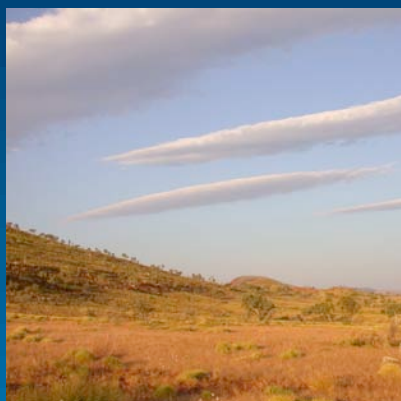
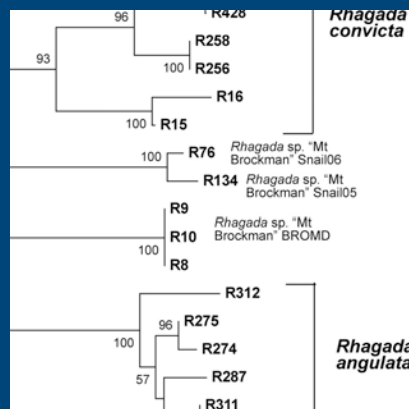


Brockman Syncline 4 Iron Ore Project Snail Management Plan



Prepared for
Pilbara Iron Pty Ltd

Prepared by
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March 2007



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Brockman Syncline 4 Snail Management Plan

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1.0 Introduction

1.1 Project Background

Pilbara Iron Pty Limited (Pilbara Iron), on behalf of the asset owner and proponent Hamersley Iron Pty Limited, is currently developing the Brockman Syncline 4 Iron Ore Project (BS4 Project) (Hamersley Iron Pty Limited 2005). The BS4 Project is situated approximately 25 km south-west of the existing Pilbara Iron Brockman 2 Mine (B2), and approximately 60 km west-northwest of the town of Tom Price in the Pilbara region of Western Australia. The BS4 project area is shown in Figure 1.1 and Figure 1.2. The major components of the BS4 Project are:

- three mine areas (broadly referred to as the eastern, central and western areas);
- a dry processing plant;
- associated mine infrastructure (waste dumps, low grade stockpiles, haul roads);
- an extension of the existing B2 rail spur to BS4 (approximately 35 km in length); and
- associated infrastructure (a new camp, mine offices, new airstrip, bore fields, power transmission lines, bulk fuel storage, various workshops, waste water treatment plant, ANFO storage facility etc.).

The Western Australian Environmental Protection Authority (EPA) assessed the environmental acceptability of this project at the level of Public Environmental Review (PER). The scope of the BS4 Project is outlined in detail in the PER, as are the potential environmental impacts and the associated environmental management strategies. The EPA subsequently recommended approval of the BS4 Project and recommended conditions for the project (Environmental Protection Authority 2006). The subsequent Ministerial Statement 717 was issued on 24 March 2006. Statement 717 included a condition relating to land snails at site BROMD (Condition 717:M8), which identified the requirement for the preparation of a Snail Management Plan (SMP).

1.1.1 Land Snails at BROMD and Elsewhere in the Project Area

Site BROMD represented just one of a number of sites in the BS4 Project locality from which land snails were recorded (Biota 2005a) (Figure 1.2). However, genetic analysis found that the snails from BROMD were divergent from those recorded from two sites along the White Quartz Rd (snail05 and snail06) approximately 25 km to the east. At the time, a conservative approach was taken in respect of managing impacts at the BROMD site, which included recommendations by the consultant to consolidate impacts from a proposed pipeline to an existing disturbed area (i.e. a vehicle track slightly to the north of the proposed pipeline) (Biota 2005a).

Subsequent genetic analyses of snails from a variety of locations in the Pilbara (Biota 2006a, b, c, d) has found comparable levels of molecular divergence often over very short geographic distances (Biota 2006d), though this is typically in the more geographically complex landscape such as at the Burrup Peninsula (Biota 2006d). With the benefit of this additional work, it is now considered likely that the apparent uniqueness of the snails from BROMD is an artefact of limited samples across few locations (see Section 3.3).

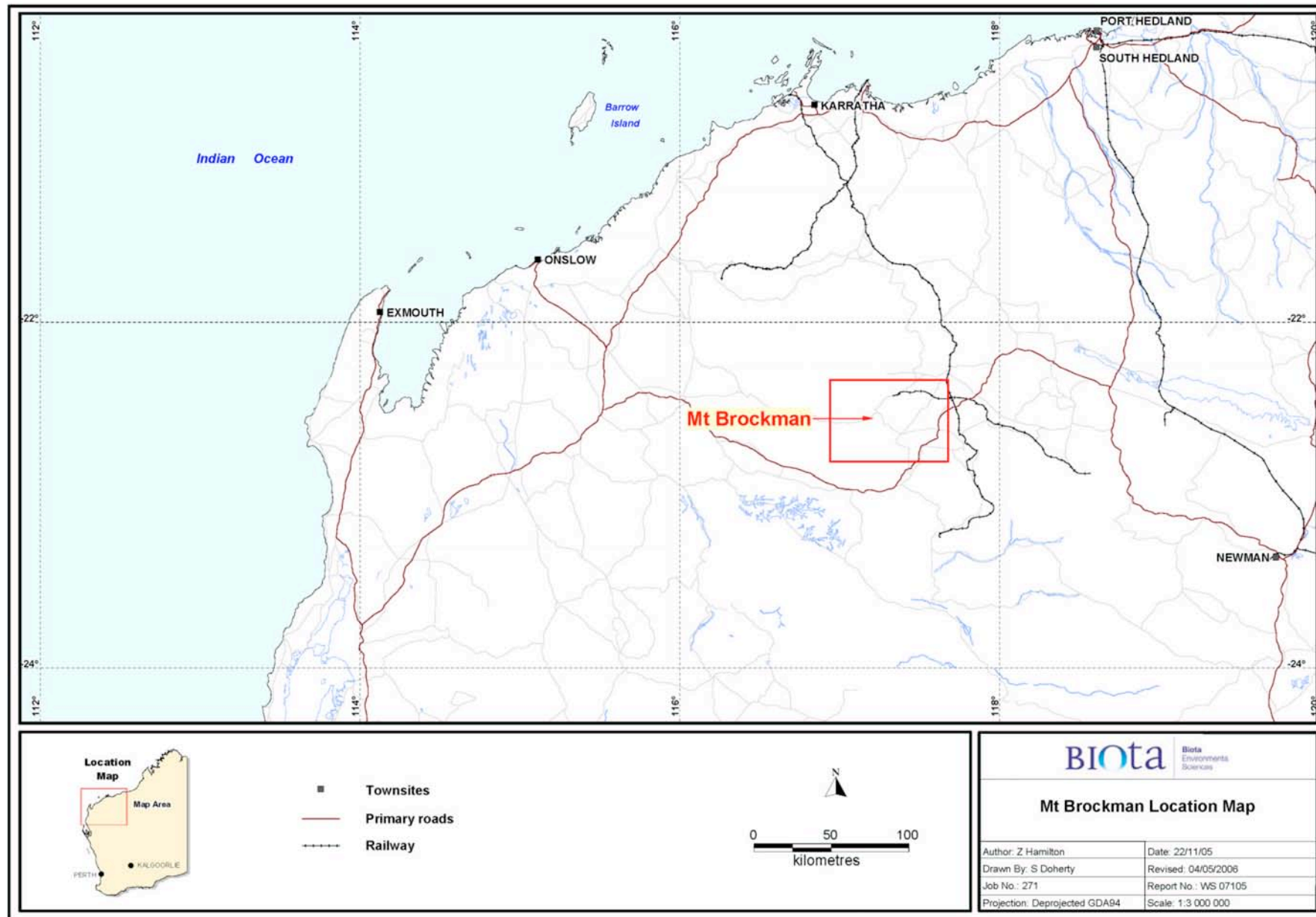


Figure 1.1: Locality Figure.

1.2 Purpose and Structure of this Document

This document has been prepared to meet the requirements of the BS4 Project Ministerial Statement 717 (Condition 717:M8) which states that:

“8-1 Prior to the commencement of mining activities, the proponent shall prepare a Snail Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

This plan shall:

1. provide protection to the genetically distinct *Rhagada* sp. “Mt Brockman” snail population and the *Triodia* under Mulga vegetation community and drainage features which support it at survey site BROMD from impacts of the development/activities by locating the pipeline along an alternate track on the north of BROMD; and
2. include a program for monitoring the *Rhagada* sp “Mt Brockman” population at survey site BROMD to ensure that the development/activities do not adversely impact the population.

8-2 The proponent shall implement the Snail Management Plan as required by condition 8- 1.

8-3 The proponent shall make the Snail Management Plan as required by condition 8-1 publicly available.

8-4 The proponent shall submit the findings of the Snail Management Plan to the Environmental Protection Authority, the Department of Conservation and Land Management and the Western Australian Museum.

This SMP has been prepared in accordance with, and with the intention of meeting, the requirements of Condition 717:M8-1.

The sections of this document that address the specifics of Condition 717:M8 are set out in cross-referenced form in Table 1.1.

Table 1.1: Structure of the *Rhagada* Snail Management Plan in relation to Condition 717:M8.

Condition Clause	Scope	Relevant section of this document
8-1, Item 1	Protect genetically distinct <i>Rhagada</i> sp. “Mt Brockman” population and habitat by relocating pipeline.	3.1
8-1, Item 2	Monitor <i>Rhagada</i> sp “Mt Brockman” population to ensure no adverse impacts from mining development/operations.	3.2
8-2	Implement of the approved plan.	3.0 and 4.0
8-3	Make the approved plan publicly available.	4.1
8-4	Report on findings.	4.2 and 4.3

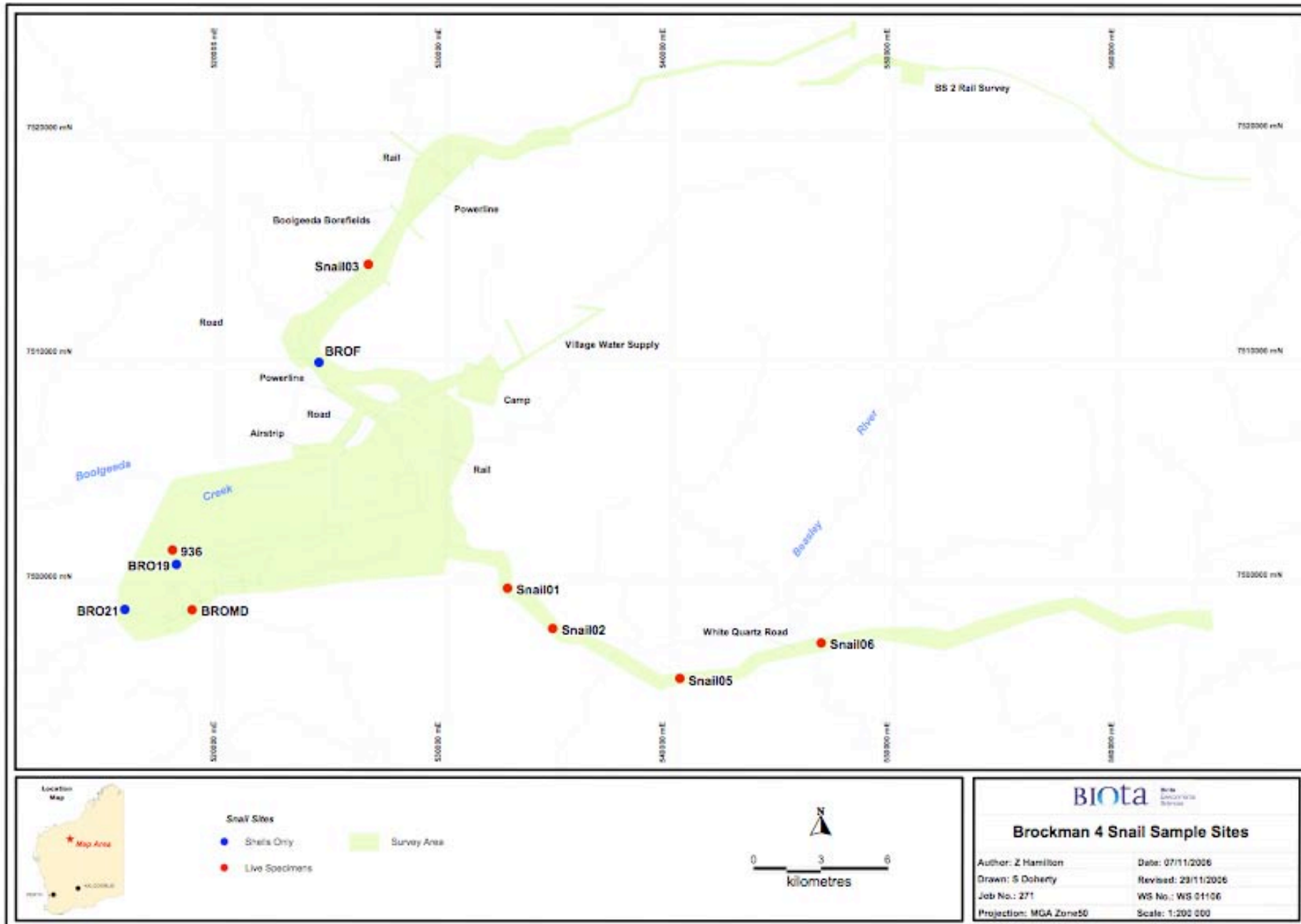


Figure 1.2: Sites from which snails were recorded in the BS4 Project Area.

2.0 Management Framework

2.1 Scope and Objectives

This SMP has been prepared to meet an approval requirement (Ministerial Statement Condition 717:M8) for Pilbara Iron's BS4 Project. It addresses possible direct and indirect impacts on the genetically distinct *Rhagada* sp. "Mt Brockman" snail population, and the *Triodia* under Mulga vegetation community (vegetation type P1 of Biota 2005b) and associated drainage features which support it at survey site BROMD.

Specifically, the SMP addresses the requirement to locate a proposed pipeline such that it avoids the P1 vegetation unit and to monitor the *Rhagada* sp "Mt Brockman" population at survey site BROMD to ensure that the mining development/activities do not adversely impact the population.

In addition, Pilbara Iron has committed to undertaking additional research on *Rhagada* sp "Mt Brockman" to establish whether the population at BROMD is truly unique or whether its uniqueness is an artefact of limited sampling. This work will involve additional sampling in the vicinity of the BS4 Project area and follow-up genetic studies and analyses to compare results with existing findings (including snails previously collected from BROMD). An outcome of this work will be an enhanced understanding of the phylogeography of *Rhagada* within the vicinity of Mt Brockman.

The content of this SMP will be reviewed every two years to update and if required, modify its content in an adaptive management approach (see Section 4.0). It is proposed that should the additional genetic studies demonstrate that the population at BROMD is not unique (see Section 4.4 for completion criteria) that the requirement of Condition 717:M8-1, Item 2 be extinguished (i.e. that no further monitoring will be required).

2.2 General Responsibilities

The Registered Mine Manager (or delegates) shall ensure that:

1. adequate resources are provided to effectively implement and monitor the performance of this SMP; and
2. adequate review mechanisms are implemented to monitor the effectiveness of this SMP.

Pilbara Iron's Manager Environment (or delegated Superintendent / Site Environmental Adviser (SEA)) shall ensure that:

1. all employees and contractors comply with this SMP as relevant to their work activities;
2. adequate specialist resources are made available to complete the survey requirements and subsequent genetic studies required by this SMP;
3. periodic reviews of the effectiveness of this management plan are conducted, with resultant modifications to monitoring and management procedures as appropriate;
4. adequate records are maintained to demonstrate compliance with Ministerial Condition requirements (see Section 1.2);
5. management requirements applicable to land snails and their habitat is a topic covered in the site specific induction attended by all employees and contractors;
6. a training and awareness program is implemented which includes the management requirements applicable to land snails and their habitat; and
7. environmental and legal compliance audits will be held during the construction period which will include auditing of the SMP.

Rio Tinto Iron Ore Expansion Projects (which is accountable during the construction phase on behalf of Pilbara Iron) shall ensure that where appropriate, the above accountabilities are applied to the construction phase as well. RTIOEP shall also ensure that access to the area under its control will be facilitated as and when required by Pilbara Iron and consultant personnel to undertake proposed sampling for *Rhagada* land snails and for the purpose of monitoring at BROMD in accordance with this SMP. Access will be conditional upon compliance with applicable safety and administrative procedures.

3.0 Mitigation Measures and Monitoring

The proposed mitigation measures and monitoring comprises three elements:

1. Relocating the pipeline to avoid the P1 vegetation unit in accordance with Condition 717:M8-1 item 1;
2. Monitoring of the habitat supporting the population at BROMD in accordance with Condition 717:M8-1 item 2; and
3. Additional sampling and genetic studies to resolve whether the population at BROMD is truly unique or whether the uniqueness is an artefact of insufficient and disparate sampling.
4. Implementing any measures that are deemed necessary following the data and management reviews.

3.1 Relocating the Pipeline

The BS4 Project requires water sourced from the Mine Area Borefield to be piped from that area so that it can be made available for mine, plant and associated purposes (eg potable uses, dust control and general plant use). Water sourced from the Mine Area Borefield is fresh (<900mg/L TDS) and will be piped using high density polyethylene pipe.

Several bores need to be located in the area near the P1 vegetation unit (mulga over *Triodia*). The location of these bores is dictated by the availability of water from aquifers. In the area of the P1 vegetation unit, the two bores (SSV13 and SSV5) cannot be moved further northward (and off the P1 area) from their original positions within the P1 area as shale occurs to the north and there is no adequate available groundwater.

Detailed design of the bore water distribution network has not yet been finalised. It is uncertain whether individual bores will need to have separate dedicated pipelines between the bore and the main feeder tank, or whether a larger sized common line (incorporating feeder or spur lines between the bore and the main pipeline) will be utilised. The current design is based on a dedicated pipeline for each individual bore.

The proposed general arrangement is shown in Figure 3.1.

As shown, the pipeline network that previously dissected the P1 vegetation unit has been re-located to the south and completely avoids the P1 area containing the *Rhagada* land snail. The bores (SSV13 and SSV5) that were previously located inside the P1 vegetation unit have been re-located outside the P1 area, albeit immediately adjacent to the southwestern boundary (Bore SSV13) and southern boundary (Bore SSV5) of the P1 area. No feeder or spur lines are incorporated into the current design. No component of the two production bores or associated pipeline infrastructure is planned to be located inside the P1 vegetation unit. The current design fulfills the intent of Condition 717:M8-1 item 1 and goes beyond its requirement.

The pipeline network will be laid out on the surface of the ground. Pipelines will not be buried except where they cross roads. No section of the pipeline will be raised above the ground.

Power supplies to the bores will be through overhead lines with localised footprints for support poles. The alignment of these power lines has not been determined, but they will not dissect the P1 vegetation unit.

It is considered that the operation of the bores in the P1 area will have no impact on the land snail population in the broader P1 area vegetation unit as groundwater levels in the general BROMD area are >30m below ground level and the adjacent *Triodia* (that support the snail) is not groundwater dependent. Furthermore, the risk of bores or pipelines failing is considered to be extremely low based on evidence from other Pilbara Iron mine operations.

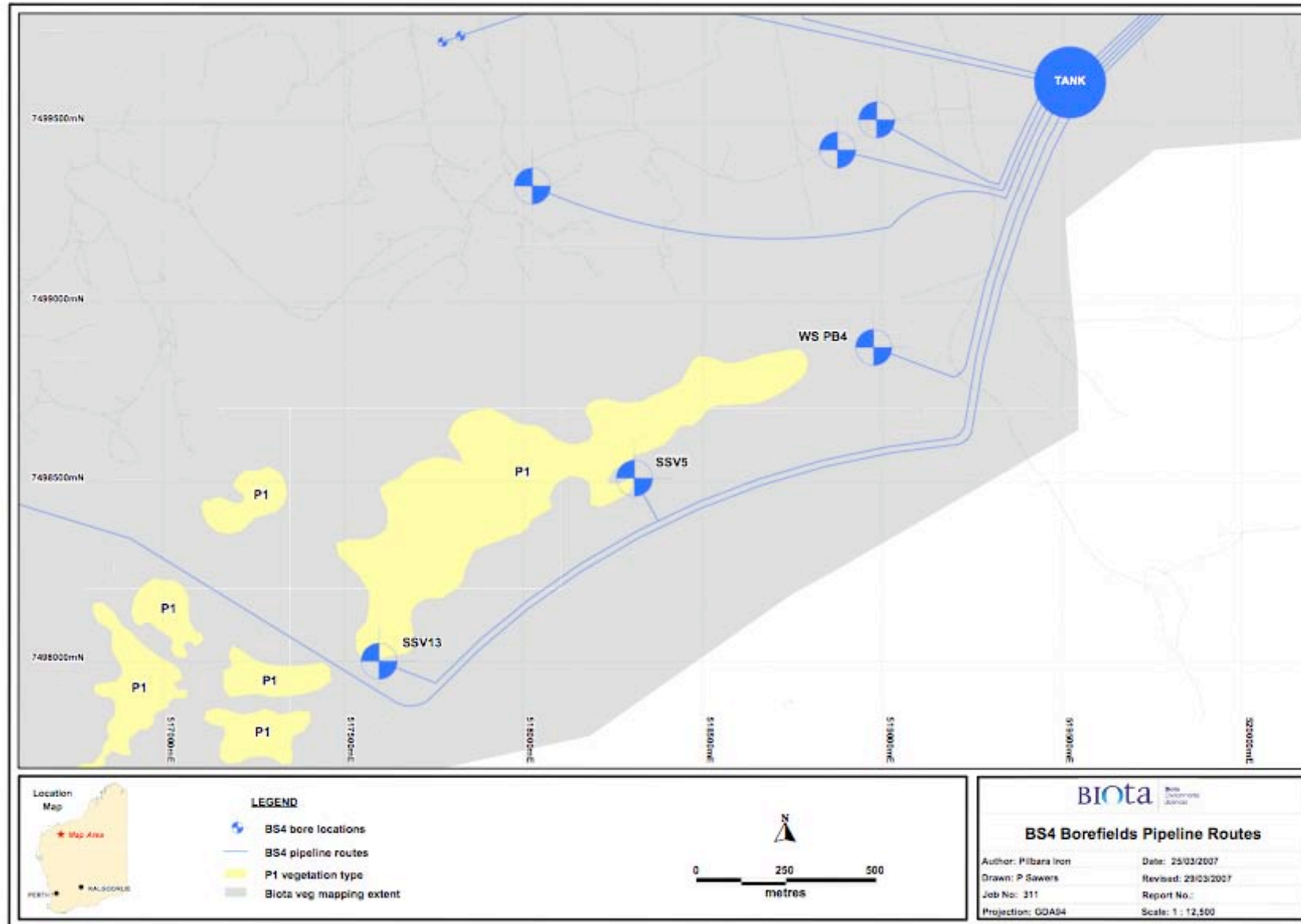


Figure 3.1: Figure showing proposed bore locations and pipelines in relation to the P1 vegetation unit.

3.2 Monitoring

Condition 717:M8 also requires that the *Rhagada* sp "Mt Brockman" population at survey site BROMD be monitored to ensure that the development does not adversely impact the population. It is impractical to monitor the actual snails for the following reasons:

- the snails aestivate beneath *Triodia* bushes and any sampling to collect/monitor them would destroy available habitat and compromise the survivorship of those snails; and
- the snails emerge unpredictably with rainfall events and it would be extremely difficult to estimate changes in abundance over time and attribute this to putative impacts from the BS4 Project with any statistical rigour.

In addition, any monitoring that occurred, would necessarily have to include populations removed from the proposed BS4 developments/activities to resolve between regional stochastic factors that may impact on snail populations (e.g. climate change) and deterministic impacts arising from mining/development activities. Typically, monitoring programs suffer from a lack of statistical power to resolve between these stochastic and deterministic factors as natural levels of variation often overwhelm the between treatment (ie impact versus control) levels of variation.

In view of the above, it is proposed that the general condition of the P1 vegetation unit and in particular the *Triodia* (which provides the necessary shelter) be monitored as a surrogate for the land snails themselves (though see Table 3.2 in relation to monitoring following significant impacts). Monitoring would focus on likely impacts arising directly from mining development/activities (see Tables 3.1 and 3.2). For example, construction of the Western Pit may create increased levels of dust-fall on the P1 vegetation unit, which would be detected using a dust-fall gauge placed at BROMD. In addition, opportunistic *Rhagada* surveys at the BROMD site will be undertaken following significant rainfall events (normally associated with cyclonic activity) (see Section 3.2.1).

Table 3.1: Activities in the immediate vicinity of the BROMD site.

Year/Quarter	Activity	Possible Consequence
Q3 2007	Construction of pipelines.	<ul style="list-style-type: none"> • Inadvertent clearing beyond the requirements stated in Section 3.1. • Flooding and ponding in vegetation P1 as a result of a rupture/leak in the pipelines. • Increase in weed invasion particularly of aggressive environmental weeds such as buffel grass.
Post Q3 2007	General construction, mining operations and activities.	<ul style="list-style-type: none"> • Inadvertent clearing of P1 vegetation unit • Unplanned fires. • Increase in weed invasion.
2014	Construction of haul road between pits.	<ul style="list-style-type: none"> • Inadequate drainage under haul road.
2015	Commencement of mining in Western Pit.	<ul style="list-style-type: none"> • Significant dust fall during mining operations

3.2.1 Monitoring Methods, Frequency and Action Triggers

Prior to the construction of the water pipelines, the boundaries of the P1 vegetation unit will be mapped and the likely habitat of the land snails determined more accurately. The condition of the vegetation will be characterised in at least two 50m² quadrats using percentage foliar cover, a list of species including weed species and a general comment on vigour. Photographs will be taken from a number of permanently marked photographic points. A dust fall gauge will be installed adjacent to one of the photographic points on commencement of mining in the Western Pit. The gauge will be monitored monthly during construction and operational activities at the Western Pit.

Monitoring of the P1 vegetation unit will take place on an annual basis, preferably during winter and in response to any unplanned impact eg inadvertent clearing, accidental flooding or unplanned fire etc. The same characteristics will be documented during each monitoring phase and the data reviewed for emerging trends eg an increase in percent foliar cover of weed species. These trends will be compared to the Action Triggers outlined in Table 3.2. Should the data suggest that the BS4 Project is impacting adversely on, or likely to impact on the P1 vegetation unit then appropriate remedial action will be undertaken in accordance with the Action Triggers outlined in Table 3.2.

As Stated in Section 3.2.1, opportunistic *Rhagada* surveys will be undertaken following significant rainfall events at least once every two years, suitable cyclonic conditions permitting. Ongoing information on the presence/absence will be essentially qualitative in nature and therefore unsuitable for management triggers.

Table 3.2: Triggers and action table for activities in the immediate vicinity of BROMD.

Activity	Possible Consequence	Mitigation measures	Monitoring activities	Action Triggers	Actions arising
General		Additional <i>Rhagada</i> surveys and genetic studies to establish whether the 'BROMD' clade is represented by individuals from other localities.	Monitoring activities should cease if further studies demonstrate that the 'BROMD' clade is not unique to the single location.	Genetic studies identify additional populations in the 'BROMD' clade.	Cease monitoring following close consultation and concurrence with the Pilbara Region Office.
Construction of pipelines.	Inadvertent clearing beyond the requirements stated in Section 3.1.	Map the extent of the P1 vegetation unit. Resolve and map the extent of likely <i>Rhagada</i> habitat in the P1 unit. Clearly identify the boundaries of the P1 vegetation unit in the field using signage and include in internal GIS layers. Include relevant information regarding the <i>Rhagada</i> at BROMD in site induction. Re-locate the pipelines outside of the P1 vegetation unit. Compliance with Construction Environmental Management Plan (CEMP) to be prepared for BS4 Project.	Visit site during and following completion of construction activities to establish whether clearing has occurred beyond requirements identified in Section 3.1.	Clearing extending beyond identified boundaries.	Undertake rehabilitation of cleared areas to re-establish <i>Triodia</i> vegetation. Investigate snail activity at the site following the next major rainfall event.
General construction, mining operations and activities.	Flooding and ponding in vegetation P1 as a result of a rupture/leak in the pipelines.	Firebreak created around main pipelines. Regular pipeline and bore inspections, repair of detected faulty items and routine maintenance testing of infrastructure. Comply with Fire Management Plan (to be covered in CEMP and Operational EMP for BS4 Project).	Routine inspection of pipelines.	Discharge of water from bores or pipelines into P1 vegetation unit.	Undertake site inspection to establish extent of inundation. Investigate snail activity at the site following the next major rainfall event.
	Increase in weed invasion particularly of aggressive environmental weeds such as	Washdown equipment prior to undertaking clearing activities. Activities to be undertaken in accordance with Weed Management Plan for the BS4 project	Monitoring of long-term vegetation plots.	Increase in percent cover of weed species.	Control weeds in accordance with Weed Management Plan.

Activity	Possible Consequence	Mitigation measures	Monitoring activities	Action Triggers	Actions arising
	buffel grass.	(to be covered in CEMP for BS4 Project). Non-essential personnel (for bore management) discouraged from entering P1 vegetation unit encompassing the BROMD site through inductions.			
	Unplanned fires.	Implement BS4 Fire Management Plan (to be covered in CEMP for BS4 Project).	Observance of fire events.	P1 vegetation unit impacted by fire arising from activities at BS4.	If a fire arising out of activities associated with the BS4 project impact on the P1 vegetation unit, then the following actions will be initiated: Map the extent of the fire in the P1 vegetation unit. Investigate snail activity at the site following the next major rainfall event.
Construction of haul road between pits.	Inadequate drainage under haul road.	Insert culverts or other structure as appropriate.	Conduct assessments at long-term vegetation plots.	Visual decline in vigour of plants associated with water stress along drainage feature.	Consider revising mine drainage structures.
Commencement of mining in Western Pit.	Significant dust fall during mining operations	Use water suppression as required.	Conduct assessments at long-term vegetation plots.	Visual layer of excessive dust coating vegetation in the P1 vegetation unit.	Revise dust suppression activities in the mine area to offer additional protection to vegetation unit P1

3.2.2 Cessation of Monitoring

If additional and similar populations of *Rhagada* sp “Mt Brockman” to those occurring at BROMD can be located elsewhere (see Section 3.3), then it is proposed that the requirement to commence or continue monitoring the BROMD location would be extinguished (see Section 4.4). Cessation of snail monitoring will be undertaken in consultation and concurrence with the DEC Pilbara Region Office.

3.3 Additional Surveys and Genetic Analyses

As noted in Section 2.1, it is possible that the apparent uniqueness of the *Rhagada* sp “Mt Brockman” collected from BROMD is an artefact of limited sampling and molecular analyses. Short range endemic taxa may be particularly prone to this type of sampling artefact as they tend to have limited capacity for dispersal reflected in highly structured phylogenies with relatively high values of sequence divergence (when compared to more mobile taxa) (Thomaz et al 1996, Biota 2006a, b, c, d). It is possible that additional sampling at closer geographic distances will in-fill the gaps between snail populations at BROMD and sites snail05 and snail06, or demonstrate that the BROMD (or similar) haplotypes are more widely distributed.

In addition, the valley supporting the P1 vegetation unit from which the BROMD haplotypes were recorded is broadly connected with valleys to the north and east supporting similar vegetation units. There does not appear to be any local landscape features to suggest that the P1 vegetation unit from which the BROMD haplotype was recorded is isolated from surrounding suitable *Rhagada* habitat, and therefore truly supports a genetically isolated population of *Rhagada*.

Additional sampling for *Rhagada* will be undertaken in the vicinity of the BS4 Project area during early 2007. Sampling will focus in habitats contiguous with the valley encompassing BROMD but in locations outside the proposed impact area associated with the BS4 Project. Specimens collected will be vouchered and included in the ongoing molecular analyses of *Rhagada* from the Pilbara and those previously collected from the BS4 Project area.

Section 4.4 discusses the evidence required to indicate that the BROMD location does not represent the only location for a unique taxon of *Rhagada*.

4.0 Reporting and Review Processes

4.1 Public Availability

This SMP will be made publicly available, consistent with the requirements of Condition 717:M8-3. This will include submission of copies to public libraries (local Shire libraries, DEC library in Perth, State Battye Library) and making the management plan available on Pilbara Iron's web site.

Pilbara Iron will advertise the availability of the SMP in the Pilbara News newspaper

4.2 Reporting and Reviews

Pilbara Iron will ensure that regular reviews (see below) of the data collected in the implementation of this SMP are undertaken. This will include both internal reporting and review processes, and formal reporting requirements with the relevant government agencies, comprising:

- **Internal reporting and data reviews**

Survey data and the results of monitoring will be reviewed on an annual basis or in the case of a single impact related event eg inadvertent clearing, accidental fire, flooding etc immediately following the site visit (see Section 3.2.1). An annual report will be prepared and submitted to the environmental representative for the BS4 project during the operational phase.

- **External reporting**

The SMP will be reviewed every two years. The review will take account of survey data, the results of monitoring over the previous period (including any opportunistic sampling) and any audit outcome. In the event that clear evidence arises that demonstrates a major change to the P1 vegetation community that is attributable to BS4 activities, then a review of the SMP will be undertaken in advance of the scheduled two yearly review.

Formal compliance reporting will be submitted to the DEC on an annual basis as part of Annual Environmental Reports (AERs), or at intervals agreed with relevant stakeholders. In addition, the findings of the SMP will be provided direct to the Western Australian Museum in accordance with Condition 717:M8-4.

Reviews of the outcomes of this SMP based on the annual reports will be undertaken both internally and externally (in liaison with the relevant government agencies). Aspects of the programme that will be reviewed may include changes to survey, monitoring or reporting frequency and requirement, data on the extent of BROMD haplotypes resulting from further survey effort, or refinements to management procedures based on feedback from their implementation.

4.3 Summary of Reporting Actions and Responsibilities

Table 4.1 provides a summary of the management actions relevant to the fulfilment of Conditions 717:M8-2 to 8-4.

Table 4.1: Summary of management actions, responsibilities, frequency and timing in relation to Condition 717:M8-2, 8-3 and 8-4.

Management Action	Responsibility	Frequency	Timing
1: Make this management plan publicly available	Senior Advisor Environmental Approvals	Once	Prior to commencement of mining activities and once SMP approved by DEC.
2: Implement the management plan	Pilbara Iron SEA / Biological Consultant	Ongoing	Prior to commencement of mining activities.
3: Submit the results of studies outlined in this management plan to the EPA, DEC and WA Museum.	Pilbara Iron SEA	Annual	Following commencement of construction.

4.4 Completion Criteria

As noted previously, it is considered possible that the “unique” status of the BROMD population is an artefact of insufficient sampling. The following criteria have therefore been developed to determine when an endpoint can be reached such that no further monitoring work focussing on the BROMD location is required:

1. demonstrate that haplotypes occurring within the P1 vegetation unit encompassing BROMD also occur outside of areas proposed for development associated with the BS4 Project; or
2. demonstrate that haplotypes with comparable levels of sequence divergence to that seen in other conspecific populations occurs in relation to the BROMD population; or
3. locate other populations with haplotypes that are positioned on the BROMD clade of the *Rhagada* phylogenetic tree.

It is proposed that any of the above would indicate that the population of snails at BROMD (and in the remainder of the P1 vegetation unit) are not restricted to this particular locality and that population-specific monitoring (at BROMD) is therefore no longer warranted. Cessation of monitoring will be undertaken only following close consultation and concurrence with the DEC Pilbara Region Office.

5.0 Glossary of Terms

Aestivation	The cessation or slowing of activity during the summer; especially slowing of metabolism in some animals during a hot or dry period.
Haplotype	A group of alleles of different genes on a single chromosome that are closely enough linked to be inherited usually as a unit.
Phylogenetic	Relating to or based on evolutionary development or history.
Putative	Commonly regarded as such; reputed; supposed.

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