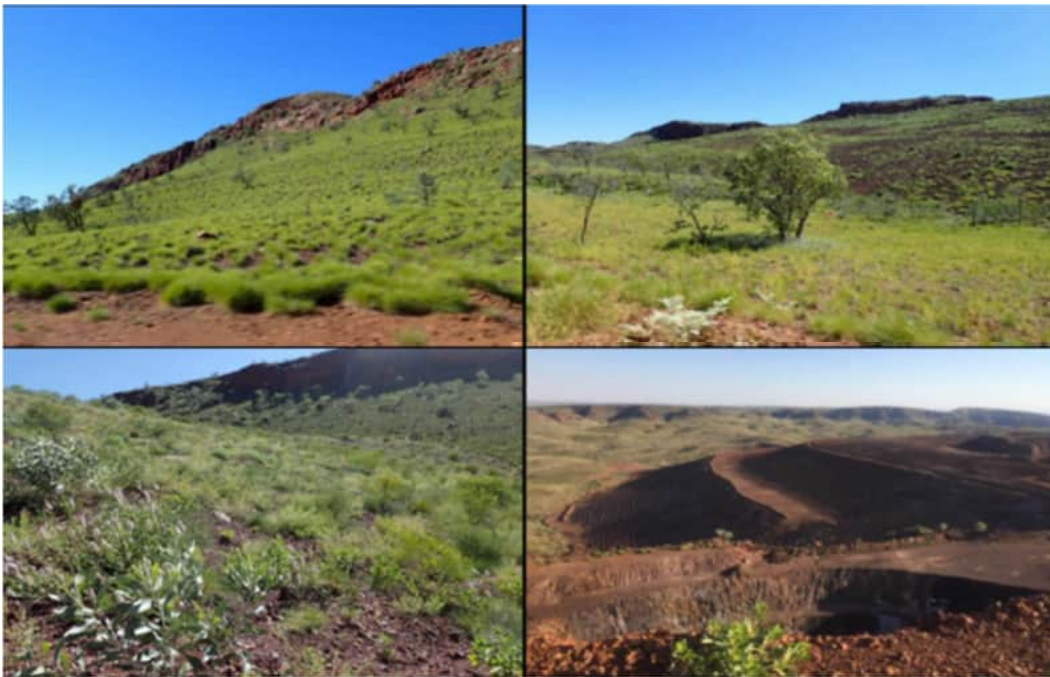


BHP

BHP Pilbara Expansion Strategic Proposal

Rehabilitation Report FY2021



January 2023

Authorisation

Version	Description	Position	Date
Rev 0	Initial version – for OB32 Below Water Table Derived Proposal	Manager Environment WA Iron Ore	July 2022
Rev 0.1	Addition of Western Ridge Derived Proposal	Manager Environment WA Iron Ore	January 2023

Glossary

Term	Meaning
Allelopathic species	Plant species which chemically inhibit another plant due to the release into the environment of substances acting as germination or growth inhibitors
Baseline data	Regional or local data (from reference sites) from a point in time used to compare data at rehabilitation sites
Completed rehabilitation	Rehabilitation areas where the revegetation phase of rehabilitation is at a stage where it can be assessed for completion (rehabilitation generally greater than 15 to 20 years old)
Completion criteria	Agreed standards or levels of performance that indicate the success of completed rehabilitation (DMIRS 2020)
Disturbed land	Total land area that is physically impacted by the activities of the business (including cleared areas)
Domain	A group of landform(s) or infrastructure that has similar rehabilitation and closure requirements and outcomes (DMIRS 2020)
Future rehabilitation activities	Rehabilitation areas where rehabilitation activities have not yet commenced, i.e areas that have been cleared or areas planned and proposed to be cleared
Post-mining land use	The outcome environment that is established for disturbed land after mining ceases (from Syrinx 2020)
Progressive criteria	Criteria developed for this report to measure how rehabilitation underway is progressing and whether it is likely to be successful (at completion)
Reference site	Location that has not been subject to mine-related disturbance that is monitored (landform and vegetation) as part of BHP's rehabilitation monitoring program
Rehabilitation	A process, which improves a degraded environment toward an agreed goal (Syrinx 2020)
Rehabilitation area	Area where rehabilitation activities have been undertaken and revegetation phase has begun
Rehabilitation site	Location within area under rehabilitation that is monitored as part of BHP's rehabilitation monitoring program
Rehabilitation underway	Rehabilitation areas where all rehabilitation activities have been undertaken but the rehabilitation is not at a stage where it can be assessed for completion (rehabilitation generally less than 15 years old)
Revegetation	Phase of rehabilitation, including any or all of the following activities - final trim, topsoil, ameliorant, contour ripping / scarification and seeding, to achieve rehabilitation

Abbreviations

Term	Meaning
AER	Annual Environmental Report
AWT	Above water table
BWT	Below water table
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environment Regulation
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
FY	Financial Year
ha	Hectare
IRR	Impact Reconciliation Reports
MCPs	Mine Closure Plans
MRF	Mining Rehabilitation Fund
MS	Ministerial Statement
MS1105	Ministerial Statement 1105
NA	Not applicable
NVCP	Native Vegetation Clearing Permit
OB	Orebody
OB32 BWT	Orebody 32 Below Water Table Proposal
OSA	Overburden Storage Area
Strategic Proposal	BHP Pilbara Expansion Strategic Proposal
TBA	To be advised
WA	Western Australia
WABSI	Western Australian Biodiversity Science Institute
WAIO	Western Australian Iron Ore
Western Ridge	Western Ridge Proposal
yrs	Years

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Summary

Purpose, approach and scope

The purpose of this report is to meet the requirement under the Pilbara Expansion Strategic Proposal Ministerial Statement (MS)1105 to include a report on rehabilitation with a request to declare a referred proposal to be a derived proposal (see 1(c) of the *Guidelines for submitting a derived proposal* (MS1105 Guidelines)). BHP has prepared this report to support the derived proposal requests for the following proposals:

- Newman Hub - Orebody 32 Below Water Table
- Newman Hub - Western Ridge.

This is the first report on rehabilitation that BHP has prepared to meet the MS1105 Guidelines and it is the first time that BHP has attempted to develop scientifically-based criteria and quantitative targets to systematically, consistently and transparently assess rehabilitation progress and success across its Western Australian Iron Ore (WAIO) operations. Following testing since 2019, BHP is currently undertaking a review of the rehabilitation success methodology. Therefore, the methodology presented in this report is preliminary and will be updated for future reports.

The scope of this report is the rehabilitation (revegetation) of mining-related disturbance across BHP's WAIO operations (Jumblebar, Newman, Yandi, Mining Area C, Goldsworthy and Yarrie mine hubs) on BHP's iron ore tenure.

Guidelines 1(c)(i): Types of ecosystems and total area required to be rehabilitated

BHP has defined the types of ecosystems requiring rehabilitation across their iron ore tenure based on the major vegetation types of Beard et al. (2013). These major vegetation types were chosen as they represent the dominant ecosystems present on BHP iron ore tenure, reflect the scale of rehabilitation required and also represent the likely post-mining ecosystem.

Based on data up to the end of the 2021 financial year (FY), BHP estimates that the total area of disturbance that BHP will be required to rehabilitate to the revegetation phase (i.e. excluding open pits that remain as voids) across its iron ore tenure in the designated mine hubs including the OB32 BWT and Western Ridge derived proposals, is approximately 48,764 hectares (ha), based on the total approved disturbance limit. The total actual disturbed land is approximately 26,267 ha and the total area of rehabilitation is approximately 4,564 ha, representing 17% of the total disturbed land.

Guidelines 1(c)(ii): Analysis of rehabilitation history and success

BHP has undertaken an analysis of the history of rehabilitation undertaken by BHP in the Pilbara. The key practices and outcomes include the following:

- 1980s: Rehabilitation started at Mt Whaleback (Newman hub) – rehabilitation was 'ad hoc' and poor *Triodia* recruitment, limited species diversity and high erosion were observed.
- 1990s: Rehabilitation was initiated across all WAIO operations in Pilbara – trials with different rehabilitation landforms, slope modification and contour ripping started. There were improved trials and monitoring, and less erosion and improved recruitment was noted.
- Early 2000s onwards: Landform improvements (e.g. integrating OSAs into the landscape and altering slopes to minimise erosion) were progressed and the concept of growth media was introduced. Lower erosion impacts were noted.
- 2015 onwards: Revegetation improvements were made, e.g. understanding of seed biology and improvements in collection, dormancy breaking and seeding methods. Improvements in recruitment were noted.

As part of the preliminary methodology for measuring rehabilitation success, BHP has developed scientifically verifiable success measures (criteria and targets) based on relevant contemporary scientific evidence in the Pilbara and the quantitative analysis of BHP rehabilitation data. BHP has also developed a traffic light approach to communicate the status and success of rehabilitation at the mine hub level.

BHP has developed completion criteria to use as the measure of historical rehabilitation success, when rehabilitation is considered to be complete. For the FY2021 analysis, all hubs had rehabilitation sites that were monitored and were old enough to assess against completion criteria, except Jimblebar. From the analysis at the hub level, historical rehabilitation is variable across the hubs, but was at least partially successful for all hubs. Very few rehabilitation sites did not meet all or most criteria, which suggests that most older sites are likely to reach completion and rehabilitation will be successful, but potentially over a longer timeframe. In summary, at Newman hub rehabilitation sites hub met all criteria, Yandi and Yarrie hubs met most completion criteria and rehabilitation sites at Mining Area C and Goldsworthy hubs met some completion criteria.

The most common criteria that was not met was Hummock Grasses (*Triodia*) Cover. As *Triodia* Cover is a key indicator for rehabilitation success, improving *Triodia* Cover will be a focus of BHP's improvement activities. The rehabilitation status maps reflect the relatively small areas assessed for completion. As expected, the hubs with older mines that have ceased mining activities in some/all areas (e.g. Goldsworthy and Yarrie) have a higher proportion of rehabilitation assessed for completion, as a higher proportion of the disturbed land that has been rehabilitated. Where completion criteria were not met, BHP will review whether the criteria need to be amended (e.g. for older mines where early rehabilitation practices were used) or whether intervention is required for certain rehabilitation areas to improve rehabilitation outcomes.

Schedule 1, Table 2, 2.c and Guidelines 1(c)(iii): Future rehabilitation success

For rehabilitation areas where rehabilitation is underway but not ready to be measured for success (i.e completion), BHP has developed progressive criteria and targets to assess the likely success of future rehabilitation based on the same scientifically verifiable data and approach as the completion criteria and targets for historical rehabilitation. Rehabilitation that is underway is likely to be successful (at completion) if BHP can demonstrate that rehabilitation is progressing according to an appropriate trajectory.

The FY2021 analysis shows progressing rehabilitation is variable across the hubs, but was at least partially successful for all hubs. While the supporting criteria were met for most hubs, most hubs did not meet the major criterion (*Triodia* Cover/Total Native Cover ratio) except Jimblebar and Mining Area C. This is reflected in the rehabilitation status maps which show only some areas are considered to be on track. Where progressive criteria were not met, BHP will review whether maintenance is required for certain rehabilitation areas (e.g. to address *Triodia* Cover and Weed Cover). As part of the review of the rehabilitation success methodology, BHP is currently reviewing the progressive criteria and is developing interim milestones to enable BHP to assess whether rehabilitation underway is progressing on the right trajectory. The application of the revised criteria for future assessments will help BHP confirm whether maintenance is required at sites that were not met for the FY2021 assessment.

BHP considers that future rehabilitation activities in areas where rehabilitation activities have not yet commenced will be successful if the relevant criteria targets (progressive and completion) are met. Therefore, BHP intends to apply a similar approach for future rehabilitation activities as existing rehabilitation areas (underway and completed), adapting the current approach (rehabilitation practices, monitoring and success criteria), where relevant, based on contemporary scientific evidence from BHP data and information, and broader (including Pilbara) information. BHP will also take into account the types of areas to be rehabilitated and the scale of rehabilitation activities in assessing the likely success of future rehabilitation activities.

Based on the assessment of relevant existing rehabilitation, which demonstrates that rehabilitation is at least partially successful and at least partially progressing along the appropriate trajectory for success at completion, BHP considers that it is likely that future rehabilitation activities for the OB32 BWT and Western Ridge derived proposals will be successful.

1 Introduction

1.1 Purpose of this report

BHP has prepared this Rehabilitation Report (report) for the 2020-2021 Financial Year (FY2021), to support the derived proposal requests for the following proposals:

1. Newman Hub - Orebody 32 Below Water Table (OB32 BWT) (BHP2022a)
2. Newman Hub - Western Ridge (BHP2022b).

The purpose of this report is to meet the requirement under the Pilbara Expansion Strategic Proposal (Strategic Proposal) (BHP 2016) Ministerial Statement 1105 (MS1105) to include a report on rehabilitation with a request to declare a referred proposal to be a derived proposal (see 1 (c) of the *Guidelines for submitting a derived proposal* (MS1105 Guidelines)). Table 1 outlines which sections in this report address the specific requirements of MS1105 (main section in **bold**).

Table 1: MS1105 Rehabilitation Report requirements

MS1105 reference	Rehabilitation Report requirement	Section addressed
Guidelines 1(c)(i)	The types of ecosystems and total area of rehabilitation that the proponent will be required to rehabilitate across their iron ore tenure including the derived proposal.	Section 2
Guidelines 1(c)(ii)	An analysis of the history of rehabilitation that the proponent has undertaken in the Pilbara and the demonstrated success of this rehabilitation.	Section 3 Sections 4.1, 4.2 Appendices 1 to 9
Guidelines 1(c)(iii)	The likely success of future rehabilitation activities in establishing self-sustaining areas of rehabilitation, taking into account: <ul style="list-style-type: none"> • relevant contemporary scientific evidence • the types of area to be rehabilitated • the scale of rehabilitation activities. 	Section 3 Sections 4.1, 4.3 Section 5 Appendices 1 to 9
Schedule 1, Table 2, Column 3	2 Planned, designed and managed (demonstrated in the referral of future proposal and draft management plans submitted at the time of referral of future proposals) to ensure: <ul style="list-style-type: none"> c. Scientifically verifiable estimates of the likely success of future rehabilitation have been made. 	

1.2 Approach for this report

In the Environmental Protection Authority's (EPA) Report 1619 on the Strategic Proposal (EPA 2018), the EPA considered that it is important that a full understanding of the status of rehabilitation in the Pilbara is achieved and included guidance on the information related to rehabilitation that it expects to see in any request to declare a proposal a derived proposal (see MS1105 Guidelines, 1(c)). This report documents the status of rehabilitation at BHP's Western Australia Iron Ore (WAIO) operations.

This is the first Rehabilitation Report for a derived proposal that BHP has prepared as a requirement of MS1105 for the Strategic Proposal. BHP monitors rehabilitation and reports on rehabilitation for other internal and regulatory requirements, including at the approval level as part of the Annual Environmental Report (AER). However, this is the first time that BHP has attempted to develop scientifically-based criteria and quantitative targets to systematically, consistently and transparently assess rehabilitation progress and success across its WAIO operations.

BHP considers that the approach for this report sets up an effective process for BHP to continue to improve the standard of rehabilitation and to demonstrate successful broadscale rehabilitation over time. Following testing the since 2019, BHP is currently reviewing the rehabilitation success methodology. Therefore, the methodology

presented in this report is considered to be preliminary and in development. While BHP will continue to use a scientifically verifiable approach for measuring rehabilitation success, the rehabilitation success methodology will be updated for future reports.

1.3 Scope of this report

The focus of this report is the success of rehabilitation, as discussed in the EPA Report 1619 on the Strategic Proposal (EPA 2018) and required by MS1105. The scope of this report is disturbed areas requiring rehabilitation under Part IV and Part V of the *Environmental Protection Act 1986 (WA)* (EP Act) and State Agreements, on BHP's iron ore tenure.

1.3.1 Data

Unless otherwise specified, BHP will use disturbance (clearing) and rehabilitation data from the previous financial year to prepare rehabilitation reports. This report uses BHP data from approved projects up to the end of FY2021 (i.e. 30 June 2021). This enables the information presented in this report to be aligned with other regulatory reporting relating to disturbance/clearing and rehabilitation, e.g. Annual Environmental Reports (AERs), Mining Rehabilitation Fund (MRF) reports and Impact Reconciliation Reports (IRR).

As required by MS1105 Guideline 1(c)(i) and (iii), this report also includes relevant data and information (Sections 2 and 4.3) relating to the OB32 BWT and Western Ridge derived proposals.

1.3.2 Rehabilitation phase - revegetation

The report focuses on the revegetation phase of rehabilitation, where all other planned earthwork activities are complete and, if specified, topsoil, ameliorant, contour ripping/scarification and/or seeding have been undertaken. In EPA Report 1619, the EPA states that a consideration for environmental impact assessment (in the EPA's *Environmental Factor Guideline – Flora and Vegetation*) is whether the proposal area will be revegetated in a manner that promotes biological diversity and ecological integrity (EPA 2018). Other rehabilitation phases such as landform profiling, contouring and armouring are addressed in Mine Closure Plans (MCPs) and other Department of Mines, Industry Regulation and Safety (DMIRS) requirements.

1.3.3 Types of disturbed areas

In EPA Report 1619, the EPA states that the environmental impact of vegetation clearing has been exacerbated by the lack of successful rehabilitation of mines in the Pilbara (EPA 2018). Therefore, this report focuses on the rehabilitation (revegetation) of mining-related disturbance (clearing), including for overburden storage areas (OSAs), associated infrastructure and rail. The analysis of rehabilitation (revegetation) success in this report does not include:

- mine pits that will remain as open pit voids at closure (i.e. are not backfilled, including where pit lakes will form), as these landforms will not be revegetated
- the portions of the Chichester rail line that are not part of a mine hub
- exploration disturbance (as it will either be rehabilitated under Part V of the EP Act (Native Vegetation Clearing Permits (NVCPs)), or included as mine disturbance in the future if the orebody is approved for mining)
- BHP operations at Port Hedland.

1.4 Other rehabilitation reporting

This report complements other regulatory documents and reports relating to disturbance and rehabilitation that BHP is required to prepare including MCPs, AERs, IRRs (for biological offsets) and MRF reports.

2 BHP areas requiring rehabilitation

2.1 Mine operations required to be rehabilitated

BHP's iron ore tenure extends across the Pilbara (Figure 1). It includes existing operations and future operations identified in the Strategic Proposal. For the purposes of this report only, BHP has grouped mine operations into hubs, as the scale of BHP's WAIO mine operations across its iron ore tenure is hundreds of kilometres. The hub boundaries (Figure 2) are defined for calculation and mapping purposes only.

All of the mine hubs except for Goldsworthy and Yarrie are located in the Strategic Proposal Project Boundary (Figure 1) and are consistent with the existing mining operations identified in MS1105. The hub boundaries are arbitrary only for the purposes of grouping operations to assess rehabilitation success. As future operations are proposed (including future proposals identified in the Strategic Proposal), BHP may amend the hubs or add new hubs.

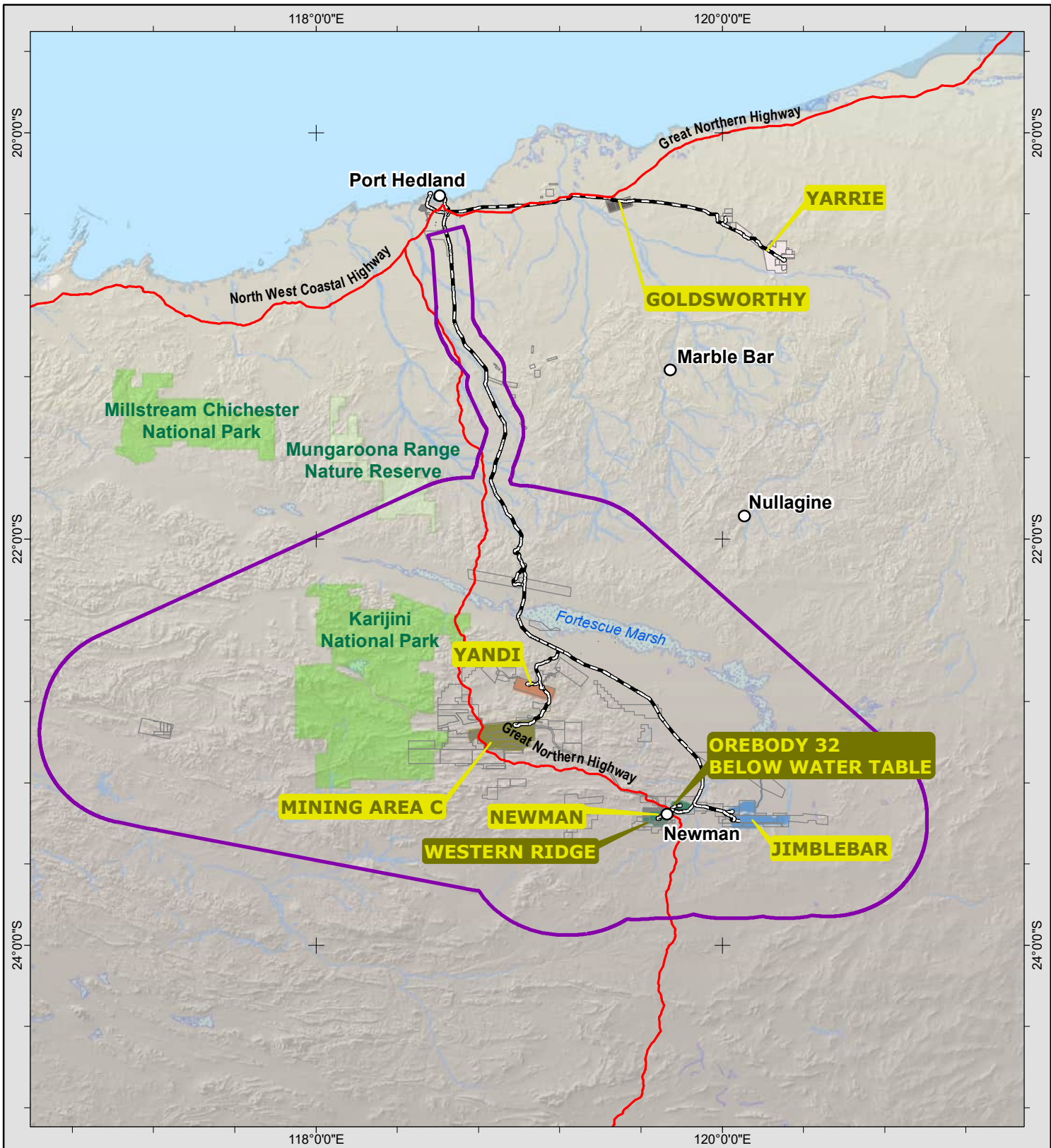
Table 2 lists the current approvals under Part IV of the EP Act (Ministerial Statements) for mines within each hub that authorise disturbance and/or require rehabilitation. There are also approvals through Part V of the EP Act (NVCPs) and State Agreements. While most mines are approved under Part IV of the EP Act, some older mines (e.g. Whaleback and Goldsworthy) or smaller mines are approved under State Agreements and/or NVCPs. Table 2 also includes the OB32 BWT derived proposal and Western Ridge derived proposal.

Table 2: Mine operations requiring rehabilitation

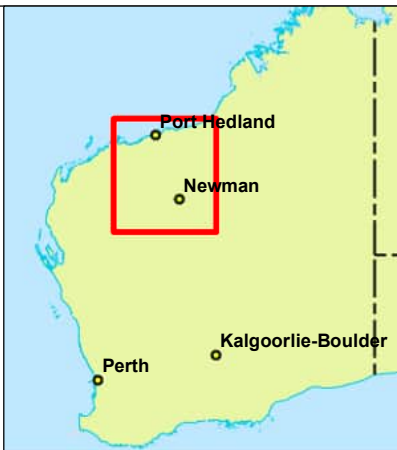
Mine hub	Mine	Approval status	Date original Part IV approval	Current Ministerial Statement	Operational phase	Estimated mining ¹ completion date
Jimblebar	Jimblebar	Approved	2011	MS1126	Operations	2060
	Orebody 31	Approved	2015	MS1021	Operations	2069
	Orebody 17, 18	Approved	1997	MS439 (and MS1012)	Operations	
Newman	Whaleback	Approved	N/A Pre EP Act (1964) ²	N/A	Operations	2040
	Orebody 29/30/35 Below Water Table	Approved	2014	MS963	Operations	2069
	Western Ridge	Proposed	N/A	N/A	Planning	2045
	Eastern Ridge (Orebodies 24, 25, 25W and 32 ³)	Approved	2006	MS1037	Operations	2068
	Orebody 32 Below Water Table	Proposed	N/A	N/A	Planning	
	Orebody 23 ⁴	Approved	1998	MS478	Mining ceased	-
Yandi	Marillana Creek (Yandi)	Approved	2005	MS679 (and MS1039)	Operations	2028
Mining Area C	Mining Area C (Northern and southern flanks)	Approved	1998	MS1072	Operations	2049

Mine hub	Mine	Approval status	Date original Part IV approval	Current Ministerial Statement	Operational phase	Estimated mining ¹ completion date
Goldsworthy	Goldsworthy	Approved	N/A Pre- EP Act (1964) ¹	N/A	Mining ceased	-
Yarrie	Yarrie (Y2, Y3)	Approved	1993	MS303	Suspended Operations	To be advised (TBA)
	Nimingarra (Nim 1) Yarrie (Y4A, Y7W and Y10) Cattle Gorge	Approved	2005	MS682	Mining ceased Suspended Operations Mining ceased	
	Cundaline Callawa	Approved	2009	MS814	Suspended Operations Mining not started	

1. Latest mining completion date according to current MCPs. Decommissioning and demolition of infrastructure will occur decades later at some hubs (eg Newman and Mining Area C), where the infrastructure is used to service other operations. The estimated closure date in Appendix 3 includes removal of infrastructure.
2. Date State Agreement approval.
3. Above water table mining at Orebody 32 is approved.
4. BHP also includes Orebody 23 as part of the Eastern Ridge operations, however it was not included in the Eastern Ridge Revised Proposal approved under MS1037.



— BHP Rail
 — Major Roads
 □ BHP Tenements
 □ Strategic Proposal MS1105 Project Boundary
Existing hubs in Strategic Proposal boundary
 ■ Jimblebar
 ■ Mining Area C
 ■ Newman
 ■ Yandi



BHP Spatial Data - Studies & Access
BHP IRON ORE

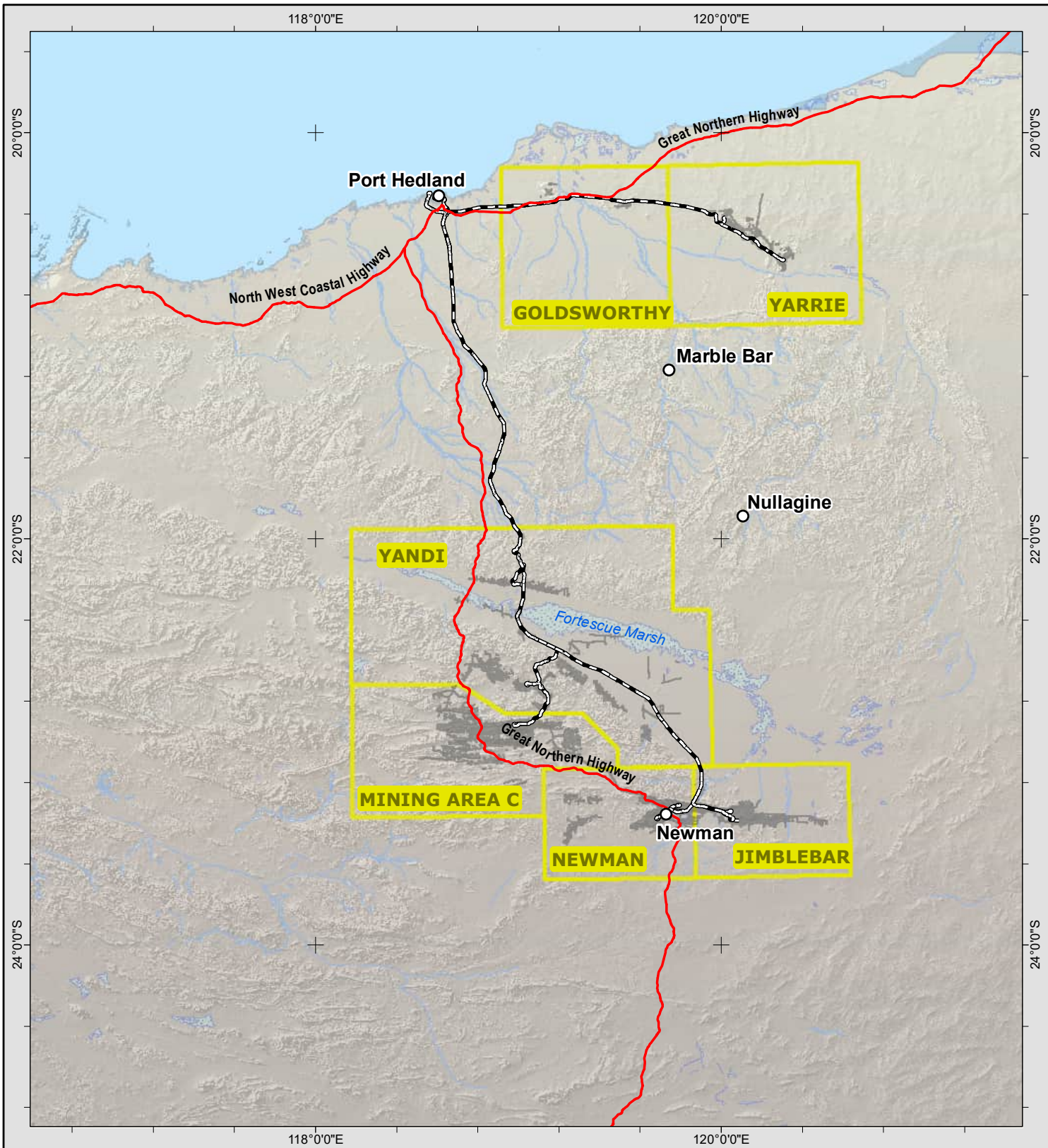
REHABILITATION REPORT FY2021
BHP tenure and Strategic Proposal boundary



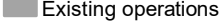

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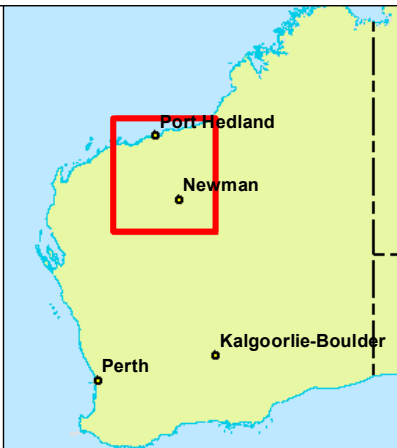
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Coordinate System: GCS GDA 1994, Datum: GDA1994, Units: Degree

Scale @ A4: 1:2,925,000	Prepared: J. Vis	Project No: A1079/005 REV B
Date: 12/10/2022	Reviewed: Env. Approvals	Figure: 1



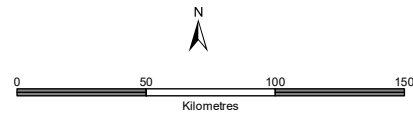
-  BHP Rail
-  Major Roads
-  Existing operations
-  Rehabilitation Report hub boundaries



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REHABILITATION REPORT FY2021
Existing operations and Rehabilitation Report hubs



Coordinate System: GCS GDA 1994, Datum: GDA 1994, Units: Degree

Scale @ A4: 1:2,925,000	Prepared: J. Vis	Project No: A1079/005 REV B
Date: 13/07/2022	Reviewed: Env. Approvals	Figure: 2

2.2 Types of ecosystems to be rehabilitated

MS1105 Guidelines (1(c)(i) requires information on ‘*the types of ecosystems that the proponent will be required to rehabilitate across their iron ore tenure including the derived proposal*’.

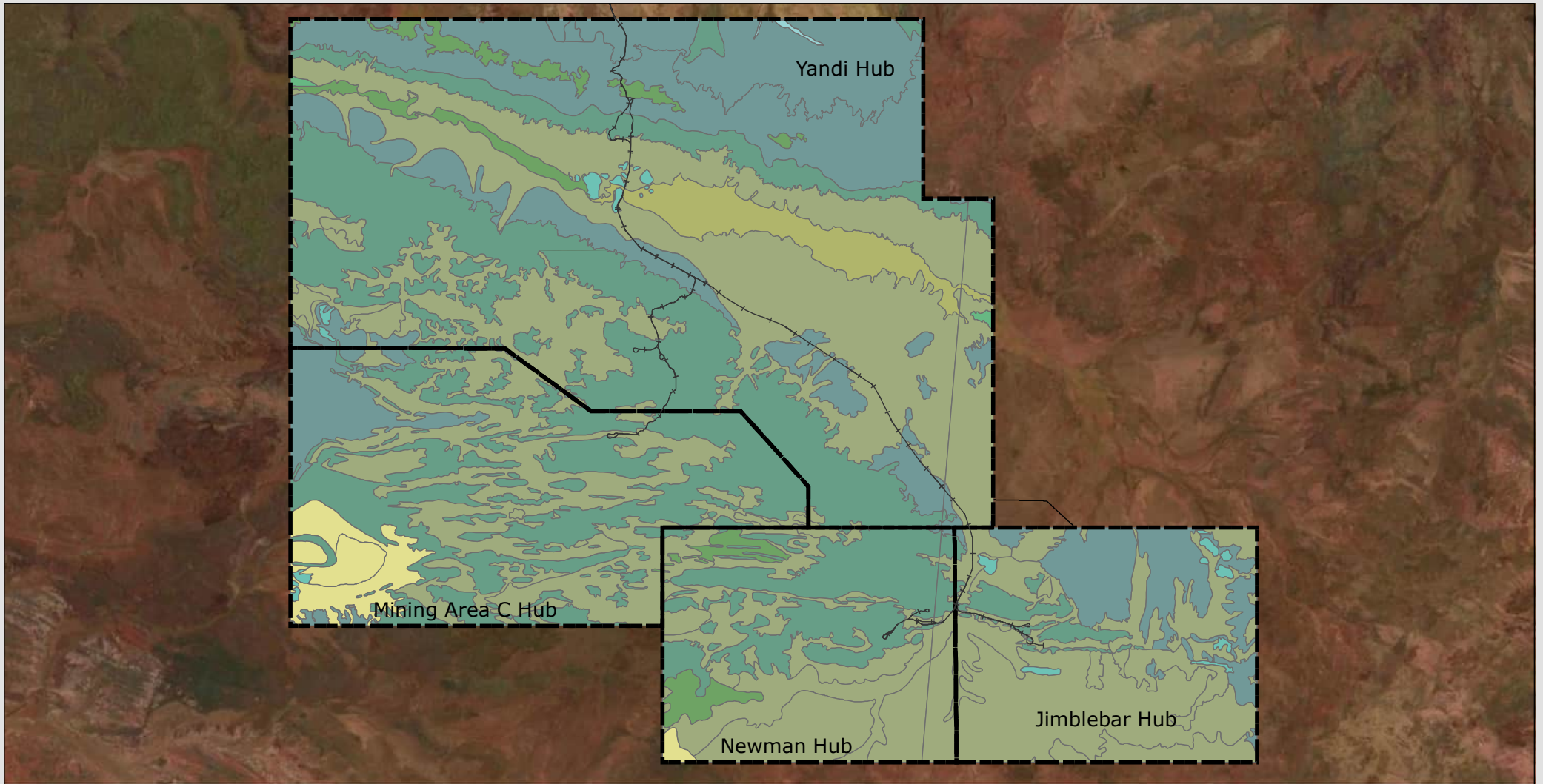
The term ecosystem is applied at various scales, and in WA has been used at the scale of a specific community (e.g. wetland communities associated with Weeli Wolli spring) as well as at the broader vegetation scale (e.g. spinifex grasslands) or geomorphic scale (e.g. claypan) (Syrinx 2020).

BHP has defined the types of ecosystems requiring rehabilitation across their iron ore tenure based on the Beard 1:3,000,000 scale major vegetation types (Beard *et al.* 2013). These major vegetation types were chosen based on the analysis undertaken by Syrinx (2020), as they represent the dominant ecosystems present on BHP iron ore tenure and reflect the scale of rehabilitation required.

The major vegetation types (Table 3, Figure 3 and Figure 4) allow for the analysis of rehabilitation (revegetation), based on vegetation attributes including indicator species, vegetation cover and species richness. The major vegetation types also represent the likely post-mining ecosystem as the pre-mining environment is generally significantly altered following mining.

Table 3: Ecosystem types

Ecosystem type	
Beard vegetation type	
Spinifex grassland	35 Low tree-steppe
	38 Shrub-steppe
	40 Grass-steppe
Low forest and woodlands	8 Low woodland, open low woodland or sparse woodland
Bunch grassland	32 Riverine sedgeland/grassland with trees

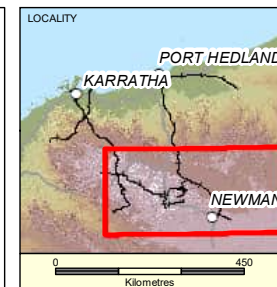


Rehabilitation Report hubs

Vegetation Structure Description (Beard et al. 2013)

- Grass-steppe
- Grasslands, short bunch-grass savanna
- Low tree-steppe
- Low woodland, open low woodland or sparse woodland
- Pindan with low trees
- Riverine sedgeland/grassland with trees

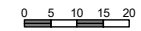
- Salt lake, lagoon, clay pan
- Samphire
- Scrub, open scrub or sparse scrub
- Short bunch-grass savanna / Grass-steppe
- Shrub-steppe
- Sparse low tree-steppe / Sparse shrub-steppe
- Tidal mud flat
- Woodland other



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BHP IRON ORE

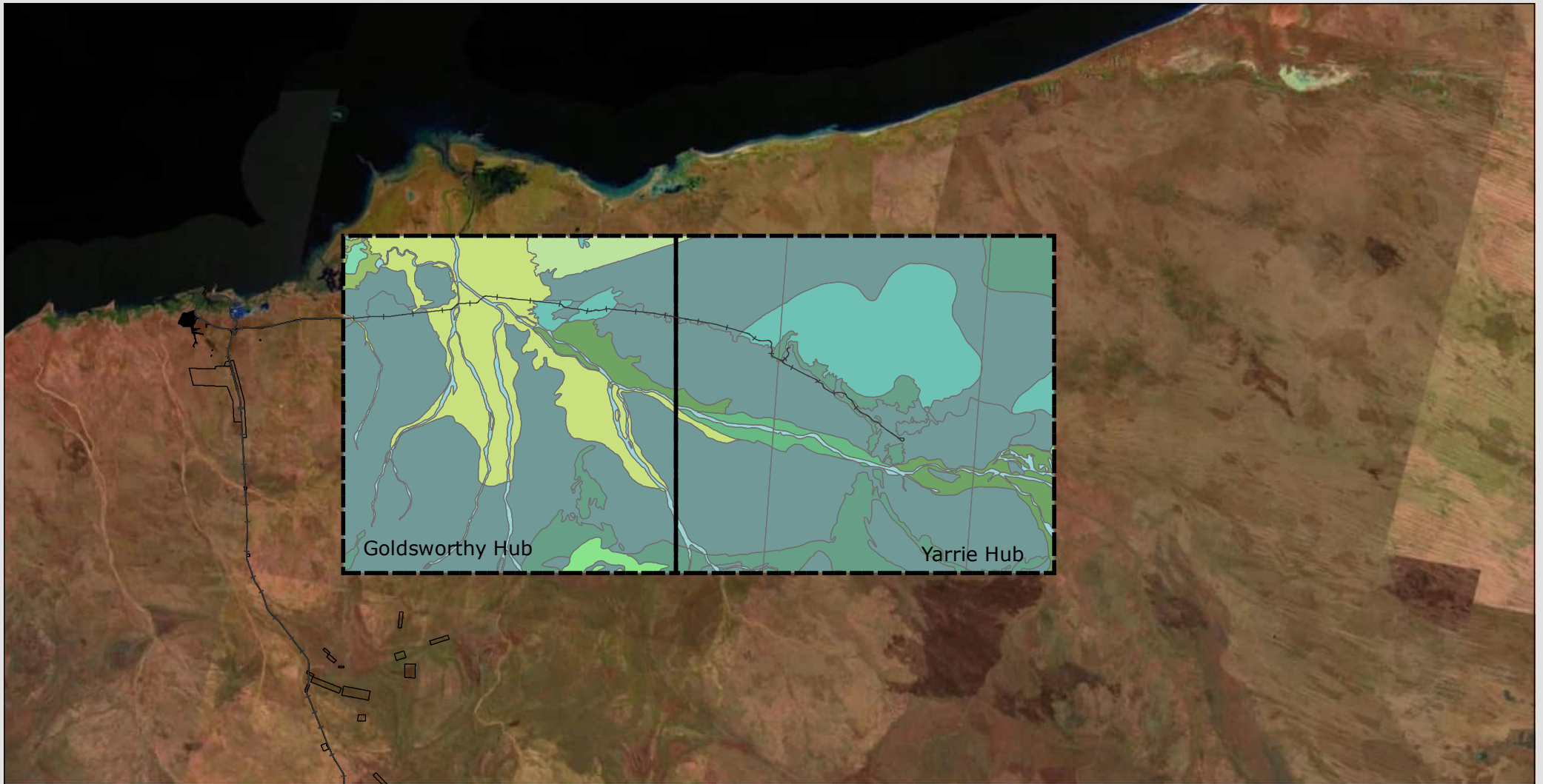
REHABILITATION REPORT FY2021
Ecosystem types for the Eastern and Central Pilbara




Coordinate System: GDA 1984 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1984, Units: Meter

















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Date: 13/07/2022	Checked:	Figure: 3
	Reviewed: ENVIRO. A&I	

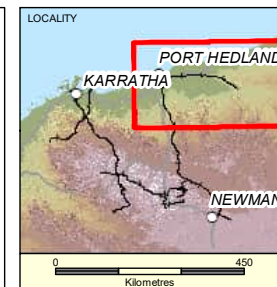


 Rehabilitation Report hubs

Vegetation Structure Description (Beard et al. 2013)

-  Grass-steppe
-  Grasslands, short bunch-grass savanna
-  Low tree-steppe
-  Low woodland, open low woodland or sparse woodland
-  Pindan with low trees
-  Riverine sedgeland/grassland with trees

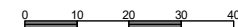
-  Salt lake, lagoon, clay pan
-  Samphire
-  Scrub, open scrub or sparse scrub
-  Short bunch-grass savanna / Grass-steppe
-  Shrub-steppe
-  Sparse low tree-steppe / Sparse shrub-steppe
-  Tidal mud flat
-  Woodland other



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

REHABILITATION REPORT FY2021
Ecosystem types for the Northern Pilbara



Kilometres Coordinate System: GDA 1994 MGA Zone 50 Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter		
Scale @ A4: 1:1,450,000	Prepared: P. GANT	Project No: 1004/014 Rev A
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Reviewed: ENVIRO. A&I		

2.3 Types of areas to be rehabilitated

MS1105 Guidelines (1(c)(iii) requires information on *'the likely success of future rehabilitation activities in establishing self-sustaining areas of rehabilitation, taking into account ... the types of area to be rehabilitated'*...

The success of rehabilitation will depend to a degree on the type of landforms and/or infrastructure constructed as part of a mining operation. Consistent with DMIRS *Statutory Guidelines for mine closure plans* (DMIRS 2020), BHP considers domains, which are a group of landform(s) or infrastructure that have similar rehabilitation and closure requirements and outcomes. Rehabilitation is likely to be more successful and/or take less time to be successful in areas where there is a lower impact on the land (e.g. infrastructure areas), compared to areas where there is a higher impact (e.g. overburden storage areas (OSAs)).

BHP also reports disturbance to DMIRS for the MRF (as part of BHP's AER process) for infrastructure and land features within domains. The main domains are OSAs, infrastructure, mine voids and rail.

As discussed in Section 1.3.3, the analysis of rehabilitation (revegetation) success in this report does not include mine pits that will remain as open pit voids at closure (i.e. are not backfilled, including where pit lakes will form), as these landforms will not be revegetated. This report does include all other types of areas associated with mining operations in the mine hubs that will be rehabilitated, i.e. OSAs, infrastructure and rail.

2.4 Total area of disturbance to be rehabilitated

MS1105 Guidelines (1(c)(i) requires information on *the total area of rehabilitation that the proponent will be required to rehabilitate across their iron ore tenure including the derived proposal*.

Table 4 tabulates disturbance (clearing) data for approved operations under Part IV and Part V of the EP Act and State Agreements for each hub as at the end of FY2021 (30 June 2021). Table 4 also includes data for operations approved and Part IV proposals that BHP has progressed to the referral stage since 1 July 2021; the OB32 BWT and Western Ridge derived proposals. Table 5 does not include data for other future proposals identified in the Strategic Proposal. Table 4 shows that, assuming all approved and proposed disturbance (Approved disturbance limit) requires rehabilitation, the total area of disturbance that BHP will be required to rehabilitate across its iron ore tenure in the designated mine hubs including the derived proposals (OB32 BWT and Western Ridge) is approximately 65,500 ha. However, as stated Section 1.3.3, mine pits that will remain as open pit voids at closure (i.e. are not backfilled to pit crest, including where pit lakes will form) will not be revegetated. Based on actual disturbance data including areas classified as pits, approximately 74% of the total actual disturbance excludes pits (Table 4).

Therefore, the current total area of disturbance that BHP will be required to rehabilitate (to the revegetation phase) across its iron ore tenure in the designated mine hubs including the derived proposals is estimated to be 48,764 ha (74% of the 65,500 ha total disturbance limit). The actual area will depend on the final pit backfill strategy selected for each mine.

Table 4: Mine disturbance requiring rehabilitation

Mine hub ¹	Type of Approval	Approved disturbance limit (ha) ²	Actual disturbance at FY21 (ha) ³	Actual disturbance at FY21 excluding pits ⁴ (ha)	Disturbance excluding pits as % of actual disturbance
Jimblebar	MS	10,195	5,406	3,509	65%
	Other (NVCP, State Agreements)	1,536	1,042	1,042	100%
	Subtotal	11,731	6,449	4,552	71%
Newman	MS	3,957	1,980	1,266	64%
	Other (NVCP, State Agreements)	7,677	5,323	4,260	80%
	Proposed: (OB32 BWT)	224	-	-	-
	Proposed: (Western Ridge)	4,281	-	-	-
	Subtotal	16,139	7,303	5,526	76%
Yandi	MS	5,176	4,721	2,960	63%
	Other (NVCP, State Agreements)	3,756	2,892	2,877	99%
	Subtotal	8,933	7,613	5,837	77%
Mining Area C	MS	21,606	8,057	5,265	65%
	Other (NVCP, State Agreements)	1,130	341	341	100%
	Subtotal	22,736	8,398	5,606	67%
Goldsworthy	MS	-	-	-	-
	Other (NVCP, State Agreements)	1,303	1,303	1,239	95%
	Subtotal	1,303	1,303	1,239	95%
Yarrie	MS	1,362	926	656	71%
	Other (NVCP, State Agreements)	3,296	3,290	2,850	87%
	Subtotal	4,658	4,216	3,506	83%
Total		65,500	35,282	26,267	74%
Total area requiring rehabilitation (revegetation) ⁵		48,764			

- The figures for each mine hub are approximate only, as some approvals overlap more than one mine hub (especially for linear infrastructure). Where an approval overlaps more than one hub the areas have been apportioned to each hub (e.g. small proportion of MS1072 for Mining Area C extends into Yandi hub).
- Includes disturbance (clearing) authorised through Ministerial Statements, NVCPs and State Agreements and assumes the derived proposals are approved. Excludes disturbance authorised for exploration. 'Other' also includes historical clearing other than State Agreements (including clearing from current and previous *Mining Act 1978* (WA) tenure, previous clearing from NVCPs, clearing exempt from approval, e.g. firebreaks). For historical clearing without an approved disturbance limit, it was assumed that the approved disturbance limit is the actual disturbance (see 3. below).
- Actual disturbance is from BHP land disturbance data as at 30 June 2021. This differs from the total in the 2021 AER (BHP 2021), as the AER reports on data from Ministerial Statements and active NVCPs only, not inactive approvals or disturbance authorised only through State Agreements, e.g. Whaleback. Historical calculations exclude clearing attributed to current MS and NVCPs. Note there may be overlap where historical clearing and/or previous approval (e.g. NVCP) has been superseded by a more recent approval (e.g. MS).
- Pit area data derived from disturbed areas classified under MRF landuse category as a pit.
- Total area requiring rehabilitation (to revegetation phase is Total Approved disturbance limit multiplied by Disturbance excluding pits as % of actual disturbance.

3 Preliminary methodology for measuring rehabilitation success

3.1 Background

Following the publishing of EPA Report 1619 on the Strategic Proposal in July 2018, which included the guidelines for a rehabilitation report as part of the EPA's recommended conditions, BHP initiated work to develop a methodology for measuring rehabilitation success across BHP's iron ore tenure (WAIO operations). To meet the requirements of the rehabilitation report under MS1105 Guidelines 1(c) and Schedule 1, Table 2, Column 3 (see Table 1), BHP commissioned Syrinx Environmental (Syrinx) to develop rehabilitation success criteria and a methodology for measuring rehabilitation success.

The *BHP Pilbara Strategic Proposal: Inputs to Rehabilitation Report* (Syrinx 2020; Appendix 1) is a supporting document to this report. It provides the scientific detail to support the preliminary approach to measure rehabilitation success in this report, including the following:

- relevant contemporary scientific evidence in the Pilbara, including factors that influence rehabilitation success (e.g. rainfall, vegetation cover, diversity of species and growth media)
- development of scientifically verifiable success measures based on revegetation objectives, considering; post-mining land use (Pastoral or Natural System), appropriate floristic (vegetation) attributes, appropriate spatial and time scales
- development of criteria and targets using quantitative BHP reference site and baseline data compared and verified with published data specific to the Pilbara
- methodology for measuring rehabilitation success and initial testing of the methodology using BHP rehabilitation data up to FY2018.

After testing the rehabilitation success methodology since 2019, BHP is currently reviewing the methodology (including the rehabilitation monitoring approach and rehabilitation criteria). Therefore, the rehabilitation success methodology used for analysing historical and future rehabilitation success in Section 4 is considered to be preliminary and in development. Information on the reasons for reviewing and updating the methodology and work currently underway and planned is provided in Sections 4 and 5, respectively.

3.1.1 Rehabilitation standards and guidance

There are currently no adopted international, national or state standards (or criteria) for mine rehabilitation and management. The Western Australian Biodiversity Science Institute (WABSI) concluded that the most relevant and detailed sources of publicly available guidance for establishing criteria in WA were those from the EPA, Department of Water and Environmental Regulation (DWER), DMIRS, and the Australian Government Department of Industry Innovation and Science (Syrinx 2020). BHP follows internal rehabilitation standards, which align with current guidance from these departments.

3.1.2 Challenges in measuring rehabilitation success

The key challenges BHP has met in measuring rehabilitation success in the past are:

- no agreed post-mining land use
- no measurable completion criteria
- changes in rehabilitation monitoring methods
- success being measured against natural analogues (rather than likely post-mining land use)

- unrealistic measures for constructed landforms (i.e. OSAs), which represent a very different environment compared to natural landforms.

The above challenges were considered in developing the preliminary rehabilitation success methodology and criteria.

3.2 Rehabilitation criteria

BHP has developed criteria that are indicators of rehabilitation success at different points in time:

- Completion criteria: the end point criteria that measure rehabilitation success when rehabilitation is considered to be complete.
- Progressive criteria: the criteria that measure whether rehabilitation progress for rehabilitation underway is likely to be on a trajectory to achieve rehabilitation success in the future.

3.2.1 Completion criteria

Completion criteria are used to determine whether the closure revegetation objectives (naturalness, resilience, habitat connectivity etc.) for the post-mining land uses have been met and whether rehabilitation is successful. The criteria need to achieve the goal of establishing self-sustaining areas of rehabilitation that support the post-mining land use. The degree to which completion criteria are met provides a measure of historical rehabilitation success.

The development of the completion criteria considered:

- relevant contemporary scientific evidence - including a scientific literature review and recent BHP data (Syrinx 2020)
- the types of ecosystems to be rehabilitated (Section 2.2) and the types of areas to be rehabilitated (Section 2.3).

To assess appropriate timeframes for measuring rehabilitation success, Syrinx (2020) analysed *Triodia* data based on the age of rehabilitation. *Triodia* was selected as it is the major component of most of the target ecosystem (vegetation) types and has typically been considered as the most important plant genera in terms of naturalness. The likely timeframe to be able to measure rehabilitation success (i.e. when rehabilitation is considered to be completed) is 15 to 20 years, based on the strong correlation between time when rehabilitation started and *Triodia* cover Syrinx (2020).

The preliminary criteria and metrics to measure the success of each of the vegetation attributes (from Syrinx 2020) are provided in Appendix 2. The criteria targets are presented in the completion criteria summary tables in Appendix 4 to Appendix 9 for each hub.

3.2.2 Progressive criteria

As rehabilitation areas are unlikely to be ready for assessment against completion criteria for at least 15 years, interim (progressive) targets are needed to track rehabilitation progress of rehabilitation underway at certain intervals to assess whether rehabilitation is likely to be on a trajectory to achieve success. This provides a measure of the likely future success of rehabilitation and allows for early intervention if rehabilitation is not on track.

The following progressive categories were defined for measuring rehabilitation progress against criteria, based on patterns observed in the historical rehabilitation datasets to date for different ages of rehabilitation:

1. Young rehabilitation (less than 5 years) – areas where all rehabilitation activities have been undertaken, however revegetation is incomplete (seedlings still emerging or too young to monitor accurately).
2. Progressing rehabilitation (5 - 15 years) – ecological succession processes are establishing with progress made against criteria.

The key principle in deriving progressive criteria is that they should be consistent with the completion criteria, post-mining land uses and the closure revegetation objectives. To derive meaningful criteria to provide confidence that a site is progressing along the appropriate trajectory, a review of ecological thresholds was undertaken (Syrinx 2020).

The analysis indicates that *Triodia* cover, shrub cover, and weed cover are key trajectory criteria, and that relative abundance is important and differs at different points in time. Ratios represent the dynamics of developing sites and are informative in terms of identifying where intervention may be required.

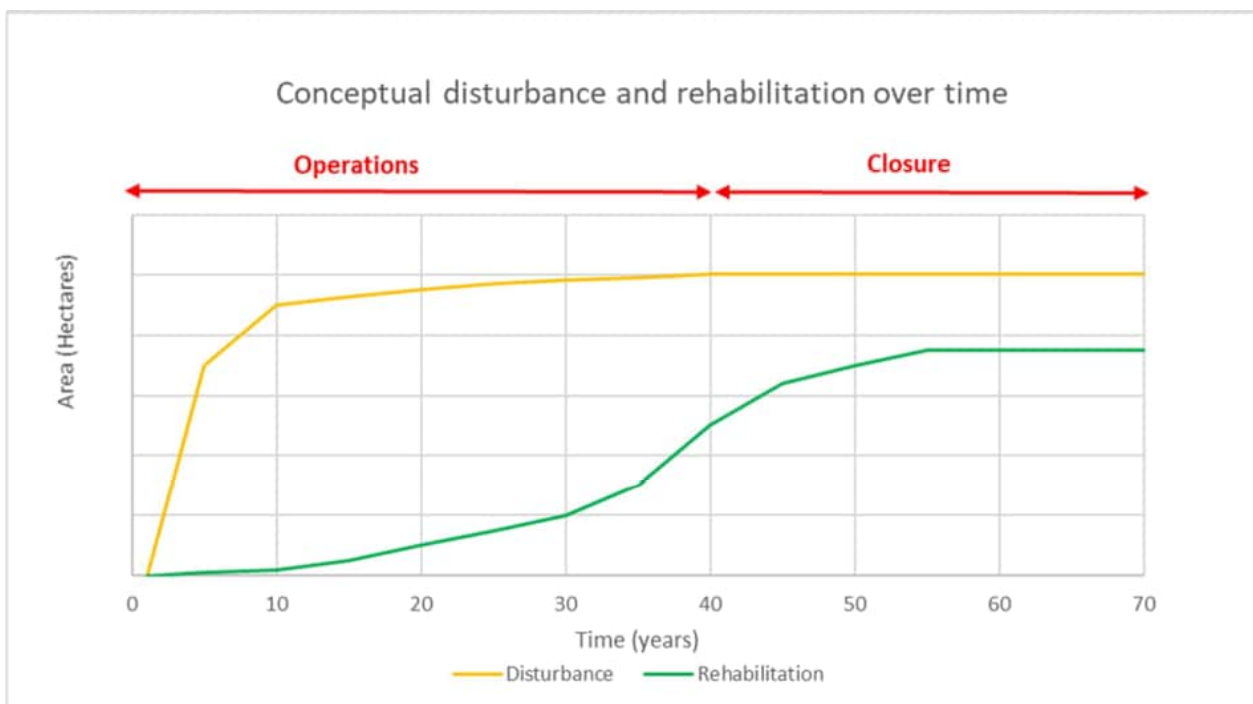
The preliminary criteria and targets to measure the progress of rehabilitation (from Syrinx 2020) are provided in Appendix 2. The FY2021 results for rehabilitation sites analysed against each target are presented in the progressive criteria output tables for each hub (Appendix 4 to Appendix 9).

BHP will assess the progress of rehabilitation at sites against progressive criteria to ensure they are at a level ready to transition into the next category, rather than specific ages as these are a guide only. However, BHP will still monitor the progress of rehabilitation sites at a minimum frequency of three years as part of the rehabilitation monitoring program to allow continuous improvement (e.g. to confirm that seed is germinating, the appropriate species are germinating and rehabilitation areas have not washed away etc.).

3.3 Quantity of rehabilitation

BHP notes the EPA’s discussion in EPA Report 1619 regarding the limited evidence of large-scale rehabilitation in the Pilbara (EPA 2018). BHP measures and reports on the amount (quantity) of rehabilitation against each relevant active approval (MS, NVCP, State Agreement etc.) in its AERs. This report quantifies and reports on the cumulative amount of rehabilitation across its WAIO operations at the hub scale.

During operations, only a portion of the land disturbed is available to be rehabilitated, as many areas of the mine site are still active (e.g. mine pits, active overburden storage areas). Figure 5 shows conceptual disturbance and rehabilitation over time for a typical iron ore mine, highlighting that most of the area to be rehabilitated is only available towards the end of the mine life. Therefore, the quantity of rehabilitation relative to the area of disturbed land will be greater for older mine sites that are closer to the end of the mine life.



Note: Area rehabilitated is less than the area disturbed, as pits that remain as voids will not be rehabilitated (revegetated)

Figure 5: Conceptual disturbance and rehabilitation over time

3.4 Communicating rehabilitation success

The assessment of rehabilitation success across BHP's iron ore tenure involves the analysis of numerous rehabilitation and reference sites. This level of detail is necessary to make scientifically verifiable estimates of the success of historical rehabilitation and the likely success of future rehabilitation. However, as the scale of BHP's WAIO mine operations is hundreds of kilometres, BHP has assessed overall rehabilitation success at the hub level.

BHP has developed a traffic light approach to report the status of rehabilitation at each hub using the following categories:

- **Operations:** Disturbed land that is still required for operations and is not yet available to be rehabilitated (i.e. not assessable).
- **Progressive rehabilitation:**
 - *Young rehabilitation (<5 years):* Areas of rehabilitation where rehabilitation activities have been undertaken within the last 5 years.
 - *Progressing rehabilitation (5 - 15 years) - on track:* Areas of rehabilitation that have progressed enough to assess rehabilitation progress and rehabilitation is on track to achieve success (all progressive criteria met).
 - *Progressing rehabilitation (5-15 years) - maintenance required:* Areas of rehabilitation that have progressed enough to assess rehabilitation progress and rehabilitation requires maintenance (one or more progressive criteria has not been met).
 - *Status unknown:* Areas where data is not suitable to assess against progressing rehabilitation criteria.
- **Completion rehabilitation:**
 - *Completion rehabilitation (>15 years) - criteria met:* Areas of rehabilitation that have progressed enough to assess whether rehabilitation is successful and have met all completion criteria.
 - *Completion rehabilitation (>15 years) - criteria not met:* Areas of rehabilitation that have progressed enough to assess whether rehabilitation is successful and one or more completion criteria has not been met that will be reviewed to determine the appropriate intervention.

BHP has used the traffic light approach for the rehabilitation status table for all hubs (Table 5) and maps for each hub (Figure 6 to Figure 11) in Section 4.1. The traffic light maps used in this report are the same as those used in the previous version of this report for the OB32 Below Water Table Derived Proposal (V.0) as both reports present rehabilitation status for the FY2021 period.

4 Rehabilitation success

This section provides the assessment of rehabilitation success across BHP's WAIO operations as at the end of FY2021 for existing areas under rehabilitation.

4.1 Rehabilitation summary

Appendix 3 summarises key information relevant to rehabilitation for each hub that may influence historical rehabilitation success and progress towards future rehabilitation success (i.e. when rehabilitation started, number of rehabilitation sites, time to closure etc.) and the target ecosystem (vegetation) type and assumed post-mining land use used for the criteria analysis.

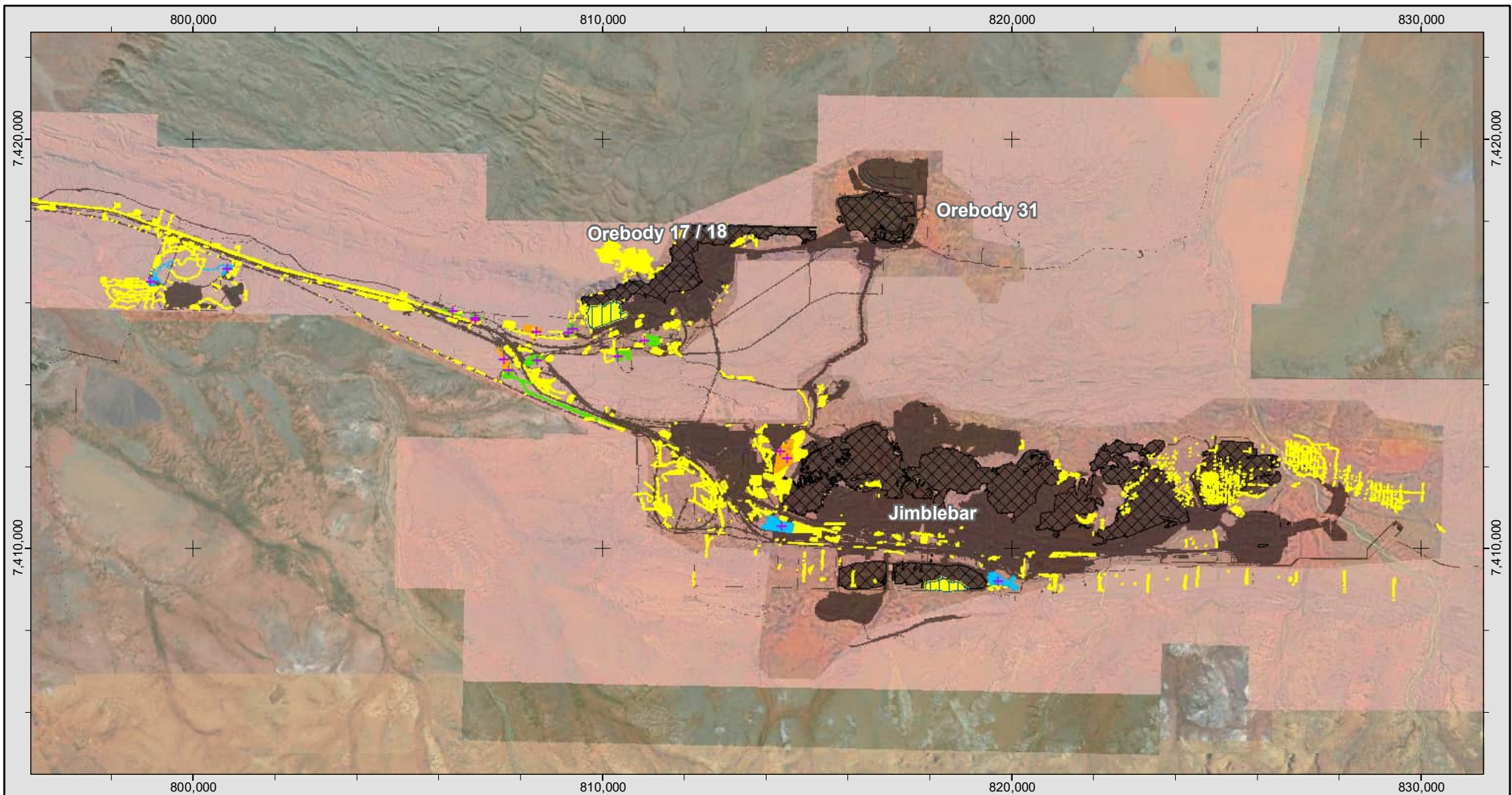
The results of the criteria analysis are provided in Appendix 4 to Appendix 9. The results were then applied to rehabilitation areas to undertake the spatial analysis, to calculate the areas of rehabilitation status for each rehabilitation category for each hub. The summary of the status of disturbance and rehabilitation is presented in Table 5 and the status of rehabilitation for each hub is presented visually in Figure 6 to Figure 11.

Table 5: Status of rehabilitation progress and success FY2021

Rehabilitation status	Hub							TOTAL
	Jimblebar	Newman	Yandi	Mining Area C	Goldsworthy	Yarrie		
Areas under rehabilitation								
<i>Assessment against Completion Criteria (>15 yrs)</i>								
Criteria met (ha)	-	5	-	0	64	-	69	
Criteria not met (ha)	-	2	53	7	280	31	373	
<i>Assessment against Progressing Criteria (5-15 yrs)</i>								
On track (ha)	33	15	16	9	-	94	167	
Maintenance required (ha)	39	184	162	11	28	429	852	
<i>Young rehabilitation (<5yrs)</i>								
Young rehabilitation (ha)	39	149	3	28	-	114	334	
<i>Unknown areas</i>								
Status unknown (ha)	464	625	568	536	102	473	2,769	
Summary data								
Total disturbed land (ha) ¹	6,449	7,303	7,613	8,398	1,303	4,216	35,282	
Total disturbed land - excluding pits (ha) ¹	4,552	5,526	5,837	5,606	1,239	3,506	26,267	
Total rehabilitation (ha) ²	576	980	802	591	475	1142	4,564	
Rehabilitation as % of Total disturbed land - excluding pits	13%	18%	14%	11%	38%	33%	17%	

1. From Table 4. Total disturbed land (ha) = Actual disturbance at FY21. Total disturbed land - excluding pits = Actual disturbance at FY21 excluding pits. Includes Areas under rehabilitation.

2. Total rehabilitation is total of all Areas under rehabilitation



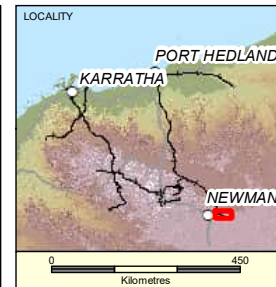
No rehabilitation

- Operations
- ⊠ Pits

+ Recently monitored site (2018-2021) included in analysis

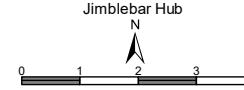
Areas under rehabilitation

- Completion rehabilitation (>15 years) – criteria met (0ha)
- Completion rehabilitation (>15 years) – criteria not met (0ha)
- Progressing rehabilitation (5-15 years) – on track (33ha)
- Progressing rehabilitation (5-15 years) – maintenance required (39ha)
- Young rehabilitation (<5 years) (39ha)
- Rehabilitation – status unknown (464ha)
- Rehabilitation – status checked



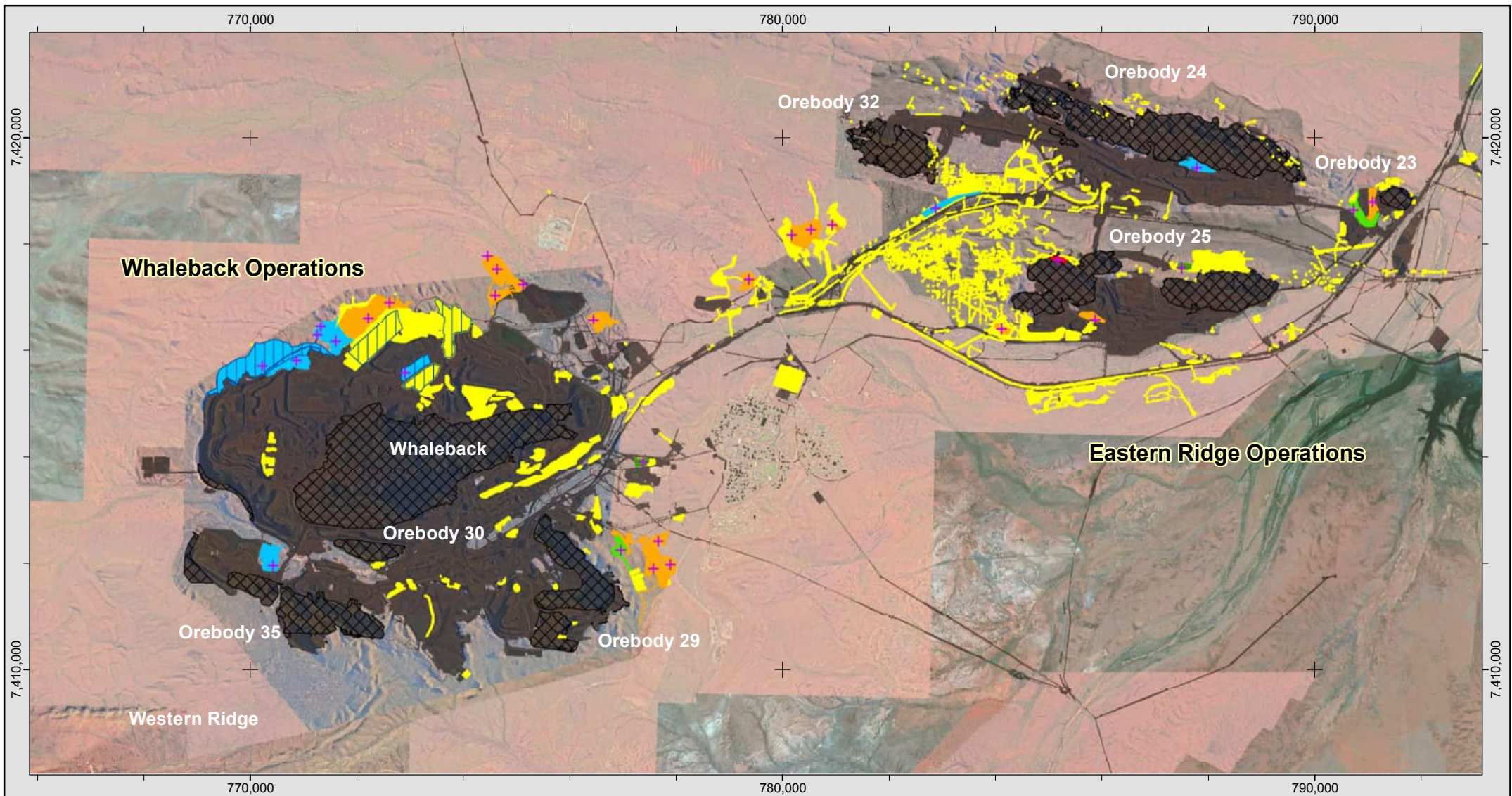
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REHABILITATION REPORT FY2021
Jimblebar Hub

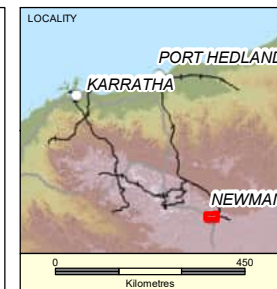


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Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

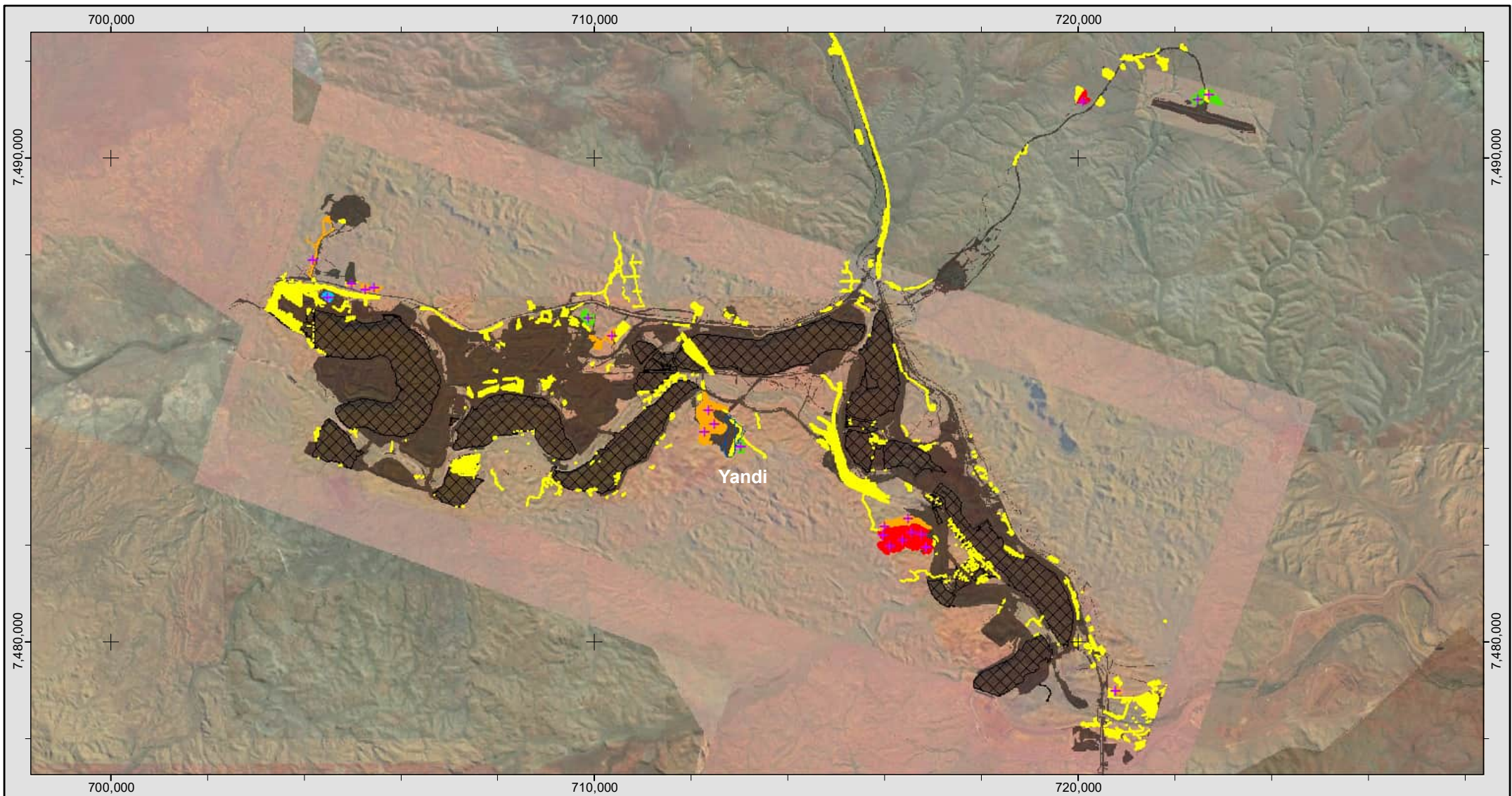
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- | | | |
|--------------------------|--|--|
| No rehabilitation | + | Recently monitored site (2018-2021) included in analysis |
| ■ Operations | Areas under rehabilitation | |
| ▨ Pits | ■ Completion rehabilitation (>15 years) – criteria met (5ha) | |
| | ■ Completion rehabilitation (>15 years) – criteria not met (2ha) | |
| | ■ Progressing rehabilitation (5-15 years) – on track (14ha) | |
| | ■ Progressing rehabilitation (5-15 years) – maintenance required (184ha) | |
| | ■ Young rehabilitation (<5 years) (149ha) | |
| | ■ Rehabilitation – status unknown (625ha) | |
| | ▨ Rehabilitation – status checked | |



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Newman Hub			
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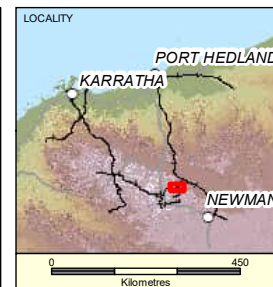
No rehabilitation

- Operations
- ▨ Pits

+ Recently monitored site (2018-2021) included in analysis

Areas under rehabilitation

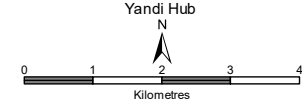
- Completion rehabilitation (>15 years) – criteria met (0ha)
- Completion rehabilitation (>15 years) – criteria not met (53ha)
- Progressing rehabilitation (5-15 years) – on track (16ha)
- Progressing rehabilitation (5-15 years) – maintenance required (161ha)
- Young rehabilitation (<5 years) (3ha)
- Rehabilitation – status unknown (568ha)
- ▨ Rehabilitation – status checked



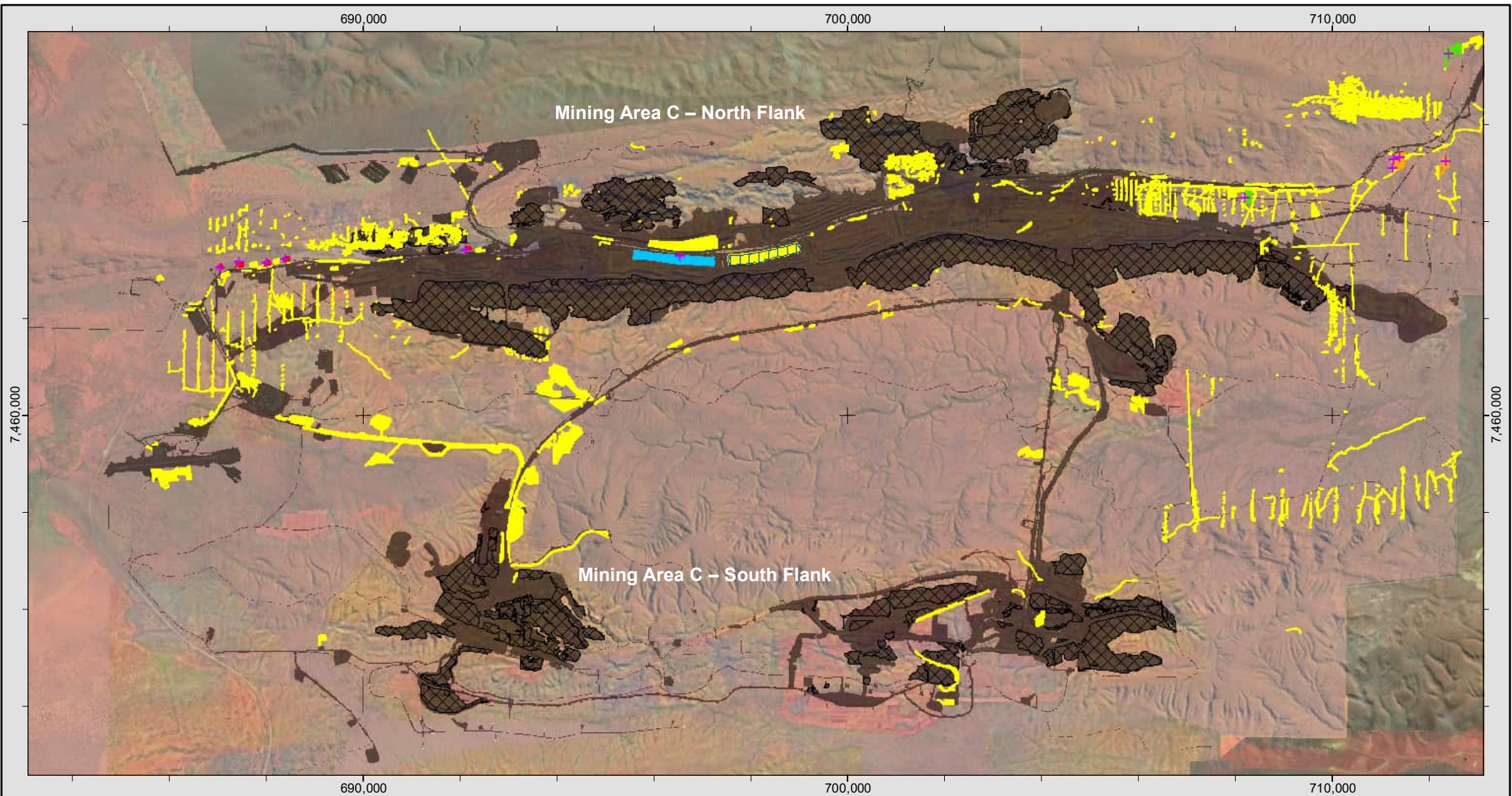
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REHABILITATION REPORT FY2021
Yandi Hub



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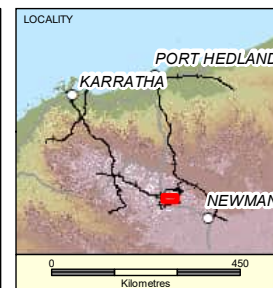
No rehabilitation

- Operations
- ▨ Pits

+ Recently monitored site (2018-2021) included in analysis

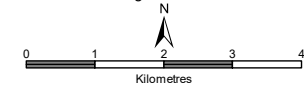
Areas under rehabilitation

- Completion rehabilitation (>15 years) – criteria met (0ha)
- Completion rehabilitation (>15 years) – criteria not met (6ha)
- Progressing rehabilitation (5-15 years) – on track (9ha)
- Progressing rehabilitation (5-15 years) – maintenance required (10ha)
- Young rehabilitation (<5 years) (28ha)
- Rehabilitation – status unknown (536ha)
- ▨ Rehabilitation – status checked



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REHABILITATION REPORT FY2021
Mining Area C Hub

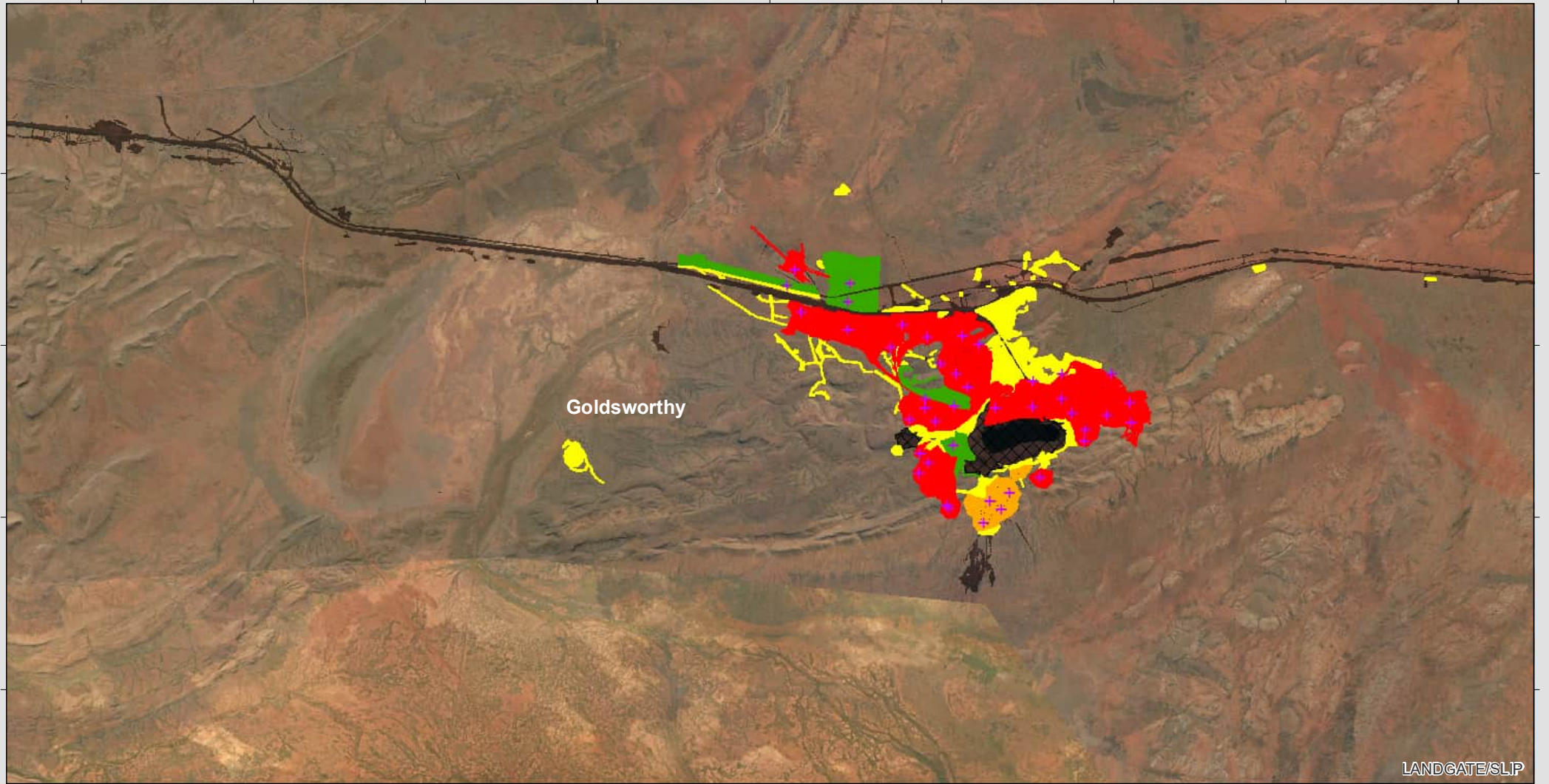


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760,000

770,000



760,000

770,000

LANDGATE/SLIP

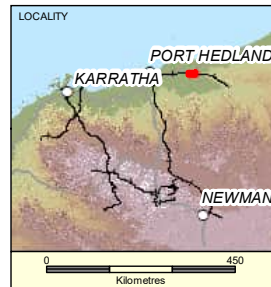
No rehabilitation

- Operations
- ▨ Pits

+ Recently monitored site (2018-2021) included in analysis

Areas under rehabilitation

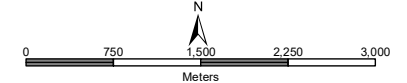
- Completion rehabilitation (>15 years) – criteria met (64ha)
- Completion rehabilitation (>15 years) – criteria not met (280ha)
- Progressing rehabilitation (5-15 years) – on track (0ha)
- Progressing rehabilitation (5-15 years) – maintenance required (28.5ha)
- Young rehabilitation (0ha)
- Progressing rehabilitation - unknown status (101.5ha)
- Rehabilitation – status checked



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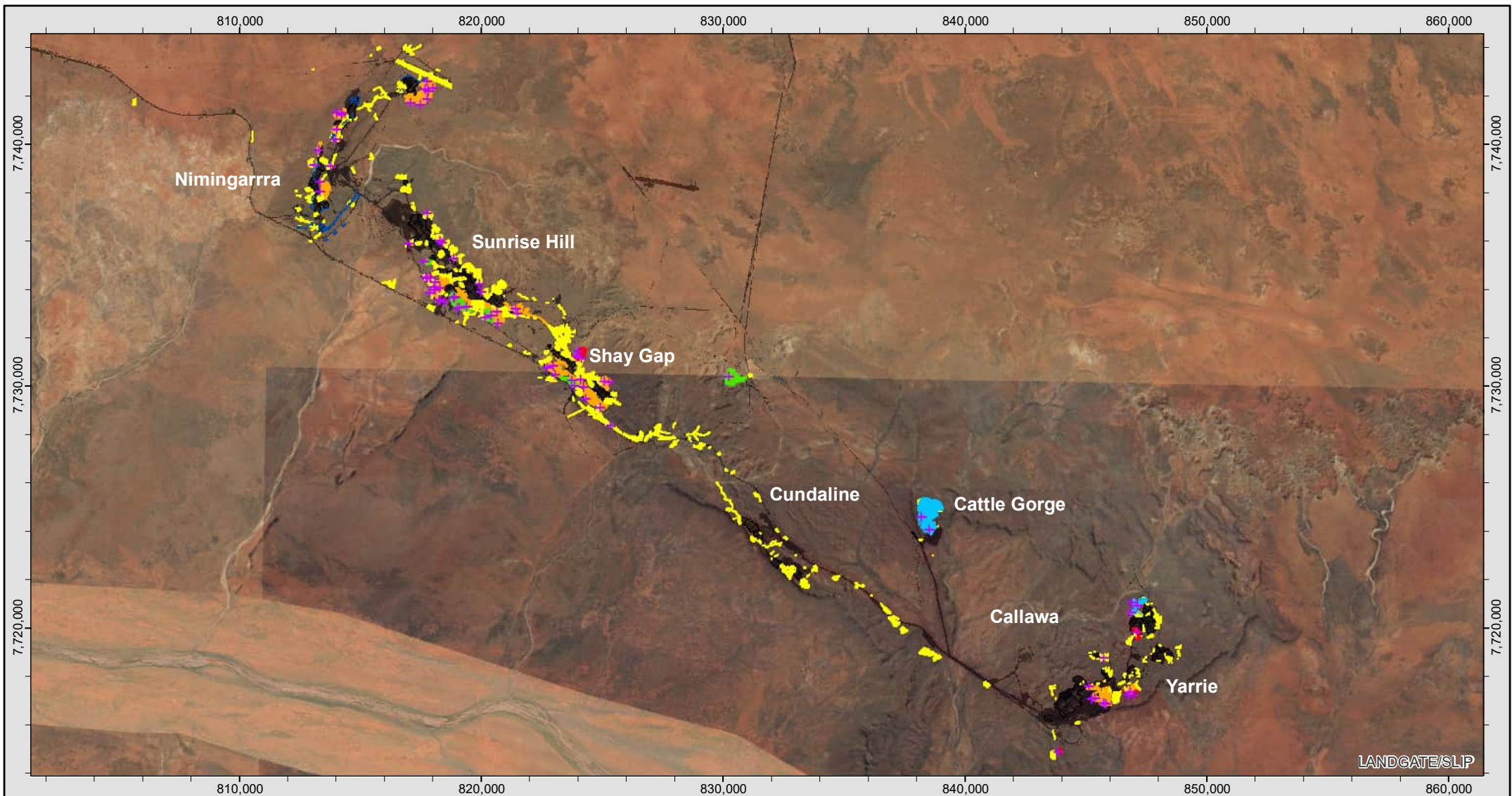
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BHP IRON ORE

REHABILITATION REPORT FY2021
Goldsworthy Hub



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Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

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LANDGATE/SLIP

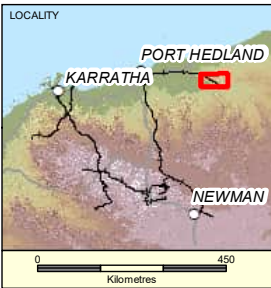
No rehabilitation

- Operations
- ▣ Pits

+ Recently monitored site (2018-2021) included in analysis

Areas under rehabilitation

- Completion rehabilitation (>15 years) – criteria met (0ha)
- Completion rehabilitation (>15 years) – criteria not met (31ha)
- Progressing rehabilitation (5-15 years) – on track (94ha)
- Progressing rehabilitation (5-15 years) – maintenance required (429ha)
- Young rehabilitation (<5 years) (114ha)
- Progressing rehabilitation - unknown status (473ha)
- ▣ Rehabilitation – status checked



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REHABILITATION REPORT FY2021

Yarrie Hub



Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

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4.2 Historical rehabilitation success

MS1105 Guidelines 1(c)(ii) requires ‘an analysis of the history of rehabilitation that BHP has undertaken in the Pilbara and the demonstrated success of this rehabilitation’.

4.2.1 Analysis of rehabilitation history

BHP presented a chronology of BHP’s rehabilitation and closure activities in the Pilbara since the mid-1970s (when revegetation trials were first undertaken at Mt Whaleback) in the PERSP (BHP Billiton 2016; Table 83). In EPA Report 1619, the EPA noted that these activities are of a small scale, and broadscale rehabilitation remains an area of improvement. The EPA also noted that the information provided by the small-scale activities since 1974 contribute to the knowledge base required for successful broadscale rehabilitation (EPA 2018).

Syrinx (2020; Table 12) provides an analysis of BHP’s rehabilitation history (Appendix 1). A summary of this analysis is provided in Table 6.

Table 6: Summary of rehabilitation history analysis

Timeframe	Relevant hubs	Key practices	Rehabilitation outcomes
1980s	Newman	<ul style="list-style-type: none"> First rehabilitation undertaken at Mt Whaleback by contractors with no specific guidelines or standards to follow. Steep slopes and use of incompetent materials. Seed generally limited to generic Pilbara species lists and absence of seed quality checks compromised germination success. Rehabilitation activities were ‘ad hoc’ and not timed to suit recruitment. 	<ul style="list-style-type: none"> Poor or no records of rehabilitation works. Poor <i>Triodia</i> recruitment, limited species diversity and high erosion were observed.
1990s (1990-2002)	Newman Jimblebar Goldsworthy Yarrie	<p>As above and:</p> <ul style="list-style-type: none"> First ‘moonscaping’ (scalloping) of rehabilitation landforms to increase water harvesting potential First trials with linear landforms, gentler slopes (20 degrees) and contour ripping Various trials initiated to determine recruitment success/failure factors Review of seed collection methods and quality was undertaken. 	<ul style="list-style-type: none"> Improved trials, audit process undertaken and improved monitoring of success across different landforms. Less erosion and improved recruitment noted.
Early 2000s (2003 to 2013)	All hubs	<ul style="list-style-type: none"> Moonscaping was abandoned, and linear landform with ripping adopted as new approach. New OSA cover systems implemented. First use of rock armouring on OSAs to reduce erosion and mimic natural mesa formations OSA slope profiles changed to 15-18 degrees and final landforms designed to integrate with surrounding terrain. (from 2010). Material classification and management of rehabilitation substrates initiated across sites. Concept of ‘growth media’ introduced to enable use of subsoil in place of topsoil Seed collection methods, and revegetation species lists changed. Seed quality assessment, provenance records, revegetation lists targeted to each mine region. 	<ul style="list-style-type: none"> Lower erosion impacts noted.

Timeframe	Relevant hubs	Key practices	Rehabilitation outcomes
		<ul style="list-style-type: none"> External audits of existing practices was undertaken to develop formal standards. First closure and rehabilitation standards developed to guide future rehabilitation across sites. Draft completion criteria developed and used to assess rehabilitation sites. Research Strategy developed and specific rehabilitation initiatives established and funded to improve rehabilitation outcomes. 	
2015 onwards	All new rehabilitation sites in all hubs	<ul style="list-style-type: none"> Rehabilitation of all sites undertaken using primed seeds (<i>Acacia</i> species). Long range data analysis used to assess rehabilitation and define gaps and future directions. Seed sourcing strategy established to address quality control, provenance and seasonal variation. Standardised approach to monitoring of sites introduced (2015-2016) and new survey methods (plot size etc.) rolled out (2017-2018). 	<ul style="list-style-type: none"> Seed technologies (pre-treatment, seeding) show improvements in recruitment in rehabilitation sites. Growth media studies show that soil moisture and secondly carbon content, not substrate type, are the overriding factor influencing emergence of a range of Pilbara species.

4.2.2 Historical rehabilitation assessment

As discussed in Section 3.2.1, BHP considers that it is appropriate to measure rehabilitation success when the revegetation phase of rehabilitation is at a stage where it can be assessed for completion (rehabilitation generally greater than 15 to 20 years old). To assess the success of the history of rehabilitation for this report (as required by Guidelines 1(c)(ii), BHP has defined 'historical rehabilitation' as rehabilitation that is ready to be assessed against the completion criteria discussed in Section 3.2.1.

The FY2021 results for rehabilitation sites analysed are provided in the completion criteria output tables in Appendix 4 to Appendix 9. The appendices also provide a summary table for the overall performance of the hub against the vegetation attributes. A vegetation attribute is considered to be met at the hub level if the median of the results of the individual sites in the completion criteria output tables meets the target. For the FY2021 analysis, all hubs had rehabilitation sites that were monitored and were old enough to assess against completion criteria, except Jimblebar (Table 7). The low number of sites assessed for completion reflects BHP's change in sampling methods in 2017 to align with the EPA's revised technical guidance on flora and vegetation surveys in 2015 (EPA 2016) and because rehabilitation sites were monitored in 2021 using remote sensing only, as on ground monitoring was restricted due to COVID restrictions.

Table 7 presents the summary of the completion assessment for historical rehabilitation success. From the analysis at the hub level, historical rehabilitation is variable across the hubs, but was at least partially successful for all hubs. Very few rehabilitation sites did not meet all or most criteria, which suggests that most older sites are likely to reach completion and rehabilitation will be successful, but potentially over a longer timeframe. In summary:

- rehabilitation sites at Newman hub met all criteria
- rehabilitation sites at Yandi and Yarrie hubs met most completion criteria
- rehabilitation sites at Mining Area C and Goldsworthy hubs met some completion criteria.

The most common criteria that wasn't met was Hummock Grasses (*Triodia*) Cover, followed by Annual Species Richness. As *Triodia* Cover is a key indicator for rehabilitation success, improving *Triodia* Cover will be a focus of improvement activities (see Section 5).

Reasons that completion criteria weren't met across the hubs include the following:

- Poor rainfall years when rehabilitation areas are seeded. Spinifex (*Triodia*) germination is reliant on rainfall, hence many sites are not meeting Hummock Grasses (*Triodia*) Cover criteria.
- Older seeding techniques used in the past at some sites have not been conducive to *Triodia* germination or encouraging species richness (i.e. limited species seed mix). Some native species may have been used in the past which are allelopathic (i.e. plant species that produce substances that inhibit the germination or growth, survival, of other species), which may have affected hummock grasses.
- Weed infestation causing pronounced weed cover levels at some sites and in some cases restricting the growth and establishment of native species (e.g. where there are infestations of Buffel Grass (*Cenchrus ciliaris*), an allelopathic species).
- Lack of topsoil available or topsoil which cannot be used due to high weed seed loads (e.g. Whaleback in the Newman hub).
- Erosion of topsoil (e.g. Eastern Ridge in the Newman hub). Rock armour is being considered as an option to prevent future erosion.
- The past use of 'moonscaping' (from 1990 to early 2000s until it was replaced with other landforming methods) where the landform was scalloped to increase the water harvesting potential (e.g. Goldsworthy).

The rehabilitation status maps (Figure 6 to Figure 11) reflect the relatively small areas assessed for completion (442 ha). As expected, the hubs with older mines that have ceased mining activities in some/all areas (see Table 2) (e.g. Goldsworthy and Yarrie) have a higher proportion of rehabilitation assessed for completion, as a higher proportion of the disturbed land has been rehabilitated (Table 5). The maps also show large areas where the status of the rehabilitation is unknown, which is either where rehabilitation sites have not been monitored or the monitoring does not align with the preliminary methodology. Initial ground-truthing of the results of the analysis has indicated that there are additional areas of rehabilitation that are suitable to be assessed for completion (e.g. small areas at Mining Area C and Yandi that are meeting completion criteria) that are shown as 'Status Unknown' on the maps.

BHP will review areas where performance against the completion criteria was poor and the reason for low areas of rehabilitation assessed for completion. As discussed in Section 3, BHP is currently reviewing the rehabilitation success methodology, as part of BHP's Rehabilitation Improvement Program. BHP is aware that there are large areas of rehabilitation that have not been captured in the current analysis (shown as 'Status Unknown') due to data gaps and lack of alignment with the current rehabilitation monitoring approach. This is a key focus of the review of the rehabilitation success methodology (Section 5).

Where completion criteria were not met, BHP will review whether the criteria need to be amended or whether intervention is required for certain rehabilitation areas (e.g. to address *Triodia* Cover and Annual Species Richness). There are also several older mines across BHP (Whaleback in the Newman hub, Goldsworthy and Yarrie) where rehabilitation activities were undertaken using different land forming and revegetation techniques that were acceptable at that time and therefore are likely to perform poorly against the preliminary criteria used for this report. Specific completion criteria will be developed for these sites as part of the review of the rehabilitation success methodology (Section 5).

Table 7: Historical rehabilitation success – FY2021 completion criteria assessment

Mining hub	Years post-rehabilitation ¹	Target vegetation type	No. of sites assessed	Completion assessment	Summary
Jimblebar (Figure 6, Appendix 4)	Not assessed	Low Tree Steppe	0	Not assessed - no sites monitored using revised sampling methods (since 2017) were old enough to assess against completion criteria.	Not assessed - no sites monitored were old enough to assess completion.
Newman (Figure 7, Appendix 5)	20 to 30 years	Low Tree Steppe	3	Only three sites assessed. Individual sites met most targets (one site did not meet Tree Cover and one site did not meet Hummock Grasses (<i>Triodia</i>) and Weed Cover). At the hub level, targets for all vegetation attribute criteria were met.	Successful –all completion criteria met at hub level.
Yandi (Figure 8, Appendix 6)	16 to 23 years	Low Tree Steppe	7	All sites met Shrub and Other Grasses Cover, and Perennial Species Richness targets. Most sites met Tree, Herb and Weed Cover, and Perennial Species Richness. Most sites did not meet Hummock Grasses (<i>Triodia</i>) Cover target. At the hub level, targets for all vegetation attribute criteria were met except Tree and Hummock Grasses (<i>Triodia</i>) Cover.	Partially successful - most completion criteria met at hub level.
Mining Area C (Figure 9, Appendix 7)	16 to 17 years	Low Tree Steppe	5	All sites met Tree and Weed Cover and most sites met Shrub Cover targets. Most sites did not meet Hummock Grasses (<i>Triodia</i>), Other Grasses and Herb Cover, and Annual Species Richness. All sites did not meet Perennial Species Richness. At the hub level, targets for vegetation attribute criteria were met except Species Richness, and Hummock Grasses (<i>Triodia</i>), Other Grasses and Herb Cover.	Partially successful - some completion criteria met at hub level.
Goldsworthy (Figure 10, Appendix 8)	25 to 27 years	Grass Steppe	38	All sites met Tree and Shrub Cover target and most sites met Other Grasses and Weed Cover, and Perennial Species Richness targets. Most sites did not meet Hummock Grasses (<i>Triodia</i>) Cover and Annual Species Richness. At the hub level, targets for most vegetation attribute criteria were met except Annual Species Richness, Hummock Grasses (<i>Triodia</i>) and presence of Indicator Species from each Target Vegetation Type.	Partially successful - some completion criteria met at hub level.
Yarrie (Figure 11, Appendix 9)	16 – 27 years	Shrub Steppe	5	All sites met Shrub and Weed Cover, and Perennial Species Richness targets. Most sites met Tree, Other Grasses and Herb Cover. Most sites did not meet Hummock Grasses (<i>Triodia</i>) Cover and Annual Species Richness. At the hub level, targets for most vegetation attribute criteria were met except Annual Species Richness and Hummock Grasses (<i>Triodia</i>).	Partially successful - most completion criteria met at hub level.

1. For sites assessed. Years from start of rehabilitation (see Appendix 3).

4.3 Future rehabilitation success

To discuss future rehabilitation success, BHP has chosen to distinguish between areas where rehabilitation activities have been undertaken but the rehabilitation is not yet ready to be measured for success against completion criteria (rehabilitation underway) and areas where rehabilitation activities have not yet commenced, i.e areas that have been cleared or areas planned and proposed to be cleared (future rehabilitation activities).

4.3.1 Rehabilitation underway

MS1105 Schedule 1, Table 2, Column 3 2.c. requires that '*Scientifically verifiable estimates of the likely success of future rehabilitation have been made*'.

To address the requirements of MS1105 Schedule 1, Table 2, Column 3 2.c., BHP considers that 'future rehabilitation' is rehabilitation where all rehabilitation activities have been undertaken but the rehabilitation is not at a stage where it can be assessed for completion (rehabilitation generally less than 15 years old). BHP has used the assessment of rehabilitation at each hub against progressive criteria as the basis for analysing the likely success of future rehabilitation because:

- the progressive criteria and targets are based on the same scientifically verifiable data and approach as the completion criteria and targets, which BHP has used to measure historical rehabilitation success (Section 4.2.2)
- rehabilitation is likely to be successful (at completion) if BHP can demonstrate that rehabilitation is progressing according to an appropriate trajectory.

BHP has assessed the performance of 'future rehabilitation' using the progressive criteria discussed in Section 3.2.2 to understand whether rehabilitation underway that is young and progressing is likely to be successful in the future (i.e when considered to be completed).

The FY2021 results for rehabilitation sites analysed are provided in the progressive criteria output tables (Young and Progressing) in Appendix 4 to Appendix 9. For the FY2021 analysis, all hubs had rehabilitation sites that were monitored and categorised as progressing (i.e. 5 to 15 years) and young (less than 5 years), except Goldsworthy, which did not have young rehabilitation (Table 8). The Mining Area C and Yandi hubs only had one young rehabilitation site each assessed. The low number of sites assessed against progressive criteria reflects the low overall number of sites assessed and the smaller age range of young sites (5 years) compared to the other categories. As expected, the hubs with older mines that have ceased mining activities in some/all areas (e.g. Goldsworthy) have less younger rehabilitation sites.

Table 8 presents the summary of the progressive assessment for the likely future rehabilitation success. Although the data is limited, the analysis shows progressing rehabilitation is variable across the hubs, but was at least partially successful for all hubs. While the supporting criteria were met for most hubs, most hubs did not meet the major criterion (*Triodia* Cover/Total Native Cover ratio) except Jimblebar and Mining Area C. Newman hub also did not meet the supporting Weed Cover/*Triodia* Cover ratio. As discussed in Section 4.1, *Triodia* Cover is a key indicator for rehabilitation success, and improving *Triodia* will be a focus of improvement activities (see Section 5). The reasons that completion criteria weren't met are also applicable to why the progressing criteria weren't met. The results of the young rehabilitation cannot be extrapolated to the hub level as only three of the hubs had more than one rehabilitation site that was assessed.

The rehabilitation status maps (Figure 6 to Figure 11) show that of the areas assessed against progressing criteria (1,020 ha), only 16% (167 ha) is considered on track, which reflects that the major criterion was not met at most sites. The maps also show large areas where the status of the rehabilitation is unknown, which is either where rehabilitation sites have not been monitored or the monitoring does not align with the preliminary methodology. Initial ground-truthing of the results of the analysis has indicated that there are additional areas of young and progressing

rehabilitation that are shown as 'Status Unknown' on the maps, including young rehabilitation at Yandi, Yarrie, Newman and Jimblebar and progressing rehabilitation at Yandi and Jimblebar.

Where progressive criteria were not met, BHP will review whether maintenance is required for certain rehabilitation areas (e.g. to address *Triodia* Cover and Weed Cover). As discussed in Section 4.2, BHP is also currently reviewing the rehabilitation success methodology, as part of BHP's Rehabilitation Improvement Program. The progressive criteria used for the FY2021 assessment was the first attempt by BHP to develop criteria for the likely future success of rehabilitation. BHP is currently reviewing the progressive criteria to ensure that they are reflective of rehabilitation success and is developing interim milestones to enable BHP to assess whether rehabilitation underway is progressing on the right trajectory (see Section 5). The application of the revised progressive criteria for future assessments will help BHP confirm whether maintenance is required at sites that were not met for the FY2021 assessment.

Analysis of rehabilitation underway using scientifically-based targets (rather than aspirational targets) demonstrates that all hubs have met at least some progressive criteria targets. The new rehabilitation assessment approach BHP has implemented for this report (together with on-ground monitoring and remote sensing monitoring) provides BHP with early warning if sites are not progressing along the appropriate trajectory and enables BHP to undertake early maintenance work to get sites back on track to be successful at completion.

4.3.2 Future rehabilitation activities

MS1105 Guidelines 1(c)(iii) requires information on '*the likely success of future rehabilitation activities in establishing self-sustaining areas of rehabilitation, taking into account: relevant contemporary scientific evidence; the types of area to be rehabilitated; and the scale of rehabilitation activities.*'

Based on BHP's experience with rehabilitation to date and the scientific analysis undertaken by Syrinx (2020), BHP considers that the likely success of establishing self-sustaining areas of rehabilitation depends on the following elements:

- the types of areas (i.e. domains) to be rehabilitated (Section 2.3). Rehabilitation is likely to be more successful and/or take less time to be successful in areas where there is a lower impact on the land (e.g. infrastructure areas), compared to areas where there is a higher impact (e.g. OSAs)
- smaller areas of disturbance (e.g. borrow pits or laydown areas) and linear disturbance (e.g. pipelines and roads) will be easier to rehabilitate than larger areas and landforms, e.g. OSAs
- availability of growth media (and the type of waste when rehabilitating OSAs)
- realistic, scientifically-based, criteria and targets that are used to measure success (Section 3.2)
- the capacity for BHP to adapt from rehabilitation learnings, including the success of existing rehabilitation and relevant contemporary scientific evidence, e.g. to:
 - adjust the rehabilitation monitoring program if required
 - revise criteria or targets if justified from scientific evidence
 - undertake maintenance work, where appropriate, if rehabilitation progress is not on track.

While the scale of rehabilitation required is not a direct consideration for rehabilitation success, larger mines will operate for longer and larger areas will take longer to rehabilitate. Therefore, there is likely to be a longer time period from when rehabilitation activities start at a mine to when rehabilitation is complete.

BHP considers that future rehabilitation activities will be successful if the relevant criteria targets (progressive and completion) are met. Therefore, BHP intends to apply a similar approach for future rehabilitation activities as existing areas under rehabilitation (underway and completed), adapting the current approach (rehabilitation practices, monitoring and success criteria), where relevant, based on contemporary scientific evidence (BHP data and information and broader (including Pilbara) information). The relevant contemporary scientific evidence BHP has

taken into account for the current rehabilitation approach is detailed in Syrinx 2020 (Sections 2.3, 4.0, 5.0 and 9.0). A full list of the scientific reports is provided in Syrinx 2020 (References).

BHP considers that future rehabilitation activities are likely to be successful because BHP plans early for rehabilitation as part of the closure planning process, implements the latest rehabilitation techniques and incorporates learnings from the performance of existing rehabilitation. The assessment of historical rehabilitation (Section 4.2.2) and future rehabilitation (where rehabilitation is underway) (Section 4.3.1) demonstrates that rehabilitation is at least partially successful and at least partially progressing along the appropriate trajectory for success at completion, particularly for native species cover.

For the derived proposals (OB32 BWT and Western Ridge), based on relevant aspects of the completion criteria (Section 4.2.2) and progressive criteria (Section 4.3.1) analysis for the Newman Hub and the relevant considerations for the likely success of establishing self-sustaining areas of rehabilitation, BHP considers that it is likely that future rehabilitation activities for the OB32 BWT and Western Ridge derived proposals will be successful.

For the OB32 BWT derived proposal (BHP 2022a), the proposed disturbance for the construction and operation of a surplus water pipeline from the OB32 BWT mine to Ophthalmia Dam (linear infrastructure only) will be relatively small scale (224 ha). The analysis of rehabilitation sites (including the Eastern Ridge mining operation where the existing OB32 AWT mine is located and sites located on similar flat terrain where the disturbance for the OB32 BWT will occur), demonstrates a high likelihood of success. Given the larger scale and nature of proposed mining activities for the Western Ridge derived proposal, where the area of proposed disturbance is up to 4,281 ha (BHP 2022b), it is likely that it will take longer for rehabilitation to be complete. However, analysis of rehabilitation sites, particularly where rehabilitation activities have been undertaken using more recent rehabilitation techniques, demonstrates that there is also a high likelihood of success at the mine scale. BHP will also apply any relevant rehabilitation learnings when areas associated with the OB32 BWT pipeline and Western Ridge mine and associated infrastructure, are ready to be rehabilitated.

Table 8: Future rehabilitation success – FY2021 progressive criteria assessment

Mining hub	Target vegetation type	No of sites assessed	Progressive assessment	Summary
Jimblebar (Figure 6, Appendix 4)	Low Tree Steppe	Young: 3	All sites did not meet target for major criterion <i>Triodia</i> Cover/Shrub Cover ratio. Two of three sites met targets for supporting criteria Minimum Total Native Cover and one site met supporting Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria not met
		Progressing: 14	Most sites met targets for major criterion for <i>Triodia</i> Cover/Total Native Cover ratio and supporting criterion Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria met
Newman (Figure 7, Appendix 5)	Low Tree Steppe	Young: 5	Most sites met targets for major criterion <i>Triodia</i> Cover/Shrub Cover ratio, and supporting criteria Minimum Total Native Cover and Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria met
		Progressing: 23	Most sites did not meet targets for major criterion <i>Triodia</i> Cover/Total Native Cover ratio and supporting criterion Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria not met
Yandi (Figure 8, Appendix 6)	Low Tree Steppe	Young: 1	Only 1 site assessed. Did not meet target for major criterion <i>Triodia</i> Cover/Shrub Cover ratio. Met targets for supporting criteria Minimum Total Native Cover and Weed Cover/ <i>Triodia</i> Cover ratio.	Only 1 site - met supporting criteria only
		Progressing: 15	Most sites did not meet target for major criterion <i>Triodia</i> Cover/Total Native Cover ratio. Most sites met target for supporting criterion Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria not met
Mining Area C (Figure 9, Appendix 7)	Low Tree Steppe	Young: 1	Only 1 site assessed. Did not meet target for major criterion <i>Triodia</i> Cover/Shrub Cover ratio. Met targets for supporting criteria Minimum Total Native Cover and Weed Cover/ <i>Triodia</i> Cover ratio.	Only 1 site - met supporting criteria only
		Progressing: 6	50% of sites met target for major criterion for <i>Triodia</i> Cover/Total Native Cover ratio and all sites met target for supporting criteria Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria met
Goldsworthy (Figure 10, Appendix 8)	Grass Steppe	Young - 0	Not assessed - all sites old enough to assess against progressive or completion criteria.	Not assessed
		Progressing: 4	All sites did not meet target for major criterion <i>Triodia</i> Cover/Shrub Cover ratio. 50% of sites met target for supporting criterion Weed Cover/ <i>Triodia</i> Cover ratio.	Most criteria not met
Yarrie (Figure 11, Appendix 8)	Shrub Steppe	Young: 4	Most sites did not meet target for major criterion <i>Triodia</i> Cover/Shrub Cover ratio. All sites met targets for supporting criteria Minimum Total Native Cover and Weed Cover/ <i>Triodia</i> Cover ratio.	Met supporting criteria
		Progressing: 67	Most sites did not meet target for major criterion <i>Triodia</i> Cover/Shrub Cover ratio. Most sites met target for supporting criterion Weed Cover/ <i>Triodia</i> Cover ratio.	Met supporting criteria

5 Continuous improvement and future work

Through the development of the preliminary rehabilitation success methodology (including criteria and targets), and analysis of BHP's rehabilitation data, BHP has identified areas of continuous improvement and future work.

Methodology for assessing rehabilitation success

To support the approach for assessing rehabilitation success used in this report, as part of the Rehabilitation Improvement Program, BHP will review and improve a number of standards and procedures/processes currently being used by WAIO and where necessary, address identified gaps. This includes the following:

Review of rehabilitation criteria

BHP is currently reviewing the preliminary completion criteria developed to assess rehabilitation success for completed rehabilitation. This will involve testing the criteria for both the Pastoral and Natural Vegetation post-mining land uses against additional data collected through monitoring over the past three years. BHP is reviewing the appropriateness of the criteria for use at older mines (i.e Whaleback in the Newman Hub, Goldsworthy and Yarrie) and may modify the criteria where appropriate, to recognise historical rehabilitation practices. Once the completion criteria are reviewed and updated and agreed within BHP, MCPs will be updated to reflect the revised completion criteria, where relevant. BHP has started discussions with DMIRS regarding revising the completion criteria and is currently exploring options to enable the completion criteria to be approved.

BHP has also started reviewing the progressive criteria and is developing interim milestones to enable BHP to assess whether rehabilitation underway is progressing on the right trajectory towards rehabilitation success.

Review of monitoring methodology

BHP has started to review the current rehabilitation monitoring methodology, to identify gaps in the monitoring and to better align the monitoring to the revised rehabilitation criteria. This will include reviewing the locations, frequency and method of monitoring (i.e on-ground and remote-sensing). Once the review of rehabilitation criteria is complete, BHP will revise the monitoring program to ensure appropriate data is collected to measure rehabilitation success at key development points on the rehabilitation trajectory (interim milestones) and at completion. The aim of the revised monitoring program is also to provide clear data on whether rehabilitation intervention / maintenance is required, for continuous improvement.

Review of rehabilitation status and success reporting

Once the rehabilitation criteria and monitoring program reviews are complete, BHP will review the traffic light approach for spatially presenting the status and success of rehabilitation, aligning it to any new monitoring methodology.

Rehabilitation activities

In parallel with the review of the methodology for assessing rehabilitation success, BHP will continue to ground-truth the analysis contained in this report to confirm the assessment of rehabilitation progress and success (including Status Unknown areas). This will include reviewing rehabilitation sites that are not performing against targets, or where there is variability across sites in the same hub, and decide if maintenance / intervention is required. For example, in response to poor performance against rehabilitation targets, the Buffel Grass (*Cenchrus ciliaris*) management techniques at the Newman hub are under review and a *Triodia* seeding program is commencing at areas near Yandi's putrescible landfill which has not met progressive criteria targets.

BHP will also continue to undertake progressive rehabilitation. BHP aims to complete landforming and stabilisation works within 3 years of disturbed areas becoming available for rehabilitation and complete topsoil and/or growth media spreading and revegetation works within 5 years. BHP will also align the timing of rehabilitation activities to

the optimal time of year as far as practicable. In extended drought periods, BHP will implement accelerated and/or advanced revegetation methods, to avoid extensive bare areas and to facilitate plant cover.

Investigation/research

BHP will identify work based on the outcomes of this report (e.g. where criteria have not been met - mostly Hummock Grasses (*Triodia*) criteria). Relevant investigations and research include the following:

- Jimblebar hub: Ongoing research is underway to investigate seeding placement and cover strategies to enhance rehabilitation success.
- Newman hub: Irrigation trials will commence at Whaleback rehabilitation areas with the aim of improving rehabilitation success, in particular seed germination.

6 References

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Appendices

Appendix 1 BHP Pilbara Strategic Proposal: Inputs to Rehabilitation Report

Separate document

Appendix 2 Preliminary rehabilitation criteria

Completion criteria

CLOSURE REVEGETATION OBJECTIVES: <i>Naturalness</i> (major vegetation types, characteristic (icon) species, structure, pattern), <i>Resilience</i> (vegetation cover, richness, recruitment, stability) and <i>Habitat Connectivity</i>				
Attribute	Criteria	Metric	Rationale	Method of Assessment
Bare Ground (Non-vegetated)	Bare ground to have stony/rocky cover and be typical of the regional landforms and generally evenly dispersed between vegetation	% bare ground with rock or stony cover for individual landforms (e.g. hills, slopes etc.)	Critical for achieving key attributes such as patterns, diversity, soil stability	Survey by plot or equivalent method
Species Richness	Perennial and annual native species richness to reflect each major vegetation type present within the rehabilitation	Number of perennial and annual species to be within the median range (Q1 - Q3) for each major Vegetation Type	Strong indicator of resilience in Pilbara; important for achieving diversity and vegetation cover	Survey by plot and releve (median of aggregated plots per site compared to Q1-Q3 range for natural end use, >Q1 for pastoral) Not less than 15 years post rehabilitation
Weed Invasiveness	DBCAs priority list weed species to be managed so as not to cause unacceptable risk to surrounding environments	Absence of priority weed species or if present, cover not greater than in the regional surrounds No new priority species to be introduced	Critical for achieving naturalness and resilience objectives	Surveys and comparison with regional baseline data
	Total weed cover to be typical for each site and landform, and reflect final end use	% total weed cover and % buffel grass (* <i>Cenchrus ciliaris</i>) cover per post-mining land use and landform		Survey by plot and releve or equivalent method
Target Vegetation Types	Vegetation types to respond to biogeographic region and finished landforms. All major vegetation types (Beard et al 2013) present at each site to be represented in post-mined landscapes	Presence of appropriate Vegetation Types	Provides variability of habitat types and is critical for achieving naturalness objective	Survey by plot or equivalent method and comparison with Beard et al 2013 Pilbara vegetation types
Indicator Species	Presence of dominant and common species from each Target Vegetation Type represented in post-mined landscapes	Presence of dominant species to reflect end use Presence of iconic species	Critical for achieving naturalness objective and ensuring required species and structure diversity	Survey by plot or equivalent method
Plant Cover	Vegetation cover for each strata to reflect major vegetation type present within the rehabilitation	% cover for each strata (e.g. trees, shrubs, grasses, etc.) to be within the median range (Q1 - Q3) for each major vegetation type	<u>Key attribute</u> of closure revegetation objectives (naturalness, resilience and habitat connectivity)	Survey by plot or equivalent method (median of aggregated plots per site compared to Q1-Q3 range for Natural Environment post-mining land use, >Q1 for Pastoral Environment) By plot not less than 15 years post-rehabilitation

Progressive criteria

PROGRESSIVE CRITERIA		
Young rehabilitation (< 5 years)		
	Criteria	Targets
Major criterion	<i>Triodia</i> cover / Shrub cover ratio	> 2
Supporting criteria	Minimum total native cover (%)	> 12%
	Weed cover / <i>Triodia</i> cover ratio	< 1
Progressing rehabilitation (5 - 15 years)		
	Criteria	Targets
Major criterion	<i>Triodia</i> Cover / Total Native Cover	≥ 0.32
Supporting criterion	Weed cover / <i>Triodia</i> cover ratio	< 1

Appendix 3 Hub key information

Element	Jimblebar	Newman	Yandi	Mining Area C	Goldsworthy	Yarrie
Start of disturbance (Year)	1989	1968	1991	2000	1965	1991
Start of rehabilitation (Year)	1990	1975	1998	2002	1992	1993
Start of rehabilitation monitoring (Year)	1991	1976	1999	2004	1993	1994
Number of plots with rehabilitation >= 15 years [2006 or earlier]	17	25	25	12	41	30
Number of plots with rehabilitation < 15 years [2007 onwards]	15	21	20	18	0	32
Operations status	Operations	Operations	Operations	Operations	Mining ceased	Suspended operations
Estimated closure date¹	2069	2080	2028	2068	-	TBA
Geographic region	Eastern Pilbara, Northern Gascoyne	Eastern Pilbara	Central Pilbara	Central Pilbara	Northern Pilbara	Northern Pilbara
Target ecosystem (vegetation) type	Low tree-steppe	Low tree-steppe	Low tree-steppe	Low tree-steppe	Grass-steppe	Shrub-steppe
Assumed post-mining land use	Pastoral environment	Pastoral environment	Pastoral environment	Natural environment	Pastoral environment	Pastoral environment

1. Date when infrastructure is decommissioned and removed, according to current MCPs.

Appendix 4 Jimblebar hub: completion and progressive criteria output tables FY2021

Jimblebar hub completion criteria analysis

Note: No sites met the requirements for quantitative completion assessment

SITE: Jimblebar					
YEARS POST REHAB:		0 to 0			
No. SITES ASSESSED:		0			
VEG TYPE:		Low Tree Steppe			
END USE:		Pastoral			
ATTRIBUTE	METRIC	TARGETS	PERFORMANCE		
Bare Ground (non-vegetated)	% bare ground with rock and story cover	Hills, slopes, dry plains	≤ 50 %		
		Drainage lines (excluding channel bed)	≤ 20 %		
		Floodplains	≤ 10 %		
Species Richness	Perennial and annual native species richness (number of species)	> Q1		median	
		Perennial native species	> 16	Sample size too small	-
		Annual native species	> 5	Sample size too small	-
Weed Invasiveness	Priority Alert weed species	Priority alert weed species presence and cover	Not present or cover ≤ regional baseline	none	√
		Introduction of new priority species	No new priority species introduced	none	√
	Percentage cover of total weeds	Total weed cover (%)			
		drainage lines, floodplains upland hills, slopes and flats	< 20 % < 10 %	Sample size too small Sample size too small	- -
	Percentage cover of Cenchrus ciliaris	Cenchrus ciliaris cover (%)			
drainage lines, floodplains upland hills, slopes and flats	< 10 % < 10 %	Sample size too small Sample size too small	- -		
Target Vegetation Types	Presence of appropriate vegetation types			Low Tree Steppe	
Indicator Species	Presence of dominant and common species from each Target Vegetation Type	All dominant species present		NO	-
		>50% of common species present		YES	-
Plant Cover	% cover for each strata Low Tree Steppe	> Q1		median	
		Trees	> 1 %	Sample size too small	-
		Shrubs	> 2 %	Sample size too small	-
		Hummock Grasses	> 20 %	Sample size too small	-
		Other Grasses	> 0.04 %	Sample size too small	-
		Herbs	> 0.05 %	Sample size too small	-

Jimblebar hub progressive criteria analysis

Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	PROGRESSING REHABILITATION (5-15 YEARS) CRITERIA	
						MAJOR	SUPPORTING
						Triodia cover / Total native cover ratio	Weed cover / Triodia cover ratio
Target						≥ 0.32	< 1
BJB42	Jimblebar	2021	6	Wheelara 1/2	Flat	0.052	0.1
BJB43	Jimblebar	2021	7	Wheelara 1/2	Slope	0.288	0.0
BJB45	Jimblebar	2021	8	OB18 Rail Loop	Flat	0.470	0.0
BJB46	Jimblebar	2021	9	Unnamed Area	Flat	0.338	0.0
BJB_R01	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.528	0.0
BJB_R02	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.155	0.0
BJB_R03	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.434	0.0
BJB_R04	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.045	5.0
BJB_R05	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.579	0.0
BJB_R08	Jimblebar	2019	6	Borrow Pit - Rail	Flat	0.762	0.0
BJB_R09	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.682	0.0
BJB_R10	Jimblebar	2019	7	Borrow Pit - Rail	Flat	0.769	0.0
BJB33	Jimblebar	2019	8	Borrow Pit - Rail	Flat	0.014	0.8
BJB41	Jimblebar	2019	5	Previous Geotech - Jimblebar	Flat	0.042	12.5

% sites meeting targets	57%	86%
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Transect	Mine	Date of monitoring	Years post rehabilitation	Type	Terrain	YOUNG REHABILITATION (< 5 YEARS) CRITERIA		
						MAJOR	SUPPORTING	
						Triodia cover / Shrub cover ratio	Minimum total native cover (%)	Weed cover / Triodia cover ratio
Target						> 2	> 12	< 1
BJB44	Jimblebar	2019	3	West Jimblebar	Flat	0.00	12.6	21
BJB47	Jimblebar	2019	2	Jimblebar - EA Validated for	Flat	0.01	3.1	0
BJB40	Jimblebar	2019	3	Previous Geotech - Jimblebar	Flat	0.00	13.3	20

% sites meeting targets	0%	67%	33%
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Appendix 5 Newman hub: completion and progressive criteria output tables FY2021

Newman hub completion criteria analysis

						COMPLETION (>15 YEARS) CRITERIA							
Transect	Location	Date of	Years post rehabilitation	Type	Terrain	% Cover						Species richness	
						Tree	Shrub	Triodia	Other grass	Herb	Weed	Perennial	Annual
						>1	>2	>20	>0.04	>0.05	<10	>16	>5
BFO03	Eastern Ridge	2021	22	OSA - OB25 Fire Trial (c Crest		0.3	11.1	30.0	0.40	2.9	0.2	32	13
BO2-11	Eastern Ridge	2018	20	Pit 1 Face South Face, 1 Slope		2.1	17.0	1.5	2.36	0.1	10.0	36	9
BWB01	Mount Whalebac	2017	30	Borrow Pit - Security Gate Flat		1.5	14.6	26.0	1.38	0.3	2.0	31	6
% sites meeting targets						67%	100%	67%	100%	100%	67%	100%	100%

SITE: Newman						
YEARS POST REHAB: 20 to 30						
No. SITES ASSESSED: 3						
VEG TYPE: Low Tree Steppe						
END USE: Pastoral						
ATTRIBUTE	METRIC	TARGETS	PERFORMANCE			
Bare Ground (non-vegetated)	% bare ground with rock and stony cover	Hills, slopes, dry plains	≤ 50 %			
		Drainage lines (excluding channel bed)	≤ 20 %			
		Floodplains	≤ 10 %			
Species Richness	Perennial and annual native species richness (number of species)	> Q1	median			
		Perennial native species	> 16	32	✓	
		Annual native species	> 5	9	✓	
Weed Invasiveness	Priority Alert weed species	Priority alert weed species presence and cover	Not present or cover ≤ regional baseline	none	✓	
		Introduction of new priority species	No new priority species introduced	none	✓	
	Percentage cover of total weeds	Total weed cover (%)	drainage lines, floodplains	< 20 %	2	✓
			upland hills, slopes and flats	< 10 %	2	✓
	Percentage cover of Cenchrus ciliaris	Cenchrus ciliaris cover (%)	drainage lines, floodplains	< 10 %	0.1	✓
upland hills, slopes and flats			< 10 %	0.1	✓	
Target Vegetation Types	Presence of appropriate vegetation types			Low Tree Steppe		
Indicator Species	Presence of dominant and common species from each Target Vegetation Type	All dominant species present		YES	✓	
		>50% of common species present		YES	✓	
Plant Cover	% cover for each strata Low Tree Steppe	> Q1	median			
		Trees	> 1 %	1.50	✓	
		Shrubs	> 2 %	14.6	✓	
		Hummock Grasses	> 20 %	26.0	✓	
		Other Grasses	> 0.04 %	1.4	✓	
		Herbs	> 0.05 %	0.34	✓	

Newman hub progressive criteria analysis

						PROGRESSING REHABILITATION (5-15 YEARS) CRITERIA	
Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	MAJOR	SUPPORTING
						Triodia cover / Total native cover ratio	Weed cover / Triodia cover ratio
						≥	<
						0.32	1
BO2-12	Eastern Ridge	2021	13	OSA - Southern Landform	Slope	0.003	500.0
BO2-13	Eastern Ridge	2021	13	OSA - OB23 OSA	Slope	0.355	1.0
BO2-18	Eastern Ridge	2021	10	OSA - OB23 OSA	Slope	0.216	5.6
BO2-28	Eastern Ridge	2021	5	OB23 WS Dump	Crest	0.682	0.0
BO2-60	Eastern Ridge	2019	5	Unnamed Area	Flat	0.672	0.0
BO2_R01	Eastern Ridge	2019	6	Old Projects Rehab from Roac	Flat	0.010	2.0
BO2-27	Eastern Ridge	2019	7	Rail Borrow Pit	Crest	0.718	1.1
BO2-48	Eastern Ridge	2019	7	Borrow Pit	Flat	0.024	50.0
BO2-47	Eastern Ridge	2019	6	Borrow Pit	Flat	0.000	402.0
BO2-51	Eastern Ridge	2019	6	Borrow Pit	Flat	0.005	150.0
BWB51	Mount Whaleback	2021	7	-	Flat	0.512	0.0
BWB55	Mount Whaleback	2021	7	Evap Ponds	Flat	0.000	
BWB_R01	Mount Whaleback	2019	7	No name	Flat	0.000	
BWB_R02	Mount Whaleback	2019	7	No name	Flat	0.000	
BWB26	Mount Whaleback	2019	9	W41 Soak Cells (cells 1-3)	Flat	0.000	
BWB36	Mount Whaleback	2019	5	WD 41_EXTN1	Flat	0.024	62.5
BWB37	Mount Whaleback	2019	5	WD 41_EXTN2	Flat	0.107	5.6
BWB41	Mount Whaleback	2019	5	OB29 Old Town Landfill	Flat	0.000	
BWB54	Mount Whaleback	2019	7	Evap Ponds	Flat	0.000	
BWB56	Mount Whaleback	2019	7	Evap Ponds	Flat	0.000	
BWB27	Mount Whaleback	2019	8	W41 Soak Cells (cells 4-17)	Flat	0.195	4.9
BWB49	Mount Whaleback	2019	6	Old Landfill	Flat	0.321	1.0
BWB50	Mount Whaleback	2019	6	Old Landfill	Flat	0.094	7.4
% sites meeting targets						26%	25%

						YOUNG REHABILITATION (< 5 YEARS) CRITERIA		
Transect	Mine	Date of monitoring	Years post rehabilitation	Type	Terrain	MAJOR	SUPPORTING	
						Triodia cover / Shrub cover ratio	Minimum total native cover (%)	Weed cover / Triodia cover ratio
						>	>	<
						2	12	1
BWB200	Mount Whaleback	2019	3	-	Flat	9.65	28.8	0
BWB44	Mount Whaleback	2019	4	W28 Old Topsoil storage	Slope	5.95	32.1	0
BWB45	Mount Whaleback	2019	4	W28 Old Topsoil storage	Crest	1.54	20.8	0
BWB46	Mount Whaleback	2019	4	OB35 PAF contingency dum	Flat	6.89	9.7	19
BWB52	Mount Whaleback	2019	2	SPA	Crest	0.07	5.0	77
% sites meeting targets						60%	60%	60%

Appendix 6 Yandi hub: completion and progressive criteria output tables FY2021

Yandi hub completion criteria analysis

							COMPLETION (>15 YEARS) CRITERIA							
							% Cover					Species richness		
Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain		Tree	Shrub	Triodia	Other grass	Herb	Weed	Perennial	Annual
							<i>Target</i>					>16	>5	
BMC03	Yandi	2021	19	OSA - E20SA	Slope		0.3	7.7	6.5	11.10	1.2	25.0	24	12
BMC04	Yandi	2021	19	OSA - E20SA	Slope		2.0	9.1	32.0	1.39	2.5	12.0	37	20
BMC12	Yandi	2021	17	OSA - E20SA	Crest		3.0	19.7	0.6	12.03	0.1	0.0	84	3
BMC13	Yandi	2021	23	OSA - E20SA	Crest		8.5	2.0	12.0	1.82	0.3	0.4	52	9
BMC14	Yandi	2021	23	OSA - E20SA	Crest		0.5	12.3	35.0	2.99	1.5	0.4	76	20
BMC15	Yandi	2021	23	OSA - E20SA	Crest		1.0	23.5	2.5	11.40	0.4	0.0	73	7
BMC10	Yandi	2018	16	Borrow Pit for Barimunya Flat			0.0	13.1	15.1	0.06	0.0	0.0	17	5
% sites meeting targets							57%	100%	29%	100%	86%	71%	100%	86%

SITE: Yandi					
YEARS POST REHAB: 16 to 23					
No. SITES ASSESSED: 7					
VEG TYPE: Low Tree Steppe					
END USE: Pastoral					
ATTRIBUTE	METRIC	TARGETS	PERFORMANCE		
Bare Ground (non-vegetated)	% bare ground with rock and stony cover	Hills, slopes, dry plains	≤ 50 %		
		Drainage lines (excluding channel bed)	≤ 20 %		
		Floodplains	≤ 10 %		
Species Richness	Perennial and annual native species richness (number of species)	> Q1	median		
		Perennial native species	> 16	52	✓
		Annual native species	> 5	9	✓
Weed Invasiveness	Priority Alert weed species	Priority alert weed species presence and cover	not present or cover ≤ regional baseline	none	✓
		Introduction of new priority species	No new priority species introduced	none	✓
	Percentage cover of total weeds	Total weed cover (%)			
		drainage lines, floodplains upland hills, slopes and flats	< 20 %	0.35	✓
	Percentage cover of Cenchrus ciliaris	Cenchrus ciliaris cover (%)			
drainage lines, floodplains upland hills, slopes and flats		< 10 %	0.1	✓	
Target Vegetation Types	Presence of appropriate vegetation types		Low Tree Steppe		
Indicator Species	Presence of dominant and common species from each Target Vegetation Type	All dominant species present	YES	✓	
		>50% of common species present	YES	✓	
Plant Cover	% cover for each strata Low Tree Steppe	> Q1	median		
		Trees	> 1 %	1.00	-
		Shrubs	> 2 %	12.3	✓
		Hummock Grasses	> 20 %	12.0	-
		Other Grasses	> 0.04 %	3.0	✓
Herbs	> 0.05 %	0.36	✓		

Yandi hub progressive criteria analysis

							PROGRESSING REHABILITATION (5-15 YEARS) CRITERIA	
							MAJOR	SUPPORTING
Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain		Triodia cover / Total native cover ratio	Weed cover / Triodia cover ratio
							<i>Target</i>	
BMC05	Yandi	2019	15	OSA - E20SA	Slope		0.022	0.0
BMC06	Yandi	2021	14	OSA - E20SA	Slope		0.136	0.0
BMC21	Yandi	2021	12	OSA - Central OSA	Flat		0.468	0.0
BMC247	Yandi	2021	12	OSA - Central OSA	Slope		0.260	0.6
BMC26	Yandi	2019	10	OSA - Central OSA	Crest		0.436	0.0
BMC27	Yandi	2019	10	Infrastructure - OHP2 Rail Loo Flat			0.053	0.1
BMC62	Yandi	2019	10	Yandi 2 Rail Loop Borrow Pit	Flat		0.522	0.1
BMC67	Yandi	2019	7	Access Rd upgrade Borrow Pi Flat			0.133	0.0
BMC_R01	Yandi	2019	7	RGP5 Spinifex Village HV Acc Crest			0.107	0.0
BMC_R02	Yandi	2019	7	Access Rd upgrade Borrow Pi Flat			0.067	0.0
BMC_R03	Yandi	2019	7	Access Rd upgrade Borrow Pi Flat			0.199	0.0
BMC18	Yandi	2019	10	Borrow Pit - Marillana	Flat		0.197	8.7
BMC20	Yandi	2019	14	OSA - Central OSA East	Crest		0.525	0.1
BMC08	Yandi	2019	15	Borrow Pit for Barimunya Airpr Flat			0.342	0.0
BMC09	Yandi	2019	15	Borrow Pit for Barimunya Airpr Flat			0.658	0.0
% sites meeting targets							40%	93%

						YOUNG REHABILITATION (< 5 YEARS) CRITERIA		
						MAJOR	SUPPORTING	
Transect	Mine	Date of monitoring	Years post rehabilitation	Type	Terrain	Triodia cover / Shrub cover ratio	Minimum total native cover (%)	Weed cover / Triodia cover ratio
						<i>Target</i>	>	<
BMC68	Yandi	2019	4	YNMS679	Flat	0.02	24.3	0
% sites meeting targets						0%	100%	100%

Appendix 7 Mining Area C hub: completion and progressive criteria output tables

Mining Area C hub completion criteria analysis

						COMPLETION (>15 YEARS) CRITERIA							
						% Cover					Species richness		
Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	Tree	Shrub	Triodia	Other grass	Herb	Weed	Perennial	Annual
						1 - 10	2 - 10	20 - 30	0.04 - 0.62	0.05 - 0.4	<5	16 - 29	5 - 11
BAC04	Area C	2018	16	Bulk sample borrow pits 11a	Flat	9.5	9.2	45.1	1.51	0.1	0.0	46	8
BAC_R04	Area C	2019	17	Bulk Sample Borrow Pit 6	Flat	4.0	8.7	10.0	3.00	0.0	0.0	12	0
BAC_R05	Area C	2019	17	Bulk Sample Borrow Pit 2	Slope	2.0	9.3	29.0	0.60	0.0	0.0	11	0
BAC_R06	Area C	2019	17	Bulk Sample Borrow Pit 1	Flat	10.0	6.6	15.0	2.00	0.0	0.0	12	0
BAC_R07	Area C	2019	17	Bulk Sample Borrow Pit 4	Flat	3.0	12.8	20.0	1.00	0.0	0.0	11	1
Target						1 - 10	2 - 10	20 - 30	0.04 - 0.62	0.05 - 0.4	<5	16 - 29	5 - 11
% sites meeting targets						100%	80%	40%	20%	20%	100%	0%	20%

SITE: Area C				
YEARS POST REHAB: 16 to 17				
No. SITES ASSESSED: 5				
VEG TYPE: Low Tree Steppe				
END USE: Natural				
ATTRIBUTE	METRIC	TARGETS	PERFORMANCE	
Bare Ground (non-vegetated)	% bare ground with rock and stony cover	Hills, slopes, dry plains	≤ 50 %	
		Drainage lines (excluding channel bed)	≤ 20 %	
		Floodplains	≤ 10 %	
Species Richness	Perennial and annual native species richness (number of species)	> Q1 < Q3	median	
		Perennial native species	> 16 < 29	
		Annual native species	> 5 < 11	
Weed Invasiveness	Priority Alert weed species	Priority alert weed species presence and cover	Not present or cover ≤ regional baseline	
		Introduction of new priority species	No new priority species introduced	
	Percentage cover of total weeds	Total weed cover (%)	drainage lines, floodplains	< 15 %
			upland hills, slopes and flats	< 5 %
			Percentage cover of Cenchrus ciliaris	Cenchrus ciliaris cover (%)
		drainage lines, floodplains	< 10 %	
		upland hills, slopes and flats	< 5 %	
Target Vegetation Types	Presence of appropriate vegetation types		Low Tree Steppe	
Indicator Species	Presence of dominant and common species from each Target Vegetation Type	All dominant species present	YES	
		>50% of common species present	YES	
Plant Cover	% cover for each strata Low Tree Steppe	> Q1 < Q3	median	
		Trees	> 1 % < 10 %	
		Shrubs	> 2 % < 10 %	
		Hummock Grasses	> 20 % < 30 %	
		Other Grasses	> 0.04 % < 0.62 %	
		Herbs	> 0.05 % < 0.4 %	

Mining Area C Hub progressive criteria analysis

						PROGRESSING REHABILITATION (5-15 YEARS) CRITERIA	
						MAJOR	SUPPORTING
Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	Triodia cover / Total native cover ratio	Weed cover / Triodia cover ratio
						Target	Target
BAC24	Area C	2021	10	Packsaddle Range Detritals - Rail Borr	Flat	0.733	0.0
BAC30	Area C	2021	9	Rail Borrow Pit	Flat	0.745	0.0
BAC32	Area C	2021	7	Borrow Pit Ch 335.6	Flat	0.310	0.0
BAC_R01	Area C	2019	7	Borrow Pit Ch 335.6	Flat	0.022	0.0
BAC_R02	Area C	2019	8	No name	Flat	0.242	0.0
BAC_R03	Area C	2019	8	No name	Crest	0.789	0.0
% sites meeting targets						50%	100%

						YOUNG REHABILITATION (< 5 YEARS) CRITERIA		
						MAJOR	SUPPORTING	
Transect	Mine	Date of monitoring	Years post rehabilitation	Type	Terrain	Triodia cover / Shrub cover ratio	Minimum total native cover (%)	Weed cover / Triodia cover ratio
						Target	Target	Target
BAC31	Area C	2019	2	Regrade works Not picked up for FY1	Slope	0.32	19.9	0
% sites meeting targets						0%	100%	100%

Appendix 8 Goldsworthy hub: completion and progressive criteria output tables

Goldsworthy hub completion criteria analysis

Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	COMPLETION (>15 YEARS) CRITERIA								
						% Cover						Species richness		
						Tree	Shrub	Triodia	Other grass	Herb	Weed	Perennial	Annual	
						Target	>0	>0.2	>15	>0.01	>0.1	<10	>8	>6
BGW07	Goldsworthy	2020	27	Industrial area C - Light Ir Flat	Flat		0.0	2.3	45.0	0.05	0.0	0.0	24	7
BGW09	Goldsworthy	2020	27	Airstrip - sandy soils	Flat		0.0	23.7	25.0	0.13	0.2	0.0	43	6
BGW11	Goldsworthy	2020	27	Industrial Area B - Mine C Flat	Flat		0.0	4.4	30.0	0.15	0.4	0.9	53	11
BGW17	Goldsworthy	2018	25	Railway Waste Dump 8 - Crest	Crest		0.0	3.1	0.0	1.03	0.8	0.3	15	6
BGW22	Goldsworthy	2020	27	Magazine Waste Dump 8 Crest	Crest		2.5	9.2	15.0	6.02	0.1	0.1	52	8
BGW28	Goldsworthy	2018	25	Goldsworthy and Erector Crest	Crest		0.0	6.9	0.5	2.04	0.1	0.0	24	10
BGW30	Goldsworthy	2020	27	Goldsworthy and Erector Crest	Crest		0.0	5.1	4.0	4.13	0.2	5.3	44	12
BGW31	Goldsworthy	2020	27	Goldsworthy and Erector Crest	Crest		2.5	6.0	40.0	4.13	0.3	0.2	62	12
BGW42	Goldsworthy	2020	27	Golf Course (sandy soils)	Flat		1.5	19.5	30.5	0.14	0.2	0.5	51	9
BGW43	Goldsworthy	2020	27	Golf Course (sandy soils)	Flat		1.5	4.3	25.0	0.13	0.4	0.2	52	9
BGW_R01	Goldsworthy	2019	26	Rosemary Waste Dump	Moonscape		1.0	1.3	0.1	0.00	0.4	0.1	9	1
BGW_R02	Goldsworthy	2019	26	Rosemary Waste Dump	Moonscape		2.0	17.6	0.5	2.00	0.0	0.0	7	1
BGW_R03	Goldsworthy	2019	26	Rosemary Waste Dump	Moonscape		0.2	0.2	1.0	0.02	0.0	0.0	6	0
BGW_R04	Goldsworthy	2019	26	Rosemary Waste Dump	Moonscape		2.5	5.1	3.0	0.60	0.1	0.0	11	1
BGW_R05	Goldsworthy	2019	26	Magazine Waste Dump 8	Moonscape		1.0	0.5	0.1	2.00	0.2	2.2	9	1
BGW_R06	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		0.5	2.6	5.0	0.13	0.0	0.1	8	2
BGW_R07	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		1.0	4.6	0.5	1.00	0.0	0.0	10	0
BGW_R08	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		1.2	6.2	0.1	0.10	0.0	0.1	10	0
BGW_R09	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		0.0	7.0	0.1	0.50	0.0	0.0	11	0
BGW_R10	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		0.0	0.3	0.0	0.03	0.0	0.0	9	1
BGW_R11	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		0	9	0.2	0.01	0	0	4	1
BGW_R12	Goldsworthy	2019	26	No name	Moonscape		1	7.21	0.5	3.00	0.51	0.02	12	0
BGW_R16	Goldsworthy	2019	26	Goldsworthy and Erector	Moonscape		2.0	1.3	0.0	0.50	0.0	0.0	10	0
BGW_R17	Goldsworthy	2019	26	Goldsworthy and Erector	Moonscape		1	2.9	0.0	0.50	0.0	0.11	8	1
BGW_R18	Goldsworthy	2019	26	Goldsworthy and Erector	Moonscape		0.0	16.2	5.0	3.00	0.2	0.0	12	0
BGW_R20	Goldsworthy	2019	26	Bustard Waste Dump	Moonscape		4.1	3.5	1.0	1.00	0.1	0.0	12	0
BGW_R21	Goldsworthy	2019	26	Railway Waste Dump 8	Moonscape		1.0	3.5	0.0	1.01	0.0	0.2	10	0
BGW_R22	Goldsworthy	2019	26	Bustard Waste Dump	Moonscape		2	6.6	0.2	0.01	0.1	8.01	9	1
BGW04	Goldsworthy	2018	25	Town site - Mixed Road	Flat		0.5	3.62	9	0.04	0.06	15.02	23	4
BGW05	Goldsworthy	2018	25	Town site - Mixed Road	Flat		0.3	9.9	8.0	0.04	0.1	20.2	19	6
BGW10	Goldsworthy	2018	25	Old town site	Flat		0	13.1	40.0	0.13	0.1	11	20	8
BGW13	Goldsworthy	2018	25	Rosemary Waste Dump	Crest		0	12.2	0.1	0.13	0.2	1	14	8
BGW21	Goldsworthy	2018	25	Water Tank Waste Dump	Crest		0	12.3	5.0	4.12	1.2	23.1	24	9
BGW26	Goldsworthy	2018	25	Billygoat Dump	Crest		0	4.7	2.0	0.24	0.7	0.1	18	9
BGW32	Goldsworthy	2018	25	Railway OSA	Crest		0.1	1.1	1.0	0.03	1.0	21.61	19	9
BGW35	Goldsworthy	2018	25	Gravel/Borrow Pit (near K)	Flat		0	26.7	5.0	0.21	0.1	0	17	6
BGW40	Goldsworthy	2018	25	Sewerage Ponds	Flat		0	4.3	1.5	1.13	0.4	60	18	14
BGW45	Goldsworthy	2018	25	Borrow pit near townsite	Flat		1.5	6.0	40.0	0.02	0.1	0.1	20	3
% sites meeting targets							100%	100%	24%	97%	55%	84%	92%	47%

SITE: Goldsworthy					
YEARS POST REHAB: 25 to 27					
No. SITES ASSESSED: 38					
VEG TYPE: Grass Steppe					
END USE: Pastoral					
ATTRIBUTE	METRIC	TARGETS	PERFORMANCE		
Bare Ground (non-vegetated)	% bare ground with rock and stony cover	Hills, slopes, dry plains	≤ 50 %		
		Drainage lines (excluding channel bed)	≤ 20 %		
		Floodplains	≤ 10 %		
Species Richness	Perennial and annual native species richness (number of species)	> Q1	median		
		Perennial native species	> 8	15	✓
		Annual native species	> 6	4	-
Weed Invasiveness	Priority Alert weed species	Priority alert weed species presence and cover	Not present or cover ≤ regional baseline	none	✓
		Introduction of new priority species	No new priority species introduced	none	✓
	Percentage cover of total weeds	Total weed cover (%) drainage lines, floodplains upland hills, slopes and flats	< 20 %	0.1	✓
			< 10 %	0.1	✓
	Percentage cover of Cenchrus ciliaris	Cenchrus ciliaris cover (%) drainage lines, floodplains upland hills, slopes and flats	< 10 %	0	✓
< 10 %			0	✓	
Target Vegetation Types	Presence of appropriate vegetation types		Grass Steppe		
Indicator Species	Presence of dominant and common species from each Target Vegetation Type	All dominant species present	NO	-	
		>50% of common species present	YES	✓	
Plant Cover	% cover for each strata Grass Steppe	> Q1	median		
		Trees	> 0 %	0.38	✓
		Shrubs	> 0.2 %	5.1	✓
		Hummock Grasses	> 15 %	1.3	-
		Other Grasses	> 0.01 %	0.2	✓
Herbs	> 0.1 %	0.11	✓		

Goldsworthy hub progressive criteria analysis

Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	PROGRESSING REHABILITATION (5-15 YEARS) CRITERIA		
						MAJOR	SUPPORTING	
						Triodia cover / Total native cover ratio	Weed cover / Triodia cover ratio	
						≥	<	
						Target	0.32	1
BGW_R13	Goldsworthy	2019	7	Billygoat Waste Dump	Moonscape	0.047	1.0	
BGW_R14	Goldsworthy	2019	7	Billygoat Waste Dump	Moonscape	0.034	0.0	
BGW_R15	Goldsworthy	2019	7	Billygoat Waste Dump	Moonscape	0.111	0.0	
BGW_R19	Goldsworthy	2019	7	Bustard Waste Dump	Moonscape	0.017	1.0	
% sites meeting targets						0%	50%	

Appendix 9 Yarrie hub: completion and progressive criteria output tables

Yarrie hub completion criteria analysis

Transect	Location	Date of	Years post rehabilitation	Type	Terrain	COMPLETION (>15 YEARS) CRITERIA							
						% Cover						Species richness	
						Tree	Shrub	Triodia	Other grass	Herb	Weed	Perennial	Annual
					Target	>1	>3	>19	>0.02	>0.1	<10	>15	>9
BYA03	Yarrie	2020	27	Borrow Pit 1	Flat	0.1	5.7	30.0	0.01	0.0	0.0	17	1
BYA07	Shay Gap	2018	23	OSA - Flying Circus	Crest	1.0	21.9	15.0	0.15	0.2	0.0	28	15
BYA08	Shay Gap	2018	23	Shay Ridge Flat	Flat	10.1	17.6	5.0	4.07	0.2	0.0	35	17
BYA31	Yarrie	2020	16	Y7D Growth Trials - Tops Slope		2.0	5.6	15.1	0.21	0.2	0.0	84	6
BYA01	Yarrie	2019	16	OSA - Y10 Contour Rippl Slope		0.3	13.6	5.0	3.05	0.0	0.2	36	3
% sites meeting targets						60%	100%	20%	80%	60%	100%	100%	40%

SITE: Yarrie					
YEARS POST REHAB: 16 to 27					
No. SITES ASSESSED: 5					
VEG TYPE: Shrub Steppe					
END USE: Pastoral					
ATTRIBUTE	METRIC	TARGETS	PERFORMANCE		
Bare Ground (non-vegetated)	% bare ground with rock and stony cover	Hills, slopes, dry plains	≤ 50 %		
		Drainage lines (excluding channel bed)	≤ 20 %		
		Floodplains	≤ 10 %		
Species Richness	Perennial and annual native species richness (number of species)		> Q1	median	
		Perennial native species	> 15	35	
		Annual native species	> 9	6	
Weed Invasiveness	Priority Alert weed species	Priority alert weed species presence and cover	Not present or cover ≤ regional baseline	none	
		Introduction of new priority species	No new priority species introduced	none	
	Percentage cover of total weeds	Total weed cover (%) drainage lines, floodplains upland hills, slopes and flats	< 20 %	0	√
			< 10 %	0	√
	Percentage cover of Cenchrus ciliaris	Cenchrus ciliaris cover (%) drainage lines, floodplains upland hills, slopes and flats	< 10 %	0	√
< 10 %			0	√	
Target Vegetation Types	Presence of appropriate vegetation types			Shrub Steppe	
Indicator Species	Presence of dominant and common species from each Target Vegetation Type	All dominant species present		YES	
		>50% of common species present		YES	
Plant Cover	% cover for each strata Shrub Steppe		> Q1	median	
		Trees	> 1 %	1.01	
		Shrubs	> 3 %	13.6	
		Hummock Grasses	> 19 %	15.0	
		Other Grasses	> 0.02 %	0.2	
Herbs	> 0.1 %	0.15			

Yarrie hub progressive criteria analysis

Transect	Location	Date of monitoring	Years post rehabilitation	Type	Terrain	PROGRESSING REHABILITATION (5-15 YEARS) CRITERIA	
						MAJOR	SUPPORTING
						Triodia cover / Total native cover ratio	Weed cover / Triodia cover ratio
Target						≥ 0.32	< 1
BYA28	Yarrie	2020	10	OSA - W1 Lower batter	Slope	0.218	16.7
BYA29	Yarrie	2020	10	OSA - W1 Lower batter	Crest	0.332	3.1
BYA35	Yarrie	2020	10	OSA - W1 238 RL Batter	Slope	0.218	7.6
BYA36	Yarrie	2020	10	OSA - W1 238 RL Batter	Slope	0.131	4.3
BYA40	Yarrie	2018	9	Y6/7	Crest	0.199	0.0
BYA43	Yarrie	2018	13	Y6/7	Crest	0.719	0.0
BYA44	Yarrie	2018	6	Y10 Sisters	Crest	0.526	0.0
BYA45	Yarrie	2018	10	Yarrie 4 Crustal	Crest	0.574	0.0
BYA51	Nimingarra	2018	8	Nimingarra A	Crest	0.018	8.4
BYA52	Nimingarra	2018	8	Nimingarra A	Crest	0.108	0.1
BYA58	Shay Gap	2018	8	Lower Shay Gap	Flat	0.682	0.0
BYA60	Shay Gap	2018	6	Shay Gap 6	Crest	0.304	0.0
BYA63	Shay Gap	2018	8	Shay Gap 3 North	Crest	0.265	0.0
BYA_R01	Yarrie	2019	7	Nimingarra A	Moonscape	0.010	1.1
BYA_R02	Yarrie	2019	7	Nimingarra A	Moonscape	0.006	1.1
BYA_R03	Yarrie	2019	7	Nimingarra A	Moonscape	0.007	4.0
BYA_R04	Yarrie	2019	7	Nimingarra A	Moonscape	0.000	
BYA_R05	Yarrie	2019	7	Nimingarra A	Moonscape	0.051	2.0
BYA_R06	Yarrie	2019	7	Nimingarra A	Moonscape	0.182	0.0
BYA_R07	Yarrie	2019	7	Nimingarra A	Moonscape	0.089	0.0
BYA_R08	Yarrie	2019	7	Nimingarra A	Moonscape	0.056	1.0
BYA_R09	Yarrie	2019	7	Nimingarra A	Moonscape	0.034	0.0
BYA_R10	Yarrie	2019	7	Nimingarra A	Moonscape	0.041	0.3
BYA_R100	Yarrie	2019	7	Sunrise Hill	Flat	0.714	0.0
BYA_R101	Yarrie	2018	7	Sunrise Hill West 8	Flat	0.038	0.1
BYA_R102	Yarrie	2018	7	Sunrise Hill West 8	Flat	0.851	0.0
BYA_R103	Yarrie	2018	7	Sunrise Hill West 8	Flat	0.124	0.0
BYA_R104	Yarrie	2018	7	Sunrise Hill West 8	Flat	0.905	0.0
BYA_R11	Yarrie	2018	7	Nimingarra C	Moonscape	0.005	0.1
BYA_R110	Yarrie	2018	7	Sunrise Hill 8	Flat	0.786	0.0
BYA_R119	Yarrie	2018	7	Sunrise Hill 8	Flat	0.769	0.0
BYA_R12	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.268	0.0
BYA_R14	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.103	0.0
BYA_R15	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.809	0.0
BYA_R16	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.322	0.0
BYA_R17	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.240	0.0
BYA_R20	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.251	0.0
BYA_R21	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.070	0.2
BYA_R22	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.143	0.8
BYA_R23	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.516	0.0
BYA_R24	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.007	6.1
BYA_R25	Yarrie	2018	7	Sunrise Hill	Moonscape	0.053	1.3
BYA_R27	Yarrie	2018	7	Sunrise Hill	Moonscape	0.103	0.0
BYA_R28	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.021	2.0
BYA_R30	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.026	0.2
BYA_R31	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.008	0.0
BYA_R33	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.356	0.0
BYA_R35	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.108	0.0
BYA_R36	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.112	0.0
BYA_R37	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.067	0.0
BYA_R38	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.003	0.5
BYA_R39	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.001	1.0
BYA_R40	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.001	0.0
BYA_R41	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.009	0.0
BYA_R42	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.007	0.1
BYA_R43	Yarrie	2018	7	Shay Ridge Flat	Moonscape	0.016	0.0
BYA_R44	Yarrie	2018	7	Shay Ridge Flat	Moonscape	0.022	0.0
BYA_R45	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.087	0.0
BYA_R46	Yarrie	2018	7	Shay Gap Upper	Moonscape	0.179	0.0
BYA39	Yarrie	2018	8	C Pit	Slope	0.240	0.0
BYA53	Nimingarra	2018	6	Nimingarra C	Crest	0.062	0.0
BYA54	Nimingarra	2018	6	Nimingarra DE	Crest	0.354	0.0
BYA55	Nimingarra	2018	6	Nimingarra DE	Crest	0.001	501.0
BYA56	Shay Gap	2018	6	Lower Shay Gap	Crest	0.421	0.9
BYA59	Shay Gap	2018	6	Shay Gap 5	Crest	0.017	3.1
BYA61	Shay Gap	2018	6	OSA - Flying Circus	Flat	0.000	0.0
BYA62	Shay Gap	2018	6	Shay Gap 2	Flat	0.721	0.1

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% sites meeting targets	31%	74%
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Transect	Mine	Date of monitoring	Years post rehabilitation	Type	Terrain	YOUNG REHABILITATION (< 5 YEARS) CRITERIA		
						MAJOR	SUPPORTING	
						Triodia cover / Shrub cover ratio	Minimum total native cover (%)	Weed cover / Triodia cover ratio
Target						> 2	> 12	< 1
BYA67	Yarrie	2018	3	Cattle Gorge waste dump	Crest	1.42	28.2	0
BYA69	Yarrie	2018	2	Yarrie 10 - Rehab	Crest	1.02	29.8	0
BYA70	Yarrie	2018	2	Yarrie 10 - Rehab	Slope	0.97	16.3	0
BYA66	Yarrie	2018	2	Cattle Gorge waste dump	Slope	3.35	12.4	0

% sites meeting targets	25%	100%	100%
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