to be prepared under section 88 of the Act.

The nature of a temporary suspension in operations is such that all rehabilitation and closure works would generally not be in a final state. In addition to safety and access provisions, as required in the regulations, the suspension plan would also need to address a range of environmental factors as listed in Table 6. The suspension plan would also need to cater for ongoing caretaker/maintenance functions that necessitate some continued provision of services such as power, water, communication and waste disposal at the site.

Table 6: Suspension plan criteria

Criteria	Description
Surface water	All disturbed areas will not be stabilised, so potential for erosion will remain. Suspension plan will address ongoing drain and sump maintenance to ensure continued sediment control.
Hazardous substances	Storage of large volumes of chemicals and fuel will not be required with closure of the mine, processing plant and power generation. The suspension plan will address removal of surplus quantities of hazardous materials.
Waste management	Empty all rubbish bins on site. Remove bulk bins. Empty out all oil/water separators, washdown bay sumps etc. Close the active face at the landfill site and remove all quantities of recyclable material.
Reporting	With no activities on site, continued requirements for environmental reporting need to be reviewed (eg: DoE Licence and National Pollutant Inventory trigger thresholds). The suspension plan will address the issue of renewal or cancellation of licences and what reporting functions may still be required during the suspension period.

7. CLOSURE ACTIONS

Actions required to achieve the end land use objective and ensure completion criteria are met are grouped into general and area specific measures. General measures are applied across the site and are not uniquely defined for any particular location. In addition, area specific measures may be required for locations that have unique issues that may not be adequately managed using general measures.

7.1 GENERAL MEASURES

The following default measures will be applied during rehabilitation and closure works.

7.1.1 Demolition

1. All plant and structures not required for sequential use will be dismantled, demolished and removed. Recoverable materials may be sold if a suitable market can be found at the time of decommissioning. A reasonable estimate of salvage values that could be offset against the closure cost has not yet been calculated. This will be calculated from an asset register and incorporated in subsequent versions of this document.
2. The site's operational landfill in the waste landform will be used to dispose of demolition materials and waste. Liquid or hazardous wastes will be disposed at appropriately licensed facilities off site.
3. All surface pipelines, power lines and security fences will be removed and materials sold or buried.
4. Sub surface pipelines will remain if they cannot be economically salvaged, but will be drained, flushed and sealed (crimped or capped).
5. Dam liners will be cut, folded and buried in situ for belowground dams or removed to the landfill for aboveground dams.
6. General rubbish will be disposed in the landfill.

7.1.2 Hazardous materials

1. The largest quantity of hazardous material on site is diesel fuel, used for power generation and mining equipment.
2. At closure, remaining inventories of chemicals and hydrocarbons will be returned to the supplier or sold to a third party. Waste chemicals and hydrocarbons will be removed offsite for disposal at a licensed facility.

7.1.3 Contaminated sites

1. Large scale contaminated soil will be excavated and remediated on site in a purpose built facility or disposed as agreed with regulatory authorities.
2. Localised (small) hydrocarbon contaminated soils will be remediated in-situ using bioremediation additives.

7.1.4 Revegetation

1. Following demolition of infrastructure and site clean-up, disturbed areas will be regraded to blend into surrounding contours and land profiles.
2. Prior to the expected onset of seasonal rains, the following works will be undertaken:
    a. Available topsoil will be respread over regraded areas to approximately 100 millimetres in depth.
    b. Stockpiled vegetation, where available, will be spread over regraded surface.
    c. The area ripped/scarified on contour to a minimum depth of 300 millimetres and up to 800millimetres if soil conditions allow.
    d. Seeding with native, shrubs and trees will be conducted to supplement the seed source in topsoil and respread vegetation. Local provenance seed will be sourced, within 10 kilometres of the project site.

7.2 MANAGEMENT AREAS

For the purpose of this closure plan, the project area has been divided into eleven management areas. At this stage of the project it is not possible to fully detail the infrastructure components of each management area. Once the site is operational, further information can be included in subsequent versions of the document. The final closure plan will include a more detailed description of facilities and area specific measures necessary to achieve closure objectives.

The eleven management areas are:

1. Open pit and surrounds.
2. Waste landform(s).
3. Mine infrastructure area.
4. Rail siding.
5. Workshop, supply store and power station.
6. Offices, laboratory and site buildings.
7. Contractor yards and laydown areas.
8. Accommodation village.
9. Roads, powerlines, fences and drains.
10. Sundry areas (eg, explosives compound, borefield)

7.2.1 Open pit and surrounds

The open pit and surrounds is comprised of the following:

- Open pit.
- Access ramps.
- Survey stations.
- Surrounding disturbed land within the confines of the pit abandonment bund.

The following area specific provisions apply.

- Vehicle access to the open pit will be suitably blocked using a pit abandonment bund constructed in accordance with DoIR Guidelines on Safety Bund Walls Around Abandoned Open Pit Mines.

7.2.2 Waste landform

The waste landform is comprised of the following:

- Waste landform
- Stockpiles of topsoil and vegetation.

The waste landform will be constructed using a traditional 'bottom up - paddock dump' construction method. The following steps occur in the process:

- Clear the waste landform footprint. Vegetation is pushed into stockpiles or windrows around the perimeter of the landform footprint, beyond the 'batter to' line.
- Strip topsoil from the waste landform footprint. Low stockpiles/windrows of topsoil are constructed around the perimeter of the landform footprint, beyond the 'batter to' line and avoiding natural drainage lines.
- The construction method of waste landforms reflect the pit design and number of pit ramps constructed. Trucks firstly dump loads of mine waste end to end around the outer 'dump to' line of the waste landform.
- As the basal footprint of the waste landform is filled, mine waste is used to construct a ramp up the waste landform to create a tipping face. Waste tipped off this face advances the tipping face over the paddock dumped area.
- The waste landform is constructed in two 15 metre high lifts, with a 10 metre wide (final) berm between the lifts.

Construction using this method enables progressive completion of portions of the waste landform, allowing establishment of rehabilitation trials which will provide data on optimum rehabilitation methods for the final closure plan.

Rehabilitation earthworks on the waste landform involve battering the final 'dump to' line to the final ('batter to') slope angle of approximately 18 degrees. Sufficient width on the 'dump to' line on the berm must account for the toe of the final 'batter to' line to maintain a final 10 metre wide berm.

The waste landform will be designed as a partly internally draining and partly externally draining system. To prevent water from the top flowing down the outer slope, a 1 metre high crown bund will be constructed around the leading edge of each lift and the top surface will be concaved to drain runoff away from the edge of the landform.

Ramps up the waste landform will be retained and used to direct water to the pit void during very heavy rainfall events. This allows 'controlled release' of peak flow stormwater and sediment into a location which is fully contained.

Further details of waste landform rehabilitation earthworks and revegetation are contained in the rehabilitation plan.

7.2.3 Mine infrastructure area

The mine infrastructure area is comprised of the following:

- ROM pad.
- Portable site office, lunch room and ablution buildings.
- Power supply.
- Fuel storage.
- Workshop.
- Product stockpile and loading area

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.4 Rail siding

The rail siding is comprised of the following:

- Crushing and screening plant.
- Product stockpile area
- Power generation site
- Water storage dam
- Loading area
- Portable office, lunch room and ablutions buildings
- Rail loop line

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.5 Workshop, supply store and power station.

The workshop, stores and power station is comprised of the following:

- Power generation engines and building
- Main electrical transform and distribution room
- Bulk Fuel and oil storage facilities.
- Heavy equipment workshop.
- Light vehicle workshop.
- Washdown bay.
- Supply yard.

This area is the most likely area for contamination of soil by hydrocarbons. At closure, a site investigation will be undertaken to identify the extent of contamination and appropriate treatment methods.

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.6 Laboratory and site buildings.

The laboratory and site buildings are comprised of the following:

- Site laboratory building.
- Other sheds or portable buildings

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.7 Contractor yards and laydown area.

The contractor yard is comprised of the following:

- Mining contractor yard.
- Drilling contractor yard.
- Contractors laydown/stores area

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.8 Accommodation village.

The accommodation village is comprised of the following:

- Portable accommodation buildings
- Kitchen facilities and dining room
- Footpaths
- Recreation facilities
- Potable water treatment plant
- Wastewater treatment plant and disposal area

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.9 Roads, power lines, pipelines and drains.

The roads, powerlines fences and drains comprise of the following:

- Main haul road to rail siding
- Other site haul roads and access roads
- Power line network
- Water pipeline network
- Diversion drains and culverts under roads

No area specific closure measures are identified at this time. General measures will be implemented.

7.2.10 Sundry areas

Sundry areas comprise remaining infrastructure on site. These include the following:

- Explosives magazine and storage compound
- Water bores
- Turkey nest water storages

No area specific closure measures are identified at this time. General measures will be implemented.

8. REFERENCES

DoIR (2006) Mining environmental management guidelines: Mining Proposals in WA

Ludwig, J., Tongway, D., Freudenberger, D., Noble, J and Hodgkinson, K. (eds) (1997). Landscape Ecology Function and Management: Principles from Australia's Rangelands

APPENDICES

APPENDIX 1:
ENVIRONMENTAL POLICY

POLARIS
METALS NL

Environmental Policy

Polaris is committed to achieving the best balance between economic development and protection of the environment. Polaris recognises that we cannot continue to operate or be successful without fully integrating environmental considerations with regard for the aspirations of all stakeholders into our daily processes. To achieve this, Polaris will aim to:

- Comply with and, where appropriate, exceed the requirements of applicable legislation, regulations and other policies, codes and standards to which we subscribe
- Promote environmental awareness among our personnel and contractors to increase understanding of their roles and responsibilities in environmental management
- Develop our people and provide resources to meet our environmental objectives
- Ensure that the environmental issues are integrated into the decision making process of all aspects of exploration and project development.
- Identify and assess the potential environmental effects of our activities and manage environmental risk
- Continually improve and regularly monitor, audit and review our environmental performance, and practice wherever possible the waste reduction principles of ‘reduce, reuse, recycle’
- At all time maintain an open and honest relationship with all stakeholders
- Promote our environmental progress and performance through liaison with and public reporting to the Government and community

Jonathan Lea
Managing Director

Alan Tough
Executive Director Operations